Edge of Discovery

Preparing for massive advances in medical science.

By Sophia Fischer

Imagine a future with no cancer, Alzheimer's or diabetes, where DNA and gene editing corrects disease before it happens, where blindness can be reversed. As these and other major innovations in medical research progress, more students want in. UC Santa Barbara has seen a significant jump in the number of undergraduates choosing life science majors from biochemistry to cell biology; molecular to marine biology; ecology and evolution to psychology and pharmacology. To meet the demand, the university is creating new majors, revamping courses, increasing research opportunities and hiring additional faculty.

"The 20th century saw tremendous advances in the physical sciences," said Pierre Wiltzius, executive dean of the College of Letters and Science. "The biological sciences are still in their infancy stages in terms of predicting what happens to living systems and that's the biggest trophy of the 21st century: making biology and life sciences into something that has the same level of prediction and understanding that we have in physical science. I want undergraduate students to be part of that and indeed they are motivated to participate."

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The Numbers

Biological science majors have been the most popular among students every year since 2011 with about one-quarter of all incoming UCSB freshmen declaring biology as a major. There were more bachelor's degrees conferred in life science majors - more than 1,300 - than any other area of study among the 5,580 UCSB graduates in June, 2017, according to UCSB's Institutional Research, Planning and Assessment.

UCSB faculty and administrators offer reasons for the increased interest in life science including perceived job security, marketplace demand, and exciting new tools and techniques developed in science research and healthcare.

"I think when the economic meltdown happened people stopped wanting to go into business, finance and law. Going into healthcare seemed like a good job," explained Stephen Poole, UCSB associate professor and chair of Molecular Cellular Developmental Biology. "On the first day of class we ask, 'What do you want to do with your career?' Most students say health sciences: physician assistant, biotech, pharmacist, doctor, anything in allied health fields that requires a bachelor's degree. It's pretty diverse and not just MD."

In fact, there has been a huge increase nationwide with 15.8 percent of all incoming college freshmen to four-year institutions indicating their intended major in the biological and life sciences, according to the Higher Education Research Institute at UCLA. Of the 30 fastest growing occupations over the next seven years, the United States Bureau of Labor Statistics lists 20 as health related.

New Directions

Reflecting this emphasis, UCSB is developing majors in neuroscience, bioengineering, marine science and data science. New classes are being offered in psychological and brain science. UCSB renamed the Department of Chemistry to the Department of Chemistry and Biochemistry, and the Department of Psychology to the Department of Psychological & Brain Sciences. The university established the Brain Initiative, part of a federal program to encourage collaborative brain research, and a new bioengineering building opened on campus in August to house engineering, chemistry and biochemistry departments.

"I'm excited about having a diverse collection of researchers all with interests at the interface of life sciences and engineering together in a single building," said Kevin Plaxco, Chemistry & Biochemistry vice chair and director of the Center for Bioengineering. "Until now, the biology hadn't advanced far enough, our understanding wasn't sophisticated enough to seriously exploit biology-inspired ideas and biological materials in engineering applications. But that has changed; the time is ripe for an engineering revolution."

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For fall, 2017, 15 new faculty were hired across science disciplines. Last year 24 new science professors joined the university. Wiltzius expects robust hiring to continue.

"It will take biophysicists, biochemists, computer scientists, bio statisticians and others with different competencies and disciplines to work together," Wiltzius remarked. "At UCSB, this is what we are good at, working outside of our disciplines on large complex problems that we can make major contributions to."

B.N. Queenan, associate director of the UCSB Brain Initiative, with a student researcher. Photo: Matt Perko/OPAC

To help students succeed in these demanding science majors, support programs and new ways of teaching have been introduced. There is more engagement rather than lecture in the classroom, small discussion groups, peer mentors, and research opportunities. In 2014, UCSB received a $1.5 million grant from the Howard Hughes Medical Institute to fund the BioMentors program to increase success and retention of students in biology.

"There's been a lot of effort in biological science departments to improve the quality of teaching especially in these large initial classes," said Associate Professor Rolf Christoffersen, who teaches Intro to Biology to several thousand UCSB students each year.

More Research

As one of the top research centers in the world, UCSB will continue to place an emphasis on student research. About 57 percent of all undergraduates participate in research and the university hopes to increase that number to 100 percent. With that goal in mind, a biology research lab experience class was introduced attracting more than 800 students each year.

"Students ask what's supposed to happen and we tell them we don't know because you are the first person to do it. That's what science is, the exploration of the unknown and it's exciting to students to do an experiment no one has done before," Christoffersen commented. "With the results, we're creating this huge database that is really useful to the scientific community."

One of the biggest unknowns in the biological sciences is the brain. The relatively new UCSB Brain Initiative is bringing together faculty, researchers and students from many disciplines to create the type of research collaborations the university prides itself on. B.N. Queenan, associate director of the UCSB Brain Initiative, is particularly interested in training non-science majors to play a role in the future of biomedical sciences. Students studying programming, graphic design, marketing, economics and financial analysis can contribute their skills.

"Diseases of the mind and brain have become the most pressing issues medically, economically and socially," Queenan said. "The lost quality of life is enormous- we all have a loved one suffering from Parkinsons, Alzheimer's, depression, bipolar disorder, schizophrenia or autism. We need new thinking, expertise from multiple areas, we need an all hands-on deck effort."

The impact of these research initiatives will have an effect for decades, said UCSB Vice Chancellor for Research Joseph Incandela.

"Physics, chemistry and other hard sciences will continue to make progress and in some sense there are revolutions going on in all of these areas but to a large extent biological systems are becoming more accessible to be understood," Incandela said. "Scientists really focus on what they can solve."

Queenan values the unique research environment at UCSB, adding that not having a medical school at the university promotes the fundamental research that leads to long-term scientific revolutions.

"The future of medicine is and has always been in basic research, in people studying things they find interesting," Queenan said. "If we want things to improve, it's critical for society to train students to be scientists and to keep pushing the boundaries of discovery in the fundamental sciences. But we also need to train students regardless of their major to know how each of them is capable of making medicine better. We need to convince every student that they can contribute to solving the world's health problems."