CARDIOVASCULAR AND CARDIOLOGY RESEARCH

By Amy (Shi Hui)
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Heart disease is the leading cause of death in the United States with about 600,000 related deaths every year. Many of the research labs at the Georgia Institute of Technology are conducting experiments specifically dealing with the heart and blood vessels of the human body, as well as understanding the mechanisms of blood circulation. The opportunity to untangle the puzzles of cardiology inspires many at Georgia Tech, including the labs of Dr. Robert Taylor and Dr. Don Giddens.

Dr. Robert Taylor is a professor in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University as well as a cardiologist. His research focuses on vascular inflammation in the pathogenesis of vascular diseases, specifically hypertension, diabetes, and atherosclerosis. The research involves strong collaborative efforts with other members of the Coulter Department who have a focus on applying nanotechnology and imaging approaches to the general area of atherosclerosis. His work employs novel animal models of human vascular disease to study the role of various mechanical and humoral factors in the development of hypertension and atherosclerosis. He has a particular interest in the renin angiotensin system, advanced glycation endproducts, biomechanical forces, and oxidative stress. His research also examines the interaction between vascular inflammation and bone marrow-derived endothelial progenitor cells. This research employs many areas of engineering and science including imagining technology, regenerative therapy, cell biology, etc.

Dr. Don Giddens, Dean Emeritus of the Coulter Department, is also involved in cardiovascular research. His lab's objective is to develop techniques to quantify the fluid mechanical environment to better understand the development and progression of numerous cardiovascular pathologies, as well as develop optimal treatment strategies. The research team actively collaborates with vascular biologists, vascular surgeons, and interventional cardiology in order to better understand the limitations in their current diagnostic, prognostic, and treatment strategies as well as how engineering principles can be applied to improve patient care. The research team focuses on discovering the mechanical environment in systems ranging from the single cell up to human coronary vasculature. Possible applications for this research include the development of robust methods that can be implemented clinically to better understand and treat atherosclerosis as well as other cardiovascular diseases. This research is useful to understand how the blood flow environment can predispose a region of the vascular system for atherosclerosis development or lead to failure of medical devices. For example, in collaboration with interventional cardiologist at Emory University, the researchers investigated the rapid progression of coronary artery disease. Clinically, this is important as patients can be asymptomatic but, due to rapid disease progression, have a potentially fatal heart attack without warning. The research team utilizes various clinical imaging techniques to reconstruct a patient's coronary vascular system and employ advanced computational methods to model their hemodynamic environment. The clinical studies follow patients over periods of six months and one year, which allows quantification in coronary artery disease progression and relate it to blood flow induced mechanical forces. The research lab is also involved in research projects on modeling the transport of nanoparticles to treat atherosclerosis, microfluidics in microelectromechanical systems (MEMS), and vascular disease development in heart transplant patients.

For BME students interested in such research topics, possible applicable courses are all (bio)mechanics courses offered in the BME department. The most applicable include BMED 3300 (Biotransport) and BMED 4757 (Biofluid Mechanics). Courses covering human physiology and anatomy, such as BMED 3100 (Systems Physiology) are also advantageous.

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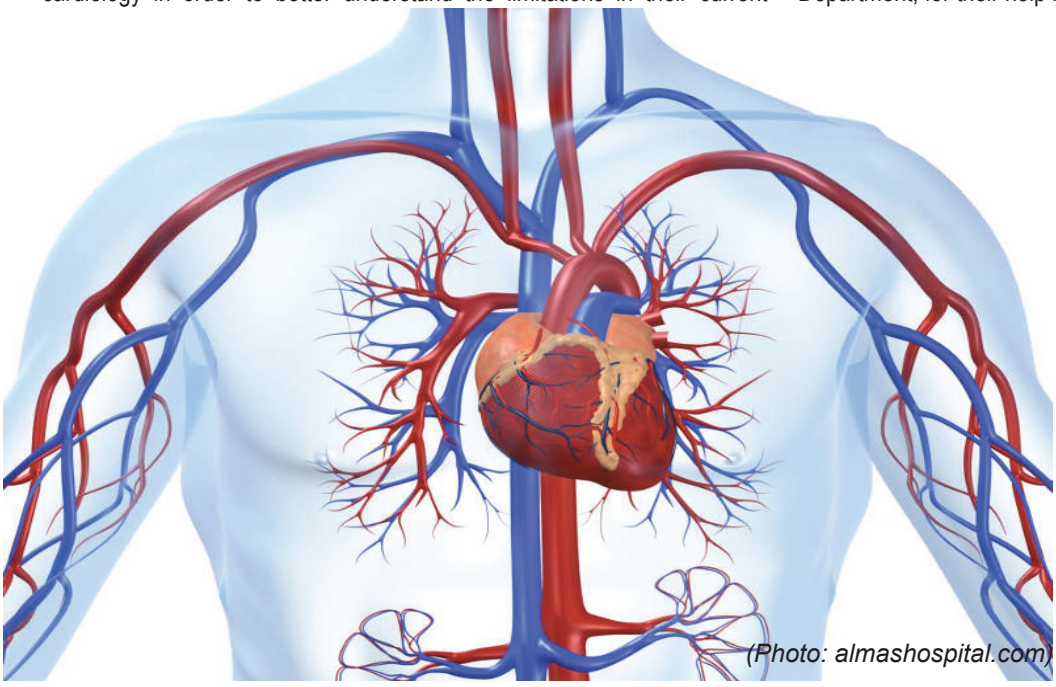

(Photo: almashospital.com)

"The most applicable courses offered in the BME department are BMED 3300 (Transport), BMED 4757 (Biofluid Mechanics) and BMED 3100 (Systems Physiology."

STARTING UP A BIOMEDICAL COMPANY

By Shi (Amy) Hui

Undergraduate Student in the Coulter Department

Biomedical Engineering graduates choose different career paths. Some choose to go to graduate school while others choose to enter industry by joining a large company. A small minority, however, follow a more difficult route by starting a new technology company. One such entrepreneur is Dr. Samirkumar Patel. Patel received his doctoral degree in Chemical and Biomolecular Engineering from the Georgia Institute of Technology in the drug delivery lab of Dr. Mark Prausnitz. His work in the field of ophthalmic drug delivery led to the development of a microneedle technology for the treatment of ocular diseases, and he is now a scientific founder of the company Clearside Biomedical. Starting a new technology company is an onerous task, and most startups fail within the first few years. According to a University of Tennessee research study, the percentage of startups that continue to operate in the education and health field after four Years is only 56%. Why do so many companies fail? Starting a company has no certainties and requires constantly making tough decisions without clear answers. Therefore, making good decisions is crucial for successfully operating a business.

The first difficult decision that Patel encountered was whether to sell his intellectual rights to existing technology companies or start his own. Sometimes the technology requires a preexisting infrastructure or other unavailable technologies, necessitating that it be sold to another company. Retaining the rights to the technology, however, allows you to use it to start a business potentially yield a much greater financial return. Patel decided that starting a company was the better choice despite many others trying to dissuade him.

When people start up a company, they always face the problem of choosing whom to recruit into the company. As quoted by Patel, "People matter." In the case of established companies, the founders don't actually need to work for the company as they let others do the grunt work. However with startups, the founders often have to do a bulk of the work for the company since they know the most about their idea. The supporting cast that startup companies bring in could be new employees or consultants. It is important that the people whom they bring in are those who have similar goals and vision for the company and can be trusted.

The most challenging thing for a startup company is trust and alignment of goals for everyone involved. At the start of Clearside Medical, Patel hired two employees who didn't have much background in ophthalmology but had plenty of experience in starting a company. Those people seem very excited about the project, and, as the months progressed, Patel began to realize that they weren't very interested. Patel noticed an imbalance in their relationship with the company. These so-called experts were receiving access to a lot of useful information from the company, but they no longer contributed anything useful to it. That is when

DR. SAMIRKUMAR IS CURRENTLY WORKING AS THE DIRECTOR OF RESEARCH IN A STARTUP COMPANY CALLED CLEARSIDE BIOMEDICAL. THIS COMPANY MAKES BOTH DRUGS AND DEVICES TO HELP SPREAD THE DRUG IN THE BACK OF THE EYES.
(Credit: Gary Meek)

Dr. Patel knew that something has to change. The company needed to find someone else and so they got in touch with contacts from the Advance Technology Development Center. With their help, Clearside Medical finally had the right person for each position. In a startup company, time is a very valuable asset and so it is very important that the person you hire matches the company's goal.

Aside from labor, capital is also a very important factor for starting a company. The founder needs to sell their idea to investors to get funding. Firstly, one needs to understand the total amount of money that is needed to be successful. There are three main funding sources that a founder could seek: a venture capital, a bank and a government grant. Dr. Patel wanted to move fast so he pursued venture capital funding. A venture capital fund is the fund that a company looks for outside capital to grow their business. A typical VC fund will be a professionally managed fund that has a few partners and junior level individuals who manage a pool of money raised from individual investors and institutional money.

Starting up a company is definitely challenging. From raising funds to hiring people, it all requires successful decision-making. It is important that people know the purpose of the company. An entrepreneur needs to hold their initial mission and keep an open mind toward innovation. In this way, they could be successful. When things fail, they should learn about why things fail and try again. Clearside Biomedical has become a successful running company and the credit goes to its founders' wise decision-making. For the students who are courageous, entrepreneurial and innovative, they could also think about starting their own business.

MAKE SURE THAT MEDICAL SCHOOL IS STILL THE RIGHT PATH FOR YOU.

Shadow another doctor or volunteer at another hospital. Try out an internship in another career that you have always been interested in. Medical school is expensive and long. You have already gone through nearly 17 years of school. Do you really want to go through another four at one of the toughest schools in the nation? Attending medical school is not an easy choice, and it is normal if you hesitate in pursuing that route. Explore all your options. If you want money, there are easier ways of getting it. If you want respect, there are plenty of professions that can get you that. If you really care about helping the sick and needy, why not become an Emergency Medical Technician? It is hard to be 100% certain for such a big step, but the more you find out about where you stand, the easier it is to write your personal statement. If you need to, feel free to take a gap year. The average age of people that begin medical school is about 23-24 years old, and a gap year often increases the competitiveness of your application.

MAINTAIN YOUR SANITY

One of the worst things that can happen to a pre-med student is that he or she burns out, especially near the end of application season. Keep your health up by eating right and working out. Think about it this way: why should a medical school train you to be a doctor if it looks like you cannot even take care of yourself?

BME ANSWERS

By **ALPHA ETA MU BETA–** The BME Secret Society

Is it a problem if I was not able to take BMED 1000 my first semester?

Not at all. Plenty of people take BMED 1000 their second semester or later. In fact, only about half the declared BMEs can take BMED 1000 their first semester. BMED 1000 is only a pre-requisite for BME classes, and non-BME classes will make up the bulk of your schedule your first year or two anyway. Most people don't really start taking a lot of BME classes until later in their sophomore or junior year, so you won't be hung up if you can't take BMED 1000 immediately. You'll also still be able to take plenty of classes together with your friends who took BMED 1000 their first semester. You won't get left behind.

What are some really good BME clubs for freshmen to join?

Almost all BME clubs are open to freshmen and are great ways to meet other students, faculty, and staff. The general organization that most BMEs join is BMES (Biomedical Engineering Society) which is our largest organization. If you are interested in more specific things, BROS (Biomedical Research and Opportunities Society) is great for helping freshmen learn about research opportunities on campus and how to get into a lab that you're interested in. The *Pioneer* is a great way to practice your writing, editing, or photography. You also get to meet faculty and leaders in the BME field which is awesome. We also have great community service organizations like EWH (Engineering World Health) which goes to MedShare at least once or twice a month.

I found an organization that I am interested in joining. Is it too late for me to join in the middle of the semester?

Most of the time, no. Many of the clubs at Georgia Tech do a lot of their active recruitment in the beginning of the semester, but unless there is an application process to get into that organization, they hardly ever just stop recruiting members. Most of the BME clubs are open to anybody. All you have to do is sign up and pay your dues. They will accept members at almost any time of the year. However, organizations like the Pioneer require new members to go through an application process, so you can only join near the beginning of each semester. It's important to stay on top of deadlines for these organizations.

I'm struggling in a class. What are some good ways to get help?

The academic office is always great. Paul can often help hook you up with a tutor if it is for a BME specific class. Sometimes this involves you and the tutor coming to an arrangement about pay, but there are other options that are free. Get in contact with some of the upper classmen in any BME organization, and they will often be willing to help or will know someone that can help you. For non-BME core classes, Georgia Tech has several programs like one-on-one tutoring which can give students more in depth help. Of course, going to see your TA and your professor during their office hours is a must if you are struggling in a class. It is a great way to network for a potential letter of recommendation in the future, and nobody should know your class' material better than those that are trying to teach it to you.

What are some awesome things to do around campus that don't require driving?

Atlanta is an awesome city with tons of great foods and events to go to. Centennial Park is walking distance away and is often the site of races and concerts. Tech Square also hosts several great events throughout the year like Taste of Atlanta and MomoCon. If you travel east a little bit more, Peachtree Street has a good chain of restaurants including the Vortex which you have to go to at least once while you are in Atlanta. If you want to go out a little farther, Marta can often take you to great places like the Aquarium, the Georgia Dome, and the Coca-Cola Museum. Piedmont Park is also a great place to visit and is not too far from campus. However, wherever you go, remember to always travel in groups, and try not to be out on the street when it's late.