UNIVERSITY OF CALIFORNIA SANTA BARBARA

We are in a new era of human health research where progress depends on disciplines working together to understand the complex mechanisms of disease and illness that impact millions of lives worldwide. UC Santa Barbara sets the global precedent for collaboration. Our biological sciences, engineering, and physical sciences join forces to develop innovative basic research and technological solutions. Our researchers work in partnership with academic, industry, and medical communities around the world to confront society's most pressing medical problems.

MACULAR DEGENERATION
HEART DISEASE CANCER

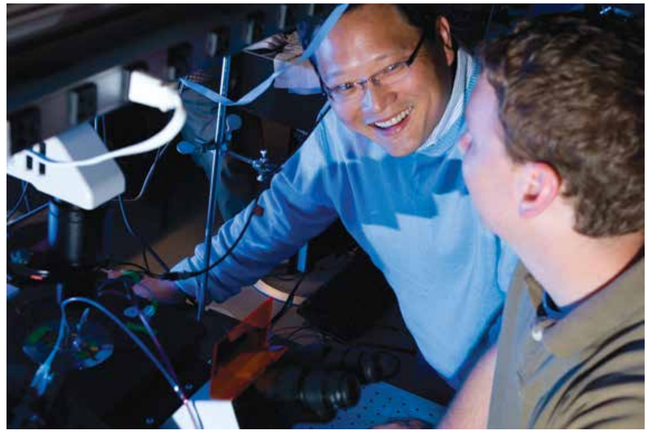
UNIVERSITY OF CALIFORNIA SANTA BARBARA
EMBODI
Engineering • Medicine • Biology • Discovery • Innovation

THIS IS THE NEW MEDICINE

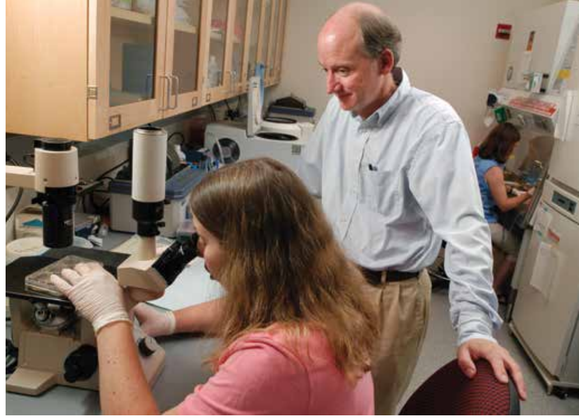
ALZHEIMERS DIABETES
DRUG DELIVERY BRAIN
QUANTITATIVE BIOLOGY

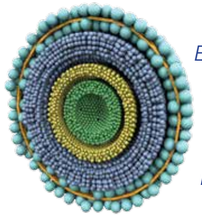
COLLABORATING FOR A CURE FOR BLINDNESS

Among the most influential leaders in stem cell research worldwide, UC Santa Barbara's researchers are spearheading the charge in regenerative medicine. Dennis Clegg (left), Tom Soh (middle), James Thomson (upper right), and Peter Coffey (lower right), are as versatile as the pluripotent stem cells they are studying. These award-winning faculty are passionate about understanding the complexities of human vision and finding cures for neurodegenerative diseases. They feed on each others' strengths and have been drawn together because they recognize that this combined passion and creativity will lead to discovery, and, ultimately, a cure.

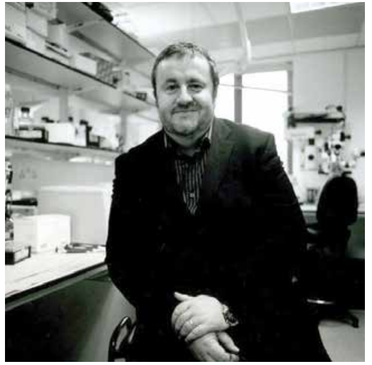


A stem cell is essentially a "blank" cell, capable of becoming another more differentiated cell type in the body, such as a skin cell, a muscle cell, or a nerve cell. They can serve as a built-in repair system for the human body, replenishing other cells as long as a person is alive. Stem cell research and treatments represent perhaps mankind's greatest opportunity to fulfill the ancient call to "heal the sick," relieve suffering, and improve the quality of life for an untold millions of people.





Every day, the cells essential for vision, called photoreceptors, shed their outer layer. And every day, a layer of cells just below these photoreceptor cells consumes the discarded shells. But with Macular Degeneration the shells are not removed and the resulting toxins eventually kill the cells.



stemcell.ucsb.edu

COLLABORATING WITH LIFE

*Hanging with friends in the food court **and** having a snack can be possible for people with Type 1 diabetes thanks to the Artificial Pancreas System in development at UC Santa Barbara.*

Imagine every hour of your entire life controlled by diabetes. Imagine not stopping for a latte with your best friends on a long road trip. Imagine waking up in the middle of the night to inject yourself with insulin so you will make it until breakfast. UC Santa Barbara's Professor Frank Doyle (far right) and Sansum Diabetes Research Institute's Dr. Howard Zisser (right) are leading clinical trials in Santa Barbara, in collaboration with a global research team, on the first Artificial Pancreas System, which uses sophisticated algorithms to monitor and respond to blood glucose changes automatically.

Imagine a child who can grow up without worry, or someone who can finally travel or work after living with Type 1 diabetes for 30 years.

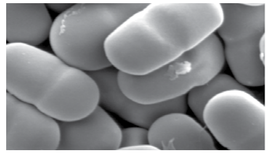
UC Santa Barbara's research will give people with Type 1 diabetes their lives back.

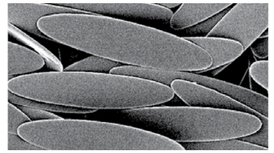
thedoylegroup.org

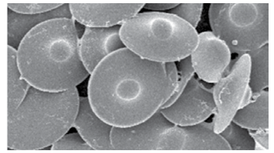
UC Santa Barbara's intelligent Artificial Pancreas System will be the solution for over three million Type 1 diabetes sufferers in the United States, and many more worldwide.

BOTTOMLESS BLOOD BANK

Millions of patients need blood transfusions each year to replace two of the body's most important cells; red blood cells and platelets. Yet limitations imposed by the supply shortage, infections, and donor-mismatch pose hurdles to getting these life-saving cells to patients when they need them. UC Santa Barabara researcher Samir Mitragotri and his colleagues are working on an engineering solution to this problem; making artificial red blood cells and platelets. Their artificial cells look remarkably similar to their natural counterparts and can mimic their key functions as well. In addition, they can do what natural cells cannot. They can carry drugs and imaging agents that can help detect damage to the blood vessels and treat them when needed.

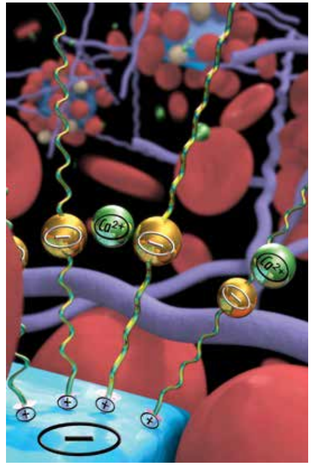






UFOs, prolate ellipsoids, oblate ellipsoids, elliptical disks, and rectangular disks are just some of the microparticle 'shapes' that have been developed to help with therapeutic drug encapsulation.

bioengineering.ucsb.edu/research

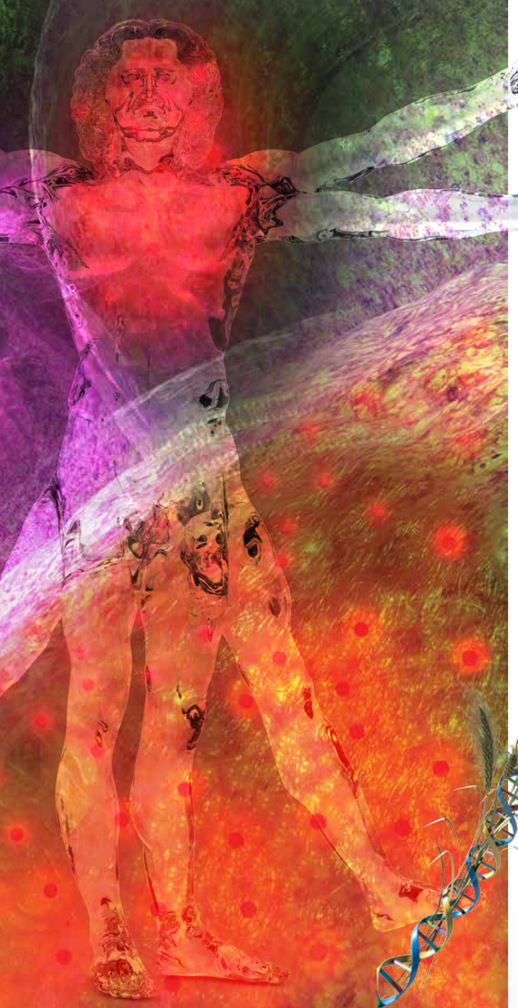


THE PATHWAY TO SURVIVAL

Severe battlefield injuries present unique problems in stemming blood loss, which is the primary cause of combat deaths. Medics may have less than two minutes to stop blood loss before death is imminent. However there is a very fine line between bleeding to death and developing fatal blood clots. The coagulation pathway is complex and recursive. It took a whole new approach to develop a solution for such a delicately balanced system. Lives are being saved around the world because of the research done at UC Santa Barbara.

Professor Galen Stucky was honored for his role in the development of a blood-clotting gauze that is helping save soldiers who suffer severe, life-threatening injuries in Iraq and Afghanistan.

convergence.ucsb.edu/article/life-saving-sand

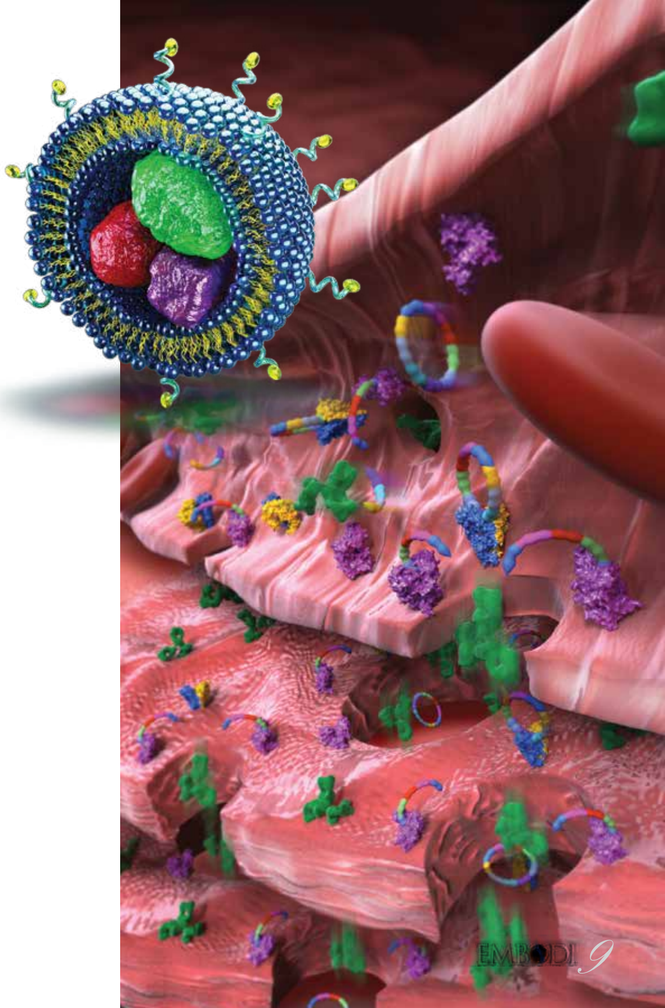


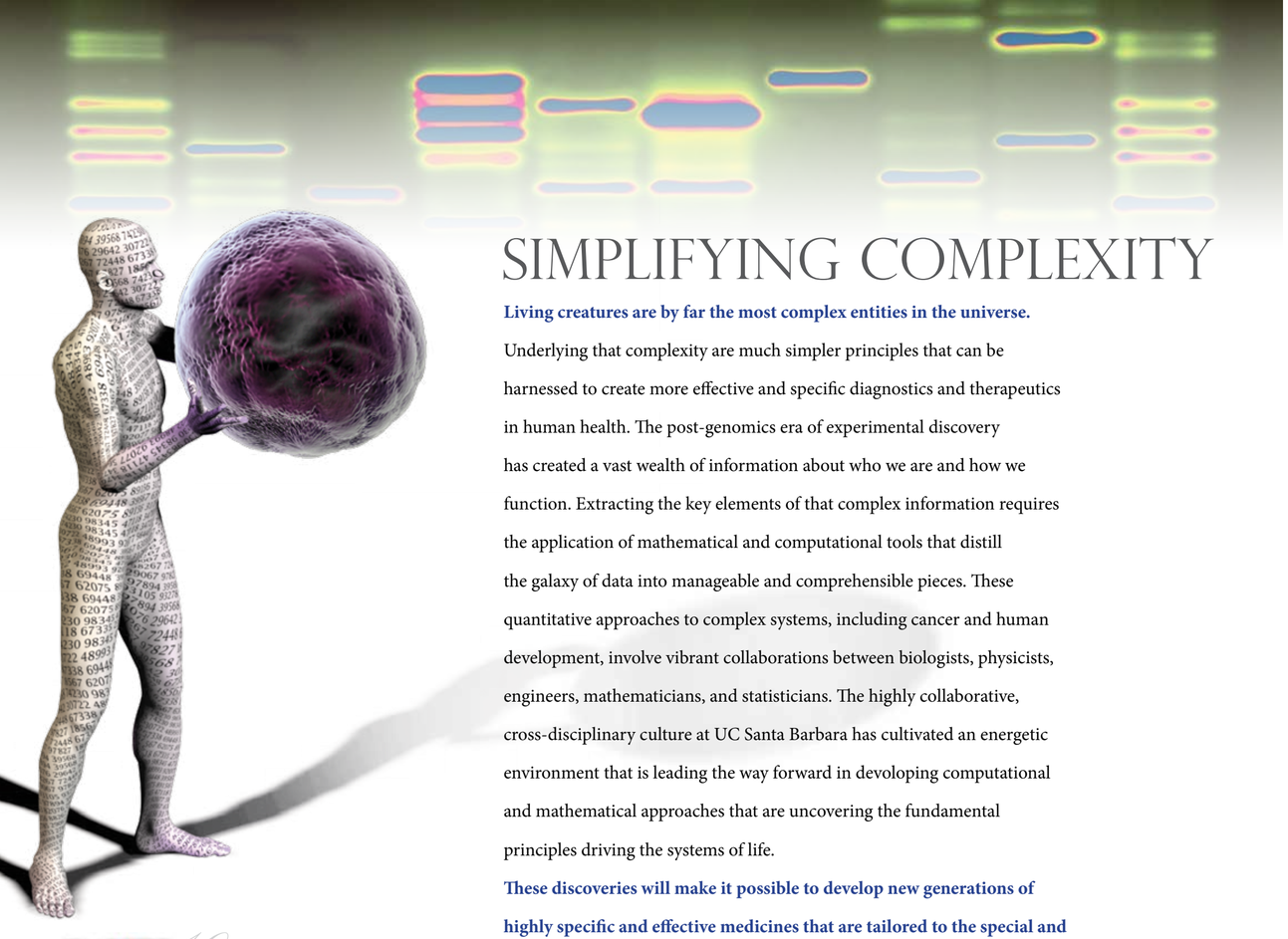
THE NEXT GENERATION OF CURES

The Center for Nanomedicine is dedicated to developing the next generation of diagnostics, therapies, and ultimately, cures for human diseases, improving the quality of life and creating a legacy for humanity. Cardiovascular disease, sepsis, neurodegeneration, autoimmune diseases, cancer, and many other egregious diseases do their best to thwart us at every turn. We cannot approach these life-threatening illnesses the same way we always have. **We must look at the entire system and then be prepared to treat the disease in revolutionary ways.** Jamey Marth and his colleagues are doing just that. By utilizing nanotechnology, they are providing methods that yield less diffuse delivery of medications, resulting in less stress on the human body and more successful medical outcomes.

Dr. Erkki Ruoslahti, (left) is a Distinguished Professor at the Sanford-Burnham Medical Research Institute at the University of California, Santa Barbara. Dr. Ruoslahti's pioneering discoveries have advanced our understanding of cancer and opened a new age in cancer diagnostics and therapeutics, paving the way for more effective and curative treatments in the era of nanomedicine. His colleague, and Director for The Center for Nanomedicine, Dr. Jamey Marth, (right) develops and applies nanotechnologies to identify the causes of grievous diseases including diabetes, autoimmune disease, cancer, and the lethal complications of infection. Identifying disease origins is essential for better diagnostics, more effective treatments, and ultimately, curative approaches.

cnm.ucsb.edu





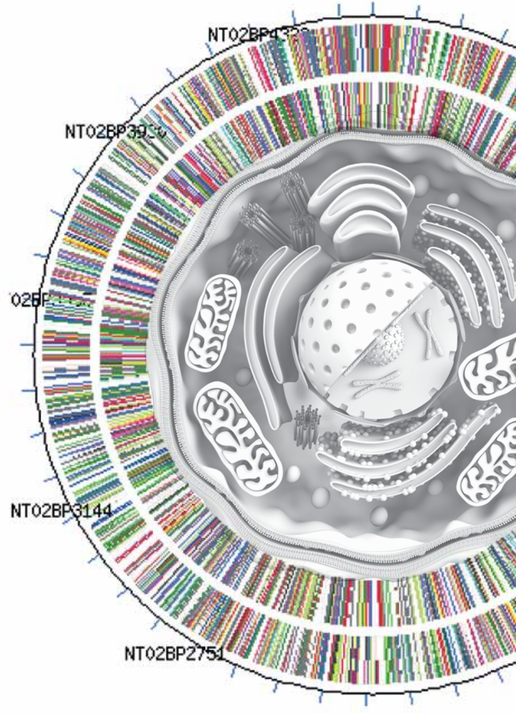
SIMPLIFYING COMPLEXITY

Living creatures are by far the most complex entities in the universe.

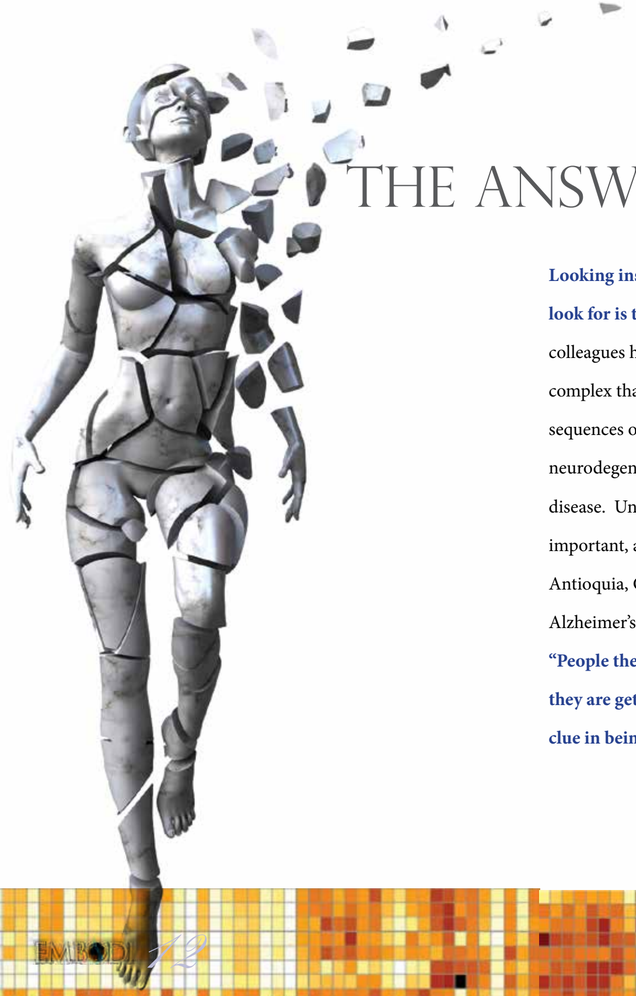
Underlying that complexity are much simpler principles that can be harnessed to create more effective and specific diagnostics and therapeutics in human health. The post-genomics era of experimental discovery has created a vast wealth of information about who we are and how we function. Extracting the key elements of that complex information requires the application of mathematical and computational tools that distill the galaxy of data into manageable and comprehensible pieces. These quantitative approaches to complex systems, including cancer and human development, involve vibrant collaborations between biologists, physicists, engineers, mathematicians, and statisticians. The highly collaborative, cross-disciplinary culture at UC Santa Barbara has cultivated an energetic environment that is leading the way forward in devoloping computational and mathematical approaches that are uncovering the fundamental principles driving the systems of life.

These discoveries will make it possible to develop new generations of highly specific and effective medicines that are tailored to the special and individual genetic make-up of each person.

Why model organisms?
UCSB systems biologists, including Professor Joel Rothman, learn how humans work by studying simpler animals such as *C. elegans*, a roundworm that has been the focus of the research of six Nobel prizewinners. The biological machinery that, when broken, leads to cancer, neurodegeneration, and many other diseases can be powerfully dissected with this little creature.



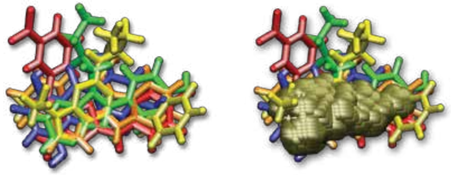
mcdb.ucsb.edu/research/systems-quantitative



THE ANSWERS FOR ALZHEIMER'S

Looking inside a living neuron is a tricky endeavor. Knowing what to look for is the second part of the puzzle. Ken Kosik (far right) and his colleagues have figured out how to do both. Kosik has engineered a peptide complex that can directly visualize translocation of untranslated RNA sequences on living neurons. Understanding the cellular mechanisms of neurodegeneration is a critical path in finding the cure for this crippling disease. Understanding the genetic pathways for the mechanism is equally important, and toward that end, Kosik is studying a small community in Antioquia, Colombia whose familes have been struck with Early-onset Alzheimer's for many generations.

"People there are getting the disease generation after generation because they are getting a mutation in one of their genes. It gives us a very big clue in being able to predict who's going to get it," says Dr. Kosik.



When protein units associated with nerve activity lose their plasticity, the nerves are no longer able to perform functions that are involved in memory and normal day-to-day activities.

Edilma suffers from Early-onset Alzheimer's disease. Among her symptoms are depression and forgetfulness. Her father also died of Alzheimer's. Finding the gene mutation that is passed down through generations in Antioquia, Colombia may provide the key for a treatment for future generations.

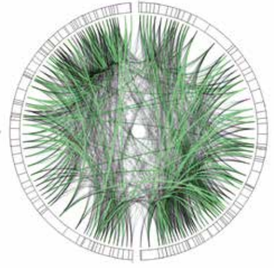
lifesci.ucsb.edu/mcdb/labs/kosik/news.html

GETTING INSIDE YOUR HEAD

Your mental life rides atop one of the most complex systems known: Your brain. Scott Grafton and colleagues at the UC Santa Barbara Brain Imaging Center (BIC) seek to understand what is going on inside your brain that allows this remarkable capacity. BIC's scientists and engineers, spanning brain sciences, engineering, and physics, use high performance MRI scanning to measure the anatomic and functional properties of the brain. Rapid progress in data modeling shows how information flow propagates in the brain and sustains complex behaviors. These methods from systems modeling are used to predict how well healthy people can learn and whether patients who have sustained a stroke will recover or benefit from therapy. The Center investigators are pushing MRI methods to the limits of sensitivity to enhance the detection of minute changes to brain architecture. This is used to identify significant damage in people who have sustained concussion or mild head injury.

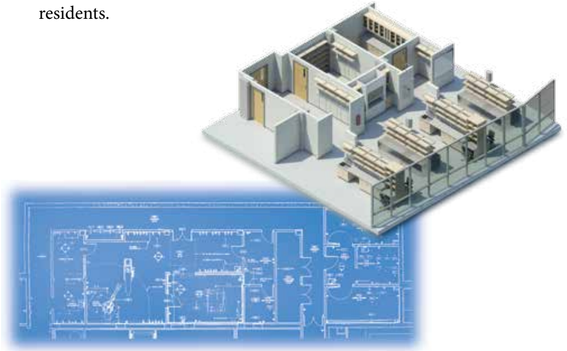
bic.ucsb.edu

State-of-the-art MRI scans generate rich measurements of dynamic brain data. MRI data can be modeled with high performance cluster computing to build models of brain wiring and patterns of connectivity. Simultaneous MRI and EEG scanning enhances the mapping of brain dynamics.



THIS IS ABOUT YOU

Translational medicine is woven throughout all of EMBODI–leveraging a **patient-centered approach to expediting the application of medical research, particularly to the community hospital setting.** Partnering with practicing physicians, patients, and with experts from around the world, UCSB is setting the precedent for working with community patient populations. A new state-of-the-art **hybrid operating room** will provide a 'collision' space to develop diagnostics, treatments, cures, more efficient protocols, and educational opportunities for students and residents.



tmrl.ucsb.edu

The technology developed by Patrick Daugherty at UCSB was found to be exactly what the international research community on pre-eclampsia was looking for, and the data discovered from patients right here at Cottage Hospital drew attention from around the world. "I think we are just seeing the early stages of something that could be really big. Therapeutics are on the horizon."

Dr. Alex Soffici, Director,
Maternal-Fetal Medicine,
Cottage Hospital

THE UNIVERSITY FOR THE FUTURE

A space where further collaboration occurs is critical to our continued success. The EMBoDI members and partners have designed a building that encourages creativity and a sound scientific method. It will house faculty, students, and industry partners with a vision and passion for changing the face of medical research and treatment.

science.ucsb.edu **engineering.ucsb.edu**

UC Santa Barbara is widely recognized as one of the premier research universities in the world. Looking forward, we are now embracing a new range of challenges in ways that promise to expand knowledge, find new solutions, and improve the quality of life for the people of California, our nation, and the world.

Your visionary support will help us recruit and retain brilliant faculty, highly motivated students, and enhance our research and education programs.

You will radically change the way we confront medical conditions that impact millions of lives worldwide.

ENGAGED AT EVERY LEVEL

UC Santa Barbara's leaders are enthusiastic champions of collaboration and the critical role of partnership in medical breakthroughs. They recognize the necessity and urgency to secure the private resources required to unravel the complexities of today's medical conditions.

Invest in manifesting the solutions.

UC Santa Barbara's Chancellor Henry Yang (left), Pierre Wiltzius (middle), the Susan and Bruce Worster Dean of Science and Professor of Physics, and Rod Alferness (right), the Richard A. Auhll Professor and Dean of the College of Engineering.

Undergraduate Chemical Engineering intern Ashwini Ashokkumar is studying ultrasound assisted chemotherapy for brain tumors.

THE PROMISE CONTINUES

*"Our legacy is the promise of the highest standards of excellence, opportunity, and innovation. The Campaign for the University of California, Santa Barbara ensures that during our time and for all future generations...*The Promise Continues."

THE CAMPAIGN FOR THE
University of California
Santa Barbara

Henry T. Yang
Chancellor

ia.ucsb.edu/campaign

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