UNIVERSITY OF MINNESOTA
GRADUATE MEDICAL EDUCATION

2015-2016
FELLOWSHIP POLICY MANUAL

Department of Surgery
Cardiothoracic Surgery Fellowship Program
i. Introduction/Explanation of Manual

The information contained in this Fellowship Policy Manual pertains specifically to cardiothoracic surgery fellows in the Division of Cardiothoracic Surgery training program including the General Thoracic Surgery Section of the Department of Surgery.

“The Institution Manual is designed to be an umbrella policy manual. Some programs may have policies that are more rigid than the Institution Manual in which case the program policy would be followed. Should a policy in a Program Manual conflict with the Institution Manual, the Institution Manual would take precedence.”


For information that applies to all residents/fellows in a residency/fellowship training program in the Department of Surgery, please consult the Department of Surgery Policy Manual found at http://www.surg.umn.edu/education-residency-fellowships/general-surgery-residency/program-manual/index.htm.

Information in the Institutional Policy and Procedure Manual and the Department of Surgery Policy Manuals take precedence over information in this Procedure Manual in cases where there is conflict.

Statement of inclusion of fellowship programs in Manual

This fellowship addendum outlines specific policies and procedures specific to this training program. Please refer to the Surgery Department Program Manual or Institutional Policy and Procedure Manual for further departmental policies and procedures.

ii. Department Mission Statement

The mission of the Department of Surgery is teaching, research, and provision of excellent clinical service. The primary academic mission is to teach medical students, residents and fellows, and advanced degree candidates with the focus of developing academic surgeons and advancing knowledge in surgical specialties through scientific and clinical research endeavors.

iii. Program Mission Statement

The academic charge of the Division of Cardiothoracic Surgery at the University of Minnesota is to provide the ideal environment to facilitate training, cardiovascular and thoracic surgery residents, general surgery residents, and medical students in the discipline of cardiovascular and thoracic surgical sciences.

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SECTION 1 - STUDENT SERVICES

LABORATORY COATS

All residents are provided with two long white laboratory coats with their name embroidered above the pocket. If the residents wish for them to be laundered by the hospital, soiled coats can be dropped off in the Cardiothoracic Surgery main office, room 347 Dwan/KE. You will be notified when the laundry is returned.

UNIVERSITY, DIVISION, AND CAMPUS MAIL

Each resident has an assigned mailbox located in the Fellows office at 450 VCRC. You have access to these boxes 24 hours a day. These boxes are not locked and it is essential that you pick up your mail weekly.

Mail is stamped once daily through the main office of the Division of Cardiothoracic Surgery. Please bring your out-going mail to the office for stamping and mailing.

Your campus mail address is

Division of Cardiothoracic Surgery
420 Delaware St SE
Mayo Mail Code 207
Minneapolis, MN 55455.

For shipping, please use the following address:

University of Minnesota
Cardiothoracic Surgery
425 E. River Parkway, Suite 347
Minneapolis, MN 55455

EMAIL AND INTERNET ACCESS

All fellows must use their University of Minnesota email account.

Department of Surgery website: http://www.surg.umn.edu/

Graduate Medical Education website: http://www.med.umn.edu/gme/

Medical School website: http://www.med.umn.edu/

To set up email account:
1. Check to make sure you are in the University of Minnesota system. You can do this by going to the U of MN-Twin Cities home page at http://www1.umn.edu/twincities/. Click on Search icon. Under search for people, type in your name and click on search. If you are not registered, you will not be in the system, and you should contact the coordinator at 612-625-8698 to
make sure all of your paperwork is complete.

2. Go to the website https://www.umn.edu/initiate. Enter your University of Minnesota ID number and birthday (you do not need to enter your Social Security number). You then need to set your Internet Account Password that needs to be at least six characters long.

To access your email account:
Any computer with Internet access can be used to access your email. (See below for setting up access from home.)
1. Go to http://www.mail.umn.edu/ (if you forget this address, there is a link to this page on the Department of Surgery homepage at http://www.surg.umn.edu ).
2. Click on Check your email via your Web browser.
3. Enter your X500 ID, NOT YOUR EMAIL ADDRESS.
   **Ex:** If your email address is smith999@umn.edu, your X500 ID is smith999.
4. Enter your password.
5. Click on Login.

Forwarding email:
If you want to forward your University email address to your personal email address, please go to the website http://www.umn.edu/dirtools. You will be asked to enter your X500 and password. After you are logged in, go to “Set email forwarding and autoreply.” Once you are there, go to “Set Email Forwarding,” and check “other.” Enter your personal email address and submit.

**HIPAA PRIVACY REGULATIONS**

There are new privacy standards reflected in the HIPAA legislation. In order to be in compliance with the new HIPAA privacy regulations, every University of Minnesota student, faculty member, researcher, and staff person are required to complete at least three on-line courses about privacy and data security.

To access training, log on to http://www.myu.umn.edu. Everyone will need to complete the following **three** courses:
- The Video Awareness course
- The Privacy and Confidentiality in the Clinical Setting course
- The Privacy and Confidentiality in Research course

Step-by-step instructions can be found on the Privacy and Security Projects Web Site at http://www.privacysecurity.umn.edu. Follow the link entitled “University HIPAA Training.” Technical assistance is available by calling 301-HELP or 1-Help (internal). If access to a computer is an issue, the computer lab in the Bio-Medical Library on the 2nd Floor of Diehl Hall has been made available. Please feel free to call the Privacy Office at 612-624-7447 if you have any questions or concerns. EVERY EFFORT will be made to assist you in completing this process.

**Accessing the Online HIPAA Courses**
1. Go to http://www.myu.umn.edu
2. Select “Click here to Sign-in”, located in the upper left hand corner of the portal homepage.
3. Authenticate using your U of M Internet ID and password.
4. Confirm that authentication was successful by looking for the “Signed in as (your name)” in the upper left hand corner where you selected “Click here to Sign-in”.
5. Select my Toolkit.
6. Go to the section titled “(Your Name) Projects To Do lists”.
7. Look for the title of the training course that you need to complete. Select the course and a new window will open up. You can begin taking the course.
8. After you complete the course, close the window to return to your To Do list. You can then proceed with the next course or if you are finished, you can log out of the portal.
9. If you have to quit the training in the middle of a course that is in WebCT, you can go back into the course and select the “Resume Course” button in the upper navigation to get back to the page you were on.
10. You will receive an email confirming your completion of the course. Print out the confirmation for your records. Your completion of the courses will be tracked electronically.
11. Please remember to LOG OUT of the portal when you are finished. If you leave the computer while you are logged in, others could use your log in to access your private information such as HR information.

PAGERS

Each Cardiothoracic Surgery resident is assigned a University alpha pager for the entire duration of their three years of training. This is turned in at the completion of the program. At the VA Medical Center, the resident will be supplied with a VA-specific pager to complement the University pager. The resident is expected to wear both pagers during his time at the VA and return the VA pager when his rotation is complete.

Your fellowship coordinator will have a pager available for you at the time that you start the program. The UMMC main information desk should be contacted for assistance with a malfunctioning pager. New batteries can be obtained in the Division of Cardiothoracic Surgery main office.

TUITION AND FEES

Tuition and fees are being waived at this time. Trainees who are enrolled in Graduate School pay tuition and fees.

UMMC BADGE

Fairview campus parking office (3rd floor, Mayo Bldg) is open from 7:30 a.m. to 4 p.m. for photo ID badges. Upon arrival at the parking office you should identify yourself as a resident or fellow. They will then ask to see a state issued ID or passport, and verify the status in reports received from Medical Staff/GME. They will log your information and take your photo. The photo is then sent over to the Riverside campus for the ID badge to be made. The ID badge should arrive back to the U Parking Office by 3 p.m. the following business day.

To access Amplatz Childrens Hospital, you will need to go to the Riverside Parking Office, present your Fairview ID and ask for access for the ER, OR, NICU and Station 6, as well as the main entrance.
UNIVERSITY BADGES

The University U-Card office is located in Coffman Union, room G22. This office is open Monday through Friday from 8am to 430pm. To obtain your U Card, bring your Driver's License, State ID, Military ID, Tribal ID or passport to any of the locations listed below and be prepared to have your picture taken.

PARKING

A parking card is provided to the fellow for a three year period. All of these cards are set up to access the River Road Garage,

Residents are also able to park in the Patient Visitor ramp 3:30 p.m. to 4 a.m. Monday – Friday, and Saturday and Sunday all day long.

As far as parking at Riverside, you will receive a parking card for the duration of your pediatric CV surgery rotation and will park in the Yellow Ramp. To gain access to the ramp, you will need to go to the Riverside Parking Office where they will verify your fellowship rotation. A $25 refundable deposit is required at that time.

TUITION AND FEES

Tuition and fees are being waived at this time for our fellows. However, trainees who are enrolled in Graduate School are responsible for paying their own tuition and fees.

SURGICAL LOUPES

The training program will purchase one pair of surgical loupes for each resident during the first year with the target expense of approximately $1,200. You may work with the vendor of your choice. Arrangements should be made through the Fellowship Coordinator regarding obtaining these “surgical telescopes” which will be charged to the Division Purchasing Card.

TEXTBOOKS

The Division will purchase each resident a textbook of choice during their first year. This should be ordered through the Fellowship Coordinator.

SECTION 2 – BENEFITS

STIPENDS

Trainees in all programs at the same level of training must be paid in accordance with the stipends set by the Graduate Medical Education Committee (GMEC). Trainees may not be paid less than or in excess of the stipend set by the GMEC for their level of training.

Augmentations may be provided to chief residents.

Credit will be given to individuals who complete an ACGME-accredited combined residency.

Credit is not given for a chief resident year (when it is done as an extra year of training after completing the core program).

A trainee entering a training program after completing a portion or all of the Board requirements in another specialty may receive credit for only the portion of training which is acceptable to board requirements for certification in that specialty which he/she is entering. This credit will impact their stipend level.

It is recognized that there are trainees accepted into a training programs that have completed additional GME training above and beyond what is required for the training program they are entering. There may also be trainees accepted into a program that have spent time in non-GME activity (employment, graduate school, etc.). While these accomplishments are noteworthy, only training that is required to start in the training program will affect the stipend level.

| University of Minnesota Medical School |
| Graduate Medical Education Administration |
| 2014/2015 Annual Base Stipend Rates with Biweekly Amount |
| Reviewed by GMEC: 11/26/2013 |
| Approved by GMEC: 11/26/2013 |

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<th>Level:</th>
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<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Step 5</th>
<th>Step 6</th>
<th>Step 7</th>
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<td>50,756</td>
<td>52,317</td>
<td>54,117</td>
<td>56,051</td>
<td>58,208</td>
<td>60,251</td>
<td>62,178</td>
<td>64,167</td>
<td>66,222</td>
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<tr>
<td>Biweekly Stipend:</td>
<td>1,952.15</td>
<td>2,012.19</td>
<td>2,081.42</td>
<td>2,155.81</td>
<td>2,238.77</td>
<td>2,317.35</td>
<td>2,391.46</td>
<td>2,467.96</td>
<td>2,547.00</td>
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PAY DAYS AND PAY PERIODS

The University of Minnesota pays employees on a biweekly pay period basis, with each pay period starting on a Monday and ending on a Sunday. Employees are paid every other Wednesday, 10 days after the end of the pay period. For additional information regarding payday calendar, please visit the Human Resources website at http://www1.umn.edu/ohr/payroll/calendars/
FELLOWSHIP LEAVES

BEREAVEMENT LEAVE

A resident/fellow (trainee) shall be granted, upon request to the program director, up to five days off to attend the funeral of an immediate family member. Sick, vacation or personal time must be used. Immediate family shall include spouse, significant others, registered same sex domestic partners, children, stepchildren, parents, parents of spouse, and the stepparents, grandparents, guardian, grandchildren, brothers, sisters, or wards of the trainee.

PARENTAL LEAVE

The resident/fellow (trainee) as defined below must give notice, in writing, of intent to use parental leave and other leaves used in conjunction with parental leave to their program director at least four (4) weeks in advance, except under unusual circumstances.

Birth mother:
A birth mother shall be granted, upon request to the program director, up to six weeks parental (maternity) leave for the birth of a child. The maternity leave may begin at the time requested by the trainee, but no later than six weeks after the birth and no sooner than two weeks before the birth. The leave must be consecutive and without interruption.

Trainees on maternity leave will receive the first two weeks of their leave as paid parental leave. This paid parental leave shall not be charged against the trainees’ vacation, sick or PTO allocation.

Note: The first two weeks of this paid parental leave covers the required fourteen day wait period before they may be eligible to receive the short-term disability benefit, see Short Term Disability Policy.

Birth father:
A birth father shall be granted, upon request to the program director, up to two weeks paid parental leave for the birth of a child. The leave may begin at the time requested by the trainee, but no later than six weeks after the birth and no sooner than two weeks before the birth. The leave must be consecutive and without interruption. This paid parental leave shall not be charged against the trainees’ vacation, sick or PTO allocation.
Registered same sex domestic partner:
Registered same sex domestic partner of someone giving birth shall be granted, upon request to the program director, up to two weeks paid parental leave. The leave may begin at the time requested by the trainee, but no later than six weeks after the birth and no sooner than two weeks before the birth. The leave must be consecutive and without interruption. This paid parental leave shall not be charged against the trainees’ vacation, sick or PTO allocation.

Adoption:
An adoptive parent shall be granted, upon request to the program director, up to two weeks paid parental leave for the adoption of a child. Trainees who are registered same sex domestic partners of someone adopting a child shall be granted two weeks paid leave. The leave may begin at the time requested by the trainee, but no later than six weeks after the adoption and no sooner than two weeks before the adoption. The leave must be consecutive and without interruption. This paid parental leave shall not be charged against the trainees’ vacation, sick or PTO allocation.

Clarification
Holidays that occur during a leave of absence run concurrent with the leave and are not in addition to the leave.

MEDICAL LEAVE

The resident/fellow (trainee) must give notice, in writing, of intent to use medical leave to their program director at least four (4) weeks in advance, except under unusual circumstances.

A trainee shall be granted, upon request to the program director, a leave of absence for their serious illness/injury that requires an absence of greater than 14 days. The trainee may qualify for Short Term and Long Term Disability benefits. See “trainee’s next steps” below for more information.

Clarification
Holidays that occur during a leave of absence run concurrent with the leave and are not in addition to the leave.

** Check with your department/program to determine**: 
- what type of paperwork needs to be completed;
- if you qualify for Family Medical Leave Act (FMLA) and how it will be managed;
- how your pay will be impacted;
- how your benefits need to be coordinated; and
- if your leave will extend your training.

FAMILY MEDICAL LEAVE ACT

Residents and fellows (trainees) are eligible for the Family Medical Leave Act (FMLA). Trainees must check with their department to determine if they qualify.

Leave shall not exceed 12 weeks in any 12-month period. The 12-month period is based on an academic year (July 1 – June 30). The trainee may qualify for Short Term and Long Term Disability benefits.
HOLIDAYS

Holiday scheduling for trainees is rotation specific by program. The educational requirements and the 24 hour operational needs of the hospital are taken into consideration when scheduling holiday time off.

JURY/WITNESS DUTY

Witness Duty: Upon request to the program director, leave is provided to residents/fellows (trainees) who are subpoenaed to testify before a court or legislative committee concerning the University or the federal or state government.

Jury Duty: Upon request to the program director, leave is provided to trainees who are called to serve on a jury. Trainees do not lose pay when serving on a jury or testifying as described above. The training program and the trainee may write a letter to the court asking that the appointment for jury duty be deferred based on hardship to the trainee and the program. The decision for deferment is made by the court.

MILITARY LEAVE

The resident/fellow (trainee) must notify the program as soon as they are called to active military duty. It is incumbent upon the Program Director to notify both the individual RRC and the Board of this change in status.

Trainees on military leave for up to five years generally are eligible for reinstatement to their training programs once active duty is completed. Trainees may resume their training at the PG-Y level they were in when called to duty or may be required to repeat earlier training experiences. The appropriate level of training upon return will be determined based on several factors: length of leave; medical duties, if any, performed by the trainee while in military service; and curricular changes in the training program during the trainee’s absence.

Leave for Immediate Family Members of Military Personnel Injured or Killed in Active Service:
According to Minnesota Statute 181.947 trainees are allowed up to 10 days unpaid leave. Please refer to the following link for further details (http://www.leg.state.mn.us/leg/statutes.asp search by Statute number).

Additional leave may be granted under the Family Medical Leave Act (FMLA). Please refer to the Office of Human Resources website for further information:

Leave to Attend Military Ceremonies: According to Minnesota Statute 181.989 trainees are allowed up to 1 day unpaid leave. Please refer to the following link for further details (http://www.leg.state.mn.us/leg/statutes.asp search by Statute number).
PERSONAL LEAVE OF ABSENCE

The resident/fellow (trainee) must give notice, in writing, of intent to use personal leave to their program director at least four (4) weeks in advance, except under unusual circumstances.

A trainee may be granted, upon request to the program director, a personal leave of absence. If applicable, trainees on a personal leave may use available vacation, sick or PTO to continue receiving their stipend while on a personal leave.

Please see your Program Manual for specific department policies and procedures.

Trainee’s Next Steps

** Check with your department/program to determine**: 

- what type of paperwork needs to be completed;
- how your pay will be impacted;
- how your benefits need to be coordinated; and
- if your leave will extend your training.

PROFESSIONAL LEAVE

Programs may provide time off for their residents/fellows (trainees) that is not deducted from their vacation, sick or PTO allocation.

Additional time off may include, but is not limited to:

- Academic
- Continuing Medical Education (CME)
- Interviewing
- Professional Conference Attendance/Presentation

Program Addendum:

During the first year, time-off requests for studying for general surgery boards should be used as either personal days or vacation time. During the third year, fellows who are requesting time away for job interviews and house hunting must utilize personal days and vacation time for that as well. Vacation may not be requested during the general surgery annual review course in June. The last week of June may not be taken as vacation to depart from the fellowship early by University regulations.

Fellows are allowed five days off to attend one national meeting per year, with an expense limit of $2,500 for domestic meetings within the contiguous states.
Fellows are also allowed up to an additional three days off to present a manuscripts or poster that is accepted at a “valid meeting” to be determined by the Program Director. Time off is limited to travel and presentation time only.

Time off is allowed for taking board exams. Approved meeting or exam days do not count against vacation or personal days.

**VACATION/SICK LEAVE**

The vacation policy for first and second year cardiothoracic surgery fellows includes two weeks of vacation time per year, and seven personal days per year. The vacation policy for third year fellows includes two weeks of vacation time per year, and 14 personal days. These additional personal days are allowed for the purpose of interviewing.

It is strongly recommended that vacation be taken as a one week vacation every six month period, with the personal days being scattered through the year for emergency situations. Vacation not utilized during that academic year cannot be carried over to the next academic year. Requests for vacation and personal days, as well as professional leave, must be submitted in writing to the fellowship coordinator using the specified form available from the program coordinator. **All time off must be approved by the fellowship office at least two weeks prior to the time away. Coverage must be secured at the time of the request.**

It is best for the fellow to discuss time off plans with the staff early when planning for time away. Surgery scheduling can be done around your time off when possible.

Vacation time requests must include any weekend days that are attached to your vacation time that you plan to be away. If you do not expect to be in on Saturday or Sunday preceding or following requested days off, you must include those in your requested days. Otherwise, there is no way to prevent overlapping with other service personnel. This is the policy for all surgery residents and fellows.

**EFFECT OF LEAVE FOR SATISFYING COMPLETION OF PROGRAM**

University of Minnesota Graduate Medical Education leave policies are in compliance with and governed by the regulations of the various specialty boards and accrediting organizations.

It is the responsibility of the department, program, and resident or fellow to be in compliance with the Program Requirements concerning the effect of leaves of absence on satisfying the criteria for completion of the training program, and guaranteeing eligibility for certification by the relevant certifying Board prior to granting leave.

American Board requirements should be reviewed by the program director and resident or fellow to assure that the trainee is familiar with the possibility of having to make up time away from training. If extended leave results in the requirement for additional training in order to satisfy American Board requirements, financial support for the additional training time must be determined when arrangements are made for the leave and the makeup activity.
HEALTH AND DENTAL INSURANCE COVERAGE INCLUDING DENTAL, HEALTH, LIFE, VOLUNTARY LIFE, LONG-TERM AND SHORT-TERM DISABILITY AND INSURANCE COVERAGE CHANGES

The Office of Student Health Benefits manages resident and fellow benefits including: dental; health; life; voluntary life, long-term and short-term disability, insurance coverage changes and pre-tax benefits.

For comprehensive information on your benefits please refer to the Office of Student Health Benefits website at: http://www.shb.umn.edu/twincities/residents-fellows-medical.htm

Questions about your benefits, or to make changes in your benefits, can be directed to the Office of Student Health Benefits.

Office of Student Health Benefits
University of Minnesota
410 Church Street S.E., N323
Minneapolis, MN 55455
Phone: 612-624-0627 or 1-800-232-9017
Fax: 612-626-5183 or 1-800-624-9881
Email: umshbo@umn.edu

Also, please refer to the Institutional Policy Manual for additional information.

Surgery Department HR contact is Joy Wise Davis at jwisedav@umn.edu or 612-625-4837.

Surgery Department Administrative Director for Education is Emily Langerak at langer274@umn.edu or 612-624-7149.

PROFESSIONAL LIABILITY INSURANCE

Professional liability insurance is provided by the Regents of the University of Minnesota. The insurance carrier is RUMINO Limited. Coverage limits are $1,000,000 each claim/$3,000,000 each occurrence and form of insurance is claims made. “Tail” coverage is automatically provided. On 7/1/14 the RUMINCO policy number will change to: RUM-1005-14.

Coverage is in effect only while acting within the scope of your duties as a trainee. Claims arising out of extracurricular professional activities (i.e. internal or external moonlighting) are not covered. Coverage is not provided during unpaid leaves of absence.

Outlined below are the methods to either request a Certificate of Insurance or to request a Liability Credentialing/Claims History.

Procedure for Requesting a Certificate of Insurance
Contact your fellowship coordinator for a current copy of the University’s Certificate of Professional Liability Insurance.
If the entity requesting the Certificate has specifically asked that the trainee’s name appear on it:

- Ask the fellowship coordinator to complete the Certificate of Insurance Request form.
- E-mail completed form back to Risk Management Office at ORM@umn.edu

Contact:
Pam Ubel, Assistant to Director, Risk Management and Insurance
Phone: 612-624-5884
E-mail: ORM@umn.edu

Procedure for Requesting a Liability Credentialing/Claims History
In order to process requests for professional liability (malpractice) credentialing/claims history, the provider may send an e-mail to Krista Ostrum directly (see contact information below) requesting that the information be released. An e-mail/letter from a third party is also acceptable when accompanied by a document signed by the provider authorizing that the information be released.

Contact:
X
Tara Atkisson, Assistant to Keith Dunder, Office of the General Counsel
Phone: 612-625-9995
E-mail: atkis002@umn.edu

Also, please refer to the Institutional Policy Manual for additional information.

Surgery Department HR contact is Joy Wise Davis at jwisedav@umn.edu or 612-625-4837.

Surgery Department Administrative Director for Education is Emily Langerak at lange274@umn.edu or 612-624-7149

MEAL CARD POLICY AND PROCEDURE

Fairview meal cards may be used at UMMC in the 8th floor Bridges cafeteria and at the Riverside cafeteria.

I. PURPOSE
To provide food service for resident and fellows who have been assigned to provide on-call services in the hospital on either campus, Riverside or University, for a specific period of time other than a normal work day.

II. POLICY
A. On-call meals (dinner & breakfast) will be provided for residents and fellows who work 24 consecutive hours on site, interns that are scheduled to work the maximum number hours allowed (16 hrs), are pre-scheduled 5 or more 12 hour night shifts (night float), or are called from home to return to the hospital while on home call. No meal will be provided if they are on call from home or stay at home.
B. ID Badge Requirement - Residents and fellows are required to have a Fairview ID badge visible and present in order to obtain on-call meals.

C. Bulk Purchase Limitation – Bulk purchases (i.e., extra sodas/waters, bags of candy) are not allowed. Limit of 3 bottles and one half pound of candy or snacks may be purchased at one time.

D. Sharing Restriction – This privilege is for the resident and/or fellow use in the hospital and may not be shared with medical students, families, or other hospital staff.

III. PROCEDURE
A. Each resident and/or fellow involved in clinical duties and meets the above criteria will receive a meal card at the start of the academic year. The dollar amount on each card will be determined by the number of on-call months the department designates to the resident and/or fellow.

B. Changes to a resident and/or fellow schedule throughout the academic year that increases the amount of time spent on-call will be eligible for an increase in their meal card allotment. The department will contact the GME office at UMMC-F with the resident name and increase request for approval.

C. Non-compliance with this policy may result in short-term suspension of meal card privileges or termination of privileges. The Vice President of Medical Affairs at UMMC-F reserves the right to suspend or terminate meal card privileges at any time, without notice.

D. Each resident and/or fellow eligible for meal card privileges must sign the statement of understanding (attachment A), in order to receive their meal card for the academic year.

E. Questions and/or issues regarding meal cards at UMMC-F may be directed to the UMMC-F GME office at 612-273-7482.

LAUNDRY SERVICES

All residents are provided with two long white laboratory coats with their name embroidered above the pocket. If the residents wish for them to be laundered by the Department, soiled coats can be dropped off in the Cardiothoracic Surgery main office, room 347 Dwan/KE. Clean coats can be picked up two weeks later in the same location.

WORKERS COMPENSATION PROGRAM SPECIFIC POLICIES AND PROCEDURES

The University is committed to providing trainees with comprehensive medical care for on-the-job injuries. Under Minnesota statute, Medical trainees are considered employees of the University of Minnesota for Workers’ Compensation insurance purposes. When a trainee is injured during training, they must take immediate steps to report the injury to the University.

*The University cannot pay bills for trainee treatment unless an injury report is on file.*

Links to the Office of Risk Management's current policy and procedure regarding reporting Workers' Compensation injuries:

Reporting Workers Compensation Related Injuries
POLICY FOR NON-RENEWAL OF CONTRACTS

We have adopted a policy on non-renewal of Agreement of Appointment of the University of Minnesota Graduate Education Committee. This policy, approved November 21, 2003, read, “In instances where a resident’s agreement is not going to be renewed, the University of Minnesota Medical School ensures that its ACGME accredited programs provide the resident(s) with a written notice of intent not to renew a resident’s agreement no later than four months prior to the end of the resident’s current agreement. Resident(s) will be allowed to implement the institution’s grievance procedures if they have received a written notice of intent not to renew their agreements.”

SECTION 3 - INSTITUTION RESPONSIBILITIES

Please refer to the Institution Policy Manual located on the GME website at:

SECTION 4 - DISCIPLINARY AND GRIEVANCE PROCEDURES

Please refer to the Institution Policy Manual located on the GME website at:

GRIEVANCE PROCEDURE AND DUE PROCESS

Division policy is to refer to Institutional Policy Manual at
SECTION 5 - GENERAL POLICIES AND PROCEDURES


PROGRAM CURRICULUM

Cardiothoracic Surgery Conference Schedule
January 2014 – December 2014
7:00-8:00 a.m.
Room 347C KE Building

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>CONCEPTS COVERED</th>
<th>PRESENTER</th>
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<tr>
<td>2014</td>
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<tr>
<td>January 1</td>
<td>New Year’s Day</td>
<td>NO CONFERENCE</td>
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<tr>
<td>January 8</td>
<td>TS 05</td>
<td>Neoplasm of the Lung I</td>
<td>Podgaetz</td>
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<tr>
<td>January 15</td>
<td>CV 05</td>
<td>Cardiopulmonary Bypass/Myocardial Protection/Circulatory Support I</td>
<td>Loor</td>
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<tr>
<td>January 22</td>
<td>M&amp;M</td>
<td>Room 130KE/FSH Board Room</td>
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<td>January 29</td>
<td>STS (1/25-29/13)</td>
<td>NO CONFERENCE</td>
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<tr>
<td>February 5</td>
<td>CD 03</td>
<td>Pediatric Circulatory Support &amp; Perioperative Care</td>
<td>MacIver</td>
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<tr>
<td>February 12</td>
<td>TS 06</td>
<td>Neoplasm of the Lung II</td>
<td>Andrade</td>
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<tr>
<td>February 19</td>
<td>Fellow Talks</td>
<td>Room 114KE</td>
<td>Larson &amp; Shukrallah</td>
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<td>February 26</td>
<td>M&amp;M</td>
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<td>March 5</td>
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<td>Misc discussion w/fellows &amp; Loor</td>
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<td>March 12</td>
<td>CV 06</td>
<td>Cardiopulmonary Bypass/Myocardial Protection/Circulatory Support II</td>
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<td>March 19</td>
<td>CD 04</td>
<td>Left to Right Shunts</td>
<td>St. Louis</td>
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<td>March 26</td>
<td>M&amp;M</td>
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<tr>
<td>April 2</td>
<td>TS 07</td>
<td>Neoplasm of the Lung III</td>
<td>Andrade</td>
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<tr>
<td>April 9</td>
<td>CV 07</td>
<td>Ischemic Heart Disease I</td>
<td>Liao</td>
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<td>April 16</td>
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<td>April 23</td>
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<td>April 30</td>
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<td>Room 114KE</td>
<td>Topalidis &amp; Mudy</td>
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<td>TS 08</td>
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<td>May 14</td>
<td>CD 05</td>
<td>Cyanotic Heart Disease</td>
<td>MacIver - canceled</td>
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<td>May 21</td>
<td>CV 08</td>
<td>Ischemic Heart Disease II</td>
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<td>May 28</td>
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<td>Room 114KE</td>
<td>Weide &amp; Kirchner</td>
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<td>TS 09</td>
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<td>July 2</td>
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<td>Orientation</td>
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<td>July 9</td>
<td>CD 06</td>
<td>Single Ventricle Lesions</td>
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<td>August 6</td>
<td>CV 10</td>
<td>Ischemic Heart Disease IV</td>
<td>Ward</td>
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<td>August 13</td>
<td>TS 12</td>
<td>Benign Lung Conditions II</td>
<td>Podgaetz</td>
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<td>August 20</td>
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<td>TS 13</td>
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<td>September 24</td>
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<td>TS 14</td>
<td>Benign Lung Conditions IV</td>
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<td>CD 11</td>
<td>Adult Congenital Heart Disease</td>
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<td>November 5</td>
<td>CV 13A + 13 B</td>
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<td>TS 15</td>
<td>Disorders of the Pleura I</td>
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<td>December 31</td>
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<td>New Year’s Eve</td>
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Starting January 2014 we will use the Thoracic Surgical Curriculum through Joint Counsel for Thoracic Surgery Education which is web based through WebBrain website. The moodle link is http://jctse.mrooms.net. Each fellow will receive an I-Pad to ensure access to the material. This is a three year curriculum. We also do fellows talks monthly and wet lab quarterly.
PROGRAM GOALS AND OBJECTIVES

Year 1

Year 1: At the end of year 1, the cardiothoracic resident will be expected to master the following items:

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine thoracoscopic diagnostic procedures, lobectomy and pneumonectomy, mediastinoscopy and mediastinotomy, laparoscopic Nissen fundoplication, esophagectomy, and flexible/rigid bronchoscopy and esophagoscopy.

Use information technology: Fellows learn to use currently available information technology sources – Medline, Pubmed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC.

Evaluate diagnostic studies: During the thoracic rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest computed tomography examinations, PET examinations, bone scans, pulmonary function studies, contrast esophagrams, 24 hour pH studies, and esophageal manometry. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Thoracic Oncology Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.
Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the General Thoracic Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.

Counsel and educate patients and families:
Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

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Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Maintain a log of continuity of care of patients seen in the Thoracic Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.
Medical Knowledge: Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

The Thoracic Fellow is expected to master the following core topics by the end of the rotation:

**TRANSPLANTATION**

**A. Cardiac Transplantation**

Objective:

At the end of this year, the resident knows the principles of organ preservation, immunosuppressive therapy, signs and treatment of rejection, and the indications for and techniques of cardiac transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

1. Knows the indications for cardiac transplantation;
2. Understands the management of immunosuppressive therapy in cardiac transplantation;
3. Knows the techniques of cardiac transplantation;
4. Recognizes the signs and symptoms of cardiac rejection and knows the appropriate management;
5. Understands the evaluation and management of organ donors;
6. Knows the methods of organ harvest and preservation;
7. Is familiar with the techniques and complications of endomyocardial biopsy.

Contents:

1. **Indications for cardiac transplantation**
   a. Patient evaluation
   b. Patient selection
   c. Informed consent
2. **Immunosuppressive therapy in cardiac transplantation**
   a. Evaluation of therapy
   b. Drugs
   c. Complications
3. **Technique of cardiac transplantation**
   a. Orthotopic
   b. Heterotopic
4. **Donor preparation and organ harvest**
   a. Brain death, legal and family-related issues
   b. Donor evaluation
   c. Methods of organ procurement and preservation
5. **Cardiac rejection**
   a. Signs and symptoms
   b. Endomyocardial biopsy
   c. Histologic evaluation
   d. Management
   e. Mechanical support and re-transplantation

6. **Immunosuppressive therapy**
   a. Immunosuppressive drugs and their side effects
   b. Polyclonal and monoclonal antibody therapy and side effects
   c. Complications

**Clinical Skills:**

During the training program the resident:

1. Manages organ donors;
2. Performs organ harvest and preservation;
3. Performs cardiac transplantation;
4. Manages the cardiac transplant recipient preoperatively and postoperatively;
5. Participates in the immunosuppressive therapy for cardiac transplantation;
6. Evaluates transplant recipients for signs of rejection or infection and initiates appropriate therapy;
7. Performs endomyocardial biopsy.

**B. Lung Transplantation**

Objective:

At the end of this year the resident understands the basic principles of lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the indications for and performs lung transplantation.

**Learner Objectives:**

Upon completion of the rotation the resident:

1. Understands the evaluation and management of organ donors;
2. Knows the indications for lung transplantation;
3. Understands the management of immunosuppressive therapy in lung transplantation;
4. Knows the techniques of single and double lung transplantation;
5. Recognizes the signs and symptoms of lung rejection or infection and knows the appropriate management;
6. Knows the methods for harvesting and preserving donor lungs;
7. Is familiar with the techniques and complications of bronchoscopy of the transplanted lung.
Contents:

Indications for lung transplantation

a. Patient evaluation
b. Patient selection
c. Informed consent

2. Immunosuppressive therapy in lung transplantation
a. Evaluation of therapy
b. Drugs
c. Complications

3. Technique of single and double lung transplantation
a. Left lung
b. Right lung
c. Extracorporeal bypass techniques and indications for their use

4. Donor evaluation
a. History
b. Physiology
c. Radiology

5. Donor preparation and organ harvest
a. Brain death, legal and family-related issues
b. Organ procurement and preservation
c. Pharmacologic and technical aspects of donor lung harvest operations

6. Pulmonary rejection
a. Signs and symptoms
b. Endobronchial biopsy
c. Histologic evaluation of rejection
d. Management of rejection

7. Immunosuppressive therapy
a. Immunosuppressive drugs and their side effects
b. Antibody therapy and side effects
c. Complications of immunosuppressive therapy

Clinical Skills:

During the training program the resident:

1. Performs or participates in donor evaluation and management;
2. Performs or participates in donor lung harvest and preservation;
3. Performs or participates in lung transplantation;
4. Participates in the immunosuppressive therapy for lung transplantation;
5. Manages the lung transplant recipient preoperatively and postoperatively;
6. Evaluates transplant recipients for signs of rejection or infection, and initiates appropriate therapy;
7. Performs transbronchial biopsy.

C. Heart-Lung Transplantation
Objective:

At the end of this year the resident understands the principles of heart-lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the techniques of heart-lung transplantation.

Learner Objectives:

Upon completion of the year the resident:

1. Knows the indications for heart-lung transplantation;
2. Understands the management of immunosuppressive therapy of heart-lung transplantation;
3. Knows the operative techniques of heart-lung transplantation;
4. Recognizes the signs and symptoms of pulmonary rejection in cardiopulmonary transplantation;
5. Recognizes infection and rejection, and knows the appropriate management of each;
6. Understands the evaluation and management of heart-lung donors;
7. Knows the methods for harvesting and preserving heart-lung blocs;
8. Is familiar with the techniques and complications of radiologic and fiberoptic bronchoscopy of the transplanted lung in the heart-lung recipient.

Contents:

1. Immunosuppressive therapy in cardiopulmonary transplantation
   a. Evaluation of therapy
   b. Drugs
   c. Complications
2. Technique of heart-lung transplantation
3. Donor evaluation
   a. History
   b. Physiology
   c. Radiology
4. Donor preparation and harvest
   a. Brain death, legal and family-related issues
   b. Organ procurement and preservation
   c. Pharmacologic and technical aspects of donor heart-lung harvesting
5. Rejection in cardiopulmonary transplantation
   a. Signs and symptoms
   b. Frequency of cardiac rejection and indications for endomyocardial biopsy
   c. Techniques for diagnosing lung rejection in the cardiopulmonary transplant patient
   d. Histologic evaluation of pulmonary rejection in the cardiopulmonary transplant patient
   e. Management of rejection in the cardiopulmonary transplant recipient
6. Immunosuppressive therapy
   a. Immunosuppressive drugs and their side effects
   b. Monoclonal and polyclonal antibody therapy and their side effects
   c. Complications
Clinical Skills:

During the training program the resident:

1. Participates in the evaluation and management of donors for cardiopulmonary transplantation;
2. Performs heart-lung bloc harvesting and preservation;
3. Performs heart-lung transplantation;
4. Participates in immunosuppressive therapy for transplantation;
5. Manages transplant recipients preoperatively and postoperatively;
6. Evaluates transplant recipients for signs of pulmonary rejection and infection, and of cardiac dysfunction; Performs endobronchial biopsy, thorascopic biopsy of the lung, and endocardial biopsy of cardiopulmonary transplantation patients, as indicated.

ACQUIRED HEART DISEASE

A. Coronary Artery Disease

Objective:

At the end of this year the resident understands the physiology of coronary circulation, the pathophysiologic causes and derangement of ischemic heart disease and the sequelae of coronary events, and performs comprehensive short and long-term management.

Learner Objectives:

Upon completion of the year the resident:

1. Understands the physiology of coronary circulation and the physiologic derangements caused by stenosis and obstruction;
2. Understands the development of atherosclerotic plaques and the current theories of plaque origination;
3. Knows the normal and variant anatomy of coronary circulation as well as the radiographic anatomy of the coronary arteries and the left and right ventricles;
4. Understands the rationale for and techniques of coronary artery bypass operations as well as the use of various conduits;
5. Understands the risks and complications of coronary artery bypass operations, coronary angiography, and percutaneous coronary artery balloon angioplasty;
6. Understands the preoperative and postoperative care of patients undergoing coronary artery bypass grafting;
7. Can describe outcomes of angioplasty and of operative and non-operative treatment of coronary artery disease, using statistical methods.

Contents:

1. Cardiac anatomy
   a. Left and right main coronary arteries
   b. Left anterior descending coronary artery
c. Circumflex coronary artery
d. Right coronary artery
e. Coronary venous system
f. Left and right ventricular anatomy

2. Radiographic cardiac and coronary anatomy
   a. Right anterior oblique views
   b. Left anterior oblique views
   c. Cranial view
d. Ventriculography

3. Pathologic development of atherosclerotic plaque
   a. Endothelial injury
   b. Platelet factors
c. Cellular factors
d. Serum factors

4. Coronary artery bypass grafting
   a. Rationale
   b. Conduits
c. Techniques
d. Technical considerations
e. Myocardial protection

5. Preoperative evaluation
   a. Symptoms of cardiac ischemia
   b. Non-invasive testing
c. Invasive testing
d. Decision making

6. Postoperative care
   a. Intensive care
   b. Acute care
c. Long term management
d. Late complications

7. Outcome
   a. Expected operative mortality
   b. Long term results

8. Complications of ischemic heart disease
   a. Chronic mitral insufficiency
   b. Ruptured papillary muscle (non-operative and operative management)
c. Ventricular septal defect (non-operative and operative management)
d. Cardiac rupture (non-operative and operative management)
e. Left ventricular aneurysm

Clinical Skills:

During the training program the resident:

1. Evaluates patients with angina pectoris, unstable angina pectoris, and acute myocardial infarction;
2. Reads and interprets invasive and non-invasive tests of patients with ischemic heart disease;
3. Performs operative and non-operative management of patients with ischemic heart disease, including coronary artery bypass grafting using the internal mammary artery;
4. Participates in or performs surgery for the complications of myocardial infarction;
5. Directs the critical care management of preoperative and postoperative patients with ischemic heart disease;
6. Participates in the performance and evaluation of exercise tolerance tests, echocardiograms, and cardiac catheterizations.

B. Myocarditis, Cardiomyopathy, Hypertrophic Obstructive Cardiomyopathy, Cardiac Tumors

Objective:

At the end of this year the resident understands the pathology and etiology of diseased myocardium, the natural history of the diseases and physiologic alterations, and performs operative and non-operative management.

Learner Objectives:

Upon completion of the year the resident:

1. Understands the types of cardiac tumors (frequency, anatomic location, physiologic and pathologic derangements, diagnostic methods and surgical management);
2. Understands myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes);
3. Understands hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment);
4. Knows the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment);
5. Understands cardiac transplantation (immunology/rejection and treatment, physiology, indications, operative techniques, diagnostic techniques in follow-up).

Contents:

1. Tumors
   a. Types, pathology
   b. Location
   c. Physiology
   d. Primary vs. metastatic
   e. Malignant pericardial effusion
   f. Diagnostic methods
   g. Treatment
   h. Outcome
2. Myocarditis
   a. Pathologic changes
   b. Etiology
   c. Clinical findings
3. Hypertrophic cardiomyopathy (HCM)
   a. Pathologic changes
   b. Anatomic changes
   c. Pathophysiology
   d. Obstructive vs. non-obstructive
   e. Arrhythmias
   f. Diagnosis
   g. History and physical examination
      i. echocardiography
      ii. cardiac catheterization
   h. Mitral valve
      i. systolic anterior motion
      ii. mitral regurgitation
   i. Treatment
      i. mitral valve replacement
      ii. myectomy and myotomy
      iii. pacing
   j. Outcome
      i. complications
      ii. long-term results
4. Cardiomyopathy
   a. Dilated
   b. Restrictive
   c. Causes
   d. Pathology
   e. Pathophysiology
   f. Diagnosis
      i. echocardiography
      ii. endomyocardial biopsy
   g. Clinical course
   h. Treatment
   i. Outcome
5. Cardiac transplantation
   a. Techniques
   b. Indications
   c. Immunology
   d. Immunosuppressive treatment
   e. Physiology
   f. Complications and infection
   g. Rejection
      i. diagnosis
ii. treatment
h. Coronary artery disease development
i. Organ harvesting, preservation
j. Long term complications and outcome

Clinical Skills:
During the training program the resident

1. Evaluates and interprets chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with cardiac tumors, myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM);
2. Participates in or performs operative excision of cardiac tumors;
3. Participates in or performs operations for the treatment of HCM when indicated;
4. Participates in or performs heart transplants and provides preoperative and postoperative care;
5. Participates in echocardiography, cardiac catheterization, endomyocardial biopsy, and donor heart harvesting.

C. Abnormalities of the Aorta

Objective:
At the end of this year the resident understands the etiology and physiology of diseases of the aorta and performs operative and non-operative treatment.

Learner Objectives:
Upon completion of the year the resident:

1. Understands the etiology and the physiology of aortic dissections and all aneurysms involving the ascending, transverse, descending, and abdominal aorta;
2. Recognizes the potential morbidity and mortality associated with aortic aneurysms and develops appropriate treatment plans for their management;
3. Knows the operative and nonoperative management of patients with acute and chronic aortic dissections;

Contents:

1. Aortic aneurysms (atherosclerotic, aortic dissections)
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
2. Operative and non-operative treatment
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
Clinical Skills:

During the training program the resident:

1. Evaluates and interprets plain radiography, echocardiography, CT scans, MRI, and contrast studies for diseases of the aorta;
2. Participates in or performs operative and non-operative management of thoracic aortic disease, including aneurysms, dissections, and occlusive disease;
3. Plans and directs the use of extracorporeal bypass, hypothermia, and circulatory arrest for aortic diseases;
4. Performs preoperative and postoperative care of patients with aneurysms, dissections, and occlusive disease of the aorta.

D. Cardiac Arrhythmias

Objective:

At the end of this year the resident understands the etiology and physiology of cardiac arrhythmias, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

1. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
2. Understands operative and non-operative management;
3. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

1. Cardiac arrhythmias
   a. Atrial
   b. Ventricular
2. Non-operative management
   a. Anti-arrhythmic drugs
   b. Electrical cardioversion and pacing
   c. Catheter ablation
3. Operative management
   a. AICD
   b. Intraoperative mapping and ablation
   c. Permanent pacing systems

Clinical Skills:

During the training program the resident:
1. Performs the operative and non-operative management of patients with atrial arrhythmias;
2. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;
3. Participates in electrophysiologic studies.

**E. Valvular Heart Disease**

Objective:

At the end of this year the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

1. Understands the normal and pathologic anatomy of the atrioventricular and semilunar valves;
2. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
3. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
4. Knows the techniques for repair and replacement of cardiac valves;
5. Knows the preoperative and postoperative management of patients with valvular heart disease.

Contents:

1. Assessment of patients with valvular heart disease
   a. History and physical examination
   b. Echocardiogram
   c. Cardiac catheterization data
2. Choice of treatment
   a. Prosthetic valves
   b. Stented xenografts
   c. Non-stented human and xenograft valves
   d. Autograft valves for aortic valve replacement
   e. Valve repair
3. Long term complications of replacement devices
   a. Thrombosis
   b. Embolus
   c. Prosthetic dysfunction
4. Mitral valve
   a. Normal anatomy
   b. Normal function
   c. Mitral stenosis
      i. etiology and pathologic anatomy
ii. natural history and complications
iii. physiology
iv. non-operative treatment
v. indications for intervention (risk stratification)
vi. merits of balloon valve dilation vs. operative repair or replacement
vii. techniques of valve repair and replacement
viii. intraoperative and postoperative complications and management
ix. early and late results of operative and balloon valvulotomy
d. Mitral incompetence
   i. etiology and pathologic anatomy
   ii. natural history and complications
   iii. physiology (mechanisms of incompetence)
   iv. non-operative treatment
      ▪ for nonischemic etiology
      ▪ for ischemic etiology
   v. indications for surgical intervention (risk stratification)
   vi. techniques of valve repair
      ▪ ring and suture annuloplasty
      ▪ leaflet plication, excision
      ▪ chordal/papillary muscle shortening
      ▪ chordal transposition and artificial chordae
   vii. perioperative care
   viii. early and late results of repair and replacement
5. Aortic valve
   a. Normal anatomy
   b. Normal function
   c. Aortic stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (ventricular hypertrophy, mitral incompetence)
      iv. non-operative therapy
      v. indications for operative intervention (risk stratification)
      vi. techniques of valve replacement and repair
         ▪ management of small aortic root
         ▪ homograft and autograft valve replacement
      vii. perioperative care considerations
      viii. early and late results
   d. Aortic incompetence
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (LV dilatation and LV dysfunction)
      iv. non-operative treatment
      v. indications for operative intervention
         ▪ in absence of clinical symptoms
         ▪ when complicated by endocarditis
         ▪ when complicated by aortic root aneurysm
vi. techniques of valve repair and replacement
   • with endocarditis and aortic root abscess
   • with ascending and root aneurysm
vii. perioperative care considerations
viii. early and late results

6. Tricuspid valve
   a. Normal anatomy
   b. Normal function
c. Tricuspid incompetence
   i. etiology and pathologic anatomy
   ii. physiology
   iii. indications for operation
      • functional incompetence
      • endocarditis
iv. techniques of repair, indications for replacement
      • ring and suture annuloplasty
      • endocarditis (valve excision vs. repair or replacement)
v. perioperative care
      • management of RV dysfunction
      • interventions to decrease pulmonary vascular resistance
vi. early and late results
d. Tricuspid stenosis
   i. etiology and pathologic anatomy
   ii. physiology
   iii. differentiation from constrictive pericarditis
   iv. indications for operative repair vs. replacement
v. techniques of repair and replacement
vi. early and late results

Clinical Skills:

During the training program the resident:

1. Evaluates, diagnoses and selects management strategies for patients with valvular heart disease, including participation in and interpretation of cardiac catheterizations and echocardiograms;
2. Makes use of the therapeutic options and relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
3. Manages preoperative clinical preparation and early and intermediate postoperative care;

Performs valve repair and replacement for valvular disease, interprets intraoperative echo.
CONGENITAL HEART DISEASE

A. Embryology, Anatomy and History

Objective:

At the end of the year, the resident understands the embryology of the heart and great vessels as it relates to the development of congenital heart anomalies, the normal anatomy of the heart, and the abnormal anatomy of the principal congenital cardiac anomalies, and applies this knowledge to the interpretation of echocardiograms, angiocardiograms, and other imaging techniques.

Learner Objectives:

Upon completion of the year the resident:

1. Knows the embryology and anatomy of the normal heart;
2. Knows the embryology and anatomy of major cardiac anomalies;
3. Interprets angiocardiograms, echocardiograms, and other images and correlates these with normal and abnormal cardiac anatomy;
4. Knows the history of congenital cardiac surgery, and the intellectual development of operations used to manage each cardiac anomaly.

Contents:

1. Anatomy and embryology of the normal heart;
2. Embryology and pathologic anatomy of each major congenital cardiac anomaly;
3. Interpretation of angiocardiograms, echocardiograms, and other images
   a. Normal heart
   b. Major congenital cardiac anomalies
4. History of cardiac surgery of congenital heart disease.

Clinical Skills:

During the training program the resident:

1. Applies knowledge of the normal and abnormal anatomy of the heart to the planning and performance of operations;
2. Interprets angiocardiograms, echocardiograms, and other images to diagnose congenital heart disease;
3. Uses knowledge to select the best procedure for individual patients.

B. Physiology and Physiologic Evaluation

Objective:
At the end of this year the resident understands the physiology of the developing heart, the physiologic changes of advancing age and transition ex-utero, and the physiologic consequences of congenital heart disease. The resident understands the findings in and limitations of invasive and non-invasive tests to define physiologic abnormalities and uses them in patient management.

Learner Objectives:

Upon completion of the rotation the resident:

1. Understands normal fetal circulation;
2. Understands the transitional nature of circulation as the fetus becomes a neonate;
3. Understands the physiology of obstructions, of intra- and extracardiac shunts, of abnormal connections to the heart, and of combinations of these anomalies in the fetus, neonate, and child.

Contents:

1. Fetal circulation
   a. Oxygen source
   b. Flow pattern of blood through the heart and circulation
   c. Cardiac output and its distribution
   d. Myocardial function
   e. Regulation of the circulation
2. Transitional and neonatal circulation
   a. General changes
   b. Pulmonary circulation changes (e.g., mechanical factors, oxygen effects, vasoactive substances, hormonal factors)
   c. Ductus arteriosus changes (factors effecting closure or maintaining patency)
   d. Foramen ovale changes (factors effecting closure or maintaining patency)
   e. Physiologic assessment of the neonate
3. Fundamental anatomic abnormalities and physiologic consequences
   a. Anatomic abnormalities: obstruction (e.g., aortic stenosis, pulmonary atresia); extra pathways (e.g., atrial septal defect, ventricular septal defect); abnormal connections (e.g., transposition of the great vessels)
   b. Increased blood flow to a region
   c. Decreased blood flow to a region
   d. Combinations of increased or decreased blood flow to a region (e.g., tetralogy of Fallot, double outlet right ventricle, anomalous pulmonary veins)
   e. Application of these anatomic and physiologic principles to derive the common names for defects
   f. Hemodynamic manifestations of these anatomic and physiologic elements
4. Hemodynamic assessment
   a. Usefulness and limitations of echocardiographic doppler
   b. Usefulness and limitations of cardiac catheterization
   c. Calculations of regional flows and resistances
   d. Calculation of flow resistance and ratio
   e. Pulmonary vascular resistance and pulmonary hypertension
5. Indications for operation
   a. Clinical symptoms and signs of obstructive lesions
   b. Clinical symptoms and signs of extra pathway lesions
   c. Clinical symptoms and signs of abnormal connections

Clinical Skills:

During the training program the resident:

1. Describes the physiologic changes of circulation during neonatal life;
2. Diagnoses clinically important congenital heart diseases in the neonate, infant, and child;
3. Applies a knowledge of anatomic abnormalities and their physiologic consequences to diagnose congenital heart defects;
4. Manages the physiologic aspects of the neonate, infant, and child with congenital heart disease preoperatively, intraoperatively, and postoperatively;
5. Stabilizes patients who are critically ill with congenital heart disease;
6. Performs calculations of blood flows and resistances from cardiac catheterization data.

C. Cardiopulmonary Bypass for Operations on Congenital Cardiac Anomalies

Objective:

At the end of this year the resident has a working knowledge of the principles of cardiopulmonary bypass for congenital heart disease, the techniques of myocardial preservation, and the use of profound hypothermia and total circulatory arrest in the infant and child.

Learner Objectives:

Upon completion of the rotation the resident:

1. Knows the indications for the various techniques of bypass (anatomy, pathophysiology, and technical requirements of the underlying cardiac defects);
2. Knows arterial and venous cannulation techniques for different intracardiac defects;
3. Understands the techniques of myocardial protection in the neonate and young infant;
4. Understands the use of varying levels of hemodilution and anticoagulation;
5. Understands perfusion flow and pressure control;
6. Knows the methods of body temperature manipulation, and the indications for and techniques of profound hypothermia with and without total circulatory arrest.

Contents:

1. Monitoring for cardiopulmonary bypass
   a. Arterial pressure lines
   b. Central venous pressure, pulmonary artery pressure
   c. Temperature monitoring (nasopharyngeal, esophageal, rectal, bladder)
   d. O2 saturation, end-tidal CO2
2. Cannulation
   a. Single venous (indications, technique)
   b. Double venous (indications, technique)
   c. Arterial (technique)
   d. Venting (indications, technique)
   e. Cardioplegia

3. Myocardial preservation techniques
   a. Crystalloid, blood
   b. Cold, warm
   c. Antegrade, retrograde
   d. Additives
   e. Fibrillation

4. Profound hypothermia and total circulatory arrest
   a. Indications
   b. Benefits, disadvantages
   c. Safe duration of total circulatory arrest
   d. Early cerebral complications
   e. Late intellectual, neurological, psychiatric outcome

Clinical Skills:

During the training program the resident:

1. Performs arterial and venous cannulation and initiates cardiopulmonary bypass;
2. Directs the perfusionist in the intraoperative management and conduct of cardiopulmonary bypass;
3. Performs or participates in the repair of congenital heart defects using cardiopulmonary bypass.

D. Left-To-Right Shunts

Objective:

At the end of the year the resident understands the diagnosis and treatment of left-to-right shunts caused by congenital cardiac anomalies, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

1. Knows the anatomy, embryology, and physiology of the most common or important anomalies;
2. Knows the operative indications of the most common or important anomalies;
3. Knows the technical components of the operative repair of the most common or important anomalies;
4. Understands the postoperative care of each anomaly.

Contents:
1. Atrial septal defect
   a. Anatomy
      i. types of atrial septal defects and key landmarks of the right atrium.
   b. Clinical features
      i. natural history, indications for operation
      ii. clinical signs and symptoms, physical exam
      iii. chest x-ray and ECG
      iv. echocardiogram and cardiac catheterization
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. incisions in the heart
      iii. techniques for defect closure
      iv. treatment of associated anomalies (e.g., cleft mitral valve)
      v. complications of closure (e.g., air embolism, conduction abnormalities, residual defects)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
2. Ventricular septal defect
   a. Anatomy
      i. types
   b. Clinical features
      i. clinical signs and symptoms, physical exam
      ii. echocardiogram and cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history
      v. indications, contraindications, timing of operation (e.g., total repair vs. pulmonary artery banding)
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. incisions for different types of defects
      iii. closure techniques (direct suture vs. patch)
      iv. treatment of associated anomalies (e.g., atrial septal defect, right ventricular muscle bands)
      v. complications (rhythm disturbances, residual defects, air)
      vi. techniques of PA banding
   d. Outcomes
      i. expected operative mortality
      ii. long-term results
      iii. complications
3. Patent ductus arteriosus
   a. Anatomy
   b. Physiology
      i. neonate vs. older child
      ii. effect of prostaglandin and prostaglandin inhibitors
   c. Diagnosis and clinical features
i. symptoms and physical findings  
ii. echocardiogram and cardiac catheterization  
iii. chest x-ray and ECG  
iv. natural history (neonate vs. older child, endocarditis)  
v. indications for operation  
vi. associated anomalies (e.g., ductus-dependent conditions)  
d. Operative repair and complications  
i. operative techniques for simple ductus  
ii. management of the difficult ductus  
iii. complications of operative repair  
e. Outcome  
i. expected operative mortality  
ii. long-term results  
iii. complications

4. Atrioventricular septal defect

a. Anatomy
   i. types (complete, transitional, ostium primum ASD)
   ii. atrioventricular valve pathologic anatomy
b. Physiology
   i. shunts and resistance calculation  
   ii. complete vs. incomplete

c. Diagnosis and clinical features
   i. symptoms and signs (infant vs. older patient, physical exam)  
   ii. echocardiogram, angiocardiogram, cardiac catheterization  
   iii. chest x-ray and ECG  
   iv. natural history (development of Eisenmenger's syndrome)  
   v. indications for and timing of operation (size of shunt, endocarditis risk, total repair vs. pulmonary artery banding)
d. Operative repair and complications  
i. cardiopulmonary bypass and myocardial protection  
ii. incisions in the heart  
iii. operative techniques  
iv. complications (residual defects, residual “mitral valve” insufficiency, heart block)  
e. Outcome  
i. expected operative mortality  
ii. long-term results  
iii. complications

5. Double-outlet right ventricle

a. Anatomy
   i. types (subaortic, subpulmonic, uncommitted)  
   ii. associated anomalies

b. Clinical features
   i. natural history  
   ii. indications for and timing of operation  
   iii. signs and symptoms of each of the anatomic types  
   iv. chest x-ray, ECG
v. echocardiogram and cardiac catheterization

c. Operative repair and complications
   i. palliative operations vs. total repair (application of shunts, pulmonary artery band, total repair)
   ii. cardiopulmonary bypass and myocardial protection
   iii. approach to each anatomic subtype and placement of incisions in the heart
   iv. specific operative techniques (e.g., suturing, placement of patches)
   v. complications and their management

d. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

6. Aorto-pulmonary window
   a. Anatomy
   b. Clinical features
      i. natural history (development of pulmonary vascular obstructive disease)
      ii. symptoms and signs
      iii. echocardiogram, angiocardiogram, cardiac catheterization
      iv. chest x-ray, ECG
   c. Operative repair
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

Clinical Skills:

During the training program the resident:

1. Participates in or performs the operative repair of atrial septal defects, ventricular septal defects, patent ductus arteriosus, and pulmonary artery banding;
2. Participates in or performs the repair of more complex cardiac anomalies;
3. Performs the preoperative evaluation of patients with each of these anomalies;
4. Manages postoperative care.

E. Cyanotic Anomalies

Objective:

At the end of this year the resident knows the anatomy and physiology of anomalies that result in cyanosis, their diagnosis, their preoperative, operative, and postoperative management, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:
1. Knows the anatomy and physiology of each anomaly;
2. Knows the methods of diagnosis;
3. Understands the role of medical management and interventional cardiology as treatment options;
4. Knows the indications for and timing of operation;
5. Understands the technical components of operative repair;
6. Knows the postoperative care, expected outcome, long-term results, and complications.

Contents:

1. Tetralogy of Fallot
   a. Anatomy and embryology
      i. embryology of malaligned ventricular septal defect
      ii. levels of right ventricular outflow tract obstruction
   b. Physiology
      i. genesis of “tet spells” and infundibular spasm
      ii. factors which affect degree of right-to-left shunt
      iii. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. role of systemic-to-pulmonary artery shunt vs. total repair
      ii. types of aortic-to-pulmonary artery shunts
      iii. extracorporeal bypass and myocardial protection
      iv. ventricular septal defect closure by transventricular or transatrial approach
      v. techniques for relief of right ventricular outflow tract obstruction and indications for transannular patching
      vi. indications for conduit repair
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
2. Transposition of the great vessels (TGA)
   a. Anatomy
      i. simple TGA
      ii. complex TGA (ventricular septal defect, pulmonary stenosis)
   b. Physiology
      i. concept of circulations in parallel and mixing
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
v. indications for and timing of operations
d. Operative repair and complications
   i. technique of Blalock-Hanlon atrial septectomy, open atrial septectomy
   ii. cardiopulmonary bypass and myocardial protection
   iii. operative techniques for total repair (Mustard, Senning, arterial switch, Rastelli)
   iv. palliative operations (PA band, systemic-to-pulmonary artery shunt)
e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
   iv. arrhythmias after atrial repairs
   v. semilunar insufficiency, PA stenosis, coronary problems after arterial switch
   vi. conduit obstruction after Rastelli
3. Truncus arteriosus
   a. Anatomy
      i. types of truncus arteriosus
      ii. associated anomalies (VSD, left ventricular outflow tract obstruction, arch interruption, DiGeorge syndrome)
b. Clinical features
   i. symptoms and physical findings
   ii. cardiac catheterization, echocardiogram, angiocardiogram
   iii. chest x-ray, ECG
   iv. natural history (development of pulmonary vascular obstructive disease)
   v. indications for and timing of operation
c. Operative repair and complications
   i. extracorporeal bypass and myocardial protection
   ii. operative techniques
      • conduits (composite and homograft)
      • modifications required for types II and III truncus
   iii. techniques for repair of associated anomalies
d. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
4. Tricuspid atresia
   a. Anatomy
      i. types I and II, subtypes
b. Physiology
   i. subtypes with right-to-left shunt
   ii. subtypes with left-to-right shunt
c. Clinical features
   i. symptoms and physical findings
   ii. echocardiogram, angiocardiogram, cardiac catheterization
   iii. chest x-ray, ECG
   iv. natural history, role of balloon atrial septostomy
   v. indications for and timing of operation
vi. role of palliative operations (systemic-pulmonary artery shunts, PA banding, bidirectional Glenn, Fontan, other right heart bypass operations)

d. Operative repair and complications
   i. palliative operations
   ii. operations for right heart bypass (bidirectional Glenn, Fontan)

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

5. Total anomalous pulmonary venous connection
   a. Anatomy
      i. supracardiac, cardiac, infracardiac, mixed
   b. Physiology
      i. obstructive vs. nonobstructive
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardioan
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques for different subtypes
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

6. Ebstein's anomaly
   a. Anatomy
   b. Physiology
      i. concept of atrialized ventricle
      ii. right ventricular outflow tract obstruction
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardioan
      iii. chest x-ray, ECG
      iv. natural history
      v. associated lesions (e.g., Wolf-Parkinson-White syndrome)
      vi. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. technique of tricuspid repair, obliteration of atrIALIZED ventricle
      iii. technique of tricuspid valve replacement
   e. Outcome
      i. expected operative mortality
      ii. long-term results
iii. complications

Clinical Skills:

During the training program the resident:

1. Participates in or performs the major palliative operations for these congenital cardiac anomalies;
2. Participates in or performs operative repair of tetralogy, TGA, truncus arteriosus, TAPVR, Ebstein's anomaly, and Fontan-type operations;
3. Performs preoperative evaluation and preparation;
4. Manages postoperative care.

F. Obstructive Anomalies

Objective:

At the end of this year the resident understands the anatomy and physiology of obstructive anomalies of the left and right sides of the heart and aorta, their diagnosis, management, and postoperative care, and performs the operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

1. Knows the anatomy and physiology of each anomaly;
2. Knows the methods of diagnosis;
3. Understands the role of medical management and interventional cardiology;
4. Knows the indications for and timing of operation;
5. Knows the technical components of operative repair;
6. Understands the principles of postoperative care;
7. Knows the expected outcome, long-term results and complications

Contents:

1. Aortic stenosis
   a. Anatomy
      i. supravalvular, valvular, subvalvular (including subtypes)
   b. Physiology
      i. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
i. extracorporeal bypass, myocardial protection
ii. operative techniques
iii. pros and cons of various techniques and patch configurations for supravalvular stenosis
iv. techniques of aortic valvotomy
v. operations to enlarge the aortic annulus (e.g., Konno-Rastan procedure, Ross procedure)
vi. technique of apical aortic conduit
vii. myomectomy and myotomy for subaortic obstruction
e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

2. Pulmonary stenosis
   a. Anatomy
      i. valvular and supravalvular
      ii. associated anomalies (e.g., atrial septal defect, ventricular septal defect, branch stenosis)
   b. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history; role of balloon valvuloplasty
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. incisions in the heart and great vessels
      iii. operative considerations (technique of valvulotomy, indications for transannular patching, division of right ventricular muscle bands)
      iv. complications (residual obstruction)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

3. Coarctation of the aorta
   a. Anatomy
      i. relationship to the ductus arteriosus
      ii. associated anomalies (e.g., hypoplasia of transverse aorta, patent ductus arteriosus, LVOT obstruction)
   b. Physiology
      i. infant vs. older child
      ii. “preductal” vs. “postductal”
      iii. assessment of adequacy of collateral circulation
   c. Clinical features
      i. symptoms and physical findings (neonate with a closing ductus vs. older infant and child)
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
vi. role of prostaglandins in stabilizing neonates
vii. effect of associated anomalies (e.g., patent ductus arteriosus, aortic stenosis, ventricular septal defect)

d. Operative repair and complications
   i. methods of repair (end-to-end vs. patch vs. subclavian angioplasty)
   ii. methods of arch reconstruction
   iii. complications (residual obstruction, paraplegia, chylothorax)
   iv. extracorporeal bypass, shunts in the absence of adequate collateral circulation

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
   iv. re-coarctation

4. Interrupted aortic arch
   a. Anatomy
      i. types A, B, and C
      ii. associated anomalies (e.g., DiGeorge syndrome, VSD)
   b. Physiology
      i. role of ductal patency, prostaglandin
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. the role of prostaglandins in preoperative stabilization
      vii. DiGeorge syndrome (hypocalcemia, need for irradiated blood)
   d. Operative repair and complications
      i. extracorporeal bypass, hypothermic arrest
      ii. median sternotomy vs. left thoracotomy
      iii. techniques (e.g., end-to-end anastomosis, interposition grafting, absorbable vs. nonabsorbable sutures)
      iv. complications (e.g., residual obstruction, recurrent laryngeal nerve injury, chylothorax)
      v. repair of associated anomalies
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
      iv. reoperation
      v. management of DiGeorge syndrome

5. Vascular ring
   a. Anatomy
      i. double aortic arch, anomalous subclavian artery, unusual rings, pulmonary artery sling
   b. Physiology
      i. compression of airway and esophagus
   c. Clinical features
i. signs and symptoms
ii. barium esophagogram, CT scan, MRI

**d. Operative repair and complications**

i. techniques for exposure by left thoracotomy, indications for other approaches
ii. technique for correction of each type
iii. role of aortopexy
iv. complications (e.g., recurrent laryngeal nerve paralysis, chylothorax, residual tracheomalacia)

**e. Outcome**

i. expected operative mortality
ii. long-term results
iii. complications
iv. residual tracheomalacia

**Clinical Skills:**

During the training program the resident:

1. Performs corrections for patent ductus arteriosus and coarctation of the aorta;
2. Participates in or performs aortic valvotomy, repair of supravalvular and subvalvular aortic stenosis, pulmonary valvotomy, correction of subvalvular pulmonary stenosis, correction of vascular rings;
3. Participates in or performs operations for left ventricular outflow obstruction and interrupted aortic arch;
4. Performs preoperative evaluation and preparation;
5. Manages postoperative care;
6. Uses prostaglandins in the management of patients with neonatal coarctation, interrupted aortic arch, critical aortic stenosis.

**G. Miscellaneous Anomalies**

**Objective:**

At the end of this year the resident is familiar with the anatomy, physiology, diagnosis, and operative treatment of unusual complex congenital anomalies and performs operative and non-operative treatment.

**Learner Objectives:**

Upon completion of the year the resident:

1. Understands the natural history, evaluation, and treatment of coronary anomalies, congenital complete heart block, hypoplastic left heart syndrome, pulmonary atresia (with and without VSD), “corrected transposition”, single ventricle, cleft atriatium, and cardiac tumors;
2. Understands the role of corrective and palliative operations for the above anomalies and of cardiac transplantation for appropriate cardiac pathology.

**Contents:**
1. Normal and abnormal anatomy
2. Physiology of each anomaly
3. Preoperative evaluation and diagnosis
4. Operative strategies and complications
5. Outcomes

Clinical Skills:
During the training program the resident:

1. Performs or assists in pacemaker insertion, systemic-to-pulmonary artery shunting for pulmonary atresia or stenosis (with or without VSD), and pulmonary artery banding for large left-to-right shunts;
2. Evaluates angiograms, echocardiograms, and cardiac catheterizations of the above anomalies;
3. Develops treatment plans for the above anomalies;
4. Participates in or performs operative treatment for the above anomalies;
5. Manages postoperative care for the above anomalies.

**H. Principles of Postoperative Care**

Objective:

At the end of this year the resident understands postoperative care of patients having palliation or correction of congenital cardiac anomalies and manages all aspects of their postoperative care.
GOALS AND OBJECTIVES
GENERAL THORACIC SURGERY ROTATION
Institution #1 – University of Minnesota Medical Center
Duration: 6 months, Year 1

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine thoracoscopic diagnostic procedures, lobectomy and pneumonectomy, mediastinoscopy and mediastinotomy, laparoscopic Nissen fundoplication, esophagectomy, and flexible/rigid bronchoscopy and esophagoscopy.

Use information technology: Fellows learn to use currently available information technology sources – Medline, Pubmed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC.

Evaluate diagnostic studies: During the thoracic rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest computed tomography examinations, PET examinations, bone scans, pulmonary function studies, contrast esophagrams, 24 hour pH studies, and esophageal manometry. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Thoracic Oncology Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.
Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the General Thoracic Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.

Counsel and educate patients and families:
Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

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Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Maintain a log of continuity of care of patients seen in the Thoracic Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.
Medical Knowledge: Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

The Thoracic Fellow is expected to master the following core topics by the end of the rotation:

CHEST WALL

A. Anatomy, Physiology and Embryology

Learner Objectives—upon completion of this unit the fellow:

1. Understands the anatomy and physiology of the cutaneous, muscular, and bony components of the chest wall and their anatomic and physiologic relationships to adjacent structures;
2. Understands the anatomy of the vascular, neural, muscular, and bony components of the thoracic outlet;
3. Knows all operative approaches to the chest wall;
4. Knows the surgical anatomy, neural, vascular, and skeletal components of the chest wall, as well as the major musculocutaneous flaps.

Contents:

1. Chest wall embryology
   a. Ectodermal, mesodermal, endodermal
2. Chest wall anatomy
   a. Skeletal
   b. Muscular
   c. Neural
   d. Vascular
   e. Relationships to adjacent structures
3. Diagnostic tests to define chest wall anatomy
   a. Chest x-ray
   b. CAT scans
   c. MRI scans
   d. Nuclear scans
   e. Pulmonary function tests
4. Major flaps of the chest wall and their vascular pedicles
   a. Latissimus dorsi
   b. Pectoralis major
   c. Serratus anterior
   d. Trapezius
   e. Intercostal
   f. Pleural
   g. Pericardial fat pad
   h. Rectus abdominis
   i. Omental
   j. Vascularized rib graft
Clinical Skills—during the training program the fellow:

1. Recognizes the normal and abnormal anatomy of the chest wall;
2. Reads and interprets tests to diagnose chest wall abnormalities;
3. Performs operations utilizing major chest wall flaps and the correct application of prosthetic materials.

B. Acquired Abnormalities and Neoplasms

Learner Objectives—upon completion of this rotation the fellow:

1. Understands the diagnosis and management of various chest wall infections;
2. Evaluates and diagnoses primary and metastatic chest wall tumors, knows their histologic appearance, and understands the indications for incisional versus excisional biopsy;
3. Knows the radiologic characteristics of tumors;
4. Knows the indications for and methods of prosthetic chest wall reconstruction (e.g., methylmethacrylate, Marlex®, Gortex®, Vicryl®, and Dacron® mesh);
5. Knows the types of chemotherapy and radiotherapy (induction neo-adjuvant and adjuvant therapy) of chest wall tumors and the indications for preoperative and postoperative therapy;
6. Knows the management of osteoradionecrosis of the chest wall.

Contents:

1. Malignant neoplasms of the chest wall
   a. Chondrosarcoma
   b. Osteogenic sarcoma
   c. Myeloma
   d. Ewing's sarcoma
   e. Metastatic lesions
   f. Lung cancer invading the chest wall
2. Benign neoplasms of the chest wall
   a. Fibrous dysplasia
   b. Chondroma
   c. Osteochondroma
   d. Eosinophilic granuloma

Clinical Skills—during the training program the fellow:

1. Performs a variety of surgical incisions to expose components of the chest wall and interior thoracic organs;
2. Performs surgical resections of primary and secondary chest wall tumors;
3. Identifies the need for major flaps of the chest wall;
4. Identifies the need for prosthetic replacement of the chest wall;
5. Performs surgical reconstruction of chest wall defects.

LUNGS AND PLEURA
A. Anatomy, Physiology, Embryology and Testing

Learner Objectives—upon completion of this rotation the fellow:

1. Understands the segmental anatomy of the bronchial tree and bronchopulmonary segments;
2. Understands the arterial, venous and bronchial anatomy of the lungs and their inter-relationships;
3. Understands the lymphatic anatomy of the lungs, the major lymphatic nodal stations, and lymphatic drainage routes of the lung segments;
4. Knows the indications for different thoracic incisions, the surgical anatomy encountered, and the physiological impact;
5. Knows the indications for plain radiography, CT scan, magnetic resonance imaging, and PET scanning for staging of lung cancer;
6. Knows the indications, interpretation, and use of nuclear medicine ventilation/perfusion scanning (V/Q scan) to determine the operability of candidates for pulmonary resection;
7. Understands the methods of invasive staging (e.g., mediastinoscopy, Chamberlain procedure, scalene node biopsy, thoracoscopy);
8. Knows how to interpret pulmonary function tests;
9. Knows how to perform pulmonary function tests.

Contents:

1. Normal anatomy and histology of the lung
   a. Segmental anatomy of the bronchial tree
   b. Bronchopulmonary segments (topography)
   c. Hilar anatomy
   d. Lymphatic anatomy and drainage of the lung
   e. Histologic anatomy and cell types of the lung
   f. Endoscopic anatomy of the larynx, trachea, and bronchi
2. Normal physiology of the lung
   a. Chest wall mechanics
   b. Large and small airway mechanics
   c. Alveolar mechanics and gas exchange
   d. Chest x-ray
   e. CT scan of the chest and abdomen
   f. MRI of the chest
   g. Contrast angiography of major vessels within the chest
   h. Radioactive isotope scanning of organs within the chest
   i. Anterior thoracotomy
   j. Posterolateral thoracotomy
   k. Posterior thoracotomy
   l. Muscle sparing thoracotomy
   m. Mediastinotomy
   n. Transverse anterior sternotomy
   o. Incisions common to video assisted thoracic surgery
   p. Incisions common to cervical and anterior mediastinoscopy
Clinical Skills—during the training program the fellow:

1. Reads and interprets pulmonary function studies, ventilation/perfusion scans, pulmonary arteriograms and arterial blood gases, and correlates the results with operability;
2. Applies knowledge of thoracic anatomy to the physical examination of the chest, heart, and vascular tree;
3. Applies knowledge of thoracic anatomy to flexible and rigid endoscopy;
4. Uses knowledge of chest, pulmonary, and cardiac physiology to interpret tests involving the thoracic cavity and to understand and treat diseases of the chest and its contents;
5. Reads and interprets plain radiography, CT scans, magnetic resonance imaging, and PET scanning of the chest;
6. Participates in the performance of exercise tolerance tests and pulmonary function tests.

B. Non-Neoplastic Lung Disease

Learner Objectives—upon completion of this rotation the fellow:

1. Understands diagnostic procedures used to evaluate non-neoplastic lung disease;
2. Knows the common pathogens that produce lung infections, including their presentation and pathologic processes, and knows the treatment and indications for operative intervention;
3. Understands the natural history, presentation and treatment of chronic obstructive lung disease;
4. Knows the indications for bullectomy, lung reduction, and pulmonary transplantation;
5. Understands the pathologic results and alterations of pulmonary function due to bronchospasm;
6. Understands the principles of surgical resection for non-neoplastic lung disease;
7. Understands the mechanisms by which foreign bodies reach the airways, how they cause pulmonary pathology, and the management of patients with airway foreign bodies;
8. Understands the causes, physiology, evaluation and management of hemoptysis;

Contents:

1. Common pulmonary pathogens
   a. Bacteria
   b. Fungi
   c. Tuberculosis mycobacterium
   d. Viruses
   e. Protozoa
   f. Immunocompromised patients
2. Chronic obstructive pulmonary disease
   a. Natural history
   b. Presentation, evaluation
   c. Alteration of lung function
   d. Complications requiring operative treatment
   e. Treatment (operative and non-operative)
3. Bronchospasm  
   a. Natural history  
   b. Evaluation  
   c. Complications requiring operative treatment  
   d. Treatment (operative and non-operative)  
4. Foreign bodies of the lung and airways  
   a. Common types  
   b. Causes, pathology  
   c. Evaluation  
   d. Treatment (operative and non-operative)  
5. Hemoptysis  
   a. Causes  
   b. Physiologic derangements  
   c. Evaluation  
   d. Treatment (operative and non-operative)  
6. Pneumothorax  
   a. Etiology  
   b. Indications for treatment  
   c. Types of treatment  

Clinical Skills—during the training program the fellow:  
1. Diagnoses and treats patients with bacterial, fungal, tuberculous, and viral lung infections;  
2. Performs operative and non-operative management of lung abscess;  
3. Performs resections of lung and bronchi in patients with non-neoplastic lung disease;  
4. Manages patients with chronic obstructive lung disease, bronchospastic airway disease, foreign bodies of the airways, and hemoptysis;  
5. Performs thoracentesis, mediastinoscopy, mediastinotomy, flexible and rigid bronchoscopy, thoracoscopy, and open lung biopsy;  
6. Performs bronchoalveolar lavage and transbronchial lung biopsy.  

C. Neoplastic Lung Disease  

Learner Objectives—upon completion of this rotation the fellow:  
1. Understands TNM staging of lung carcinoma and its application to the diagnosis, therapeutic planning, and management of patients with lung carcinoma;  
2. Evaluates and diagnoses neoplasia of the lung, using a knowledge of the histologic appearance of the major types;  
3. Knows the signs of inoperability;  
4. Understands the therapeutic options for patients with lung neoplasms;  
5. Understands the principles of bronchoplastical surgery;  
6. Understands the complications of pulmonary resection and their management;  
7. Understands the role of adjuvant therapy for lung neoplasms;
8. Understands the indications for resection of benign lung neoplasms;
9. Understands the indications for resection of pulmonary metastases.

Contents:

1. Benign tumors of the lung and airways
   a. Pathology, biologic behavior
   b. Evaluation, diagnosis, treatment (operative and non-operative)
2. Solitary lung nodule
   a. Differential diagnosis, evaluation, diagnostic techniques
   b. Treatment (operative and non-operative)
3. Malignant tumors of the lung and airways
   a. Pathology, biologic behavior
   b. Evaluation, diagnosis, treatment (operative and non-operative)
4. Metastatic tumors to the lungs
   a. Pathology and biologic behavior
   b. Evaluation, diagnosis, treatment (operative and non-operative)

Clinical Skills—during the training program the fellow:

1. Evaluates patients with lung neoplasia and recommends therapy based on their functional status, pulmonary function and tumor type;
2. Performs staging procedures (e.g., bronchoscopy, mediastinoscopy, mediastinotomy, and thoracoscopy);
3. Performs operations to extirpate neoplasms of the lung (e.g., local excision, wedge resection, segmental resection, lobectomy, pneumonectomy, sleeve lobectomy, carinal resection, chest wall resection);
4. Recognizes and manages complications of pulmonary resections (e.g., space problem, persistent air leak, bronchopleural fistula, bronchovascular fistula, empyema, cardiac arrhythmia);
5. Performs bedside bronchoscopies and placement of tracheostomies and/or minitracheostomies;
6. Recognizes and treats the early signs of non-cardiac pulmonary edema.

E. Diseases of the Pleura

Learner Objectives—upon completion of this rotation the fellow:

1. Is familiar with the clinical presentation of benign and malignant diseases of the pleura;
2. Understands the types of pleural effusions, their evaluation and treatment;
3. Understands the management of empyema with and without bronchopleural fistula;
4. Understands the indications, contraindications, and complications of video assisted thoracic surgery and has a working knowledge of the equipment;
5. Understands the treatment of benign and malignant diseases of the pleura.

Contents:

1. Mesothelioma
a. Pathology, biologic behavior, and natural history
b. Treatment (operative and non-operative)

2. Pleural effusions
   a. Types
   b. Diagnosis
   c. Treatment (operative and non-operative)

3. Empyema
   a. Presentation with and without bronchopleural fistula
   b. Diagnosis
   c. Treatment (operative and non-operative)
   d. Surgical options (e.g., thoracentesis, tube thoracostomy, decortication, rib resection, repair of bronchopleural fistula)

Clinical Skills—during the training program the fellow:

1. Evaluates pleural effusions and recommends appropriate therapy;
2. Performs invasive diagnostic studies (e.g., incisional and excisional biopsy, needle biopsy, fluid analysis);
3. Places tube thoracostomies and performs chemical or mechanical pleurodesis;
4. Performs initial drainage procedures and subsequent procedures for empyema (e.g., decortication, empyemectomy, rib resection, Eloesser flap, Claggett procedure, closure of bronchopleural fistula);
5. Performs video assisted thorascopic surgery as necessary for the diagnosis and treatment of pleural disease.
6. Places pleuroperitoneal shunts;
7. Performs pleural stripping for mesothelioma.
MEDIASTINUM AND PERICARDIUM

A. Anatomy, Physiology and Embryology

Learner Objectives—upon completion of this rotation the fellow:

1. Understands the anatomic boundaries of the mediastinum and the structures found within each region;
2. Understands the embryologic development of structures within the mediastinum and the variations and pathologic consequences of abnormally located structures;
3. Understands the radiologic assessment of the mediastinum including CT scan, MRI, contrast studies, and angiography;
4. Understands the aberrations caused by pericardial abnormalities and their effects on the heart and circulation.

Contents:

1. Superior mediastinum
   a. Major structures
   b. Diagnostic studies
2. Anterior mediastinum
   a. Major structures
   b. Diagnostic studies
3. Middle mediastinum (visceral compartment)
   a. Major structures
   b. Diagnostic studies
4. Posterior mediastinum (paravertebral sulcus)
   a. Major structures
   b. Diagnostic studies

During the training program the fellow:

1. Reads and interprets mediastinal plain radiographs, CT scans, MRI, and contrast studies;
2. Applies knowledge of mediastinal anatomy and physiology to the diagnosis of mediastinal abnormalities;
3. Applies knowledge of pericardial physiology to the diagnosis of pericardial abnormalities.

B. Congenital Abnormalities of the Mediastinum

Learner Objectives—upon completion of this rotation the fellow:

1. Is able to diagnose mediastinal cysts;
2. Is familiar with the symptoms associated with mediastinal abnormalities;
3. Knows the indications for operations involving the mediastinum and the anatomic approaches.

Contents:
1. Mediastinal cysts
   a. Mediastinal cysts
   b. Pericardial cysts
   c. Cystic hygroma
   d. Bronchogenic cysts
   e. Esophageal duplications
   f. Management (operative and non-operative)
2. Symptoms of mediastinal abnormalities

Clinical Skills—during the training program the fellow:

1. Reads and interprets plain radiographs, CT scans, MRI's and contrast studies of congenital abnormalities of the mediastinum;
2. Diagnoses and manages patients with congenital abnormalities of the mediastinum;
3. Performs operations for congenital abnormalities of the mediastinum.

C. Acquired Abnormalities of the Mediastinum

Learner Objectives—upon completion of this rotation the fellow:

1. Understands mediastinal infections and their management;
2. Understands the diagnostic tests available;
3. Recognizes the histologic appearance of benign and malignant mediastinal neoplasms;
4. Understands the neoplastic and non-neoplastic mediastinal diseases;
5. Understands the operative management of benign and malignant mediastinal neoplasms;
6. Understands chemotherapy and radiotherapy in mediastinal neoplasm management.

Contents:

1. Anterior mediastinal tumors
   a. Thymoma
   b. Thyroid
   c. Teratoma
   d. Lymphoma
   e. Germ cell tumor
   f. Histologic appearance
   g. Management (operative and non-operative)
2. Middle mediastinal tumors
   a. Lymphoma
   b. Hamartoma
   c. Cardiac tumors
   d. Histologic appearance
   e. Management (operative and non-operative)
3. Posterior mediastinum (paravertebral sulcus)
   a. Neurilemoma
   b. Neurofibroma
c. Pheochromocytoma
d. Ganglion neuroma
e. Dumbbell neurogenic tumor
f. Histologic appearance
g. Management (operative and non-operative)

4. Mediastinal infection
   a. Postoperative
   b. Primary
   c. Management (operative and non-operative)

5. Diagnostic tests
   a. Plain radiographs
   b. CT scans
   c. MRI
d. Contrast studies
e. Radionucleotide studies
f. Ultrasound
g. Fine needle aspiration
h. Core biopsy
i. Mediastinoscopy
j. Serologic tests

Clinical Skills—during the training program the fellow:

1. Performs diagnostic tests and operations on the mediastinum;
2. Diagnoses and manages mediastinal infection;
3. Recognizes the histologic appearance of mediastinal tumors;

**TRACHEA AND BRONCHI**

A. Anatomy, Physiology and Embryology

Learner Objectives—upon completion of this rotation the fellow:

1. Understands the anatomy and blood supply of the trachea and bronchi;
2. Understands the endoscopic anatomy of the nasopharynx, hypopharynx, larynx, trachea, and major bronchi;
3. Understands and interprets pulmonary function studies of the trachea and bronchi;
4. Understands the radiologic assessment of the trachea and bronchi.

Contents:

1. Trachea
   a. Blood supply
b. Histologic and gross anatomy
c. Lymphatic anatomy and drainage
d. Contiguous structures
e. Radiographic anatomy and tests
f. Endoscopic anatomy and tests

2. Bronchi
   a. Blood supply
   b. Histologic and gross anatomy
c. Segmental anatomy
d. Lymphatic relationships
e. Radiographic anatomy and tests
f. Endoscopic anatomy and tests

3. Physiologic evaluation
   a. Pulmonary function tests
   b. Flow volume loops

4. Radiologic evaluation
   a. Plain radiographs
   b. Tomography
c. CT scan
d. Fluoroscopy
e. MRI
f. Barium swallow

Clinical Skills—during the training program the fellow:

1. Interprets plain radiographic analyses, CT scan, MRI, and pulmonary function studies involving the trachea and bronchi;
2. Performs endoscopy of the upper airway, trachea and major bronchi.

B. Congenital and Acquired Abnormalities

Learner Objectives—upon completion of this rotation the fellow:

1. Understands congenital abnormalities and idiopathic diseases of the trachea;
2. Understands the etiology, presentation and management of acquired tracheal strictures and their prevention;
3. Understands the etiology, presentation, diagnosis and management of tracheoesophageal fistulas and tracheoinnominate artery fistulas;
4. Knows the operative approaches to the trachea and techniques of mobilization;
5. Knows the methods of airway management, anesthesia and ventilation for tracheal operations;
6. Knows the principles of tracheal surgery and release maneuvers;
7. Understands the complications of tracheal surgery and their management;
8. Understands the etiology, presentation, and principles of airway trauma management;
9. Understands the radiologic evaluation of tracheal abnormalities.

Contents:
1. Radiologic assessment of the trachea and bronchi
   a. Plain x-rays
   b. CT scans
   c. MRI
   d. Barium swallow
2. Stricture of the trachea
   a. Post-intubation
   b. Post-tracheostomy
   c. Post-traumatic
3. Anesthesia for tracheal operations
   a. Methods of airway control
   b. Extubation concerns
4. Operative approaches to the trachea
   a. Reconstruction of the upper trachea
   b. Reconstruction of the lower trachea
   c. Mediastinal tracheostomy
5. Tracheostomy and its complications
   a. Tracheal stenosis
   b. Tracheo-esophageal fistula
   c. Tracheo-innominate artery fistula
   d. Persistent tracheal stoma
6. Airway trauma
   a. Airway control
   b. Evaluation of associated injuries
   c. Principles of repair (primary and secondary)
   d. Protecting tracheostomies

Clinical Skills during the training program the fellow:

1. Evaluates diagnostic tests of the trachea and bronchi;
2. Performs laryngoscopy and bronchoscopy of the trachea and bronchi, including dilation of stenoses;
3. Performs tracheostomy
4. Evaluates patients for tracheal resection and plans the operation;
5. Performs tracheal resection and reconstruction for tracheal stenosis;
6. Performs placement of tracheal T-tubes;
7. Performs the operations for tracheo-esophageal fistula, tracheo-innominate fistula, subglottic stenosis, and traumatic airway injury.

C. Neoplasms

Learner Objectives—upon completion of this rotation the fellow:

1. Knows the types, histology, and clinical presentation of tracheal neoplasms;
2. Understands the radiologic evaluation and operative management of tracheal neoplasms;
3. Understands the methods of airway management;
4. Knows the indications for and the use of radiotherapy and chemotherapy.
Contents:

1. Neoplasms of the trachea  
   a. Benign  
   b. Malignant  
   c. Metastatic  
2. Operative techniques  
   a. Resection of tracheal tumors  
   b. Methods of tracheal reconstruction  
   c. Operative approaches  
3. Prosthetics  
   a. Silastic prosthetics  
   b. Stents  
   c. Types of tracheostomy tubes and tracheal T-tubes  
4. Airway management  
   a. Bronchoscopic “core out”  
   b. Laser  

Clinical Skills—during the training program the fellow:

1. Performs rigid and flexible bronchoscopy for diagnosis and “core-out”;
2. Performs resection of tracheal tumors;
3. Manages patients and their airways after tracheal resection;
4. Uses laser techniques in the management of endoluminal tumors;
5. Uses stents, tracheal T-tubes and tracheostomy tubes in the management of tracheal neoplasms;
6. Uses adjunctive therapy for the management of tracheal tumors.

DIAPHRAGM

A. Anatomy, Physiology and Embryology

1. Knows the embryologic origin of the diaphragm;
2. Understands the anatomy of the diaphragm and adjacent structures;
3. Understands the neural and vascular supply of the diaphragm and the pathologic consequences of injury;
4. Understands imaging studies for assessing the diaphragm;
5. Understands the consequences of incisions in the diaphragm;
6. Understands developmental anomalies of the diaphragm.

Contents:

1. Normal anatomy of the diaphragm  
   a. Origins and insertions  
   b. Vascular and neural supply  
2. Foramina of the diaphragm
a. Esophageal
b. Vascular
c. Morgagni and Bochdalek

3. Contiguous structures
   a. Heart
   b. Lungs
   c. Vessels
   d. Chest wall

Clinical Skills—during the training program the fellow:

1. Uses knowledge of the normal anatomy and physiology of the diaphragm to treat primary or contiguous abnormalities;
2. Evaluates and interprets radiographic studies of the diaphragm, including fluoroscopy, CT scan, and MRI.

B. Acquired Abnormalities, Neoplasms

1. Understands the presentation of diaphragmatic rupture and associated injuries;
2. Knows evaluation methods for penetrating injuries of the diaphragm;
3. Knows management of infections immediately above and below the diaphragm;
4. Understands the etiology, presentation, diagnosis, and management of acquired diaphragmatic hernias;
5. Understands the etiology, diagnosis, and treatment of diaphragmatic paralysis;
6. Understands the primary and secondary tumors of the diaphragm and their management;
7. Understands reconstruction methods for the diaphragm;
8. Understands the indications for and techniques of diaphragmatic pacing.

Contents:

1. Diaphragmatic rupture
   a. Clinical presentation
   b. Physiologic effects
   c. Operative management
   d. Management of associated injuries
2. Periphrenic abscess
   a. Clinical presentation
   b. Physiologic effects
   c. Operative management
3. Acquired diaphragmatic hernias
   a. Esophageal
   b. Eventration
   c. Treatment
4. Tumors of the diaphragm
   a. Mesenchymal origin (benign and malignant)
b. Neurogenic (benign and malignant)
c. Secondary (lung, esophageal, mesothelioma)
d. Treatment

5. Paralysis of the diaphragm
   a. Causes
   b. Diagnosis
   c. Treatment

Clinical Skills—during the training program the fellow:

1. Interprets plain and contrast x-rays, fluoroscopy, CT scans, and MRI of the diaphragm;
2. Performs operative repair of acquired diaphragmatic abnormalities and provides preoperative and postoperative care;
3. Reconstructs defects of the diaphragm;
4. Performs diagnostic studies of the diaphragm (e.g., pneumoperitoneum, direct incisional and excisional biopsy, video assisted thoracoscopic surgery);
5. Performs diaphragmatic mobilization for exposure of the spine and aorta;
6. Performs operative removal of diaphragmatic tumors;
7. Inserts permanent diaphragmatic pacemakers.

ESOPHAGUS

A. Anatomy, Physiology and Embryology

1. Understands the anatomy, embryology, innervation, and vascular supply of the esophagus and adjacent structures;
2. Understands the physiologic function of the esophagus and pharynx;
3. Understands the radiographic evaluation of the esophagus.

Contents:

1. Anatomy of the esophagus
   a. Histology
   b. Blood supply
   c. Nerve supply
   d. Sphincters
   e. Muscular composition
   f. Mucosa
2. Physiology of the esophagus
   a. Normal peristalsis
   b. Hormonal influences
   c. Neural influences
3. Assessment of the esophagus
   a. Contrast studies
   b. Manometry
c. pH studies
d. Radionucleotide scans
e. Endoscopy

During the rotation the fellow:

1. Interprets esophageal plain radiographs, contrast studies, CT scans, MRI, and intraluminal echo;
2. Orders and interprets manometric and pH studies of the esophagus;
3. Performs rigid and flexible endoscopy of the pharynx and esophagus.

B. Acquired Abnormalities

1. Understands the pathophysiology, histology, complications, and diagnosis of esophageal reflux;
2. Understands the indications for and principles of anti-reflux operations;
3. Understands the clinical presentation, diagnosis, and management of paraesophageal hernias;
4. Knows the clinical presentation, causes, diagnosis, and treatment of motility disorders of the esophagus;
5. Understands the clinical presentation, diagnosis, and management of esophageal perforation;
6. Understands the clinical presentation, diagnosis, and management of chemical injuries and trauma of the esophagus;
7. Understands the indications, methods, and operative approaches for esophageal replacement;
8. Understands the clinical presentation, diagnosis, and management of esophageal foreign bodies;
9. Understands the presentation and management of complications of esophageal operations;
10. Understands the etiology, presentation, and management of infections after esophageal injuries and operations.

Contents:

1. Esophageal reflux
   a. Histology
   b. Clinical presentation
   c. Etiology
   d. Diagnosis
   e. Operative and non-operative management
   f. Management of complications (bleeding, ulceration, Barrett's mucosa, stricture)
2. Paraesophageal hernias
   a. Clinical presentation
   b. Diagnosis and indications for operation
   c. Operative management
3. Motility disorders
   a. Achalasia
   b. Scleroderma
   c. Spasm
   d. Diverticula
   e. Clinical presentation
   f. Diagnosis
   g. Operative and non-operative management
4. Esophageal perforation
   a. Etiology
   b. Clinical presentation and diagnosis
   c. Operative and non-operative management
5. Trauma
   a. Chemical injuries
   b. Blunt and penetrating trauma
   c. Clinical presentation and diagnosis
   d. Operative and non-operative management
6. Esophageal replacement
   a. Stomach
   b. Jejunum
   c. Colon
   d. Free jejunal replacement
7. Foreign bodies
   a. Clinical presentation and diagnosis
   b. Methods of removal
8. Video assisted thoracic surgery for esophageal disorders
   a. Indications
   b. Techniques
9. Infections
   a. Moniliasis
   b. Diagnosis
   c. Treatment
10. Rings and webs
    a. Diagnosis
    b. Treatment

During the rotation the fellow:

1. Interprets esophageal plain radiographs, contrast studies, CT scans, MRI, manometry, pH studies, and intraluminal echo;
2. Performs esophagoscopy, foreign body removal and biopsy;
3. Uses various operative approaches to different parts of the esophagus;
4. Performs anti-reflux operations including management of strictures;
5. Performs resection and reconstruction using various esophageal substitutes;
6. Evaluates and manages patients with esophageal motility disorders, performs myotomy and resection of diverticula;
7. Diagnoses, manages, and performs operations for esophageal perforation, chemical burns, and trauma;
8. Manages the complications of esophageal operations;
9. Uses video assisted thoracic surgery for esophageal diseases where appropriate.

C. Neoplasms

1. Understands the types of benign esophageal neoplasms, their clinical presentation, diagnosis, and treatment;
2. Understands the types of malignant esophageal neoplasms, their clinical presentation, diagnosis, histologic appearance, and treatment;
3. Understands the TNM staging of esophageal cancer;
4. Understands the role of chemotherapy and radiotherapy in esophageal cancer;
5. Understands the operative approaches, methods, and complications of esophageal resection and reconstruction;
6. Understands the indications for operative and non-operative treatment of esophageal cancer;
7. Understands the principles of patient management after esophageal resection;
8. Understands the nutritional management of patients with esophageal neoplasms.

Contents:

1. Benign esophageal tumors
   a. Histology
   b. Fibrovascular polyps
   c. Leiomyoma
   d. Operative and non-operative management
2. Malignant esophageal tumors
   a. Histology
   b. Squamous cell carcinoma
   c. Adenocarcinoma
   d. Sarcoma
   e. Small cell carcinoma
   f. Melanoma
   g. Staging
   h. Adjuvant treatment
   i. Operative management
   j. Methods of palliation

During the rotation the fellow:

1. Evaluates malignant and benign esophageal tumors and recommends overall management, including neoadjuvant therapy;
2. Performs diagnostic tests for esophageal neoplasms and correlates the results with clinical staging;
3. Performs esophagectomy through various approaches;
4. Performs reconstruction with various esophageal substitutes;
5. Diagnoses and manages complications of esophageal surgery;
6. Manages nutritional needs after esophageal surgery;
7. Performs palliative operations for obstructing esophageal lesions;
8. Recommends appropriate postoperative or alternate therapy for advanced or recurrent disease.
GOALS AND OBJECTIVES
GENERAL THORACIC SURGERY ROTATION
Institution #2 – VA Medical Center
Duration: 6 months, Year 1

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine thoracoscopic diagnostic procedures, lobectomy and pneumonectomy, mediastinoscopy and mediastinotomy, laparoscopic Nissen fundoplication, esophagectomy, and flexible/rigid bronchoscopy and esophagoscopy.

Use information technology: Fellows learn to use currently available information technology sources – Medline, Pubmed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC.

Evaluate diagnostic studies: During the thoracic rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest computed tomography examinations, PET examinations, bone scans, pulmonary function studies, contrast esophagrams, 24 hour pH studies, and esophageal manometry. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Thoracic Oncology Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program

Counsel and educate patients and families:
Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the General Thoracic Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.
Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

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Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Maintain a log of continuity of care of patients seen in the Thoracic Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.
Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

**Medical Knowledge**: Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

*The Thoracic Fellow is expected to master the following core topics by the end of the rotation:*

**CHEST WALL**

**A. Anatomy, Physiology and Embryology**

Learner Objectives—upon completion of this rotation the fellow:

5. Understands the anatomy and physiology of the cutaneous, muscular, and bony components of the chest wall and their anatomic and physiologic relationships to adjacent structures;

6. Understands the anatomy of the vascular, neural, muscular, and bony components of the thoracic outlet;

7. Knows all operative approaches to the chest wall;

8. Knows the surgical anatomy, neural, vascular, and skeletal components of the chest wall, as well as the major musculocutaneous flaps.

**Contents:**

5. Chest wall embryology  
   a. Ectodermal, mesodermal, endodermal

6. Chest wall anatomy  
   a. Skeletal  
   b. Muscular  
   c. Neural  
   d. Vascular  
   e. Relationships to adjacent structures

7. Diagnostic tests to define chest wall anatomy  
   a. Chest x-ray  
   b. CAT scans  
   c. MRI scans  
   d. Nuclear scans  
   e. Pulmonary function tests

8. Major flaps of the chest wall and their vascular pedicles  
   a. Latissimus dorsi  
   b. Pectoralis major  
   c. Serratus anterior  
   d. Trapezius  
   e. Intercostal  
   f. Pleural  
   g. Pericardial fat pad  
   h. Rectus abdominis
Clinical Skills - during the training program the fellow:

4. Recognizes the normal and abnormal anatomy of the chest wall;
5. Reads and interprets tests to diagnose chest wall abnormalities;
6. Performs operations utilizing major chest wall flaps and the correct application of prosthetic materials.

B. Acquired Abnormalities and Neoplasms

Learner Objectives - upon completion of this rotation the fellow:

7. Understands the diagnosis and management of various chest wall infections;
8. Evaluates and diagnoses primary and metastatic chest wall tumors, knows their histologic appearance, and understands the indications for incisional versus excisional biopsy;
9. Knows the radiologic characteristics of tumors;
10. Knows the indications for and methods of prosthetic chest wall reconstruction (e.g., methylmethacrylate, Marlex®, Gortex®, Vicryl®, and Dacron® mesh);
11. Knows the types of chemotherapy and radiotherapy (induction neo-adjuvant and adjuvant therapy) of chest wall tumors and the indications for preoperative and postoperative therapy;
12. Knows the management of osteoradionecrosis of the chest wall.

Contents:

3. Malignant neoplasms of the chest wall
   a. Chondrosarcoma
   b. Osteogenic sarcoma
   c. Myeloma
   d. Ewing's sarcoma
   e. Metastatic lesions
   f. Lung cancer invading the chest wall

4. Benign neoplasms of the chest wall
   a. Fibrous dysplasia
   b. Chondroma
   c. Osteochondroma
   d. Eosinophilic granuloma

Clinical Skills - during the training program the fellow:

6. Performs a variety of surgical incisions to expose components of the chest wall and interior thoracic organs;
7. Performs surgical resections of primary and secondary chest wall tumors;
8. Identifies the need for major flaps of the chest wall;
9. Identifies the need for prosthetic replacement of the chest wall;
10. Performs surgical reconstruction of chest wall defects.
LUNGS AND PLEURA

A. Anatomy, Physiology, Embryology and Testing

Learner Objectives—upon completion of this rotation the fellow:

10. Understands the segmental anatomy of the bronchial tree and bronchopulmonary segments;
11. Understands the arterial, venous and bronchial anatomy of the lungs and their inter-relationships;
12. Understands the lymphatic anatomy of the lungs, the major lymphatic nodal stations, and lymphatic drainage routes of the lung segments;
13. Knows the indications for different thoracic incisions, the surgical anatomy encountered, and the physiological impact;
14. Knows the indications for plain radiography, CT scan, magnetic resonance imaging, and PET scanning for staging of lung cancer;
15. Knows the indications, interpretation, and use of nuclear medicine ventilation/perfusion scanning (V/Q scan) to determine the operability of candidates for pulmonary resection;
16. Understands the methods of invasive staging (e.g., mediastinoscopy, Chamberlain procedure, scalene node biopsy, thoracoscopy);
17. Knows how to interpret pulmonary function tests;
18. Knows how to perform pulmonary function tests.

Contents:

3. Normal anatomy and histology of the lung
   a. Segmental anatomy of the bronchial tree
   b. Bronchopulmonary segments (topography)
   c. Hilar anatomy
   d. Lymphatic anatomy and drainage of the lung
   e. Histologic anatomy and cell types of the lung
   f. Endoscopic anatomy of the larynx, trachea, and bronchi

4. Normal physiology of the lung
   a. Chest wall mechanics
   b. Large and small airway mechanics
   c. Alveolar mechanics and gas exchange
   d. Chest x-ray
   e. CT scan of the chest and abdomen
   f. MRI of the chest
   g. Contrast angiography of major vessels within the chest
   h. Radioactive isotope scanning of organs within the chest
   i. Anterior thoracotomy
   j. Posterolateral thoracotomy
   k. Posterior thoracotomy
   l. Muscle sparing thoracotomy
   m. Mediastinotomy
   n. Transverse anterior sternotomy
   o. Incisions common to video assisted thoracic surgery
7. Incisions common to cervical and anterior mediastinoscopy

Clinical Skills—during the training program the fellow:

7. Reads and interprets pulmonary function studies, ventilation/perfusion scans, pulmonary arteriograms and arterial blood gases, and correlates the results with operability;
8. Applies knowledge of thoracic anatomy to the physical examination of the chest, heart, and vascular tree;
9. Applies knowledge of thoracic anatomy to flexible and rigid endoscopy;
10. Uses knowledge of chest, pulmonary, and cardiac physiology to interpret tests involving the thoracic cavity and to understand and treat diseases of the chest and its contents;
11. Reads and interprets plain radiography, CT scans, magnetic resonance imaging, and PET scanning of the chest;
12. Participates in the performance of exercise tolerance tests and pulmonary function tests.

B. Non-Neoplastic Lung Disease

Learner Objectives—upon completion of this rotation the fellow:

10. Understands diagnostic procedures used to evaluate non-neoplastic lung disease;
11. Knows the common pathogens that produce lung infections, including their presentation and pathologic processes, and knows the treatment and indications for operative intervention;
12. Understands the natural history, presentation and treatment of chronic obstructive lung disease;
13. Knows the indications for bullectomy, lung reduction, and pulmonary transplantation;
14. Understands the pathologic results and alterations of pulmonary function due to bronchospasm;
15. Understands the principles of surgical resection for non-neoplastic lung disease;
16. Understands the mechanisms by which foreign bodies reach the airways, how they cause pulmonary pathology, and the management of patients with airway foreign bodies;
17. Understands the causes, physiology, evaluation and management of hemoptysis;
18. Knows the complications of lung resection and their management.

Contents:

7. Common pulmonary pathogens
   a. Bacteria
   b. Fungi
   c. Tuberculosis mycobacterium
   d. Viruses
   e. Protozoa
   f. Immunocompromised patients

8. Chronic obstructive pulmonary disease
   a. Natural history
   b. Presentation, evaluation
   c. Alteration of lung function
d. Complications requiring operative treatment
e. Treatment (operative and non-operative)

9. Bronchospasm
   a. Natural history
   b. Evaluation
c. Complications requiring operative treatment
d. Treatment (operative and non-operative)

10. Foreign bodies of the lung and airways
   a. Common types
   b. Causes, pathology
c. Evaluation
d. Treatment (operative and non-operative)

11. Hemoptysis
   a. Causes
   b. Physiologic derangements
c. Evaluation
d. Treatment (operative and non-operative)

12. Pneumothorax
   a. Etiology
   b. Indications for treatment
c. Types of treatment

Clinical Skills—during the training program the fellow:

7. Diagnoses and treats patients with bacterial, fungal, tuberculous, and viral lung infections;
8. Performs operative and non-operative management of lung abscess;
10. Manages patients with chronic obstructive lung disease, bronchospastic airway disease, foreign bodies of the airways, and hemoptysis;
11. Performs thoracentesis, mediastinoscopy, mediastinotomy, flexible and rigid bronchoscopy, thoracoscopy, and open lung biopsy;
12. Performs bronchoalveolar lavage and transbronchial lung biopsy.

C. Neoplastic Lung Disease

Learner Objectives—upon completion of this rotation the fellow:

10. Understands TNM staging of lung carcinoma and its application to the diagnosis, therapeutic planning, and management of patients with lung carcinoma;
11. Evaluates and diagnoses neoplasia of the lung, using a knowledge of the histologic appearance of the major types;
12. Knows the signs of inoperability;
13. Understands the therapeutic options for patients with lung neoplasms;
14. Understands the principles of bronchoplastic surgery;
15. Understands the complications of pulmonary resection and their management;
16. Understands the role of adjuvant therapy for lung neoplasms;
17. Understands the indications for resection of benign lung neoplasms;
18. Understands the indications for resection of pulmonary metastases.

Contents:

5. Benign tumors of the lung and airways
   a. Pathology, biologic behavior
   b. Evaluation, diagnosis, treatment (operative and non-operative)

6. Solitary lung nodule
   a. Differential diagnosis, evaluation, diagnostic techniques
   b. Treatment (operative and non-operative)

7. Malignant tumors of the lung and airways
   a. Pathology, biologic behavior
   b. Evaluation, diagnosis, treatment (operative and non-operative)

8. Metastatic tumors to the lungs
   a. Pathology and biologic behavior
   b. Evaluation, diagnosis, treatment (operative and non-operative)

Clinical Skills—during the training program the fellow:

7. Evaluates patients with lung neoplasia and recommends therapy based on their functional status, pulmonary function and tumor type;
8. Performs staging procedures (e.g., bronchoscopy, mediastinoscopy, mediastinotomy, and thoracoscopy);
9. Performs operations to extirpate neoplasms of the lung (e.g., local excision, wedge resection, segmental resection, lobectomy, pneumonectomy, sleeve lobectomy, carinal resection, chest wall resection);
10. Recognizes and manages complications of pulmonary resections (e.g., space problem, persistent air leak, bronchopleural fistula, bronchovascular fistula, empyema, cardiac arrhythmia);
11. Performs bedside bronchoscopies and placement of tracheostomies and/or minitracheostomies;
12. Recognizes and treats the early signs of non-cardiac pulmonary edema.

E. Diseases of the Pleura

Learner Objectives—upon completion of this rotation the fellow:

6. Is familiar with the clinical presentation of benign and malignant diseases of the pleura;
7. Understands the types of pleural effusions, their evaluation and treatment;
8. Understands the management of empyema with and without bronchopleural fistula;
9. Understands the indications, contraindications, and complications of video assisted thoracic surgery and has a working knowledge of the equipment;
10. Understands the treatment of benign and malignant diseases of the pleura.

Contents:
4. Mesothelioma  
   a. Pathology, biologic behavior, and natural history  
   b. Treatment (operative and non-operative)  
5. Pleural effusions  
   a. Types  
   b. Diagnosis  
   c. Treatment (operative and non-operative)  
6. Empyema  
   a. Presentation with and without bronchopleural fistula  
   b. Diagnosis  
   c. Treatment (operative and non-operative)  
   d. Surgical options (e.g., thoracentesis, tube thoracostomy, decortication, rib resection, repair of bronchopleural fistula)  

Clinical Skills—during the training program the fellow:  

8. Evaluates pleural effusions and recommends appropriate therapy;  
9. Performs invasive diagnostic studies (e.g., incisional and excisional biopsy, needle biopsy, fluid analysis);  
10. Places tube thoracostomies and performs chemical or mechanical pleurodesis;  
11. Performs initial drainage procedures and subsequent procedures for empyema (e.g., decortication, empyemectomy, rib resection, Eloesser flap, Claggett procedure, closure of bronchopleural fistula);  
12. Performs video assisted thorascopic surgery as necessary for the diagnosis and treatment of pleural disease.  
13. Places pleuropertitoneal shunts;  
MEDIASTINUM AND PERICARDIUM

A. Anatomy, Physiology and Embryology

Learner Objectives—upon completion of this rotation the fellow:

5. Understands the anatomic boundaries of the mediastinum and the structures found within each region;
6. Understands the embryologic development of structures within the mediastinum and the variations and pathologic consequences of abnormally located structures;
7. Understands the radiologic assessment of the mediastinum including CT scan, MRI, contrast studies, and angiography;
8. Understands the aberrations caused by pericardial abnormalities and their effects on the heart and circulation.

Contents:

5. Superior mediastinum
   a. Major structures
   b. Diagnostic studies
6. Anterior mediastinum
   a. Major structures
   b. Diagnostic studies
7. Middle mediastinum (visceral compartment)
   a. Major structures
   b. Diagnostic studies
8. Posterior mediastinum (paravertebral sulcus)
   a. Major structures
   b. Diagnostic studies

During the training program the fellow:

4. Reads and interprets mediastinal plain radiographs, CT scans, MRI, and contrast studies;
5. Applies knowledge of mediastinal anatomy and physiology to the diagnosis of mediastinal abnormalities;
6. Applies knowledge of pericardial physiology to the diagnosis of pericardial abnormalities.

B. Congenital Abnormalities of the Mediastinum

Learner Objectives—upon completion of this rotation the fellow:

4. Is able to diagnose mediastinal cysts;
5. Is familiar with the symptoms associated with mediastinal abnormalities;
6. Knows the indications for operations involving the mediastinum and the anatomic approaches.

Contents:
3. Mediastinal cysts
   a. Mediastinal cysts
   b. Pericardial cysts
   c. Cystic hygroma
   d. Bronchogenic cysts
   e. Esophageal duplications
   f. Management (operative and non-operative)

4. Symptoms of mediastinal abnormalities

Clinical Skills—during the training program the fellow:

4. Reads and interprets plain radiographs, CT scans, MRI's and contrast studies of congenital abnormalities of the mediastinum;
5. Diagnoses and manages patients with congenital abnormalities of the mediastinum;
6. Performs operations for congenital abnormalities of the mediastinum.

C. Acquired Abnormalities of the Mediastinum

Learner Objectives—upon completion of this rotation the fellow:

7. Understands mediastinal infections and their management;
8. Understands the diagnostic tests available;
9. Recognizes the histologic appearance of benign and malignant mediastinal neoplasms;
10. Understands the neoplastic and non-neoplastic mediastinal diseases;
11. Understands the operative management of benign and malignant mediastinal neoplasms;
12. Understands chemotherapy and radiotherapy in mediastinal neoplasm management.

Contents:

6. Anterior mediastinal tumors
   a. Thymoma
   b. Thyroid
   c. Teratoma
   d. Lymphoma
   e. Germ cell tumor
   f. Histologic appearance
   g. Management (operative and non-operative)

7. Middle mediastinal tumors
   a. Lymphoma
   b. Hamartoma
   c. Cardiac tumors
   d. Histologic appearance
   e. Management (operative and non-operative)

8. Posterior mediastinum (paravertebral sulcus)
   a. Neurilemoma
   b. Neurofibroma
c. Pheochromocytoma
d. Ganglion neuroma
e. Dumbbell neurogenic tumor
f. Histologic appearance
g. Management (operative and non-operative)

9. Mediastinal infection
   a. Postoperative
   b. Primary
   c. Management (operative and non-operative)

10. Diagnostic tests
   a. Plain radiographs
   b. CT scans
   c. MRI
   d. Contrast studies
   e. Radionucleotide studies
   f. Ultrasound
   g. Fine needle aspiration
   h. Core biopsy
   i. Mediastinoscopy
   j. Serologic tests

Clinical Skills—during the training program the fellow:

5. Performs diagnostic tests and operations on the mediastinum;
6. Diagnoses and manages mediastinal infection;
7. Recognizes the histologic appearance of mediastinal tumors;
8. Manages patients with mediastinal tumors.

TRACHEA AND BRONCHI

A. Anatomy, Physiology and Embryology

Learner Objectives—upon completion of this rotation the fellow:

5. Understands the anatomy and blood supply of the trachea and bronchi;
6. Understands the endoscopic anatomy of the nasopharynx, hypopharynx, larynx, trachea, and major bronchi;
7. Understands and interprets pulmonary function studies of the trachea and bronchi;
8. Understands the radiologic assessment of the trachea and bronchi.

Contents:

5. Trachea
   a. Blood supply
b. Histologic and gross anatomy
c. Lymphatic anatomy and drainage
d. Contiguous structures
e. Radiographic anatomy and tests
f. Endoscopic anatomy and tests

6. Bronchi
   a. Blood supply
   b. Histologic and gross anatomy
   c. Segmental anatomy
d. Lymphatic relationships
e. Radiographic anatomy and tests
f. Endoscopic anatomy and tests

7. Physiologic evaluation
   a. Pulmonary function tests
   b. Flow volume loops

8. Radiologic evaluation
   a. Plain radiographs
   b. Tomography
c. CT scan
d. Fluoroscopy
e. MRI
f. Barium swallow

Clinical Skills—during the training program the fellow:

3. Interprets plain radiographic analyses, CT scan, MRI, and pulmonary function studies involving the trachea and bronchi;
4. Performs endoscopy of the upper airway, trachea and major bronchi.

B. Congenital and Acquired Abnormalities

Learner Objectives—upon completion of this rotation the fellow:

10. Understands congenital abnormalities and idiopathic diseases of the trachea;
11. Understands the etiology, presentation and management of acquired tracheal strictures and their prevention;
12. Understands the etiology, presentation, diagnosis and management of tracheoesophageal fistulas and tracheoinnominate artery fistulas;
13. Knows the operative approaches to the trachea and techniques of mobilization;
14. Knows the methods of airway management, anesthesia and ventilation for tracheal operations;
15. Knows the principles of tracheal surgery and release maneuvers;
16. Understands the complications of tracheal surgery and their management;
17. Understands the etiology, presentation, and principles of airway trauma management;
18. Understands the radiologic evaluation of tracheal abnormalities.

Contents:
7. Radiologic assessment of the trachea and bronchi
   a. Plain x-rays
   b. CT scans
   c. MRI
   d. Barium swallow
8. Stricture of the trachea
   a. Post-intubation
   b. Post-tracheostomy
   c. Post-traumatic
9. Anesthesia for tracheal operations
   a. Methods of airway control
   b. Extubation concerns
10. Operative approaches to the trachea
    a. Reconstruction of the upper trachea
    b. Reconstruction of the lower trachea
    c. Mediastinal tracheostomy
11. Tracheostomy and its complications
    a. Tracheal stenosis
    b. Tracheo-esophageal fistula
    c. Tracheo-innominate artery fistula
    d. Persistent tracheal stoma
12. Airway trauma
    a. Airway control
    b. Evaluation of associated injuries
    c. Principles of repair (primary and secondary)
    d. Protecting tracheostomies

Clinical Skills-during the training program the fellow:

8. Evaluates diagnostic tests of the trachea and bronchi;
9. Performs laryngoscopy and bronchoscopy of the trachea and bronchi, including dilation of stenoses;
10. Performs tracheostomy
11. Evaluates patients for tracheal resection and plans the operation;
12. Performs tracheal resection and reconstruction for tracheal stenosis;
13. Performs placement of tracheal T-tubes;

C. Neoplasms

Learner Objectives-upon completion of this rotation the fellow:

5. Knows the types, histology, and clinical presentation of tracheal neoplasms;
6. Understands the radiologic evaluation and operative management of tracheal neoplasms;
7. Understands the methods of airway management;
8. Knows the indications for and the use of radiotherapy and chemotherapy.
Contents:

5. Neoplasms of the trachea
   a. Benign
   b. Malignant
   c. Metastatic
6. Operative techniques
   a. Resection of tracheal tumors
   b. Methods of tracheal reconstruction
   c. Operative approaches
7. Prosthetics
   a. Silastic prosthetics
   b. Stents
   c. Types of tracheostomy tubes and tracheal T-tubes
8. Airway management
   a. Bronchoscopic “core out”
   b. Laser

Clinical Skills—during the training program the fellow:

7. Performs rigid and flexible bronchoscopy for diagnosis and “core-out”;
8. Performs resection of tracheal tumors;
9. Manages patients and their airways after tracheal resection;
10. Uses laser techniques in the management of endoluminal tumors;
11. Uses stents, tracheal T-tubes and tracheostomy tubes in the management of tracheal neoplasms;
12. Uses adjunctive therapy for the management of tracheal tumors.

DIAPHRAGM

A. Anatomy, Physiology and Embryology

7. Knows the embryologic origin of the diaphragm;
8. Understands the anatomy of the diaphragm and adjacent structures;
9. Understands the neural and vascular supply of the diaphragm and the pathologic consequences of injury;
10. Understands imaging studies for assessing the diaphragm;
11. Understands the consequences of incisions in the diaphragm;
12. Understands developmental anomalies of the diaphragm.

Contents:

4. Normal anatomy of the diaphragm
   a. Origins and insertions
   b. Vascular and neural supply
5. Foramina of the diaphragm
6. Contiguous structures
   a. Heart
   b. Lungs
   c. Vessels
   d. Chest wall

Clinical Skills—during the training program the fellow:

3. Uses knowledge of the normal anatomy and physiology of the diaphragm to treat primary or contiguous abnormalities;
4. Evaluates and interprets radiographic studies of the diaphragm, including fluoroscopy, CT scan, and MRI.

B. Acquired Abnormalities, Neoplasms

9. Understands the presentation of diaphragmatic rupture and associated injuries;
10. Knows evaluation methods for penetrating injuries of the diaphragm;
11. Knows management of infections immediately above and below the diaphragm;
12. Understands the etiology, presentation, diagnosis, and management of acquired diaphragmatic hernias;
13. Understands the etiology, diagnosis, and treatment of diaphragmatic paralysis;
14. Understands the primary and secondary tumors of the diaphragm and their management;
15. Understands reconstruction methods for the diaphragm;
16. Understands the indications for and techniques of diaphragmatic pacing.

Contents:

6. Diaphragmatic rupture
   a. Clinical presentation
   b. Physiologic effects
   c. Operative management
   d. Management of associated injuries
7. Periphereic abscess
   a. Clinical presentation
   b. Physiologic effects
   c. Operative management
8. Acquired diaphragmatic hernias
   a. Esophageal
   b. Eventration
   c. Treatment
9. Tumors of the diaphragm
   a. Mesenchymal origin (benign and malignant)
b. Neurogenic (benign and malignant)
c. Secondary (lung, esophageal, mesothelioma)
d. Treatment

10. Paralysis of the diaphragm
   a. Causes
   b. Diagnosis
   c. Treatment

Clinical Skills—during the training program the fellow:

8. Interprets plain and contrast x-rays, fluoroscopy, CT scans, and MRI of the diaphragm;
9. Performs operative repair of acquired diaphragmatic abnormalities and provides preoperative and postoperative care;
10. Reconstructs defects of the diaphragm;
11. Performs diagnostic studies of the diaphragm (e.g., pneumoperitoneum, direct incisional and excisional biopsy, video assisted thoracoscopic surgery);
12. Performs diaphragmatic mobilization for exposure of the spine and aorta;
13. Performs operative removal of diaphragmatic tumors;

ESOPHAGUS

A. Anatomy, Physiology and Embryology

4. Understands the anatomy, embryology, innervation, and vascular supply of the esophagus and adjacent structures;
5. Understands the physiologic function of the esophagus and pharynx;
6. Understands the radiographic evaluation of the esophagus.

Contents:

4. Anatomy of the esophagus
   a. Histology
   b. Blood supply
   c. Nerve supply
   d. Sphincters
   e. Muscular composition
   f. Mucosa
5. Physiology of the esophagus
   a. Normal peristalsis
   b. Hormonal influences
   c. Neural influences
6. Assessment of the esophagus
   a. Contrast studies
   b. Manometry
c. pH studies  
d. Radionuclide scans  
e. Endoscopy

During the rotation the fellow:

4. Interprets esophageal plain radiographs, contrast studies, CT scans, MRI, and intraluminal echo;  
5. Orders and interprets manometric and pH studies of the esophagus;  
6. Performs rigid and flexible endoscopy of the pharynx and esophagus.

B. Acquired Abnormalities

11. Understands the pathophysiology, histology, complications, and diagnosis of esophageal reflux;  
12. Understands the indications for and principles of anti-reflux operations;  
13. Understands the clinical presentation, diagnosis, and management of paraesophageal hernias;  
14. Knows the clinical presentation, causes, diagnosis, and treatment of motility disorders of the esophagus;  
15. Understands the clinical presentation, diagnosis, and management of esophageal perforation;  
16. Understands the clinical presentation, diagnosis, and management of chemical injuries and trauma of the esophagus;  
17. Understands the indications, methods, and operative approaches for esophageal replacement;  
18. Understands the clinical presentation, diagnosis, and management of esophageal foreign bodies;  
19. Understands the presentation and management of complications of esophageal operations;  
20. Understands the etiology, presentation, and management of infections after esophageal injuries and operations.

Contents:

11. Esophageal reflux  
   a. Histology  
   b. Clinical presentation  
   c. Etiology  
   d. Diagnosis  
   e. Operative and non-operative management  
   f. Management of complications (bleeding, ulceration, Barrett's mucosa, stricture)

12. Paraesophageal hernias  
   a. Clinical presentation  
   b. Diagnosis and indications for operation  
   c. Operative management

13. Motility disorders  
   a. Achalasia  
   b. Scleroderma  
   c. Spasm  
   d. Diverticula  
   e. Clinical presentation  
   f. Diagnosis  
   g. Operative and non-operative management
14. Esophageal perforation
   a. Etiology
   b. Clinical presentation and diagnosis
   c. Operative and non-operative management
15. Trauma
   a. Chemical injuries
   b. Blunt and penetrating trauma
   c. Clinical presentation and diagnosis
   d. Operative and non-operative management
16. Esophageal replacement
   a. Stomach
   b. Jejunum
   c. Colon
   d. Free jejunal replacement
17. Foreign bodies
   a. Clinical presentation and diagnosis
   b. Methods of removal
18. Video assisted thoracic surgery for esophageal disorders
   a. Indications
   b. Techniques
19. Infections
   a. Moniliasis
   b. Diagnosis
   c. Treatment
20. Rings and webs
   a. Diagnosis
   b. Treatment

During the rotation the fellow:

10. Interprets esophageal plain radiographs, contrast studies, CT scans, MRI, manometry, pH studies, and intraluminal echo;
11. Performs esophagoscopy, foreign body removal and biopsy;
12. Uses various operative approaches to different parts of the esophagus;
13. Performs anti-reflux operations including management of strictures;
14. Performs resection and reconstruction using various esophageal substitutes;
15. Evaluates and manages patients with esophageal motility disorders, performs myotomy and resection of diverticula;
16. Diagnoses, manages, and performs operations for esophageal perforation, chemical burns, and trauma;
17. Manages the complications of esophageal operations;
18. Uses video assisted thoracic surgery for esophageal diseases where appropriate.

C. Neoplasms

9. Understands the types of benign esophageal neoplasms, their clinical presentation, diagnosis, and treatment;
10. Understands the types of malignant esophageal neoplasms, their clinical presentation, diagnosis, histologic appearance, and treatment;
11. Understands the TNM staging of esophageal cancer;
12. Understands the role of chemotherapy and radiotherapy in esophageal cancer;
13. Understands the operative approaches, methods, and complications of esophageal resection and reconstruction;
14. Understands the indications for operative and non-operative treatment of esophageal cancer;
15. Understands the principles of patient management after esophageal resection;
16. Understands the nutritional management of patients with esophageal neoplasms.

Contents:

3. Benign esophageal tumors
   a. Histology
   b. Fibrovascular polyps
   c. Leiomyoma
   d. Operative and non-operative management

4. Malignant esophageal tumors
   a. Histology
   b. Squamous cell carcinoma
   c. Adenocarcinoma
   d. Sarcoma
   e. Small cell carcinoma
   f. Melanoma
   g. Staging
   h. Adjuvant treatment
   i. Operative management
   j. Methods of palliation

During the rotation the fellow:

9. Evaluates malignant and benign esophageal tumors and recommends overall management, including neoadjuvant therapy;
10. Performs diagnostic tests for esophageal neoplasms and correlates the results with clinical staging;
11. Performs esophagectomy through various approaches;
12. Performs reconstruction with various esophageal substitutes;
13. Diagnoses and manages complications of esophageal surgery;
14. Manages nutritional needs after esophageal surgery;
15. Performs palliative operations for obstructing esophageal lesions;
16. Recommends appropriate postoperative or alternate therapy for advanced or recurrent disease.
PROGRAM GOALS AND OBJECTIVES

Year 2

Year 2: At the end of year 2, the cardiothoracic resident will be expected to master the following items:

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine thoracoscopic diagnostic procedures, lobectomy and pneumonectomy, mediastinoscopy and mediastinotomy, adult cardiac procedures, and repair of congenital cardiac anomalies.

Use information technology: Fellows learn to use currently available information technology sources – Medline, Pubmed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC, VAMC, and Abbott-Northwestern Hospitals.

Evaluate diagnostic studies: During the adult cardiac, congenital, endovascular and thoracic rotations fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest CT examinations, coronary angiography, and cardiac catheterization studies. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program.

Counsel and educate patients and families:
Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Endovascular, Congenital, and Adult Cardiothoracic Services. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.
Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Endovascular, Congenital, and Adult Cardiothoracic Surgery Services. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Maintain a log of continuity of care of patients seen in the Thoracic Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

Systems-Based Practice: Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.
Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

**Medical Knowledge:** Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

The Thoracic Fellow is expected to master the following core topics by the end of the year:

**ACQUIRED HEART DISEASE**

**A. Coronary Artery Disease**

Objective:

At the end of this year the resident understands the physiology of coronary circulation, the pathophysiologic causes and derangement of ischemic heart disease and the sequelae of coronary events, and performs comprehensive short and long-term management.

Learner Objectives:

Upon completion of the year the resident:

8. Understands the physiology of coronary circulation and the physiologic derangements caused by stenosis and obstruction;
9. Understands the development of atherosclerotic plaques and the current theories of plaque origination;
10. Knows the normal and variant anatomy of coronary circulation as well as the radiographic anatomy of the coronary arteries and the left and right ventricles;
11. Understands the rationale for and techniques of coronary artery bypass operations as well as the use of various conduits;
12. Understands the risks and complications of coronary artery bypass operations, coronary angiography, and percutaneous coronary artery balloon angioplasty;
13. Understands the preoperative and postoperative care of patients undergoing coronary artery bypass grafting;

Contents:

9. Cardiac anatomy
   a. Left and right main coronary arteries
   b. Left anterior descending coronary artery
   c. Circumflex coronary artery
   d. Right coronary artery
   e. Coronary venous system
   f. Left and right ventricular anatomy
10. Radiographic cardiac and coronary anatomy
a. Right anterior oblique views  
b. Left anterior oblique views  
c. Cranial view  
d. Ventriculography

11. Pathologic development of atherosclerotic plaque  
a. Endothelial injury  
b. Platelet factors  
c. Cellular factors  
d. Serum factors

12. Coronary artery bypass grafting  
a. Rationale  
b. Conduits  
c. Techniques  
d. Technical considerations  
e. Myocardial protection

13. Preoperative evaluation  
a. Symptoms of cardiac ischemia  
b. Non-invasive testing  
c. Invasive testing  
d. Decision making

14. Postoperative care  
a. Intensive care  
b. Acute care  
c. Long term management  
d. Late complications

15. Outcome  
a. Expected operative mortality  
b. Long term results

16. Complications of ischemic heart disease  
a. Chronic mitral insufficiency  
b. Ruptured papillary muscle (non-operative and operative management)  
c. Ventricular septal defect (non-operative and operative management)  
d. Cardiac rupture (non-operative and operative management)  
e. Left ventricular aneurysm

Clinical Skills:

During the training program the resident:

7. Evaluates patients with angina pectoris, unstable angina pectoris, and acute myocardial infarction;  
8. Reads and interprets invasive and non-invasive tests of patients with ischemic heart disease;  
9. Performs operative and non-operative management of patients with ischemic heart disease, including coronary artery bypass grafting using the internal mammary artery;  
10. Participates in or performs surgery for the complications of myocardial infarction;  
11. Directs the critical care management of preoperative and postoperative patients with ischemic heart disease;
12. Participates in the performance and evaluation of exercise tolerance tests, echocardiograms, and cardiac catheterizations.

**B. Myocarditis, Cardiomyopathy, Hypertrophic Obstructive Cardiomyopathy, Cardiac Tumors**

Objective:

At the end of this year the resident understands the pathology and etiology of diseased myocardium, the natural history of the diseases and physiologic alterations, and performs operative and non-operative management.

Learner Objectives:

Upon completion of the year the resident:

6. Understands the types of cardiac tumors (frequency, anatomic location, physiologic and pathologic derangements, diagnostic methods and surgical management);
7. Understands myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes);
8. Understands hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment);
9. Knows the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment);
10. Understands cardiac transplantation (immunology/rejection and treatment, physiology, indications, operative techniques, diagnostic techniques in follow-up).

Contents:

6. Tumors
   a. Types, pathology
   b. Location
   c. Physiology
   d. Primary vs. metastatic
   e. Malignant pericardial effusion
   f. Diagnostic methods
   g. Treatment
   h. Outcome

7. Myocarditis
   a. Pathologic changes
   b. Etiology
   c. Clinical findings
   d. Radiographic changes
   e. Electrocardiography
   f. Echocardiography
   g. Treatment
   h. Outcome
8. Hypertrophic cardiomyopathy (HCM)
   a. Pathologic changes
   b. Anatomic changes
   c. Pathophysiology
   d. Obstructive vs. non-obstructive
   e. Arrhythmias
   f. Diagnosis
   g. History and physical examination
      i. echocardiography
      ii. cardiac catheterization
   h. Mitral valve
      i. systolic anterior motion
      ii. mitral regurgitation
   i. Treatment
      i. mitral valve replacement
      ii. myectomy and myotomy
      iii. pacing
   j. Outcome
      i. complications
      ii. long-term results

9. Cardiomyopathy
   a. Dilated
   b. Restrictive
   c. Causes
   d. Pathology
   e. Pathophysiology
   f. Diagnosis
      i. echocardiography
      ii. endomyocardial biopsy
   g. Clinical course
   h. Treatment
   i. Outcome

10. Cardiac transplantation
    a. Techniques
    b. Indications
    c. Immunology
    d. Immunosuppressive treatment
    e. Physiology
    f. Complications and infection
    g. Rejection
        i. diagnosis
        ii. treatment
    h. Coronary artery disease development
    i. Organ harvesting, preservation
    j. Long term complications and outcome
Clinical Skills:
During the training program the resident

6. Evaluates and interprets chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with cardiac tumors, myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM);
7. Participates in or performs operative excision of cardiac tumors;
8. Participates in or performs operations for the treatment of HCM when indicated;
9. Participates in or performs heart transplants and provides preoperative and postoperative care;

C. Abnormalities of the Aorta

Objective:

At the end of this year the resident understands the etiology and physiology of diseases of the aorta and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

4. Understands the etiology and the physiology of aortic dissections and all aneurysms involving the ascending, transverse, descending, and abdominal aorta;
5. Recognizes the potential morbidity and mortality associated with aortic aneurysms and develops appropriate treatment plans for their management;
6. Knows the operative and nonoperative management of patients with acute and chronic aortic dissections;

Contents:

3. Aortic aneurysms (atherosclerotic, aortic dissections)
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
4. Operative and non-operative treatment
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal

Clinical Skills:

During the training program the resident:
5. Evaluates and interprets plain radiography, echocardiography, CT scans, MRI, and contrast studies for diseases of the aorta;
6. Participates in or performs operative and non-operative management of thoracic aortic disease, including aneurysms, dissections, and occlusive disease;
7. Plans and directs the use of extracorporeal bypass, hypothermia, and circulatory arrest for aortic diseases;
8. Performs preoperative and postoperative care of patients with aneurysms, dissections, and occlusive disease of the aorta.

**D. Cardiac Arrhythmias**

Objective:

At the end of this year the resident understands the etiology and physiology of cardiac arrhythmias, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

4. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
5. Understands operative and non-operative management;
6. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

4. **Cardiac arrhythmias**
   a. Atrial
   b. Ventricular
5. **Non-operative management**
   a. Anti-arrhythmic drugs
   b. Electrical cardioversion and pacing
   c. Catheter ablation
6. **Operative management**
   a. AICD
   b. Intraoperative mapping and ablation
   c. Permanent pacing systems

Clinical Skills:

During the training program the resident:

4. Performs the operative and non-operative management of patients with atrial arrhythmias;
5. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;
6. Participates in electrophysiologic studies.

**E. Valvular Heart Disease**

**Objective:**

At the end of this year the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

**Learner Objectives:**

Upon completion of the year the resident:

6. Understands the normal and pathologic anatomy of the atrioventricular and semilunar valves;
7. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
8. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
9. Knows the techniques for repair and replacement of cardiac valves;
10. Knows the preoperative and postoperative management of patients with valvular heart disease.

**Contents:**

7. Assessment of patients with valvular heart disease
   a. History and physical examination
   b. Echocardiogram
   c. Cardiac catheterization data
8. Choice of treatment
   a. Prosthetic valves
   b. Stented xenografts
   c. Non-stented human and xenograft valves
   d. Autograft valves for aortic valve replacement
   e. Valve repair
9. Long term complications of replacement devices
   a. Thrombosis
   b. Embolus
   c. Prosthetic dysfunction
10. Mitral valve
    a. Normal anatomy
    b. Normal function
    c. Mitral stenosis
       i. etiology and pathologic anatomy
       ii. natural history and complications
       iii. physiology
       iv. non-operative treatment
v. indications for intervention (risk stratification)
vi. merits of balloon valve dilation vs. operative repair or replacement
vii. techniques of valve repair and replacement
viii. intraoperative and postoperative complications and management
ix. early and late results of operative and balloon valvulotomy
d. Mitral incompetence
  i. etiology and pathologic anatomy
  ii. natural history and complications
  iii. physiology (mechanisms of incompetence)
  iv. non-operative treatment
    ▪ for nonischemic etiology
    ▪ for ischemic etiology
  v. indications for surgical intervention (risk stratification)
  vi. techniques of valve repair
    ▪ ring and suture annuloplasty
    ▪ leaflet plication, excision
    ▪ chordal/papillary muscle shortening
    ▪ chordal transposition and artificial chordae
  vii. perioperative care
  viii. early and late results of operative and balloon valvulotomy

11. Aortic valve
  a. Normal anatomy
  b. Normal function
  c. Aortic stenosis
    i. etiology and pathologic anatomy
    ii. natural history and complications
    iii. physiology (ventricular hypertrophy, mitral incompetence)
    iv. non-operative therapy
    v. indications for operative intervention (risk stratification)
    vi. techniques of valve replacement and repair
      ▪ management of small aortic root
      ▪ homograft and autograft valve replacement
    vii. perioperative care considerations
    viii. early and late results
  d. Aortic incompetence
    i. etiology and pathologic anatomy
    ii. natural history and complications
    iii. physiology (LV dilatation and LV dysfunction)
    iv. non-operative treatment
    v. indications for operative intervention
      ▪ in absence of clinical symptoms
      ▪ when complicated by endocarditis
      ▪ when complicated by aortic root aneurysm
    vi. techniques of valve repair and replacement
      ▪ with endocarditis and aortic root abscess
      ▪ with ascending and root aneurysm
vii. perioperative care considerations
viii. early and late results

12. Tricuspid valve
   a. Normal anatomy
   b. Normal function
   c. Tricuspid incompetence
      i. etiology and pathologic anatomy
      ii. physiology
      iii. indications for operation
           ▪ functional incompetence
           ▪ endocarditis
      iv. techniques of repair, indications for replacement
           ▪ ring and suture annuloplasty
           ▪ endocarditis (valve excision vs. repair or replacement)
   v. perioperative care
      ▪ management of RV dysfunction
      ▪ interventions to decrease pulmonary vascular resistance
   vi. early and late results
   d. Tricuspid stenosis
      i. etiology and pathologic anatomy
      ii. physiology
      iii. differentiation from constrictive pericarditis
      iv. indications for operative repair vs. replacement
      v. techniques of repair and replacement
      vi. early and late results

Clinical Skills:

During the training program the resident:

4. Evaluates, diagnoses and selects management strategies for patients with valvular heart disease, including participation in and interpretation of cardiac catheterizations and echocardiograms;
5. Makes use of the therapeutic options and relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
6. Manages preoperative clinical preparation and early and intermediate postoperative care;

Performs valve repair and replacement for valvular disease, interprets intraoperative echo.

CONGENITAL HEART DISEASE

A. Embryology, Anatomy and History

Objective:
At the end of the year, the resident understands the embryology of the heart and great vessels as it relates to the development of congenital heart anomalies, the normal anatomy of the heart, and the abnormal anatomy of the principal congenital cardiac anomalies, and applies this knowledge to the interpretation of echocardiograms, angiocardograms, and other imaging techniques.

**Learner Objectives:**

Upon completion of the year the resident:

5. Knows the embryology and anatomy of the normal heart;
6. Knows the embryology and anatomy of major cardiac anomalies;
7. Interprets angiocardograms, echocardiograms, and other images and correlates these with normal and abnormal cardiac anatomy;
8. Knows the history of congenital cardiac surgery, and the intellectual development of operations used to manage each cardiac anomaly.

**Contents:**

5. Anatomy and embryology of the normal heart;
6. Embryology and pathologic anatomy of each major congenital cardiac anomaly;
7. Interpretation of angiocardograms, echocardiograms, and other images
   a. Normal heart
   b. Major congenital cardiac anomalies
8. History of cardiac surgery of congenital heart disease.

**Clinical Skills:**

During the training program the resident:

4. Applies knowledge of the normal and abnormal anatomy of the heart to the planning and performance of operations;
5. Interprets angiocardograms, echocardiograms, and other images to diagnose congenital heart disease;
6. Uses knowledge to select the best procedure for individual patients.

**B. Physiology and Physiologic Evaluation**

**Objective:**

At the end of this year the resident understands the physiology of the developing heart, the physiologic changes of advancing age and transition ex-utero, and the physiologic consequences of congenital heart disease. The resident understands the findings in and limitations of invasive and non-invasive tests to define physiologic abnormalities and uses them in patient management.

**Learner Objectives:**

Upon completion of the rotation the resident:
4. Understands normal fetal circulation;
5. Understands the transitional nature of circulation as the fetus becomes a neonate;
6. Understands the physiology of obstructions, of intra- and extracardiac shunts, of abnormal connections to the heart, and of combinations of these anomalies in the fetus, neonate, and child.

Contents:

6. Fetal circulation
   a. Oxygen source
   b. Flow pattern of blood through the heart and circulation
   c. Cardiac output and its distribution
   d. Myocardial function
   e. Regulation of the circulation
7. Transitional and neonatal circulation
   a. General changes
   b. Pulmonary circulation changes (e.g., mechanical factors, oxygen effects, vasoactive substances, hormonal factors)
   c. Ductus arteriosus changes (factors effecting closure or maintaining patency)
   d. Foramen ovale changes (factors effecting closure or maintaining patency)
   e. Physiologic assessment of the neonate
8. Fundamental anatomic abnormalities and physiologic consequences
   a. Anatomic abnormalities: obstruction (e.g., aortic stenosis, pulmonary atresia); extra pathways (e.g., atrial septal defect, ventricular septal defect); abnormal connections (e.g., transposition of the great vessels)
   b. Increased blood flow to a region
   c. Decreased blood flow to a region
   d. Combinations of increased or decreased blood flow to a region (e.g., tetralogy of Fallot, double outlet right ventricle, anomalous pulmonary veins)
   e. Application of these anatomic and physiologic principles to derive the common names for defects
   f. Hemodynamic manifestations of these anatomic and physiologic elements
9. Hemodynamic assessment
   a. Usefulness and limitations of echocardiographic doppler
   b. Usefulness and limitations of cardiac catheterization
   c. Calculations of regional flows and resistances
   d. Calculation of flow resistance and ratio
   e. Pulmonary vascular resistance and pulmonary hypertension
10. Indications for operation
    a. Clinical symptoms and signs of obstructive lesions
    b. Clinical symptoms and signs of extra pathway lesions
    c. Clinical symptoms and signs of abnormal connections

Clinical Skills:

During the training program the resident:
7. Describes the physiologic changes of circulation during neonatal life;
8. Diagnoses clinically important congenital heart diseases in the neonate, infant, and child;
9. Applies a knowledge of anatomic abnormalities and their physiologic consequences to diagnose congenital heart defects;
10. Manages the physiologic aspects of the neonate, infant, and child with congenital heart disease preoperatively, intraoperatively, and postoperatively;
11. Stabilizes patients who are critically ill with congenital heart disease;
12. Performs calculations of blood flows and resistances from cardiac catheterization data.

C. Cardiopulmonary Bypass for Operations on Congenital Cardiac Anomalies

Objective:

At the end of this year the resident has a working knowledge of the principles of cardiopulmonary bypass for congenital heart disease, the techniques of myocardial preservation, and the use of profound hypothermia and total circulatory arrest in the infant and child.

Learner Objectives:

Upon completion of the rotation the resident:

7. Knows the indications for the various techniques of bypass (anatomy, pathophysiology, and technical requirements of the underlying cardiac defects);
8. Knows arterial and venous cannulation techniques for different intracardiac defects;
9. Understands the techniques of myocardial protection in the neonate and young infant;
10. Understands the use of varying levels of hemodilution and anticoagulation;
11. Understands perfusion flow and pressure control;
12. Knows the methods of body temperature manipulation, and the indications for and techniques of profound hypothermia with and without total circulatory arrest.

Contents:

5. Monitoring for cardiopulmonary bypass
   a. Arterial pressure lines
   b. Central venous pressure, pulmonary artery pressure
   c. Temperature monitoring (nasopharyngeal, esophageal, rectal, bladder)
   d. O2 saturation, end-tidal CO2
   e. Urine output

6. Cannulation
   a. Single venous (indications, technique)
   b. Double venous (indications, technique)
   c. Arterial (technique)
   d. Venting (indications, technique)
   e. Cardioplegia

7. Myocardial preservation techniques
   a. Crystalloid, blood
b. Cold, warm

c. Antegrade, retrograde

d. Additives

e. Fibrillation

8. Profound hypothermia and total circulatory arrest

   a. Indications
   b. Benefits, disadvantages
   c. Safe duration of total circulatory arrest
   d. Early cerebral complications
   e. Late intellectual, neurological, psychiatric outcome

Clinical Skills:

During the training program the resident:

4. Performs arterial and venous cannulation and initiates cardiopulmonary bypass;
5. Directs the perfusionist in the intraoperative management and conduct of cardiopulmonary bypass;
6. Performs or participates in the repair of congenital heart defects using cardiopulmonary bypass.

D. Left-To-Right Shunts

Objective:

At the end of the year the resident understands the diagnosis and treatment of left-to-right shunts caused by congenital cardiac anomalies, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

5. Knows the anatomy, embryology, and physiology of the most common or important anomalies;
6. Knows the operative indications of the most common or important anomalies;
7. Knows the technical components of the operative repair of the most common or important anomalies;
8. Understands the postoperative care of each anomaly.

Contents:

7. Atrial septal defect
   a. Anatomy
      i. types of atrial septal defects and key landmarks of the right atrium.
   b. Clinical features
      i. natural history, indications for operation
      ii. clinical signs and symptoms, physical exam
      iii. chest x-ray and ECG
      iv. echocardiogram and cardiac catheterization
   c. Operative repair and complications
i. extracorporeal bypass and myocardial protection  
ii. incisions in the heart  
iii. techniques for defect closure  
iv. treatment of associated anomalies (e.g., cleft mitral valve)  
v. complications of closure (e.g., air embolism, conduction abnormalities, residual defects)  
d. Outcome  
   i. expected operative mortality  
   ii. long-term results  
   iii. complications  

8. Ventricular septal defect  
a. Anatomy  
   i. types  
b. Clinical features  
   i. clinical signs and symptoms, physical exam  
   ii. echocardiogram and cardiac catheterization  
   iii. chest x-ray and ECG  
   iv. natural history  
   v. indications, contraindications, timing of operation (e.g., total repair vs. pulmonary artery banding)  
c. Operative repair and complications  
   i. extracorporeal bypass and myocardial protection  
   ii. incisions for different types of defects  
   iii. closure techniques (direct suture vs. patch)  
   iv. treatment of associated anomalies (e.g., atrial septal defect, right ventricular muscle bands)  
   v. complications (rhythm disturbances, residual defects, air)  
   vi. techniques of PA banding  
d. Outcomes  
   i. expected operative mortality  
   ii. long-term results  
   iii. complications  

9. Patent ductus arteriosus  
a. Anatomy  
b. Physiology  
   i. neonate vs. older child  
   ii. effect of prostaglandin and prostaglandin inhibitors  
c. Diagnosis and clinical features  
   i. symptoms and physical findings  
   ii. echocardiogram and cardiac catheterization  
   iii. chest x-ray and ECG  
   iv. natural history (neonate vs. older child, endocarditis)  
   v. indications for operation  
   vi. associated anomalies (e.g., ductus-dependent conditions)  
d. Operative repair and complications  
   i. operative techniques for simple ductus  
   ii. management of the difficult ductus
iii. complications of operative repair
e. Outcome  
   i. expected operative mortality  
   ii. long-term results  
   iii. complications

10. Atrioventricular septal defect  
   a. Anatomy  
      i. types (complete, transitional, ostium primum ASD)  
      ii. atrioventricular valve pathologic anatomy  
   b. Physiology  
      i. shunts and resistance calculation  
      ii. complete vs. incomplete  
   c. Diagnosis and clinical features  
      i. symptoms and signs (infant vs. older patient, physical exam)  
      ii. echocardiogram, angiocardiogram, cardiac catheterization  
      iii. chest x-ray and ECG  
      iv. natural history (development of Eisenmenger's syndrome)  
      v. indications for and timing of operation (size of shunt, endocarditis risk, total repair vs. pulmonary artery banding)  
   d. Operative repair and complications  
      i. cardiopulmonary bypass and myocardial protection  
      ii. incisions in the heart  
      iii. operative techniques  
      iv. complications (residual defects, residual “mitral valve” insufficiency, heart block)  
   e. Outcome  
      i. expected operative mortality  
      ii. long-term results  
      iii. complications

11. Double-outlet right ventricle  
   a. Anatomy  
      i. types (subaortic, subpulmonic, uncommitted)  
      ii. associated anomalies  
   b. Clinical features  
      i. natural history  
      ii. indications for and timing of operation  
      iii. signs and symptoms of each of the anatomic types  
      iv. chest x-ray, ECG  
      v. echocardiogram and cardiac catheterization  
   c. Operative repair and complications  
      i. palliative operations vs. total repair (application of shunts, pulmonary artery band, total repair)  
      ii. cardiopulmonary bypass and myocardial protection  
      iii. approach to each anatomic subtype and placement of incisions in the heart  
      iv. specific operative techniques (e.g., suturing, placement of patches)  
      v. complications and their management  
   d. Outcome
i. expected operative mortality  
ii. long-term results  
iii. complications  

12. Aorto-pulmonary window  
a. Anatomy  
b. Clinical features  
   i. natural history (development of pulmonary vascular obstructive disease)  
   ii. symptoms and signs  
   iii. echocardiogram, angiocardiogram, cardiac catheterization  
   iv. chest x-ray, ECG  
c. Operative repair  
d. Outcome  
   i. expected operative mortality  
   ii. long-term results  
   iii. complications  

Clinical Skills:  
During the training program the resident:  

5. Participates in or performs the operative repair of atrial septal defects, ventricular septal defects, patent ductus arteriosus, and pulmonary artery banding;  
6. Participates in or performs the repair of more complex cardiac anomalies;  
7. Performs the preoperative evaluation of patients with each of these anomalies;  
8. Manages postoperative care.  

E. Cyanotic Anomalies  

Objective:  
At the end of this year the resident knows the anatomy and physiology of anomalies that result in cyanosis, their diagnosis, their preoperative, operative, and postoperative management, and performs operative and non-operative treatment.  

Learner Objectives:  
Upon completion of the year the resident:  

7. Knows the anatomy and physiology of each anomaly;  
8. Knows the methods of diagnosis;  
9. Understands the role of medical management and interventional cardiology as treatment options;  
10. Knows the indications for and timing of operation;  
11. Understands the technical components of operative repair;  
12. Knows the postoperative care, expected outcome, long-term results, and complications.  

Contents:
7. Tetralogy of Fallot
   a. Anatomy and embryology
      i. embryology of malaligned ventricular septal defect
      ii. levels of right ventricular outflow tract obstruction
   b. Physiology
      i. genesis of “tet spells” and infundibular spasm
      ii. factors which affect degree of right-to-left shunt
      iii. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. role of systemic-to-pulmonary artery shunt vs. total repair
      ii. types of aortic-to-pulmonary artery shunts
      iii. extracorporeal bypass and myocardial protection
      iv. ventricular septal defect closure by transventricular or transatrial approach
      v. techniques for relief of right ventricular outflow tract obstruction and indications for transannular patching
      vi. indications for conduit repair
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

8. Transposition of the great vessels (TGA)
   a. Anatomy
      i. simple TGA
      ii. complex TGA (ventricular septal defect, pulmonary stenosis)
   b. Physiology
      i. concept of circulations in parallel and mixing
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
      v. indications for and timing of operations
   d. Operative repair and complications
      i. technique of Blalock-Hanlon atrial septectomy, open atrial septectomy
      ii. cardiopulmonary bypass and myocardial protection
      iii. operative techniques for total repair (Mustard, Senning, arterial switch, Rastelli)
      iv. palliative operations (PA band, systemic-to-pulmonary artery shunt)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
iii. complications  
iv. arrhythmias after atrial repairs  
v. semilunar insufficiency, PA stenosis, coronary problems after arterial switch  
vi. conduit obstruction after Rastelli

9. Truncus arteriosus  
a. Anatomy  
i. types of truncus arteriosus  
ii. associated anomalies (VSD, left ventricular outflow tract obstruction, arch interruption, DiGeorge syndrome)  
b. Clinical features  
i. symptoms and physical findings  
ii. cardiac catheterization, echocardiogram, angiocardiogram  
iii. chest x-ray, ECG  
iv. natural history (development of pulmonary vascular obstructive disease)  
v. indications for and timing of operation  
c. Operative repair and complications  
i. extracorporeal bypass and myocardial protection  
ii. operative techniques  
   • conduits (composite and homograft)  
   • modifications required for types II and III truncus  
iii. techniques for repair of associated anomalies  
d. Outcome  
i. expected operative mortality  
ii. long-term results  
iii. complications  

10. Tricuspid atresia  
a. Anatomy  
i. types I and II, subtypes  
b. Physiology  
i. subtypes with right-to-left shunt  
ii. subtypes with left-to-right shunt  
c. Clinical features  
i. symptoms and physical findings  
ii. echocardiogram, angiocardiogram, cardiac catheterization  
iii. chest x-ray, ECG  
iv. natural history, role of balloon atrial septostomy  
v. indications for and timing of operation  
vi. role of palliative operations (systemic-pulmonary artery shunts, PA banding, bidirectional Glenn, Fontan, other right heart bypass operations)  
d. Operative repair and complications  
i. palliative operations  
ii. operations for right heart bypass (bidirectional Glenn, Fontan)  
e. Outcome  
i. expected operative mortality  
ii. long-term results  
iii. complications
11. Total anomalous pulmonary venous connection
   a. Anatomy
      i. supracardiac, cardiac, infracardiac, mixed
   b. Physiology
      i. obstructive vs. nonobstructive
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques for different subtypes
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

12. Ebstein's anomaly
   a. Anatomy
   b. Physiology
      i. concept of atrialized ventricle
      ii. right ventricular outflow tract obstruction
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. associated lesions (e.g., Wolf-Parkinson-White syndrome)
      vi. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. technique of tricuspid repair, obliteration of atrialized ventricle
      iii. technique of tricuspid valve replacement
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

Clinical Skills:

During the training program the resident:

5. Participates in or performs the major palliative operations for these congenital cardiac anomalies;
6. Participates in or performs operative repair of tetralogy, TGA, truncus arteriosus, TAPVR, Ebstein's anomaly, and Fontan-type operations;
7. Performs preoperative evaluation and preparation;
8. Manages postoperative care.

**F. Obstructive Anomalies**

Objective:

At the end of this year the resident understands the anatomy and physiology of obstructive anomalies of the left and right sides of the heart and aorta, their diagnosis, management, and postoperative care, and performs the operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

8. Knows the anatomy and physiology of each anomaly;
9. Knows the methods of diagnosis;
10. Understands the role of medical management and interventional cardiology;
11. Knows the indications for and timing of operation;
12. Knows the technical components of operative repair;
13. Understands the principles of postoperative care;
14. Knows the expected outcome, long-term results and complications

Contents:

6. Aortic stenosis
   a. Anatomy
      i. supravalvular, valvular, subvalvular (including subtypes)
   b. Physiology
      i. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardio gram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques
      iii. pros and cons of various techniques and patch configurations for supravalvular stenosis
      iv. techniques of aortic valvotomy
      v. operations to enlarge the aortic annulus (e.g., Konno-Rastan procedure, Ross procedure)
      vi. technique of apical aortic conduit
      vii. myomectomy and myotomy for subaortic obstruction
   e. Outcome
      i. expected operative mortality
ii. long-term results
iii. complications

7. Pulmonary stenosis
   a. Anatomy
      i. valvular and supravalvular
      ii. associated anomalies (e.g., atrial septal defect, ventricular septal defect, branch stenosis)
   b. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history; role of balloon valvuloplasty
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. incisions in the heart and great vessels
      iii. operative considerations (technique of valvulotomy, indications for transannular patching, division of right ventricular muscle bands)
      iv. complications (residual obstruction)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

8. Coarctation of the aorta
   a. Anatomy
      i. relationship to the ductus arteriosus
      ii. associated anomalies (e.g., hypoplasia of transverse aorta, patent ductus arteriosus, LVOT obstruction)
   b. Physiology
      i. infant vs. older child
      ii. “preductal” vs. “postductal”
      iii. assessment of adequacy of collateral circulation
   c. Clinical features
      i. symptoms and physical findings (neonate with a closing ductus vs. older infant and child)
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. role of prostaglandins in stabilizing neonates
      vii. effect of associated anomalies (e.g., patent ductus arteriosus, aortic stenosis, ventricular septal defect)
   d. Operative repair and complications
      i. methods of repair (end-to-end vs. patch vs. subclavian angioplasty)
      ii. methods of arch reconstruction
      iii. complications (residual obstruction, paraplegia, chylothorax)
      iv. extracorporeal bypass, shunts in the absence of adequate collateral circulation
   e. Outcome
i. expected operative mortality
ii. long-term results
iii. complications
iv. re-coarctation

9. Interrupted aortic arch
   a. Anatomy
      i. types A, B, and C
      ii. associated anomalies (e.g., DiGeorge syndrome, VSD)
   b. Physiology
      i. role of ductal patency, prostaglandin
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardioogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. the role of prostaglandins in preoperative stabilization
      vii. DiGeorge syndrome (hypocalcemia, need for irradiated blood)
   d. Operative repair and complications
      i. extracorporeal bypass, hypothermic arrest
      ii. median sternotomy vs. left thoracotomy
      iii. techniques (e.g., end-to-end anastomosis, interposition grafting, absorbable vs. nonabsorbable sutures)
      iv. complications (e.g., residual obstruction, recurrent laryngeal nerve injury, chylothorax)
      v. repair of associated anomalies
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
      iv. reoperation
      v. management of DiGeorge syndrome

10. Vascular ring
    a. Anatomy
       i. double aortic arch, anomalous subclavian artery, unusual rings, pulmonary artery sling
    b. Physiology
       i. compression of airway and esophagus
    c. Clinical features
       i. signs and symptoms
       ii. barium esophagogram, CT scan, MRI
    d. Operative repair and complications
       i. techniques for exposure by left thoracotomy, indications for other approaches
       ii. technique for correction of each type
       iii. role of aortopexy
       iv. complications (e.g., recurrent laryngeal nerve paralysis, chylothorax, residual tracheomalacia)
    e. Outcome
i. expected operative mortality
ii. long-term results
iii. complications
iv. residual tracheomalacia

Clinical Skills:

During the training program the resident:

7. Performs corrections for patent ductus arteriosus and coarctation of the aorta;
8. Participates in or performs aortic valvotomy, repair of supravalvular and subvalvular aortic stenosis, pulmonary valvotomy, correction of subvalvular pulmonary stenosis, correction of vascular rings;
9. Participates in or performs operations for left ventricular outflow obstruction and interrupted aortic arch;
10. Performs preoperative evaluation and preparation;
11. Manages postoperative care;
12. Uses prostaglandins in the management of patients with neonatal coarctation, interrupted aortic arch, critical aortic stenosis.

G. Miscellaneous Anomalies

Objective:

At the end of this year the resident is familiar with the anatomy, physiology, diagnosis, and operative treatment of unusual complex congenital anomalies and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the year the resident:

3. Understands the natural history, evaluation, and treatment of coronary anomalies, congenital complete heart block, hypoplastic left heart syndrome, pulmonary atresia (with and without VSD), “corrected transposition”, single ventricle, cortriatrium, and cardiac tumors;
4. Understands the role of corrective and palliative operations for the above anomalies and of cardiac transplantation for appropriate cardiac pathology.

Contents:

6. Normal and abnormal anatomy
7. Physiology of each anomaly
8. Preoperative evaluation and diagnosis
9. Operative strategies and complications
10. Outcomes

Clinical Skills:
During the training program the resident:
6. Performs or assists in pacemaker insertion, systemic-to-pulmonary artery shunting for pulmonary atresia or stenosis (with or without VSD), and pulmonary artery banding for large left-to-right shunts;
7. Evaluates angiocardiograms, echocardiograms, and cardiac catheterizations of the above anomalies;
8. Develops treatment plans for the above anomalies;
9. Participates in or performs operative treatment for the above anomalies;
10. Manages postoperative care for the above anomalies.

H. Principles of Postoperative Care

Objective:

At the end of this year the resident understands postoperative care of patients having palliation or correction of congenital cardiac anomalies and manages all aspects of their postoperative care.
GOALS AND OBJECTIVES
ADULT CARDIAC AND GENERAL THORACIC ROTATION
Institution #3 – Abbott-Northwestern Hospital
Duration: 3 – 6 months, Year 2

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine thoracoscopic diagnostic procedures, lobectomy and pneumonectomy, mediastinoscopy and mediastinotomy, adult coronary procedures, adult cardiac valve procedures, and general thoracic surgery.

Use information technology: Fellows learn to use currently available information technology sources – Medline, PubMed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at Abbott-Northwestern Hospital.

Evaluate diagnostic studies: During the thoracic rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest CT scans, coronary angiography and cardiac catheterization studies. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program.

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.
Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Adult Cardiothoracic Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Practice-Based Learning and Improvement: Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

Professionalism: Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.

Counsel and educate patients and families:
Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the General Thoracic Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

Maintain a log of continuity of care of patients seen in the Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

**Medical Knowledge:** Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

In addition to the general competencies, the thoracic surgical resident will work closely with the faculty to learn the general principles and specific procedures for adult cardiothoracic procedures. Dr. Kshettry will be in overall charge of this rotation and the resident is expected to evaluate the patient preoperatively, perform essential portions of the procedure intraoperatively, and deliver postoperative care in the hospital setting as well as in the outpatient setting.

The thoracic and cardiovascular surgical resident, at the end of this rotation, will be expected to master the following items:
**ACQUIRED HEART DISEASE**

**A. Coronary Artery Disease**

Rotation Objective:

At the end of this rotation the resident understands the physiology of coronary circulation, the pathophysiologic causes and derangement of ischemic heart disease and the sequelae of coronary events, and performs comprehensive short and long-term management.

Learner Objectives:

Upon completion of the rotation the resident:

15. Understands the physiology of coronary circulation and the physiologic derangements caused by stenosis and obstruction;
16. Understands the development of atherosclerotic plaques and the current theories of plaque origination;
17. Knows the normal and variant anatomy of coronary circulation as well as the radiographic anatomy of the coronary arteries and the left and right ventricles;
18. Understands the rationale for and techniques of coronary artery bypass operations as well as the use of various conduits;
19. Understands the risks and complications of coronary artery bypass operations, coronary angiography, and percutaneous coronary artery balloon angioplasty;
20. Understands the preoperative and postoperative care of patients undergoing coronary artery bypass grafting;

Contents:

17. Cardiac anatomy
   a. Left and right main coronary arteries
   b. Left anterior descending coronary artery
   c. Circumflex coronary artery
   d. Right coronary artery
   e. Coronary venous system
   f. Left and right ventricular anatomy
18. Radiographic cardiac and coronary anatomy
   a. Right anterior oblique views
   b. Left anterior oblique views
   c. Cranial view
19. Pathologic development of atherosclerotic plaque  
   a. Endothelial injury  
   b. Platelet factors  
   c. Cellular factors  
   d. Serum factors  

20. Coronary artery bypass grafting  
   a. Rationale  
   b. Conduits  
   c. Techniques  
   d. Technical considerations  
   e. Myocardial protection  

21. Preoperative evaluation  
   a. Symptoms of cardiac ischemia  
   b. Non-invasive testing  
   c. Invasive testing  
   d. Decision making  

22. Postoperative care  
   a. Intensive care  
   b. Acute care  
   c. Long term management  
   d. Late complications  

23. Outcome  
   a. Expected operative mortality  
   b. Long term results  

24. Complications of ischemic heart disease  
   a. Chronic mitral insufficiency  
   b. Ruptured papillary muscle (non-operative and operative management)  
   c. Ventricular septal defect (non-operative and operative management)  
   d. Cardiac rupture (non-operative and operative management)  
   e. Left ventricular aneurysm  

Clinical Skills:  

During the training program the resident:  

13. Evaluates patients with angina pectoris, unstable angina pectoris, and acute myocardial infarction;  
14. Reads and interprets invasive and non-invasive tests of patients with ischemic heart disease;  
15. Performs operative and non-operative management of patients with ischemic heart disease, including coronary artery bypass grafting using the internal mammary artery;  
16. Participates in or performs surgery for the complications of myocardial infarction;  
17. Directs the critical care management of preoperative and postoperative patients with ischemic heart disease;  
18. Participates in the performance and evaluation of exercise tolerance tests, echocardiograms, and cardiac catheterizations.
B. Myocarditis, Cardiomyopathy, Hypertrophic Obstructive Cardiomyopathy, Cardiac Tumors

Rotation Objective:

At the end of this rotation the resident understands the pathology and etiology of diseased myocardium, the natural history of the diseases and physiologic alterations, and performs operative and non-operative management.

Learner Objectives:

Upon completion of the rotation the resident:

11. Understands the types of cardiac tumors (frequency, anatomic location, physiologic and pathologic derangements, diagnostic methods and surgical management);
12. Understands myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes);
13. Understands hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment);
14. Knows the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment);
15. Understands cardiac transplantation (immunology/rejection and treatment, physiology, indications, operative techniques, diagnostic techniques in follow-up).

Contents:

11. Tumors
   a. Types, pathology
   b. Location
   c. Physiology
   d. Primary vs. metastatic
   e. Malignant pericardial effusion
   f. Diagnostic methods
   g. Treatment
   h. Outcome
12. Myocarditis
   a. Pathologic changes
   b. Etiology
   c. Clinical findings
   d. Radiographic changes
   e. Electrocardiography
   f. Echocardiography
   g. Treatment
   h. Outcome
13. Hypertrophic cardiomyopathy (HCM)
   a. Pathologic changes
b. Anatomic changes
c. Pathophysiology
d. Obstructive vs. non-obstructive
e. Arrhythmias
f. Diagnosis
g. History and physical examination
   i. echocardiography
   ii. cardiac catheterization
h. Mitral valve
   i. systolic anterior motion
   ii. mitral regurgitation
i. Treatment
   i. mitral valve replacement
   ii. myectomy and myotomy
   iii. pacing
j. Outcome
   i. complications
   ii. long-term results

14. Cardiomyopathy
   a. Dilated
   b. Restrictive
c. Causes
d. Pathology
e. Pathophysiology
f. Diagnosis
   i. echocardiography
   ii. endomyocardial biopsy
g. Clinical course
h. Treatment
i. Outcome

15. Cardiac transplantation
   a. Techniques
   b. Indications
c. Immunology
d. Immunosuppressive treatment
e. Physiology
f. Complications and infection
g. Rejection
   i. diagnosis
   ii. treatment
h. Coronary artery disease development
i. Organ harvesting, preservation
j. Long term complications and outcome

Clinical Skills:
During the training program the resident
11. Evaluates and interprets chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with cardiac tumors, myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM);
12. Participates in or performs operative excision of cardiac tumors;
13. Participates in or performs operations for the treatment of HCM when indicated;
14. Participates in or performs heart transplants and provides preoperative and postoperative care;
15. Participates in echocardiography, cardiac catheterization, endomyocardial biopsy, and donor heart harvesting.

**C. Abnormalities of the Aorta**

Rottaion Objective:

At the end of this rotation the resident understands the etiology and physiology of diseases of the aorta and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

7. Understands the etiology and the physiology of aortic dissections and all aneurysms involving the ascending, transverse, descending, and abdominal aorta;
8. Recognizes the potential morbidity and mortality associated with aortic aneurysms and develops appropriate treatment plans for their management;
9. Knows the operative and nonoperative management of patients with acute and chronic aortic dissections;

Contents:

5. Aortic aneurysms (atherosclerotic, aortic dissections)
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
6. Operative and non-operative treatment
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal

Clinical Skills:

During the training program the resident:

9. Evaluates and interprets plain radiography, echocardiography, CT scans, MRI, and contrast studies for diseases of the aorta;
10. Participates in or performs operative and non-operative management of thoracic aortic disease, including aneurysms, dissections, and occlusive disease;
11. Plans and directs the use of extracorporeal bypass, hypothermia, and circulatory arrest for aortic diseases;
12. Performs preoperative and postoperative care of patients with aneurysms, dissections, and occlusive disease of the aorta.

**D. Cardiac Arrhythmias**

**Rotation Objective:**

At the end of this rotation the resident understands the etiology and physiology of cardiac arrhythmias, and performs operative and non-operative treatment.

**Learner Objectives:**

Upon completion of the rotation the resident:

7. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
8. Understands operative and non-operative management;
9. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

**Contents:**

7. Cardiac arrhythmias  
   a. Atrial  
   b. Ventricular  
8. Non-operative management  
   a. Anti-arrhythmic drugs  
   b. Electrical cardioversion and pacing  
   c. Catheter ablation  
9. Operative management  
   a. AICD  
   b. Intraoperative mapping and ablation  
   c. Permanent pacing systems

**Clinical Skills:**

During the training program the resident:

7. Performs the operative and non-operative management of patients with atrial arrhythmias;
8. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;
E. Valvular Heart Disease

Unit Objective:

At the end of this unit, the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the unit the resident:

11. Understands the normal and pathologic anatomy of the atrioventricular and semilunar valves;
12. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
13. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
14. Knows the techniques for repair and replacement of cardiac valves;
15. Knows the preoperative and postoperative management of patients with valvular heart disease.

10. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
11. Understands operative and non-operative management;
12. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

10. Cardiac arrhythmias
   a. Atrial
   b. Ventricular
11. Non-operative management
   a. Anti-arrhythmic drugs
   b. Electrical cardioversion and pacing
   c. Catheter ablation
12. Operative management
   a. AICD
   b. Intraoperative mapping and ablation
   c. Permanent pacing systems

Clinical Skills:

During the training program the resident:

10. Performs the operative and non-operative management of patients with atrial arrhythmias;
11. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;

**E. Valvular Heart Disease**

Unit Objective:

At the end of this unit, the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the unit the resident:

16. Understands the normal and pathologic anatomy of the atroventricular and semilunar valves;
17. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
18. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
19. Knows the techniques for repair and replacement of cardiac valves;
20. Knows the preoperative and postoperative management of patients with valvular heart disease.

Contents:

13. Assessment of patients with valvular heart disease
   a. History and physical examination
   b. Echocardiogram
   c. Cardiac catheterization data
14. Choice of treatment
   a. Prosthetic valves
   b. Stented xenografts
   c. Non-stented human and xenograft valves
   d. Autograft valves for aortic valve replacement
   e. Valve repair
15. Long term complications of replacement devices
   a. Thrombosis
   b. Embolus
   c. Prosthetic dysfunction
16. Mitral valve
   a. Normal anatomy
   b. Normal function
   c. Mitral stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology
      iv. non-operative treatment
v. indications for intervention (risk stratification)
vi. merits of balloon valve dilation vs. operative repair or replacement
vii. techniques of valve repair and replacement
viii. intraoperative and postoperative complications and management
ix. early and late results of operative and balloon valvulotomy
d. Mitral incompetence
i. etiology and pathologic anatomy
ii. natural history and complications
iii. physiology (mechanisms of incompetence)
iv. non-operative treatment
   • for nonischemic etiology
   • for ischemic etiology
v. indications for surgical intervention (risk stratification)
vi. techniques of valve repair
   • ring and suture annuloplasty
   • leaflet plication, excision
   • chordal/papillary muscle shortening
   • chordal transposition and artificial chordae
vii. perioperative care
viii. early and late results of repair and replacement

17. Aortic valve
   a. Normal anatomy
   b. Normal function
   c. Aortic stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (ventricular hypertrophy, mitral incompetence)
      iv. non-operative therapy
      v. indications for operative intervention (risk stratification)
      vi. techniques of valve replacement and repair
         • management of small aortic root
         • homograft and autograft valve replacement
      vii. perioperative care considerations
      viii. early and late results
   d. Aortic incompetence
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (LV dilatation and LV dysfunction)
      iv. non-operative treatment
      v. indications for operative intervention
         • in absence of clinical symptoms
         • when complicated by endocarditis
         • when complicated by aortic root aneurysm
      vi. techniques of valve repair and replacement
         • with endocarditis and aortic root abscess
         • with ascending and root aneurysm
vii. perioperative care considerations
viii. early and late results

18. Tricuspid valve
   a. Normal anatomy
   b. Normal function
   c. Tricuspid incompetence
      i. etiology and pathologic anatomy
      ii. physiology
      iii. indications for operation
          • functional incompetence
          • endocarditis
      iv. techniques of repair, indications for replacement
          • ring and suture annuloplasty
          • endocarditis (valve excision vs. repair or replacement)
   v. perioperative care
      • management of RV dysfunction
      • interventions to decrease pulmonary vascular resistance
   vi. early and late results
   d. Tricuspid stenosis
      i. etiology and pathologic anatomy
      ii. physiology
      iii. differentiation from constrictive pericarditis
      iv. indications for operative repair vs. replacement
      v. techniques of repair and replacement
      vi. early and late results

Clinical Skills:

During the training program the resident:

7. Evaluates, diagnoses and selects management strategies for patients with valvular heart disease, including participation in and interpretation of cardiac catheterizations and echocardiograms;
8. Makes use of the therapeutic options and relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
9. Manages preoperative clinical preparation and early and intermediate postoperative care;

Performs valve repair and replacement for valvular disease, interprets intraoperative echo.
GOALS AND OBJECTIVES
CONGENITAL HEART DISEASE SURGICAL ROTATION
Institution #1 – University of Minnesota Childrens Hospital, University of Minnesota
Duration: 2-4 months, Year 2

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine congenital cardiac anomaly repair procedures.

Use information technology: Fellows learn to use currently available information technology sources – Medline, PubMed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at Amplatz.

Evaluate diagnostic studies: During the congenital rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of cardiac catheterizations and cardiac echoes. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals while on the congenital service.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program.

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.
Function as a team member and/or leader: The Thoracic Fellow is expected to provide overall leadership for the Congenital Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.
Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Congenital Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Maintain a log of continuity of care of patients seen in the Peds Specialty Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

Systems-Based Practice: Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

Medical Knowledge: Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.
The Thoracic Fellow is expected to master the following core topics by the end of the rotation:

At the end of this unit the resident understands the physiology of the developing heart, the physiologic changes of advancing age and transition ex-utero, and the physiologic consequences of congenital heart disease. The resident understands the findings in and limitations of invasive and non-invasive tests to define physiologic abnormalities and uses them in patient management.

Learner Objectives:

Upon completion of the rotation the resident:

7. Understands normal fetal circulation;
8. Understands the transitional nature of circulation as the fetus becomes a neonate;
9. Understands the physiology of obstructions, of intra- and extracardiac shunts, of abnormal connections to the heart, and of combinations of these anomalies in the fetus, neonate, and child.

Contents:

11. Fetal circulation
   a. Oxygen source
   b. Flow pattern of blood through the heart and circulation
   c. Cardiac output and its distribution
   d. Myocardial function
   e. Regulation of the circulation

12. Transitional and neonatal circulation
   a. General changes
   b. Pulmonary circulation changes (e.g., mechanical factors, oxygen effects, vasoactive substances, hormonal factors)
   c. Ductus arteriosus changes (factors effecting closure or maintaining patency)
   d. Foramen ovale changes (factors effecting closure or maintaining patency)
   e. Physiologic assessment of the neonate

13. Fundamental anatomic abnormalities and physiologic consequences
   a. Anatomic abnormalities: obstruction (e.g., aortic stenosis, pulmonary atresia); extra pathways (e.g., atrial septal defect, ventricular septal defect); abnormal connections (e.g., transposition of the great vessels)
   b. Increased blood flow to a region
   c. Decreased blood flow to a region
   d. Combinations of increased or decreased blood flow to a region (e.g., tetralogy of Fallot, double outlet right ventricle, anomalous pulmonary veins)
14. Hemodynamic assessment
   a. Usefulness and limitations of echocardiographic doppler
   b. Usefulness and limitations of cardiac catheterization
   c. Calculations of regional flows and resistances
   d. Calculation of flow resistance and ratio
   e. Pulmonary vascular resistance and pulmonary hypertension

15. Indications for operation
   a. Clinical symptoms and signs of obstructive lesions
   b. Clinical symptoms and signs of extra pathway lesions
   c. Clinical symptoms and signs of abnormal connections

Clinical Skills:

During the training program the resident:

13. Describes the physiologic changes of circulation during neonatal life;
14. Diagnoses clinically important congenital heart diseases in the neonate, infant, and child;
15. Applies a knowledge of anatomic abnormalities and their physiologic consequences to diagnose congenital heart defects;
16. Manages the physiologic aspects of the neonate, infant, and child with congenital heart disease preoperatively, intraoperatively, and postoperatively;
17. Stabilizes patients who are critically ill with congenital heart disease;
18. Performs calculations of blood flows and resistances from cardiac catheterization data.

C. Cardiopulmonary Bypass for Operations on Congenital Cardiac Anomalies

Rotation Objective:

At the end of this rotation the resident has a working knowledge of the principles of cardiopulmonary bypass for congenital heart disease, the techniques of myocardial preservation, and the use of profound hypothermia and total circulatory arrest in the infant and child.

Learner Objectives:

Upon completion of the rotation the resident:

13. Knows the indications for the various techniques of bypass (anatomy, pathophysiology, and technical requirements of the underlying cardiac defects);
14. Knows arterial and venous cannulation techniques for different intracardiac defects;
15. Understands the techniques of myocardial protection in the neonate and young infant;
16. Understands the use of varying levels of hemodilution and anticoagulation;
17. Understands perfusion flow and pressure control;
18. Knows the methods of body temperature manipulation, and the indications for and techniques of profound hypothermia with and without total circulatory arrest.

Contents:

9. Monitoring for cardiopulmonary bypass
   a. Arterial pressure lines
   b. Central venous pressure, pulmonary artery pressure
   c. Temperature monitoring (nasopharyngeal, esophageal, rectal, bladder)
   d. O2 saturation, end-tidal CO2
   e. Urine output

10. Cannulation
    a. Single venous (indications, technique)
    b. Double venous (indications, technique)
    c. Arterial (technique)
    d. Venting (indications, technique)
    e. Cardioplegia

11. Myocardial preservation techniques
    a. Crystalloid, blood
    b. Cold, warm
    c. Antegrade, retrograde
    d. Additives
    e. Fibrillation

12. Profound hypothermia and total circulatory arrest
    a. Indications
    b. Benefits, disadvantages
    c. Safe duration of total circulatory arrest
    d. Early cerebral complications
    e. Late intellectual, neurological, psychiatric outcome

Clinical Skills:

During the training program the resident:

7. Performs arterial and venous cannulation and initiates cardiopulmonary bypass;
8. Directs the perfusionist in the intraoperative management and conduct of cardiopulmonary bypass;
9. Performs or participates in the repair of congenital heart defects using cardiopulmonary bypass.

D. Left-To-Right Shunts

Rotation Objective:

At the end of the rotation the resident understands the diagnosis and treatment of left-to-right shunts caused by congenital cardiac anomalies, and performs operative and non-operative treatment.

Learner Objectives:
Upon completion of the rotation the resident:

9. Knows the anatomy, embryology, and physiology of the most common or important anomalies;
10. Knows the operative indications of the most common or important anomalies;
11. Knows the technical components of the operative repair of the most common or important anomalies;
12. Understands the postoperative care of each anomaly.

Contents:

13. Atrial septal defect
   a. Anatomy
      i. types of atrial septal defects and key landmarks of the right atrium.
   b. Clinical features
      i. natural history, indications for operation
      ii. clinical signs and symptoms, physical exam
      iii. chest x-ray and ECG
      iv. echocardiogram and cardiac catheterization
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. incisions in the heart
      iii. techniques for defect closure
      iv. treatment of associated anomalies (e.g., cleft mitral valve)
      v. complications of closure (e.g., air embolism, conduction abnormalities, residual defects)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

14. Ventricular septal defect
   a. Anatomy
      i. types
   b. Clinical features
      i. clinical signs and symptoms, physical exam
      ii. echocardiogram and cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history
      v. indications, contraindications, timing of operation (e.g., total repair vs. pulmonary artery banding)
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. incisions for different types of defects
      iii. closure techniques (direct suture vs. patch)
      iv. treatment of associated anomalies (e.g., atrial septal defect, right ventricular muscle bands)
      v. complications (rhythm disturbances, residual defects, air)
      vi. techniques of PA banding
d. Outcomes
   i. expected operative mortality
   ii. long-term results
   iii. complications

15. Patent ductus arteriosus
   a. Anatomy
   b. Physiology
      i. neonate vs. older child
      ii. effect of prostaglandin and prostaglandin inhibitors
   c. Diagnosis and clinical features
      i. symptoms and physical findings
      ii. echocardiogram and cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history (neonate vs. older child, endocarditis)
      v. indications for operation
      vi. associated anomalies (e.g., ductus-dependent conditions)
   d. Operative repair and complications
      i. operative techniques for simple ductus
      ii. management of the difficult ductus
      iii. complications of operative repair
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

16. Atrioventricular septal defect
   a. Anatomy
      i. types (complete, transitional, ostium primum ASD)
      ii. atrioventricular valve pathologic anatomy
   b. Physiology
      i. shunts and resistance calculation
      ii. complete vs. incomplete
   c. Diagnosis and clinical features
      i. symptoms and signs (infant vs. older patient, physical exam)
      ii. echocardiogram, angiocardio gram, cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history (development of Eisenmenger's syndrome)
      v. indications for and timing of operation (size of shunt, endocarditis risk, total repair vs. pulmonary artery banding)
   d. Operative repair and complications
      i. cardiopulmonary bypass and myocardial protection
      ii. incisions in the heart
      iii. operative techniques
      iv. complications (residual defects, residual “mitral valve” insufficiency, heart block)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
iii. complications

17. Double-outlet right ventricle
   a. Anatomy
      i. types (subaortic, subpulmonic, uncommitted)
      ii. associated anomalies
   b. Clinical features
      i. natural history
      ii. indications for and timing of operation
      iii. signs and symptoms of each of the anatomic types
      iv. chest x-ray, ECG
      v. echocardiogram and cardiac catheterization
   c. Operative repair and complications
      i. palliative operations vs. total repair (application of shunts, pulmonary artery band, total repair)
      ii. cardiopulmonary bypass and myocardial protection
      iii. approach to each anatomic subtype and placement of incisions in the heart
      iv. specific operative techniques (e.g., suturing, placement of patches)
      v. complications and their management
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

18. Aorto-pulmonary window
   a. Anatomy
   b. Clinical features
      i. natural history (development of pulmonary vascular obstructive disease)
      ii. symptoms and signs
      iii. echocardiogram, angiocardiogram, cardiac catheterization
      iv. chest x-ray, ECG
   c. Operative repair
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

Clinical Skills:

During the training program the resident:

9. Participates in or performs the operative repair of atrial septal defects, ventricular septal defects, patent ductus arteriosus, and pulmonary artery banding;
10. Participates in or performs the repair of more complex cardiac anomalies;
11. Performs the preoperative evaluation of patients with each of these anomalies;
12. Manages postoperative care.
E. Cyanotic Anomalies

Rotation Objective:
At the end of this rotation the resident knows the anatomy and physiology of anomalies that result in cyanosis, their diagnosis, their preoperative, operative, and postoperative management, and performs operative and non-operative treatment.

Learner Objectives:
Upon completion of the rotation the resident:

13. Knows the anatomy and physiology of each anomaly;
14. Knows the methods of diagnosis;
15. Understands the role of medical management and interventional cardiology as treatment options;
16. Knows the indications for and timing of operation;
17. Understands the technical components of operative repair;
18. Knows the postoperative care, expected outcome, long-term results, and complications.

Contents:

13. Tetralogy of Fallot
   a. Anatomy and embryology
      i. embryology of malaligned ventricular septal defect
      ii. levels of right ventricular outflow tract obstruction
   b. Physiology
      i. genesis of “tet spells” and infundibular spasm
      ii. factors which affect degree of right-to-left shunt
      iii. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. role of systemic-to-pulmonary artery shunt vs. total repair
      ii. types of aortic-to-pulmonary artery shunts
      iii. extracorporeal bypass and myocardial protection
      iv. ventricular septal defect closure by transvenricular or transatrial approach
      v. techniques for relief of right ventricular outflow tract obstruction and indications for transannular patching
      vi. indications for conduit repair
   e. Outcome
      i. expected operative mortality
      ii. long-term results
iii. complications

14. Transposition of the great vessels (TGA)
   a. Anatomy
      i. simple TGA
      ii. complex TGA (ventricular septal defect, pulmonary stenosis)
   b. Physiology
      i. concept of circulations in parallel and mixing
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
      v. indications for and timing of operations
   d. Operative repair and complications
      i. technique of Blalock-Hanlon atrial septectomy, open atrial septectomy
      ii. cardiopulmonary bypass and myocardial protection
      iii. operative techniques for total repair (Mustard, Senning, arterial switch, Rastelli)
      iv. palliative operations (PA band, systemic-to-pulmonary artery shunt)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
      iv. arrhythmias after atrial repairs
      v. semilunar insufficiency, PA stenosis, coronary problems after arterial switch
      vi. conduit obstruction after Rastelli

15. Truncus arteriosus
   a. Anatomy
      i. types of truncus arteriosus
      ii. associated anomalies (VSD, left ventricular outflow tract obstruction, arch interruption, DiGeorge syndrome)
   b. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiogram
      iii. chest x-ray, ECG
      iv. natural history (development of pulmonary vascular obstructive disease)
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. operative techniques
         - conduits (composite and homograft)
         - modifications required for types II and III truncus
      iii. techniques for repair of associated anomalies
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
16. Tricuspid atresia
   a. Anatomy
      i. types I and II, subtypes
   b. Physiology
      i. subtypes with right-to-left shunt
      ii. subtypes with left-to-right shunt
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiography, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
      v. indications for and timing of operation
      vi. role of palliative operations (systemic-pulmonary artery shunts, PA banding, bidirectional Glenn, Fontan, other right heart bypass operations)
   d. Operative repair and complications
      i. palliative operations
      ii. operations for right heart bypass (bidirectional Glenn, Fontan)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

17. Total anomalous pulmonary venous connection
   a. Anatomy
      i. supracardiac, cardiac, infracardiac, mixed
   b. Physiology
      i. obstructive vs. nonobstructive
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiography, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques for different subtypes
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

18. Ebstein's anomaly
   a. Anatomy
   b. Physiology
      i. concept of atrialized ventricle
      ii. right ventricular outflow tract obstruction
   c. Clinical features
      i. symptoms and physical findings
ii. cardiac catheterization, echocardiogram, angiocardiogram
iii. chest x-ray, ECG
iv. natural history
v. associated lesions (e.g., Wolf-Parkinson-White syndrome)
vi. indications for and timing of operation
d. Operative repair and complications
   i. extracorporeal bypass and myocardial protection
   ii. technique of tricuspid repair, obliteration of atrialized ventricle
   iii. technique of tricuspid valve replacement
e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

Clinical Skills:

During the training program the resident:

9. Participates in or performs the major palliative operations for these congenital cardiac anomalies;
10. Participates in or performs operative repair of tetralogy, TGA, truncus arteriosus, TAPVR, Ebstein's anomaly, and Fontan-type operations;
11. Performs preoperative evaluation and preparation;
12. Manages postoperative care.

F. Obstructive Anomalies

Rotation Objective:

At the end of this rotation the resident understands the anatomy and physiology of obstructive anomalies of the left and right sides of the heart and aorta, their diagnosis, management, and postoperative care, and performs the operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

15. Knows the anatomy and physiology of each anomaly;
16. Knows the methods of diagnosis;
17. Understands the role of medical management and interventional cardiology;
18. Knows the indications for and timing of operation;
19. Knows the technical components of operative repair;
20. Understands the principles of postoperative care;
21. Knows the expected outcome, long-term results and complications

Contents:
11. Aortic stenosis
   a. Anatomy
      i. supravalvular, valvular, subvalvular (including subtypes)
   b. Physiology
      i. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques
      iii. pros and cons of various techniques and patch configurations for supravalvular stenosis
      iv. techniques of aortic valvotomy
      v. operations to enlarge the aortic annulus (e.g., Konno-Rastan procedure, Ross procedure)
      vi. technique of apical aortic conduit
      vii. myomectomy and myotomy for subaortic obstruction
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

12. Pulmonary stenosis
   a. Anatomy
      i. valvular and supravalvular
      ii. associated anomalies (e.g., atrial septal defect, ventricular septal defect, branch stenosis)
   b. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history; role of balloon valvuloplasty
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. incisions in the heart and great vessels
      iii. operative considerations (technique of valvulotomy, indications for transannular patching, division of right ventricular muscle bands)
      iv. complications (residual obstruction)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

13. Coarctation of the aorta
   a. Anatomy
      i. relationship to the ductus arteriosus
ii. associated anomalies (e.g., hypoplasia of transverse aorta, patent ductus arteriosus, LVOT obstruction)

b. Physiology
   i. infant vs. older child
   ii. “preductal” vs. “postductal”
   iii. assessment of adequacy of collateral circulation

c. Clinical features
   i. symptoms and physical findings (neonate with a closing ductus vs. older infant and child)
   ii. echocardiogram, angiogram, cardiac catheterization
   iii. chest x-ray, ECG
   iv. natural history
   v. indications for and timing of operation
   vi. role of prostaglandins in stabilizing neonates
   vii. effect of associated anomalies (e.g., patent ductus arteriosus, aortic stenosis, ventricular septal defect)

d. Operative repair and complications
   i. methods of repair (end-to-end vs. patch vs. subclavian angioplasty)
   ii. methods of arch reconstruction
   iii. complications (residual obstruction, paraplegia, chylothorax)
   iv. extracorporeal bypass, shunts in the absence of adequate collateral circulation

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
   iv. re-coarctation

14. Interrupted aortic arch
a. Anatomy
   i. types A, B, and C
   ii. associated anomalies (e.g., DiGeorge syndrome, VSD)

b. Physiology
   i. role of ductal patency, prostaglandin

c. Clinical features
   i. symptoms and physical findings
   ii. echocardiogram, angiocardiogram, cardiac catheterization
   iii. chest x-ray, ECG
   iv. natural history
   v. indications for and timing of operation
   vi. the role of prostaglandins in preoperative stabilization
   vii. DiGeorge syndrome (hypocalcemia, need for irradiated blood)

d. Operative repair and complications
   i. extracorporeal bypass, hypothermic arrest
   ii. median sternotomy vs. left thoracotomy
   iii. techniques (e.g., end-to-end anastomosis, interposition grafting, absorbable vs. nonabsorbable sutures)
   iv. complications (e.g., residual obstruction, recurrent laryngeal nerve injury, chylothorax)
   v. repair of associated anomalies
e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
   iv. reoperation
   v. management of DiGeorge syndrome

15. Vascular ring
   a. Anatomy
      i. double aortic arch, anomalous subclavian artery, unusual rings, pulmonary artery sling
   b. Physiology
      i. compression of airway and esophagus
   c. Clinical features
      i. signs and symptoms
      ii. barium esophagogram, CT scan, MRI
   d. Operative repair and complications
      i. techniques for exposure by left thoracotomy, indications for other approaches
      ii. technique for correction of each type
      iii. role of aortopexy
      iv. complications (e.g., recurrent laryngeal nerve paralysis, chylothorax, residual tracheomalacia)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
      iv. residual tracheomalacia

Clinical Skills:

During the training program the resident:

13. Performs corrections for patent ductus arteriosus and coarctation of the aorta;
14. Participates in or performs aortic valvotomy, repair of supravalvular and subvalvular aortic stenosis, pulmonary valvotomy, correction of subvalvular pulmonary stenosis, correction of vascular rings;
15. Participates in or performs operations for left ventricular outflow obstruction and interrupted aortic arch;
16. Performs preoperative evaluation and preparation;
17. Manages postoperative care;
18. Uses prostaglandins in the management of patients with neonatal coarctation, interrupted aortic arch, critical aortic stenosis.

G. Miscellaneous Anomalies

Rotation Objective:

At the end of this rotation the resident is familiar with the anatomy, physiology, diagnosis, and operative treatment of unusual complex congenital anomalies and performs operative and non-operative treatment.
Learner Objectives:

Upon completion of the rotation the resident:

5. Understands the natural history, evaluation, and treatment of coronary anomalies, congenital complete heart block, hypoplastic left heart syndrome, pulmonary atresia (with and without VSD), “corrected transposition”, single ventricle, cor triatriatum, and cardiac tumors;
6. Understands the role of corrective and palliative operations for the above anomalies and of cardiac transplantation for appropriate cardiac pathology.

Contents:

11. Normal and abnormal anatomy
12. Physiology of each anomaly
13. Preoperative evaluation and diagnosis
14. Operative strategies and complications
15. Outcomes

Clinical Skills:
During the training program the resident:

11. Performs or assists in pacemaker insertion, systemic-to-pulmonary artery shunting for pulmonary atresia or stenosis (with or without VSD), and pulmonary artery banding for large left-to-right shunts;
12. Evaluates angiocardiograms, echocardiograms, and cardiac catheterizations of the above anomalies;
13. Develops treatment plans for the above anomalies;
14. Participates in or performs operative treatment for the above anomalies;
15. Manages postoperative care for the above anomalies.

H. Principles of Postoperative Care

Rotation Objective:

At the end of this rotation the resident understands postoperative care of patients having palliation or correction of congenital cardiac anomalies and manages all aspects of their postoperative care.
GOALS AND OBJECTIVES
ADULT CARDIAC SURGERY ROTATION
Institution #4 – Fairview Southdale Hospital
Duration: 2 - 6 months, Year 2

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine thoracoscopic diagnostic procedures, lobectomy and pneumonectomy, mediastinoscopy and mediastinotomy, adult coronary procedures, adult cardiac valve procedures, and general thoracic surgery.

Use information technology: Fellows learn to use currently available information technology sources – Medline, PubMed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at Fairview Southdale Hospital.

Evaluate diagnostic studies: During the thoracic rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest CT scans, coronary angiography and cardiac catheterization studies. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.
Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: The Thoracic Fellow is expected to provide overall leadership for the Adult Cardiothoracic Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Practice-Based Learning and Improvement: Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

Professionalism: Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.
Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the General Thoracic Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

Maintain a log of continuity of care of patients seen in the Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

**Medical Knowledge:** Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

In addition to the general competencies, the thoracic surgical resident will work closely with the faculty to learn the general principles and specific procedures for adult cardiothoracic procedures. Dr. Ranjit John will be in overall charge of this rotation and the resident is expected to evaluate the patient preoperatively, perform essential portions of the procedure intraoperatively, and deliver postoperative care in the hospital setting as well as in the outpatient setting.
The thoracic and cardiovascular surgical resident, at the end of this rotation, will be expected to master the following items:

**ACQUIRED HEART DISEASE**

**A. Coronary Artery Disease**

Rotation Objective:

At the end of this rotation the resident understands the physiology of coronary circulation, the pathophysiologic causes and derangement of ischemic heart disease and the sequelae of coronary events, and performs comprehensive short and long-term management.

Learner Objectives:

Upon completion of the rotation the resident:

22. Understands the physiology of coronary circulation and the physiologic derangements caused by stenosis and obstruction;
23. Understands the development of atherosclerotic plaques and the current theories of plaque origination;
24. Knows the normal and variant anatomy of coronary circulation as well as the radiographic anatomy of the coronary arteries and the left and right ventricles;
25. Understands the rationale for and techniques of coronary artery bypass operations as well as the use of various conduits;
26. Understands the risks and complications of coronary artery bypass operations, coronary angiography, and percutaneous coronary artery balloon angioplasty;
27. Understands the preoperative and postoperative care of patients undergoing coronary artery bypass grafting;

Contents:

25. Cardiac anatomy
   a. Left and right main coronary arteries
   b. Left anterior descending coronary artery
   c. Circumflex coronary artery
   d. Right coronary artery
   e. Coronary venous system
   f. Left and right ventricular anatomy
26. Radiographic cardiac and coronary anatomy
a. Right anterior oblique views  
b. Left anterior oblique views  
c. Cranial view  
d. Ventriculography  

27. Pathologic development of atherosclerotic plaque  
a. Endothelial injury  
b. Platelet factors  
c. Cellular factors  
d. Serum factors  

28. Coronary artery bypass grafting  
a. Rationale  
b. Conduits  
c. Techniques  
d. Technical considerations  
e. Myocardial protection  

29. Preoperative evaluation  
a. Symptoms of cardiac ischemia  
b. Non-invasive testing  
c. Invasive testing  
d. Decision making  

30. Postoperative care  
a. Intensive care  
b. Acute care  
c. Long term management  
d. Late complications  

31. Outcome  
a. Expected operative mortality  
b. Long term results  

32. Complications of ischemic heart disease  
a. Chronic mitral insufficiency  
b. Ruptured papillary muscle (non-operative and operative management)  
c. Ventricular septal defect (non-operative and operative management)  
d. Cardiac rupture (non-operative and operative management)  
e. Left ventricular aneurysm  

Clinical Skills:  

During the training program the resident:  

19. Evaluates patients with angina pectoris, unstable angina pectoris, and acute myocardial infarction;  
20. Reads and interprets invasive and non-invasive tests of patients with ischemic heart disease;  
21. Performs operative and non-operative management of patients with ischemic heart disease, including coronary artery bypass grafting using the internal mammary artery;  
22. Participates in or performs surgery for the complications of myocardial infarction;  
23. Directs the critical care management of preoperative and postoperative patients with ischemic heart disease;
24. Participates in the performance and evaluation of exercise tolerance tests, echocardiograms, and cardiac catheterizations.

**B. Myocarditis, Cardiomyopathy, Hypertrophic Obstructive Cardiomyopathy, Cardiac Tumors**

**Rotation Objective:**

At the end of this rotation the resident understands the pathology and etiology of diseased myocardium, the natural history of the diseases and physiologic alterations, and performs operative and non-operative management.

**Learner Objectives:**

Upon completion of the rotation the resident:

16. Understands the types of cardiac tumors (frequency, anatomic location, physiologic and pathologic derangements, diagnostic methods and surgical management);
17. Understands myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes);
18. Understands hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment);
19. Knows the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment);
20. Understands cardiac transplantation (immunology/rejection and treatment, physiology, indications, operative techniques, diagnostic techniques in follow-up).

**Contents:**

16. Tumors
   a. Types, pathology
   b. Location
   c. Physiology
   d. Primary vs. metastatic
   e. Malignant pericardial effusion
   f. Diagnostic methods
   g. Treatment
   h. Outcome
17. Myocarditis
   a. Pathologic changes
   b. Etiology
   c. Clinical findings
   d. Radiographic changes
   e. Electrocardiography
   f. Echocardiography
   g. Treatment
18. Hypertrophic cardiomyopathy (HCM)
   a. Pathologic changes
   b. Anatomic changes
   c. Pathophysiology
   d. Obstructive vs. non-obstructive
   e. Arrhythmias
   f. Diagnosis
   g. History and physical examination
   i. echocardiography
   ii. cardiac catheterization
   h. Mitral valve
   i. systolic anterior motion
   ii. mitral regurgitation
   i. Treatment
   i. mitral valve replacement
   ii. myectomy and myotomy
   iii. pacing
   j. Outcome
   i. complications
   ii. long-term results

19. Cardiomyopathy
   a. Dilated
   b. Restrictive
   c. Causes
   d. Pathology
   e. Pathophysiology
   f. Diagnosis
   i. echocardiography
   ii. endomyocardial biopsy
   g. Clinical course
   h. Treatment
   i. Outcome

20. Cardiac transplantation
   a. Techniques
   b. Indications
   c. Immunology
   d. Immunosuppressive treatment
   e. Physiology
   f. Complications and infection
   g. Rejection
   i. diagnosis
   ii. treatment
   h. Coronary artery disease development
   i. Organ harvesting, preservation
   j. Long term complications and outcome
Clinical Skills:
During the training program the resident

16. Evaluates and interprets chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with cardiac tumors, myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM);
17. Participates in or performs operative excision of cardiac tumors;
18. Participates in or performs operations for the treatment of HCM when indicated;
19. Participates in or performs heart transplants and provides preoperative and postoperative care;
20. Participates in echocardiography, cardiac catheterization, endomyocardial biopsy, and donor heart harvesting.

C. Abnormalities of the Aorta

Rottaion Objective:

At the end of this rotation the resident understands the etiology and physiology of diseases of the aorta and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

10. Understands the etiology and the physiology of aortic dissections and all aneurysms involving the ascending, transverse, descending, and abdominal aorta;
11. Recognizes the potential morbidity and mortality associated with aortic aneurysms and develops appropriate treatment plans for their management;
12. Knows the operative and nonoperative management of patients with acute and chronic aortic dissections;

Contents:

7. Aortic aneurysms (atherosclerotic, aortic dissections)
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
8. Operative and non-operative treatment
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal

Clinical Skills:

During the training program the resident:
13. Evaluates and interprets plain radiography, echocardiography, CT scans, MRI, and contrast studies for diseases of the aorta;
14. Participates in or performs operative and non-operative management of thoracic aortic disease, including aneurysms, dissections, and occlusive disease;
15. Plans and directs the use of extracorporeal bypass, hypothermia, and circulatory arrest for aortic diseases;
16. Performs preoperative and postoperative care of patients with aneurysms, dissections, and occlusive disease of the aorta.

**D. Cardiac Arrhythmias**

Rotation Objective:

At the end of this rotation the resident understands the etiology and physiology of cardiac arrhythmias, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

13. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
14. Understands operative and non-operative management;
15. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

13. Cardiac arrhythmias
   a. Atrial
   b. Ventricular
14. Non-operative management
   a. Anti-arrhythmic drugs
   b. Electrical cardioversion and pacing
   c. Catheter ablation
15. Operative management
   a. AICD
   b. Intraoperative mapping and ablation
   c. Permanent pacing systems

Clinical Skills:

During the training program the resident:

13. Performs the operative and non-operative management of patients with atrial arrhythmias;
14. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;
15. Participates in electrophysiologic studies.

**E. Valvular Heart Disease**

Unit Objective:

At the end of this unit, the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the unit the resident:

21. Understands the normal and pathologic anatomy of the atroventricular and semilunar valves;
22. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
23. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
24. Knows the techniques for repair and replacement of cardiac valves;
25. Knows the preoperative and postoperative management of patients with valvular heart disease.

16. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
17. Understands operative and non-operative management;
18. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

16. Cardiac arrhythmias
   a. Atrial
   b. Ventricular
17. Non-operative management
   a. Anti-arrhythmic drugs
   b. Electrical cardioversion and pacing
   c. Catheter ablation
18. Operative management
   a. AICD
   b. Intraoperative mapping and ablation
   c. Permanent pacing systems

Clinical Skills:

During the training program the resident:

16. Performs the operative and non-operative management of patients with atrial arrhythmias;
17. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;
18. Participates in electrophysiologic studies.

**E. Valvular Heart Disease**

Unit Objective:

At the end of this unit, the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the unit the resident:

26. Understands the normal and pathologic anatomy of the atrioventricular and semilunar valves;
27. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
28. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
29. Knows the techniques for repair and replacement of cardiac valves;
30. Knows the preoperative and postoperative management of patients with valvular heart disease.

Contents:

19. Assessment of patients with valvular heart disease
   a. History and physical examination
   b. Echocardiogram
   c. Cardiac catheterization data
20. Choice of treatment
   a. Prosthetic valves
   b. Stented xenografts
   c. Non-stented human and xenograft valves
   d. Autograft valves for aortic valve replacement
   e. Valve repair
21. Long term complications of replacement devices
   a. Thrombosis
   b. Embolus
   c. Prosthetic dysfunction
22. Mitral valve
   a. Normal anatomy
   b. Normal function
   c. Mitral stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
iii. physiology
iv. non-operative treatment
v. indications for intervention (risk stratification)
vi. merits of balloon valve dilation vs. operative repair or replacement
vii. techniques of valve repair and replacement
viii. intraoperative and postoperative complications and management
ix. early and late results of operative and balloon valvulotomy
d. Mitral incompetence
i. etiology and pathologic anatomy
ii. natural history and complications
iii. physiology (mechanisms of incompetence)
iv. non-operative treatment
   • for nonischemic etiology
   • for ischemic etiology
v. indications for surgical intervention (risk stratification)
vi. techniques of valve repair
   • ring and suture annuloplasty
   • leaflet plication, excision
   • chordal/papillary muscle shortening
   • chordal transposition and artificial chordae
vii. perioperative care
viii. early and late results of repair and replacement
23. Aortic valve
   a. Normal anatomy
   b. Normal function
   c. Aortic stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (ventricular hypertrophy, mitral incompetence)
      iv. non-operative therapy
      v. indications for operative intervention (risk stratification)
      vi. techniques of valve replacement and repair
         • management of small aortic root
         • homograft and autograft valve replacement
      vii. perioperative care considerations
      viii. early and late results
d. Aortic incompetence
   i. etiology and pathologic anatomy
   ii. natural history and complications
   iii. physiology (LV dilatation and LV dysfunction)
   iv. non-operative treatment
   v. indications for operative intervention
      • in absence of clinical symptoms
      • when complicated by endocarditis
      • when complicated by aortic root aneurysm
   vi. techniques of valve repair and replacement
- with endocarditis and aortic root abscess
- with ascending and root aneurysm

vii. perioperative care considerations
viii. early and late results

24. Tricuspid valve
   a. Normal anatomy
   b. Normal function
   c. Tricuspid incompetence
      i. etiology and pathologic anatomy
      ii. physiology
      iii. indications for operation
         - functional incompetence
         - endocarditis
      iv. techniques of repair, indications for replacement
         - ring and suture annuloplasty
         - endocarditis (valve excision vs. repair or replacement)
   v. perioperative care
      - management of RV dysfunction
      - interventions to decrease pulmonary vascular resistance
   vi. early and late results

d. Tricuspid stenosis
   i. etiology and pathologic anatomy
   ii. physiology
   iii. differentiation from constrictive pericarditis
   iv. indications for operative repair vs. replacement
   v. techniques of repair and replacement
   vi. early and late results

Clinical Skills:

During the training program the resident:

10. Evaluates, diagnoses and selects management strategies for patients with valvular heart disease, including participation in and interpretation of cardiac catheterizations and echocardiograms;
11. Makes use of the therapeutic options and relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
12. Manages preoperative clinical preparation and early and intermediate postoperative care;

Performs valve repair and replacement for valvular disease, interprets intraoperative echo.
GOALS AND OBJECTIVES
CATHETER BASED ROTATION
Institution #2 – VA Medical Center
Duration: 3 months, Year 2

In addition to adherence to the general competencies, the thoracic surgical resident will work closely with endovascular surgeons on the faculty to learn the general principles and specific procedures for endovascular procedures. This will include the evaluation of appropriate imaging, a detailed knowledge of the diseases of the vascular system that lend themselves to repair with endovascular techniques, and the ability to select the appropriate procedures and care regimen for each patient.

The resident is expected to work on a close basis with the endovascular faculty members and to collaborate closely with them to learn the evolving techniques and surgical decision-making that is involved with each disease entity and with each patient.

The resident is also expected to evaluate the patient preoperatively, perform essential portions of the procedure intraoperatively, and deliver postoperative care in the hospital setting as well as in the outpatient setting.

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

**Demonstrate technical ability:** Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing endovascular procedures.

**Use information technology:** Fellows learn to use currently available information technology sources – Medline, PubMed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC, VAMC and Fairview-Southdale Hospital.

**Evaluate diagnostic studies:** During the endovascular rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of vascular diagnostic examinations. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.
Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Endovascular Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or
in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: The Thoracic Fellow is expected to provide overall leadership for the Endovascular Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

Maintain a log of continuity of care of patients seen in the Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: The Thoracic Fellow is expected to provide overall leadership for the Endovascular Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.
The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

**Medical Knowledge:** Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

In addition to the general competencies, the thoracic surgical resident will work closely with endovascular surgeons on the faculty to learn the general principles and specific procedures for endovascular procedures. This will include the evaluation of appropriate imaging, a detailed knowledge of the diseases of the vascular system that lend themselves to repair with endovascular techniques, and the ability to select the appropriate procedures and care regimen for each patient.

The resident is expected to work on a close basis with the endovascular faculty members and to collaborate closely with them to learn the evolving techniques and surgical decision-making that is involved with each disease entity and with each patient.

The resident is also expected to evaluate the patient preoperatively, perform essential portions of the procedure intraoperatively, and deliver postoperative care in the hospital setting as well as in the outpatient setting.
GOALS AND OBJECTIVES

ENT ROTATION (Thoracic Track only)
Institution #1 – University of Minnesota Medical Center
Duration: 1 month, Year 2

This rotation is currently being established specifically for the thoracic track training.
GOALS AND OBJECTIVES

MINIMALLY INVASIVE FOREGUT ROTATION (Thoracic Track only)
Institution #1 – University of Minnesota Medical Center
Duration: 2 months, Year 2

This rotation is currently being established specifically for the thoracic track training.
GOALS AND OBJECTIVES
INTERVENTIONAL RADIOLOGY ROTATION (Thoracic Track only)
Institution #1 – University of Minnesota Medical Center
Duration: 1 month, Year 2

This rotation is currently being established specifically for the thoracic track training.
GOALS AND OBJECTIVES
CATHETER BASED SURGERY ROTATION
Institution #2 – Minneapolis VA
Duration: 2 months, Year 2

This rotation is currently being established specifically for the thoracic track training.
Year 3 (Senior/Chief Resident Year):

In this year, the thoracic and cardiovascular surgical resident is expected to assume the highest level of responsibilities and is involved at the senior levels in every aspect of the training program.

The resident is expected to perform at the highest levels of responsibility, surgical skill, and overall care of the patients on the entire service. Six months are spent in institution #1 and six months are spent in institution #2.

In addition to performing at the highest levels, the third year (senior/chief) resident is expected to assume administrative control of the service and is responsible for the education and progress of the residents and students under his responsibility. He will work closely on a daily and hourly basis with the thoracic surgical faculty in assuming progressive levels of responsibility.

At the end of year 3, the cardiothoracic resident will be expected to master the following items:

THIRD YEAR GOALS AND OBJECTIVES:

Patient Care: deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to:

Develop and execute patient care plan: During the outpatient clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine thoracoscopic diagnostic procedures, lobectomy and pneumonectomy, mediastinoscopy and mediastinotomy, adult cardiac surgery including difficult coronary artery bypass surgeries, valve replacements, implantation of ventricular assist devices, heart and lung transplantation, management of heart failure patients, and reoperations.

Use information technology: fellows learn to use currently available information technology sources – Medline, PubMed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC and VAMC.

Evaluate diagnostic studies: During the Adult cardiac surgery rotations the fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest scan examinations, coronary angiogram, heart catheterization. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.
Interpersonal and Communication Skills: demonstrate effective information exchange and teaming with patients, their families, and other health professionals. The thoracic fellow is expected to:

Communicate with other healthcare professionals:

**Physician to Physician**: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

**Physician to other Health Team Members**: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program.

Counsel and educate patients and families:

**Physician to Patient**: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

**Physician to Family**: as appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Adult Cardiac Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

Caring/respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the adult cardiac surgery rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

Practice-Based Learning and Improvement: demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:
Demonstrate ability to practice lifelong learning: fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes: though case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: routine use of on-line resources ad-lib to address clinical decision making or care.

Professionalism: demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to:

Maintain high standards of ethical behavior.

Demonstrate continuity of care - - preoperative, operative and postoperative: the fellow will maintain a log of continuity of care of patients seen in the Tuesday General Thoracic Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

Systems-Based Practice: demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

Medical Knowledge: develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

The Thoracic Fellow is expected to master the following core topics by the end of the year:

CHEST WALL
A. Anatomy, Physiology and Embryology

Objectives-upon completion of this year the fellow:

1. Understands the anatomy and physiology of the cutaneous, muscular, and bony components of the chest wall and their anatomic and physiologic relationships to adjacent structures;

2. Understands the anatomy of the vascular, neural, muscular, and bony components of the thoracic outlet;

3. Knows all operative approaches to the chest wall;

4. Knows the surgical anatomy, neural, vascular, and skeletal components of the chest wall, as well as the major musculocutaneous flaps.

Contents:

1. Chest wall embryology
   a. Ectodermal, mesodermal, endodermal

2. Chest wall anatomy
   a. Skeletal
   b. Muscular
   c. Neural
   d. Vascular
   e. Relationships to adjacent structures

3. Diagnostic tests to define chest wall anatomy
   a. Chest x-ray
   b. CAT scans
   c. MRI scans
   d. Nuclear scans
   e. Pulmonary function tests

4. Major flaps of the chest wall and their vascular pedicles
   a. Latissimus dorsi
   b. Pectoralis major
   c. Serratus anterior
   d. Trapezius
   e. Intercostal
   f. Pleural
   g. Pericardial fat pad
   h. Rectus abdominis
i. Omental  
j. Vascularized rib graft

Clinical Skills during the training program the fellow:

7. Recognizes the normal and abnormal anatomy of the chest wall;  
8. Reads and interprets tests to diagnose chest wall abnormalities;  
9. Performs operations utilizing major chest wall flaps and the correct application of prosthetic materials.

B. Acquired Abnormalities and Neoplasms

Objectives upon completion of this year the fellow:

13. Understands the diagnosis and management of various chest wall infections;  
14. Evaluates and diagnoses primary and metastatic chest wall tumors, knows their histologic appearance, and understands the indications for incisional versus excisional biopsy;  
15. Knows the radiologic characteristics of tumors;  
16. Knows the indications for and methods of prosthetic chest wall reconstruction (e.g., methylmethacrylate, Marlex®, Gortex®, Vicryl®, and Dacron® mesh);  
17. Knows the types of chemotherapy and radiotherapy (induction neo-adjuvant and adjuvant therapy) of chest wall tumors and the indications for preoperative and postoperative therapy;  
18. Knows the management of osteoradionecrosis of the chest wall.

Contents:

5. Malignant neoplasms of the chest wall  
   a. Chondrosarcoma  
   b. Osteogenic sarcoma  
   c. Myeloma  
   d. Ewing's sarcoma  
   e. Metastatic lesions  
   f. Lung cancer invading the chest wall

6. Benign neoplasms of the chest wall  
   a. Fibrous dysplasia  
   b. Chondroma  
   c. Osteochondroma  
   d. Eosinophilic granuloma

Clinical Skills during the training program the fellow:

11. Performs a variety of surgical incisions to expose components of the chest wall and interior thoracic organs;  
12. Performs surgical resections of primary and secondary chest wall tumors;  
13. Identifies the need for major flaps of the chest wall;  
14. Identifies the need for prosthetic replacement of the chest wall;  
15. Performs surgical reconstruction of chest wall defects.
LUNGS AND PLEURA

A. Anatomy, Physiology, Embryology and Testing

Objectives—upon completion of this year the fellow:

19. Understands the segmental anatomy of the bronchial tree and bronchopulmonary segments;
20. Understands the arterial, venous and bronchial anatomy of the lungs and their inter-relationships;
21. Understands the lymphatic anatomy of the lungs, the major lymphatic nodal stations, and lymphatic drainage routes of the lung segments;
22. Knows the indications for different thoracic incisions, the surgical anatomy encountered, and the physiological impact;
23. Knows the indications for plain radiography, CT scan, magnetic resonance imaging, and PET scanning for staging of lung cancer;
24. Knows the indications, interpretation, and use of nuclear medicine ventilation/perfusion scanning (V/Q scan) to determine the operability of candidates for pulmonary resection;
25. Understands the methods of invasive staging (e.g., mediastinoscopy, Chamberlain procedure, scalene node biopsy, thoracoscopy);
26. Knows how to interpret pulmonary function tests;
27. Knows how to perform pulmonary function tests.

Contents:

5. Normal anatomy and histology of the lung
   a. Segmental anatomy of the bronchial tree
   b. Bronchopulmonary segments (topography)
   c. Hilar anatomy
   d. Lymphatic anatomy and drainage of the lung
   e. Histologic anatomy and cell types of the lung
   f. Endoscopic anatomy of the larynx, trachea, and bronchi

6. Normal physiology of the lung
   a. Chest wall mechanics
   b. Large and small airway mechanics
   c. Alveolar mechanics and gas exchange
   d. Chest x-ray
   e. CT scan of the chest and abdomen
   f. MRI of the chest
   g. Contrast angiography of major vessels within the chest
   h. Radioactive isotope scanning of organs within the chest
   i. Anterior thoracotomy
   j. Posterolateral thoracotomy
   k. Posterior thoracotomy
   l. Muscle sparing thoracotomy
Clinical Skills—during the training program the fellow:

13. Reads and interprets pulmonary function studies, ventilation/perfusion scans, pulmonary arteriograms and arterial blood gases, and correlates the results with operability;
14. Applies knowledge of thoracic anatomy to the physical examination of the chest, heart, and vascular tree;
15. Applies knowledge of thoracic anatomy to flexible and rigid endoscopy;
16. Uses knowledge of chest, pulmonary, and cardiac physiology to interpret tests involving the thoracic cavity and to understand and treat diseases of the chest and its contents;
17. Reads and interprets plain radiography, CT scans, magnetic resonance imaging, and PET scanning of the chest;
18. Participates in the performance of exercise tolerance tests and pulmonary function tests.

B. Non-Neoplastic Lung Disease

Learner Objectives—upon completion of this year the fellow:

19. Understands diagnostic procedures used to evaluate non-neoplastic lung disease;
20. Knows the common pathogens that produce lung infections, including their presentation and pathologic processes, and knows the treatment and indications for operative intervention;
21. Understands the natural history, presentation and treatment of chronic obstructive lung disease;
22. Knows the indications for bullectomy, lung reduction, and pulmonary transplantation;
23. Understands the pathologic results and alterations of pulmonary function due to bronchospasm;
24. Understands the principles of surgical resection for non-neoplastic lung disease;
25. Understands the mechanisms by which foreign bodies reach the airways, how they cause pulmonary pathology, and the management of patients with airway foreign bodies;
26. Understands the causes, physiology, evaluation and management of hemoptysis;
27. Knows the complications of lung resection and their management.

Contents:

13. Common pulmonary pathogens
   a. Bacteria
   b. Fungi
   c. Tuberculosis mycobacterium
   d. Viruses
   e. Protozoa
   f. Immunocompromised patients
14. Chronic obstructive pulmonary disease
a. Natural history
b. Presentation, evaluation
c. Alteration of lung function
d. Complications requiring operative treatment
e. Treatment (operative and non-operative)

15. Bronchospasm
   a. Natural history
   b. Evaluation
   c. Complications requiring operative treatment
   d. Treatment (operative and non-operative)

16. Foreign bodies of the lung and airways
   a. Common types
   b. Causes, pathology
   c. Evaluation
   d. Treatment (operative and non-operative)

17. Hemoptysis
   a. Causes
   b. Physiologic derangements
   c. Evaluation
   d. Treatment (operative and non-operative)

18. Pneumothorax
   a. Etiology
   b. Indications for treatment
   c. Types of treatment

Clinical Skills—during the training program the fellow:

13. Diagnoses and treats patients with bacterial, fungal, tuberculous, and viral lung infections;
14. Performs operative and non-operative management of lung abscess;
15. Performs resections of lung and bronchi in patients with non-neoplastic lung disease;
16. Manages patients with chronic obstructive lung disease, bronchospastic airway disease, foreign bodies
   of the airways, and hemoptysis;
17. Performs thoracentesis, mediastinoscopy, mediastinotomy, flexible and rigid bronchoscopy,
   thoracoscopy, and open lung biopsy;
18. Performs bronchoalveolar lavage and transbronchial lung biopsy.

C. Neoplastic Lung Disease

Objectives—upon completion of this year the fellow:

19. Understands TNM staging of lung carcinoma and its application to the diagnosis, therapeutic planning,
   and management of patients with lung carcinoma;
20. Evaluates and diagnoses neoplasia of the lung, using a knowledge of the histologic appearance of the
   major types;
21. Knows the signs of inoperability;
22. Understands the therapeutic options for patients with lung neoplasms;
23. Understands the principles of bronchoplastic surgery;
24. Understands the complications of pulmonary resection and their management;
25. Understands the role of adjuvant therapy for lung neoplasms;
26. Understands the indications for resection of benign lung neoplasms;
27. Understands the indications for resection of pulmonary metastases.

Contents:

9. Benign tumors of the lung and airways
   a. Pathology, biologic behavior
   b. Evaluation, diagnosis, treatment (operative and non-operative)
10. Solitary lung nodule
    a. Differential diagnosis, evaluation, diagnostic techniques
    b. Treatment (operative and non-operative)
11. Malignant tumors of the lung and airways
    a. Pathology, biologic behavior
    b. Evaluation, diagnosis, treatment (operative and non-operative)
12. Metastatic tumors to the lungs
    a. Pathology and biologic behavior
    b. Evaluation, diagnosis, treatment (operative and non-operative)

Clinical Skills—during the training program the fellow:

13. Evaluates patients with lung neoplasia and recommends therapy based on their functional status, pulmonary function and tumor type;
14. Performs staging procedures (e.g., bronchoscopy, mediastinoscopy, mediastinotomy, and thoracoscopy);
15. Performs operations to extirpate neoplasms of the lung (e.g., local excision, wedge resection, segmental resection, lobectomy, pneumonectomy, sleeve lobectomy, carinal resection, chest wall resection);
16. Recognizes and manages complications of pulmonary resections (e.g., space problem, persistent air leak, bronchopleural fistula, bronchovascular fistula, empyema, cardiac arrhythmia);
17. Performs bedside bronchoscopies and placement of tracheostomies and/or minitracheostomies;
18. Recognizes and treats the early signs of non-cardiac pulmonary edema.

E. Diseases of the Pleura

Objectives—upon completion of this year the fellow:

11. Is familiar with the clinical presentation of benign and malignant diseases of the pleura;
12. Understands the types of pleural effusions, their evaluation and treatment;
13. Understands the management of empyema with and without bronchopleural fistula;
14. Understands the indications, contraindications, and complications of video assisted thoracic surgery and has a working knowledge of the equipment;
15. Understands the treatment of benign and malignant diseases of the pleura.

Contents:

7. Mesothelioma
   a. Pathology, biologic behavior, and natural history
   b. Treatment (operative and non-operative)
8. Pleural effusions
   a. Types
   b. Diagnosis
   c. Treatment (operative and non-operative)
9. Empyema
   a. Presentation with and without bronchopleural fistula
   b. Diagnosis
   c. Treatment (operative and non-operative)
   d. Surgical options (e.g., thoracentesis, tube thoracostomy, decortication, rib resection, repair of bronchopleural fistula)

Clinical Skills—during the training program the fellow:

15. Evaluates pleural effusions and recommends appropriate therapy;
16. Performs invasive diagnostic studies (e.g., incisional and excisional biopsy, needle biopsy, fluid analysis);
17. Places tube thoracostomies and performs chemical or mechanical pleurodesis;
18. Performs initial drainage procedures and subsequent procedures for empyema (e.g., decortication, empyemectomy, rib resection, Eloesser flap, Claggett procedure, closure of bronchopleural fistula);
19. Performs video assisted thorascopic surgery as necessary for the diagnosis and treatment of pleural disease.
20. Places pleuroperitoneal shunts;

MEDIASTINUM AND PERICARDIUM

A. Anatomy, Physiology and Embryology

Objectives—upon completion of this year the fellow:

9. Understands the anatomic boundaries of the mediastinum and the structures found within each region;
10. Understands the embryologic development of structures within the mediastinum and the variations and pathologic consequences of abnormally located structures;
11. Understands the radiologic assessment of the mediastinum including CT scan, MRI, contrast studies, and angiography;
12. Understands the aberrations caused by pericardial abnormalities and their effects on the heart and circulation.

Contents:
9. Superior mediastinum
   a. Major structures
   b. Diagnostic studies
10. Anterior mediastinum
    a. Major structures
    b. Diagnostic studies
11. Middle mediastinum (visceral compartment)
    a. Major structures
    b. Diagnostic studies
12. Posterior mediastinum (paravertebral sulcus)
    a. Major structures
    b. Diagnostic studies

During the training program the fellow:

   7. Reads and interprets mediastinal plain radiographs, CT scans, MRI, and contrast studies;
   8. Applies knowledge of mediastinal anatomy and physiology to the diagnosis of mediastinal abnormalities;
   9. Applies knowledge of pericardial physiology to the diagnosis of pericardial abnormalities.

B. Congenital Abnormalities of the Mediastinum

Objectives- upon completion of this year the fellow:

   7. Is able to diagnose mediastinal cysts;
   8. Is familiar with the symptoms associated with mediastinal abnormalities;
   9. Knows the indications for operations involving the mediastinum and the anatomic approaches.

Contents:

5. Mediastinal cysts
   a. Mediastinal cysts
   b. Pericardial cysts
   c. Cystic hygroma
   d. Bronchogenic cysts
   e. Esophageal duplications
   f. Management (operative and non-operative)
6. Symptoms of mediastinal abnormalities

Clinical Skills- during the training program the fellow:

   7. Reads and interprets plain radiographs, CT scans, MRI's and contrast studies of congenital abnormalities of the mediastinum;
   8. Diagnoses and manages patients with congenital abnormalities of the mediastinum;
9. Performs operations for congenital abnormalities of the mediastinum.

C. Acquired Abnormalities of the Mediastinum

Learner Objectives—upon completion of this year the fellow:

13. Understands mediastinal infections and their management;
14. Understands the diagnostic tests available;
15. Recognizes the histologic appearance of benign and malignant mediastinal neoplasms;
16. Understands the neoplastic and non-neoplastic mediastinal diseases;
17. Understands the operative management of benign and malignant mediastinal neoplasms;
18. Understands chemotherapy and radiotherapy in mediastinal neoplasm management.

Contents:

11. Anterior mediastinal tumors
   a. Thymoma
   b. Thyroid
   c. Teratoma
   d. Lymphoma
   e. Germ cell tumor
   f. Histologic appearance
   g. Management (operative and non-operative)

12. Middle mediastinal tumors
   a. Lymphoma
   b. Hamartoma
   c. Cardiac tumors
   d. Histologic appearance
   e. Management (operative and non-operative)

13. Posterior mediastinum (paravertebral sulcus)
   a. Neurilemoma
   b. Neurofibroma
   c. Pheochromocytoma
   d. Ganglion neuroma
   e. Dumbbell neurogenic tumor
   f. Histologic appearance
   g. Management (operative and non-operative)

14. Mediastinal infection
   a. Postoperative
   b. Primary
   c. Management (operative and non-operative)

15. Diagnostic tests
   a. Plain radiographs
   b. CT scans
   c. MRI
   d. Contrast studies
Clinical Skills—during the training program the fellow:

9. Performs diagnostic tests and operations on the mediastinum;
10. Diagnoses and manages mediastinal infection;
11. Recognizes the histologic appearance of mediastinal tumors;
12. Manages patients with mediastinal tumors.

TRACHEA AND BRONCHI

A. Anatomy, Physiology and Embryology

Objectives—upon completion of this year the fellow:

9. Understands the anatomy and blood supply of the trachea and bronchi;
10. Understands the endoscopic anatomy of the nasopharynx, hypopharynx, larynx, trachea, and major bronchi;
11. Understands and interprets pulmonary function studies of the trachea and bronchi;
12. Understands the radiologic assessment of the trachea and bronchi.

Contents:

9. Trachea
   a. Blood supply
   b. Histologic and gross anatomy
   c. Lymphatic anatomy and drainage
   d. Contiguous structures
   e. Radiographic anatomy and tests
   f. Endoscopic anatomy and tests
10. Bronchi
    a. Blood supply
    b. Histologic and gross anatomy
    c. Segmental anatomy
    d. Lymphatic relationships
    e. Radiographic anatomy and tests
    f. Endoscopic anatomy and tests
11. Physiologic evaluation
    a. Pulmonary function tests
b. Flow volume loops

12. Radiologic evaluation
   a. Plain radiographs
   b. Tomography
   c. CT scan
   d. Fluoroscopy
   e. MRI
   f. Barium swallow

Clinical Skills—during the training program the fellow:

5. Interprets plain radiographic analyses, CT scan, MRI, and pulmonary function studies involving the trachea and bronchi;
6. Performs endoscopy of the upper airway, trachea and major bronchi.

B. Congenital and Acquired Abnormalities

Objectives—upon completion of this year the fellow:

19. Understands congenital abnormalities and idiopathic diseases of the trachea;
20. Understands the etiology, presentation and management of acquired tracheal strictures and their prevention;
21. Understands the etiology, presentation, diagnosis and management of tracheoesophageal fistulas and tracheoinnominate artery fistulas;
22. Knows the operative approaches to the trachea and techniques of mobilization;
23. Knows the methods of airway management, anesthesia and ventilation for tracheal operations;
24. Knows the principles of tracheal surgery and release maneuvers;
25. Understands the complications of tracheal surgery and their management;
26. Understands the etiology, presentation, and principles of airway trauma management;
27. Understands the radiologic evaluation of tracheal abnormalities.

Contents:

13. Radiologic assessment of the trachea and bronchi
   a. Plain x-rays
   b. CT scans
   c. MRI
   d. Barium swallow
14. Stricture of the trachea
   a. Post-intubation
   b. Post-tracheostomy
   c. Post-traumatic
15. Anesthesia for tracheal operations
   a. Methods of airway control
   b. Extubation concerns
16. Operative approaches to the trachea
a. Reconstruction of the upper trachea
b. Reconstruction of the lower trachea
c. Mediastinal tracheostomy

17. Tracheostomy and its complications
   a. Tracheal stenosis
   b. Tracheo-esophageal fistula
   c. Tracheo-innominate artery fistula
   d. Persistent tracheal stoma

18. Airway trauma
   a. Airway control
   b. Evaluation of associated injuries
   c. Principles of repair (primary and secondary)
   d. Protecting tracheostomies

Clinical Skills—during the training program the fellow:

15. Evaluates diagnostic tests of the trachea and bronchi;
16. Performs laryngoscopy and bronchoscopy of the trachea and bronchi, including dilation of stenoses;
17. Performs tracheostomy
18. Evaluates patients for tracheal resection and plans the operation;
19. Performs tracheal resection and reconstruction for tracheal stenosis;
20. Performs placement of tracheal T-tubes;

C. Neoplasms

Objectives—upon completion of this year the fellow:

9. Knows the types, histology, and clinical presentation of tracheal neoplasms;
10. Understands the radiologic evaluation and operative management of tracheal neoplasms;
11. Understands the methods of airway management;
12. Knows the indications for and the use of radiotherapy and chemotherapy.

Contents:

9. Neoplasms of the trachea
   a. Benign
   b. Malignant
   c. Metastatic
10. Operative techniques
    a. Resection of tracheal tumors
    b. Methods of tracheal reconstruction
    c. Operative approaches
11. Prosthetics
    a. Silastic prosthetics
b. Stents
c. Types of tracheostomy tubes and tracheal T-tubes

12. Airway management
   a. Bronchoscopic “core out”
   b. Laser

Clinical Skills-during the training program the fellow:

13. Performs rigid and flexible bronchoscopy for diagnosis and “core-out”;
14. Performs resection of tracheal tumors;
15. Manages patients and their airways after tracheal resection;
16. Uses laser techniques in the management of endoluminal tumors;
17. Uses stents, tracheal T-tubes and tracheostomy tubes in the management of tracheal neoplasms;
18. Uses adjunctive therapy for the management of tracheal tumors.

DIAPHRAGM

A. Anatomy, Physiology and Embryology

13. Knows the embryologic origin of the diaphragm;
14. Understands the anatomy of the diaphragm and adjacent structures;
15. Understands the neural and vascular supply of the diaphragm and the pathologic consequences of injury;
16. Understands imaging studies for assessing the diaphragm;
17. Understands the consequences of incisions in the diaphragm;
18. Understands developmental anomalies of the diaphragm.

Contents:

7. Normal anatomy of the diaphragm
   a. Origins and insertions
   b. Vascular and neural supply
8. Foramina of the diaphragm
   a. Esophageal
   b. Vascular
   c. Morgagni and Bochdalek
9. Contiguous structures
   a. Heart
   b. Lungs
   c. Vessels
   d. Chest wall

Clinical Skills-during the training program the fellow:
5. Uses knowledge of the normal anatomy and physiology of the diaphragm to treat primary or contiguous abnormalities;
6. Evaluates and interprets radiographic studies of the diaphragm, including fluoroscopy, CT scan, and MRI.

**B. Acquired Abnormalities, Neoplasms**

17. Understands the presentation of diaphragmatic rupture and associated injuries;
18. Knows evaluation methods for penetrating injuries of the diaphragm;
19. Knows management of infections immediately above and below the diaphragm;
20. Understands the etiology, presentation, diagnosis, and management of acquired diaphragmatic hernias;
21. Understands the etiology, diagnosis, and treatment of diaphragmatic paralysis;
22. Understands the primary and secondary tumors of the diaphragm and their management;
23. Understands reconstruction methods for the diaphragm;
24. Understands the indications for and techniques of diaphragmatic pacing.

**Contents:**

11. Diaphragmatic rupture
   a. Clinical presentation
   b. Physiologic effects
   c. Operative management
   d. Management of associated injuries
12. Periphrenic abscess
   a. Clinical presentation
   b. Physiologic effects
   c. Operative management
13. Acquired diaphragmatic hernias
   a. Esophageal
   b. Eventration
   c. Treatment
14. Tumors of the diaphragm
   a. Mesenchymal origin (benign and malignant)
   b. Neurogenic (benign and malignant)
   c. Secondary (lung, esophageal, mesothelioma)
   d. Treatment
15. Paralysis of the diaphragm
   a. Causes
   b. Diagnosis
   c. Treatment

**Clinical Skills** during the training program the fellow:

15. Interprets plain and contrast x-rays, fluoroscopy, CT scans, and MRI of the diaphragm;
16. Performs operative repair of acquired diaphragmatic abnormalities and provides preoperative and postoperative care;
17. Reconstructs defects of the diaphragm;
18. Performs diagnostic studies of the diaphragm (e.g., pneumoperitoneum, direct incisional and excisional biopsy, video assisted thoracoscopic surgery);
19. Performs diaphragmatic mobilization for exposure of the spine and aorta;
20. Performs operative removal of diaphragmatic tumors;
21. Inserts permanent diaphragmatic pacemakers.

ESOPHAGUS

A. Anatomy, Physiology and Embryology

7. Understands the anatomy, embryology, innervation, and vascular supply of the esophagus and adjacent structures;
8. Understands the physiologic function of the esophagus and pharynx;
9. Understands the radiographic evaluation of the esophagus.

Contents:

7. Anatomy of the esophagus
   a. Histology
   b. Blood supply
   c. Nerve supply
   d. Sphincters
   e. Muscular composition
   f. Mucosa
8. Physiology of the esophagus
   a. Normal peristalsis
   b. Hormonal influences
   c. Neural influences
9. Assessment of the esophagus
   a. Contrast studies
   b. Manometry
   c. pH studies
   d. Radionucleotide scans
   e. Endoscopy

During the year the fellow:

7. Interprets esophageal plain radiographs, contrast studies, CT scans, MRI, and intraluminal echo;
8. Orders and interprets manometric and pH studies of the esophagus;
9. Performs rigid and flexible endoscopy of the pharynx and esophagus.

B. Acquired Abnormalities

21. Understands the pathophysiology, histology, complications, and diagnosis of esophageal reflux;
22. Understands the indications for and principles of anti-reflux operations;
23. Understands the clinical presentation, diagnosis, and management of paraesophageal hernias;
24. Knows the clinical presentation, causes, diagnosis, and treatment of motility disorders of the esophagus;
25. Understands the clinical presentation, diagnosis, and management of esophageal perforation;
26. Understands the clinical presentation, diagnosis, and management of chemical injuries and trauma of the esophagus;
27. Understands the indications, methods, and operative approaches for esophageal replacement;
28. Understands the clinical presentation, diagnosis, and management of esophageal foreign bodies;
29. Understands the presentation and management of complications of esophageal operations;
30. Understands the etiology, presentation, and management of infections after esophageal injuries and operations.

Contents:

21. Esophageal reflux
   a. Histology
   b. Clinical presentation
   c. Etiology
   d. Diagnosis
   e. Operative and non-operative management
   f. Management of complications (bleeding, ulceration, Barrett's mucosa, stricture)

22. Paraesophageal hernias
   a. Clinical presentation
   b. Diagnosis and indications for operation
   c. Operative management

23. Motility disorders
   a. Achalasia
   b. Scleroderma
   c. Spasm
   d. Diverticula
   e. Clinical presentation
   f. Diagnosis
   g. Operative and non-operative management

24. Esophageal perforation
   a. Etiology
   b. Clinical presentation and diagnosis
   c. Operative and non-operative management

25. Trauma
   a. Chemical injuries
   b. Blunt and penetrating trauma
   c. Clinical presentation and diagnosis
   d. Operative and non-operative management

26. Esophageal replacement
   a. Stomach
   b. Jejunum
   c. Colon
d. Free jejunal replacement

27. Foreign bodies
   a. Clinical presentation and diagnosis
   b. Methods of removal

28. Video assisted thoracic surgery for esophageal disorders
   a. Indications
   b. Techniques

29. Infections
   a. Moniliasis
   b. Diagnosis
   c. Treatment

30. Rings and webs
   a. Diagnosis
   b. Treatment

During the year the fellow:

19. Interprets esophageal plain radiographs, contrast studies, CT scans, MRI, manometry, pH studies, and intraluminal echo;
20. Performs esophagoscopy, foreign body removal and biopsy;
21. Uses various operative approaches to different parts of the esophagus;
22. Performs anti-reflux operations including management of strictures;
23. Performs resection and reconstruction using various esophageal substitutes;
24. Evaluates and manages patients with esophageal motility disorders, performs myotomy and resection of diverticula;
25. Diagnoses, manages, and performs operations for esophageal perforation, chemical burns, and trauma;
26. Manages the complications of esophageal operations;
27. Uses video assisted thoracic surgery for esophageal diseases where appropriate.

C. Neoplasms

17. Understands the types of benign esophageal neoplasms, their clinical presentation, diagnosis, and treatment;
18. Understands the types of malignant esophageal neoplasms, their clinical presentation, diagnosis, histologic appearance, and treatment;
19. Understands the TNM staging of esophageal cancer;
20. Understands the role of chemotherapy and radiotherapy in esophageal cancer;
21. Understands the operative approaches, methods, and complications of esophageal resection and reconstruction;
22. Understands the indications for operative and non-operative treatment of esophageal cancer;
23. Understands the principles of patient management after esophageal resection;
24. Understands the nutritional management of patients with esophageal neoplasms.

Contents:

5. Benign esophageal tumors
a. Histology
b. Fibrovascular polyps
c. Leiomyoma
d. Operative and non-operative management

6. Malignant esophageal tumors
   a. Histology
   b. Squamous cell carcinoma
c. Adenocarcinoma
d. Sarcoma
e. Small cell carcinoma
f. Melanoma
g. Staging
h. Adjuvant treatment
i. Operative management
j. Methods of palliation

During the rotation the fellow:

17. Evaluates malignant and benign esophageal tumors and recommends overall management, including neoadjuvant therapy;
18. Performs diagnostic tests for esophageal neoplasms and correlates the results with clinical staging;
19. Performs esophagectomy through various approaches;
20. Performs reconstruction with various esophageal substitutes;
21. Diagnoses and manages complications of esophageal surgery;
22. Manages nutritional needs after esophageal surgery;
23. Performs palliative operations for obstructing esophageal lesions;
24. Recommends appropriate postoperative or alternate therapy for advanced or recurrent disease.

TRANSPLANTATION

A. Cardiac Transplantation

Objective:

At the end of this year, the resident knows the principles of organ preservation, immunosuppressive therapy, signs and treatment of rejection, and the indications for and techniques of cardiac transplantation.

Objectives:

Upon completion of the year the resident:

8. Knows the indications for cardiac transplantation;
9. Understands the management of immunosuppressive therapy in cardiac transplantation;
10. Knows the techniques of cardiac transplantation;
11. Recognizes the signs and symptoms of cardiac rejection and knows the appropriate management;
12. Understands the evaluation and management of organ donors;
13. Knows the methods of organ harvest and preservation;

Contents:

7. **Indications for cardiac transplantation**
   a. Patient evaluation
   b. Patient selection
   c. Informed consent

8. **Immunosuppressive therapy in cardiac transplantation**
   a. Evaluation of therapy
   b. Drugs
   c. Complications

9. **Technique of cardiac transplantation**
   a. Orthotopic
   b. Heterotopic

10. **Donor preparation and organ harvest**
    a. Brain death, legal and family-related issues
    b. Donor evaluation
    c. Methods of organ procurement and preservation

11. **Cardiac rejection**
    a. Signs and symptoms
    b. Endomyocardial biopsy
    c. Histologic evaluation
    d. Management
    e. Mechanical support and re-transplantation

12. **Immunosuppressive therapy**
    a. Immunosuppressive drugs and their side effects
    b. Polyclonal and monoclonal antibody therapy and side effects
    c. Complications

Clinical Skills:

During the training program the resident:

8. Manages organ donors;
9. Performs organ harvest and preservation;
10. Performs cardiac transplantation;
11. Manages the cardiac transplant recipient preoperatively and postoperatively;
12. Participates in the immunosuppressive therapy for cardiac transplantation;
13. Evaluates transplant recipients for signs of rejection or infection and initiates appropriate therapy;

B. Lung Transplantation

Objective:

At the end of this year the resident understands the basic principles of lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the indications for and performs lung transplantation.

Objectives:

Upon completion of the year the resident:

8. Understands the evaluation and management of organ donors;
9. Knows the indications for lung transplantation;
10. Understands the management of immunosuppressive therapy in lung transplantation;
11. Knows the techniques of single and double lung transplantation;
12. Recognizes the signs and symptoms of lung rejection or infection and knows the appropriate management;
13. Knows the methods for harvesting and preserving donor lungs;

Contents:

Indications for lung transplantation

d. Patient evaluation
e. Patient selection
f. Informed consent

8. Immunosuppressive therapy in lung transplantation
   a. Evaluation of therapy
   b. Drugs

   c. Complications

9. Technique of single and double lung transplantation
   a. Left lung
   b. Right lung
   c. Extracorporeal bypass techniques and indications for their use

10. Donor evaluation
   a. History
   b. Physiology
   c. Radiology

11. Donor preparation and organ harvest
a. Brain death, legal and family-related issues
b. Organ procurement and preservation
c. Pharmacologic and technical aspects of donor lung harvest operations

12. Pulmonary rejection
   a. Signs and symptoms
   b. Endobronchial biopsy
   c. Histologic evaluation of rejection
   d. Management of rejection

13. Immunosuppressive therapy
   a. Immunosuppressive drugs and their side effects
   b. Antibody therapy and side effects
   c. Complications of immunosuppressive therapy

Clinical Skills:

During the training program the resident:

8. Performs or participates in donor evaluation and management;
9. Performs or participates in donor lung harvest and preservation;
10. Performs or participates in lung transplantation;
11. Participates in the immunosuppressive therapy for lung transplantation;
12. Manages the lung transplant recipient preoperatively and postoperatively;
13. Evaluates transplant recipients for signs of rejection or infection, and initiates appropriate therapy;

C. Heart-Lung Transplantation

Objective:

At the end of this year the resident understands the principles of heart-lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the techniques of heart-lung transplantation.

Objectives:

Upon completion of the year the resident:

9. Knows the indications for heart-lung transplantation;
10. Understands the management of immunosuppressive therapy of heart-lung transplantation;
11. Knows the operative techniques of heart-lung transplantation;
12. Recognizes the signs and symptoms of pulmonary rejection in cardiopulmonary transplantation;
13. Recognizes infection and rejection, and knows the appropriate management of each;
14. Understands the evaluation and management of heart-lung donors;
15. Knows the methods for harvesting and preserving heart-lung blocs;
16. Is familiar with the techniques and complications of radiologic and fiberoptic bronchoscopy of the transplanted lung in the heart-lung recipient.

Contents:

7. Immunosuppressive therapy in cardiopulmonary transplantation  
   a. Evaluation of therapy  
   b. Drugs  
   c. Complications  
8. Technique of heart-lung transplantation  
9. Donor evaluation  
   a. History  
   b. Physiology  
   c. Radiology  
10. Donor preparation and harvest  
    a. Brain death, legal and family-related issues  
    b. Organ procurement and preservation  
    c. Pharmacologic and technical aspects of donor heart-lung harvesting  
11. Rejection in cardiopulmonary transplantation  
    a. Signs and symptoms  
    b. Frequency of cardiac rejection and indications for endomyocardial biopsy  
    c. Techniques for diagnosing lung rejection in the cardiopulmonary transplant patient  
    d. Histologic evaluation of pulmonary rejection in the cardiopulmonary transplant patient  
    e. Management of rejection in the cardiopulmonary transplant recipient  
12. Immunosuppressive therapy  
    a. Immunosuppressive drugs and their side effects  
    b. Monoclonal and polyclonal antibody therapy and their side effects  
    c. Complications  

Clinical Skills:

During the training program the resident:

7. Participates in the evaluation and management of donors for cardiopulmonary transplantation;  
8. Performs heart-lung bloc harvesting and preservation;  
9. Performs heart-lung transplantation;  
10. Participates in immunosuppressive therapy for transplantation;  
11. Manages transplant recipients preoperatively and postoperatively;  
12. Evaluates transplant recipients for signs of pulmonary rejection and infection, and of cardiac dysfunction;  
13. Performs endobronchial biopsy, thoracoscopic biopsy of the lung, and endocardial biopsy of cardiopulmonary transplantation patients, as indicated.
ACQUIRED HEART DISEASE

A. Coronary Artery Disease

Objective:

At the end of this unit the resident understands the physiology of coronary circulation, the pathophysiologic causes and derangement of ischemic heart disease and the sequelae of coronary events, and performs comprehensive short and long-term management.

Objectives:

Upon completion of the year the resident:

29. Understands the physiology of coronary circulation and the physiologic derangements caused by stenosis and obstruction;
30. Understands the development of atherosclerotic plaques and the current theories of plaque origination;
31. Knows the normal and variant anatomy of coronary circulation as well as the radiographic anatomy of the coronary arteries and the left and right ventricles;
32. Understands the rationale for and techniques of coronary artery bypass operations as well as the use of various conduits;
33. Understands the risks and complications of coronary artery bypass operations, coronary angiography, and percutaneous coronary artery balloon angioplasty;
34. Understands the preoperative and postoperative care of patients undergoing coronary artery bypass grafting;
35. Can describe outcomes of angioplasty and of operative and non-operative treatment of coronary artery disease, using statistical methods.

Contents:

33. Cardiac anatomy
   a. Left and right main coronary arteries
   b. Left anterior descending coronary artery
   c. Circumflex coronary artery
   d. Right coronary artery
   e. Coronary venous system
   f. Left and right ventricular anatomy
34. Radiographic cardiac and coronary anatomy
   a. Right anterior oblique views
   b. Left anterior oblique views
   c. Cranial view
   d. Ventriculography
35. Pathologic development of atherosclerotic plaque
   a. Endothelial injury
   b. Platelet factors
c. Cellular factors
d. Serum factors

36. Coronary artery bypass grafting
   a. Rationale
   b. Conduits
   c. Techniques
   d. Technical considerations
   e. Myocardial protection

37. Preoperative evaluation
   a. Symptoms of cardiac ischemia
   b. Non-invasive testing
   c. Invasive testing
   d. Decision making

38. Postoperative care
   a. Intensive care
   b. Acute care
   c. Long term management
   d. Late complications

39. Outcome
   a. Expected operative mortality
   b. Long term results

40. Complications of ischemic heart disease
   a. Chronic mitral insufficiency
   b. Ruptured papillary muscle (non-operative and operative management)
   c. Ventricular septal defect (non-operative and operative management)
   d. Cardiac rupture (non-operative and operative management)
   e. Left ventricular aneurysm

Clinical Skills:

During the training program the resident:

25. Evaluates patients with angina pectoris, unstable angina pectoris, and acute myocardial infarction;
26. Reads and interprets invasive and non-invasive tests of patients with ischemic heart disease;
27. Performs operative and non-operative management of patients with ischemic heart disease, including coronary artery bypass grafting using the internal mammary artery;
28. Participates in or performs surgery for the complications of myocardial infarction;
29. Directs the critical care management of preoperative and postoperative patients with ischemic heart disease;
30. Participates in the performance and evaluation of exercise tolerance tests, echocardiograms, and cardiac catheterizations.

B. Myocarditis, Cardiomyopathy, Hypertrophic Obstructive Cardiomyopathy, Cardiac Tumors

Objective:
At the end of this year the resident understands the pathology and etiology of diseased myocardium, the natural history of the diseases and physiologic alterations, and performs operative and non-operative management.

Objectives:

Upon completion of the year the resident:

21. Understands the types of cardiac tumors (frequency, anatomic location, physiologic and pathologic derangements, diagnostic methods and surgical management);
22. Understands myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes);
23. Understands hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment);
24. Knows the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment);
25. Understands cardiac transplantation (immunology/rejection and treatment, physiology, indications, operative techniques, diagnostic techniques in follow-up).

Contents:

21. Tumors
   a. Types, pathology
   b. Location
   c. Physiology
   d. Primary vs. metastatic
   e. Malignant pericardial effusion
   f. Diagnostic methods
   g. Treatment
   h. Outcome

22. Myocarditis
   a. Pathologic changes
   b. Etiology
   c. Clinical findings
   d. Radiographic changes
   e. Electrocardiography
   f. Echocardiography
   g. Treatment
   h. Outcome

23. Hypertrophic cardiomyopathy (HCM)
   a. Pathologic changes
   b. Anatomic changes
   c. Pathophysiology
   d. Obstructive vs. non-obstructive
   e. Arrhythmias
   f. Diagnosis
g. History and physical examination
   i. echocardiography
   ii. cardiac catheterization
h. Mitral valve
   i. systolic anterior motion
   ii. mitral regurgitation
   i. Treatment
      i. mitral valve replacement
      ii. myectomy and myotomy
      iii. pacing
j. Outcome
   i. complications
   ii. long-term results

24. Cardiomyopathy
   a. Dilated
   b. Restrictive
   c. Causes
   d. Pathology
   e. Pathophysiology
   f. Diagnosis
      i. echocardiography
      ii. endomyocardial biopsy
g. Clinical course
h. Treatment
   i. Outcome

25. Cardiac transplantation
   a. Techniques
   b. Indications
   c. Immunology
   d. Immunosuppressive treatment
   e. Physiology
   f. Complications and infection
   g. Rejection
      i. diagnosis
      ii. treatment
   h. Coronary artery disease development
   i. Organ harvesting, preservation
   j. Long term complications and outcome

Clinical Skills:
During the training program the resident

21. Evaluates and interprets chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with cardiac tumors, myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM);
22. Participates in or performs operative excision of cardiac tumors;
23. Participates in or performs operations for the treatment of HCM when indicated;
24. Participates in or performs heart transplants and provides preoperative and postoperative care;
25. Participates in echocardiography, cardiac catheterization, endomyocardial biopsy, and donor heart harvesting.

C. Abnormalities of the Aorta

Objective:

At the end of this year the resident understands the etiology and physiology of diseases of the aorta and performs operative and non-operative treatment.

Objectives:

Upon completion of the year the resident:

13. Understands the etiology and the physiology of aortic dissections and all aneurysms involving the ascending, transverse, descending, and abdominal aorta;
14. Recognizes the potential morbidity and mortality associated with aortic aneurysms and develops appropriate treatment plans for their management;
15. Knows the operative and nonoperative management of patients with acute and chronic aortic dissections;

Contents:

9. Aortic aneurysms (atherosclerotic, aortic dissections)
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
10. Operative and non-operative treatment
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal

Clinical Skills:

During the training program the resident:

17. Evaluates and interprets plain radiography, echocardiography, CT scans, MRI, and contrast studies for diseases of the aorta;
18. Participates in or performs operative and non-operative management of thoracic aortic disease, including aneurysms, dissections, and occlusive disease;
19. Plans and directs the use of extracorporeal bypass, hypothermia, and circulatory arrest for aortic diseases;
20. Performs preoperative and postoperative care of patients with aneurysms, dissections, and occlusive disease of the aorta.

**D. Cardiac Arrhythmias**

Objective:

At the end of this year the resident understands the etiology and physiology of cardiac arrhythmias, and performs operative and non-operative treatment.

Objectives:

Upon completion of the year the resident:

19. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
20. Understands operative and non-operative management;
21. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

19. Cardiac arrhythmias
   a. Atrial
   b. Ventricular
20. Non-operative management
   a. Anti-arrhythmic drugs
   b. Electrical cardioversion and pacing
   c. Catheter ablation
21. Operative management
   a. AICD
   b. Intraoperative mapping and ablation
   c. Permanent pacing systems

Clinical Skills:

During the training program the resident:

19. Performs the operative and non-operative management of patients with atrial arrhythmias;
20. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;

**E. Valvular Heart Disease**

Objective:
At the end of this year, the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Objectives:

Upon completion of the year the resident:

31. Understands the normal and pathologic anatomy of the atrioventricular and semilunar valves;
32. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
33. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
34. Knows the techniques for repair and replacement of cardiac valves;
35. Knows the preoperative and postoperative management of patients with valvular heart disease.

Contents:

25. Assessment of patients with valvular heart disease
   a. History and physical examination
   b. Echocardiogram
   c. Cardiac catheterization data
26. Choice of treatment
   a. Prosthetic valves
   b. Stented xenografts
   c. Non-stented human and xenograft valves
   d. Autograft valves for aortic valve replacement
   e. Valve repair
27. Long term complications of replacement devices
   a. Thrombosis
   b. Embolus
   c. Prosthetic dysfunction
28. Mitral valve
   a. Normal anatomy
   b. Normal function
   c. Mitral stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology
      iv. non-operative treatment
      v. indications for intervention (risk stratification)
      vi. merits of balloon valve dilation vs. operative repair or replacement
      vii. techniques of valve repair and replacement
      viii. intraoperative and postoperative complications and management
      ix. early and late results of operative and balloon valvulotomy
d. Mitral incompetence
   i. etiology and pathologic anatomy
   ii. natural history and complications
   iii. physiology (mechanisms of incompetence)
   iv. non-operative treatment
      • for nonischemic etiology
      • for ischemic etiology
   v. indications for surgical intervention (risk stratification)
   vi. techniques of valve repair
      • ring and suture annuloplasty
      • leaflet plication, excision
      • chordal/papillary muscle shortening
      • chordal transposition and artificial chordae
   vii. perioperative care
   viii. early and late results of repair and replacement

29. Aortic valve
   a. Normal anatomy
   b. Normal function
   c. Aortic stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (ventricular hypertrophy, mitral incompetence)
      iv. non-operative therapy
      v. indications for operative intervention (risk stratification)
      vi. techniques of valve replacement and repair
         • management of small aortic root
         • homograft and autograft valve replacement
      vii. perioperative care considerations
      viii. early and late results
   d. Aortic incompetence
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (LV dilatation and LV dysfunction)
      iv. non-operative treatment
      v. indications for operative intervention
         • in absence of clinical symptoms
         • when complicated by endocarditis
         • when complicated by aortic root aneurysm
      vi. techniques of valve repair and replacement
         • with endocarditis and aortic root abscess
         • with ascending and root aneurysm
      vii. perioperative care considerations
      viii. early and late results

30. Tricuspid valve
   a. Normal anatomy
   b. Normal function
c. Tricuspid incompetence
   i. etiology and pathologic anatomy
   ii. physiology
   iii. indications for operation
       • functional incompetence
       • endocarditis
   iv. techniques of repair, indications for replacement
       • ring and suture annuloplasty
       • endocarditis (valve excision vs. repair or replacement)
   v. perioperative care
       • management of RV dysfunction
       • interventions to decrease pulmonary vascular resistance
   vi. early and late results

d. Tricuspid stenosis
   i. etiology and pathologic anatomy
   ii. physiology
   iii. differentiation from constrictive pericarditis
   iv. indications for operative repair vs. replacement
   v. techniques of repair and replacement
   vi. early and late results

Clinical Skills:

During the training program the resident:

13. Evaluates, diagnoses and selects management strategies for patients with valvular heart disease, including participation in and interpretation of cardiac catheterizations and echocardiograms;
14. Makes use of the therapeutic options and relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
15. Manages preoperative clinical preparation and early and intermediate postoperative care;

Performs valve repair and replacement for valvular disease, interprets intraoperative echo.
CONGENITAL HEART DISEASE

A. Embryology, Anatomy and History

Objective:
At the end of the year, the resident understands the embryology of the heart and great vessels as it relates to the development of congenital heart anomalies, the normal anatomy of the heart, and the abnormal anatomy of the principal congenital cardiac anomalies, and applies this knowledge to the interpretation of echocardiograms, angiocardiograms, and other imaging techniques.

Objectives:
Upon completion of the year the resident:

9. Knows the embryology and anatomy of the normal heart;
10. Knows the embryology and anatomy of major cardiac anomalies;
11. Interprets angiocardiograms, echocardiograms, and other images and correlates these with normal and abnormal cardiac anatomy;
12. Knows the history of congenital cardiac surgery, and the intellectual development of operations used to manage each cardiac anomaly.

Contents:

9. Anatomy and embryology of the normal heart;
10. Embryology and pathologic anatomy of each major congenital cardiac anomaly;
11. Interpretation of angiocardiograms, echocardiograms, and other images
   a. Normal heart
   b. Major congenital cardiac anomalies

Clinical Skills:
During the training program the resident:

7. Applies knowledge of the normal and abnormal anatomy of the heart to the planning and performance of operations;
8. Interprets angiocardiograms, echocardiograms, and other images to diagnose congenital heart disease;
9. Uses knowledge to select the best procedure for individual patients.

B. Physiology and Physiologic Evaluation

Objective:
At the end of this year the resident understands the physiology of the developing heart, the physiologic changes of advancing age and transition ex-utero, and the physiologic consequences of congenital heart disease. The resident understands the findings in and limitations of invasive and non-invasive tests to define physiologic abnormalities and uses them in patient management.

Objectives:

Upon completion of the year the resident:

10. Understands normal fetal circulation;
11. Understands the transitional nature of circulation as the fetus becomes a neonate;
12. Understands the physiology of obstructions, of intra- and extracardiac shunts, of abnormal connections to the heart, and of combinations of these anomalies in the fetus, neonate, and child.

Contents:

16. Fetal circulation
   a. Oxygen source
   b. Flow pattern of blood through the heart and circulation
   c. Cardiac output and its distribution
   d. Myocardial function
   e. Regulation of the circulation
17. Transitional and neonatal circulation
   a. General changes
   b. Pulmonary circulation changes (e.g., mechanical factors, oxygen effects, vasoactive substances, hormonal factors)
   c. Ductus arteriosus changes (factors effecting closure or maintaining patency)
   d. Foramen ovale changes (factors effecting closure or maintaining patency)
   e. Physiologic assessment of the neonate
18. Fundamental anatomic abnormalities and physiologic consequences
   a. Anatomic abnormalities: obstruction (e.g., aortic stenosis, pulmonary atresia); extra pathways (e.g., atrial septal defect, ventricular septal defect); abnormal connections (e.g., transposition of the great vessels)
   b. Increased blood flow to a region
   c. Decreased blood flow to a region
   d. Combinations of increased or decreased blood flow to a region (e.g., tetralogy of Fallot, double outlet right ventricle, anomalous pulmonary veins)
   e. Application of these anatomic and physiologic principles to derive the common names for defects
   f. Hemodynamic manifestations of these anatomic and physiologic elements
19. Hemodynamic assessment
   a. Usefulness and limitations of echocardiographic doppler
   b. Usefulness and limitations of cardiac catheterization
   c. Calculations of regional flows and resistances
   d. Calculation of flow resistance and ratio
e. Pulmonary vascular resistance and pulmonary hypertension

20. Indications for operation
   a. Clinical symptoms and signs of obstructive lesions
   b. Clinical symptoms and signs of extra pathway lesions
   c. Clinical symptoms and signs of abnormal connections

Clinical Skills:

During the training program the resident:

19. Describes the physiologic changes of circulation during neonatal life;
20. Diagnoses clinically important congenital heart diseases in the neonate, infant, and child;
21. Applies a knowledge of anatomic abnormalities and their physiologic consequences to diagnose congenital heart defects;
22. Manages the physiologic aspects of the neonate, infant, and child with congenital heart disease preoperatively, intraoperatively, and postoperatively;
23. Stabilizes patients who are critically ill with congenital heart disease;
24. Performs calculations of blood flows and resistances from cardiac catheterization data.

C. Cardiopulmonary Bypass for Operations on Congenital Cardiac Anomalies

Objective:

At the end of this year the resident has a working knowledge of the principles of cardiopulmonary bypass for congenital heart disease, the techniques of myocardial preservation, and the use of profound hypothermia and total circulatory arrest in the infant and child.

Objectives:

Upon completion of the year the resident:

19. Knows the indications for the various techniques of bypass (anatomy, pathophysiology, and technical requirements of the underlying cardiac defects);
20. Knows arterial and venous cannulation techniques for different intracardiac defects;
21. Understands the techniques of myocardial protection in the neonate and young infant;
22. Understands the use of varying levels of hemodilution and anticoagulation;
23. Understands perfusion flow and pressure control;
24. Knows the methods of body temperature manipulation, and the indications for and techniques of profound hypothermia with and without total circulatory arrest.

Contents:

13. Monitoring for cardiopulmonary bypass
   a. Arterial pressure lines
   b. Central venous pressure, pulmonary artery pressure
   c. Temperature monitoring (nasopharyngeal, esophageal, rectal, bladder)
d. O2 saturation, end-tidal CO2
e. Urine output

14. Cannulation
   a. Single venous (indications, technique)
   b. Double venous (indications, technique)
   c. Arterial (technique)
   d. Venting (indications, technique)
   e. Cardioplegia

15. Myocardial preservation techniques
   a. Crystalloid, blood
   b. Cold, warm
   c. Antegrade, retrograde
   d. Additives
   e. Fibrillation

16. Profound hypothermia and total circulatory arrest
   a. Indications
   b. Benefits, disadvantages
   c. Safe duration of total circulatory arrest
   d. Early cerebral complications
   e. Late intellectual, neurological, psychiatric outcome

Clinical Skills:

During the training program the resident:

10. Performs arterial and venous cannulation and initiates cardiopulmonary bypass;
11. Directs the perfusionist in the intraoperative management and conduct of cardiopulmonary bypass;
12. Performs or participates in the repair of congenital heart defects using cardiopulmonary bypass.

D. Left-To-Right Shunts

Objective:

At the end of the year the resident understands the diagnosis and treatment of left-to-right shunts caused by congenital cardiac anomalies, and performs operative and non-operative treatment.

Objectives:

Upon completion of the year the resident:

13. Knows the anatomy, embryology, and physiology of the most common or important anomalies;
14. Knows the operative indications of the most common or important anomalies;
15. Knows the technical components of the operative repair of the most common or important anomalies;
16. Understands the postoperative care of each anomaly.

Contents:
19. Atrial septal defect
   a. Anatomy
      i. types of atrial septal defects and key landmarks of the right atrium.
   b. Clinical features
      i. natural history, indications for operation
      ii. clinical signs and symptoms, physical exam
      iii. chest x-ray and ECG
      iv. echocardiogram and cardiac catheterization
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. incisions in the heart
      iii. techniques for defect closure
      iv. treatment of associated anomalies (e.g., cleft mitral valve)
      v. complications of closure (e.g., air embolism, conduction abnormalities, residual defects)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

20. Ventricular septal defect
   a. Anatomy
      i. types
   b. Clinical features
      i. clinical signs and symptoms, physical exam
      ii. echocardiogram and cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history
      v. indications, contraindications, timing of operation (e.g., total repair vs. pulmonary artery banding)
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. incisions for different types of defects
      iii. closure techniques (direct suture vs. patch)
      iv. treatment of associated anomalies (e.g., atrial septal defect, right ventricular muscle bands)
      v. complications (rhythm disturbances, residual defects, air)
      vi. techniques of PA banding
   d. Outcomes
      i. expected operative mortality
      ii. long-term results
      iii. complications

21. Patent ductus arteriosus
   a. Anatomy
   b. Physiology
      i. neonate vs. older child
      ii. effect of prostaglandin and prostaglandin inhibitors
   c. Diagnosis and clinical features
i. symptoms and physical findings
ii. echocardiogram and cardiac catheterization
iii. chest x-ray and ECG
iv. natural history (neonate vs. older child, endocarditis)
v. indications for operation
vi. associated anomalies (e.g., ductus-dependent conditions)

d. Operative repair and complications
   i. operative techniques for simple ductus
   ii. management of the difficult ductus
   iii. complications of operative repair

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

22. Atrioventricular septal defect
   a. Anatomy
      i. types (complete, transitional, ostium primum ASD)
      ii. atrioventricular valve pathologic anatomy
   b. Physiology
      i. shunts and resistance calculation
      ii. complete vs. incomplete
   c. Diagnosis and clinical features
      i. symptoms and signs (infant vs. older patient, physical exam)
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history (development of Eisenmenger's syndrome)
      v. indications for and timing of operation (size of shunt, endocarditis risk, total repair vs. pulmonary artery banding)

d. Operative repair and complications
   i. cardiopulmonary bypass and myocardial protection
   ii. incisions in the heart
   iii. operative techniques
   iv. complications (residual defects, residual “mitral valve” insufficiency, heart block)

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

23. Double-outlet right ventricle
   a. Anatomy
      i. types (subaortic, subpulmonic, uncommitted)
      ii. associated anomalies

   b. Clinical features
      i. natural history
      ii. indications for and timing of operation
      iii. signs and symptoms of each of the anatomic types
      iv. chest x-ray, ECG
v. echocardiogram and cardiac catheterization

c. Operative repair and complications
   i. palliative operations vs. total repair (application of shunts, pulmonary artery band, total repair)
   ii. cardiopulmonary bypass and myocardial protection
   iii. approach to each anatomic subtype and placement of incisions in the heart
   iv. specific operative techniques (e.g., suturing, placement of patches)
   v. complications and their management

d. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

24. Aorto-pulmonary window
   a. Anatomy
   b. Clinical features
      i. natural history (development of pulmonary vascular obstructive disease)
      ii. symptoms and signs
      iii. echocardiogram, angiocardiogram, cardiac catheterization
      iv. chest x-ray, ECG
   c. Operative repair
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

Clinical Skills:

During the training program the resident:

13. Participates in or performs the operative repair of atrial septal defects, ventricular septal defects, patent ductus arteriosus, and pulmonary artery banding;
14. Participates in or performs the repair of more complex cardiac anomalies;
15. Performs the preoperative evaluation of patients with each of these anomalies;

E. Cyanotic Anomalies

Objective:

At the end of this year the resident knows the anatomy and physiology of anomalies that result in cyanosis, their diagnosis, their preoperative, operative, and postoperative management, and performs operative and non-operative treatment.

Objectives:

Upon completion of the year the resident:
19. Knows the anatomy and physiology of each anomaly;
20. Knows the methods of diagnosis;
21. Understands the role of medical management and interventional cardiology as treatment options;
22. Knows the indications for and timing of operation;
23. Understands the technical components of operative repair;
24. Knows the postoperative care, expected outcome, long-term results, and complications.

Contents:

19. Tetralogy of Fallot
   a. Anatomy and embryology
      i. embryology of malaligned ventricular septal defect
      ii. levels of right ventricular outflow tract obstruction
   b. Physiology
      i. genesis of “tet spells” and infundibular spasm
      ii. factors which affect degree of right-to-left shunt
      iii. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. role of systemic-to-pulmonary artery shunt vs. total repair
      ii. types of aortic-to-pulmonary artery shunts
      iii. extracorporeal bypass and myocardial protection
      iv. ventricular septal defect closure by transventricular or transatrial approach
      v. techniques for relief of right ventricular outflow tract obstruction and indications for transannular patching
      vi. indications for conduit repair
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

20. Transposition of the great vessels (TGA)
   a. Anatomy
      i. simple TGA
      ii. complex TGA (ventricular septal defect, pulmonary stenosis)
   b. Physiology
      i. concept of circulations in parallel and mixing
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
v. indications for and timing of operations

d. Operative repair and complications
   i. technique of Blalock-Hanlon atrial septectomy, open atrial septectomy
   ii. cardiopulmonary bypass and myocardial protection
   iii. operative techniques for total repair (Mustard, Senning, arterial switch, Rastelli)
   iv. palliative operations (PA band, systemic-to-pulmonary artery shunt)

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
   iv. arrhythmias after atrial repairs
   v. semilunar insufficiency, PA stenosis, coronary problems after arterial switch
   vi. conduit obstruction after Rastelli

21. Truncus arteriosus
   a. Anatomy
      i. types of truncus arteriosus
      ii. associated anomalies (VSD, left ventricular outflow tract obstruction, arch interruption, DiGeorge syndrome)
   b. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiogram
      iii. chest x-ray, ECG
      iv. natural history (development of pulmonary vascular obstructive disease)
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. operative techniques
         ▪ conduits (composite and homograft)
         ▪ modifications required for types II and III truncus
      iii. techniques for repair of associated anomalies
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

22. Tricuspid atresia
   a. Anatomy
      i. types I and II, subtypes
   b. Physiology
      i. subtypes with right-to-left shunt
      ii. subtypes with left-to-right shunt
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
      v. indications for and timing of operation
vi. role of palliative operations (systemic-pulmonary artery shunts, PA banding, bidirectional Glenn, Fontan, other right heart bypass operations)

d. Operative repair and complications
   i. palliative operations
   ii. operations for right heart bypass (bidirectional Glenn, Fontan)

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

23. Total anomalous pulmonary venous connection
   a. Anatomy
      i. supracardiac, cardiac, infracardiac, mixed
   b. Physiology
      i. obstructive vs. nonobstructive
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardio gram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques for different subtypes
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

24. Ebstein's anomaly
   a. Anatomy
   b. Physiology
      i. concept of atrialized ventricle
      ii. right ventricular outflow tract obstruction
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardio gram
      iii. chest x-ray, ECG
      iv. natural history
      v. associated lesions (e.g., Wolf-Parkinson-White syndrome)
      vi. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. technique of tricuspid repair, obliteration of atrialized ventricle
      iii. technique of tricuspid valve replacement
   e. Outcome
      i. expected operative mortality
      ii. long-term results
iii. complications

Clinical Skills:

During the training program the resident:

13. Participates in or performs the major palliative operations for these congenital cardiac anomalies;
14. Participates in or performs operative repair of tetralogy, TGA, truncus arteriosus, TAPVR, Ebstein's anomaly, and Fontan-type operations;
15. Performs preoperative evaluation and preparation;

F. Obstructive Anomalies

Objective:

At the end of this year the resident understands the anatomy and physiology of obstructive anomalies of the left and right sides of the heart and aorta, their diagnosis, management, and postoperative care, and performs the operative and non-operative treatment.

Objectives:

Upon completion of the year the resident:

22. Knows the anatomy and physiology of each anomaly;
23. Knows the methods of diagnosis;
24. Understands the role of medical management and interventional cardiology;
25. Knows the indications for and timing of operation;
26. Knows the technical components of operative repair;
27. Understands the principles of postoperative care;
28. Knows the expected outcome, long-term results and complications

Contents:

16. Aortic stenosis
   a. Anatomy
      i. supravalvular, valvular, subvalvular (including subtypes)
   b. Physiology
      i. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
i. extracorporeal bypass, myocardial protection
ii. operative techniques
iii. pros and cons of various techniques and patch configurations for supravalvular stenosis
iv. techniques of aortic valvotomy
v. operations to enlarge the aortic annulus (e.g., Konno-Rastan procedure, Ross procedure)
vii. technique of apical aortic conduit
vii. myomectomy and myotomy for subaortic obstruction

e. Outcome
i. expected operative mortality
ii. long-term results
iii. complications

17. Pulmonary stenosis
a. Anatomy
i. valvular and supravalvular
ii. associated anomalies (e.g., atrial septal defect, ventricular septal defect, branch stenosis)
b. Clinical features
i. symptoms and physical findings
ii. echocardiogram, angiocardiogram, cardiac catheterization
iii. chest x-ray, ECG
iv. natural history; role of balloon valvuloplasty
v. indications for and timing of operation
c. Operative repair and complications
i. extracorporeal bypass, myocardial protection
ii. incisions in the heart and great vessels
iii. operative considerations (technique of valvulotomy, indications for transannular patching, division of right ventricular muscle bands)
iv. complications (residual obstruction)
d. Outcome
i. expected operative mortality
ii. long-term results
iii. complications

18. Coarctation of the aorta
a. Anatomy
i. relationship to the ductus arteriosus
ii. associated anomalies (e.g., hypoplasia of transverse aorta, patent ductus arteriosus, LVOT obstruction)
b. Physiology
i. infant vs. older child
ii. “preductal” vs. “postductal”
iii. assessment of adequacy of collateral circulation
c. Clinical features
i. symptoms and physical findings (neonate with a closing ductus vs. older infant and child)
ii. echocardiogram, angiogram, cardiac catheterization
iii. chest x-ray, ECG
iv. natural history
v. indications for and timing of operation
vi. role of prostaglandins in stabilizing neonates
vii. effect of associated anomalies (e.g., patent ductus arteriosus, aortic stenosis, ventricular septal defect)
d. Operative repair and complications
   i. methods of repair (end-to-end vs. patch vs. subclavian angioplasty)
   ii. methods of arch reconstruction
   iii. complications (residual obstruction, paraplegia, chylothorax)
   iv. extracorporeal bypass, shunts in the absence of adequate collateral circulation
e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
   iv. re-coarctation
19. Interrupted aortic arch
   a. Anatomy
      i. types A, B, and C
      ii. associated anomalies (e.g., DiGeorge syndrome, VSD)
   b. Physiology
      i. role of ductal patency, prostaglandin
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. the role of prostaglandins in preoperative stabilization
      vii. DiGeorge syndrome (hypocalcemia, need for irradiated blood)
d. Operative repair and complications
   i. extracorporeal bypass, hypothermic arrest
   ii. median sternotomy vs. left thoracotomy
   iii. techniques (e.g., end-to-end anastomosis, interposition grafting, absorbable vs. nonabsorbable sutures)
   iv. complications (e.g., residual obstruction, recurrent laryngeal nerve injury, chylothorax)
   v. repair of associated anomalies
e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
   iv. reoperation
   v. management of DiGeorge syndrome
20. Vascular ring
   a. Anatomy
      i. double aortic arch, anomalous subclavian artery, unusual rings, pulmonary artery sling
   b. Physiology
      i. compression of airway and esophagus
   c. Clinical features
Clinical Skills:

During the training program the resident:

19. Performs corrections for patent ductus arteriosus and coarctation of the aorta;
20. Participates in or performs aortic valvotomy, repair of supravalvular and subvalvular aortic stenosis, pulmonary valvotomy, correction of subvalvular pulmonary stenosis, correction of vascular rings;
21. Participates in or performs operations for left ventricular outflow obstruction and interrupted aortic arch;
22. Performs preoperative evaluation and preparation;
23. Manages postoperative care;
24. Uses prostaglandins in the management of patients with neonatal coarctation, interrupted aortic arch, critical aortic stenosis.

G. Miscellaneous Anomalies

Objective:

At the end of this year the resident is familiar with the anatomy, physiology, diagnosis, and operative treatment of unusual complex congenital anomalies and performs operative and non-operative treatment.

Objectives:

Upon completion of the year the resident:

7. Understands the natural history, evaluation, and treatment of coronary anomalies, congenital complete heart block, hypoplastic left heart syndrome, pulmonary atresia (with and without VSD), “corrected transposition”, single ventricle, cor triatriatum, and cardiac tumors;
8. Understands the role of corrective and palliative operations for the above anomalies and of cardiac transplantation for appropriate cardiac pathology.

Contents:
Clinical Skills:
During the training program the resident:

7. Performs or assists in pacemaker insertion, systemic-to-pulmonary artery shunting for pulmonary atresia or stenosis (with or without VSD), and pulmonary artery banding for large left-to-right shunts;
8. Evaluates angiograms, echocardiograms, and cardiac catheterizations of the above anomalies;
9. Develops treatment plans for the above anomalies;
10. Participates in or performs operative treatment for the above anomalies;
11. Manages postoperative care for the above anomalies.

H. Principles of Postoperative Care

Objective:
At the end of this year the resident understands postoperative care of patients having palliation or correction of congenital cardiac anomalies and manages all aspects of their postoperative care.

Learner Objectives:
Upon completion of the year the resident:

1. Knows the physiologic characteristics of neonates and small infants;
2. Understands the management of infants and children who have undergone operative correction of simple and complex congenital cardiac anomalies;
3. Understands the postoperative management of patients with systemic-to-pulmonary artery shunts;
4. Understands the management of patients who have had a right heart bypass operation;
5. Understands the physiologic preoperative and postoperative management of patients with hypoplastic left heart syndrome;
6. Understands which infants and children are prone to have a pulmonary hypertensive crisis;

Contents:

1. Preoperative assessment and preparation
   a. Clinical and diagnostic data
   b. Physical examination.
2. Expected postoperative course for each operation.
3. Ventilatory management
   a. Reactive pulmonary vasculature
   b. Left heart syndrome
   c. Right heart bypass operations
4. Pharmacologic management  
   a. After right heart bypass operations  
   b. With parallel circulation  
   c. With reactive pulmonary vasculature

Clinical Skills:

During the training program the resident:

1. Manages ventilators for infants and children with and without obligatory intracardiac shunts;  
2. Assesses the cardiac output and pulmonary and systemic resistance in infants and children;  
3. Uses physiologic and pharmacologic manipulation of preload, myocardial contractility, heart rate, and afterload to optimize cardiac output in critically ill infants and children;  
4. Evaluates the metabolic reserve of neonates and infants and provides prompt therapeutic intervention as indicated;  
5. Anticipates problems and complications of postoperative pediatric patients and provides appropriate treatment.

**THORACIC TRAUMA**

**A. Trauma of the Chest Wall**

Objective:

At the end of this year the resident understands the pathophysiology of chest wall injury, and diagnoses, resuscitates and treats trauma patients.

Objectives:

Upon completion of this year the resident:

1. Evaluates patients with blunt or penetrating chest wall injury;  
2. Understands the physiology and mechanics of operative drainage of the thoracic cavity;  
3. Understands the operative and non-operative management of chest wall injuries;  
4. Understands the pathophysiology of flail chest.

Contents:

1. Thorax  
   a. Rib fracture  
   b. Flail chest  
   c. Sucking chest wounds  
   d. Diagnosis and management  
   e. Simple
f. Tension

g. Diagnosis and treatment

2. Hemothorax
   a. Diagnosis
   b. Operative and non-operative management

Clinical Skills:
During the training program the resident:

1. Evaluates and treats chest wall injuries;
2. Performs emergency operations to repair chest wall injuries and provides postoperative management.

**B. Tracheobronchial and Pulmonary Trauma**

Objective:

At the end of this year the resident understands the pathophysiology of tracheobronchial and pulmonary trauma, and diagnoses, resuscitates and treats patients with these injuries.

Objectives:

Upon completion of this year the resident:

1. Understands clinical presentation and radiologic findings of tracheobronchial injury;
2. Understands the principles of airway management;
3. Understands the bronchoscopic findings of tracheobronchial and pulmonary injury;
4. Understands the management of tracheobronchial and pulmonary injury;
5. Understands the injuries associated with tracheobronchial and pulmonary injury.

Contents:

1. Tracheobronchial injury
   a. Signs and symptoms
   b. Radiologic findings
   c. Diagnosis and management
2. Airway control
   a. Intubation
   b. Bronchoscopy
   c. Emergency tracheostomy
   d. One-lung ventilation
   e. High-frequency ventilation
3. Pulmonary contusion
   a. Signs and symptoms
   b. Pathophysiology
   c. Radiologic findings
   d. Operative and non-operative management
4. Penetrating injury
   a. Signs and symptoms
   b. Indications for operation
   c. Management of peripheral injuries
   d. Management of hilar injuries
   e. Air embolism

Clinical Skills:

During the training program the resident:

1. Evaluates and manages patients with tracheobronchial trauma;
2. Manages the airway of patients with tracheobronchial injuries;
3. Repairs tracheobronchial and associated injuries;
4. Performs non-operative management of pulmonary contusion;
5. Performs emergency operations to repair peripheral pulmonary and hilar injuries;
6. Uses precautions to avoid air embolism in patients with penetrating and blunt injuries.

C. Esophageal Trauma

Objective:

At the end of this year the resident understands the pathophysiology of esophageal trauma, and diagnoses, resuscitates and treats patients with these injuries.

Objectives:

Upon completion of this year the resident:

1. Understands the etiology and presentation of esophageal trauma;
2. Understands the methods of assessment and diagnosis of esophageal trauma;
3. Understands the management of injuries that disrupt the esophagus;

Contents:

1. Esophageal trauma
   a. Signs and symptoms
   b. Radiologic assessment (e.g., plain radiographs, CT scans, contrast studies)
2. Methods of repair
   a. Primary repair
   b. Resection and reconstruction
   c. Diversion
3. Complications
   a. Esophageal leak
   b. Esophageal obstruction
   c. Management

Clinical Skills:

During the training program the resident:

1. Evaluates and interprets diagnostic tests of patients with esophageal trauma;
2. Performs the operative treatment of patients with esophageal injuries;
3. Manages the complications of operations for esophageal injury.

D. Diaphragmatic Trauma

Objective:

At the end of this year the resident understands the pathophysiology of diaphragmatic trauma, and diagnoses, resuscitates, and treats patients with these injuries.

Objectives:

Upon completion of this year the resident:

1. Understands the presentation, evaluation, and treatment of blunt and penetrating diaphragmatic injuries;
2. Understands the evaluation and management of associated injuries;
3. Knows the presentation of delayed diaphragmatic injury, its diagnosis and management.

Contents:

1. Blunt trauma
   a. Signs and symptoms
   b. Radiologic findings
   c. Indication for operation
   d. Operative approach
   e. Techniques of repair
   f. Delayed presentation
   g. Associated injuries
2. Penetrating trauma
   a. Signs and symptoms
   b. Radiologic findings
   c. Operative approaches and techniques of repair
   d. Management of associated injuries

Clinical Skills:
During the training program the resident:

1. Performs emergency evaluation and diagnosis of diaphragmatic and associated injuries;
2. Performs operative repair of acute and chronic diaphragmatic and associated injuries;
3. Knows the presentation of delayed diaphragmatic injury, its diagnosis and management.

E. Cardiovascular Trauma

Objective:

At the end of this year the resident understands the pathophysiology of thoracic trauma resulting in injury to the heart and great vessels, and diagnoses, resuscitates and treats patients with these injuries.

Learner Objectives:

Upon completion of the unit the resident:

1. Evaluates patients who have sustained cardiovascular trauma;
2. Understands the physiology of deceleration injuries to the thoracic aorta;

Contents:

1. Cardiac contusion
   a. Pathophysiology
   b. Noninvasive diagnostic techniques
   c. Management
   d. Follow-up and outcomes
2. Penetrating cardiovascular injuries
   a. Major vessel laceration
   b. Penetrating cardiac trauma
   c. Laceration of coronary arteries
   d. Pericardial tamponade
   e. Diagnostic methods
   f. Management
      i. operative approaches for specific injuries
      ii. use of cardiopulmonary bypass or partial mechanical support
      iii. management of concomitant injuries
3. Postoperative management
   a. Outcomes
4. Traumatic aortic transection
   a. Pathophysiology
   b. Anatomic locations and operative approaches
   c. Operative management
   d. Management of associated injuries
e. Outcomes

Clinical Skills:

During the training program the resident:

1. Evaluates and treats cardiac contusion;
2. Performs or participates in emergency operations to repair penetrating injuries of the heart and thoracic great vessels, and provides postoperative management;

Performs emergency operations to repair traumatic transections of the thoracic aorta and provide postoperative management.
EXTRACORPOREAL BYPASS AND COAGULATION-BLOOD PRODUCTS

A. Physiology of Extracorporeal Bypass

Objective:

At the end of this year the resident understands the physiology and pathologic derangements of pulsatile and non-pulsatile extracorporeal bypass, and has a working knowledge of oxygenators, perfusion systems, and ventricular support devices as they apply to adult patients.

Learner Objectives:

Upon completion of the unit the resident:

1. Understands the physiology and mechanics of membrane and bubble oxygenators;
2. Understands the mechanics and operation of roller and vortex pumps;
3. Understands the physiology of various extracorporeal bypass circuits and the derangements caused by their use;
4. Knows the coagulation system and alterations of blood elements;
5. Understands the basic design and function of ventricular support devices.

Contents:

1. Membrane oxygenators
   a. Physiology
   b. Design
   c. Complications
2. Bubble oxygenators
   a. Physiology
   b. Design
   c. Complications
3. Roller head pumps
   a. Design
   b. Safety measures
   c. Complications
4. Vortex pumps
   a. Mechanism and design
   b. Safety measures
   c. Complications
5. Extracorporeal circuits
   a. Set-up
   b. Types of tubing, filters, hemoconcentrators
   c. Safety measures
   d. Blood and artificial surface interaction
6. Perfusion solutions
   a. Prime solutions
   b. Hemodilution
   c. Oxygenators (types, indications, benefits, disadvantages)
   d. Venous reservoir
   e. Cardiotomy reservoir
   f. Tubing (choice of adequate internal diameter)
   g. Osmotic pressure, oncotic pressure (use of mannitol, albumin)
   h. Blood gas control
7. Manipulation of:
   a. Flow
   b. Pressure
   c. Temperature

Clinical Skills:

During the training program the resident:

1. Uses knowledge of the effects of extracorporeal bypass to ensure its safe use;
2. Recognizes the correct and incorrect set-up and operation of an extracorporeal circuit;
3. Plans and uses extracorporeal circuits in clinical practice;
4. Understands and treats physiologic derangements caused by blood-artificial surface interaction;
5. Plans and uses ventricular support devices in clinical practice.

**B. Techniques of Extracorporeal Bypass**

Objective:

At the end of this year the resident understands the techniques of extracorporeal bypass and their application to solve specific clinical problems.

Objectives:

Upon completion of the year the resident:

1. Understands the standard techniques for extracorporeal bypass;
2. Understands the techniques for left heart bypass and right heart bypass for the treatment of specific clinical problems;
3. Understands the techniques of cannulation for extracorporeal bypass;
4. Oversees the management of patients undergoing extracorporeal bypass.

Contents:

1. Standard cardiopulmonary bypass
   a. Routes for cannulation (arterial and venous)
   b. Types of extracorporeal circuits
2. Anticoagulation for cardiopulmonary bypass
   a. Heparin and other agents
   b. Monitoring
   c. Reversal
   d. Complications
3. Special situations
   a. Left and/or right heart bypass
   b. Profound hypothermia and circulatory arrest

Clinical Skills:

During the training program the resident:

1. Performs cannulation for extracorporeal bypass using appropriate access routes;
2. Uses appropriate types of extracorporeal bypass to solve specific clinical problems;
3. Uses left and right heart bypass.

C. Mechanical Support

Objective:

At the end of this year, the resident understands the indications for mechanical cardiac support and ECMO, patient selection, device selection, recognition and treatment of the complications of mechanical support, methods for weaning the patient from support, and “bridging” to transplantation.

Learner Objectives:

Upon completion of the unit the resident:

1. Understands the indications for cardiac support with mechanical devices or ECMO;
2. Understands alternatives to mechanical support (e.g., intra-aortic and intra-pulmonary balloon pumping);
3. Knows the techniques for inserting these ventricular support devices;
4. Recognizes complications of the devices;
5. Understands the principles of weaning patients from these devices;
6. Understands the use of mechanical devices as a “bridge” to transplantation;
7. Knows the requirements for anticoagulation and monitoring of blood trauma;
8. Understands Federal regulations that apply to the use of these devices.

Contents:

1. Indications for mechanical support
   a. Deterioration of an established prospective transplant recipient
b. Patient unable to be weaned from cardiopulmonary bypass but is a candidate for “postcardiotomy” usage or “bridging” to transplantation
c. Acute myocardial infarction with balloon-dependent left heart failure

2. Respiratory failure
   a. Indications for ECMO
   b. Alternatives to ECMO

3. Alternatives to mechanical devices
   a. Balloon pumping (left and right)
   b. Centrifugal devices
   c. Impeller devices
d. Pulsatile devices
e. Total artificial heart

4. Techniques of insertion
   a. Cardiac
   b. ECMO

5. Complications
   a. Blood trauma
   b. Thrombosis
   c. Bleeding
d. Infection

6. Weaning the patient from support devices and the use of mechanical devices to “bridge” to transplantation
   a. Hemodynamic parameters used in weaning from cardiac support, criteria for weaning and rate of weaning
   b. Concept of “rehabilitation” of the bridging patient and modification of transplantation criteria for the bridging patient

7. Anticoagulation
   a. Requirements for various mechanical devices
   b. Detection of blood trauma
c. Early detection of thrombotic problems

Clinical Skills:

During the training program the resident:

1. Evaluates and participates in the preoperative and postoperative management of patients requiring mechanical support;
2. Uses appropriate mechanical cardiac support and ECMO;
3. Manages the complications from the use of mechanical support and ECMO;
4. Weans patients from mechanical support and ECMO;
5. Manages patients bridging to transplantation;
6. Manages the anticoagulation of patients on mechanical support and ECMO.

D. Fundamentals of Coagulation Management and Blood Component Therapy

Objective:
At the end of this year the resident knows the physiology, methods, and techniques to manage the coagulation and fibrinolytic systems, and uses component therapy to treat specific clinical problems.

Learner Objectives:

At the end of the year the resident:

1. Understands the major blood groups, the clotting cascade, and the pathophysiology of clotting (e.g., abnormal clotting, activation of compliment, Kallikrein, prostanoids);
2. Understands the specific hemorrhagic and thrombotic complications of cardiac surgery and their management;
3. Understands the methods used in blood component storage and the measures taken to ensure a safe blood supply;
4. Understands the use of specific blood components to treat abnormalities of red cell quantity and quality, platelet quantity and quality, and coagulation function;
5. Knows the preoperative risk factors for excessive blood loss and blood utilization;
6. Understands the operative and postoperative techniques to ensure blood conservation.

Contents:

1. Blood characteristics
   a. Blood groups and specific antigens
   b. Cellular elements
   c. Clotting cascade
   d. Pathophysiology of clotting
   e. Drugs that affect clotting and platelet function
2. Hemorrhagic and thrombotic complications of cardiac surgery
   a. Diagnosis
   b. Preoperative, intraoperative, and postoperative management
   c. Heparin, Protamine
   d. Cardiac and vascular prostheses
3. Component therapy
   a. Packed red blood cells
   b. Fresh frozen plasma
   c. Platelets
   d. Cryoprecipitate
   e. Specific clotting factors
4. Blood conservation
   a. Indications for transfusion
   b. Autotransfusion
   c. Cell-plasma salvage
   d. Hemoconcentration
   e. Pharmacologic manipulation

Clinical Skills:
During the course of the program, the resident:

1. Evaluates patients requiring component therapy and develops management strategies to correct abnormalities of the coagulation system;
2. Uses appropriate tests to ensure the safety of blood and blood components;
3. Uses appropriate blood conservation techniques.

**NON-CLINICAL ELEMENTS OF THORACIC SURGICAL PRACTICE**

Objective:

At the end of this year the resident understands the non-clinical elements of a thoracic surgical practice.

Learner Objectives:

Upon completion of this year the resident:

1. Understand the ethical components of surgical practice;
2. Understands and will be able to use clinical database and outcome analysis in surgical practice;
3. Knows the medico-legal aspects of surgical practice;
4. Understands critical pathways and cost-benefit analysis in clinical decision-making;
5. Understand organizational structure and mechanics of solo practice, group specialty practice, multispecialty practice, and academic practice;
6. Knows the structure, responsibilities and requirements of managed care, capitation payment, contractual agreements, physician-hospital organizations, and independent practice agreements;
7. Understands the time constraints imposed by the responsibilities of practice and the need for effective time management.

Contents:

1. Fundamental elements of ethical practice
   a. Hippocratic oath
   b. Primum non nocere
   c. Personal responsibility
   d. Honest and open communications
   e. Critical self analysis
2. Clinical database and outcome analysis
   a. Data collection
   b. Risk stratification
   c. Statistical analysis
   d. Regular review of data
   e. Comparative analysis
3. Cost factors and clinical outcome
   a. Analysis of redundancy, waste, inefficiency
   b. Entrepreneurial approach to cost and quality
4. Practice arrangements  
   a. Administration of practice (e.g., fees, collections, insurance, billing, overhead, office management)  
   b. Advantages and disadvantages of different practice arrangements  
5. External economic forces  
   a. Managed care  
   b. Medicare, Medicaid, Champus  
   c. PROs, IPAs  
   d. Contracts  
   e. Capitation  
6. Medico-legal factors  
   a. Prevention of litigation  
   b. Record keeping  
   c. Response to malpractice lawsuit  
   d. Expert witness testimony  
7. Time management  
   a. Family needs  
   b. Practice needs (e.g., patients, administration, associates)  
   c. Community responsibilities  
   d. Personal needs (e.g., continuing education, personal growth, life outside medicine)
GOALS AND OBJECTIVES
ADULT CARDIAC SURGERY ROTATION
Institution #1 – University of Minnesota Medical Center
Duration: 6 months, Year 3

**Patient Care:** Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine as well as difficult adult cardiac surgery including coronary artery bypass and heart valve replacement, ventricular assist device implantations, heart transplantation, reoperations, and management of heart failure patients.

Use information technology: Fellows learn to use currently available information technology sources – Medline, PubMed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC.

Evaluate diagnostic studies: During the thoracic rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest CT examinations, coronary angiogram, and cardiac catheterization. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

**Interpersonal and Communication Skills:** Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program.

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.
Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Adult Cardiac Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.

Counsel and educate patients and families:
Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Adult Cardiac Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

Maintain a log of continuity of care of patients seen in the Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

**Medical Knowledge:** Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

The Thoracic Fellow is expected to master the following core topics by the end of the rotation:

**TRANSPLANTATION**

**A. Cardiac Transplantation**
Rotation Objective:

At the end of this rotation, the resident knows the principles of organ preservation, immunosuppressive therapy, signs and treatment of rejection, and the indications for and techniques of cardiac transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

15. Knows the indications for cardiac transplantation;
16. Understands the management of immunosuppressive therapy in cardiac transplantation;
17. Knows the techniques of cardiac transplantation;
18. Recognizes the signs and symptoms of cardiac rejection and knows the appropriate management;
19. Understands the evaluation and management of organ donors;
20. Knows the methods of organ harvest and preservation;
21. Is familiar with the techniques and complications of endomyocardial biopsy.

Contents:

13. Indications for cardiac transplantation
   a. Patient evaluation
   b. Patient selection
   c. Informed consent
14. Immunosuppressive therapy in cardiac transplantation
    a. Evaluation of therapy
    b. Drugs
    c. Complications
15. Technique of cardiac transplantation
    a. Orthotopic
    b. Heterotopic
16. Donor preparation and organ harvest
    a. Brain death, legal and family-related issues
    b. Donor evaluation
    c. Methods of organ procurement and preservation
17. Cardiac rejection
    a. Signs and symptoms
    b. Endomyocardial biopsy
    c. Histologic evaluation
    d. Management
    e. Mechanical support and re-transplantation
18. Immunosuppressive therapy
    a. Immunosuppressive drugs and their side effects
    b. Polyclonal and monoclonal antibody therapy and side effects
    c. Complications

Clinical Skills:
During the training program the resident:

15. Manages organ donors;
16. Performs organ harvest and preservation;
17. Performs cardiac transplantation;
18. Manages the cardiac transplant recipient preoperatively and postoperatively;
19. Participates in the immunosuppressive therapy for cardiac transplantation;
20. Evaluates transplant recipients for signs of rejection or infection and initiates appropriate therapy;

**B. Lung Transplantation**

**Rotation Objective:**

At the end of this rotation the resident understands the basic principles of lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the indications for and performs lung transplantation.

**Learner Objectives:**

Upon completion of the rotation the resident:

15. Understands the evaluation and management of organ donors;
16. Knows the indications for lung transplantation;
17. Understands the management of immunosuppressive therapy in lung transplantation;
18. Knows the techniques of single and double lung transplantation;
19. Recognizes the signs and symptoms of lung rejection or infection and knows the appropriate management;
20. Knows the methods for harvesting and preserving donor lungs;
21. Is familiar with the techniques and complications of bronchoscopy of the transplanted lung.

**Contents:**

   Indications for lung transplantation
      
      d. Patient evaluation
      e. Patient selection
      f. Informed consent

14. Immunosuppressive therapy in lung transplantation
   
   a. Evaluation of therapy
   b. Drugs

   c. Complications

15. Technique of single and double lung transplantation
a. Left lung
b. Right lung
c. Extracorporeal bypass techniques and indications for their use

16. Donor evaluation
   a. History
   b. Physiology
   c. Radiology

17. Donor preparation and organ harvest
   a. Brain death, legal and family-related issues
   b. Organ procurement and preservation
   c. Pharmacologic and technical aspects of donor lung harvest operations

18. Pulmonary rejection
   a. Signs and symptoms
   b. Endobronchial biopsy
   c. Histologic evaluation of rejection
   d. Management of rejection

19. Immunosuppressive therapy
   a. Immunosuppressive drugs and their side effects
   b. Antibody therapy and side effects
   c. Complications of immunosuppressive therapy

Clinical Skills:

During the training program the resident:

15. Performs or participates in donor evaluation and management;
16. Performs or participates in donor lung harvest and preservation;
17. Performs or participates in lung transplantation;
18. Participates in the immunosuppressive therapy for lung transplantation;
19. Manages the lung transplant recipient preoperatively and postoperatively;
20. Evaluates transplant recipients for signs of rejection or infection, and initiates appropriate therapy;

C. Heart-Lung Transplantation

Rotation Objective:

At the end of this rotation the resident understands the principles of heart-lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the techniques of heart-lung transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

17. Knows the indications for heart-lung transplantation;
18. Understands the management of immunosuppressive therapy of heart-lung transplantation;
19. Knows the operative techniques of heart-lung transplantation;
20. Recognizes the signs and symptoms of pulmonary rejection in cardiopulmonary transplantation;
21. Recognizes infection and rejection, and knows the appropriate management of each;
22. Understands the evaluation and management of heart-lung donors;
23. Knows the methods for harvesting and preserving heart-lung blocs;
24. Is familiar with the techniques and complications of radiologic and fiberoptic bronchoscopy of the transplanted lung in the heart-lung recipient.

Contents:

14. Immunosuppressive therapy in cardiopulmonary transplantation
   a. Evaluation of therapy
   b. Drugs
   c. Complications
15. Technique of heart-lung transplantation
16. Donor evaluation
   a. History
   b. Physiology
   c. Radiology
17. Donor preparation and harvest
   a. Brain death, legal and family-related issues
   b. Organ procurement and preservation
   c. Pharmacologic and technical aspects of donor heart-lung harvesting
18. Rejection in cardiopulmonary transplantation
   a. Signs and symptoms
   b. Frequency of cardiac rejection and indications for endomyocardial biopsy
   c. Techniques for diagnosing lung rejection in the cardiopulmonary transplant patient
   d. Histologic evaluation of pulmonary rejection in the cardiopulmonary transplant patient
   e. Management of rejection in the cardiopulmonary transplant recipient
19. Immunosuppressive therapy
   a. Immunosuppressive drugs and their side effects
   b. Monoclonal and polyclonal antibody therapy and their side effects
   c. Complications

Clinical Skills:

During the training program the resident:

13. Participates in the evaluation and management of donors for cardiopulmonary transplantation;
14. Performs heart-lung bloc harvesting and preservation;
15. Performs heart-lung transplantation;
16. Participates in immunosuppressive therapy for transplantation;
17. Manages transplant recipients preoperatively and postoperatively;
18. Evaluates transplant recipients for signs of pulmonary rejection and infection, and of cardiac dysfunction;
19. Performs endobronchial biopsy, thoracoscopic biopsy of the lung, and endocardial biopsy of cardiopulmonary transplantation patients, as indicated.

**ACQUIRED HEART DISEASE**

**A. Coronary Artery Disease**

**Rotation Objective:**

At the end of this rotation the resident understands the physiology of coronary circulation, the pathophysiologic causes and derangement of ischemic heart disease and the sequelae of coronary events, and performs comprehensive short and long-term management.

**Learner Objectives:**

Upon completion of the rotation the resident:

36. Understands the physiology of coronary circulation and the physiologic derangements caused by stenosis and obstruction;
37. Understands the development of atherosclerotic plaques and the current theories of plaque origination;
38. Knows the normal and variant anatomy of coronary circulation as well as the radiographic anatomy of the coronary arteries and the left and right ventricles;
39. Understands the rationale for and techniques of coronary artery bypass operations as well as the use of various conduits;
40. Understands the risks and complications of coronary artery bypass operations, coronary angiography, and percutaneous coronary artery balloon angioplasty;
41. Understands the preoperative and postoperative care of patients undergoing coronary artery bypass grafting;
42. Can describe outcomes of angioplasty and of operative and non-operative treatment of coronary artery disease, using statistical methods.

**Contents:**

41. Cardiac anatomy
   a. Left and right main coronary arteries
   b. Left anterior descending coronary artery
   c. Circumflex coronary artery
   d. Right coronary artery
   e. Coronary venous system
   f. Left and right ventricular anatomy
42. Radiographic cardiac and coronary anatomy
   a. Right anterior oblique views
   b. Left anterior oblique views
   c. Cranial view
   d. Ventriculography
43. Pathologic development of atherosclerotic plaque
   a. Endothelial injury
   b. Platelet factors
   c. Cellular factors
   d. Serum factors
44. Coronary artery bypass grafting
   a. Rationale
   b. Conduits
   c. Techniques
   d. Technical considerations
   e. Myocardial protection
45. Preoperative evaluation
   a. Symptoms of cardiac ischemia
   b. Non-invasive testing
   c. Invasive testing
   d. Decision making
46. Postoperative care
   a. Intensive care
   b. Acute care
   c. Long term management
   d. Late complications
47. Outcome
   a. Expected operative mortality
   b. Long term results
48. Complications of ischemic heart disease
   a. Chronic mitral insufficiency
   b. Ruptured papillary muscle (non-operative and operative management)
   c. Ventricular septal defect (non-operative and operative management)
   d. Cardiac rupture (non-operative and operative management)
   e. Left ventricular aneurysm

Clinical Skills:

During the training program the resident:

31. Evaluates patients with angina pectoris, unstable angina pectoris, and acute myocardial infarction;
32. Reads and interprets invasive and non-invasive tests of patients with ischemic heart disease;
33. Performs operative and non-operative management of patients with ischemic heart disease, including coronary artery bypass grafting using the internal mammary artery;
34. Participates in or performs surgery for the complications of myocardial infarction;
35. Directs the critical care management of preoperative and postoperative patients with ischemic heart disease;
36. Participates in the performance and evaluation of exercise tolerance tests, echocardiograms, and cardiac catheterizations.
B. Myocarditis, Cardiomyopathy, Hypertrophic Obstructive Cardiomyopathy, Cardiac Tumors

Rotation Objective:

At the end of this rotation the resident understands the pathology and etiology of diseased myocardium, the natural history of the diseases and physiologic alterations, and performs operative and non-operative management.

Learner Objectives:

Upon completion of the rotation the resident:

26. Understands the types of cardiac tumors (frequency, anatomic location, physiologic and pathologic derangements, diagnostic methods and surgical management);
27. Understands myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes);
28. Understands hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment);
29. Knows the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment);
30. Understands cardiac transplantation (immunology/rejection and treatment, physiology, indications, operative techniques, diagnostic techniques in follow-up).

Contents:

26. Tumors
   a. Types, pathology
   b. Location
   c. Physiology
   d. Primary vs. metastatic
   e. Malignant pericardial effusion
   f. Diagnostic methods
   g. Treatment
   h. Outcome

27. Myocarditis
   a. Pathologic changes
   b. Etiology
   c. Clinical findings
   d. Radiographic changes
   e. Electrocardiography
   f. Echocardiography
   g. Treatment
   h. Outcome

28. Hypertrophic cardiomyopathy (HCM)
   a. Pathologic changes
b. Anatomic changes
c. Pathophysiology
d. Obstructive vs. non-obstructive
e. Arrhythmias
f. Diagnosis
g. History and physical examination
   i. echocardiography
   ii. cardiac catheterization
h. Mitral valve
   i. systolic anterior motion
   ii. mitral regurgitation
i. Treatment
   i. mitral valve replacement
   ii. myectomy and myotomy
   iii. pacing
j. Outcome
   i. complications
   ii. long-term results

29. Cardiomyopathy
   a. Dilated
   b. Restrictive
c. Causes
d. Pathology
e. Pathophysiology
f. Diagnosis
   i. echocardiography
   ii. endomyocardial biopsy
g. Clinical course
h. Treatment
i. Outcome

30. Cardiac transplantation
   a. Techniques
   b. Indications
c. Immunology
d. Immunosuppressive treatment
e. Physiology
f. Complications and infection
g. Rejection
   i. diagnosis
   ii. treatment
h. Coronary artery disease development
i. Organ harvesting, preservation
j. Long term complications and outcome

Clinical Skills:
During the training program the resident
26. Evaluates and interprets chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with cardiac tumors, myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM);
27. Participates in or performs operative excision of cardiac tumors;
28. Participates in or performs operations for the treatment of HCM when indicated;
29. Participates in or performs heart transplants and provides preoperative and postoperative care;
30. Participates in echocardiography, cardiac catheterization, endomyocardial biopsy, and donor heart harvesting.

C. Abnormalities of the Aorta

Unit Objective:

At the end of this unit the resident understands the etiology and physiology of diseases of the aorta and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the unit the resident:

16. Understands the etiology and the physiology of aortic dissections and all aneurysms involving the ascending, transverse, descending, and abdominal aorta;
17. Recognizes the potential morbidity and mortality associated with aortic aneurysms and develops appropriate treatment plans for their management;
18. Knows the operative and nonoperative management of patients with acute and chronic aortic dissections;

Contents:

11. Aortic aneurysms (atherosclerotic, aortic dissections)
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
12. Operative and non-operative treatment
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal

Clinical Skills:

During the training program the resident:

21. Evaluates and interprets plain radiography, echocardiography, CT scans, MRI, and contrast studies for diseases of the aorta;
22. Participates in or performs operative and non-operative management of thoracic aortic disease, including aneurysms, dissections, and occlusive disease;
23. Plans and directs the use of extracorporeal bypass, hypothermia, and circulatory arrest for aortic diseases;
24. Performs preoperative and postoperative care of patients with aneurysms, dissections, and occlusive disease of the aorta.

**D. Cardiac Arrhythmias**

**Rotation Objective:**

At the end of this rotation the resident understands the etiology and physiology of cardiac arrhythmias, and performs operative and non-operative treatment.

**Learner Objectives:**

Upon completion of the rotation the resident:

22. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
23. Understands operative and non-operative management;
24. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

**Contents:**

22. Cardiac arrhythmias  
   a. Atrial  
   b. Ventricular  
23. Non-operative management  
   a. Anti-arrhythmic drugs  
   b. Electrical cardioversion and pacing  
   c. Catheter ablation  
24. Operative management  
   a. AICD  
   b. Intraoperative mapping and ablation  
   c. Permanent pacing systems

**Clinical Skills:**

During the training program the resident:

22. Performs the operative and non-operative management of patients with atrial arrhythmias;  
23. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;  
24. Participates in electrophysiologic studies.
**E. Valvular Heart Disease**

Rotation Objective:

At the end of this rotation, the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

36. Understands the normal and pathologic anatomy of the atrioventricular and semilunar valves;
37. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
38. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
39. Knows the techniques for repair and replacement of cardiac valves;
40. Knows the preoperative and postoperative management of patients with valvular heart disease.

Contents:

31. Assessment of patients with valvular heart disease
   a. History and physical examination
   b. Echocardiogram
   c. Cardiac catheterization data
32. Choice of treatment
   a. Prosthetic valves
   b. Stented xenografts
   c. Non-stented human and xenograft valves
   d. Autograft valves for aortic valve replacement
   e. Valve repair
33. Long term complications of replacement devices
   a. Thrombosis
   b. Embolus
   c. Prosthetic dysfunction
34. Mitral valve
   a. Normal anatomy
   b. Normal function
   c. Mitral stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology
      iv. non-operative treatment
      v. indications for intervention (risk stratification)
vi. merits of balloon valve dilation vs. operative repair or replacement
vii. techniques of valve repair and replacement
viii. intraoperative and postoperative complications and management
ix. early and late results of operative and balloon valvulotomy

d. Mitral incompetence
   i. etiology and pathologic anatomy
   ii. natural history and complications
   iii. physiology (mechanisms of incompetence)
   iv. non-operative treatment
      ▪ for nonischemic etiology
      ▪ for ischemic etiology
   v. indications for surgical intervention (risk stratification)
   vi. techniques of valve repair
      ▪ ring and suture annuloplasty
      ▪ leaflet plication, excision
      ▪ chordal/papillary muscle shortening
      ▪ chordal transposition and artificial chordae
   vii. perioperative care
   viii. early and late results of repair and replacement

35. Aortic valve
   a. Normal anatomy
   b. Normal function
   c. Aortic stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (ventricular hypertrophy, mitral incompetence)
      iv. non-operative therapy
      v. indications for operative intervention (risk stratification)
      vi. techniques of valve replacement and repair
         ▪ management of small aortic root
         ▪ homograft and autograft valve replacement
   vii. perioperative care considerations
   viii. early and late results
   d. Aortic incompetence
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology (LV dilatation and LV dysfunction)
      iv. non-operative treatment
      v. indications for operative intervention
         ▪ in absence of clinical symptoms
         ▪ when complicated by endocarditis
         ▪ when complicated by aortic root aneurysm
      vi. techniques of valve repair and replacement
         ▪ with endocarditis and aortic root abscess
         ▪ with ascending and root aneurysm
   vii. perioperative care considerations
viii. early and late results

36. Tricuspid valve
   a. Normal anatomy
   b. Normal function
   c. Tricuspid incompetence
      i. etiology and pathologic anatomy
      ii. physiology
      iii. indications for operation
         ▪ functional incompetence
         ▪ endocarditis
      iv. techniques of repair, indications for replacement
         ▪ ring and suture annuloplasty
         ▪ endocarditis (valve excision vs. repair or replacement)
   v. perioperative care
      ▪ management of RV dysfunction
      ▪ interventions to decrease pulmonary vascular resistance
   vi. early and late results

d. Tricuspid stenosis
   i. etiology and pathologic anatomy
   ii. physiology
   iii. differentiation from constrictive pericarditis
   iv. indications for operative repair vs. replacement
   v. techniques of repair and replacement
   vi. early and late results

Clinical Skills:

During the training program the resident:

16. Evaluates, diagnoses and selects management strategies for patients with valvular heart disease, including participation in and interpretation of cardiac catheterizations and echocardiograms;
17. Makes use of the therapeutic options and relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
18. Manages preoperative clinical preparation and early and intermediate postoperative care;

Performs valve repair and replacement for valvular disease, interprets intraoperative echo.

CONGENITAL HEART DISEASE

A. Embryology, Anatomy and History

Rotation Objective:

At the end of the rotation the resident understands the embryology of the heart and great vessels as it relates to the development of congenital heart anomalies, the normal anatomy of the heart, and the abnormal anatomy of
the principal congenital cardiac anomalies, and applies this knowledge to the interpretation of echocardiograms, angiocardiograms, and other imaging techniques.

Learner Objectives:

Upon completion of the rotation the resident:

13. Knows the embryology and anatomy of the normal heart;
14. Knows the embryology and anatomy of major cardiac anomalies;
15. Interprets angiocardiograms, echocardiograms, and other images and correlates these with normal and abnormal cardiac anatomy;
16. Knows the history of congenital cardiac surgery, and the intellectual development of operations used to manage each cardiac anomaly.

Contents:

13. Anatomy and embryology of the normal heart;
14. Embryology and pathologic anatomy of each major congenital cardiac anomaly;
15. Interpretation of angiocardiograms, echocardiograms, and other images
   a. Normal heart
   b. Major congenital cardiac anomalies

Clinical Skills:

During the training program the resident:

10. Applies knowledge of the normal and abnormal anatomy of the heart to the planning and performance of operations;
11. Interprets angiocardiograms, echocardiograms, and other images to diagnose congenital heart disease;
12. Uses knowledge to select the best procedure for individual patients.

B. Physiology and Physiologic Evaluation

Rotation Objective:

At the end of this rotation the resident understands the physiology of the developing heart, the physiologic changes of advancing age and transition ex-utero, and the physiologic consequences of congenital heart disease. The resident understands the findings in and limitations of invasive and non-invasive tests to define physiologic abnormalities and uses them in patient management.

Learner Objectives:

Upon completion of the rotation the resident:

13. Understands normal fetal circulation;
14. Understands the transitional nature of circulation as the fetus becomes a neonate;
15. Understands the physiology of obstructions, of intra- and extracardiac shunts, of abnormal connections
to the heart, and of combinations of these anomalies in the fetus, neonate, and child.

Contents:

21. Fetal circulation
   a. Oxygen source
   b. Flow pattern of blood through the heart and circulation
   c. Cardiac output and its distribution
   d. Myocardial function
   e. Regulation of the circulation

22. Transitional and neonatal circulation
   a. General changes
   b. Pulmonary circulation changes (e.g., mechanical factors, oxygen effects, vasoactive substances,
      hormonal factors)
   c. Ductus arteriosus changes (factors effecting closure or maintaining patency)
   d. Foramen ovale changes (factors effecting closure or maintaining patency)
   e. Physiologic assessment of the neonate

23. Fundamental anatomic abnormalities and physiologic consequences
   a. Anatomic abnormalities: obstruction (e.g., aortic stenosis, pulmonary atresia); extra pathways
      (e.g., atrial septal defect, ventricular septal defect); abnormal connections (e.g., transposition of
      the great vessels)
   b. Increased blood flow to a region
   c. Decreased blood flow to a region
   d. Combinations of increased or decreased blood flow to a region (e.g., tetralogy of Fallot, double
      outlet right ventricle, anomalous pulmonary veins)
   e. Application of these anatomic and physiologic principles to derive the common names for
      defects
   f. Hemodynamic manifestations of these anatomic and physiologic elements

24. Hemodynamic assessment
   a. Usefulness and limitations of echocardiographic doppler
   b. Usefulness and limitations of cardiac catheterization
   c. Calculations of regional flows and resistances
   d. Calculation of flow resistance and ratio
   e. Pulmonary vascular resistance and pulmonary hypertension

25. Indications for operation
   a. Clinical symptoms and signs of obstructive lesions
   b. Clinical symptoms and signs of extra pathway lesions
   c. Clinical symptoms and signs of abnormal connections

Clinical Skills:

During the training program the resident:

25. Describes the physiologic changes of circulation during neonatal life;
26. Diagnoses clinically important congenital heart diseases in the neonate, infant, and child;
27. Applies a knowledge of anatomic abnormalities and their physiologic consequences to diagnose congenital heart defects;
28. Manages the physiologic aspects of the neonate, infant, and child with congenital heart disease preoperatively, intraoperatively, and postoperatively;
29. Stabilizes patients who are critically ill with congenital heart disease;
30. Performs calculations of blood flows and resistances from cardiac catheterization data.

C. Cardiopulmonary Bypass for Operations on Congenital Cardiac Anomalies

Rotation Objective:

At the end of this rotation the resident has a working knowledge of the principles of cardiopulmonary bypass for congenital heart disease, the techniques of myocardial preservation, and the use of profound hypothermia and total circulatory arrest in the infant and child.

Learner Objectives:

Upon completion of the rotation the resident:

25. Knows the indications for the various techniques of bypass (anatomy, pathophysiology, and technical requirements of the underlying cardiac defects);
26. Knows arterial and venous cannulation techniques for different intracardiac defects;
27. Understands the techniques of myocardial protection in the neonate and young infant;
28. Understands the use of varying levels of hemodilution and anticoagulation;
29. Understands perfusion flow and pressure control;
30. Knows the methods of body temperature manipulation, and the indications for and techniques of profound hypothermia with and without total circulatory arrest.

Contents:

17. Monitoring for cardiopulmonary bypass
   a. Arterial pressure lines
   b. Central venous pressure, pulmonary artery pressure
   c. Temperature monitoring (nasopharyngeal, esophageal, rectal, bladder)
   d. O2 saturation, end-tidal CO2
   e. Urine output
18. Cannulation
   a. Single venous (indications, technique)
   b. Double venous (indications, technique)
   c. Arterial (technique)
   d. Venting (indications, technique)
   e. Cardioplegia
19. Myocardial preservation techniques
   a. Crystalloid, blood
   b. Cold, warm
c. Antegrade, retrograde
d. Additives
e. Fibrillation

20. Profound hypothermia and total circulatory arrest
   a. Indications
   b. Benefits, disadvantages
   c. Safe duration of total circulatory arrest
   d. Early cerebral complications
   e. Late intellectual, neurological, psychiatric outcome

Clinical Skills:

During the training program the resident:

13. Performs arterial and venous cannulation and initiates cardiopulmonary bypass;
14. Directs the perfusionist in the intraoperative management and conduct of cardiopulmonary bypass;
15. Performs or participates in the repair of congenital heart defects using cardiopulmonary bypass.

D. Left-To-Right Shunts

Rotation Objective:

At the end of the rotation the resident understands the diagnosis and treatment of left-to-right shunts caused by congenital cardiac anomalies, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

17. Knows the anatomy, embryology, and physiology of the most common or important anomalies;
18. Knows the operative indications of the most common or important anomalies;
19. Knows the technical components of the operative repair of the most common or important anomalies;
20. Understands the postoperative care of each anomaly.

Contents:

25. Atrial septal defect
   a. Anatomy
      i. types of atrial septal defects and key landmarks of the right atrium.
   b. Clinical features
      i. natural history, indications for operation
      ii. clinical signs and symptoms, physical exam
      iii. chest x-ray and ECG
      iv. echocardiogram and cardiac catheterization
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
d. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

26. Ventricular septal defect
   a. Anatomy
      i. types
   b. Clinical features
      i. clinical signs and symptoms, physical exam
      ii. echocardiogram and cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history
      v. indications, contraindications, timing of operation (e.g., total repair vs. pulmonary artery banding)
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. incisions for different types of defects
      iii. closure techniques (direct suture vs. patch)
      iv. treatment of associated anomalies (e.g., atrial septal defect, right ventricular muscle bands)
      v. complications (rhythm disturbances, residual defects, air)
      vi. techniques of PA banding
   d. Outcomes
      i. expected operative mortality
      ii. long-term results
      iii. complications

27. Patent ductus arteriosus
   a. Anatomy
   b. Physiology
      i. neonate vs. older child
      ii. effect of prostaglandin and prostaglandin inhibitors
   c. Diagnosis and clinical features
      i. symptoms and physical findings
      ii. echocardiogram and cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history (neonate vs. older child, endocarditis)
      v. indications for operation
      vi. associated anomalies (e.g., ductus-dependent conditions)
   d. Operative repair and complications
      i. operative techniques for simple ductus
      ii. management of the difficult ductus
      iii. complications of operative repair
28. Atrioventricular septal defect
   a. Anatomy
      i. types (complete, transitional, ostium primum ASD)
      ii. atrioventricular valve pathologic anatomy
   b. Physiology
      i. shunts and resistance calculation
      ii. complete vs. incomplete
   c. Diagnosis and clinical features
      i. symptoms and signs (infant vs. older patient, physical exam)
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray and ECG
      iv. natural history (development of Eisenmenger's syndrome)
      v. indications for and timing of operation (size of shunt, endocarditis risk, total repair vs. pulmonary artery banding)
   d. Operative repair and complications
      i. cardiopulmonary bypass and myocardial protection
      ii. incisions in the heart
      iii. operative techniques
      iv. complications (residual defects, residual “mitral valve” insufficiency, heart block)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

29. Double-outlet right ventricle
   a. Anatomy
      i. types (subaortic, subpulmonic, uncommitted)
      ii. associated anomalies
   b. Clinical features
      i. natural history
      ii. indications for and timing of operation
      iii. signs and symptoms of each of the anatomic types
      iv. chest x-ray, ECG
      v. echocardiogram and cardiac catheterization
   c. Operative repair and complications
      i. palliative operations vs. total repair (application of shunts, pulmonary artery band, total repair)
      ii. cardiopulmonary bypass and myocardial protection
      iii. approach to each anatomic subtype and placement of incisions in the heart
      iv. specific operative techniques (e.g., suturing, placement of patches)
      v. complications and their management
   d. Outcome
      i. expected operative mortality
ii. long-term results
iii. complications

30. Aorto-pulmonary window
   a. Anatomy
   b. Clinical features
      i. natural history (development of pulmonary vascular obstructive disease)
      ii. symptoms and signs
      iii. echocardiogram, angiocardiogram, cardiac catheterization
      iv. chest x-ray, ECG
   c. Operative repair
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

Clinical Skills:

During the training program the resident:

17. Participates in or performs the operative repair of atrial septal defects, ventricular septal defects, patent ductus arteriosus, and pulmonary artery banding;
18. Participates in or performs the repair of more complex cardiac anomalies;
19. Performs the preoperative evaluation of patients with each of these anomalies;
20. Manages postoperative care.

**E. Cyanotic Anomalies**

Rotation Objective:

At the end of this rotation the resident knows the anatomy and physiology of anomalies that result in cyanosis, their diagnosis, their preoperative, operative, and postoperative management, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

25. Knows the anatomy and physiology of each anomaly;
26. Knows the methods of diagnosis;
27. Understands the role of medical management and interventional cardiology as treatment options;
28. Knows the indications for and timing of operation;
29. Understands the technical components of operative repair;
30. Knows the postoperative care, expected outcome, long-term results, and complications.

Contents:
25. Tetralogy of Fallot
   a. Anatomy and embryology
      i. embryology of malaligned ventricular septal defect
      ii. levels of right ventricular outflow tract obstruction
   b. Physiology
      i. genesis of “tet spells” and infundibular spasm
      ii. factors which affect degree of right-to-left shunt
      iii. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. role of systemic-to-pulmonary artery shunt vs. total repair
      ii. types of aortic-to-pulmonary artery shunts
      iii. extracorporeal bypass and myocardial protection
      iv. ventricular septal defect closure by transventricular or transatrial approach
      v. techniques for relief of right ventricular outflow tract obstruction and indications for transannular patching
      vi. indications for conduit repair
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

26. Transposition of the great vessels (TGA)
   a. Anatomy
      i. simple TGA
      ii. complex TGA (ventricular septal defect, pulmonary stenosis)
   b. Physiology
      i. concept of circulations in parallel and mixing
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
      v. indications for and timing of operations
   d. Operative repair and complications
      i. technique of Blalock-Hanlon atrial septectomy, open atrial septectomy
      ii. cardiopulmonary bypass and myocardial protection
      iii. operative techniques for total repair (Mustard, Senning, arterial switch, Rastelli)
      iv. palliative operations (PA band, systemic-to-pulmonary artery shunt)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
iii. complications
iv. arrhythmias after atrial repairs
v. semilunar insufficiency, PA stenosis, coronary problems after arterial switch
vi. conduit obstruction after Rastelli

27. Truncus arteriosus
a. Anatomy
   i. types of truncus arteriosus
   ii. associated anomalies (VSD, left ventricular outflow tract obstruction, arch interruption, DiGeorge syndrome)
b. Clinical features
   i. symptoms and physical findings
   ii. cardiac catheterization, echocardiogram, angiogram
   iii. chest x-ray, ECG
   iv. natural history (development of pulmonary vascular obstructive disease)
   v. indications for and timing of operation
c. Operative repair and complications
   i. extracorporeal bypass and myocardial protection
   ii. operative techniques
      • conduits (composite and homograft)
      • modifications required for types II and III truncus
   iii. techniques for repair of associated anomalies
d. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

28. Tricuspid atresia
a. Anatomy
   i. types I and II, subtypes
b. Physiology
   i. subtypes with right-to-left shunt
   ii. subtypes with left-to-right shunt
c. Clinical features
   i. symptoms and physical findings
   ii. echocardiogram, angiogram, cardiac catheterization
   iii. chest x-ray, ECG
   iv. natural history, role of balloon atrial septostomy
   v. indications for and timing of operation
   vi. role of palliative operations (systemic-pulmonary artery shunts, PA banding, bidirectional Glenn, Fontan, other right heart bypass operations)
d. Operative repair and complications
   i. palliative operations
   ii. operations for right heart bypass (bidirectional Glenn, Fontan)
e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications
29. Total anomalous pulmonary venous connection
   a. Anatomy
      i. supracardiac, cardiac, infracardiac, mixed
   b. Physiology
      i. obstructive vs. nonobstructive
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques for different subtypes
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

30. Ebstein's anomaly
   a. Anatomy
   b. Physiology
      i. concept of atrialized ventricle
      ii. right ventricular outflow tract obstruction
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. associated lesions (e.g., Wolf-Parkinson-White syndrome)
      vi. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. technique of tricuspid repair, obliteration of atrialized ventricle
      iii. technique of tricuspid valve replacement
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

Clinical Skills:

During the training program the resident:

17. Participates in or performs the major palliative operations for these congenital cardiac anomalies;
18. Participates in or performs operative repair of tetralogy, TGA, truncus arteriosus, TAPVR, Ebstein's anomaly, and Fontan-type operations;
19. Performs preoperative evaluation and preparation;
20. Manages postoperative care.

**F. Obstructive Anomalies**

Rotation Objective:

At the end of this rotation the resident understands the anatomy and physiology of obstructive anomalies of the left and right sides of the heart and aorta, their diagnosis, management, and postoperative care, and performs the operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

29. Knows the anatomy and physiology of each anomaly;
30. Knows the methods of diagnosis;
31. Understands the role of medical management and interventional cardiology;
32. Knows the indications for and timing of operation;
33. Knows the technical components of operative repair;
34. Understands the principles of postoperative care;
35. Knows the expected outcome, long-term results and complications

Contents:

21. Aortic stenosis
   a. Anatomy
      i. supravalvular, valvular, subvalvular (including subtypes)
   b. Physiology
      i. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques
      iii. pros and cons of various techniques and patch configurations for supravalvular stenosis
      iv. techniques of aortic valvotomy
      v. operations to enlarge the aortic annulus (e.g., Konno-Rastan procedure, Ross procedure)
      vi. technique of apical aortic conduit
      vii. myomectomy and myotomy for subaortic obstruction
   e. Outcome
      i. expected operative mortality
ii. long-term results
iii. complications

22. Pulmonary stenosis
   a. Anatomy
      i. valvular and supravalvular
      ii. associated anomalies (e.g., atrial septal defect, ventricular septal defect, branch stenosis)
   b. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history; role of balloon valvuloplasty
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. incisions in the heart and great vessels
      iii. operative considerations (technique of valvulotomy, indications for transannular patching, division of right ventricular muscle bands)
      iv. complications (residual obstruction)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

23. Coarctation of the aorta
   a. Anatomy
      i. relationship to the ductus arteriosus
      ii. associated anomalies (e.g., hypoplasia of transverse aorta, patent ductus arteriosus, LVOT obstruction)
   b. Physiology
      i. infant vs. older child
      ii. “preductal” vs. “postductal”
      iii. assessment of adequacy of collateral circulation
   c. Clinical features
      i. symptoms and physical findings (neonate with a closing ductus vs. older infant and child)
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. role of prostaglandins in stabilizing neonates
      vii. effect of associated anomalies (e.g., patent ductus arteriosus, aortic stenosis, ventricular septal defect)
   d. Operative repair and complications
      i. methods of repair (end-to-end vs. patch vs. subclavian angioplasty)
      ii. methods of arch reconstruction
      iii. complications (residual obstruction, paraplegia, chylothorax)
      iv. extracorporeal bypass, shunts in the absence of adequate collateral circulation
   e. Outcome
i. expected operative mortality
ii. long-term results
iii. complications
iv. re-coarctation

24. Interrupted aortic arch
   a. Anatomy
      i. types A, B, and C
      ii. associated anomalies (e.g., DiGeorge syndrome, VSD)
   b. Physiology
      i. role of ductal patency, prostaglandin
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. the role of prostaglandins in preoperative stabilization
      vii. DiGeorge syndrome (hypocalcemia, need for irradiated blood)
   d. Operative repair and complications
      i. extracorporeal bypass, hypothermic arrest
      ii. median sternotomy vs. left thoracotomy
      iii. techniques (e.g., end-to-end anastomosis, interposition grafting, absorbable vs. nonabsorbable sutures)
      iv. complications (e.g., residual obstruction, recurrent laryngeal nerve injury, chylothorax)
      v. repair of associated anomalies
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
      iv. reoperation
      v. management of DiGeorge syndrome

25. Vascular ring
   a. Anatomy
      i. double aortic arch, anomalous subclavian artery, unusual rings, pulmonary artery sling
   b. Physiology
      i. compression of airway and esophagus
   c. Clinical features
      i. signs and symptoms
      ii. barium esophagogram, CT scan, MRI
   d. Operative repair and complications
      i. techniques for exposure by left thoracotomy, indications for other approaches
      ii. technique for correction of each type
      iii. role of aortopexy
      iv. complications (e.g., recurrent laryngeal nerve paralysis, chylothorax, residual tracheomalacia)
   e. Outcome
Clinical Skills:

During the training program the resident:

25. Performs corrections for patent ductus arteriosus and coarctation of the aorta;
26. Participates in or performs aortic valvotomy, repair of supravalvular and subvalvular aortic stenosis, pulmonary valvotomy, correction of subvalvular pulmonary stenosis, correction of vascular rings;
27. Participates in or performs operations for left ventricular outflow obstruction and interrupted aortic arch;
28. Performs preoperative evaluation and preparation;
29. Manages postoperative care;
30. Uses prostaglandins in the management of patients with neonatal coarctation, interrupted aortic arch, critical aortic stenosis.

G. Miscellaneous Anomalies

Rotation Objective:

At the end of this rotation the resident is familiar with the anatomy, physiology, diagnosis, and operative treatment of unusual complex congenital anomalies and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

9. Understands the natural history, evaluation, and treatment of coronary anomalies, congenital complete heart block, hypoplastic left heart syndrome, pulmonary atresia (with and without VSD), “corrected transposition”, single ventricle, cor triatriatum, and cardiac tumors;
10. Understands the role of corrective and palliative operations for the above anomalies and of cardiac transplantation for appropriate cardiac pathology.

Contents:

21. Normal and abnormal anatomy
22. Physiology of each anomaly
23. Preoperative evaluation and diagnosis
24. Operative strategies and complications
25. Outcomes

Clinical Skills:

During the training program the resident:
12. Performs or assists in pacemaker insertion, systemic-to-pulmonary artery shunting for pulmonary atresia or stenosis (with or without VSD), and pulmonary artery banding for large left-to-right shunts;
13. Evaluates angiocardiograms, echocardiograms, and cardiac catheterizations of the above anomalies;
14. Develops treatment plans for the above anomalies;
15. Participates in or performs operative treatment for the above anomalies;
16. Manages postoperative care for the above anomalies.

**H. Principles of Postoperative Care**

Rotation Objective:

At the end of this unit the resident understands postoperative care of patients having palliation or correction of congenital cardiac anomalies and manages all aspects of their postoperative care.

**ADDITIONAL GOALS AND OBJECTIVES:**

During the three year period, the thoracic and cardiovascular surgical resident is expected to attain the highest degree of competency in the care of trauma, extracorporeal bypass and coagulation blood products, and the non-clinical elements of thoracic surgical practice. Throughout the three year period, the thoracic surgical resident is expected to master the following items.

Upon completion of the rotation the resident:

8. Knows the physiologic characteristics of neonates and small infants;
9. Understands the management of infants and children who have undergone operative correction of simple and complex congenital cardiac anomalies;
10. Understands the postoperative management of patients with systemic-to-pulmonary artery shunts;
11. Understands the management of patients who have had a right heart bypass operation;
12. Understands the physiologic preoperative and postoperative management of patients with hypoplastic left heart syndrome;
13. Understands which infants and children are prone to have a pulmonary hypertensive crisis;

Contents:

5. Preoperative assessment and preparation
   a. Clinical and diagnostic data
   b. Physical examination.
6. Expected postoperative course for each operation.
7. Ventilatory management
   a. Reactive pulmonary vasculature
   b. Left heart syndrome
   c. Right heart bypass operations
8. Pharmacologic management
   a. After right heart bypass operations
   b. With parallel circulation
   c. With reactive pulmonary vasculature

Clinical Skills:

During the training program the resident:

   6. Manages ventilators for infants and children with and without obligatory intracardiac shunts;
   7. Assesses the cardiac output and pulmonary and systemic resistance in infants and children;
   8. Uses physiologic and pharmacologic manipulation of preload, myocardial contractility, heart rate, and afterload to optimize cardiac output in critically ill infants and children;
   9. Evaluates the metabolic reserve of neonates and infants and provides prompt therapeutic intervention as indicated;
   10. Anticipates problems and complications of postoperative pediatric patients and provides appropriate treatment.

**THORACIC TRAUMA**

**A. Trauma of the Chest Wall**

Rotation Objective:

At the end of this rotation the resident understands the pathophysiology of chest wall injury, and diagnoses, resuscitates and treats trauma patients.

Learner Objectives:

Upon completion of this rotation the resident:

   5. Evaluates patients with blunt or penetrating chest wall injury;
   6. Understands the physiology and mechanics of operative drainage of the thoracic cavity;
   7. Understands the operative and non-operative management of chest wall injuries;
   8. Understands the pathophysiology of flail chest.

Contents:

   3. Thorax
      a. Rib fracture
      b. Flail chest
      c. Sucking chest wounds
      d. Diagnosis and management
      e. Simple
f. Tension

g. Diagnosis and treatment

4. Hemothorax

a. Diagnosis

b. Operative and non-operative management

Clinical Skills:
During the training program the resident:

3. Evaluates and treats chest wall injuries;

4. Performs emergency operations to repair chest wall injuries and provides postoperative management.

B. Tracheobronchial and Pulmonary Trauma

Rotation Objective:
At the end of this rotation the resident understands the pathophysiology of tracheobronchial and pulmonary trauma, and diagnoses, resuscitates and treats patients with these injuries.

Learner Objectives:
Upon completion of this rotation the resident:

6. Understands clinical presentation and radiologic findings of tracheobronchial injury;

7. Understands the principles of airway management;

8. Understands the bronchoscopic findings of tracheobronchial and pulmonary injury;

9. Understands the management of tracheobronchial and pulmonary injury;

10. Understands the injuries associated with tracheobronchial and pulmonary injury.

Contents:

5. Tracheobronchial injury

a. Signs and symptoms

b. Radiologic findings

c. Diagnosis and management

6. Airway control

a. Intubation

b. Bronchoscopy

c. Emergency tracheostomy

d. One-lung ventilation

e. High-frequency ventilation

7. Pulmonary contusion

a. Signs and symptoms

b. Pathophysiology

c. Radiologic findings

d. Operative and non-operative management
8. Penetrating injury  
   a. Signs and symptoms  
   b. Indications for operation  
   c. Management of peripheral injuries  
   d. Management of hilar injuries  
   e. Air embolism  

Clinical Skills:  

During the training program the resident:  

7. Evaluates and manages patients with tracheobronchial trauma;  
8. Manages the airway of patients with tracheobronchial injuries;  
9. Repairs tracheobronchial and associated injuries;  
10. Performs non-operative management of pulmonary contusion;  
11. Performs emergency operations to repair peripheral pulmonary and hilar injuries;  
12. Uses precautions to avoid air embolism in patients with penetrating and blunt injuries.  

C. Esophageal Trauma  

Rotation Objective:  

At the end of this rotation the resident understands the pathophysiology of esophageal trauma, and diagnoses, resuscitates and treats patients with these injuries.  

Learner Objectives:  

Upon completion of this rotation the resident:  

5. Understands the etiology and presentation of esophageal trauma;  
6. Understands the methods of assessment and diagnosis of esophageal trauma;  
7. Understands the management of injuries that disrupt the esophagus;  

Contents:  

4. Esophageal trauma  
   a. Signs and symptoms  
   b. Radiologic assessment (e.g., plain radiographs, CT scans, contrast studies)  
5. Methods of repair  
   a. Primary repair  
   b. Resection and reconstruction  
   c. Diversion  
6. Complications  
   a. Esophageal leak  
   b. Esophageal obstruction

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c. Management

Clinical Skills:

During the training program the resident:

4. Evaluates and interprets diagnostic tests of patients with esophageal trauma;
5. Performs the operative treatment of patients with esophageal injuries;
6. Manages the complications of operations for esophageal injury.

D. Diaphragmatic Trauma

Rotation Objective:

At the end of this rotation the resident understands the pathophysiology of diaphragmatic trauma, and diagnoses, resuscitates, and treats patients with these injuries.

Learner Objectives:

Upon completion of this rotation the resident:

4. Understands the presentation, evaluation, and treatment of blunt and penetrating diaphragmatic injuries;
5. Understands the evaluation and management of associated injuries;
6. Knows the presentation of delayed diaphragmatic injury, its diagnosis and management.

Contents:

3. Blunt trauma
   a. Signs and symptoms
   b. Radiologic findings
   c. Indication for operation
   d. Operative approach
   e. Techniques of repair
   f. Delayed presentation
   g. Associated injuries

4. Penetrating trauma
   a. Signs and symptoms
   b. Radiologic findings
   c. Operative approaches and techniques of repair
   d. Management of associated injuries

Clinical Skills:

During the training program the resident:

4. Performs operative repair of acute and chronic diaphragmatic and associated injuries;
5. Knows the presentation of delayed diaphragmatic injury, its diagnosis and management.

**E. Cardiovascular Trauma**

Rotation Objective:

At the end of this rotation the resident understands the pathophysiology of thoracic trauma resulting in injury to the heart and great vessels, and diagnoses, resuscitates and treats patients with these injuries.

Learner Objectives:

Upon completion of the rotation the resident:

4. Evaluates patients who have sustained cardiovascular trauma;
5. Understands the physiology of deceleration injuries to the thoracic aorta;

Contents:

5. Cardiac contusion  
   a. Pathophysiology  
   b. Noninvasive diagnostic techniques  
   c. Management  
   d. Follow-up and outcomes  
6. Penetrating cardiovascular injuries  
   a. Major vessel laceration  
   b. Penetrating cardiac trauma  
   c. Laceration of coronary arteries  
   d. Pericardial tamponade  
   e. Diagnostic methods  
   f. Management  
      i. operative approaches for specific injuries  
      ii. use of cardiopulmonary bypass or partial mechanical support  
      iii. management of concomitant injuries  
7. Postoperative management  
   a. Outcomes  
8. Traumatic aortic transection  
   a. Pathophysiology  
   b. Anatomic locations and operative approaches  
   c. Operative management  
   d. Management of associated injuries  
   e. Outcomes

Clinical Skills:
During the training program the resident:

3. Evaluates and treats cardiac contusion;
4. Performs or participates in emergency operations to repair penetrating injuries of the heart and thoracic great vessels, and provides postoperative management;

Performs emergency operations to repair traumatic transections of the thoracic aorta and provide postoperative management.

**EXTRACORPOREAL BYPASS AND COAGULATION-BLOOD PRODUCTS**

**A. Physiology of Extracorporeal Bypass**

Rotation Objective:

At the end of this rotation the resident understands the physiology and pathologic derangements of pulsatile and non-pulsatile extracorporeal bypass, and has a working knowledge of oxygenators, perfusion systems, and ventricular support devices as they apply to adult patients.

Learner Objectives:

Upon completion of the rotation the resident:

6. Understands the physiology and mechanics of membrane and bubble oxygenators;
7. Understands the mechanics and operation of roller and vortex pumps;
8. Understands the physiology of various extracorporeal bypass circuits and the derangements caused by their use;
9. Knows the coagulation system and alterations of blood elements;
10. Understands the basic design and function of ventricular support devices.

Contents:

8. Membrane oxygenators
   a. Physiology
   b. Design
   c. Complications
9. Bubble oxygenators
   a. Physiology
   b. Design
   c. Complications
10. Roller head pumps
    a. Design
    b. Safety measures
    c. Complications
11. Vortex pumps
   a. Mechanism and design
   b. Safety measures
   c. Complications

12. Extracorporeal circuits
   a. Set-up
   b. Types of tubing, filters, hemoconcentrators
   c. Safety measures
   d. Blood and artificial surface interaction

13. Perfusion solutions
   a. Prime solutions
   b. Hemodilution
   c. Oxygenators (types, indications, benefits, disadvantages)
   d. Venous reservoir
   e. Cardiotomy reservoir
   f. Tubing (choice of adequate internal diameter)
   g. Osmotic pressure, oncotic pressure (use of mannitol, albumin)
   h. Blood gas control

14. Manipulation of:
   a. Flow
   b. Pressure
   c. Temperature

Clinical Skills:

During the training program the resident:

   6. Uses knowledge of the effects of extracorporeal bypass to ensure its safe use;
   7. Recognizes the correct and incorrect set-up and operation of an extracorporeal circuit;
   8. Plans and uses extracorporeal circuits in clinical practice;
   9. Understands and treats physiologic derangements caused by blood-artificial surface interaction;
   10. Plans and uses ventricular support devices in clinical practice.

B. Techniques of Extracorporeal Bypass

Rotation Objective:

At the end of this rotation the resident understands the techniques of extracorporeal bypass and their application to solve specific clinical problems.

Learner Objectives:

Upon completion of the rotation the resident:

   5. Understands the standard techniques for extracorporeal bypass;
6. Understands the techniques for left heart bypass and right heart bypass for the treatment of specific clinical problems;
7. Understands the techniques of cannulation for extracorporeal bypass;
8. Oversees the management of patients undergoing extracorporeal bypass.

Contents:

4. Standard cardiopulmonary bypass
   a. Routes for cannulation (arterial and venous)
   b. Types of extracorporeal circuits
   c. Monitoring
   d. Complications
5. Anticoagulation for cardiopulmonary bypass
   a. Heparin and other agents
   b. Monitoring
   c. Reversal
   d. Complications
6. Special situations
   a. Left and/or right heart bypass
   b. Profound hypothermia and circulatory arrest

Clinical Skills:
During the training program the resident:

4. Performs cannulation for extracorporeal bypass using appropriate access routes;
5. Uses appropriate types of extracorporeal bypass to solve specific clinical problems;
6. Uses left and right heart bypass.

\textit{C. Mechanical Support}

Rotation Objective:

At the end of this rotation, the resident understands the indications for mechanical cardiac support and ECMO, patient selection, device selection, recognition and treatment of the complications of mechanical support, methods for weaning the patient from support, and “bridging” to transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

9. Understands the indications for cardiac support with mechanical devices or ECMO;
10. Understands alternatives to mechanical support (e.g., intra-aortic and intra-pulmonary balloon pumping);
11. Knows the techniques for inserting these ventricular support devices;
12. Recognizes complications of the devices;
13. Understands the principles of weaning patients from these devices;
14. Understands the use of mechanical devices as a “bridge” to transplantation;
15. Knows the requirements for anticoagulation and monitoring of blood trauma;
16. Understands Federal regulations that apply to the use of these devices.

Contents:

8. Indications for mechanical support
   a. Deterioration of an established prospective transplant recipient
   b. Patient unable to be weaned from cardiopulmonary bypass but is a candidate for “postcardiotomy” usage or “bridging” to transplantation
   c. Acute myocardial infarction with balloon-dependent left heart failure
9. Respiratory failure
   a. Indications for ECMO
   b. Alternatives to ECMO
10. Alternatives to mechanical devices
    a. Balloon pumping (left and right)
    b. Centrifugal devices
    c. Impeller devices
    d. Pulsatile devices
    e. Total artificial heart
11. Techniques of insertion
    a. Cardiac
    b. ECMO
12. Complications
    a. Blood trauma
    b. Thrombosis
    c. Bleeding
    d. Infection
13. Weaning the patient from support devices and the use of mechanical devices to “bridge” to transplantation
    a. Hemodynamic parameters used in weaning from cardiac support, criteria for weaning and rate of weaning
    b. Concept of “rehabilitation” of the bridging patient and modification of transplantation criteria for the bridging patient
14. Anticoagulation
    a. Requirements for various mechanical devices
    b. Detection of blood trauma
    c. Early detection of thrombotic problems

Clinical Skills:

During the training program the resident:

7. Evaluates and participates in the preoperative and postoperative management of patients requiring mechanical support;
8. Uses appropriate mechanical cardiac support and ECMO;
9. Manages the complications from the use of mechanical support and ECMO;
10. Weans patients from mechanical support and ECMO;
11. Manages patients bridging to transplantation;
12. Manages the anticoagulation of patients on mechanical support and ECMO.

**D. Fundamentals of Coagulation Management and Blood Component Therapy**

**Rotation Objective:**

At the end of this rotation the resident knows the physiology, methods, and techniques to manage the coagulation and fibrinolytic systems, and uses component therapy to treat specific clinical problems.

**Learner Objectives:**

At the end of the rotation the resident:

7. Understands the major blood groups, the clotting cascade, and the pathophysiology of clotting (e.g., abnormal clotting, activation of compliment, Kallikrein, prostanoids);
8. Understands the specific hemorrhagic and thrombotic complications of cardiac surgery and their management;
9. Understands the methods used in blood component storage and the measures taken to ensure a safe blood supply;
10. Understands the use of specific blood components to treat abnormalities of red cell quantity and quality, platelet quantity and quality, and coagulation function;
11. Knows the preoperative risk factors for excessive blood loss and blood utilization;
12. Understands the operative and postoperative techniques to ensure blood conservation.

**Contents:**

5. Blood characteristics
   a. Blood groups and specific antigens
   b. Cellular elements
   c. Clotting cascade
   d. Pathophysiology of clotting
   e. Drugs that affect clotting and platelet function
6. Hemorrhagic and thrombotic complications of cardiac surgery
   a. Diagnosis
   b. Preoperative, intraoperative, and postoperative management
   c. Heparin, Protamine
   d. Cardiac and vascular prostheses
7. Component therapy
   a. Packed red blood cells
   b. Fresh frozen plasma
   c. Platelets
   d. Cryoprecipitate
Clinical Skills:

During the course of the program, the resident:

4. Evaluates patients requiring component therapy and develops management strategies to correct abnormalities of the coagulation system;
5. Uses appropriate tests to ensure the safety of blood and blood components;
6. Uses appropriate blood conservation techniques.

NON-CLINICAL ELEMENTS OF THORACIC SURGICAL PRACTICE

Rotation Objective:

At the end of this rotation the resident understands the non-clinical elements of a thoracic surgical practice.

Learner Objectives:

Upon completion of this rotation the resident:

8. Understand the ethical components of surgical practice;
9. Understands and will be able to use clinical database and outcome analysis in surgical practice;
10. Knows the medico-legal aspects of surgical practice;
11. Understands critical pathways and cost-benefit analysis in clinical decision-making;
12. Understand organizational structure and mechanics of solo practice, group specialty practice, multi-specialty practice, and academic practice;
13. Knows the structure, responsibilities and requirements of managed care, capitation payment, contractual agreements, physician-hospital organizations, and independent practice agreements;
14. Understands the time constraints imposed by the responsibilities of practice and the need for effective time management.

Contents:

8. Fundamental elements of ethical practice
   a. Hippocratic oath
   b. Primum non nocere
   c. Personal responsibility
   d. Honest and open communications
   e. Critical self analysis
9. Clinical database and outcome analysis
   a. Data collection
   b. Risk stratification
   c. Statistical analysis
   d. Regular review of data
   e. Comparative analysis

10. Cost factors and clinical outcome
    a. Analysis of redundancy, waste, inefficiency
    b. Entrepreneurial approach to cost and quality

11. Practice arrangements
    a. Administration of practice (e.g., fees, collections, insurance, billing, overhead, office management)
    b. Advantages and disadvantages of different practice arrangements

12. External economic forces
    a. Managed care
    b. Medicare, Medicaid, Champus
    c. PROs, IPAs
    d. Contracts
    e. Capitation

13. Medico-legal factors
    a. Prevention of litigation
    b. Record keeping
    c. Response to malpractice lawsuit
    d. Expert witness testimony

14. Time management
    a. Family needs
    b. Practice needs (e.g., patients, administration, associates)
    c. Community responsibilities
    d. Personal needs (e.g., continuing education, personal growth, life outside medicine)
GOALS AND OBJECTIVES
ADULT CARDIAC SURGERY ROTATION
Institution #2 – Minneapolis VA
Duration: 6 months, Year 3

Patient Care: Deliver care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The thoracic fellow is expected to develop and execute a patient care plan. During the thoracic clinic and with in-patient consults, fellows will be expected to develop patient care plans, and following attending approval, execute the plan with appropriate follow-up.

Demonstrate technical ability: Fellows will demonstrate progressive acquisition of technical skills and the ability to progressively perform more complex procedures, leading to independent operative ability. By the end of the rotation, fellows should be comfortable performing routine as well as difficult adult cardiac surgery including coronary artery bypass and heart valve replacement, ventricular assist device implantations, heart transplantation, reoperations, and management of heart failure patients.

Use information technology: Fellows learn to use currently available information technology sources – Medline, PubMed, electronic journals – for information and learning related to patient care. In addition, fellows will become proficient with the electronic medical records and computer systems at UMMC.

Evaluate diagnostic studies: During the thoracic rotation fellows will become proficient at both ordering (area to be scanned, high resolution or not, type and route of contrast to be used) and interpretation of chest CT examinations, coronary angiogram, and cardiac catheterization. This will be accomplished by interpreting diagnostic studies independently, and then presenting the interpretation to faculty with subsequent review.

Interpersonal and Communication Skills: Demonstrate effective information exchange and teaming with patients, their families, and other health professionals.

The thoracic fellow is expected to communicate with other healthcare professionals.

Physician to Physician: Accurate, timely, and efficient daily communication of clinical information to attending faculty, fellow residents, medical students, and consultants.

Physician to other Health Team Members: Daily follow-up communication with ward nurses, Program coordinators, and Social Workers as appropriate to ensure a smooth, efficient, and uninterrupted patient daily care program.

Counsel and educate patients and families:

Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.
Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Adult Cardiac Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

The Thoracic Fellows is expected to show caring and respectful behavior:

Fellow to Patient/Family: Fellow will demonstrate sensitivity to and consideration of patient’s and family’s physical and mental well-being through patience and attentiveness in listening and the use of appropriate body language. Will be sensitive to patient’s pain or psychological discomfort while conducting history &/or physical examinations in clinic or on the ward. Examples include, but are not limited to: sensitivity to being awakened abruptly, movement to an examining position while in discomfort, sensitivity to bodily exposure during examination with other team members present.

Fellow will maintain appropriate records documenting practice activities and outcomes: while on the thoracic rotation a log will be kept of all cases performed, clinic attendance, continuity of care, and postoperative complications.

**Practice-Based Learning and Improvement:** Demonstrate investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care. The Thoracic Fellow is expected to:

Demonstrate ability to practice lifelong learning: Fellows will demonstrate this trait by routinely preparing for all cases in advance by reading standard textbooks and both pre- and post-operatively by surveying seminal and recent literature on the topic.

Analyze personal practice outcomes through case tracking and complication listing. In addition, fellows will, on a real-time basis, with faculty, actively assess complications and how either judgment in decision making or in technical approach may have impacted patient care. In addition, complications will be reviewed in a similar manner at the Division Morbidity and Mortality Conference.

Use information technology to optimize patient care: Routine use of on-line resources ad-lib to address clinical decision making or care.

**Professionalism:** Demonstrate commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The Thoracic Fellow is expected to maintain high standards of ethical behavior, demonstrate continuity of care preoperatively, operatively and postoperatively.

Counsel and educate patients and families:
Physician to Patient: Daily review of patient’s status and progress with plan for the day’s activities/examinations, with clear communication of such plans to ensure proper patient expectations. Ongoing communication of results of diagnostic test results as available in a timely fashion.

Physician to Family: As appropriate – communication of patient’s medical progress, expected discharge date, and thorough review of discharge planning and expectations. Clear communication of patient’s method for seeking medical help post-discharge if necessary.

Function as a team member and/or leader: the Thoracic Fellow is expected to provide overall leadership for the Adult Cardiac Surgery Service. This entails proper communication with other health care team members as noted above, assigning daily activities/tasks to residents and students on the service, and ongoing education of residents and students both on the clinical service and in the operating room.

Maintain a log of continuity of care of patients seen in the Clinic.

Demonstrate sensitivity to age, gender, culture and other differences.

Demonstrate honesty, dependability and commitment.

**Systems-Based Practice:** Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The Thoracic Fellow is expected to:

Practice cost effective care without compromising quality: Through interaction with faculty, fellows will develop skills and awareness of assessing the value of diagnostic resources and whether they are necessary for optimal patient care delivery.

Promote disease prevention.

Demonstrate risk-benefit analysis.

Know how different practice systems operate to deliver care. The thoracic fellow will attend core lecture series provided by the Graduate Medical Education Committee of the Medical School for coverage of this topic.

**Medical Knowledge:** Develop knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

The Thoracic Fellow is expected to master the following core topics by the end of the rotation:

**TRANSPLANTATION**

**A. Cardiac Transplantation**
Rotation Objective:

At the end of this rotation, the resident knows the principles of organ preservation, immunosuppressive therapy, signs and treatment of rejection, and the indications for and techniques of cardiac transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

22. Knows the indications for cardiac transplantation;
23. Understands the management of immunosuppressive therapy in cardiac transplantation;
24. Knows the techniques of cardiac transplantation;
25. Recognizes the signs and symptoms of cardiac rejection and knows the appropriate management;
26. Understands the evaluation and management of organ donors;
27. Knows the methods of organ harvest and preservation;
28. Is familiar with the techniques and complications of endomyocardial biopsy.

Contents:

19. Indications for cardiac transplantation
   a. Patient evaluation
   b. Patient selection
   c. Informed consent
20. Immunosuppressive therapy in cardiac transplantation
   a. Evaluation of therapy
   b. Drugs
   c. Complications
21. Technique of cardiac transplantation
   a. Orthotopic
   b. Heterotopic
22. Donor preparation and organ harvest
   a. Brain death, legal and family-related issues
   b. Donor evaluation
   c. Methods of organ procurement and preservation
23. Cardiac rejection
   a. Signs and symptoms
   b. Endomyocardial biopsy
   c. Histologic evaluation
   d. Management
   e. Mechanical support and re-transplantation
24. Immunosuppressive therapy
   a. Immunosuppressive drugs and their side effects
   b. Polyclonal and monoclonal antibody therapy and side effects
Clinical Skills:

During the training program the resident:

22. Manages organ donors;
23. Performs organ harvest and preservation;
24. Performs cardiac transplantation;
25. Manages the cardiac transplant recipient preoperatively and postoperatively;
26. Participates in the immunosuppressive therapy for cardiac transplantation;
27. Evaluates transplant recipients for signs of rejection or infection and initiates appropriate therapy;

**B. Lung Transplantation**

Rotation Objective:

At the end of this rotation the resident understands the basic principles of lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the indications for and performs lung transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

22. Understands the evaluation and management of organ donors;
23. Knows the indications for lung transplantation;
24. Understands the management of immunosuppressive therapy in lung transplantation;
25. Knows the techniques of single and double lung transplantation;
26. Recognizes the signs and symptoms of lung rejection or infection and knows the appropriate management;
27. Knows the methods for harvesting and preserving donor lungs;
28. Is familiar with the techniques and complications of bronchoscopy of the transplanted lung.

Contents:

Indications for lung transplantation

d. Patient evaluation
e. Patient selection
f. Informed consent

20. Imunosuppressive therapy in lung transplantation

a. Evaluation of therapy
b. Drugs
c. Complications

21. Technique of single and double lung transplantation
22. Donor evaluation
   a. History
   b. Physiology
   c. Radiology

23. Donor preparation and organ harvest
   a. Brain death, legal and family-related issues
   b. Organ procurement and preservation
   c. Pharmacologic and technical aspects of donor lung harvest operations

24. Pulmonary rejection
   a. Signs and symptoms
   b. Endobronchial biopsy
   c. Histologic evaluation of rejection
   d. Management of rejection

25. Immunosuppressive therapy
   a. Immunosuppressive drugs and their side effects
   b. Antibody therapy and side effects
   c. Complications of immunosuppressive therapy

Clinical Skills:

During the training program the resident:

   22. Performs or participates in donor evaluation and management;
   23. Performs or participates in donor lung harvest and preservation;
   24. Performs or participates in lung transplantation;
   25. Participates in the immunosuppressive therapy for lung transplantation;
   26. Manages the lung transplant recipient preoperatively and postoperatively;
   27. Evaluates transplant recipients for signs of rejection or infection, and initiates appropriate therapy;
   28. Performs transbronchial biopsy.

C. Heart-Lung Transplantation

Rotation Objective:

At the end of this rotation the resident understands the principles of heart-lung preservation and immunosuppressive therapy, recognizes and treats rejection, and knows the techniques of heart-lung transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

   25. Knows the indications for heart-lung transplantation;
26. Understands the management of immunosuppressive therapy of heart-lung transplantation;
27. Knows the operative techniques of heart-lung transplantation;
28. Recognizes the signs and symptoms of pulmonary rejection in cardiopulmonary transplantation;
29. Recognizes infection and rejection, and knows the appropriate management of each;
30. Understands the evaluation and management of heart-lung donors;
31. Knows the methods for harvesting and preserving heart-lung blocs;
32. Is familiar with the techniques and complications of radiologic and fiberoptic bronchoscopy of the transplanted lung in the heart-lung recipient.

Contents:

20. Immunosuppressive therapy in cardiopulmonary transplantation
   a. Evaluation of therapy
   b. Drugs
   c. Complications
21. Technique of heart-lung transplantation
22. Donor evaluation
   a. History
   b. Physiology
   c. Radiology
23. Donor preparation and harvest
   a. Brain death, legal and family-related issues
   b. Organ procurement and preservation
   c. Pharmacologic and technical aspects of donor heart-lung harvesting
24. Rejection in cardiopulmonary transplantation
   a. Signs and symptoms
   b. Frequency of cardiac rejection and indications for endomyocardial biopsy
   c. Techniques for diagnosing lung rejection in the cardiopulmonary transplant patient
   d. Histologic evaluation of pulmonary rejection in the cardiopulmonary transplant patient
   e. Management of rejection in the cardiopulmonary transplant recipient
25. Immunosuppressive therapy
   a. Immunosuppressive drugs and their side effects
   b. Monoclonal and polyclonal antibody therapy and their side effects
   c. Complications

Clinical Skills:

During the training program the resident:

20. Participates in the evaluation and management of donors for cardiopulmonary transplantation;
21. Performs heart-lung bloc harvesting and preservation;
22. Performs heart-lung transplantation;
23. Participates in immunosuppressive therapy for transplantation;
24. Manages transplant recipients preoperatively and postoperatively;
25. Evaluates transplant recipients for signs of pulmonary rejection and infection, and of cardiac dysfunction;
26. Performs endobronchial biopsy, thoracoscopic biopsy of the lung, and endocardial biopsy of cardiopulmonary transplantation patients, as indicated.

**ACQUIRED HEART DISEASE**

**A. Coronary Artery Disease**

Rotation Objective:

At the end of this rotation the resident understands the physiology of coronary circulation, the pathophysiologic causes and derangement of ischemic heart disease and the sequelae of coronary events, and performs comprehensive short and long-term management.

Learner Objectives:

Upon completion of the rotation the resident:

43. Understands the physiology of coronary circulation and the physiologic derangements caused by stenosis and obstruction;

44. Understands the development of atherosclerotic plaques and the current theories of plaque origination;

45. Knows the normal and variant anatomy of coronary circulation as well as the radiographic anatomy of the coronary arteries and the left and right ventricles;

46. Understands the rationale for and techniques of coronary artery bypass operations as well as the use of various conduits;

47. Understands the risks and complications of coronary artery bypass operations, coronary angiography, and percutaneous coronary artery balloon angioplasty;

48. Understands the preoperative and postoperative care of patients undergoing coronary artery bypass grafting;

49. Can describe outcomes of angioplasty and of operative and non-operative treatment of coronary artery disease, using statistical methods.

Contents:

49. Cardiac anatomy
   a. Left and right main coronary arteries
   b. Left anterior descending coronary artery
   c. Circumflex coronary artery
   d. Right coronary artery
   e. Coronary venous system
   f. Left and right ventricular anatomy

50. Radiographic cardiac and coronary anatomy
   a. Right anterior oblique views
   b. Left anterior oblique views
c. Cranial view
d. Ventriculography
51. Pathologic development of atherosclerotic plaque
   a. Endothelial injury
   b. Platelet factors
   c. Cellular factors
   d. Serum factors
52. Coronary artery bypass grafting
   a. Rationale
   b. Conduits
   c. Techniques
   d. Technical considerations
   e. Myocardial protection
53. Preoperative evaluation
   a. Symptoms of cardiac ischemia
   b. Non-invasive testing
   c. Invasive testing
   d. Decision making
54. Postoperative care
   a. Intensive care
   b. Acute care
   c. Long term management
   d. Late complications
55. Outcome
   a. Expected operative mortality
   b. Long term results
56. Complications of ischemic heart disease
   a. Chronic mitral insufficiency
   b. Ruptured papillary muscle (non-operative and operative management)
   c. Ventricular septal defect (non-operative and operative management)
   d. Cardiac rupture (non-operative and operative management)
   e. Left ventricular aneurysm

Clinical Skills:

During the training program the resident:

37. Evaluates patients with angina pectoris, unstable angina pectoris, and acute myocardial infarction;
38. Reads and interprets invasive and non-invasive tests of patients with ischemic heart disease;
39. Performs operative and non-operative management of patients with ischemic heart disease, including coronary artery bypass grafting using the internal mammary artery;
40. Participates in or performs surgery for the complications of myocardial infarction;
41. Directs the critical care management of preoperative and postoperative patients with ischemic heart disease;
42. Participates in the performance and evaluation of exercise tolerance tests, echocardiograms, and cardiac catheterizations.
B. Myocarditis, Cardiomyopathy, Hypertrophic Obstructive Cardiomyopathy, Cardiac Tumors

Rotation Objective:

At the end of this rotation the resident understands the pathology and etiology of diseased myocardium, the natural history of the diseases and physiologic alterations, and performs operative and non-operative management.

Learner Objectives:

Upon completion of the rotation the resident:

31. Understands the types of cardiac tumors (frequency, anatomic location, physiologic and pathologic derangements, diagnostic methods and surgical management);
32. Understands myocarditis (causes, physiologic changes, treatment, prognosis, and radiographic, EKG and echocardiographic changes);
33. Understands hypertrophic cardiomyopathy (genetic linkage, pathologic and anatomic changes, physiologic derangements, clinical features, diagnostic tests, natural history, medical and surgical treatment);
34. Knows the types of cardiomyopathies (causes, natural history, diagnostic methods, operative and nonoperative treatment);
35. Understands cardiac transplantation (immunology/rejection and treatment, physiology, indications, operative techniques, diagnostic techniques in follow-up).

Contents:

31. Tumors
   a. Types, pathology
   b. Location
   c. Physiology
   d. Primary vs. metastatic
   e. Malignant pericardial effusion
   f. Diagnostic methods
   g. Treatment
   h. Outcome
32. Myocarditis
   a. Pathologic changes
   b. Etiology
   c. Clinical findings
   d. Radiographic changes
   e. Electrocardiography
   f. Echocardiography
   g. Treatment
   h. Outcome
33. Hypertrophic cardiomyopathy (HCM)
   a. Pathologic changes
b. Anatomic changes
c. Pathophysiology
d. Obstructive vs. non-obstructive
e. Arrhythmias
f. Diagnosis
g. History and physical examination
   i. echocardiography
   ii. cardiac catheterization
h. Mitral valve
   i. systolic anterior motion
   ii. mitral regurgitation
i. Treatment
   i. mitral valve replacement
   ii. myectomy and myotomy
   iii. pacing
j. Outcome
   i. complications
   ii. long-term results

34. Cardiomyopathy
   a. Dilated
   b. Restrictive
c. Causes
d. Pathology
e. Pathophysiology
f. Diagnosis
   i. echocardiography
   ii. endomyocardial biopsy
g. Clinical course
h. Treatment
i. Outcome

35. Cardiac transplantation
   a. Techniques
   b. Indications
c. Immunology
d. Immunosuppressive treatment
e. Physiology
f. Complications and infection
g. Rejection
   i. diagnosis
   ii. treatment
h. Coronary artery disease development
i. Organ harvesting, preservation
j. Long term complications and outcome

Clinical Skills:
During the training program the resident
31. Evaluates and interprets chest x-rays, CT scans, MRI, echocardiograms, and cardiac catheterizations of patients with cardiac tumors, myocarditis, cardiomyopathy and hypertrophic cardiomyopathy (HCM);
32. Participates in or performs operative excision of cardiac tumors;
33. Participates in or performs operations for the treatment of HCM when indicated;
34. Participates in or performs heart transplants and provides preoperative and postoperative care;
35. Participates in echocardiography, cardiac catheterization, endomyocardial biopsy, and donor heart harvesting.

C. Abnormalities of the Aorta

Rotation Objective:

At the end of this rotation the resident understands the etiology and physiology of diseases of the aorta and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

19. Understands the etiology and the physiology of aortic dissections and all aneurysms involving the ascending, transverse, descending, and abdominal aorta;
20. Recognizes the potential morbidity and mortality associated with aortic aneurysms and develops appropriate treatment plans for their management;
21. Knows the operative and nonoperative management of patients with acute and chronic aortic dissections;

Contents:

13. Aortic aneurysms (atherosclerotic, aortic dissections)
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal
14. Operative and non-operative treatment
   a. Ascending
   b. Transverse
   c. Descending
   d. Abdominal

Clinical Skills:

During the training program the resident:

25. Evaluates and interprets plain radiography, echocardiography, CT scans, MRI, and contrast studies for diseases of the aorta;
26. Participates in or performs operative and non-operative management of thoracic aortic disease, including aneurysms, dissections, and occlusive disease;
27. Plans and directs the use of extracorporeal bypass, hypothermia, and circulatory arrest for aortic diseases;
28. Performs preoperative and postoperative care of patients with aneurysms, dissections, and occlusive disease of the aorta.

D. Cardiac Arrhythmias

Rotation Objective:

At the end of this rotation the resident understands the etiology and physiology of cardiac arrhythmias, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

25. Understands the etiology of cardiac arrhythmias and underlying physiologic disturbances;
26. Understands operative and non-operative management;
27. Knows the indications for and techniques of electrophysiologic studies and the application of this information to patient management.

Contents:

25. Cardiac arrhythmias
   a. Atrial
   b. Ventricular
26. Non-operative management
   a. Anti-arrhythmic drugs
   b. Electrical cardioversion and pacing
   c. Catheter ablation
27. Operative management
   a. AICD
   b. Intraoperative mapping and ablation
   c. Permanent pacing systems

Clinical Skills:

During the training program the resident:

25. Performs the operative and non-operative management of patients with atrial arrhythmias;
26. Participates in or performs operative management of patients with ventricular arrhythmias, including placement of automatic implantable cardioverter-defibrillator;
27. Participates in electrophysiologic studies.
E. Valvular Heart Disease

Rotation Objective:

At the end of this rotation the resident knows the normal and pathologic anatomy of the cardiac valves, understands their natural history, physiology and clinical assessment, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

41. Understands the normal and pathologic anatomy of the atrioventricular and semilunar valves;
42. Knows the natural history, pathophysiology, and clinical presentation of each major valvular lesion (mitral stenosis and incompetence, aortic stenosis and incompetence, tricuspid stenosis and incompetence);
43. Understands the operative and non-operative therapeutic options for the treatment of each major valvular lesion;
44. Knows the techniques for repair and replacement of cardiac valves;
45. Knows the preoperative and postoperative management of patients with valvular heart disease.

Contents:

37. Assessment of patients with valvular heart disease
   a. History and physical examination
   b. Echocardiogram
   c. Cardiac catheterization data
38. Choice of treatment
   a. Prosthetic valves
   b. Stented xenografts
   c. Non-stented human and xenograft valves
   d. Autograft valves for aortic valve replacement
   e. Valve repair
39. Long term complications of replacement devices
   a. Thrombosis
   b. Embolus
   c. Prosthetic dysfunction
40. Mitral valve
   a. Normal anatomy
   b. Normal function
   c. Mitral stenosis
      i. etiology and pathologic anatomy
      ii. natural history and complications
      iii. physiology
      iv. non-operative treatment
      v. indications for intervention (risk stratification)
vi. merits of balloon valve dilation vs. operative repair or replacement
vii. techniques of valve repair and replacement
viii. intraoperative and postoperative complications and management
ix. early and late results of operative and balloon valvulotomy
d. Mitral incompetence
i. etiology and pathologic anatomy
ii. natural history and complications
iii. physiology (mechanisms of incompetence)
iv. non-operative treatment
   - for nonischemic etiology
   - for ischemic etiology
v. indications for surgical intervention (risk stratification)
vi. techniques of valve repair
   - ring and suture annuloplasty
   - leaflet plication, excision
   - chordal/papillary muscle shortening
   - chordal transposition and artificial chordae
vii. perioperative care
viii. early and late results of repair and replacement
41. Aortic valve
a. Normal anatomy
b. Normal function
c. Aortic stenosis
i. etiology and pathologic anatomy
ii. natural history and complications
iii. physiology (ventricular hypertrophy, mitral incompetence)
iv. non-operative therapy
v. indications for operative intervention (risk stratification)
vi. techniques of valve replacement and repair
   - management of small aortic root
   - homograft and autograft valve replacement
vii. perioperative care considerations
viii. early and late results
d. Aortic incompetence
i. etiology and pathologic anatomy
ii. natural history and complications
iii. physiology (LV dilatation and LV dysfunction)
iv. non-operative treatment
v. indications for operative intervention
   - in absence of clinical symptoms
   - when complicated by endocarditis
   - when complicated by aortic root aneurysm
vi. techniques of valve repair and replacement
   - with endocarditis and aortic root abscess
   - with ascending and root aneurysm
vii. perioperative care considerations
viii. early and late results

42. Tricuspid valve
   a. Normal anatomy
   b. Normal function
   c. Tricuspid incompetence
      i. etiology and pathologic anatomy
      ii. physiology
      iii. indications for operation
          ▪ functional incompetence
          ▪ endocarditis
      iv. techniques of repair, indications for replacement
          ▪ ring and suture annuloplasty
          ▪ endocarditis (valve excision vs. repair or replacement)
   v. perioperative care
      ▪ management of RV dysfunction
      ▪ interventions to decrease pulmonary vascular resistance
   vi. early and late results

d. Tricuspid stenosis
   i. etiology and pathologic anatomy
   ii. physiology
   iii. differentiation from constrictive pericarditis
   iv. indications for operative repair vs. replacement
   v. techniques of repair and replacement
   vi. early and late results

Clinical Skills:

During the training program the resident:

19. Evaluates, diagnoses and selects management strategies for patients with valvular heart disease, including participation in and interpretation of cardiac catheterizations and echocardiograms;
20. Makes use of the therapeutic options and relative risks of operative and non-operative treatment for valvular heart disease in planning interventions;
21. Manages preoperative clinical preparation and early and intermediate postoperative care;

Performs valve repair and replacement for valvular disease, interprets intraoperative echo.

CONGENITAL HEART DISEASE

A. Embryology, Anatomy and History

Rotation Objective:

At the end of the rotation, the resident understands the embryology of the heart and great vessels as it relates to the development of congenital heart anomalies, the normal anatomy of the heart, and the abnormal anatomy of
the principal congenital cardiac anomalies, and applies this knowledge to the interpretation of echocardiograms, angiocardiograms, and other imaging techniques.

Learner Objectives:

Upon completion of the rotation the resident:

17. Knows the embryology and anatomy of the normal heart;
18. Knows the embryology and anatomy of major cardiac anomalies;
19. Interprets angiocardiograms, echocardiograms, and other images and correlates these with normal and abnormal cardiac anatomy;
20. Knows the history of congenital cardiac surgery, and the intellectual development of operations used to manage each cardiac anomaly.

Contents:

17. Anatomy and embryology of the normal heart;
18. Embryology and pathologic anatomy of each major congenital cardiac anomaly;
19. Interpretation of angiocardiograms, echocardiograms, and other images
   a. Normal heart
   b. Major congenital cardiac anomalies
20. History of cardiac surgery of congenital heart disease.

Clinical Skills:

During the training program the resident:

13. Applies knowledge of the normal and abnormal anatomy of the heart to the planning and performance of operations;
14. Interprets angiocardiograms, echocardiograms, and other images to diagnose congenital heart disease;
15. Uses knowledge to select the best procedure for individual patients.

B. Physiology and Physiologic Evaluation

Rotation Objective:

At the end of this rotation the resident understands the physiology of the developing heart, the physiologic changes of advancing age and transition ex-utero, and the physiologic consequences of congenital heart disease. The resident understands the findings in and limitations of invasive and non-invasive tests to define physiologic abnormalities and uses them in patient management.

Learner Objectives:

Upon completion of the rotation the resident:

16. Understands normal fetal circulation;
17. Understands the transitional nature of circulation as the fetus becomes a neonate;
18. Understands the physiology of obstructions, of intra- and extracardiac shunts, of abnormal connections to the heart, and of combinations of these anomalies in the fetus, neonate, and child.

Contents:

26. Fetal circulation
   a. Oxygen source
   b. Flow pattern of blood through the heart and circulation
   c. Cardiac output and its distribution
   d. Myocardial function
   e. Regulation of the circulation

27. Transitional and neonatal circulation
   a. General changes
   b. Pulmonary circulation changes (e.g., mechanical factors, oxygen effects, vasoactive substances, hormonal factors)
   c. Ductus arteriosus changes (factors effecting closure or maintaining patency)
   d. Foramen ovale changes (factors effecting closure or maintaining patency)
   e. Physiologic assessment of the neonate

28. Fundamental anatomic abnormalities and physiologic consequences
   a. Anatomic abnormalities: obstruction (e.g., aortic stenosis, pulmonary atresia); extra pathways (e.g., atrial septal defect, ventricular septal defect); abnormal connections (e.g., transposition of the great vessels)
   b. Increased blood flow to a region
   c. Decreased blood flow to a region
   d. Combinations of increased or decreased blood flow to a region (e.g., tetralogy of Fallot, double outlet right ventricle, anomalous pulmonary veins)
   e. Application of these anatomic and physiologic principles to derive the common names for defects
   f. Hemodynamic manifestations of these anatomic and physiologic elements

29. Hemodynamic assessment
   a. Usefulness and limitations of echocardiographic doppler
   b. Usefulness and limitations of cardiac catheterization
   c. Calculations of regional flows and resistances
   d. Calculation of flow resistance and ratio
   e. Pulmonary vascular resistance and pulmonary hypertension

30. Indications for operation
   a. Clinical symptoms and signs of obstructive lesions
   b. Clinical symptoms and signs of extra pathway lesions
   c. Clinical symptoms and signs of abnormal connections

Clinical Skills:

During the training program the resident:

31. Describes the physiologic changes of circulation during neonatal life;
32. Diagnoses clinically important congenital heart diseases in the neonate, infant, and child;
33. Applies a knowledge of anatomic abnormalities and their physiologic consequences to diagnose congenital heart defects;
34. Manages the physiologic aspects of the neonate, infant, and child with congenital heart disease preoperatively, intraoperatively, and postoperatively;
35. Stabilizes patients who are critically ill with congenital heart disease;
36. Performs calculations of blood flows and resistances from cardiac catheterization data.

C. Cardiopulmonary Bypass for Operations on Congenital Cardiac Anomalies

Rotation Objective:

At the end of this rotation the resident has a working knowledge of the principles of cardiopulmonary bypass for congenital heart disease, the techniques of myocardial preservation, and the use of profound hypothermia and total circulatory arrest in the infant and child.

Learner Objectives:

Upon completion of the rotation the resident:

31. Knows the indications for the various techniques of bypass (anatomy, pathophysiology, and technical requirements of the underlying cardiac defects);
32. Knows arterial and venous cannulation techniques for different intracardiac defects;
33. Understands the techniques of myocardial protection in the neonate and young infant;
34. Understands the use of varying levels of hemodilution and anticoagulation;
35. Understands perfusion flow and pressure control;
36. Knows the methods of body temperature manipulation, and the indications for and techniques of profound hypothermia with and without total circulatory arrest.

Contents:

21. Monitoring for cardiopulmonary bypass
   a. Arterial pressure lines
   b. Central venous pressure, pulmonary artery pressure
   c. Temperature monitoring (nasopharyngeal, esophageal, rectal, bladder)
   d. O2 saturation, end-tidal CO2
   e. Urine output
22. Cannulation
   a. Single venous (indications, technique)
   b. Double venous (indications, technique)
   c. Arterial (technique)
   d. Venting (indications, technique)
   e. Cardioplegia
23. Myocardial preservation techniques
   a. Crystalloid, blood
   b. Cold, warm
c. Antegrade, retrograde  
d. Additives  
e. Fibrillation  
24. Profound hypothermia and total circulatory arrest  
   a. Indications  
   b. Benefits, disadvantages  
   c. Safe duration of total circulatory arrest  
   d. Early cerebral complications  
   e. Late intellectual, neurological, psychiatric outcome  

Clinical Skills:  

During the training program the resident:  

16. Performs arterial and venous cannulation and initiates cardiopulmonary bypass;  
17. Directs the perfusionist in the intraoperative management and conduct of cardiopulmonary bypass;  
18. Performs or participates in the repair of congenital heart defects using cardiopulmonary bypass.  

D. Left-To-Right Shunts  

Rotation Objective:  

At the end of the rotation the resident understands the diagnosis and treatment of left-to-right shunts caused by congenital cardiac anomalies, and performs operative and non-operative treatment.  

Learner Objectives:  

Upon completion of the rotation the resident:  

21. Knows the anatomy, embryology, and physiology of the most common or important anomalies;  
22. Knows the operative indications of the most common or important anomalies;  
23. Knows the technical components of the operative repair of the most common or important anomalies;  
24. Understands the postoperative care of each anomaly.  

Contents:  

31. Atrial septal defect  
   a. Anatomy  
      i. types of atrial septal defects and key landmarks of the right atrium.  
   b. Clinical features  
      i. natural history, indications for operation  
      ii. clinical signs and symptoms, physical exam  
      iii. chest x-ray and ECG  
      iv. echocardiogram and cardiac catheterization  
   c. Operative repair and complications  
      i. extracorporeal bypass and myocardial protection
ii. incisions in the heart
iii. techniques for defect closure
iv. treatment of associated anomalies (e.g., cleft mitral valve)
v. complications of closure (e.g., air embolism, conduction abnormalities, residual defects)

d. Outcome
i. expected operative mortality
ii. long-term results
iii. complications

32. Ventricular septal defect
a. Anatomy
i. types
b. Clinical features
i. clinical signs and symptoms, physical exam
ii. echocardiogram and cardiac catheterization
iii. chest x-ray and ECG
iv. natural history
v. indications, contraindications, timing of operation (e.g., total repair vs. pulmonary artery banding)
c. Operative repair and complications
i. extracorporeal bypass and myocardial protection
ii. incisions for different types of defects
iii. closure techniques (direct suture vs. patch)
iv. treatment of associated anomalies (e.g., atrial septal defect, right ventricular muscle bands)
v. complications (rhythm disturbances, residual defects, air)
vi. techniques of PA banding
d. Outcomes
i. expected operative mortality
ii. long-term results
iii. complications

33. Patent ductus arteriosus
a. Anatomy
b. Physiology
i. neonate vs. older child
ii. effect of prostaglandin and prostaglandin inhibitors
c. Diagnosis and clinical features
i. symptoms and physical findings
ii. echocardiogram and cardiac catheterization
iii. chest x-ray and ECG
iv. natural history (neonate vs. older child, endocarditis)
v. indications for operation
vi. associated anomalies (e.g., ductus-dependent conditions)
d. Operative repair and complications
i. operative techniques for simple ductus
ii. management of the difficult ductus
iii. complications of operative repair
34. Atrioventricular septal defect

a. Anatomy
   i. types (complete, transitional, ostium primum ASD)
   ii. atroventricular valve pathologic anatomy

b. Physiology
   i. shunts and resistance calculation
   ii. complete vs. incomplete

c. Diagnosis and clinical features
   i. symptoms and signs (infant vs. older patient, physical exam)
   ii. echocardiogram, angiocardiogram, cardiac catheterization
   iii. chest x-ray and ECG
   iv. natural history (development of Eisenmenger's syndrome)
   v. indications for and timing of operation (size of shunt, endocarditis risk, total repair vs. pulmonary artery banding)

d. Operative repair and complications
   i. cardiopulmonary bypass and myocardial protection
   ii. incisions in the heart
   iii. operative techniques
   iv. complications (residual defects, residual “mitral valve” insufficiency, heart block)

e. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

35. Double-outlet right ventricle

a. Anatomy
   i. types (subaortic, subpulmonic, uncommitted)
   ii. associated anomalies

b. Clinical features
   i. natural history
   ii. indications for and timing of operation
   iii. signs and symptoms of each of the anatomic types
   iv. chest x-ray, ECG
   v. echocardiogram and cardiac catheterization

c. Operative repair and complications
   i. palliative operations vs. total repair (application of shunts, pulmonary artery band, total repair)
   ii. cardiopulmonary bypass and myocardial protection
   iii. approach to each anatomic subtype and placement of incisions in the heart
   iv. specific operative techniques (e.g., suturing, placement of patches)
   v. complications and their management

d. Outcome
   i. expected operative mortality
36. Aorto-pulmonary window
   a. Anatomy
   b. Clinical features
      i. natural history (development of pulmonary vascular obstructive disease)
      ii. symptoms and signs
      iii. echocardiogram, angiogram, cardiac catheterization
      iv. chest x-ray, ECG
c. Operative repair
d. Outcome
   i. expected operative mortality
   ii. long-term results
   iii. complications

Clinical Skills:

During the training program the resident:

21. Participates in or performs the operative repair of atrial septal defects, ventricular septal defects, patent ductus arteriosus, and pulmonary artery banding;
22. Participates in or performs the repair of more complex cardiac anomalies;
23. Performs the preoperative evaluation of patients with each of these anomalies;
24. Manages postoperative care.

E. Cyanotic Anomalies

Rotation Objective:

At the end of this rotation the resident knows the anatomy and physiology of anomalies that result in cyanosis, their diagnosis, their preoperative, operative, and postoperative management, and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

31. Knows the anatomy and physiology of each anomaly;
32. Knows the methods of diagnosis;
33. Understands the role of medical management and interventional cardiology as treatment options;
34. Knows the indications for and timing of operation;
35. Understands the technical components of operative repair;
36. Knows the postoperative care, expected outcome, long-term results, and complications.

Contents:
31. Tetralogy of Fallot
   a. Anatomy and embryology
      i. embryology of malaligned ventricular septal defect
      ii. levels of right ventricular outflow tract obstruction
   b. Physiology
      i. genesis of “tet spells” and infundibular spasm
      ii. factors which affect degree of right-to-left shunt
      iii. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. role of systemic-to-pulmonary artery shunt vs. total repair
      ii. types of aortic-to-pulmonary artery shunts
      iii. extracorporeal bypass and myocardial protection
      iv. ventricular septal defect closure by transventricular or transatrial approach
      v. techniques for relief of right ventricular outflow tract obstruction and indications for transannular patching
      vi. indications for conduit repair
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

32. Transposition of the great vessels (TGA)
   a. Anatomy
      i. simple TGA
      ii. complex TGA (ventricular septal defect, pulmonary stenosis)
   b. Physiology
      i. concept of circulations in parallel and mixing
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
      v. indications for and timing of operations
   d. Operative repair and complications
      i. technique of Blalock-Hanlon atrial septectomy, open atrial septectomy
      ii. cardiopulmonary bypass and myocardial protection
      iii. operative techniques for total repair (Mustard, Senning, arterial switch, Rastelli)
      iv. palliative operations (PA band, systemic-to-pulmonary artery shunt)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
iii. complications
iv. arrhythmias after atrial repairs
v. semilunar insufficiency, PA stenosis, coronary problems after arterial switch
vi. conduit obstruction after Rastelli

33. Truncus arteriosus
   a. Anatomy
      i. types of truncus arteriosus
      ii. associated anomalies (VSD, left ventricular outflow tract obstruction, arch interruption, DiGeorge syndrome)
   b. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history (development of pulmonary vascular obstructive disease)
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. operative techniques
         ▪ conduits (composite and homograft)
         ▪ modifications required for types II and III truncus
      iii. techniques for repair of associated anomalies
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

34. Tricuspid atresia
   a. Anatomy
      i. types I and II, subtypes
   b. Physiology
      i. subtypes with right-to-left shunt
      ii. subtypes with left-to-right shunt
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history, role of balloon atrial septostomy
      v. indications for and timing of operation
      vi. role of palliative operations (systemic-pulmonary artery shunts, PA banding, bidirectional Glenn, Fontan, other right heart bypass operations)
   d. Operative repair and complications
      i. palliative operations
      ii. operations for right heart bypass (bidirectional Glenn, Fontan)
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
35. Total anomalous pulmonary venous connection
   a. Anatomy
      i. supracardiac, cardiac, infracardiac, mixed
   b. Physiology
      i. obstructive vs. nonobstructive
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques for different subtypes
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

36. Ebstein's anomaly
   a. Anatomy
   b. Physiology
      i. concept of atrialized ventricle
      ii. right ventricular outflow tract obstruction
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. associated lesions (e.g., Wolf-Parkinson-White syndrome)
      vi. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass and myocardial protection
      ii. technique of tricuspid repair, obliteration of atrialized ventricle
      iii. technique of tricuspid valve replacement
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

Clinical Skills:

During the training program the resident:

21. Participates in or performs the major palliative operations for these congenital cardiac anomalies;
22. Participates in or performs operative repair of tetralogy, TGA, truncus arteriosus, TAPVR, Ebstein's anomaly, and Fontan-type operations;
23. Performs preoperative evaluation and preparation;
24. Manages postoperative care.

**F. Obstructive Anomalies**

Rotation Objective:

At the end of this rotation the resident understands the anatomy and physiology of obstructive anomalies of the left and right sides of the heart and aorta, their diagnosis, management, and postoperative care, and performs the operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

36. Knows the anatomy and physiology of each anomaly;
37. Knows the methods of diagnosis;
38. Understands the role of medical management and interventional cardiology;
39. Knows the indications for and timing of operation;
40. Knows the technical components of operative repair;
41. Understands the principles of postoperative care;
42. Knows the expected outcome, long-term results and complications

Contents:

26. Aortic stenosis
   a. Anatomy
      i. supravalvular, valvular, subvalvular (including subtypes)
   b. Physiology
      i. associated anomalies
   c. Clinical features
      i. symptoms and physical findings
      ii. cardiac catheterization, echocardiogram, angiocardiogram
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
   d. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. operative techniques
      iii. pros and cons of various techniques and patch configurations for supravalvular stenosis
      iv. techniques of aortic valvotomy
      v. operations to enlarge the aortic annulus (e.g., Konno-Rastan procedure, Ross procedure)
      vi. technique of apical aortic conduit
      vii. myomectomy and myotomy for subaortic obstruction
   e. Outcome
      i. expected operative mortality
ii. long-term results
iii. complications

27. Pulmonary stenosis
   a. Anatomy
      i. valvular and supravalvular
      ii. associated anomalies (e.g., atrial septal defect, ventricular septal defect, branch stenosis)
   b. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history; role of balloon valvuloplasty
      v. indications for and timing of operation
   c. Operative repair and complications
      i. extracorporeal bypass, myocardial protection
      ii. incisions in the heart and great vessels
      iii. operative considerations (technique of valvulotomy, indications for transannular patching, division of right ventricular muscle bands)
      iv. complications (residual obstruction)
   d. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications

28. Coarctation of the aorta
   a. Anatomy
      i. relationship to the ductus arteriosus
      ii. associated anomalies (e.g., hypoplasia of transverse aorta, patent ductus arteriosus, LVOT obstruction)
   b. Physiology
      i. infant vs. older child
      ii. “preductal” vs. “postductal”
      iii. assessment of adequacy of collateral circulation
   c. Clinical features
      i. symptoms and physical findings (neonate with a closing ductus vs. older infant and child)
      ii. echocardiogram, angiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. role of prostaglandins in stabilizing neonates
      vii. effect of associated anomalies (e.g., patent ductus arteriosus, aortic stenosis, ventricular septal defect)
   d. Operative repair and complications
      i. methods of repair (end-to-end vs. patch vs. subclavian angioplasty)
      ii. methods of arch reconstruction
      iii. complications (residual obstruction, paraplegia, chylothorax)
      iv. extracorporeal bypass, shunts in the absence of adequate collateral circulation
   e. Outcome
i. expected operative mortality
ii. long-term results
iii. complications
iv. re-coarctation

29. Interrupted aortic arch
   a. Anatomy
      i. types A, B, and C
      ii. associated anomalies (e.g., DiGeorge syndrome, VSD)
   b. Physiology
      i. role of ductal patency, prostaglandin
   c. Clinical features
      i. symptoms and physical findings
      ii. echocardiogram, angiocardiogram, cardiac catheterization
      iii. chest x-ray, ECG
      iv. natural history
      v. indications for and timing of operation
      vi. the role of prostaglandins in preoperative stabilization
      vii. DiGeorge syndrome (hypocalcemia, need for irradiated blood)
   d. Operative repair and complications
      i. extracorporeal bypass, hypothermic arrest
      ii. median sternotomy vs. left thoracotomy
      iii. techniques (e.g., end-to-end anastomosis, interposition grafting, absorbable vs. nonabsorbable sutures)
      iv. complications (e.g., residual obstruction, recurrent laryngeal nerve injury, chylothorax)
      v. repair of associated anomalies
   e. Outcome
      i. expected operative mortality
      ii. long-term results
      iii. complications
      iv. reoperation
      v. management of DiGeorge syndrome

30. Vascular ring
   a. Anatomy
      i. double aortic arch, anomalous subclavian artery, unusual rings, pulmonary artery sling
   b. Physiology
      i. compression of airway and esophagus
   c. Clinical features
      i. signs and symptoms
      ii. barium esophagogram, CT scan, MRI
   d. Operative repair and complications
      i. techniques for exposure by left thoracotomy, indications for other approaches
      ii. technique for correction of each type
      iii. role of aortopexy
      iv. complications (e.g., recurrent laryngeal nerve paralysis, chylothorax, residual tracheomalacia)
   e. Outcome
i. expected operative mortality
ii. long-term results
iii. complications
iv. residual tracheomalacia

Clinical Skills:

During the training program the resident:

31. Performs corrections for patent ductus arteriosus and coarctation of the aorta;
32. Participates in or performs aortic valvotomy, repair of supravalvular and subvalvular aortic stenosis, pulmonary valvotomy, correction of subvalvular pulmonary stenosis, correction of vascular rings;
33. Participates in or performs operations for left ventricular outflow obstruction and interrupted aortic arch;
34. Performs preoperative evaluation and preparation;
35. Manages postoperative care;
36. Uses prostaglandins in the management of patients with neonatal coarctation, interrupted aortic arch, critical aortic stenosis.

G. Miscellaneous Anomalies

Rotation Objective:

At the end of this rotation the resident is familiar with the anatomy, physiology, diagnosis, and operative treatment of unusual complex congenital anomalies and performs operative and non-operative treatment.

Learner Objectives:

Upon completion of the rotation the resident:

11. Understands the natural history, evaluation, and treatment of coronary anomalies, congenital complete heart block, hypoplastic left heart syndrome, pulmonary atresia (with and without VSD), “corrected transposition”, single ventricle, cortriatrium, and cardiac tumors;
12. Understands the role of corrective and palliative operations for the above anomalies and of cardiac transplantation for appropriate cardiac pathology.

Contents:

26. Normal and abnormal anatomy
27. Physiology of each anomaly
28. Preoperative evaluation and diagnosis
29. Operative strategies and complications
30. Outcomes

Clinical Skills:

During the training program the resident:
17. Performs or assists in pacemaker insertion, systemic-to-pulmonary artery shunting for pulmonary atresia or stenosis (with or without VSD), and pulmonary artery banding for large left-to-right shunts;
18. Evaluates angiocardiograms, echocardiograms, and cardiac catheterizations of the above anomalies;
19. Develops treatment plans for the above anomalies;
20. Participates in or performs operative treatment for the above anomalies;

H. Principles of Postoperative Care

Rotation Objective:

At the end of this rotation the resident understands postoperative care of patients having palliation or correction of congenital cardiac anomalies and manages all aspects of their postoperative care.

ADDITIONAL GOALS AND OBJECTIVES:

During the three year period, the thoracic and cardiovascular surgical resident is expected to attain the highest degree of competency in the care of trauma, extracorporeal bypass and coagulation blood products, and the non-clinical elements of thoracic surgical practice. Throughout the three year period, the thoracic surgical resident is expected to master the following items.

Upon completion of the unit the resident:

15. Knows the physiologic characteristics of neonates and small infants;
16. Understands the management of infants and children who have undergone operative correction of simple and complex congenital cardiac anomalies;
17. Understands the postoperative management of patients with systemic-to-pulmonary artery shunts;
18. Understands the management of patients who have had a right heart bypass operation;
19. Understands the physiologic preoperative and postoperative management of patients with hypoplastic left heart syndrome;
20. Understands which infants and children are prone to have a pulmonary hypertensive crisis;

Contents:

9. Preoperative assessment and preparation
   a. Clinical and diagnostic data
   b. Physical examination.
10. Expected postoperative course for each operation.
11. Ventilatory management
    a. Reactive pulmonary vasculature
    b. Left heart syndrome
    c. Right heart bypass operations
12. Pharmacologic management
    a. After right heart bypass operations
b. With parallel circulation  
c. With reactive pulmonary vasculature

Clinical Skills:

During the training program the resident:

11. Manages ventilators for infants and children with and without obligatory intracardiac shunts;
12. Assesses the cardiac output and pulmonary and systemic resistance in infants and children;
13. Uses physiologic and pharmacologic manipulation of preload, myocardial contractility, heart rate, and afterload to optimize cardiac output in critically ill infants and children;
14. Evaluates the metabolic reserve of neonates and infants and provides prompt therapeutic intervention as indicated;
15. Anticipates problems and complications of postoperative pediatric patients and provides appropriate treatment.

THORACIC TRAUMA

A. Trauma of the Chest Wall

Rotation Objective:

At the end of this rotation the resident understands the pathophysiology of chest wall injury, and diagnoses, resuscitates and treats trauma patients.

Learner Objectives:

Upon completion of this rotation the resident:

9. Evaluates patients with blunt or penetrating chest wall injury;
10. Understands the physiology and mechanics of operative drainage of the thoracic cavity;
11. Understands the operative and non-operative management of chest wall injuries;
12. Understands the pathophysiology of flail chest.

Contents:

5. Thorax  
   a. Rib fracture  
   b. Flail chest  
   c. Sucking chest wounds  
   d. Diagnosis and management  
   e. Simple  
   f. Tension  
   g. Diagnosis and treatment
6. Hemothorax  
   a. Diagnosis  
   b. Operative and non-operative management

Clinical Skills:
During the training program the resident:

5. Evaluates and treats chest wall injuries;  
6. Performs emergency operations to repair chest wall injuries and provides postoperative management.

B. Tracheobronchial and Pulmonary Trauma

Rotation Objective:
At the end of this rotation the resident understands the pathophysiology of tracheobronchial and pulmonary trauma, and diagnoses, resuscitates and treats patients with these injuries.

Learner Objectives:
Upon completion of this rotation the resident:

11. Understands clinical presentation and radiologic findings of tracheobronchial injury;  
12. Understands the principles of airway management;  
13. Understands the bronchoscopic findings of tracheobronchial and pulmonary injury;  
14. Understands the management of tracheobronchial and pulmonary injury;  
15. Understands the injuries associated with tracheobronchial and pulmonary injury.

Contents:

9. Tracheobronchial injury  
   a. Signs and symptoms  
   b. Radiologic findings  
   c. Diagnosis and management
10. Airway control  
    a. Intubation  
    b. Bronchoscopy  
    c. Emergency tracheostomy  
    d. One-lung ventilation  
    e. High-frequency ventilation
11. Pulmonary contusion  
    a. Signs and symptoms  
    b. Pathophysiology  
    c. Radiologic findings  
    d. Operative and non-operative management  
12. Penetrating injury  
    a. Signs and symptoms
b. Indications for operation
c. Management of peripheral injuries
d. Management of hilar injuries
e. Air embolism

Clinical Skills:

During the training program the resident:

13. Evaluates and manages patients with tracheobronchial trauma;
14. Manages the airway of patients with tracheobronchial injuries;
15. Repairs tracheobronchial and associated injuries;
16. Performs non-operative management of pulmonary contusion;
17. Performs emergency operations to repair peripheral pulmonary and hilar injuries;
18. Uses precautions to avoid air embolism in patients with penetrating and blunt injuries.

C. Esophageal Trauma

Rotation Objective:

At the end of this rotation the resident understands the pathophysiology of esophageal trauma, and diagnoses, resuscitates and treats patients with these injuries.

Learner Objectives:

Upon completion of this rotation the resident:

9. Understands the etiology and presentation of esophageal trauma;
10. Understands the methods of assessment and diagnosis of esophageal trauma;
11. Understands the management of injuries that disrupt the esophagus;

Contents:

7. Esophageal trauma
   a. Signs and symptoms
   b. Radiologic assessment (e.g., plain radiographs, CT scans, contrast studies)
8. Methods of repair
   a. Primary repair
   b. Resection and reconstruction
   c. Diversion
9. Complications
   a. Esophageal leak
   b. Esophageal obstruction
   c. Management
Clinical Skills:

During the training program the resident:

7. Evaluates and interprets diagnostic tests of patients with esophageal trauma;
8. Performs the operative treatment of patients with esophageal injuries;
9. Manages the complications of operations for esophageal injury.

D. Diaphragmatic Trauma

Rotation Objective:

At the end of this rotation the resident understands the pathophysiology of diaphragmatic trauma, and diagnoses, resuscitates, and treats patients with these injuries.

Learner Objectives:

Upon completion of this rotation the resident:

7. Understands the presentation, evaluation, and treatment of blunt and penetrating diaphragmatic injuries;
8. Understands the evaluation and management of associated injuries;
9. Knows the presentation of delayed diaphragmatic injury, its diagnosis and management.

Contents:

5. Blunt trauma
   a. Signs and symptoms
   b. Radiologic findings
   c. Indication for operation
   d. Operative approach
   e. Techniques of repair
   f. Delayed presentation
   g. Associated injuries

6. Penetrating trauma
   a. Signs and symptoms
   b. Radiologic findings
   c. Operative approaches and techniques of repair
   d. Management of associated injuries

Clinical Skills:

During the training program the resident:

6. Performs emergency evaluation and diagnosis of diaphragmatic and associated injuries;
7. Performs operative repair of acute and chronic diaphragmatic and associated injuries;
8. Knows the presentation of delayed diaphragmatic injury, its diagnosis and management.
E. Cardiovascular Trauma

Rotation Objective:

At the end of this rotation the resident understands the pathophysiology of thoracic trauma resulting in injury to the heart and great vessels, and diagnoses, resuscitates and treats patients with these injuries.

Learner Objectives:

Upon completion of the rotation the resident:

7. Evaluates patients who have sustained cardiovascular trauma;
8. Understands the physiology of deceleration injuries to the thoracic aorta;

Contents:

9. Cardiac contusion
   a. Pathophysiology
   b. Noninvasive diagnostic techniques
   c. Management
   d. Follow-up and outcomes
10. Penetrating cardiovascular injuries
    a. Major vessel laceration
    b. Penetrating cardiac trauma
    c. Laceration of coronary arteries
    d. Pericardial tamponade
    e. Diagnostic methods
    f. Management
       i. operative approaches for specific injuries
       ii. use of cardiopulmonary bypass or partial mechanical support
       iii. management of concomitant injuries
11. Postoperative management
    a. Outcomes
12. Traumatic aortic transection
    a. Pathophysiology
    b. Anatomic locations and operative approaches
    c. Operative management
    d. Management of associated injuries
    e. Outcomes

Clinical Skills:

During the training program the resident:
5. Evaluates and treats cardiac contusion;
6. Performs or participates in emergency operations to repair penetrating injuries of the heart and thoracic great vessels, and provides postoperative management;

Performs emergency operations to repair traumatic transections of the thoracic aorta and provide postoperative management.

**EXTRACORPOREAL BYPASS AND COAGULATION-BLOOD PRODUCTS**

**A. Physiology of Extracorporeal Bypass**

Rotation Objective:

At the end of this rotation the resident understands the physiology and pathologic derangements of pulsatile and non-pulsatile extracorporeal bypass, and has a working knowledge of oxygenators, perfusion systems, and ventricular support devices as they apply to adult patients.

Learner Objectives:

Upon completion of the rotation the resident:

11. Understands the physiology and mechanics of membrane and bubble oxygenators;
12. Understands the mechanics and operation of roller and vortex pumps;
13. Understands the physiology of various extracorporeal bypass circuits and the derangements caused by their use;
14. Knows the coagulation system and alterations of blood elements;
15. Understands the basic design and function of ventricular support devices.

Contents:

15. Membrane oxygenators  
   a. Physiology  
   b. Design  
   c. Complications  
16. Bubble oxygenators  
   a. Physiology  
   b. Design  
   c. Complications  
17. Roller head pumps  
   a. Design  
   b. Safety measures  
   c. Complications  
18. Vortex pumps  
   a. Mechanism and design
b. Safety measures
c. Complications

19. Extracorporeal circuits
   a. Set-up
   b. Types of tubing, filters, hemoconcentrators
   c. Safety measures
   d. Blood and artificial surface interaction

20. Perfusion solutions
   a. Prime solutions
   b. Hemodilution
   c. Oxygenators (types, indications, benefits, disadvantages)
   d. Venous reservoir
   e. Cardiotomy reservoir
   f. Tubing (choice of adequate internal diameter)
   g. Osmotic pressure, oncotic pressure (use of mannitol, albumin)
   h. Blood gas control

21. Manipulation of:
   a. Flow
   b. Pressure
   c. Temperature

Clinical Skills:

During the training program the resident:

11. Uses knowledge of the effects of extracorporeal bypass to ensure its safe use;
12. Recognizes the correct and incorrect set-up and operation of an extracorporeal circuit;
13. Plans and uses extracorporeal circuits in clinical practice;
14. Understands and treats physiologic derangements caused by blood-artificial surface interaction;
15. Plans and uses ventricular support devices in clinical practice.

**B. Techniques of Extracorporeal Bypass**

Rotation Objective:

At the end of this rotation the resident understands the techniques of extracorporeal bypass and their application to solve specific clinical problems.

Learner Objectives:

Upon completion of the rotation the resident:

9. Understands the standard techniques for extracorporeal bypass;
10. Understands the techniques for left heart bypass and right heart bypass for the treatment of specific clinical problems;
11. Understands the techniques of cannulation for extracorporeal bypass;
12. Oversees the management of patients undergoing extracorporeal bypass.

Contents:

7. Standard cardiopulmonary bypass
   a. Routes for cannulation (arterial and venous)
   b. Types of extracorporeal circuits
   c. Monitoring
   d. Complications
8. Anticoagulation for cardiopulmonary bypass
   a. Heparin and other agents
   b. Monitoring
   c. Reversal
   d. Complications
9. Special situations
   a. Left and/or right heart bypass
   b. Profound hypothermia and circulatory arrest

Clinical Skills:

During the training program the resident:

7. Performs cannulation for extracorporeal bypass using appropriate access routes;
8. Uses appropriate types of extracorporeal bypass to solve specific clinical problems;
9. Uses left and right heart bypass.

C. Mechanical Support

Rotation Objective:

At the end of this rotation, the resident understands the indications for mechanical cardiac support and ECMO, patient selection, device selection, recognition and treatment of the complications of mechanical support, methods for weaning the patient from support, and “bridging” to transplantation.

Learner Objectives:

Upon completion of the rotation the resident:

17. Understands the indications for cardiac support with mechanical devices or ECMO;
18. Understands alternatives to mechanical support (e.g., intra-aortic and intra-pulmonary balloon pumping);
19. Knows the techniques for inserting these ventricular support devices;
20. Recognizes complications of the devices;
21. Understands the principles of weaning patients from these devices;
22. Understands the use of mechanical devices as a “bridge” to transplantation;
23. Knows the requirements for anticoagulation and monitoring of blood trauma;
24. Understands Federal regulations that apply to the use of these devices.

Contents:

15. Indications for mechanical support
   a. Deterioration of an established prospective transplant recipient
   b. Patient unable to be weaned from cardiopulmonary bypass but is a candidate for “postcardiotomy” usage or “bridging” to transplantation
   c. Acute myocardial infarction with balloon-dependent left heart failure
16. Respiratory failure
   a. Indications for ECMO
   b. Alternatives to ECMO
17. Alternatives to mechanical devices
   a. Balloon pumping (left and right)
   b. Centrifugal devices
   c. Impeller devices
   d. Pulsatile devices
   e. Total artificial heart
18. Techniques of insertion
   a. Cardiac
   b. ECMO
19. Complications
   a. Blood trauma
   b. Thrombosis
   c. Bleeding
   d. Infection
20. Weaning the patient from support devices and the use of mechanical devices to “bridge” to transplantation
   a. Hemodynamic parameters used in weaning from cardiac support, criteria for weaning and rate of weaning
   b. Concept of “rehabilitation” of the bridging patient and modification of transplantation criteria for the bridging patient
21. Anticoagulation
   a. Requirements for various mechanical devices
   b. Detection of blood trauma
   c. Early detection of thrombotic problems

Clinical Skills:

During the training program the resident:

13. Evaluates and participates in the preoperative and postoperative management of patients requiring mechanical support;
14. Uses appropriate mechanical cardiac support and ECMO;
15. Manages the complications from the use of mechanical support and ECMO;
16. Weans patients from mechanical support and ECMO;
17. Manages patients bridging to transplantation;
18. Manages the anticoagulation of patients on mechanical support and ECMO.

**D. Fundamentals of Coagulation Management and Blood Component Therapy**

Rotation Objective:

At the end of this rotation the resident knows the physiology, methods, and techniques to manage the coagulation and fibrinolytic systems, and uses component therapy to treat specific clinical problems.

Learner Objectives:

At the end of the rotation the resident:

13. Understands the major blood groups, the clotting cascade, and the pathophysiology of clotting (e.g., abnormal clotting, activation of compliment, Kallikrein, prostanoids);
14. Understands the specific hemorrhagic and thrombotic complications of cardiac surgery and their management;
15. Understands the methods used in blood component storage and the measures taken to ensure a safe blood supply;
16. Understands the use of specific blood components to treat abnormalities of red cell quantity and quality, platelet quantity and quality, and coagulation function;
17. Knows the preoperative risk factors for excessive blood loss and blood utilization;
18. Understands the operative and postoperative techniques to ensure blood conservation.

Contents:

9. Blood characteristics
   a. Blood groups and specific antigens
   b. Cellular elements
   c. Clotting cascade
   d. Pathophysiology of clotting
   e. Drugs that affect clotting and platelet function
10. Hemorrhagic and thrombotic complications of cardiac surgery
    a. Diagnosis
    b. Preoperative, intraoperative, and postoperative management
    c. Heparin, Protamine
    d. Cardiac and vascular prostheses
11. Component therapy
    a. Packed red blood cells
    b. Fresh frozen plasma
    c. Platelets
    d. Cryoprecipitate
    e. Specific clotting factors
12. Blood conservation
    a. Indications for transfusion
b. Autotransfusion
c. Cell-plasma salvage
d. Hemoconcentration
e. Pharmacologic manipulation

Clinical Skills:

During the course of the program, the resident:

7. Evaluates patients requiring component therapy and develops management strategies to correct abnormalities of the coagulation system;
8. Uses appropriate tests to ensure the safety of blood and blood components;
9. Uses appropriate blood conservation techniques.

NON-CLINICAL ELEMENTS OF THORACIC SURGICAL PRACTICE

Rotation Objective:

At the end of this rotation the resident understands the non-clinical elements of a thoracic surgical practice.

Learner Objectives:

Upon completion of this rotation the resident:

15. Understand the ethical components of surgical practice;
16. Understands and will be able to use clinical database and outcome analysis in surgical practice;
17. Knows the medico-legal aspects of surgical practice;
18. Understands critical pathways and cost-benefit analysis in clinical decision-making;
19. Understand organizational structure and mechanics of solo practice, group specialty practice, multi-specialty practice, and academic practice;
20. Knows the structure, responsibilities and requirements of managed care, capitation payment, contractual agreements, physician-hospital organizations, and independent practice agreements;
21. Understands the time constraints imposed by the responsibilities of practice and the need for effective time management.

Contents:

15. Fundamental elements of ethical practice
   a. Hippocratic oath
   b. Primum non nocere
   c. Personal responsibility
   d. Honest and open communications
   e. Critical self analysis
16. Clinical database and outcome analysis
   a. Data collection
   b. Risk stratification
c. Statistical analysis  
d. Regular review of data  
e. Comparative analysis  

17. Cost factors and clinical outcome  
a. Analysis of redundancy, waste, inefficiency  
b. Entrepreneurial approach to cost and quality  

18. Practice arrangements  
a. Administration of practice (e.g., fees, collections, insurance, billing, overhead, office management)  
b. Advantages and disadvantages of different practice arrangements  

19. External economic forces  
a. Managed care  
b. Medicare, Medicaid, Champus  
c. PROs, IPAs  
d. Contracts  
e. Capitation  

20. Medico-legal factors  
a. Prevention of litigation  
b. Record keeping  
c. Response to malpractice lawsuit  
d. Expert witness testimony  

21. Time management  
a. Family needs  
b. Practice needs (e.g., patients, administration, associates)  
c. Community responsibilities  
d. Personal needs (e.g., continuing education, personal growth, life outside medicine)
GOALS AND OBJECTIVES
GENERAL THORACIC SURGERY ROTATION
Institution #1 – University of Minnesota Medical Center
Duration: 6 months, Year 3

(To be completed)

This rotation is currently being established specifically for the thoracic track training.
GOALS AND OBJECTIVES
GENERAL THORACIC SURGERY ROTATION
Institution #2 – VA Medical Center
Duration: 6 months, Year 3

(To be completed)

This rotation is currently being established specifically for the thoracic track training.
GOALS AND OBJECTIVES FOR TEACHING MEDICAL STUDENTS

Residents are an essential part of the teaching of medical students. It is critical that any resident who supervises or teaches medical students must be familiar with the educational objectives of the course or clerkship and be prepared for their roles in teaching and evaluation. Therefore, we've included in this manual the clerkship objectives for Surgery as well as the overall Educational Program Objectives.

Surgery - SURG 7500

Goals and Objectives

This course provides the medical students an opportunity to learn various responsibilities of a PGY-1 Surgery resident. At the completion of the rotation it is expected that the student will have achieved competence in the following subject areas:

- mastery of 12 assigned core topics in general surgery
- initial history and physical examination of the patient
- orderly, systematic diagnosis of surgical diseases
- suitable pre-operative preparation of the surgical patient
- function of the O.R. and the surgeon's role
- operative procedures used in treatment of surgical diseases
- perioperative patient care
- how to interpret surgical literature
- interpersonal behavior with surgical patients

Educational Program Objectives
University of Minnesota Medical School

Graduates of the University of Minnesota Medical School should be able to:

<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>OUTCOME MEASURES</th>
<th>ACGME ESSENTIAL COMPETENCY</th>
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</table>
| 1. Demonstrate mastery of key concepts and principles in the basic sciences and clinical disciplines that are the basis of current and future medical practice. | - USMLE Steps I and 2  
- Year I and 2 course performance, based on standardized examinations  
- Clinical rotation performance  
- Feedback from residency directors | Medical Knowledge |
| 2. Demonstrate mastery of key concepts and principles of other sciences and humanities that apply to current and future medical practice, including epidemiology, biostatistics, healthcare delivery and | - USMLE Steps I and 2  
- Course performance (esp. in Physician and Society, Nutrition Human Behavior at TC campus; Medical Sociology, Medical Epidemiology and biometrics, | Medical Knowledge |
<table>
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<tr>
<th>Finance, ethics, human behavior, nutrition, preventive medicine, and the cultural contexts of medical care.</th>
<th>Family Medicine Medical Ethics, Human Behavioral Development and Problems, and Psycho-Social-Spiritual Aspects of Life-Threatening Illness at DU campus</th>
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</table>
| 3. Competently gather and present in oral and written form relevant patient information through the performance of a complete history and physical examination. | Yr 2 OSCE  
Physician and Patient (PAP) course performance at TC campus, assessed by tutors using global rating forms and observed practical exams  
Course performance at DU campus in Applied Anatomy, Clinical Rounds & Clerkship (CR & C), Clinical Pathology Conference, and Integrated Clinical Medicine  
Clinical rotation performance |
| 4. Competently establish a doctor-patient relationship that facilitates patients’ abilities to effectively contribute to the decision making and management of their own health maintenance and disease treatment. | Yr 2 OSCE and Primary Care Clerkship (PCC) OSCE  
PAP course performance at TC campus, assessed by tutors using global rating forms and observed practical exams  
Preceptorship and CR & C course performance at DU campus  
Clinical rotation performance |
| 5. Competently diagnose and manage common medical problems in patients. | PCC OSCE  
Clinical rotation performance |
| 6. Assist in the diagnosis and management of uncommon medical problems; and, through knowing the limits of her/his own knowledge, adequately determine the need for referral | Clinical rotation performance  
Documented achievement of procedural skills in the Competencies Required for Graduation |
| 7. Begin to individualize care through integration of knowledge from the basic sciences, clinical disciplines, | Clinical rotation performance  
Feedback from residency directors |

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<tr>
<th>Patient Care; Interpersonal and Communication Skills</th>
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<tr>
<td>Medical Knowledge; Patient Care</td>
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<tr>
<td>Medical Knowledge; Patient Care; Practice-Based Learning and Improvement</td>
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<tr>
<td>Patient Care; Medical Knowledge; Interpersonal and</td>
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<tr>
<td>Evidence-based Medicine, and Population-based Medicine with Specific Information about the Patient and Patient's Life Situation.</td>
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</table>
| **8.** Demonstrate competence practicing in ambulatory and hospital settings, effectively working with other health professionals in a team approach toward integrative care. | • Yr 2 and PCC OSCE  
• PAP course performance at TC campus, assessed by tutors using global rating forms and observed practical exams  
• Physician and Society (PAS) course performance at TC campus  
• Preceptorship, CR & C. and Introduction to Rural Primary Care Medicine course performance at DU campus  
• Clinical rotation performance |
| | Practice-Based Learning and Improvement; Systems-Based Practice |
| **9.** Demonstrate basic understanding of health systems and how physicians can work effectively in health care organizations, including:  
• Use of electronic communication and database management for patient care.  
• Quality assessment and improvement.  
• Cost-effectiveness of health interventions.  
• Assessment of patient satisfaction.  
• Identification and alleviation of medical errors. | • PAS course performance at TC campus  
• Medical Sociology and CR & C course performance at DU campus  
• Clinical rotation performance, especially the pee  
• Feedback from residency directors  
• Feedback from local health plans |
| | Practice-Based Learning and Improvement; Systems-Based Practice |
| **10.** Competently evaluate and manage medical information. | • Critical reading exercises in PAS and other courses at TC campus  
• Clinical Pathology Conference performance and exercises in Problem Based Learning Cases at DU campus  
• Year 2 Health disparities project  
• PCC EBM project |
| | Patient Care; Medical Knowledge; Practice-Based Learning and Improvement; Systems-Based Practice |
11. Uphold and demonstrate in action/practice basic precepts of the medical profession: altruism, respect, compassion, honesty, integrity and confidentiality.

| PAS course performance at TC campus |
| Preceptorship and Cr & C course performance at DU campus |
| Clinical rotation performance |
| Participation in honor code and student peer assessment program |
| Participation in anatomy memorial |
| Participation in volunteer service activities |

Professionalism

12. Exhibit the beginning of a pattern of continuous learning and self-care through self-directed learning and systematic reflection on their experiences.

| PBL cases at DU campus |
| Yr 2 Health disparities project |
| Clinical rotation performance |
| Participation in research |

Professionalism

| Course performance in all years |
| Introduction to Rural Primary Care Medicine course project at DU campus |
| Involvement of students in international study |
| Enrollment in RPAP, RCAM, and UCAM |
| Yr 2 Health disparities project |
| Feedback from residency directors |
| Participation in volunteer service activities |

Patient Care; Medical Knowledge; Practice-Based Learning and Improvement; Professionalism; Systems-Based Practice

13. Demonstrate a basic understanding of the healthcare needs of society and a commitment to contribute to society both in the medical field and in the broader contexts of society needs.

| These objectives are written to reflect the qualities and competencies expected of our graduates. Each objective specifies the expected competency level to be attained by our students, the outcome measures used to evaluate attainment of the objective, and the essential qualities and competencies of a physician (as defined by the six ACGME Essential Competencies) addressed by the objective. The Accreditation Council for Graduate Medical Education (ACGME) has formulated essential competencies felt to be necessary for physicians practicing in the current health care climate. They are: |
| Patient Care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health |
| Medical Knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care |
• **Practice-Based Learning and Improvement** that involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care
• **Interpersonal and Communication Skills** that result in effective information exchange and teaming with patients, their families, and other health professionals
• **Professionalism**, as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population
• **Systems-Based Practice**, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide optimal patient care

The objectives for the undergraduate curriculum can be grouped as follows:

Objectives 1-3: Knowledge and skills addressed principally in the first two (preclinical) curricular years; Objectives 4-9: Knowledge and skills addressed principally in the second two (clinical) curricular years; Objectives 10-13: Knowledge, attitudes, and skills addressed throughout the curriculum.

The objectives, which relate to the ACGME essential competencies, are designed to be modified for use also by the graduate (GME) programs at the University of Minnesota Medical School. Residency programs can modify the competency level stated in the objectives and the outcome measures to reflect their own programs, while maintaining the overall integration of basic learning objectives across undergraduate and graduate medical education.

One of the primary outcome measures for the objectives is clinical rotation performance. To expand on this; clinical rotation performance is assessed by attending physicians and residents using a Web-based global rating form, evaluating the following knowledge, competencies, skills, and attitudes:

• Medical knowledge and the ability to apply knowledge in clinical situations
• Competency in patient care including communication and relationships with patients/families
• Skills in data gathering from the history, physical examination, clinical and academic sources, and diagnostic tests
• Assessment and prioritization of problems
• Management of problems, including knowledge of patient data and progress
• Appropriate decision making
• Communication in written and oral reports
• Professionalism, including: patient care and management in teams (work habits), independent learning, personal characteristics, and commitment to medicine
• Specific procedural skills (see report outlining Competencies Required for Graduation)

Ratified by Education Council 2118/03
Introduction

Int.A. Residency is an essential dimension of the transformation of the medical student to the independent practitioner along the continuum of medical education. It is physically, emotionally, and intellectually demanding, and requires longitudinally-concentrated effort on the part of the resident. The specialty education of physicians to practice independently is experiential, and necessarily occurs within the context of the health care delivery system. Developing the skills, knowledge, and attitudes leading to proficiency in all the domains of clinical competency requires the resident physician to assume personal responsibility for the care of individual patients. For the resident, the essential learning activity is interaction with patients under the guidance and supervision of faculty members who give value, context, and meaning to those interactions. As residents gain experience and demonstrate growth in their ability to care for patients, they assume roles that permit them to exercise those skills with greater independence. This concept—graded and progressive responsibility—is one of the core tenets of American graduate medical education. Supervision in the setting of graduate medical education has the goals of assuring the provision of safe and effective care to the individual patient; assuring each resident's development of the skills, knowledge, and attitudes required to enter the unsupervised practice of medicine; and establishing a foundation for continued professional growth.

Int.B. Definition and Scope of the Specialty

Thoracic Surgery encompasses the operative, perioperative, and critical care of patients with pathologic conditions within the chest. This includes the surgical care of coronary artery disease; diseases of the trachea, lungs, esophagus, and chest wall; abnormalities of the great vessels and heart valves; congenital anomalies of the chest and heart; tumors of the mediastinum; diseases of the diaphragm; and management of chest injuries.

Int.C. Duration and Scope of Education

Int.C.1. Education in thoracic surgery must be provided in one of these three formats:

Int.C.1.a) Independent Program (traditional format): Two years of thoracic surgery education, preceded by a successfully completed surgery residency program accredited by the Accreditation Council for Graduate Medical Education (ACGME) or by the Royal College of Physicians and Surgeons of Canada. Thoracic Surgery Programs wishing to provide a three-year curriculum must document an educational rationale for the program which must be approved in advance by the Review Committee.

Int.C.1.b) Joint Surgery/Thoracic Surgery Program (the 4+3 program): All seven years of the program must be completed in the same institution, and all of the years must be accredited by the ACGME. Assuming successful completion of the programs, this format provides the graduate with the ability to apply for certification in both surgery and thoracic surgery.

Int.C.1.c) Integrated Program: Six years of thoracic surgery education (completed in one institution) following completion of an M.D. or D.O. degree from an institution accredited by the Liaison Committee of Medical Education (LCME). Graduates of medical schools from countries other than the United States or Canada must present evidence of final certification by the Education Commission for Foreign Medical Graduates (ECFMG).

Int.C.1.c.(1) The integrated curriculum must document six years of clinical thoracic surgery education under the authority and direction of the thoracic surgery program director. The sequencing of the thoracic surgery educational components must be integrated throughout the program in order to provide a cohesive, progressive, and longitudinal educational experience.

Int.C.1.c.(2) A minimum of 24 months and a maximum of 36 months of the program must include education in core surgical education, including pre- and post-operative evaluation and care. The remainder of the curriculum must include education in oncology; transplantation; basic and advanced laparoscopic surgery; surgical critical care and trauma management; thoracic surgery; and adult and congenital cardiac surgery.
Int.C.1.c).(3) The last year of the integrated program must comprise chief resident responsibility on the thoracic surgery service at the primary clinical site or at an integrated site.

I. Institutions

I.A. Sponsoring Institution

One sponsoring institution must assume ultimate responsibility for the program, as described in the Institutional Requirements, and this responsibility extends to resident assignments at all participating sites.

The sponsoring institution and the program must ensure that the program director has sufficient protected time and financial support for his or her educational and administrative responsibilities to the program.

I.A.1. The sponsoring institution must ensure an administrative and academic structure that provides for educational and financial resources dedicated to the needs of the program; i.e., the appointment of teaching faculty and residents, support for program planning and evaluation, the assurance of sufficient ancillary personnel, and the provision for patient safety and the alleviation of resident fatigue. The sponsoring institution must:

I.A.1.a) demonstrate commitment to education in thoracic surgery in their support of the residency program;

I.A.1.b) provide at least 25% salary support for the program director; and,

I.A.1.c) provide and document faculty development for the program director and the faculty in education and teaching.

I.B. Participating Sites

I.B.1. There must be a program letter of agreement (PLA) between the program and each participating site providing a required assignment. The PLA must be renewed at least every five years.

The PLA should:

I.B.1.a) identify the faculty who will assume both educational and supervisory responsibilities for residents;

I.B.1.b) specify their responsibilities for teaching, supervision, and formal evaluation of residents, as specified later in this document;

I.B.1.c) specify the duration and content of the educational experience; and,

I.B.1.d) state the policies and procedures that will govern resident education during the assignment.

I.B.2. The program director must submit any additions or deletions of participating sites routinely providing an educational experience, required for all residents, of one month full time equivalent (FTE) or more through the Accreditation Council for Graduate Medical Education (ACGME) Accreditation Data System (ADS).

I.B.2.a) Multiple abbreviated assignments among several sites or simultaneous assignments to more than one institution are not acceptable. Exceptions for physically-connected or geographically close sites require advance approval of the Review Committee.

I.B.2.b) Assignments of four months or more to any participating site must be approved in advance by the Review Committee.
I.B.2.c) Major changes in participating or integrated sites must be supported by submission of the institutional operative data.

I.B.3. Integrated Sites

A formal, written integration agreement is required that specifies, in addition to the points above, that the program director:
I.B.3.a) appoints the members of the teaching faculty at the integrated site;
I.B.3.b) appoints the chief or director of the teaching service in the integrated site;
I.B.3.c) appoints all residents in the program; and
I.B.3.d) determines all rotations and assignments of both residents and members of the teaching faculty.

II. Program Personnel and Resources

II.A. Program Director

II.A.1. There must be a single program director with authority and accountability for the operation of the program. The sponsoring institution’s GMEC must approve a change in program director. After approval, the program director must submit this change to the ACGME via the ADS.

II.A.1.a) The review committee will approve the qualifications of each program director prior to the appointment. A change in program director may result in a site visit and program review within 18 months of the approved change.

II.A.2. The program director should continue in his or her position for a length of time adequate to maintain continuity of leadership and program stability.

II.A.3. Qualifications of the program director must include:

II.A.3.a) requisite specialty expertise and documented educational and administrative experience acceptable to the Review Committee;

II.A.3.b) current certification in the specialty by the American Board of Thoracic Surgery, or specialty qualifications that are acceptable to the Review Committee; and,

II.A.3.c) current medical licensure and appropriate medical staff appointment.
II.A.3.d) documented experience educating thoracic surgery residents and membership (in good standing) in the Thoracic Surgery Directors’ Association, and

II.A.3.e) documentation of formal faculty development activities in education and teaching, such as participation at local and national program director workshops and other educational activities.

II.A.4. The program director must administer and maintain an educational environment conducive to educating the residents in each of the ACGME competency areas. The program director must:

II.A.4.a) oversee and ensure the quality of didactic and clinical education in all sites that participate in the program;

II.A.4.b) approve a local director at each participating site who is accountable for resident education;
II.A.4.c) approve the selection of program faculty as appropriate;

II.A.4.d) evaluate program faculty and approve the continued participation of program faculty based on evaluation;

II.A.4.e) monitor resident supervision at all participating sites;

II.A.4.f) prepare and submit all information required and requested by the ACGME, including but not limited to the program information forms and annual program resident updates to the ADS, and ensure that the information submitted is accurate and complete;

II.A.4.g) provide each resident with documented semiannual evaluation of performance with feedback;

II.A.4.h) ensure compliance with grievance and due process procedures as set forth in the Institutional Requirements and implemented by the sponsoring institution;

II.A.4.i) provide verification of residency education for all residents, including those who leave the program prior to completion;

II.A.4.j) implement policies and procedures consistent with the institutional and program requirements for resident duty hours and the working environment, including moonlighting, and, to that end, must:

II.A.4.j).(1) distribute these policies and procedures to the residents and faculty;

II.A.4.j).(2) monitor resident duty hours, according to sponsoring institutional policies, with a frequency sufficient to ensure compliance with ACGME requirements;

II.A.4.j).(3) adjust schedules as necessary to mitigate excessive service demands and/or fatigue; and,

II.A.4.j).(4) if applicable, monitor the demands of at-home call and adjust schedules as necessary to mitigate excessive service demands and/or fatigue.

II.A.4.k) monitor the need for and ensure the provision of back up support systems when patient care responsibilities are unusually difficult or prolonged;

II.A.4.l) comply with the sponsoring institution’s written policies and procedures, including those specified in the Institutional Requirements, for selection, evaluation and promotion of residents, disciplinary action, and supervision of residents;

II.A.4.m) be familiar with and comply with ACGME and Review Committee policies and procedures as outlined in the ACGME Manual of Policies and Procedures;

II.A.4.n) obtain review and approval of the sponsoring institution’s GMEC/DIO before submitting to the ACGME information or requests for the following:

II.A.4.n).(1) all applications for ACGME accreditation of new programs;

II.A.4.n).(2) changes in resident complement;

II.A.4.n).(3) major changes in program structure or length of training;
II.A.4.n).(4) progress reports requested by the Review Committee;

II.A.4.n).(5) responses to all proposed adverse actions;

II.A.4.n).(6) requests for increases or any change to resident duty hours;

II.A.4.n).(7) voluntary withdrawals of ACGME-accredited programs;

II.A.4.n).(8) requests for appeal of an adverse action;

II.A.4.n).(9) appeal presentations to a Board of Appeal or the ACGME; and,

II.A.4.n).(10) proposals to ACGME for approval of innovative educational approaches.

II.A.4.o) obtain DIO review and co-signature on all program information forms, as well as any correspondence or document submitted to the ACGME that addresses:

II.A.4.o).(1) program citations, and/or

II.A.4.o).(2) request for changes in the program that would have significant impact, including financial, on the program or institution.

II.A.4.p) provide evidence that faculty are actively engaged in the education and scholarly productivity of Thoracic Surgery residents, as well as participation in medical student education;

II.A.4.q) provide separate and regularly-scheduled teaching conferences, mortality and morbidity conferences, rounds, and other educational activities in which both the thoracic surgery faculty and the residents attend and participate;

II.A.4.r) provide an organized written plan and a block diagram for the clinical assignments to the various services and sites in the program;

II.A.4.s) ensure that at the time of application to the program, each resident is notified in writing of the length of the program. Documentation must be maintained in each resident’s file, including any required unaccredited years;

II.A.4.t) submit a log, grouped by procedure, that details the operative experience of each trainee/fellow with the thoracic surgery resident logs at the time of the site visit;

II.A.4.u) keep records of conference attendance which must be available for review by the site visitor; and,

II.A.4.v) create opportunities for peer interaction with residents in related specialties at all participating sites.

II.B. Faculty
II.B.1. At each participating site, there must be a sufficient number of faculty with documented qualifications to instruct and supervise all residents at that location.

The faculty must:
II.B.1.a) devote sufficient time to the educational program to fulfill their supervisory and teaching responsibilities; and to demonstrate a strong interest in the education of residents, and
II.B.1.b) administer and maintain an educational environment conducive to educating residents in each of the ACGME competency areas.

II.B.1.c) include one designated cardiothoracic faculty member who should be responsible for coordinating multidisciplinary clinical conferences and for organizing instruction and research in general thoracic surgery.

II.B.1.d) include qualified thoracic surgeons and other faculty in related disciplines who should direct conferences.

II.B.2. The physician faculty must have current certification in the specialty by the American Board of Thoracic Surgery, or possess qualifications acceptable to the Review Committee.

II.B.3. The physician faculty must possess current medical licensure and appropriate medical staff appointment.

II.B.4. The nonphysician faculty must have appropriate qualifications in their field and hold appropriate institutional appointments.

II.B.5. The faculty must establish and maintain an environment of inquiry and scholarship with an active research component.

II.B.5.a) The faculty must regularly participate in organized clinical discussions, rounds, journal clubs, and conferences.

II.B.5.b) Some members of the faculty should also demonstrate scholarship by one or more of the following:

II.B.5.b).(1) peer-reviewed funding;

II.B.5.b).(2) publication of original research or review articles in peer-reviewed journals, or chapters in textbooks;

II.B.5.b).(3) publication or presentation of case reports or clinical series at local, regional, or national professional and scientific society meetings; or,

II.B.5.b).(4) participation in national committees or educational organizations.

II.B.5.c) Faculty should encourage and support residents in scholarly activities.

II.C. Other Program Personnel
The institution and the program must jointly ensure the availability of all necessary professional, technical, and clerical personnel for the effective administration of the program.

II.C.1. The sponsoring institution must provide support for a coordinator who is designated to the thoracic surgery program.

II.D. Resources
The institution and the program must jointly ensure the availability of adequate resources for resident education, as defined in the specialty program requirements.

II.D.1. provide access to information services that include:
II.D.1.a) the electronic retrieval of patient information;

II.D.1.b) a comprehensive data base for thoracic, adult cardiac, and congenital cardiac disease; and

II.D.1.c) an on-site library or electronic access to appropriate texts and journals;

II.D.2. provide access to a learning resources laboratory for resident education and remediation;

II.E. Medical Information Access
Residents must have ready access to specialty-specific and other appropriate reference material in print or electronic format. Electronic medical literature databases with search capabilities should be available.

III. Resident Appointments

III.A. Eligibility Criteria
The program director must comply with the criteria for resident eligibility as specified in the Institutional Requirements.

III.B. Number of Residents
The program director may not appoint more residents than approved by the Review Committee, unless otherwise stated in the specialty-specific requirements. The program’s educational resources must be adequate to support the number of residents appointed to the program.

III.B.1. A minimum of one thoracic surgery resident should be appointed in each year to provide for sufficient peer interaction.

III.C. Resident Transfers

III.C.1. Before accepting a resident who is transferring from another program, the program director must obtain written or electronic verification of previous educational experiences and a summative competency-based performance evaluation of the transferring resident.

III.C.2. A program director must provide timely verification of residency education and summative performance evaluations for residents who leave the program prior to completion.

III.C.2.a) Documentation of the residents’ operative experience must be included.

III.D. Appointment of Fellows and Other Learners
The presence of other learners (including, but not limited to, residents from other specialties, subspecialty fellows, PhD students, and nurse practitioners) in the program must not interfere with the appointed residents’ education. The program director must report the presence of other learners to the DIO and GMEC in accordance with sponsoring institution guidelines.

III.D.1. All trainees in both ACGME-accredited and non-accredited programs at the sponsoring and integrated sites which might affect the educational experience of the thoracic surgery residents, must be identified and their relationship to the thoracic surgery residents must be detailed.

III.D.1.a) Fellows in non-accredited positions must either be contracted with an ACGME-accredited thoracic surgery program or its equivalent, have completed their ACGME-accredited thoracic surgery educational program, or have requested and received an exception in advance from the Review Committee.

III.D.1.b) The program director must provide an impact statement addressing the goals and objectives, clinical responsibilities, duration of the educational program, and the interactions of these trainees/fellows as related to the thoracic surgery residents.
III.D.2. A chief thoracic surgery resident and a fellow (whether the fellow is in an ACGME-accredited position or not) must not have primary responsibility for the same patients.

IV. Educational Program
IV.A. The curriculum must contain the following educational components:
IV.A.1. Overall educational goals for the program, which the program must distribute to residents and faculty annually;

IV.A.2. Competency-based goals and objectives for each assignment at each educational level, which the program must distribute to residents and faculty annually, in either written or electronic form. These should be reviewed by the resident at the start of each rotation;

IV.A.3. Regularly scheduled didactic sessions;

IV.A.4. Delineation of resident responsibilities for patient care, progressive responsibility for patient management, and supervision of residents over the continuum of the program;

IV.A.5. ACGME Competencies

The program must integrate the following ACGME competencies into the curriculum:
IV.A.5.a) Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents:
IV.A.5.a).(1) will develop and execute patient care plans, demonstrate technical ability, use information technology, and evaluate diagnostic studies;

IV.A.5.a).(2) will under supervision of the thoracic surgery faculty:

IV.A.5.a).(2).(a) provide preoperative management, including the selection and timing of operative intervention and the selection of appropriate operative procedures;

IV.A.5.a).(2).(b) provide post-operative management of thoracic and cardiovascular patients;

IV.A.5.a).(2).(c) provide critical care of patients with thoracic and cardiovascular surgical disorders, including trauma patients, whether or not operative intervention is required;

IV.A.5.a).(2).(d) correlate the pathologic and diagnostic aspects of cardiothoracic disorders, demonstrating skill in diagnostic procedures (e.g., bronchoscopy and esophagoscopy), and to interpret appropriate imaging studies (e.g., ultrasound, computed tomography, roentgenographic, radionuclide, cardiac catheterization, pulmonary function, and esophageal function studies); and,

IV.A.5.a).(2).(e) demonstrate knowledge in the use of cardiac and respiratory support devices.

IV.A.5.a).(3) will have a minimum operative experience that must include:

IV.A.5.a).(3).(a) annually, a minimum of 125 major cases consistent with those listed in the program information forms;

IV.A.5.a).(3).(b) an adequate volume of operative experience, distribution of categories, and complexity of procedures to ensure each resident a balanced and equivalent clinical education;
IV.A.5.a).(3).(c) categories of procedures which must include but are not limited to the lungs, pleura, and chest wall; esophagus, mediastinum, and diaphragm; thoracic aorta and great vessels; congenital heart anomalies; valvular heart diseases; and myocardial revascularization;

IV.A.5.a).(3).(d) these additional educational experiences: cardiac pacemaker implantation, mediastinoscopy, pleuroscopy, and flexible and rigid esophagoscopy and bronchoscopy; endoscopic ultrasound, endoscopic approaches to thoracic and esophageal diseases; and multidisciplinary approaches to the treatment of thoracic malignancy; and,

IV.A.5.a).(3).(e) required experience in endovascular stents (for residents admitted on or after July 1, 2007).

IV.A.5.a).(4) will have documented operative experience showing they:

IV.A.5.a).(4).(a) participated in the diagnosis, preoperative planning, and selection of the operation for the patient;

IV.A.5.a).(4).(b) performed those technical manipulations that constituted the essential parts of the patient's operation;

IV.A.5.a).(4).(c) were substantially involved in post-operative care; and,

IV.A.5.a).(4).(d) were supervised by responsible faculty/teaching staff.

IV.A.5.a).(5) will have assignments to nonsurgical areas (i.e., cardiac catheterization and esophageal or pulmonary function labs) for a period of time not exceeding a total of three months during the clinical program, and this experience may not occur in the chief year.

IV.A.5.a).(6) will spend their chief year in the sponsoring institute or integrated sites for the program. (Exceptions require approval in advance by the Review Committee.) During this year, the resident must assume senior responsibility for the pre-, intra-, and post-operative care of patients with thoracic and cardiovascular disease.

IV.A.5.a).(7) will have outpatient responsibilities which include the following:

IV.A.5.a).(7).(a) The resident should have an opportunity to examine the patient pre-operatively, to consult with the attending surgeon regarding operative care, and to participate in the surgery and postoperative care;

IV.A.5.a).(7).(b) Outpatient care activities include resident responsibility for seeing the patient personally in an outpatient setting and, as a minimum in some cases only, consulting with the attending surgeon regarding the follow-up care rendered to the patient in the doctor's office;

IV.A.5.a).(7).(c) The policies and procedures governing pre-hospital and post-hospital involvement of the residents must be documented. Documentation of this process must be available to the site-visitor at the time of program review; and,

IV.A.5.a).(8) perform clinical assignments that should be carefully structured to ensure that graded levels of responsibility, continuity in patient care, a balance between education and service, and progressive clinical experiences are achieved for each resident.
IV.A.5.b) Medical Knowledge

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents:
IV.A.5.b).(1) will know current medical information, and critically evaluate scientific information;

IV.A.5.c) Practice-based Learning and Improvement

Residents must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Residents are expected to develop skills and habits to be able to meet the following goals:
IV.A.5.c).(1) identify strengths, deficiencies, and limits in one’s knowledge and expertise;
IV.A.5.c).(2) set learning and improvement goals;
IV.A.5.c).(3) identify and perform appropriate learning activities;
IV.A.5.c).(4) systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement;
IV.A.5.c).(5) incorporate formative evaluation feedback into daily practice;
IV.A.5.c).(6) locate, appraise, and assimilate evidence from scientific studies related to their patients’ health problems;
IV.A.5.c).(7) use information technology to optimize learning; and,
IV.A.5.c).(8) participate in the education of patients, families, students, residents and other health professionals.

IV.A.5.c).(9) demonstrate the ability to practice lifelong learning, analyze personal practice outcomes, and use information technology to optimize patient care.

IV.A.5.d) Interpersonal and Communication Skills

Residents must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Residents are expected to:
IV.A.5.d).(1) communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;
IV.A.5.d).(2) communicate effectively with physicians, other health professionals, and health related agencies;
IV.A.5.d).(3) work effectively as a member or leader of a health care team or other professional group;
IV.A.5.d).(4) act in a consultative role to other physicians and health professionals; and,
IV.A.5.d).(5) maintain comprehensive, timely, and legible medical records, if applicable.
IV.A.5.e) Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Residents are expected to demonstrate:

IV.A.5.e).(1) compassion, integrity, and respect for others;

IV.A.5.e).(2) responsiveness to patient needs that supersedes self-interest;

IV.A.5.e).(3) respect for patient privacy and autonomy;

IV.A.5.e).(4) accountability to patients, society and the profession; and,

IV.A.5.e).(5) sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation.

IV.A.5.e).(6) high standards of ethical behavior; demonstrate continuity of care (pre-operative, operative, and post-operative); demonstrate sensitivity to age, gender, culture, and other differences; and demonstrate honesty, dependability, and commitment.

IV.A.5.f) Systems-based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Residents are expected to:

IV.A.5.f).(1) work effectively in various health care delivery settings and systems relevant to their clinical specialty;

IV.A.5.f).(2) coordinate patient care within the health care system relevant to their clinical specialty;

IV.A.5.f).(3) incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate;

IV.A.5.f).(4) advocate for quality patient care and optimal patient care systems;

IV.A.5.f).(5) work in interprofessional teams to enhance patient safety and improve patient care quality; and,

IV.A.5.f).(6) participate in identifying system errors and implementing potential systems solutions.

IV.A.5.f).(7) practice cost-effective care without compromising quality, promote disease prevention, demonstrate risk-benefit analysis, and know how different practice systems operate to deliver care.

IV.B. Residents’ Scholarly Activities

IV.B.1. The curriculum must advance residents’ knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care.

IV.B.2. Residents should participate in scholarly activity.

IV.B.2.a) A protected research assignment is not permitted during the program. Resident participation in scholarly activities, however, should be encouraged.
IV.B.3. The sponsoring institution and program should allocate adequate educational resources to facilitate resident involvement in scholarly activities.

IV.B.3.a) The sponsoring institution and program should provide support for residents’ attendance at national professional meetings.

V. Evaluation
V.A. Resident Evaluation
V.A.1. Formative Evaluation

V.A.1.a) The faculty must evaluate resident performance in a timely manner during each rotation or similar educational assignment, and document this evaluation at completion of the assignment.

V.A.1.b) The program must:

V.A.1.b).(1) provide objective assessments of competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice;

V.A.1.b).(2) use multiple evaluators (e.g., faculty, peers, patients, self, and other professional staff);

V.A.1.b).(3) document progressive resident performance improvement appropriate to educational level; and,

V.A.1.b).(4) provide each resident with documented semiannual evaluation of performance with feedback.

V.A.1.c) The evaluations of resident performance must be accessible for review by the resident, in accordance with institutional policy.

V.A.2. Summative Evaluation

The program director must provide a summative evaluation for each resident upon completion of the program. This evaluation must become part of the resident’s permanent record maintained by the institution, and must be accessible for review by the resident in accordance with institutional policy. This evaluation must:

V.A.2.a) document the resident’s performance during the final period of education, and

V.A.2.b) verify that the resident has demonstrated sufficient competence to enter practice without direct supervision.

V.B. Faculty Evaluation
V.B.1. At least annually, the program must evaluate faculty performance as it relates to the educational program.

V.B.2. These evaluations should include a review of the faculty’s clinical teaching abilities, commitment to the educational program, clinical knowledge, professionalism, and scholarly activities.

V.B.3. This evaluation must include at least annual written confidential evaluations by the residents.
V.B.4. Because of the small resident cohort in each program, assurance that the content of resident evaluations of the faculty does not adversely affect resident progression is required.

V.C. Program Evaluation and Improvement
V.C.1. The program must document formal, systematic evaluation of the curriculum at least annually. The program must monitor and track each of the following areas:

V.C.1.a) resident performance; (e.g., educational activities that document improved resident cognitive performance, technical skills, and professional behaviors);

V.C.1.b) faculty development;
V.C.1.c) graduate performance, including performance of program graduates on the certification examination; and,

V.C.1.d) program quality. Specifically:

V.C.1.d).(1) Residents and faculty must have the opportunity to evaluate the program confidentially and in writing at least annually, and

V.C.1.d).(2) The program must use the results of residents’ assessments of the program together with other program evaluation results to improve the program.

V.C.1.d).(3) Program improvement (e.g., quality of the didactic and clinical curriculum, and the use of educational tools such as skills labs and other activities);

V.C.1.d).(4) Faculty improvement (e.g., development activities to improve the faculty's teaching and evaluation skills, continuing education activities related to education, the development of new skills in their specialty to improve patient care, and scholarly activities); and,

V.C.1.d).(5) The program must document its active participation in clinical databases that are used to assess and improve patient outcomes.

V.C.2. If deficiencies are found, the program should prepare a written plan of action to document initiatives to improve performance in the areas listed in section V.C.1. The action plan should be reviewed and approved by the teaching faculty and documented in meeting minutes.

VI. Resident Duty Hours in the Learning and Working Environment
VI.A. Professionalism, Personal Responsibility, and Patient Safety
VI.A.1. Programs and sponsoring institutions must educate residents and faculty members concerning the professional responsibilities of physicians to appear for duty appropriately rested and fit to provide the services required by their patients.
VI.A.2. The program must be committed to and responsible for promoting patient safety and resident well-being in a supportive educational environment.
VI.A.3. The program director must ensure that residents are integrated and actively participate in interdisciplinary clinical quality improvement and patient safety programs.
VI.A.4. The learning objectives of the program must:
VI.A.4.a) be accomplished through an appropriate blend of supervised patient care responsibilities, clinical teaching, and didactic educational events; and,
VI.A.4.b) not be compromised by excessive reliance on residents to fulfill non-physician service obligations.

VI.A.5. The program director and institution must ensure a culture of professionalism that supports patient safety and personal responsibility. Residents and faculty members must demonstrate an understanding and acceptance of their personal role in the following:

VI.A.5.a) assurance of the safety and welfare of patients entrusted to their care;
VI.A.5.b) provision of patient- and family-centered care;
VI.A.5.c) assurance of their fitness for duty;
VI.A.5.d) management of their time before, during, and after clinical assignments;
VI.A.5.e) recognition of impairment, including illness and fatigue, in themselves and in their peers;
VI.A.5.f) attention to lifelong learning;
VI.A.5.g) the monitoring of their patient care performance improvement indicators; and,
VI.A.5.h) honest and accurate reporting of duty hours, patient outcomes, and clinical experience data.

VI.A.6. All residents and faculty members must demonstrate responsiveness to patient needs that supersedes self-interest. Physicians must recognize that under certain circumstances, the best interests of the patient may be served by transitioning that patient’s care to another qualified and rested provider.

VI.B. Transitions of Care

VI.B.1. Programs must design clinical assignments to minimize the number of transitions in patient care.

VI.B.2. Sponsoring institutions and programs must ensure and monitor effective, structured hand-over processes to facilitate both continuity of care and patient safety.

VI.B.3. Programs must ensure that residents are competent in communicating with team members in the hand-over process.

VI.B.4. The sponsoring institution must ensure the availability of schedules that inform all members of the health care team of attending physicians and residents currently responsible for each patient’s care.

VI.C. Alertness Management/Fatigue Mitigation

VI.C.1. The program must:

VI.C.1.a) educate all faculty members and residents to recognize the signs of fatigue and sleep deprivation;
VI.C.1.b) educate all faculty members and residents in alertness management and fatigue mitigation processes; and,

VI.C.1.c) adopt fatigue mitigation processes to manage the potential negative effects of fatigue on patient care and learning, such as naps or back-up call schedules.

VI.C.2. Each program must have a process to ensure continuity of patient care in the event that a resident may be unable to perform his/her patient care duties.

VI.C.3. The sponsoring institution must provide adequate sleep facilities and/or safe transportation options for residents who may be too fatigued to safely return home.

VI.D. Supervision of Residents

VI.D.1. In the clinical learning environment, each patient must have an identifiable, appropriately-credentialed and privileged attending physician (or licensed independent practitioner as approved by each Review Committee) who is ultimately responsible for that patient’s care.

VI.D.1.a) This information should be available to residents, faculty members, and patients.

VI.D.1.b) Residents and faculty members should inform patients of their respective roles in each patient’s care.
VI.D.2. The program must demonstrate that the appropriate level of supervision is in place for all residents who care for patients. Supervision may be exercised through a variety of methods. Some activities require the physical presence of the supervising faculty member. For many aspects of patient care, the supervising physician may be a more advanced resident or fellow. Other portions of care provided by the resident can be adequately supervised by the immediate availability of the supervising faculty member or resident physician, either in the institution, or by means of telephonic and/or electronic modalities. In some circumstances, supervision may include post-hoc review of resident-delivered care with feedback as to the appropriateness of that care.

VI.D.3. Levels of Supervision
To ensure oversight of resident supervision and graded authority and responsibility, the program must use the following classification of supervision:

VI.D.3.a) Direct Supervision – the supervising physician is physically present with the resident and patient.

VI.D.3.b) Indirect Supervision:
VI.D.3.b).(1) with direct supervision immediately available – the supervising physician is physically within the hospital or other site of patient care, and is immediately available to provide Direct Supervision.
VI.D.3.b).(2) with direct supervision available – the supervising physician is not physically present within the hospital or other site of patient care, but is immediately available by means of telephonic and/or electronic modalities, and is available to provide Direct Supervision.

VI.D.3.c) Oversight – the supervising physician is available to provide review of procedures/encounters with feedback provided after care is delivered.

VI.D.4. The privilege of progressive authority and responsibility, conditional independence, and a supervisory role in patient care delegated to each resident must be assigned by the program director and faculty members.
VI.D.4.a) The program director must evaluate each resident’s abilities based on specific criteria. When available, evaluation should be guided by specific national standards-based criteria.
VI.D.4.b) Faculty members functioning as supervising physicians should delegate portions of care to residents, based on the needs of the patient and the skills of the residents.
VI.D.4.c) Senior residents or fellows should serve in a supervisory role of junior residents in recognition of their progress toward independence, based on the needs of each patient and the skills of the individual resident or fellow.
VI.D.5. Programs must set guidelines for circumstances and events in which residents must communicate with appropriate supervising faculty members, such as the transfer of a patient to an intensive care unit, or end-of-life decisions.

VI.D.5.a) Each resident must know the limits of his/her scope of authority, and the circumstances under which he/she is permitted to act with conditional independence.

VI.D.5.a).(1) In particular, PGY-1 residents should be supervised either directly or indirectly with direct supervision immediately available.

VI.D.5.a).(2) The program must define those physician tasks for which PGY-1 residents may be supervised indirectly, with direct supervision available, and must define “direct supervision” in the context of the program. The program must also define tasks for which PGY-1 residents must be supervised directly until they have demonstrated competence as defined by the program director, and must maintain records of such demonstrations of competence.

VI.D.6. Faculty supervision assignments should be of sufficient duration to assess the knowledge and skills of each resident and delegate to him/her the appropriate level of patient care authority and responsibility.

VI.E. Clinical Responsibilities

The clinical responsibilities for each resident must be based on PGY-level, patient safety, resident education, severity and complexity of patient illness/condition and available support services.

VI.E.1. The program director must establish guidelines for the assignment of clinical responsibilities for residents and/or fellows across the continuum of care, including clinic volume, on-call frequency, and back up requirements, as well as the appropriate role for residents/fellows in surgical procedures.

VI.F. Teamwork

Residents must care for patients in an environment that maximizes effective communication. This must include the opportunity to work as a member of effective interprofessional teams that are appropriate to the delivery of care in the specialty.

VI.G. Resident Duty Hours

VI.G.1. Maximum Hours of Work per Week

Duty hours must be limited to 80 hours per week, averaged over a four-week period, inclusive of all in-house call activities and all moonlighting.

VI.G.1.a) Duty Hour Exceptions

A Review Committee may grant exceptions for up to 10% or a maximum of 88 hours to individual programs based on a sound educational rationale.

VI.G.1.a).(1) In preparing a request for an exception the program director must follow the duty hour exception policy from the ACGME Manual on Policies and Procedures.

VI.G.1.a).(2) Prior to submitting the request to the Review Committee, the program director must obtain approval of the institution’s GMEC and DIO.

VI.G.2. Moonlighting

VI.G.2.a) Moonlighting must not interfere with the ability of the resident to achieve the goals and objectives of the educational program.

VI.G.2.b) Time spent by residents in Internal and External Moonlighting (as defined in the ACGME Glossary of Terms) must be counted towards the 80-hour Maximum Weekly Hour Limit.
VI.G.2.c) PGY-1 residents are not permitted to moonlight.

VI.G.3. Mandatory Time Free of Duty

Residents must be scheduled for a minimum of one day free of duty every week (when averaged over four weeks). At-home call cannot be assigned on these free days.

VI.G.4. Maximum Duty Period Length

VI.G.4.a) Duty periods of PGY-1 residents must not exceed 16 hours in duration.

VI.G.4.b) Duty periods of PGY-2 residents and above may be scheduled to a maximum of 24 hours of continuous duty in the hospital. Programs must encourage residents to use alertness management strategies in the context of patient care responsibilities. Strategic napping, especially after 16 hours of continuous duty and between the hours of 10:00 p.m. and 8:00 a.m., is strongly suggested.

VI.G.4.b).(1) It is essential for patient safety and resident education that effective transitions in care occur. Residents may be allowed to remain on-site in order to accomplish these tasks; however, this period of time must be no longer than an additional four hours.

VI.G.4.b).(2) Residents must not be assigned additional clinical responsibilities after 24 hours of continuous in-house duty.

VI.G.4.b).(3) In unusual circumstances, residents, on their own initiative, may remain beyond their scheduled period of duty to continue to provide care to a single patient. Justifications for such extensions of duty are limited to reasons of required continuity for a severely ill or unstable patient, academic importance of the events transpiring, or humanistic attention to the needs of a patient or family.

VI.G.4.b).(3).(a) Under those circumstances, the resident must:

VI.G.4.b).(3).(a).(i) appropriately hand over the care of all other patients to the team responsible for their continuing care; and,

VI.G.4.b).(3).(a).(ii) document the reasons for remaining to care for the patient in question and submit that documentation in every circumstance to the program director.

VI.G.4.b).(3).(b) The program director must review each submission of additional service, and track both individual resident and program-wide episodes of additional duty.

VI.G.5. Minimum Time Off between Scheduled Duty Periods

VI.G.5.a) PGY-1 residents should have 10 hours, and must have eight hours, free of duty between scheduled duty periods.

VI.G.5.b) Intermediate-level residents should have 10 hours free of duty, and must have eight hours between scheduled duty periods. They must have at least 14 hours free of duty after 24 hours of in-house duty.

For independent programs, Y-1, -2, and -3 residents are considered to be in the final years of education. For integrated programs, Y-2 and -3 fellows are considered to be at the intermediate level.
VI.G.5.c) Residents in the final years of education must be prepared to enter the unsupervised practice of medicine and care for patients over irregular or extended periods.

For independent programs, Y-1, -2, and -3 residents are considered to be in the final years of education. For integrated programs, Y-4, -5, and -6 level residents are considered to be in the final years of education.

VI.G.5.c).(1) This preparation must occur within the context of the 80-hour, maximum duty period length, and one-day-off-in-seven standards. While it is desirable that residents in their final years of education have eight hours free of duty between scheduled duty periods, there may be circumstances when these residents must stay on duty to care for their patients or return to the hospital with fewer than eight hours free of duty.

VI.G.5.c).(1).(a) Circumstances of return-to-hospital activities with fewer than eight hours away from the hospital by residents in their final years of education must be monitored by the program director.

VI.G.5.c).(1).(b) The Review Committee defines such circumstances as: required continuity of care for a severely ill or unstable patient, or a complex patient with whom the resident has been involved; events of exceptional educational value; or, humanistic attention to the needs of a patient or family.

VI.G.6. Maximum Frequency of In-House Night Float

Residents must not be scheduled for more than six consecutive nights of night float.

VI.G.6.a) Residents must not have more than four consecutive weeks of night float assignment, and night float cannot exceed one month per year.

VI.G.7. Maximum In-House On-Call Frequency

PGY-2 residents and above must be scheduled for in-house call no more frequently than every-third-night (when averaged over a four-week period).

VI.G.8. At-Home Call

VI.G.8.a) Time spent in the hospital by residents on at-home call must count towards the 80-hour maximum weekly hour limit. The frequency of at-home call is not subject to the every-third-night limitation, but must satisfy the requirement for one-day-in-seven free of duty, when averaged over four weeks.

VI.G.8.a).(1) At-home call must not be so frequent or taxing as to preclude rest or reasonable personal time for each resident.

VI.G.8.b) Residents are permitted to return to the hospital while on at-home call to care for new or established patients. Each episode of this type of care, while it must be included in the 80-hour weekly maximum, will not initiate a new “off-duty period”.

VII. Innovative Projects

Requests for innovative projects that may deviate from the institutional, common and/or specialty specific program requirements must be approved in advance by the Review Committee. In preparing requests, the program director must follow Procedures for Approving Proposals for Innovative Projects located in the ACGME Manual on Policies and Procedures. Once a Review Committee approves a project, the sponsoring institution and program are jointly responsible for the quality of education offered to residents for the duration of such a project.

***
TRAINING/GRADUATION REQUIREMENTS  
AMERICAN BOARD OF THORACIC SURGERY

For Residents who start their training on or after July 1, 2012

<table>
<thead>
<tr>
<th>Cardiac Focused Total</th>
<th>Requirements</th>
<th>General Thoracic Focused Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONGENITAL HEART DISEASE</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Primary surgeon</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>First assistant</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Subtotal Congenital Heart Disease Experience</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>ADULT CARDIAC</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Acquired Valvular Heart Disease Any combination of mitral valve, aortic valve, and/or tricuspid valve replacement or repair. **Tricuspid valve procedures performed with CABG can be double-counted with CABG</td>
<td>25</td>
</tr>
<tr>
<td>80</td>
<td>Myocardial Revascularization</td>
<td>40</td>
</tr>
<tr>
<td>15</td>
<td>Re-Do Sternotomy **Can be double-counted with any cardiac procedure</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>Interventional Skills or Procedures Any combination of intra-aortic balloon pump (IABP), intravascular ultrasound, angiography, transvenous pacemaker insertion, image-guided intervention over a wire, percutaneous tracheostomy, tracheal/esophageal stent placement, PleurX® catheter (or similar pleural drainage catheter) insertion, ultrasound-guided pigtail catheter placement for pleural drainage, radiofrequency ablation, and TEVAR.</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>Conduit Dissection and Preparation Open or endoscopic saphenous/radial vein harvest and preparation **Can be double-counted with CABG</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Aortic Procedures Any combination of ascending aorta/aortic root</td>
<td>5</td>
</tr>
</tbody>
</table>
replacement, descending aortic replacement, TEVAR, aortic dissection, aortic trauma
**Can be double-counted with CABG/Valve Procedures**
**TEVAR can be double-counted as an aortic procedure and interventional skills**

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<thead>
<tr>
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<tbody>
<tr>
<td>5</td>
<td><strong>Arrhythmia Surgery</strong></td>
<td>0</td>
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<tr>
<td></td>
<td>Left atrial or biatrial maze, pulmonary vein isolation, right-sided maze, isthmus ablation</td>
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<tr>
<td></td>
<td><strong>Can be double-counted with CABG/valve procedures</strong></td>
<td></td>
</tr>
</tbody>
</table>

| 4 | **Cardiopulmonary Bypass set-up and pump run with perfusionist** | 4 |

| 10 | **Circulatory Assist/Cardiac Transplant** | 5 |
|   | Any combination of IABP, ECMO, VAD, Cardiac Transplant |   |
|   | **Can be double-counted with another operation** |   |

| 189 | **Subtotal Adult Cardiac Experience** | 104 |

**GENERAL THORACIC**

<table>
<thead>
<tr>
<th>60</th>
<th>Lung</th>
<th>100</th>
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<tbody>
<tr>
<td>30</td>
<td>Major anatomic resections (segmentectomy, lobectomy, pneumonectomy, lung transplantation**)</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td><strong>Only 1 pneumonectomy can be double-counted for bilateral lung transplant.</strong></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Major VATS/robotic anatomic resections</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Open or VATS lung biopsy/wedge resection, lung procurement for transplantation</td>
<td>40</td>
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<thead>
<tr>
<th>10</th>
<th>Pleura**</th>
<th>20</th>
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<tbody>
<tr>
<td>5</td>
<td>Major (decortication, pleurectomy decortication, extrapleural pneumonectomy (EPP), or other tumor resection)</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>Minor (biopsy, pleurectomy, VATS sympathectomy, VATS Bleb resection, VATS pleurodesis)</td>
<td></td>
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<tr>
<td></td>
<td><strong>EPP can be double-counted as Pleura and Lung procedures</strong></td>
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<thead>
<tr>
<th>3</th>
<th>Chest Wall and Diaphragm**</th>
<th>6</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Chest wall resection, pectus repair, diaphragm resection or plication, repair of Morgagni, Bochdalek, or traumatic hernia</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Can be double-counted with pulmonary resection</strong></td>
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<table>
<thead>
<tr>
<th>5</th>
<th>Mediastinum</th>
<th>10</th>
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<tbody>
<tr>
<td></td>
<td>Tumor/cyst/mass resection via open, VATS, or robotic</td>
<td></td>
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<tr>
<td>Technique</td>
<td>Count</td>
<td></td>
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<tr>
<td>-----------------------------------</td>
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<tr>
<td><strong>Tracheobronchial – Airway Surgery</strong></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Tracheal-bronchial resection/reconstruction, laryngotracheal resection/reconstruction, airway anastomosis</td>
<td></td>
<td></td>
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<tr>
<td><strong>Sleeve lobectomy and carinal pneumonectomy can be double-counted with major anatomic lung resection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lung transplantation can be counted as either Tracheobronchial or Lung</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Esophagus</strong></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Esophagectomy (Open or minimally invasive)</td>
<td></td>
<td></td>
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<tr>
<td>Benign Esophagus-Major</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair of perforation, drain perforation, diverticulectomy, myotomy, hiatal hernia repair</td>
<td></td>
<td></td>
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<tr>
<td>For the GT focused pathway, at least 5 of the 30 esophageal procedures must be performed minimally invasively.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal General Thoracic Experience</strong></td>
<td>171</td>
<td></td>
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<tr>
<td><strong>TOTAL MAJOR OPERATIVE EXPERIENCE</strong></td>
<td>285</td>
<td></td>
</tr>
<tr>
<td><strong>MINOR PROCEDURES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All may be double-counted</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bronchoscopy</strong></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Simple (BAL, diagnostic, TBBx, Bx)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Complex (laser, dilation, stent, navigational bronchoscopy, photodynamic therapy)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>UGI Endoscopy</strong></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Simple (diagnostic, Bx)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Complex (dilation, stent, EUS, EMR)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Mediastinal Assessment</strong></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Mediastinoscopy</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>EBUS/FNA</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Chamberlain or mediastinal node dissection</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal Minor Procedures</strong></td>
<td>95</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL OPERATIVE EXPERIENCE</strong></td>
<td>380</td>
<td></td>
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### ADDITIONAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Consultation Experience</td>
<td>100</td>
</tr>
<tr>
<td>New Patients</td>
<td>50</td>
</tr>
<tr>
<td>Follow-up Patients</td>
<td>50</td>
</tr>
<tr>
<td>Multidisciplinary patient management conferences</td>
<td>20</td>
</tr>
<tr>
<td>Any combination of tumor board, cardiac catheterization conference, multidisciplinary clinics, transplant selection committee meetings, etc.</td>
<td></td>
</tr>
<tr>
<td>Cardiothoracic critical care case management experience</td>
<td>75</td>
</tr>
<tr>
<td>General thoracic</td>
<td>20</td>
</tr>
<tr>
<td>Cardiac and congenital</td>
<td>20</td>
</tr>
<tr>
<td>Simulation (hours required from any technique-based simulation curriculum or simulation of cardiopulmonary bypass management)</td>
<td>20 hrs</td>
</tr>
<tr>
<td>Previous or current FLS, ATLS, ACLS certification required</td>
<td>X</td>
</tr>
</tbody>
</table>

**CT Critical Care Management Documentation**

Select the patients who best represent all the essential aspects of intensive care unit management. Each resident is to develop a CT Critical Care Index Case (CCIC) log of at least twenty patients who best represent the full breadth of critical care management. At least two out of the seven categories listed below should be applicable to each chosen patient. The completed CCIC log should include experience, with at least one patient, in all seven of the following essential categories:

1. Ventilatory Management
   a. Etiology/indications
   b. Ventilatory modes/techniques
   c. Ventilator days
   d. Weaning method
2. Bleeding (non-trauma) greater than 3 units necessitating transfusion/monitoring in ICU setting
   a. Etiology
   b. Coagulopathy: yes no
   c. Hypothermia: yes no
   d. Autotransfusion: yes no
3. Hemodynamic Instability
   a. Etiology
   b. Volume resuscitation
   c. Inotropic/pressure support: yes no
d. Mechanical assistance of cardiac failure: (IABP, LVAD, BiVAD)

4. Organ Dysfunction/Failure (etiology/mode of management)
   a. Pulmonary
   b. Renal
   c. Hepatic
   d. Central nervous system
   e. Endocrine (Hypothyroidism, Adrenal insufficiency, Panhypopituitarism, Diabetes insipidus, SIADH)

5. Dysrhythmias
   a. Etiology
   b. Drug management
   c. Therapeutic interventions
   d. Monitoring

6. Invasive Line Management/Monitoring
   a. Arterial cannulation
   b. Pulmonary artery catheter
   c. Intracardiac catheter
   d. Complications

7. Nutrition
   a. Route (parenteral/enteral)
   b. Indications/contraindications
TRAINING/GRADUATION REQUIREMENTS

Essential Capacities for Matriculation, Promotion, and Graduation
University of Minnesota Medical School Graduate Medical Education Programs

I. General Issues

A. Overview

- Graduate Medical Education requires that the accumulation of scientific knowledge be accompanied by the simultaneous development of specific skills and competencies. Because our Medical School has a responsibility to society to graduate the best possible physicians, all resident physicians and fellows must meet both our academic standards and our technical standards to matriculate, to progress through the curriculum and to meet the requirements for graduation from University of Minnesota Medical School residency and fellowship programs.

*Academic standards* refer to acceptable demonstrations of mastery in various disciplines, before matriculation and after, as judged by faculty members, examinations, and other measurements of performance. Acceptable levels of mastery are required in six broad areas of competency once a student matriculates at the University of Minnesota Medical School. These six areas of competency are used by graduate medical education programs to evaluate their residents.

These six areas of competency are:

- Medical/scientific knowledge
- Clinical Skills/patient care
- Professionalism
- Communication/interpersonal skills
- Practice-based learning (engaging in self-assessment and utilizing appropriate resources to make improvements in one's learning and performance)
- Systems-based practice (understanding complex medical systems in order to effectively carry out responsibilities to optimize patient care)

The University of Minnesota Medical School residency and fellowship programs are committed to preparing our residents and fellows within the continuum of medical education. Our academic and technical standards are based upon the goal of training capable, well-rounded future clinicians.

Academic standards are addressed in more detail in the curriculum. Any resident or fellow who has specific questions about performance requirements, should speak with the residency/fellowship program director.

Our technical standards are described in detail under item II. Technical standards refer to the essential aptitudes and abilities that allow individuals to perform the duties required of resident physicians and fellows. Additional technical standards may be added to meet the specific requirements of individual programs.
Without the capability to meet our technical standards, residents and fellows cannot fulfill the requirements of residency/fellowship programs at the University of Minnesota Medical School. Meeting the University of Minnesota Medical School technical standards (detailed below) is, therefore, required for 1) matriculation (insomuch as the abilities can reasonably be determined before matriculation), 2) subsequent promotion from year to year, and 3) successful completion of a residency/fellowship program from the University of Minnesota Medical School.

B. Residents and Fellows with Disabilities

It is our experience that a number of individuals with disabilities (as defined by Section 504 of the Rehabilitation Act and the Americans with Disabilities Act) are qualified to study and practice medicine with the use of reasonable accommodations. To be qualified for the study of medicine at the University of Minnesota Medical School, those individuals must be able to meet both our academic and technical standards, with or without reasonable accommodation. Accommodation is viewed as a means of assisting individuals with disabilities to meet essential standards by providing them with an equal opportunity to participate in all aspects of the program. (Reasonable accommodation is not intended to guarantee that residents/fellows will be successful in meeting the requirements of the course or program.)*

*Reasonable Accommodations May Not:

- fundamentally alter the nature of the training program
- compromise the essential elements of the program
- cause an undue financial or administrative burden
- Endanger the safety of patients, self or others

C. The Use of Auxiliary Aids and Intermediaries

Qualified residents/fellows with documented disabilities are provided with reasonable accommodations at the University of Minnesota Medical School, which may include involvement of an intermediary or an auxiliary aid. No disability can be reasonably accommodated at the University of Minnesota Medical School with an intermediary that provides cognitive support or substitutes for essential clinical skills, or supplements clinical and ethical judgment. Thus, accommodations cannot eliminate essential program elements or fundamentally alter the residency/fellowship program curriculum.

II. The University of Minnesota Medical School Technical Standards

Residents and fellows at the University of Minnesota Medical School must meet the technical standards, with or without reasonable accommodations, which are grouped in five broad areas:

- Perception/observation
- Communication
- Motor/tactile function
- Cognition
- Professionalism
A. Perception/Observation

Residents and fellows must be able to perceive, by the use of senses and mental abilities, the presentation of information through:

- Small group discussions and presentations
- Large-group lectures
- One-on-one interactions
- Demonstrations
- Laboratory experiments
- Patient encounters (at a distance and close at hand)
- Diagnostic findings
- Procedures
- Written material
- Audiovisual materials

B. Communication

Residents and fellows must be able to skillfully (in English) communicate verbally and in written form with faculty members, other members of the healthcare team, patients, families, and other students, in order to:

- Elicit information
- Convey information
- Clarify information
- Create rapport
- Develop therapeutic relationships
- Demonstrate the Medical School and core competencies

C. Motor/tactile function

Residents and fellows must have sufficient motor function and tactile ability to meet the competencies required for graduation and to:

- Attend (and participate in) classes, groups, and activities which are part of the curriculum
- Communicate in a written format
- Examine patients (including observation, auscultation, palpation, percussion, and other diagnostic maneuvers)
- Do basic laboratory procedures and tests
- Perform diagnostic procedures
- Provide general and emergency patient care
- Function in outpatient, inpatient, and surgical venues
- Perform in a reasonably independent and competent way in sometimes chaotic clinical environments
- Demonstrate the Medical School and core competencies
D. Cognition

Residents and fellows must be able to demonstrate higher-level cognitive abilities, which include:

- Rational thought
- Measurement
- Calculation
- Visual-spatial comprehension
- Conceptualization
- Analysis
- Synthesis
- Organization
- Representation (oral, written, diagrammatic, three dimensional)
- Memory
- Application
- Clinical reasoning
- Ethical reasoning
- Sound judgment

E. Professionalism:

Residents and fellows must be able to:

- Consistently display integrity, honesty, empathy, caring, fairness, respect for self and others, diligence, and dedication
- Promptly complete all assignments and responsibilities attendant to the diagnosis and care of patients (beginning with study in the first year)
- Develop mature, sensitive, and effective relationships, not only with patients but with all members of the medical school community and healthcare teams
- Tolerate physically, emotionally, and mentally demanding workloads
- Function effectively under stress, and proactively make use of available resources to help maintain both physical and mental health
- Adapt to changing environments, display flexibility, and be able to learn in the face of uncertainty
- Take responsibility for themselves and their behaviors

Any residency or fellowship applicant or resident/fellow who has a question about whether he or she can meet these standards due to the functional limitations from a disability, should contact Disability Services for a confidential discussion.

Disability Services  
University of Minnesota Twin Cities  
McNamara Alumni Center  
200 Oak St SE Suite 180  
Minneapolis, MN 55455  
Phone: (612) 626-1333 (V/TTY)  
Fax: (612) 626-9654
A disability specialist is available to talk with any medical school applicant or resident/fellow about their concerns related to a physical, sensory, medical, learning, or psychiatric condition that may be a disability.

ACGME COMPETENCIES

All University of Minnesota Medical School Residency/Fellowship training programs define the specific knowledge, skills, attitudes, and educational experiences required by the RRC to ensure its residents/fellows demonstrate the following:

SECTION 1.a; LEARNING OPPORTUNITIES FOR THE GENERAL COMPETENCIES

<table>
<thead>
<tr>
<th>Competency</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Care</td>
<td>• Clinical Teaching</td>
</tr>
<tr>
<td></td>
<td>• Clinical Experiences</td>
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<td></td>
<td>• Performance Feedback</td>
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<tr>
<td></td>
<td>• Departmental Conferences,</td>
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<tr>
<td></td>
<td>Lectures or Discussions</td>
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<tr>
<td></td>
<td>• Role Modeling</td>
</tr>
<tr>
<td>Medical Knowledge</td>
<td>• Clinical Teaching</td>
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<td>• Clinical Experiences</td>
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<td>Lectures or Discussions</td>
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<td></td>
<td>• Institutional Core Curriculum</td>
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<tr>
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<td>• Individual or Group Projects</td>
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<td></td>
<td>• Role Modeling</td>
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<tr>
<td>Practice-Based Learning &amp; Improvement</td>
<td>• Clinical Teaching</td>
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<tr>
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<td>• Clinical Experiences</td>
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<td>• Institutional Core Curriculum</td>
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<tr>
<td>Interpersonal &amp; Communication Skills</td>
<td>• Clinical Teaching</td>
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<td>• Clinical Experience</td>
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<td>Lectures, or Discussions</td>
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<td>• Institutional Core Curriculum</td>
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<td>• Clinical Experiences</td>
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<td>• Performance Feedback</td>
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<tr>
<td></td>
<td>• Departmental Conferences,</td>
</tr>
<tr>
<td></td>
<td>Lectures, or Discussions</td>
</tr>
</tbody>
</table>
### Section 1.b: IMPROVING INSTRUCTION FOR THE GENERAL COMPETENCIES

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Competency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departmental Conferences</td>
<td>Medical Knowledge</td>
<td>Updated and reviewed lectures, rescheduled time blocks thus increasing attendance and attention span.</td>
</tr>
<tr>
<td>Lectures or Discussions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institutional Core Curriculum</td>
<td>Professionalism</td>
<td>Scheduling protected time for core curriculum lectures for specific topics that may not be adequately covered without the enhancement of specific lectures. Role modeling of our faculty and increasing awareness enhances the total learning process.</td>
</tr>
</tbody>
</table>

### Section 2: ASSESSING RESIDENTS’ LEARNING AND PERFORMANCE

<table>
<thead>
<tr>
<th>Assessment Method</th>
<th>360 Assessments</th>
</tr>
</thead>
</table>
| General competencies evaluated using this method | • Patient Care  
• Medical Knowledge  
• Practice-Based Learning & Improvement  
• Interpersonal & Communication Skills  
• Professionalism  
• Systems-Based Practice |
| Frequency method is used | Every rotation |
| Assessment documentation | Rating Form: < 10 Categories |
| Evaluator           | • Evaluation Committee  
• Ancillary Staff  
• Allied Health Professionals |
| Scoring/rating available to evaluator | Yes |
| Evaluators receive training | No |
| Objective Stds trigger required remediation and/or improvement to “pass” or progress | No |
| Uses for results    | • Written Feedback to Residents |
Oral Feedback to Residents
Track Resident Learning/Growth
Assess Program Effectiveness
Make Changes to Curriculum

Importance in resident evaluations | High
--- | ---
Additional info | Our system has not been statistically tested, so validity cannot be proven in the small group of 6 fellows. However, the faculty feels comfortable that this is one method that is useful for evaluations and one that does open appropriate dialog with each individual fellow.

All University of Minnesota Medical School Residency/Fellowship training programs define the specific knowledge, skills, attitudes, and educational experiences required by the RRC to ensure its residents/fellows demonstrate the following:

**Patient Care** - Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.

**Medical Knowledge** - Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, as well as the application of this knowledge to patient care.

**Practice-based Learning and Improvement** - Residents must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Residents are expected to develop skills and habits to be able to meet the following goals:
- identify strengths, deficiencies, and limits in one’s knowledge and expertise;
- set learning and improvement goals;
- identify and perform appropriate learning activities;
- systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement;
- incorporate formative evaluation feedback into daily practice;
- locate, appraise, and assimilate evidence from scientific studies related to their patients’ health problems;
- use information technology to optimize learning; and,
- participate in the education of patients, families, students, residents and other health professionals.

**Interpersonal and Communication Skills** - Residents must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Residents are expected to:
- communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;
- communicate effectively with physicians, other health professionals, and health related agencies;
- work effectively as a member or leader of a health care team or other professional group;
- act in a consultative role to other physicians and health professionals; and,
maintain comprehensive, timely, and legible medical records, if applicable.

**Professionalism** - Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Residents are expected to demonstrate:
- compassion, integrity, and respect for others;
- responsiveness to patient needs that supersedes self-interest;
- respect for patient privacy and autonomy;
- accountability to patients, society and the profession; and,
- sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation.

**Systems-based Practice** - Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Residents are expected to:
- work effectively in various health care delivery settings and systems relevant to their clinical specialty;
- coordinate patient care within the health care system relevant to their clinical specialty;
- incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate;
- advocate for quality patient care and optimal patient care systems;
- work in interprofessional teams to enhance patient safety and improve patient care quality; and
- participate in identifying system errors and implementing potential systems solutions.

**DUTY HOURS**

- Duty hours are defined as all clinical and academic activities related to the training program, ie patient care (both inpatient and outpatient), administrative duties related to patient care, the provision for transfer of patient care, time spent in-house during call activities and scheduled academic activities such as conferences. Duty hours DO NOT include reading and preparation time spent away from the duty site.
- Duty hours are limited to 80 hours per week, averaged over a four-week period, inclusive of all in-house call activities – CT Surgery has 88 hour extension.
- Residents/Fellows are provided with 1 day in 7 free from all educational and clinical responsibilities, averaged over a 4-week period, inclusive of call.
- The training program provides adequate time for rest and personal activities, which consists of a 8-10-hour time period provided between all daily duty periods and after in-house call.

The Cardiothoracic Surgery program has established an environment that is optimal for both resident education and patient care. Nationally enforced resident duty hour rules are followed strictly. Although our Program has received the 88 hour work week extension, the residents are not scheduled for any more than an 80 hour week, averaged over a four-week period. The residents enjoy one day in every seven free of patient care responsibilities, averaged over a four-week period. There is no mandatory in-house call for the cardiothoracic surgery training program. Should a cardiothoracic resident be called in, there is a 24-hour limit on on-call duty, with an added period of up to four hours for continuity and transfer of patient care. We have an 8-hour minimum rest period between duty periods. If a resident is taking call from home and is called into the hospital,
the time spent in the hospital is counted toward the weekly duty hour limit. If the resident is called in for the entirety of the evening, we fall back to the 24-hour limit on on-call duty.

To ensure that these regulations are being followed, the residents are required to document their duty hours in the RMS computer program on a continuously current basis. Their duty hours and potential violations are then evaluated at our combined weekly thoracic surgery conference to allow us to correct issues as they occur.

Excerpt from ACGME Common Program Requirements effective 7/1/11

VI.G.4. Maximum Duty Period Length
VI.G.4.b) Duty periods of PGY-2 residents and above may be scheduled to a maximum of 24 hours of continuous duty in the hospital. Programs must encourage residents to use alertness management strategies in the context of patient care responsibilities. Strategic napping, especially after 16 hours of continuous duty and between the hours of 10:00 p.m. and 8:00 a.m., is strongly suggested.

VI.G.4.b).(1) It is essential for patient safety and resident education that effective transitions in care occur. Residents may be allowed to remain on-site in order to accomplish these tasks; however, this period of time must be no longer than an additional four hours.

VI.G.4.b).(2) Residents must not be assigned additional clinical responsibilities after 24 hours of continuous in-house duty.

VI.G.4.b).(3) In unusual circumstances, residents, on their own initiative, may remain beyond their scheduled period of duty to continue providing care to a single patient. Justifications for such extensions of duty are limited to reasons of required continuity for a severely ill or unstable patient, academic importance of the events transpiring, or humanistic attention to the needs of a patient or family.

VI.G.4.b).(3).(a) Under those circumstances, the resident must:

VI.G.4.b).(3).(a).(i) appropriately hand over the care of all other patients to the team responsible for their continuing care; and,

VI.G.4.b).(3).(a).(ii) document the reasons for remaining to care for the patient in question and submit that documentation in every circumstance to the program director.

VI.G.4.b).(3).(b) The program director must review each submission of additional service, and track both individual resident and program-wide episodes of additional duty.

VI.G.5. Minimum Time Off between Scheduled Duty Periods
VI.G.5.c) Residents in the final years of education [as defined by the Review Committee] must be prepared to enter the unsupervised practice of medicine and care for patients over irregular or extended periods. While it is desirable that residents in their final years of education have eight hours free of duty between scheduled duty periods, there may be circumstances [as defined by the Review Committee] when these residents must stay on duty to care for their patients or return to the hospital with fewer than eight hours free of duty.

VI.G.5.c).(1) Circumstances of return-to-hospital activities with fewer than eight hours away from the hospital by residents in their final years of education must be monitored by the program director.

VI.G.6. Maximum Frequency of In-House Night Float
Residents must not be scheduled for more than six consecutive nights of night float. [The maximum number of consecutive weeks of night float, and maximum number of months of night float per year may be further specified by the Review Committee.]

VI.G.7. Maximum In-House On-Call Frequency
VI.G.8. At-Home Call

VI.G.8.a) Time spent in the hospital by residents on at-home call must count towards the 80-hour maximum weekly hour limit. The frequency of at-home call is not subject to the every-third-night limitation, but must satisfy the requirement for one-day-in-seven free of duty, when averaged over four weeks.

VI.G.8.a).(1) At-home call must not be so frequent or taxing as to preclude rest or reasonable personal time for each
EVALUATIONS

Each fellow is evaluated 360 following the end of each rotation. This is done electronically through Residency Management Suite (RMS) with faculty, allied health professionals, and others involved with the fellows training completing the evaluation.

Effective July 1, 2014, we will be part of the Thoracic Surgery Milestone Project. The Milestones are designed only for use in evaluation of resident physicians in the context of their participation in the ACGME-accredited residency or fellowship programs. The milestones provide a framework for the assessment of the development of the resident physician in key dimensions of the elements of physician competency in a specialty or subspecialty. They neither represent the entirety of the dimensions of the six domains of physician competency, nor are they designed to be relevant in any other context.

The Fellowship Director also meets with the fellows every six months for evaluation. These evaluations are documented and kept in the fellow’s file.

ON CALL SCHEDULES

In-house call is defined as those duty hours beyond the normal work day when residents/fellows are required to be immediately available in the assigned institution. In-house call must occur no more frequently than every third night averaged over a four hour period.

Continuous on-site duty, including in-house call, must not exceed 24 consecutive hours. Residents/Fellows may remain on duty for up to 6 additional hours to participate in didactic activities, transfer care of patients, conduct outpatient clinics and maintain continuity of medical and surgical care.

There is no required in-house call for the cardiothoracic surgery residents at any site. The residents take home call during the evenings on a rotating schedule, with the exception of their one day off per week. During this day off, they are not responsible for any patient care responsibilities, and these dates are built into the call schedule to provide cross-coverage.

ON CALL ROOMS

A dedicated workspace has been established for fellows’ use, consisting of workspaces for the University-based fellows with computer access and areas to store their work items and projects. This room, located at 305 VCRC is a very comfortable space equipped with rocker/recliner and reclining sofa, refrigerator, microwave, and coffee pot. There are two computers, scanner, and printer, as well as current medical books on the bookshelves. This space was created and supported by the Division of Cardiothoracic Surgery. Contact Sandy at 5-8698 if there are concerns regarding this space.

A similar office space is maintained at the VA for use by fellows assigned to that location.

University of Minnesota Medical Center also provides a call room in C414 Mayo.
SUPPORT SERVICES

Resident Assistance Program (RAP)

Sand Creek
610 North Main Street, Suite 200
Stillwater, MN 55082
Phone: 651-430-3383 or 1-800-632-7643

A Service For You and Your Family...

At times it's human nature to feel anxiety, frustration, depression, guilt or anger. Feelings such as these could stem from family tensions, financial problems, or career-related stresses. Whatever your situation may be, RAP is available to help.

It is understandable that for some people it takes a great deal of courage to ask for help. With that in mind, the Metro Minnesota Council on Graduate Medical Education has contracted with an agency called the Sand Creek Group to provide your Resident Assistance Program (RAP). It is an employee assistance program designed specifically for residents. Sand Creek's counselors have particular expertise in dealing with the unique needs of individuals in their residency training programs. Now there is a number you can call whenever the need arises. In making that phone call, you will receive help in addressing the issue and finding options for achieving resolution.

RAP is for you and your family members, your faculty, attending physicians; department heads and supervisors who need help in dealing with resident-related concerns.

Your Privacy is Protected...

Since privacy is a primary concern, an outside firm provides your RAP services in a strictly confidential manner. Your written consent is required to disclose information.

What is the Cost?

There is no charge associated with your assessment and short term counseling services provided through the RAP program.
When additional or more specialized services are indicated, you will be referred to outside resources for help. In those cases, your RAP counselor will work with you to locate appropriate, accessible, and affordable resources based on your specific needs and preferences. Health insurance plans most often provide some coverage for a variety of mental health and chemical dependency concerns.

**Help is Available Anytime...**

When the Sand Creek administrative offices are closed, their back-up clinical services answers calls on a 24-hour basis. Licensed mental health professionals staff this service. You can feel comfortable accessing this program at any time of the day.

**RAP Designed to be Flexible...**

RAP is designed to be flexible and to accommodate your busy schedule. You may either talk with a counselor at one of many Sand Creek clinical offices around the metro area or meet at your hospital. Appointments are scheduled throughout the day. Evening hours are available as well.

**RAP is Here for You...**

Counselors at Sand Creek are available to help you address issues and personal concerns such as the examples listed below.

- My debts have become overwhelming. How can I get a handle on them?
- I think the stress of my residency is impacting my health. How do I discreetly find out?
- I worry about my career choice. Who should I talk to?
- My relationship isn't fulfilling but I don't want to be alone. What do I do now?
- My spouse is having difficulty adjusting to my residency. How do we adjust in a way that works for both of us?

**Residents have said this about RAP...**

- "It was a pleasure to find such a refreshing team of professionals"
- "The best part of the RAP was that I was seen the same day I called for an appointment"
- "My counselor from RAP met with my attending physician, and we were able to set goals to allow me to complete my residency"
- "I was able to schedule an appointment at the hospital and with minimal disruption to my clinic schedule"
- "RAP provided great resources to my spouse and helped him adjust to our recent move to Minnesota"

**Institutional RAP Advisory Committee Contacts:**

Carol Sundberg  
Graduate Medical Education, UMMS  
(612) 626-3317
Willie Braziel
Graduate Medical Education, Regions Hospital
(651) 254-1530

Mira Jurich
Graduate Medical Education, UMMC-FV
612-273-7482

Please refer to the Institution Manual for additional services that are offered to Residents and Fellows,

LABORATORY/PATHOLOGY/RADIOLOGY SERVICES

Laboratory, pathology, and radiology services are readily available through University of Minnesota Medical Center. Below is the contact information and location of each of these medical services:

UMMC Diagnostic Laboratories
Mayo Medical Building, Room D-293
420 Delaware Street SE, MMC 198
Minneapolis, MN 55455
Tel: 612-273-7838
Fax: 612-273-0183

Pathology
Pathology Department (also, Pathology Surgical, May Room 422, MMC 76)
Mayo Medical Building, Room C-477
420 Delaware Street SE, MMC 609
Minneapolis, MN 55455
Tel: 612-273-5920
Fax: 612-273-1142

Radiology
Radiology Department (also, Reading Rooms, Registration)
Harvard at East River Road (UH), Room 2-300 (all divisions: MMC 292)
Minneapolis, MN 55455
Tel: 612-273-5690
Fax: 612-273-8954

Interventional CV Radiology, UH-2-300
Tel: 612-273-4220
Fax: 612-273-7500
Radiology Engineering, UH 2-493
Tel: 612-273-6801
Fax: 612-273-6887

Radiology Film Desk Hospital, UH 2-403
Tel: 612-273-5777
Fax: 612-273-7515
MEDICAL RECORDS

Patient records can be accessed either via the UMP Electronic Medical Records (EMR) Allscript system or through EPIC, the Fairview inpatient electronic medical record system or by calling University of Minnesota Medical Center’s (UMMC) Health Information Management (HIM) offices at 612-626-3535. The out-patient clinics have been converted over to the outpatient EPIC.

For official medical record retrieval, patients are to contact the UMMC’s HIM offices at:
University of Minnesota Medical Center
ATTN: Release of Information
420 Delaware Street SE, MMC 601
Minneapolis, MN 55455
Tel: 612-626-3535
Fax: 612-273-2345

SECURITY / SAFETY

The Security Monitor Program (SMP) is a branch of the University of Minnesota Police Department. SMP offers a walking/biking escort service to and from campus locations and nearby adjacent neighborhoods. This service is available completely free to students, staff, faculty, and visitors to the University of Minnesota – Twin Cities campus. To request an escort from a trained student security monitor, please call 624-WALK shortly before your desired departure time and walk safe.

Fairview University Medical Center also employs security officers who are on duty 24 hours a day to respond to emergencies and to escort persons to and from the parking facilities. Call 612-273-4544 if you wish to have an escort, and a security officer will meet you at your location.

MOONLIGHTING

Recognizing the demands of the cardiothoracic surgery fellowship at the University of Minnesota, no moonlighting is permitted during the three year training program.

SUPERVISION

Our program provides residents with a sound academic and clinical education, and it is carefully planned and balanced with the concerns for patient safety and resident well-being. We insure that the learning objectives of the program are not compromised by excessive reliance on residents to fulfill service obligations. Didactic and clinical education does take priority in the allotment of residents’ time and energies.

All patient care activities are supervised by qualified faculty. The program director ensures, directs, and documents adequate supervision of residents at all times. The residents are provided with rapid, reliable systems for communicating with supervising faculty. The faculty schedules are structured to provide residents with continuous supervision and consultation. The faculty and residents have been educated to recognize the
signs of fatigue and to adopt and apply the appropriate policies to prevent and counteract the potential negative effects of fatigue.

The attending physician is responsible for all aspects of the care of each patient and will supervise the conduct of each resident’s patient care. The level of complexity and independence in patient care provided by each resident on service will be determined by each faculty member. This determination will be based on the resident’s level of training and skill. This progressive delegation of responsibility is designed to allow the trainee to develop increasing degrees of autonomy in preoperative, intraoperative, and postoperative patient management. Staff surgeons will perform patient care rounds with the residents and will maintain written records in accordance with each institution’s guidelines. A staff surgeon will be available at all times to assist in his/her patient’s care.

The staff surgeon will supervise residents in preoperative patient evaluations, obtaining consent and postoperative care (including the maintenance of the medical record). The staff surgeon will be present for all operative procedures and will appropriately document his/her participation in each operation.

*Excerpt from ACGME updates effective 7/1/11*

VI.D. Supervision of Residents
VI.D.1. In the clinical learning environment, each patient must have an identifiable, appropriately-credentialed and privileged attending physician (or licensed independent practitioner as approved by each Review Committee) who is ultimately responsible for that patient’s care.
VI.D.1.a) This information should be available to residents, faculty members, and patients.
VI.D.1.b) Residents and faculty members should inform patients of their respective roles in each patient’s care.
VI.D.2. The program must demonstrate that the appropriate level of supervision is in place for all residents who care for patients. Supervision may be exercised through a variety of methods. Some activities require the physical presence of the supervising faculty member. For many aspects of patient care, the supervising physician may be a more advanced resident or fellow. Other portions of care provided by the resident can be adequately supervised by the immediate availability of the supervising faculty member or resident physician, either in the institution, or by means of telephonic and/or electronic modalities. In some circumstances, supervision may include post-hoc review of resident delivered care with feedback as to the appropriateness of that care.
VI.D.3. Levels of Supervision
To ensure oversight of resident supervision and graded authority and responsibility, the program must use the following classification of supervision:
VI.D.3.a) Direct Supervision – the supervising physician is physically present with the resident and patient.
VI.D.3.b) Indirect Supervision:
VI.D.3.b).(1) with direct supervision immediately available – the supervising physician is physically within the hospital or other site of patient care, and is immediately available to provide Direct Supervision.
VI.D.3.b).(2) with direct supervision available – the supervising physician is not physically present within the hospital or other site of patient care, but is immediately available by means of telephonic and/or electronic modalities, and is available to provide Direct Supervision.

According to ACGME guidelines effective 7/1/11:

- All patient care must be supervised by qualified faculty. The program director will ensure, direct, and document adequate supervision of residents and fellows at all times.
- Residents/Fellows will be provided with rapid, reliable systems for communication with supervising faculty.
- Residents must be supervised by teaching staff in such a way that the residents assume progressively increasing responsibility according to their level of education, ability, and experience.
- On-call schedules for teaching staff must be structured to ensure that supervision is readily available to residents on duty.
- The teaching staff must determine the level of responsibility given to each resident/fellow.
- Faculty and Residents/Fellows are educated to recognize the signs of fatigue and will adopt and apply policies to prevent and counteract the potential negative effects.

**MONITORING OF RESIDENT WELL-BEING**

Our program for monitoring resident well-being is twofold. First, the cardiothoracic and thoracic surgery staff have reviewed multiple articles about the issues of sleep deprivation, fatigue, stress, depression, burnout and impairment. We have specifically used the Life program from Duke University School of Medicine and portions of the Fight Fatigue training kit provided by HCPro Healthcare Marketplace.

In addition, our medical school has created campus-wide training on stress management and professionalism that our fellows participate in.

**ACLS/BLS/PALS CERTIFICATION REQUIREMENTS**

Upon entering an accredited GME training program all trainees who have direct contact with patients must be certified in BLS and/or ACLS, PALS, etc. depending on your program’s requirements. Certification is typically valid for two years. Once the initial certification expires, only those trainees, required by the hospital to have BLS and ACLS and/or PALS or any other life saving certification will be recertified at the teaching hospitals expense. The Division of Cardiothoracic Surgery also offers BLS certification at no expense to the fellow.

**Program Responsibility**

If life support course recertification is required by the program, the program will be responsible for the expense. If recertification is requested by the trainee, but is not a program requirement, the trainee is responsible for any fees.

Documentation and record-keeping of initial certification and recertification is the responsibility of each program.

**Note**

University of Minnesota Medical Center – Fairview Certification Requirements:

- All trainees providing patient care must maintain BLS at a minimum. Fairview does not charge for BLS training.
- If ACLS recertification is not required by the hospital, but the training program requires it there is a fee for the class.
- Adult Blue Code Team: Required to have BLS and ACLS. There is no charge for recertification.
• Anesthesia Residents
• UMMC-Fairview Family Medicine Residents
• Medicine and Med-Peds Residents (G2’s, G3’s)
• Surgery Residents (G2s)
• Training is arranged through Terry Nelson. Contact Info: email: nelson1@fairview.org.

• See UMMC, Fairview policy on Guidelines and Requirements for Life Support Training

Contacts for Affiliate Hospitals:
Children’s Hospitals & Clinics: Earnie Collins: 651-220-6129
HCMC: Tam Prose: 612-873-2357
Regions: Eugenia Canaan: 651-254-0812
VAMC: Endia Porter: 612-467-2346

MENTORING PROGRAM

At the end of their first year, all the fellows identify a mentor on the staff, someone in which they can discuss future plans and potential crises as they arise. We feel that assigning a mentor may not be in the fellow’s best interest, so we have asked them to select their own mentor from the staff. A mentoring education program is being put together for the staff, with reading materials to assist them.

The program director is responsible for monitoring resident stress, including mental or emotional conditions inhibiting performance or learning, and drug-related or alcohol-related dysfunction. Both the program director and faculty should be sensitive to the need for timely provision of confidential counseling and psychological support services to residents. Situations that demand excessive service or that consistently produce undesirable stress on residents must be evaluated and modified. Please include information on what the resident should do if fatigued or stressed, especially if unable to provide safe patient care.

GRADED RESPONSIBILITY

Our curriculum sequence emphasizes early introduction to all phases of thoracic surgical practice with graded increases in responsibility as residents advance in level and complexity of case mix. In this light, first year residents are exposed to six months of general thoracic surgery and six months of general cardiac and thoracic surgery. In these rotations, they are introduced to the core competencies for each specialty. They learn basic surgical tenants and techniques. The second year continues with more specific specialties including: pediatric cardiovascular surgery, thoracic endovascular surgery, minimally invasive cardiac and thoracic surgery, and general cardiothoracic surgery in a private practice environment. Our third year emphasizes independence, increased responsibility, and advanced specialization including heart and lung transplantation, ventricular assist device implantation, advanced surgery for heart failure, valve sparing techniques, robotic techniques and
surgery on the great vessels. The goal of our sequence is to have the resident fully independent and ready for practice of thoracic surgery upon graduation.

The residents in the thoracic surgery program participate in patient care at multiple levels. The residents are involved in and attend outpatient clinics where preoperative patients are seen in consultation. They participate alongside the attending faculty in reviewing all the pertinent patient data including the history and physical, any notes from referring physicians, catheterization data, and any other imaging information that may be available. The process for inpatient consultation is very similar. The residents then document his/her findings with respect to the individual patient in the patient’s permanent record.

In the postoperative period, the residents work on the respective thoracic services, are in charge of the care of the patients on those services. Because of resident work hour restrictions, we have integrated surgical intensive care unit services into the care of some of the postoperative cardiac and thoracic patients. It is important to point out that the resident in cardiac and thoracic surgery under these respective services is expected to direct the care, under the supervision of the appropriate cardiothoracic and thoracic surgery faculty. Once the patient leaves the surgical intensive care unit, the thoracic surgery resident remains in charge of the care until the patient is discharged from the hospital.

The same model pertains to trauma and emergency patients, as well as pediatric cardiac patients. A longstanding strength of the thoracic surgery program at the University of Minnesota has been the graduated level of responsibility for the postoperative care that is assumed by residents as they go through the program. This prepares them to multitask and to care for a wide variety of postoperative patients in whatever practice setting they may enter.

**BIBLIOGRAPHY**

The following articles about sleep deprivation, fatigue, and medical errors have been reviewed by the faculty.


MEDICAL RECORD COMPLETION

The expectation is that completion of medical records will be done timely.

DICTATION COMPLETION

The expectation is that dictation will be completed timely, ie operative report within 24 hours of leaving the Operating Room. Additionally, discharge summaries should be dictated within seven days following hospital discharge.

UNAUTHORIZED LEAVE

All leaves need to be authorized by Dr Ward, the Fellowship Program Director. Any time off taken without previous approval will be dealt with on a 1:1 basis with discipline dependent on information found in the investigative process.

PORTFOLIOS

Each fellow has been asked to begin an educational portfolio which demonstrates their clinical knowledge throughout the three years of the program. This portfolio will be maintained in the thoracic surgery education office. It consists of all of their grand rounds and teaching rounds presentations. Once a presentation has been completed, a summary is dictated which includes a copy of slides and a bibliography. By the end of their third year, they should have compiled a very nice educational portfolio. This will assist them with future talks and will assist documentation of their educational progression and understanding of topics in cardiovascular and thoracic surgery.

PROGRAM SPECIFIC VISA POLICIES

Visa Sponsorship: The J-1 alien physician visa sponsored by ECFMG is the preferred visa status for foreign national trainees in all UMN graduate medical education programs as well as the Thoracic Surgery training program. We currently do accept H1-B visas while the policy is under further review. Additional information on the Institution visa policies can be found on the UMN-GME webpage http://www.gme.umn.edu/international/home.html
### SECTION 6 – ADMINISTRATION


<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>IC</th>
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</thead>
<tbody>
<tr>
<td>Adam, Rasha</td>
<td>VAD Coordinator</td>
<td>5-6172</td>
<td>899-2955</td>
<td>203-747-2434</td>
<td></td>
</tr>
<tr>
<td>Anderson, Gregg</td>
<td>Cardiothoracic Surgeon – Primary FSH</td>
<td>4-5464</td>
<td>Jeanne</td>
<td>612-534-9425</td>
<td>952-934-2762 **</td>
</tr>
<tr>
<td>Anderson, Susan</td>
<td>Research Coord. (MB538 Riverside East)</td>
<td>6-5214</td>
<td>612-899-3458</td>
<td>763-786-3458</td>
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</tr>
<tr>
<td>Andrade, Rafael</td>
<td>Associate Professor (241 KE)</td>
<td>6-3091</td>
<td>612-899-6005</td>
<td>612-730-9718</td>
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<tr>
<td>Benyo-Albrecht, Kathy</td>
<td>Adult CTS Data Mgr (116 KE)</td>
<td>5-1193</td>
<td>899-1584 (a)</td>
<td>651-773-5360</td>
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**PATIENT TOLL-FREE LINES**

- Accommodations: 1-800-328-5576
- Hospital: 1-800-688-5252
- Transplant Center: 1-800-328-5465
- U-Access: 1-800-888-8642
- Thoracic Tx: 1-800-478-5864
- Cardiovascular Clinic: 1-800-688-5252

**Surgery Department Administrative Center**

**Human Resources and Payroll Staff**

**Joy Wise Davis**
Human Resources Manager  
Phone: 612-625-4837  
Fax: 612-625-1717  
E-mail: jwisedav@umn.edu  
Office Address: 13-102A PWB

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**Katy Cotterman, M. Ed, PHR**
Human Resources Generalist  
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**Recruitment, Employee Relations, Compensation, and Benefits Credentialing and FMLA**

**Kathleen Olakunle, BIS, CC**
Human Resources Representative for Departments (SAC and ALRT)  
Phone: 612-625-5982  
Fax: 612-625-1717  
E-mail: olaku001@umn.edu

*Notary Public Services*
Kirk Skogen  
Payroll Manager, Effort Coordinator,  
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Confirmation of Receipt of Fellowship Addendum

**Confirmation of Receipt of your Fellowship Addendum for Academic Year 2014 - 2015**

By signing this document you are confirming that you have received and reviewed your Fellowship Addendum for this academic year. This policy manual contains policies and procedures pertinent to your training program. This receipt will be kept in your personnel file.

Fellow Name (Please print) ________________________________

Fellow Signature _________________________________________

Date __________________

Coordinator Initials ________________

Date _________________