This brief introduction is geared towards those medical students who have never done research, either in the humanities or hard sciences, but recognize it is an important experience necessary to prepare them for their career as a physician.

Why should you care about research?

Most residencies require residents to complete a Senior Research Project. Often, the topic of choice is up to you and there is a support system to help you collect data and analyze it. You will go on to present this research in the form of a poster or oral presentation at one of many conferences around the country. These presentations will be in front of your fellow residents, former and future colleges, mentors, hospital administrators and potential future employers. Your research will be submitted for publication to one of many medical journals that are read worldwide and will be evaluated by non-biased experts in medical field judged for quality standards specific to each journal.

But more than just a requirement for graduate medical training, Research is the way we contribute to our medical community. It’s one of the best ways to progress knowledge and research saves lives on a large scale. Morbidity and mortality case presentations have the potential to prevent accidents by learning from our mistakes, and clinical trials can change the guidelines by which we practice to make medicine safer for our patients. Our comprehensive medical training gives us the ability to understand our patients down to their biochemistry—so naturally we should use our knowledge to advance what we know!

What if you’ve never done ANY type of research?

Start here! This is a very basic introduction meant exactly for you. There are many resources available once you have an idea of some basics. Some such resources are mentioned here while many more are available through the ACOEP-Student Chapter Research webpage. If you still have questions, email your Research Committee Chairperson for some direction and answers.

RESEARCH 101

Scientific Method:

1) Formulate a question
2) Generate hypothesis(es) based upon current knowledge of field
3) Prediction of consequence of the hypothesis(es)
4) Test hypothesis(es)
5) Analysis of results

What counts as research?

For many people, the answer involves mice in cages, black lab benches, white coats, pipettes, Petri dishes and microscopes. This is just one type of research that you can get involved in.

1) Lab-based research:
This takes place in a laboratory and often involves some component of bimolecular chemistry, physics and animal or cell-models. The Principal Investigator (PI) is focusing on a very narrow and specific area of interest. For example, a specific portion of a protein involved in a disease state or targeted by pharmaceuticals, a unique gene mutation that causes a desired or undesired phenotype, a specific cellular component of a unique immune response to certain antigens. This type of research focuses on the details to help explain the broad picture of a disease pathogenesis, biological response to specific stimuli or elucidate unknown details to a widely seen biochemical response. Often the research project is well-established around a specific topic and there are several smaller experiments occurring concurrently to help answer several broader questions.

For example:

In a lab focused on concurrent HIV and Tuberculosis infections, there might be several questions being answered at the same time: In the immunocompromised immune response of HIV-patients, what cells play the most important role in *Mycobacterium tuberculosis* infections? Is there a specific protein that is vital? How does the bacterial organism interact with specific cells in the host-response? What happens in a concurrent infection with a flu-like virus? What happens if one of the cytokines involved in normal response is up-regulated or down-regulated or knocked-out all together?

In this type of lab there are multiple roles to be played. If there is an animal or cell-based model, there is media and care required to maintain these vital research participants. If there is mutations to be created, DNA sequencing and mutating and monitoring must be done. If there is animal analysis to be done, there is dissections and tissue analysis to be done either manually through a microscope or utilizing protein/DNA/RNA analysis via ELISA, gel-electrophoresis or Western/ Southern/ Northern blotting.

These labs are often well-established and have multiple personnel involved at various levels. Your role as a new student research will play into one or more of the research projects involved. This is up to you and your PI to arrange in detail. Be prepared to help make solutions, count cells, clean animal cages, dissect and prepare tissue slides, wash dishes and analyze numbers. Some labs have paid people that do many of these vital components while in others everyone pitches in to help.

Because many of these labs require knowledge of several lab techniques, meticulous note taking skills and deep understanding of the research’s specific topic, there is a substantial time commitment. The benefit is a thorough understanding of the incredible science and powers of research to help solve some of the most vital questions about our bodies and a glimpse into the world behind the words in our textbooks.

2) **Data Analysis/ Surveys**

This takes place in your own time and often involves a set of questions answered “yes” or “no” (bimodally) or on a numerical scale. The question is often about trend or pattern, either in human behavior or clinical results/data. Specificity is focused on an association of one behavior
or data point to another in the context of a specific population. The PI is focused finding trends in order to improve or understand specific characteristics in a general group. For example, the preponderance of smoking within a specific population in one specific geographic region vs. another, the association of positive/negative outcomes from specific analysis of a particular blood test, comparison of usefulness or efficacy of one lab test vs. another in a specific clinical setting, or analysis of patient satisfaction after one or more specific clinical encounter modifications.

This type of research can be very varied and the length of the research often corresponds to the strength of the results. For example, comparison of five specific patient outcomes two months following analysis of one particular lab test vs. comparison of 100 patient outcomes two months later have very different weights. To help solve this, most researchers focus their testing to include as many data points as possible. For medical students, this might mean accessing multiple patient records to find the ones specific to your question and testing through your institution’s associated hospital or clinic. Alternatively, data analysis could be done on a specific topic in the context of social media or current research topics. Surveys can be given to a wide variety of subjects—patients, administrators, fellow students or doctors.

Because these types of studies can involve human subjects, there is specific training requirements and privacy rules to be followed and must be complied with very strictly. Also, this type of research requires a significant amount of data analysis. Many institutions have statisticians to help with this process. The benefit of this type of research is that it is fairly accessible to all students. The time and depth of the research is entirely up to you and therefore the time commitment is flexible.

3) **Case Study**

This is presentation of a unique patient discovered in the course of a clinical encounter. Case studies are meant to educate the broader medical community to an uncommon patient presentation of a specific clinical course. For the case to be relevant, either the symptoms or findings should deviate from the “textbook” definition associated with the pathogenesis.

This is hit-or-miss. There is no guarantee that you will come across such a unique case. Because this requires public presentation of a specific patient’s medical data, there are multiple restrictions and privacy laws to be followed. First and foremost, you must get the patient’s permission. Because you never know when you will encounter this situation, there is a significant amount of legal preparation and relevant training required to help facilitate the process should you find a case worth publishing and a willing patient. Case reports are fairly concise and interesting to present and the benefit of all of the preparation is the chance to be the first to present an educational case to the entire medical community.

**How do I start?**

1) **Think of a question or topic** you find interesting and want to spend time answering and learning about. If you cannot think of anything, look to your institution’s current research topics for inspiration. Contact your Research Department chairperson (list of each school’s contact can be found on the ACOEP-SC Research webpage)
2) **Educate yourself!** There is a massive amount of research being done in the world. There is probably someone, somewhere working on the same topic you are interested in. Start with Google and follow into more scholarly resources to find published research on the topic that interests you. Find out how current researchers are answering similar questions to yours and see what methods worked and what did not. (Suggestions for helpful search engines can be found under the Journal Club section of the ACOEP-SC Research webpage)

3) **Find a PI** to help guide you in this process. Many of your professors are engaged in research in a variety of ways and would enjoy helping you. Be sure to *come prepared* to this initial meeting; have a question, show that you have educated yourself on current relevant research and methods and have some idea of how you would like to conduct your own research or help them with theirs.

**What if I have more questions?**

Check out the resources on the ACOEP-SC webpage. We will keep updating them as more pertinent and helpful information is found.

If you have any questions or suggestions on improving this informational sheet, email your Research chairperson, Aadil Vora, OMS-III at av520@nova.edu.

**Good luck!**