Meet Physics Department Alumnus

William T. Newsome, Ph.D.

(Stetson University, class of 1974)

(Note: This page was compiled during the summer of 1998 and featured during the 1998-1999 academic year.)

BIOGRAPHICAL NOTES:

Dr. Newsome is an Investigator of the Howard Hughes Medical Institute and Professor of Neurobiology at the Stanford University School of Medicine. He received a B.S. degree, summa cum laude, in physics from Stetson University and a Ph.D. in biology from the California Institute of Technology. Dr. Newsome served on the faculty of the Department of Neurobiology and Behavior at SUNY Stony Brook before moving to Stanford in 1988. Among his honors are the Rank Prize in Optoelectonics, the Spencer Award for highly original contributions to research in neurobiology from the College of Physicians and Surgeons of Columbia University, and two Kaiser Awards for excellence in teaching from the students of the Stanford University School of Medicine. He recently delivered the 13th Annual Marr Lecture at the University of Cambridge, the 7th W.S. Stiles Lecture at University college, London, and the King Solomon Lectures in Mechanisms of Animal Behavior at Hebrew University in Jerusalem.

Meet Bill Newsome '74 and his family...

David, Zondra ('73), Bill, and Jonathan

OPEN LETTER TO PHYSICS MAJORS:

August 19, 1998

Hi,

It is a pleasure to serve as Tony Jusick's guinea pig (yet again!), having been selected as the first 'featured alum' for the Physics Department's web site. I graduated from Stetson almost a quarter of a century ago now, but in many ways it seems only a single heartbeat ago. My four years at Stetson were incredibly formative—intellectually, physically, spiritually and emotionally—and Stetson continues to be personal 'bedrock' for me. I rarely get back to the campus in DeLand (my trip last March was a pleasant exception), but the basic values and perspectives I developed at Stetson are with me always and inform almost everything I do—a passion for learning, a deep respect for the 'magic' of teaching/learning relationships between professors and students, an

appreciation for the broad range of the liberal arts and the unique role each plays in a rich, fully developed life, a sense of mystery and reverence before the wonder of our existence, and an experience of community within a specific academic and spiritual heritage. I met my wife at Stetson (we celebrated our 25th wedding anniversary last week!), and both of my parents as well as my siblings are Stetson graduates. I am 'Stetson' to the grave, I fear.

In professional life, my Stetson origins serve sometimes as comic relief and sometimes as a trenchant critique of the most elite universities in academia. Certainly I enjoy wearing my Stetson sweatshirt and responding to the incredulous questions it elicits ("Stetson University? Where the hell is that? Do you study hats?"). I have also enjoyed giving seminars at prestigious institutions and referring to Harvard as "the Stetson of the north" or to Caltech as "the Stetson of the west." My professional colleagues enjoy this sort of verbal sparring, but they are frequently caught up short when I tell them in all seriousness that I would rather one of my kids go to college at Stetson than at Harvard or Stanford—that the education is better at Stetson. I go on to explain that at Stetson I was always, always taught by *professors*, that the professors actually *cared* about teaching, that I had never heard of a 'TA' until I went to graduate school at Caltech, that my largest class while at Stetson was 40 students and my largest class in my major was 21 students, and that one Stetson professor actually gave me a personal tutorial course throughout my entire senior year so that I would be properly prepared for graduate work in biological sciences. This sort of devotion to undergraduate teaching is rarely seen at the elite universities because faculty are rewarded primarily for their prowess in research, not in teaching. I hope that you who are still at Stetson appreciate what you have there, and that you take full advantage of the resources offered by the Stetson faculty.

I currently serve on the faculty of the Stanford University School of Medicine, in the Department of Neurobiology. I do some teaching to medical students and graduate students, but my primary responsibility is to run a cutting-edge neurobiology research laboratory. My group consists of three postdoctoral research associates, two graduate students, and four technical staff. We study how the brain processes visual information, and how the electrical activity of nerve cells in the visual cortex enables us to see. Sometimes it takes a bit of reflection to realize how difficult this problem actually is. The first trick is to realize that vision happens in the brain, not in the eye. The eye transmits low-level information about the visual world to the cerebral cortex, but the cortex

is where this information is actually *interpreted* as revealing the presence of a face, or a table, or a moving automobile in the world. The interpretive act is the most formidable problem in vision, and you can appreciate this by putting yourself in the shoes of a small businessman who once approached a friend of mine at the Artificial Intelligence Laboratory at MIT. The fellow owned a food processing business which, among other things, assembled and distributed frozen pizzas. He sometimes paid a person to stand at the end of the pizza assembly belt and count the pieces of pepperoni on each pizza. This was a quality control measure: he didn't want to short-change his customers, but neither did he want to throw pepperoni away gratuitously. The man's request was simple: "Let's position a camera at the end of the assembly line, attach the camera to a computer, and have the computer count the pieces of pepperoni!" A very reasonable request, right? Well, the problem is that someone would have to *write software* to enable the computer to count pieces of pepperoni. What sorts of algorithms would you use? Have the computer recognize round shapes? This won't do because pieces of cheese and tomato sauce frequently overlap the pepperoni, rendering it anything but round. Can we have the computer recognize the color? Well, sometimes the color is red, and sometimes it is brown. Sometimes the color is very similar to the color of the tomato sauce. And if someone changes the overhead light from a tungsten bulb to a fluorescent bulb, standard color recognition mechanisms become totally bamboozled. Similar problems exist with texture, depth and other cues that might be used. Succinctly put, visual object recognition is incredibly difficult, and it is simply extraordinary that powerful digital computers, backed by thousands of lines of complex software, cannot perform the simplest tasks that biological visual systems accomplish quickly and effortlessly.

My laboratory works mostly on the neural mechanisms that enable us to see motion and the mechanisms that enable us to see depth by combining inputs from the two eyes (stereoscopic vision). We do some work with human subjects using new imaging technologies for monitoring human brain function nonivasively (functional magnetic resonance imaging). Most of our efforts, however, are devoted to the study of visual processing awake, behaving monkeys. We train macaque monkeys to perform motion and depth discrimination tasks, and we measure the electrical activity of nerve cells at different points in the visual pathway while the animals perform the task. We can make the task difficult or easy and see how the neural activity changes. We can also change the neural activity in certain circuits and see how performance changes. From experiments like this, we can begin to gain

insight into how the brain processes such information, and how that information relates to what is seen.

Although I am now a professional biologist, my physics background at Stetson was excellent preparation for what I am currently doing. My physics courses taught me to think carefully and quantitatively about scientific problems. I remember taking Physics 201 from Tom Lick during my freshman year at Stetson. He spent part of one period solving a typical freshman physics problem concerning the motion of a block of wood on a flat surface, the block being connected by a string and a pulley to a weight that was suspended in midair and therefore under the influence of gravity. After he finished the problem, I (being the ever diligent student) raised my hand and asked if he hadn't made a sign error at one point in the solution and whether the answer shouldn't actually have a minus sign in front of it. Dr. Lick looked at the problem on the board, looked at me, then grinned and said, "Bill, can a string *push*?" From this I learned never to get so caught up in the math that I lose sight of the overall problem I am trying to solve. It is amazing how many professional scientists continue to lose sight of the forest because they become stuck in the trees.

My physics background at Stetson also provided me with quantitative tools that I use to this day—Fourier analysis, linear algebra, differential equations, convolution—these are all standard analytic tools in vision science. If anything, I should have learned more math at Stetson, and I definitely would have benefited from advanced statistics courses. The essentials of molecular, cellular and systems biology can be picked up reasonably easily at almost any time. But quantitative tools are more difficult to master later in a career. The lack of quantitative skills can place nearly insuperable limits on the kinds of scientific problems one is able to engage.

Sometimes people ask me how I went from physics to biology. From the time I was in high school I knew that I wanted to make a career of scientific research, but I was not at all sure what kind of science I wanted to do. The best advice I received during this period was to major in physics, because with a physics background I could move into any branch of science I desired. I took this advice, but I also realized during my sophomore and junior years at Stetson that I probably wanted to move into biological science in graduate school. Somewhat to the dismay of my physics Chair at the time, I took quite a few courses in chemistry and biology during my last two years at Stetson. I also managed to find time for a few courses in religion, philosophy and history as well. I loved

them all. The switch to biology in graduate school was quite easy. Biology graduate programs love to get students with quantitative backgrounds, and my senior year tutorial from David Stock at Stetson equipped me with sufficient biological knowledge that I was not overwhelmed during my first year of graduate school.

So would you like to know anything else about me? My wife, Zondra, taught high school for 17 years after leaving Stetson. During the latter part of that time she managed to complete a Master of Divinity degree at Fuller Theological Seminary, and she is now a Minister in the Presbyterian Church. I am a member of that church as well, and spend occasional spurts of time thinking about issues around the intersection of science and faith. I recently gave a public talk on this subject at Stanford, and I would be happy to send an electronic (or hard) copy to anyone who inquires. Zondra and I have two boys, 18 and 16. Somewhat to my dismay, neither has yet discovered his 'inner scholar.' But they are both fundamentally good kids, and we have high hopes for them.

We would be happy to see any of you who make it out to the bay area. Just drop us a line and be sure we are in town. If I don't see you, just be sure you enjoy Stetson and work hard to learn as much as you can. I promise you that this effort will not be wasted; it will pay off handsomely for you down the line.

All the best,

Bill Newsome

Dr. Newsome has given us permission to publish his address information, and he would welcome contact from Stetson Physics majors (past, present, and future) or anyone else.

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