

When designing your own protocol, it is impractical for a medical student to think he or she will complete a clinically altering, randomized, double-blinded placebo controlled trial in a month or two of research. This does not mean one cannot perform a clinically relevant investigation that can add substantially to existing knowledge. A good medical student-initiated research project often consists of a retrospective chart or radiographic review of normal anatomic and/or pathologic conditions, and/or case reports. Running prospective trials is often cumbersome as patient enrollment is very sporadic, especially when dealing with a limited amount of time.

When designing your own protocol, a general outline is as follows:

1. Find a motivating mentor and choose a project.
2. Perform a literature search and read articles to familiarize you with prior research on your research topic. Finding past publications usually first starts with a literature search on Medline or PubMed, but do not forget to search the references of articles or anesthesia textbooks you read. These are often filled with publications you may have missed through Medline or PubMed.
3. Develop a general hypothesis and write your protocol. If your mentor has written prior protocols, ask to review one so you have a template. Find similar publications to the protocol you are writing and base your methods on this protocol.
4. Discuss the project with a statistician to determine adequate power and sample size. When designing the protocol or analyzing the data, a good, basic knowledge of statistical analysis will usually suffice (mean, standard deviation, confidence intervals, p values, etc.); however, if more advanced statistics are needed, do not hesitate to use a statistician.
5. Submit the protocol for IRB approval. This can take anywhere between two to three months or longer as the IRB will often have questions and ask for revisions.
6. Collect data/enroll patients.
7. Analyze data, write manuscript and submit for publication.

### Funding

Many sources are available to fund your project and provide you with a stipend for your work. These can include your medical school, your local anesthesiology department, the Foundation on Anesthesia Education and Research (FAER) (<http://faer.org/medicalstudents.php>), or the National Institutes of Health (NIH). The Medical Student Anesthesia Research Fellowship (MSARF) through FAER is a relatively new opportunity for research in anesthesiology. The application is typically due in January of the year for which you are applying. There are host institutions across the nation, requires an

eight to 12 week commitment, includes 15 percent of your time to be devoted to clinic exposure to anesthesiology, and includes a travel stipend for you to present your work at the annual American Society of Anesthesiologists meeting. For those interested in anesthesiology, this is a great opportunity!

### Closing Thoughts

Including a research project at some point in your medical career will expand your understanding of the scientific method, and hopefully, give you a greater ability to scrutinize the many new good and bad research publications that drive change in current medical practice. Performing a successful research project requires much initiative on your part. Start the process early, especially if you decide to write your own protocol. Know your topic thoroughly as it will aid you immensely in writing your manuscript and answering questions, especially when you can quote past publications. Most of all learn a lot and have fun with the project!

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## CHAPTER 17

### Cardiac Anesthesiology

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### Cardiac Anesthesiology

The unique characteristics of the cardiac surgical patient led to the development of the subspecialty of cardiac anesthesia. Cardiac anesthesiologists are perioperative physicians who specialize in the anesthetic management of patients undergoing cardiac surgery, including valve replacement and repair; coronary artery bypass grafting; thoracic aortic surgery; repair of congenital heart defects; heart transplantation; and the implantation of mechanical assist devices. Cardiac anesthesiologists also have expertise in anesthesia for thoracic (e.g., lung surgery and transplantation) and vascular surgery. In addition some cardiac anesthesiologists serve as attending physicians in the cardiothoracic intensive care unit (CTICU).

Cardiac anesthesia requires expertise in a number of areas in order to care for the cardiac surgical patient. In-depth knowledge of cardiovascular physiology and pathology is paramount, as is the ability to manage cardiac physiology with an arsenal of vasoactive and cardiotropic medications. The introduction of cardiopulmonary bypass in 1953 revolutionized cardiac surgery and cardiac anesthesiologists must understand its operation, effects on physiology, and risks. Finally, they must be proficient at acquiring vascular access for invasive monitors (e.g., arterial and central venous catheters) and interpreting the data obtained from them.



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In recent years, transesophageal echocardiography (TEE) has developed into an important tool for both cardiac and noncardiac anesthesia. Intraoperatively, TEE has many applications, including the evaluation of valvular and aortic pathology, atrial and ventricular filling and function, regional wall motion abnormalities indicative of coronary artery disease, and congenital heart defects. During cardiac surgery, the TEE examination helps to guide both the anesthetic and surgical management and allows for the immediate evaluation of cardiac repairs. During noncardiac surgery, TEE has become an important tool in determining the etiology and guiding the treatment of hemodynamic instability. Cardiac anesthesiologists were integral in the development of standards for perioperative TEE and continue to develop future applications to improve the safety and efficacy of cardiac surgery.

Prior to beginning subspecialty training in cardiac anesthesia, one must first complete a residency in anesthesiology. Residency training consists of broad training during a clinical base year followed by three years of dedicated training in anesthesiology, pain management and critical care medicine. During residency, those who wish to pursue a career in cardiac anesthesia may apply to fellowship programs, most of which are one year in

duration. Currently, there is no match program for cardiothoracic anesthesia fellowships. Cardiothoracic anesthesia fellowships have been in place for many years and were approved for accreditation by the Accreditation Council for Graduate Medical Education (ACGME) in February 2006.

The ACGME requirements for fellowship education in adult cardiothoracic anesthesiology provide for comprehensive training in the perioperative care of cardiac and thoracic surgical patients. Fellows obtain experience in preoperative evaluation and interpretation of diagnostic studies, such as coronary catheterization. Intraoperatively, Fellows learn the anesthetic management of patients undergoing various types of cardiac, pulmonary, and aortic surgery. Experience is obtained managing patients with various mechanical support devices, such as the intra-aortic balloon pump (IABP), ventricular support devices and extracorporeal membrane oxygenation (ECMO). Cardiothoracic anesthesia fellowship also includes training in perioperative TEE. Upon completion of fellowship training, board certification in perioperative TEE is available from the National Board of Echocardiography (NBE). Finally, Fellows gain experience in postoperative care through rotations in the CTICU.

Obtaining training in pediatric cardiac anesthesia can be done through two pathways. After completing a residency in anesthesiology, one may enroll in an adult cardiothoracic fellowship program and elect to concentrate in pediatric cardiac anesthesia. This provides the ability to care for both adult and pediatric cardiac surgical patients. Alternatively, after completing an anesthesiology residency, one may enroll in a pediatric anesthesia fellowship and concentrate on pediatric cardiac anesthesia. This option provides training in both pediatric cardiac anesthesia and anesthesia for complex pediatric surgery. However, a fellowship in pediatric anesthesia does not provide training in adult cardiac anesthesia. Similar to cardiothoracic anesthesia fellowship programs, pediatric anesthesia fellowships are accredited by the ACGME.

Additional information on cardiac anesthesiology can be found on the Society of Cardiovascular Anesthesiologists website ([www.scahq.org](http://www.scahq.org)). Specific fellowship information can be found on the Accreditation Council for Graduate Medical Education website ([www.acgme.org](http://www.acgme.org)).

### Reference:

1. Practice Guidelines for Perioperative Transesophageal Echocardiography. A report by the American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists Task Force on Transesophageal Echo-cardiography. *Anesthesiology*. 1996;84(4):986-1006.