

SATELLITE PHOTO COURTESY OF THE U.S. GEOLOGICAL SURVEY

You live at the
center of a
biomedical revolution.



Stanford | MEDICINE
LEADING THE BIOMEDICAL REVOLUTION

A revolution

is happening
in your backyard.



“Right here in our community, the brightest minds in biomedicine and brilliant Silicon Valley innovators are making breakthroughs that are transforming human health around the world.”

Lloyd B. Minor, MD
Dean
Stanford University
School of Medicine

“Our mission is to heal humanity with science and compassion, one patient at a time. That means ensuring that every patient benefits from the latest biomedical advances. It also means making sure their unique emotional needs and those of their family are met.”

Amir Dan Rubin
President & CEO
Stanford Hospital
& Clinics

“The nurturing care we provide to children, their families, and expectant women is the foundation for healthier, happy lives. We’re here every step of the way—whether a patient’s condition is rare or routine—to help families start strong and stay that way.”

Christopher G. Dawes
President & CEO
Lucile Packard
Children’s Hospital
Stanford and Stanford
Children’s Health

As profound and far-reaching as the digital revolution, the biomedical revolution is resulting in an explosion of knowledge about life and how it works. Breathtaking advances in imaging, genomics, bioinformatics, and stem cell medicine are offering up possibilities that were unimaginable just a few years ago. New tools that will allow us to not only heal disease, but to predict and prevent it, are finally within our reach. This is more than just a revolution in science and health care—it’s a revolution in the human condition—and Stanford Medicine, amplified by the astounding intellectual and technological capital of Silicon Valley, is leading the charge.

Read on to discover what’s happening at Stanford Medicine and learn about the breakthroughs being made every day right here in the valley. From fueling disruptive innovation in order to solve life’s deepest mysteries, to building two new hospitals that will be models of what health care can and should be in the 21st century, we’re shaking up the science and practice of medicine to help families here, and around the world, stay healthy.



Two Nobel Prizes in 2013.

In October of 2013, two more professors at Stanford University School of Medicine became Nobel laureates. Michael Levitt, PhD, was awarded the prize in chemistry while Thomas Südhof, MD, won the prize in physiology or medicine. Along with Brian Kobilka, MD, who was awarded the 2012 prize in chemistry (read about him on the next page), these two exceptional scientists bring the number of Stanford faculty who have won the Nobel Prize to 31. Thanks to their work and the work of their colleagues, our knowledge of life, disease, and health is growing faster than ever before.

Michael Levitt, PhD, simulates the chemistry of life. Thomas Südhof, MD, reveals the secrets of synapses.

IN THE OLDEN DAYS, scientists used plastic balls and sticks to visualize organic molecules and how they interact to drive all of life’s processes. Now, thanks in part to work that won Michael Levitt and his colleagues a Nobel Prize, they use supercomputers and sophisticated algorithms.

Levitt, a professor of structural biology at Stanford University School of Medicine, develops software that models chemical reactions between large, complex molecules more quickly and accurately than ever before. With fellow laureates Martin Karplus, PhD, of the University of Strasbourg in France and Harvard University, and Arieh Warshel, PhD, of the University of Southern



California, he has helped transform not just our understanding of the chemistry of life, but the way we

discover and develop new drugs.

Levitt’s path to the Nobel started in 1967, when he and Warshel wrote a program to model the structure of large molecules. Based on classical Newtonian physics, it provided an accurate picture of molecules at rest, but it couldn’t simulate chemical reactions between molecules. Karplus and Warshel then used Levitt’s program to develop an algorithm that incorporated quantum physics to explain the atomic forces working on molecules during chemical reactions. The approach worked, but the complexity of the quantum mechanics driving these interactions took tremendous processing power to simulate.

Finally, Levitt and Warshel came together again and created a new, hybrid program. An innovative combination of static Newtonian modeling and dynamic quantum modeling allowed researchers to simulate reactions quickly and accurately, regardless of the size or complexity of the molecules involved. For the first time, researchers were able to see even the most complex chemical reactions in striking 3-D detail from start to finish.

It was a tremendous accomplishment, and Levitt feels the computer industry deserves a large part of the credit. “Computers and biology go together,” he says. “Biology is very complicated, and computers are such wonderful, powerful tools. And, they just keep getting more and more powerful.”

“UNDERSTANDING HOW THE BRAIN WORKS is the most fundamental question in neuroscience,” says Thomas Südhof, Stanford professor of molecular and cellular physiology and 2013 winner of both a Nobel Prize and a Lasker Award. To advance that understanding, Südhof has spent the past 30 years scrutinizing synapses.

Synapses are the tiny gaps between neurons (nerve cells) and are

the junctions where information, in the form of chemical messengers called neurotransmitters, is passed

from one neuron to another. The simple act of taking a step forward, experiencing a fleeting

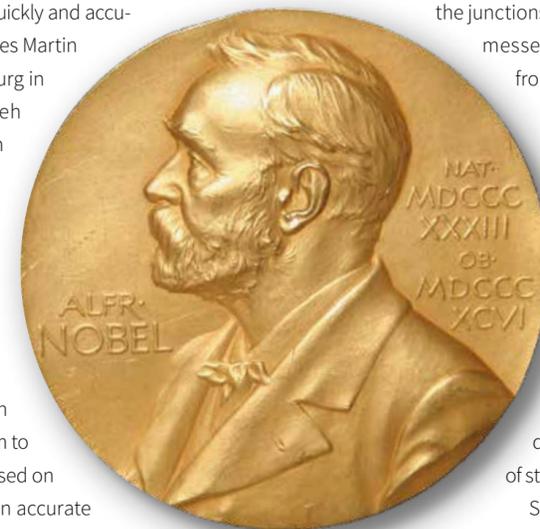
twinge of regret, recalling an incident from your morning commute, or tasting a doughnut requires millions of simultaneous and precise synaptic firing

events throughout the brain and peripheral nervous system. Your brain likely holds two quadrillion synapses—10,000 times the number of stars in the Milky Way.

Südhof’s work has helped illuminate how neurotransmitters like dopamine and serotonin are passed from

the inside of a neuron, through its cell membrane, and into the synaptic gap where they can pass their message on to the next neuron. As a result, synaptic transmission is one of the best understood phenomena in neuroscience. Given that the firing patterns of synapses determine consciousness, emotions, and behavior, Südhof’s work has profound implications for conditions like depression and schizophrenia. Researchers also believe there is a link between synaptic transmission and diseases like Alzheimer’s and Parkinson’s. Südhof shares the prize with James Rothman, PhD, a former Stanford professor of biochemistry, and Randy Schekman, PhD, who earned his doctorate at Stanford under the late Arthur Kornberg, MD, another Nobel laureate.

“There is a tremendous gap between the need to understand diseases that affect the brain and the understanding that we have,” says Südhof, “not because of lack of effort, but because the problem is so daunting. I do think that our work will contribute a little to the task, which is enormous. I am convinced that will eventually lead to therapies.”



Blazing new trails

in human health.

From delving into the inner workings of individual cells to building a complete picture of the human immune system, Stanford scientists are expanding the frontiers of medicine.

Brian Kobilka, MD, scrutinizes how cells receive the signals we need to send.

“A MOLECULAR MASTERPIECE.” That’s how the Nobel committee described the image that earned Brian Kobilka and his colleagues the 2012 Nobel Prize in chemistry.

After more than 20 years of Herculean effort, Kobilka, professor and chair of molecular and cellular physiology and the Hélène Irwin Fagan Chair of Cardiology, did what many thought impossible. He and his team took an atomic snapshot of a G-protein coupled receptor, just as it transmitted a signal.

G-protein coupled receptors (GPCRs) are molecular complexes embedded in the outer membranes of cells. They are tiny relay stations that receive chemical signals from outside the cell and transmit them inside. GPCRs are the largest class of cellular receptors, and nearly half of all drugs target them. The GPCR Kobilka’s team captured is the β_2 adrenergic receptor, which transmits signals from adrenaline and noradrenaline

hormones. A target for asthma drugs, it triggers the “fight-or-flight” reflex that accelerates heart rate and opens airways.

But getting a picture of it wasn’t easy. First, large amounts of the receptor had to be produced via recombinant DNA. Then it had to be purified, locked in its “on” position, and crystallized before being bombarded with X-rays from hundreds of angles. Finally, like recreating a sculpture from only its shadows, the image had to be extrapolated from all the diffraction patterns the X-rays produced as they hit the crystals.

Even though GPCRs play a central role in a staggering number of life’s processes, we’ve never been able to see them in action on a molecular scale. Now, thanks to Kobilka’s tenacity, we have an exquisitely detailed 3-D picture we can use, along with computer modeling, to design better drugs. 



Lucy Shapiro, PhD, untangles the genetic circuitry that makes life possible.

LIFE IS A COLLABORATION among thousands of genes, all working together to produce a functioning organism. Lucy Shapiro, the Virginia and D. K. Ludwig Professor of Developmental Biology and a 2013 National Medal of Science winner, studies bacteria to learn how genes orchestrate all the complexities of life. Her work has resulted not only in new insights into how life works, but strategies to design new antibiotics.

“As time goes by,” Shapiro says, “every single available antibiotic is becoming increasingly useless.” Every year at least 23,000 Americans die of drug-resistant bacterial infections, and the approaches currently used to discover new antibiotics are failing. But with their research on the bacterium *Caulobacter crescentus*, she and her colleagues are finding new approaches to this global problem.

Working with her husband, physicist and professor of developmental biology Harley McAdams, PhD, and their combined research teams, Shapiro

mutated *Caulobacter* cells so that each had a snippet of artificial DNA inserted at a random spot around its single, ring-shaped chromosome. Tagged to be found later, these segments disrupted genetic function wherever they landed. After letting the cells multiply for a few days, the teams sequenced the DNA of the survivors. Genes that tolerated the insertion of artificial DNA weren’t essential for viability, while those that didn’t tolerate it were essential. The essential genes comprised 12 percent of *Caulobacter*’s genome, and many were part of a complex genetic circuit that integrates multiple cell functions.

With this technique, they can quickly identify which genes are essential for survival in almost any microbial species. They can then target the functions those genes control to create antibiotics that are “resistant to resistance” because they attack multiple vulnerabilities simultaneously. They already have candidates in clinical trials. 



Matthew Porteus, MD, PhD, cuts and pastes DNA to fight HIV, sickle cell anemia, and other diseases.

PERSONALIZED MEDICINE—treatments tailored to individual patients—is the focus of the collaborative research conducted in Stanford’s Pediatric Cancer Biology Program. Among this cadre of researchers is Matthew Porteus, associate professor of pediatrics, who is developing an exciting new approach to gene therapy.

“The traditional approach is to use a genetically engineered virus to introduce a healthy version of a damaged gene into a patient’s DNA,” says Porteus. “That works for certain diseases, but the worrisome thing is that you can’t control where the virus enters the genome. It sometimes activates the normal genes, causing the cell to become cancerous.”

Instead of using a virus, Porteus and his team are exploring a cut-and-paste approach to gene therapy. The first step is to extract diseased cells from the patient. Next, they inject the cells’ DNA with engineered proteins

that recognize the target gene, split it in half, and then replace it and paste the healthy DNA back together.

Porteus and his team have used the technique to insert a series of HIV-resistant genes into T cells, specialized immune cells targeted by the AIDS virus. The new approach could ultimately replace drug treatment, where patients have to take multiple medications daily to keep the virus in check and prevent the potentially fatal infections wrought by AIDS. While this new approach won’t cure HIV and requires a labor-intensive, tailored approach for each patient, it would save patients from a lifelong dependence on antiretroviral drugs, which have adverse side effects.

The technique is at an early stage, but Porteus and his team are optimistic. They hope to begin clinical trials for HIV in three to five years and are working to adapt the technique to treat sickle cell anemia and hemophilia. 



Carlos Esquivel, MD, PhD, works to predict and prevent cancer in young transplant recipients.

PREDICTION AND EARLY DETECTION of a high-risk childhood cancer are the goals of an ambitious new study led by scientists at Lucile Packard Children’s Hospital Stanford and the School of Medicine. The study targets a form of cancer that strikes children who have received solid organ transplants.

While immune-suppressing medications keep their transplanted organs safe, these children are vulnerable to a cancer caused by an inappropriate immune system response to a common virus.

The cancer, called post-transplant lymphoproliferative disorder (PTLD), is a malignancy of the white blood cells. At present, doctors cannot tell which young organ recipients are likely to develop PTLD, and often the cancer cannot be detected until it causes clinical signs or symptoms. The cancer’s mortality rate can be as high as 35 percent. About 150 children develop the cancer each year in the United States, and many more are at risk.



“We want to develop assays so that we can identify children who are at risk for PTLD before they even develop the disease,” says Carlos Esquivel, a liver transplant surgeon at Lucile Packard Children’s Hospital Stanford, and principal investigator of the new study.

The scientists will also investigate a possible PTLD marker that may allow them to find the cancer before it causes symptoms, said Esquivel. “With these tests, we might be able to modify the child’s immunosuppression or take other preventive or early-treatment measures.”

Daniel Bernstein, MD, a professor of pediatric cardiology who co-directs the study with Esquivel, adds, “Our study is unique in that it is bringing to bear Stanford’s incredible expertise in the basic sciences of immunology, virology, and cancer to try to answer a critical clinical question that disproportionately affects children.” 

Kari Nadeau, MD, PhD, finds new ways to protect kids from dangerous food allergies.

SEVERE PEANUT ALLERGIES CAN BE DEADLY and treating them is difficult. The only option is a still-experimental therapy known as oral immunotherapy, in which a patient consumes tiny, gradually increasing doses of peanut powder under a doctor’s supervision. After months or years of successful treatment, patients must eat a small amount of peanuts every day for the rest of their lives, or risk regaining their allergy. “At first, eating two peanut butter cups a day might seem fun, but it gets a little boring and a lot of people might stop,” says Kari Nadeau, an associate professor of pediatrics and an immunologist at Stanford Hospital & Clinics and Lucile Packard Children’s Hospital Stanford.

So Nadeau and her team developed a potential blood test to see which patients can safely stop eating peanuts without losing their peanut tolerance. Their study, published in the *Journal of Allergy and Clinical Immunology*,



found that differences in the DNA of certain white blood cells separated patients who kept their immune tolerance from those who lost it after oral immunotherapy. The researchers saw epigenetic differences between the groups—genetic changes that affect the structure of the chromosome but not the gene sequence itself. The differences could be detected in small blood samples with commonly available lab equipment, pointing the way to a possible clinical test.

“It’s interesting that the change we saw is at the epigenetic level,” Nadeau says, referring to changes in gene activity and expression caused by factors other than DNA sequence. “This might help us tell people if they can safely go off of immunotherapy, or if they need to continue to eat the food every day.” The blood test, which needs FDA approval before it can be used clinically, could also help determine if some individuals would benefit from longer courses of immunotherapy. 

Mark Davis, PhD, illuminates the “black box” of the human immune system.

WHY DO KIDS EAT DIRT? Mark Davis, the Burt and Marion Avery Family Professor of Immunology, may know why. Our immune systems are incredibly complex learning machines. They “remember” all the pathogens we encounter so they can fight them off in the future. Davis suspects the urge to make (and eat) mud pies might have evolved to train our immune systems to meet the challenges of life in a messy world.

Despite the central role it plays in our health, immunity is so complex that most of its inner workings are still a mystery. Plus, much of our understanding is based on a mouse model, and while laboratory mice have served us well in our efforts to understand the basic principles of immunity, they aren’t very much like us. Bred to be genetically similar, they live their entire lives in sterile, controlled environments. That’s a far cry from how we were raised, no matter how spotless our parents kept the house. We’re exposed to thousands of germs every



day of our lives. We’re also genetically diverse, which begs the question: How much can we really learn about human immunity from mice? Davis thinks we should look to ourselves for answers. He calls his approach “immunity taught by humans,” and with technology developed at Stanford, he and his team are digging into immunity like no one ever has before.

At the Stanford Human Immune Monitoring Center, his team can take more than 50,000 different measurements from one blood sample—more than a hundred times the information in a typical blood panel. By casting such a broad net, they can analyze immunity in incredible detail, and not just on an individual level. Working with big-data experts like Atul Butte, MD, PhD (see next page), they’re comparing millions of data points from thousands of patients and healthy people to establish a baseline picture of a normal immune system. From there, real understanding of how immunity works will finally be within reach. 

● Harnessing the power of big data.

The Oxford-Stanford Global Institute for Data Science and Human Health is a collaborative effort to use big data to improve health around the world.

“BIG DATA WILL CHANGE EVERYTHING!” That’s the rallying cry of the digital revolution. It’s also the call to arms for the biomedical revolution, where big data promises everything from faster discoveries to better clinical trials to cheaper care. But how do we turn these lofty promises into concrete realities? Where do we start?

This is precisely the kind of large, complex challenge at which Stanford Medicine excels. With our engines of basic and translational research, our computational expertise, our ties to Silicon Valley, our history of tackling society’s big, intractable problems—and now, our partnership with University of Oxford—we’re formulating the best methods for putting big data to work for patients everywhere.

With Oxford, we’re creating an open source blueprint to serve scientists and clinicians around the globe. We’ll assemble the data sets, develop the tools and technologies, deliver the diagnostics and treatments, and train the next generation of talent. It will all be freely available—and built on the conviction that if we work together, we’ll realize big data’s power to relieve human suffering much faster than if we act alone. ♥

Atul Butte, MD, PhD, explores huge data sets to find life-saving patterns.

A DIGITAL TREASURE HUNTER, Atul Butte, chief of systems medicine and associate professor of pediatrics and of genetics, spends his days diving into oceans of data in search of new ways to improve health for both children and adults. Teasing out hidden patterns and correlations, he is on an endless quest for fresh insights.

A tsunami of medical data is crashing all around us. Since the advent of electronic medical records, virtually every patient leaves a detailed



data trail. These days, everything gets saved. Prescriptions, test results, imaging studies, clinical trials data, DNA sequences, and more all end up in vast

“Hiding in these seas of data is knowledge that could change a patient’s life—or the entire world.”

databases, contributing to a flood of information that’s growing by a zettabyte (10^{21} bytes or a billion terabytes) every year.

Making sense of all this data and putting it to work for patients is no small task. That’s where a visionary like Butte, supported by Stanford’s world-class programs in computer science and quantitative analysis, has an edge. With a multidisciplinary crew of collaborators, Butte searches these seas of information for what he calls “biomedical moments.”

These moments are tipping points—crucial times when things can either go well or wrong for patients—and precious insights often hide

in the data surrounding them. “We want to know what will keep patients on the right track to a good outcome,” Butte says, “and these moments tell us where to look.”

Butte calls his approach “data-driven systems medicine,” and it’s yielding valuable results fast. By comparing data from thousands of cancer patients with data on hundreds of FDA-approved drugs, he and his team found that desipramine, an antidepressant that’s been in use for years, has a surprising side effect. It kills certain lung and neuroendocrine tumors. They tested the effect and began phase 2 clinical trials in less than a tenth of the time and for a fraction of the cost it takes the pharmaceutical industry

to start trials on a new drug. And that’s just one example of many.

A wildly productive bunch, Butte and his team average a new publication every 16 days, and have recently spun out three investor-backed startup companies. They can move at this blistering pace because they don’t have to start with long, expensive laboratory experiments to gather the data they need to test their ideas. It’s already out there, much of it in public databases, just waiting for someone to ask the right questions of it.

“I think of it as thawing frozen discoveries,” says Butte, who was named a 2013 Champion for Change by President Obama. “They’re in the data, waiting. All we have to do is find them.” ♥

A revolutionary hospital that redefines health care.

We live in a time of unprecedented possibilities for human health. Bioinformatics, genomics, and other emerging disciplines promise to transform the very concept of medicine—from treating disease after it has struck, to predicting it, preventing it, and promoting lifelong health. The new Stanford Hospital will make this bold vision of personalized medicine a reality. It will empower us to deliver compassionate, coordinated, leading-edge care, tailored to the unique needs of every patient. It will capture the promises of the biomedical revolution, translating the innovations of Stanford University and Silicon Valley into better health outcomes. A model of what health care can and should be in the 21st century, it will serve our community and the world for many decades to come.

The new Stanford Hospital **opens early 2018**



An innovative design that transforms care from the ground up.



PAVILION LEVELS

GARDEN LEVEL

TREATMENT LEVEL

ENTRANCE LEVEL

INSPIRED BY THE POSSIBILITIES of the biomedical revolution and the human needs of individual patients, architect Rafael Viñoly set out to completely reimagine what a hospital could be. The result is stunning and it embodies an entirely new approach, not just to hospital design, but to the delivery of care. In the new Stanford Hospital, healing will be an upward journey that begins the moment a patient arrives.

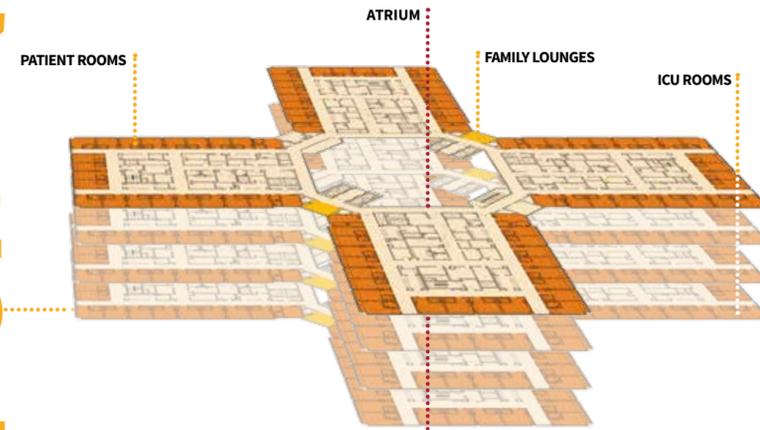
It starts on the first floor with the reassurance of a seamless admissions process in a calm space. Whether patients enter through the central atrium or the state-of-the-art Marc and Laura Andreessen Emergency Department, every detail will enhance their emotional and physical well-being. From heart attacks to earthquakes, the expanded Emergency Department and adjacent imaging center are engineered to meet all the needs of the community. Both will add critically needed capacity to the only level 1 trauma center between San Francisco and San Jose. And that capacity can scale up fast. In a disaster, the adjacent garage can convert into an extension of the Emergency Department with direct heliport access and drive-through triage capability.

One floor up, the Advanced Treatment Center will offer the most precise and powerful diagnostics and treatments available in hybrid interventional suites. These innovative suites will transform critical care medicine and revolutionize the treatment of strokes, heart attacks, traumatic injuries, and more by bringing the most advanced diagnostic and treatment technologies together. Afterward, patients can recover in individual rooms on floors four through seven in the Care Pavilions above. The fourth floor is dedicated entirely to intensive care.

Between the technology below and tranquility above lies an enormous rooftop garden. Here on the third floor, public and private spaces will merge in an oasis of trees, flowers, walking paths, and panoramic views, all carefully planned to promote healing. It's a design that will literally take health care to the next level—and make the new Stanford Hospital a global model of how best to heal both body and spirit. For more information, visit stanfordhospital.org.

- unique garden design
- central atrium fills the hospital with natural light
- powerful interventional center spans the entire second floor
- Emergency Department size more than doubles
- substantial increase in intensive care capacity
- individual patient rooms
- state-of-the-art imaging facility
- garage converts to disaster response center
- 824,000 square-foot facility
- opens early 2018

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care



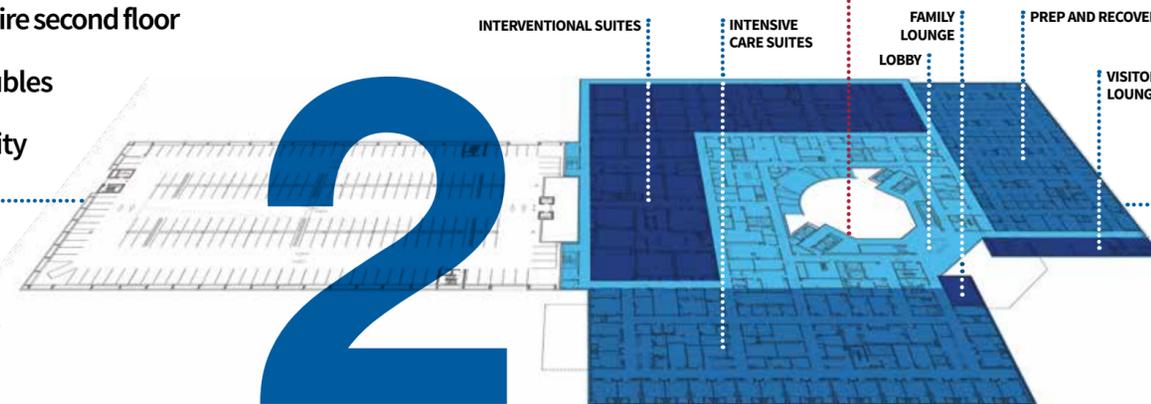
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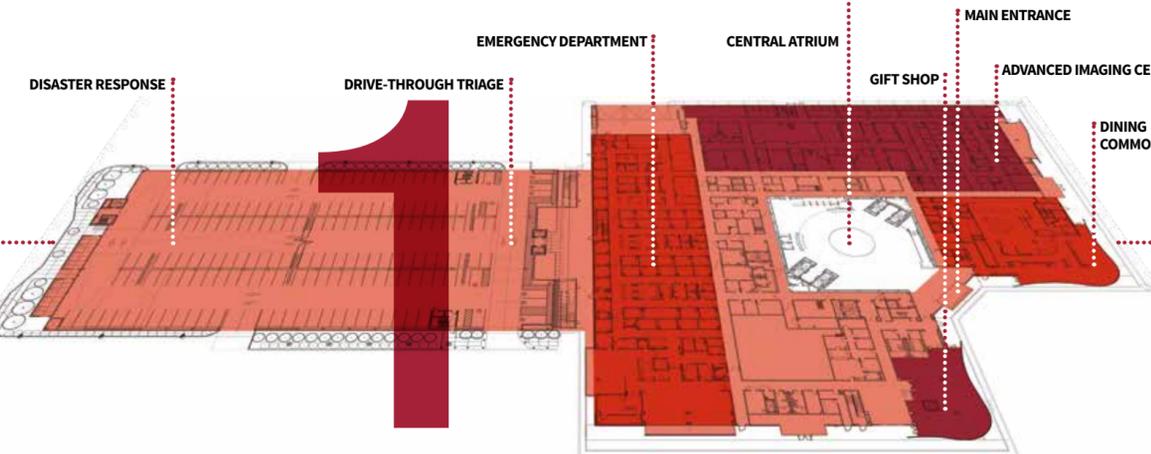
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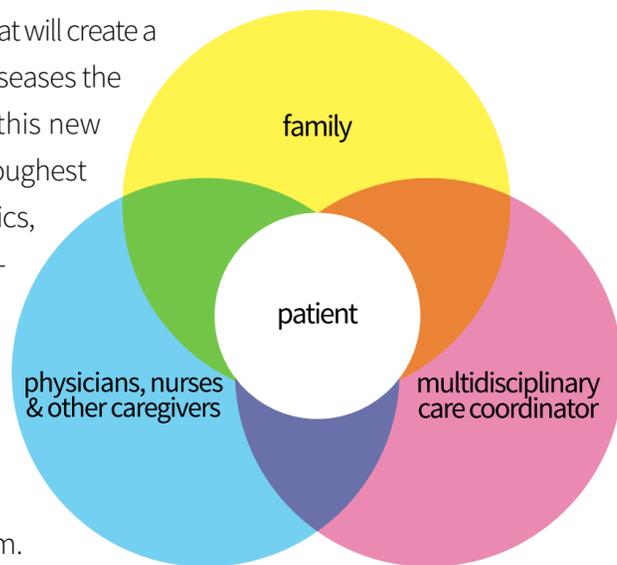
connect



Transforming cancer care.

“You have cancer.” These words will send shock waves through the lives of 1.6 million Americans next year. But we’re changing this. Through the power of Stanford innovation, the compassion of our caregivers, and a close partnership with our patients and their families, we are transforming daunting diagnoses into conditions that can be treated, managed, moved beyond—or even prevented altogether.

Transforming Cancer Care is a \$250 million initiative that will create a new standard of care for cancer and other complex diseases the whole world can follow. Personalized and precise, this new model will offer real hope even to those fighting the toughest cancers. It will capture the latest innovations in genomics, bioinformatics, imaging, stem cell medicine, immunotherapy, and more to transform not just the prognosis, but the experience of every cancer patient. With the most advanced science to fight their disease and compassionate support to help them cope, this new model will free patients to focus all their energy on what matters most—putting cancer behind them.



Stanford’s new cancer care model is centered on the needs of patients and their families. All the details will be managed by multidisciplinary care coordinators, professional navigators who will guide patients and their families every step of the way and ensure every aspect of their care is seamlessly coordinated.

Ravi Majeti, MD, PhD, rips away cancer’s disguise so the body can eat it.

“DON’T EAT ME!” That’s what CD47, a protein on the surface of baby blood cells, broadcasts to the immune system as these cells make their maiden voyage from bone marrow to spleen. Without this chemical signal, many normal cells like these could be mistaken for invaders and gobbled up by macrophages, the body’s roving cellular garbage disposals.

Researchers at Stanford’s Institute for Stem Cell Biology and Regenerative



Medicine found that leukemia cells also express a lot of CD47. Assistant Professor of Hematology Ravi Majeti and his team, with the leadership of the

“The minute we saw the cancer-killing potential of anti-CD47 treatments, we knew we had to get them to patients as fast as possible.”

institute’s director, Irving Weissman, MD, set out to discover if CD47 was the chemical disguise leukemia cells used to escape detection by the immune system.

Could they get macrophages to go after leukemia cells by silencing CD47’s don’t-eat-me signal? To find out, they injected mice with aggressive human leukemia cells. Then they treated the mice with an antibody Majeti, Weissman, and their colleagues developed that blocks CD47’s signal.

It worked. The majority of the mice were cured, and under the microscope, Majeti and his team could actually see macrophages feasting on

malignant cells. Meanwhile, others in Weissman’s labs started searching for CD47 in solid tumors and found it almost everywhere they looked. When they replicated Majeti’s methods, they had similar successes against more than 20 types of cancer, including breast, ovarian, liver, colon, prostate, bladder, and brain. The antibody shrank or even eliminated these tumors and prevented them from spreading.

And just this spring, Weissman’s labs showed silencing CD47 on cancer cells doesn’t just announce their presence to hungry macrophages; it gets killer T cells to attack them, too. Since T cells “remember,” this work could

make cancer vaccines to prevent recurrence possible. They’re also working with Kathleen Sakamoto, MD, PhD, chief of pediatric oncology at Lucile Packard Children’s Hospital Stanford, to find out if anti-CD47 treatments could help children with cancer as well as adults.

Majeti and his team were the first to reveal the key role that CD47 plays in cancer and the first to realize the huge therapeutic potential of silencing it. They’re about to start clinical trials of anti-CD47 treatments, just seven years after their initial findings. While that may seem like a long time, it’s just a third of the 20-plus years it typically takes to translate discoveries into treatments in a commercial setting. ❤️

Caring for today, building for tomorrow.



The Stanford Children’s Health network of care and, at its core, Lucile Packard Children’s Hospital Stanford, are internationally recognized leaders in world-class, extraordinary care in every pediatric and obstetric specialty from the routine to rare. Together with our Stanford Medicine physicians, nurses, and staff, we deliver innovative care and conduct research through partnerships, specialty clinics, and primary care practices at more than 100 locations, including the only pediatric emergency department on the Peninsula. As a nonprofit, we are committed to supporting our community—from caring for uninsured or underinsured kids, homeless teens, and pregnant moms to helping re-establish school nurse positions in local schools.

One of the nation’s top hospitals for the care of children and expectant moms, Lucile Packard Children’s Hospital Stanford is the only children’s hospital in Northern California with specialty programs ranked in this year’s *U.S. News & World Report* Top 10, and the only hospital in Northern California to win the national 2013 Leapfrog Group Top Children’s Hospital award for quality and patient safety. Learn more at stanfordchildrens.org.



The new Lucile Packard Children’s Hospital Stanford opens early 2017



Imagine a place designed for your family and the planet.

Lucile Packard Children's Hospital Stanford is building the most family-friendly, technologically advanced, and environmentally sustainable hospital for children and pregnant women in the nation. The \$1 billion expansion, set to open in early 2017, adds 521,000 square feet of building space, 150 new patient rooms, and more than 3.5 acres of healing gardens and green space.

This innovative new facility will enable our multidisciplinary teams to provide the most advanced care available to pediatric and obstetric patients in the Bay Area and beyond. It will add more beds, private rooms, state-of-the-art operating suites, and amenities for the whole family. It will also provide us with the flexibility to incorporate emerging technologies and provide our patients with seamlessly coordinated care.

"We designed this new hospital to meet the needs of our patients for many years to come," says Christopher G. Dawes, president and CEO. "It will incorporate the very latest diagnostic and treatment capabilities with the flexibility to change as technology changes. It will also provide more privacy and space for our patients and their families."

More than \$250 million has been contributed to the project by local philanthropists, including John and Susan Sobrato, the David and Lucile Packard Foundation, and key corporate partners.



PRIVATE PATIENT ROOMS

Single rooms will provide more space for families to be part of their child's healing process while reducing infection risks and improving efficiency. Pull-out double beds will allow moms and dads to stay overnight and family waiting areas will have tree-house-like views overlooking the gardens below.

STATE-OF-THE-ART TECHNOLOGY

Seven new operating rooms — with space to add more — will reduce scheduling delays and wait times. Two of these are specialized hybrid surgical suites with fully integrated advanced diagnostic MRI and angiography imaging equipment.



GREEN DESIGN

Sustainability is a driving force behind the design, which incorporates water-efficient systems, including a 110,000-gallon cistern to store enough rainwater to meet irrigation needs, and environmentally responsible landscaping that features drought-tolerant plants.

BRIGHT, OPEN SPACES

Research shows that a connection to the outdoors makes for healthier, happy people. That's why patient rooms will have large windows with views of the gardens and landscaping, while public spaces will have large glass walls and sliding doors that lead to decks and patios.



Families start strong at Lucile Packard Children's Hospital Stanford.



JUST 24 WEEKS INTO HER PREGNANCY, Colleen Doria and her husband Michael received devastating news: their baby, to be named Teagan, had a congenital heart defect called Tetralogy of Fallot with pulmonary atresia—meaning her pulmonary artery was completely missing. Doctors near their home outside New York City gave Teagan grim odds of surviving.

“They told us our baby would probably never leave the hospital,” says Colleen. “Or she’d go into hospice and pass away. They said that even if she had surgeries, she would still have a poor quality of life.”

Research led Colleen to remarkable success stories from the opposite side of the country—at Lucile Packard Children's Hospital Stanford. Frank Hanley, MD, director of the Children's Heart Center, had developed a complex but effective repair, called unifocalization, for patients with Teagan's condition. Hanley offered a very different prognosis to the first-time parents: a 98 percent chance of a positive outcome.

In a pregnancy like Colleen's, early and accurate diagnosis is critical, as are care collaboration and planning. The Center for Fetal and Maternal Health, under the medical direction of neonatologist Susan Hintz, MD, managed every aspect of care through a single point of contact, coordinating Colleen's care, housing, and insurance needs from across the country, and planning the delivery team and post-delivery neonatal intensive care.

“You need the human integration and the technological integration,” says Yasser El-Sayed, MD, obstetrician-in-chief. “What makes the difference is the breakdown of silos between disciplines.”

Stephanie Neves, administrative coordinator for the Center for Fetal and Maternal Health, was the point person for weekly updates sent by Colleen's obstetrician in New York. “Stephanie never spoke to us as though we should be scared. I could be a normal mom,” said Colleen.



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“We follow all our moms very closely,” says Neves. At least 40 percent come from more than 80 miles away, which makes housing arrangements especially important. “We worry about all the details so they don't have to.”

While Neves took care of logistics and cross-country communication, genetic counselor Meg Homeyer gathered the results of the tests Colleen had taken at a New York hospital. “If there is a genetic component that we can identify, it helps us explain to families what to expect and plan for,” says Homeyer. The Dorias were lucky. Though Tetralogy of Fallot is sometimes a consequence of DiGeorge syndrome, a widely variable, sometimes debilitating genetic condition, the test showed this was not the case for Teagan.

“We think about a complex fetal anomaly not just as a fetal problem, but as an issue for immediate post-delivery care and for childhood—what is best for the fetal patient, the baby and the child later on,” says Hintz, the center's medical director. “It's an enormously positive thing that we're involved in. We're helping to plan for the future of the family.”

In March 2012, the Dorias flew across the country to have their baby at Lucile Packard Children's Hospital Stanford. When Colleen and Michael arrived, all the planning was done. And when Colleen went into unexpected early labor, the teams were ready. Teagan was delivered by C-section, and then the neonatal intensive care unit team took over, closely

monitoring her to ensure she was getting enough oxygen.

The care team taught Teagan's parents how to care for her during the three months before her heart surgery. Hanley successfully performed the unifocalization surgery—the most complex procedure in congenital heart surgery.

Today, Teagan is living a happy, normal life. “When I take her out, her face just lights up,” says Colleen. “And she waves, like she's saying, ‘Hi everyone! I'm here!’”

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