# Micah Chambers Personal Statement

Among biomedical research areas, Neurology is probably audacious, and in my opinion the most interesting. While many biological systems have a thousand or more variables, the brain has more than 100 billion. In fact, our brains are so complex, super computers can only simulate 1 ten-millionth of the neurons. It would take another 30 years of Moore's law to scale raw computing power to the level of a single human brain. So the question for Neuroscientists is this: given that we cannot simulate an entire brain, what can we do? Surprisingly, the answer is plenty. While neuron-level simulation is a long way off, its possible that such an analysis may not be necessary, or even productive. By studying small *regions* of the brain, we can still learn a great deal about how the brain works, and how at times it doesn't work.

One reason that neuroscience is such an exciting field is that it is still wide open. For instance, we still have no way to accurately detect small activations, no way to generically decode activation patterns, and no standard way to determine causality. As an engineer, problem solving is a passion; and neuroscience certainly provides plenty of problems. Overcoming these difficulties requires both new techniques and new ways of applying old ones. Designing novel methods to present data is also crucial; the traditional "activation map" is intuitive, but how does one show data like causality - or switching - in an intuitive manner that doesn't oversimplify? All these problems have solutions, and it is a fascinating endeavor to search for them.

Neuroscience is more than interesting though, it can actually make a difference in people's lives. MRI, MEG and EEG can all lead to a better understanding of why people suffer from various conditions. Though the benefits aren't immediate, the ability to diagnose and understand neurological conditions could eventually lead to methods of prevention or treatment. Further, many conditions long thought to be localized may in fact stem from neurological conditions; after all, the nervous system affects every part of the body. Of course neuroimaging doesn't just benefit the ill, it benefits all of humanity by leading us to a greater understanding of ourselves. Why do some people have a propensity for alcoholism? What conditions would give one person photographic memory and another virtually no memory? The answer to these questions all reside somewhere within the brain, waiting for use to find them. The Chinese General, Sun Tzu, said that if you know your enemies and you know yourself, you will not be imperiled by a hundred battles; this is the ultimate goal of neuroscience: to know the things that harm us, and to know ourselves.

The fact that engineering is not an end unto itself is actually one of the reasons I find it so fascinating. Engineering is about designing a solution to a problem, but this often requires learning a new field well enough to propose solutions for it. Throughout my career, I have attempted to broaden my horizons: as an undergraduate I minored in math, economics and computer science because I enjoyed considering different approaches to problems. When I was working as a computer engineer in Maryland, I took a 6 hour course in Japanese at George Mason University, something I hope to take up again when my schedule permits it. In Egypt, I took an Egyptian studies course; learning about the countries' long history, its people and even it's politics. When working in a field as diverse as Biomedical Engineering, it is important to be have broad experiences because at any point these experiences may become relevant. For instance, many of the analysis tools used for

neural connectivity and activation originated in economics, and neural networks were first trained not by software engineers but by sociologists.

Last summer, I also took a robotics course in Egypt (through Virginia Tech), and halfway through the semester our team had still not been given the instructions for our semester project. Finally, as a team, we decided on our own final project. As the most experienced electronics engineer on the team, I took the lead of the electronics group. I mention this because my experiences with that team exemplify two important leadership qualities: cooperation and management.

There is a definite leadership quality to cooperation; most people spend their entire lives as subordinates to *someone*, but this shouldn't preclude leadership. Willingness to speak up in a group setting, and at times partake in vigorous discussion are important parts of teamwork. Of course willingness to make concessions and admit fault are imperative as well. The robotics team discussed what type of project we wanted to complete: we debated the merits of easier goals versus ambitious ones and we did so without a specific leader. Being able to take part in such a team is, in of itself, a leadership skill. I had a similar experience in my Operating Systems class: because there were only three of us on the team, we were able to divide responsibilities without specifying a leader. Of course, this presupposes everyone is willing to discuss disputes so they may be resolved properly. Success of such groups often depends on group dynamics, so this type of group isn't always possible. Thus there are times when one person ought to be in charge. When I took the lead of the electronics team in Egypt, I did so because everyone agreed I was the best equipped for the task. I generally knew how the parts went together, and I was able to delegate tasks because of that. During my final semester as an undergraduate, I took a Bioinformatics course, in which we had a semester long project. I started working on the project early and although I wasn't the assigned leader, I eventually began delegating tasks. As the only team member with a working knowledge of the project, it was my duty to step up. As a TA for embedded systems last spring, I acted as the project manager for five teams of four. In that case, I delegated very little, but I provided the team with direction and incentives to keep on top of their work. In the end, the type of leadership that is necessary depends on the circumstances, and my diverse experience has definitely helped me understand leadership better.

Concluding, I believe that I am uniquely qualified to research Biomedical Imaging. Besides taking courses in physiology and medical imaging, I have leadership experience which will help me work in a team, and diverse interests which which help me learn new fields.