# "The brain is the center of everything we do."

An interview with Assistant Professor of Engineering J. Harry Blaise '94, whose research in the new field of biomedical engineering seeks to discover how the brain takes in, stores, and retrieves information.

BY DREW SANBORN

**Was there a particular person or event that strongly influenced you as a Trinity undergraduate?**

The particular class was "Economics 101," taught by Professor Ward Curran. I was a first-year then and was fascinated by the subject and by Professor Curran himself. He was probably the reason I became a teacher. I was fascinated by how he clearly enjoyed doing what he was doing and by how the students were very taken by his knowledge of the subject.

As far as a mentor, I would say it was Professor Bronzino of the Engineering Department. Very early on, I became his research student, and we have had a mutually beneficial relationship ever since. I still collaborate on some of my research with him. He has taught me so much about doing meaningful research in a small liberal arts college, research that has an impact on my whole field. Some of the things he has accomplished are amazing in terms of name recognition.

**What is biomedical engineering?**

Biomedical engineering is an interdisciplinary field that brings together engineers from the traditional subdisciplines of mechanical and electrical engineering who apply basic engineering principles to solve problems in medicine and biology. It is a relatively new field, but because the world is moving towards more integration, more connectedness, it's becoming a very important component in healthcare delivery and drug discovery.

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A lot of biomedical engineers work for pharmaceutical companies on new drugs, and many are at work on new devices that help handicapped people in ways we wouldn't have even thought about five or 10 years ago. For example, there is a prosthetic device for the blind currently under development in which a sensor implanted in the brain will stimulate areas of the visual cortex. Perhaps this will give a blind person a sense of seeing, even though it might not be true vision, but at least an impression of shapes or colors will become possible.

**What are your research interests within the field of biomedical engineering?**

My own research is in the electrophysiology of learning. I am interested in how the brain takes in information, stores it, and later is able to retrieve it. In other words, how do we learn, how do we memorize things? I do research primarily in an area of the brain called the hippocampus, which is widely thought to be the first entry point for meaningful information-processing in the brain. When information comes in through the eyes or other modalities of the senses, it goes through a couple of different layers of the brain—for example, the primary cortices—and then is relayed to the hippocampus. The hippocampus is where the actual, slow, sequential processing of that information takes place. The hippocampus doesn't actually store memories, but it processes, consolidates, and relays them to other areas of the brain for storage. I am interested in that entry point where information comes in and begins to be processed by this "hippocampal machine."

A new line of research for me is the correlation of emotion and memory. We all remember traumatic things; it's something we can all relate to. How does emotion impact what we learn, what we remember, and how long we remember it? Examples I like to give are emotional events such as September 11 or the death of JFK—many people can still tell you where they were when they first learned about these events, but they can't tell you where they were on more ordinary days. When we experience emotionally traumatic events, stress hormones are released by the adrenal glands. A lot of these hormones are sent to areas of the brain responsible for learning. They enhance memory of particular events because the brain is being flooded with hormones that enhance the learning rate for memorization of these events. In today's research, we think about ways in which we can leverage that power to enhance how we learn and remember things. Once we know enough about how these mechanisms work, then it

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will be possible to develop drugs that mimic the same pattern and in this way enhance learning and memory.

Another aspect of my research is simply the matter of learning about ourselves—learning about who we are as individuals. Our brain is responsible for so much of our character, which is shaped by the experiences we have as individuals. So much of who we are is defined by the way we experience the outside world internally and how events and feelings are internally represented in the brain. The brain is the center of everything we do, of how we see the world, and how we interact with others. It all has to be done by the brain, that marvelous center of cognition and of consciousness. So, a lot of what I do is also pure research, wanting to learn about us, about human beings, about the business of life as a human being. How do we go about this, how do we discover the world? How do we view the world from a cellular point of view? From a neural-circuitry point of view? All of the information we are bombarded with every day—how does that machine (the brain) allow us to adapt to novel environments and to create new things?

**Is there a place where this work will find an eventual outlet in everyday life?**

Yes. What we have learned from the research I am doing can be easily transferable to other research that seeks to design drugs that manipulate the way we learn or enhance long-term memory. For example, Parkinson's disease attacks the brain, as does Alzheimer's. If we can learn how the brain circuitry responsible for learning and memory works, then it might be possible to create drugs that compensate for deficiencies in people who suffer from learning disabilities or other forms of brain disease.

**What are your interests outside your professional life?**

I'm a computer geek, so I can always be found on the computer! I like to play computer games and I like to go out on the Internet a lot. I'm also an avid reader, and over the last few years I have become an electronic book reader, so I get my books now as PDFs, and I read them on the computer. I read mostly non-fiction, a lot of things having to do with science and how science impacts society or religion or culture. Also, many publishing houses are coming out with textbooks in electronic form, which is helpful because I now have access to many of my texts I use in class right on my laptop, so I can do background reading right at home over the Internet.