

## CHAPTER 16

### Research as a Medical Student

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#### Introduction

Research as a medical student can be an exciting and rewarding opportunity to focus on a specific area of interest and give you a break from the long, scheduled hours of the clinic. Anesthesiology provides a unique specialty to be involved in research. We are probably one of the only specialties where the mechanism of action of our mainstay, the inhaled anesthetics, is not fully understood. Anesthesia is also unique in the collaborative approach to research. Any project can span the spectrum of all surgical and medicine specialties, allowing you to network with other physicians outside of the anesthesiology specialty.

#### Why Research?

Research as a medical student has many potential benefits. First, you have the opportunity to become an expert in a specific subject. I have found attendings in multiple other specialties to be very interested in my past projects and have asked me to present them in rounds or in clinic. Becoming an expert can set you apart from others in your class. Second, when applying for residency programs, a research background can generally give you an inside edge on academic programs and provides a topic of discussion during interviews. It also lends the opportunity to work one-on-one with a mentor who can become your biggest advocate and friend during your medical school career. In contrast to clerkship where you are often in an observational role with minimal responsibility, research provides a period of independence where you are ultimately the only person responsible for patient enrollment and completion of your project. An additional benefit can include a stipend for your work provided by your school, anesthesiology department or an outside source. Finally, some of the most exciting aspects of research are the opportunities to travel and present your project at national meetings and publication of the final manuscript. These are often the most difficult portions of research as you are questioned by national and worldwide experts in your field of investigation. This truly challenges your conceptual understanding of both the basic and clinical science behind your investigation.

#### Choosing a Research Project

A good research project can best be accomplished during the summer between the first and second years of medical school. This break provides the most natural point to complete a project, as students generally have two continuous free months off from

school. Other opportunities exist as fourth-year elective months, while other students choose to take a year off from medical school to complete more extensive investigations.

Before beginning a research project, you must choose which route you want to take (basic or clinical research) and find a mentor. Clinical research incorporates patient-oriented investigations of human pathology, therapeutic treatments, epidemiologic and behavioral studies, and patient outcomes, all of which can be performed under an M.D. Basic research often involves determining the basic mechanism of a specific phenomenon with much of this occurring through cell and/or animal research or drug development in a Ph.D. laboratory setting. Basic versus clinical research will influence your selection of a mentor as many M.D.s do not participate in basic science research.

When deciding upon a mentor, you must also settle on a specific area of interest in anesthesia (neuroanesthesia, cardiac, pediatrics, pain medicine, etc.). A physician or resident within the anesthesia department or other medical students are often good resources to guide you in the direction of a good mentor. A Medline or PubMed search under potential mentors' names will often provide a quick idea of the types of research they have performed. When meeting with a mentor for the first time, your potential work relationship should never be overlooked. Advantageous qualities in this person include active involvement in research, prior medical student involvement in research protocols, teaching ability, availability to meet and discuss questions (at least weekly), and most importantly, someone who you can see yourself working alongside.

Once meeting with your mentor, you should have a good idea of potential projects that you can further pursue. An important decision to make is if you would like to construct your own research protocol or join a preexisting protocol of your mentor. Joining a preexisting protocol is ideal for those interested in learning about the scientific method and a specific area of interest but who want no strings attached once their research month is over. Designing your own protocol is time consuming and requires much more dedication and initiative prior to and after your actual designated research month, but it is very rewarding in the end when you are the first author on a publication.

#### Designing a Protocol

Timing is the most important aspect of research as a medical student. While a student might anticipate only spending his or her scheduled one to two months performing research, he or she must have insight and diligence during the time building up to and after the actual data collection portion of the research. It may take up to six months to prepare and obtain institutional review board (IRB) approval for a protocol, analyze data; writing a manuscript and completing edits can also be a very lengthy process. Thus, the medical student must take much initiative in starting and completing his or her project.

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).