Third Annual Autism Update
The Stanford Autism Center at Packard Children’s Hospital presents Advances in Science and Clinical Care for Autism Spectrum Disorders. Join us for a day exploring the latest scientific and clinical research. This conference is intended for parents, teachers, and care providers alike. For additional information, including registration, please visit psychiatry.lpch.org.
Saturday, May 15
Frances C. Arriaga Alumni Center, Stanford University

Heart to Heart: A Seminar on Growing Up for Parents and Kids
This informative, humorous, and lively discussion sets parents and their preteens on a straight course for talking about puberty, the opposite sex, and growing up.
Wednesdays, May 12 and 19
6:30 p.m., for girls and their mothers
Mondays, May 17 and 24
Fridays, June 4 and 11
6:30 p.m., for boys and their fathers
To register, please call (650) 724-3783

---

A New Online Home for Community Support
Have you visited the revamped supportLPCH.org? Our new online home for fundraising and community engagement launched this spring. We hope you’ve already had a chance to read stories about the impact of your support, check the events calendar, and meet some of our donors. On the site you can:
- Learn about gift options that best fit your philanthropic and financial goals
- Find the tools to help you make an informed decision
- Explore our event planning resources

Visit the revamped supportLPCH.org to stay connected and get more involved with Packard Children’s and the child health programs of Stanford School of Medicine. Have a look around, and share it with family and friends!
For more information, please contact us at info@supportLPCH.org.

---

Stem Cell Therapies
Surgical Innovation
Genetic Screening

2009 Donor Roll Inside
**Dear Friends,**

This issue of *Packard Children’s News*, devoted to recent developments in pediatric research, celebrates the spirit of innovation that flourishes at Lucile Packard Children’s Hospital and the Stanford University School of Medicine.

We couldn’t pick a better location for a forward-looking children’s hospital. Packard is closely aligned with a pre-eminent medical school and situated on the campus of a world-class research university. And we enjoy a vibrant exchange of ideas with our neighbors in Silicon Valley. It’s no surprise then that Packard Children’s Hospital is steeped in a culture of ingenuity and cross-disciplinary collaboration.

Packard marries the Silicon Valley mindset with a deep concern for children’s health and well being. In medicine, the practice of moving cutting-edge scientific discoveries “from bench to bedside” is known as translational research. Physicians and scientists at Packard and Stanford ensure that children in our community and worldwide benefit from the latest advances in biology, engineering, and computing. From the stem cell lab to the genetics clinic to the medical device design studio, our efforts are rooted in the desire to create a better life for children everywhere.

The following pages offer a glimpse into some of the most exciting pediatric research taking place at Packard and Stanford. I hope that you will enjoy learning more about these projects—and remember that generous supporters like you play a key role in making them possible.

Sincerely,

David Alexander, MD  
President and Chief Executive Officer
2 Putting the Pieces Together
Packard and Stanford Form a Nexus of Pediatric Research in the Heart of Silicon Valley

4 Living on Hope
Researchers Pursue Improved Treatments for Rare, Complex Metabolic Disorders

10 Better Gadgets, Better Medicine
Biodesign Fellows Join Forces to Rethink Medical Devices

16 At the Heart of it All
Collaborative Stem Cell Studies Promise to Revolutionize Pediatric Medicine

22 In the News

26 Lucile Packard Children’s Hospital Report
A Message from Christopher Dawes, President and Chief Executive Officer

29 2009 Donor Roll

30 A Foundation of Giving

34 Children’s Circle of Care

38 Corporate Giving

40 2009 Donors

48 Lucile Salter Packard Society

52 Auxiliaries
Less than a generation ago, any child born with a congenital heart defect would undergo multiple open-chest surgeries to repair the damage. There would be long stays in the hospital, scars, and loss of normal activities. Many children would develop additional health problems from both the condition and the treatment, and most would not survive to see adulthood.

Today, frequently that child’s heart can be mended with minimally invasive, endoscopic surgery, using tiny tools specially designed for pediatric conditions. In fact, new diagnostic tests, screening methods, and imaging technologies allow physicians to spot problems and intervene even before the child is born.

Incredible progress has been made in recognizing and addressing all sorts of pediatric disorders, from heart malformations to spina bifida, cerebral palsy, sickle cell anemia, and diabetes. Breakthroughs are being made in biomedical specialties that didn’t even exist a few decades ago—fields like fetal surgery, intravascular imaging, bioinformatics, and pharmacogenomics.

At Lucile Packard Children’s Hospital, a deep commitment to biomedical research has encouraged these kinds of advances. Thanks to Packard’s close alignment with the Stanford University School of Medicine, interactions between the laboratory and the hospital bedside are streamlined—a process known as translational medicine.

“Translational medicine creates a climate of innovation and collaboration to improve the lives of patients,” says Philip Pizzo, MD, the Carl and Elizabeth Naumann Dean of the School of Medicine. “It enables close interactions between physicians and scientists in different specialties, between students and trainees, and between basic science and clinical care.”

Packard Children’s also benefits from the diverse resources and proximity of the University, which encourages interactions among specialists in engineering, computer science, chemistry, physics, biology, and business—people who might not normally cross paths.
Together of Pediatric Research in the Heart of Silicon Valley

“Stanford has a long tradition of excellence, not just in specific disciplines but in interdisciplinary research,” says Ann Arvin, MD, vice provost and dean of research at Stanford and the Lucile Salter Packard Professor of Pediatrics at Packard Children’s. “Departmental boundaries are easy to cross, allowing researchers to learn from each other and to discover areas of common ground.”

The University’s approach was integral in shaping today’s Silicon Valley and still serves as the training ground for many successful entrepreneurs in biotechnology, pharmaceuticals, and high-tech enterprises who maintain close ties to the academic community.

“Packard is no ordinary children’s hospital,” says pediatric pulmonologist Hugh O’ Brodovich, MD, the Adalyn Jay Physician-in-Chief and the Arline and Pete Harman Professor and Chair of the Department of Pediatrics. “We have a unique combination here, with world-class scientists and faculty committed to finding ways to do things better. It’s a blend of talent, expertise, creativity, dedication, and shared resources. That makes a culture of innovation. And that ultimately will improve the health of all children.”

The following stories illustrate how the back-and-forth dynamic of translational medicine has fostered insights in molecular genetics, in surgical device design, and in regenerative medicine that can be applied to diagnosing and treating a wide range of pediatric disorders. Today, physician scientists at Packard and Stanford are engaged in research that spans a wide breadth of medical science, yet shares a common objective: better health for children worldwide.

“We have a unique combination here, with world-class scientists and faculty committed to finding ways to do things better. And that ultimately will improve the health of all children.”

- Hugh O’ Brodovich, MD, Adalyn Jay Physician-in-Chief, Arline and Pete Harman Professor and Chair of the Department of Pediatrics
Living on

By Mark Shwartz

Rod Searcey
Researchers Pursue Improved Treatments for Rare, Complex Metabolic Disorders

For Divya Wadhwani, age 13, the search for the cause of her mysterious and debilitating muscle disorder turned into an eight-year, 8,000-mile odyssey that began when she was a small child in Mumbai, India.

“Divya was perfectly fine until age 4, when her nursery school told us that she was having episodes of slumping,” recalls Mahesh Wadhwani, Divya’s father. “They said that her knees were buckling, and that she was falling down.”

At first, Divya’s doctors suspected an iron deficiency or a rare neurodegenerative disease, but those causes were eventually ruled out, and her condition worsened.

Then, tragedy struck. Divya’s 2-year-old sister, Mallika, developed uncontrollable seizures and died a few months later. Doctors began to suspect that Divya and Mallika shared a mitochondrial disease, an inherited disorder that wreaks havoc on the energy-producing part of the cell called the mitochondrion.

Unfortunately for Divya, there were no laboratories in Mumbai equipped to test for these rare conditions, which affect one in 4,000 children. Then, in 2004, her father got a job reassignment to the United States, and the family moved halfway around the world to San Ramon, Calif.

Within a few months, Divya was at Lucile Packard Children’s Hospital under the care of Greg Enns, MD, one of the country’s leading experts on mitochondrial disease. “I strongly believe that life is an interplay of destiny and fate,” says Mahesh. “You try to put things together, and everything falls into place.”

Enns, director of the Biochemical Genetics Program at Stanford University, ordered a muscle and nerve biopsy, which confirmed that Divya had indeed inherited some type of mitochondrial disorder—but which one?

“Dr. Enns said that it’s like going to a mechanic,” says Mahesh. “We know there’s a problem with the engine, but we don’t know exactly what is causing it, or how you go about fixing it. That’s when the genetic pursuit started, and it took four more years of extensive workup, of trying to eliminate one thing or another, to find an answer.”

Finally, last year, highly specialized tests of Divya’s DNA revealed a defect in a gene called POLG1, which had only recently been identified as a cause of mitochondrial myopathy, a neuromuscular condition with a range of symptoms identical to those of Divya and her late sister, Mallika. The disease is recessive; a blood workup of Divya’s parents confirmed the diagnosis.

“Dr. Enns is a gem of a person,” says Mahesh. “Thanks to him, we’re no longer groping in the dark. But there are probably thousands like us who are carriers of this defect, and don’t realize it until the symptoms show up in our children.”
Metabolic disorders may be more common than scientists once assumed, says Tina Cowan, PhD, associate professor of pathology and director of the Stanford Clinical Biochemical Genetics Laboratory. In 2009 alone, the Stanford lab conducted nearly 6,500 tests for a wide range of metabolic disorders using blood samples collected from people of all ages—newborns to adults.

“We’re set up to deliver rapid diagnosis and to guide the clinicians in the follow-up care,” Cowan says (see sidebar, p. 9). “For us, the magic is really the collaboration between the lab and the clinic. Greg Enns and the other doctors tell us what they need, we tell them what we need, and we all work together to make things better for the patient.”

Early diagnosis is the key to treating most metabolic disorders, notes Enns. “We’re excited to be able to diagnose these kids before they have symptoms, because by the time they get sick, their organs can be irreversibly damaged,” he says.

At Packard, expectant mothers can be tested even before their child is born. Louanne Hudgins, MD, the Mosbacher Family Distinguished Packard Fellow and chief of the Division of Medical Genetics at Stanford, and

**Catching it Early**

Mitochondrial diseases belong to a larger group of illnesses known as inherited metabolic disorders. Scientists have identified hundreds of these disorders, each caused by specific genetic mutations that damage key enzymes responsible for converting food into energy or for removing metabolic waste from our cells.

Their complexity makes many of these rare diseases extremely difficult to diagnose and treat. Because their conditions often masquerade as other illnesses, many children with symptoms of a metabolic disorder are brought to the experts at Packard Children’s for a definitive diagnosis.

“Metabolic disorders are challenging to diagnose because they can be caused by so many different mutations affecting so many different genes,” says Enns, the Arline and Pete Harman Endowed Faculty Scholar and an associate professor of pediatrics. There are many different kinds, he adds, each caused by a unique genetic defect. “Some metabolic disorders scream their diagnosis clearly. Others, like Divya’s, are more subtle and more difficult to diagnose conclusively.”

Metabolic disorders may be more common than scientists once assumed, says Tina Cowan, PhD, associate professor of pathology and director of the Stanford Clinical Biochemical Genetics Laboratory. In 2009 alone, the Stanford lab conducted nearly 6,500 tests for a wide range of metabolic disorders using blood samples collected from people of all ages—newborns to adults.

“We’re set up to deliver rapid diagnosis and to guide the clinicians in the follow-up care,” Cowan says (see sidebar, p. 9). “For us, the magic is really the collaboration between the lab and the clinic. Greg Enns and the other doctors tell us what they need, we tell them what we need, and we all work together to make things better for the patient.”

Early diagnosis is the key to treating most metabolic disorders, notes Enns. “We’re excited to be able to diagnose these kids before they have symptoms, because by the time they get sick, their organs can be irreversibly damaged,” he says.

At Packard, expectant mothers can be tested even before their child is born. Louanne Hudgins, MD, the Mosbacher Family Distinguished Packard Fellow and chief of the Division of Medical Genetics at Stanford, and

**Catching it Early**

Mitochondrial diseases belong to a larger group of illnesses known as inherited metabolic disorders. Scientists have identified hundreds of these disorders, each caused by specific genetic mutations that damage key enzymes responsible for converting food into energy or for removing metabolic waste from our cells.

Their complexity makes many of these rare diseases extremely difficult to diagnose and treat. Because their conditions often masquerade as other illnesses, many children with symptoms of a metabolic disorder are brought to the experts at Packard Children’s for a definitive diagnosis.

“Metabolic disorders are challenging to diagnose because they can be caused by so many different mutations affecting so many different genes,” says Enns, the Arline and Pete Harman Endowed Faculty Scholar and an associate professor of pediatrics. There are many different kinds, he adds, each caused by a unique genetic defect. “Some metabolic disorders scream their diagnosis clearly. Others, like Divya’s, are more subtle and more difficult to diagnose conclusively.”

Metabolic disorders may be more common than scientists once assumed, says Tina Cowan, PhD, associate professor of pathology and director of the Stanford Clinical Biochemical Genetics Laboratory. In 2009 alone, the Stanford lab conducted nearly 6,500 tests for a wide range of metabolic disorders using blood samples collected from people of all ages—newborns to adults.

“We’re set up to deliver rapid diagnosis and to guide the clinicians in the follow-up care,” Cowan says (see sidebar, p. 9). “For us, the magic is really the collaboration between the lab and the clinic. Greg Enns and the other doctors tell us what they need, we tell them what we need, and we all work together to make things better for the patient.”

Early diagnosis is the key to treating most metabolic disorders, notes Enns. “We’re excited to be able to diagnose these kids before they have symptoms, because by the time they get sick, their organs can be irreversibly damaged,” he says.

At Packard, expectant mothers can be tested even before their child is born. Louanne Hudgins, MD, the Mosbacher Family Distinguished Packard Fellow and chief of the Division of Medical Genetics at Stanford, and

**Catching it Early**

Mitochondrial diseases belong to a larger group of illnesses known as inherited metabolic disorders. Scientists have identified hundreds of these disorders, each caused by specific genetic mutations that damage key enzymes responsible for converting food into energy or for removing metabolic waste from our cells.

Their complexity makes many of these rare diseases extremely difficult to diagnose and treat. Because their conditions often masquerade as other illnesses, many children with symptoms of a metabolic disorder are brought to the experts at Packard Children’s for a definitive diagnosis.

“Metabolic disorders are challenging to diagnose because they can be caused by so many different mutations affecting so many different genes,” says Enns, the Arline and Pete Harman Endowed Faculty Scholar and an associate professor of pediatrics. There are many different kinds, he adds, each caused by a unique genetic defect. “Some metabolic disorders scream their diagnosis clearly. Others, like Divya’s, are more subtle and more difficult to diagnose conclusively.”

Metabolic disorders may be more common than scientists once assumed, says Tina Cowan, PhD, associate professor of pathology and director of the Stanford Clinical Biochemical Genetics Laboratory. In 2009 alone, the Stanford lab conducted nearly 6,500 tests for a wide range of metabolic disorders using blood samples collected from people of all ages—newborns to adults.

“We’re set up to deliver rapid diagnosis and to guide the clinicians in the follow-up care,” Cowan says (see sidebar, p. 9). “For us, the magic is really the collaboration between the lab and the clinic. Greg Enns and the other doctors tell us what they need, we tell them what we need, and we all work together to make things better for the patient.”

Early diagnosis is the key to treating most metabolic disorders, notes Enns. “We’re excited to be able to diagnose these kids before they have symptoms, because by the time they get sick, their organs can be irreversibly damaged,” he says.

At Packard, expectant mothers can be tested even before their child is born. Louanne Hudgins, MD, the Mosbacher Family Distinguished Packard Fellow and chief of the Division of Medical Genetics at Stanford, and

**Catching it Early**

Mitochondrial diseases belong to a larger group of illnesses known as inherited metabolic disorders. Scientists have identified hundreds of these disorders, each caused by specific genetic mutations that damage key enzymes responsible for converting food into energy or for removing metabolic waste from our cells.

Their complexity makes many of these rare diseases extremely difficult to diagnose and treat. Because their conditions often masquerade as other illnesses, many children with symptoms of a metabolic disorder are brought to the experts at Packard Children’s for a definitive diagnosis.

“Metabolic disorders are challenging to diagnose because they can be caused by so many different mutations affecting so many different genes,” says Enns, the Arline and Pete Harman Endowed Faculty Scholar and an associate professor of pediatrics. There are many different kinds, he adds, each caused by a unique genetic defect. “Some metabolic disorders scream their diagnosis clearly. Others, like Divya’s, are more subtle and more difficult to diagnose conclusively.”

Metabolic disorders may be more common than scientists once assumed, says Tina Cowan, PhD, associate professor of pathology and director of the Stanford Clinical Biochemical Genetics Laboratory. In 2009 alone, the Stanford lab conducted nearly 6,500 tests for a wide range of metabolic disorders using blood samples collected from people of all ages—newborns to adults.

“We’re set up to deliver rapid diagnosis and to guide the clinicians in the follow-up care,” Cowan says (see sidebar, p. 9). “For us, the magic is really the collaboration between the lab and the clinic. Greg Enns and the other doctors tell us what they need, we tell them what we need, and we all work together to make things better for the patient.”

Early diagnosis is the key to treating most metabolic disorders, notes Enns. “We’re excited to be able to diagnose these kids before they have symptoms, because by the time they get sick, their organs can be irreversibly damaged,” he says.

At Packard, expectant mothers can be tested even before their child is born. Louanne Hudgins, MD, the Mosbacher Family Distinguished Packard Fellow and chief of the Division of Medical Genetics at Stanford, and
Enns, working jointly, recently diagnosed and treated a boy in the womb for ornithine transcarbamylase (OTC) deficiency, the most severe form of urea cycle defect, a disorder that occurs when the liver is missing a crucial enzyme that helps eliminate nitrogen waste. Without that enzyme, ammonia can build up in the bloodstream and cause severe brain damage if not treated quickly.

“We gave the mother a bolus of medication that lowered the ammonia while she was in labor, and when the boy was delivered, his ammonia levels were under control,” says Enns. “When I was training, OTC deficiency was a death sentence or meant permanent neurological damage, at best. End of story. To see this boy stable and awaiting a liver transplant is definitely a step in the right direction. It’s a wonderful era for biochemical genetics.”

Newborn Screening

Early diagnosis took a giant leap forward in 2005 when the State of California expanded its newborn genetic screening program to include some 40 metabolic disorders. The screening process is simple: A few drops of blood are taken from the newborn’s heel and shipped to a lab for analysis.

Newborn screening already has changed the prognoses for several metabolic disorders, including a disease called medium chain acyl-CoA dehydrogenase (MCAD) deficiency, in which a particular enzyme doesn’t break down medium chain fats normally. “MCAD deficiency is the poster child for the expanded newborn screening program,” says Enns. “MCAD children typically look fine, but if their body becomes stressed, say by a viral infection or flu, these kids can suffer fatal complications.”

In the past, roughly two-thirds of children with MCAD deficiency died or ended up neurologically impaired. “But since newborn screening began, we’ve had tremendous success identifying and treating these children before they fall ill,” says Enns. “Now it’s unusual for a child with MCAD deficiency even to suffer neurological problems.”

Enns was instrumental in convincing the California legislature to expand newborn screening to include metabolic disorders. Today, Packard is a designated Area Service Center, screening 100,000 newborns annually. When an infant tests positive, members of Enns’ team, including genetics counselor Rachel Cox, MS, get the
call. "Most positive newborns in Northern California are referred to us," she says. "We speak with the pediatrician and family about what a positive newborn screen means, how to care for a child with a suspected disorder, and what steps we need to take to confirm or disprove the diagnosis."

Cox and her colleagues also coordinate clinical trials of new drugs to treat metabolic disorders and train graduate students enrolled in genetic counseling at Stanford—one of only three master’s degree programs in California.

“Packard is an amazing place to be,” says Cox. “We’re in the center of such exciting progress, not only on the medical campus but also in biotechnology and pharmaceutical research. We focus on preventive care and catching babies as soon as they’re born so we can improve their long-term prospects, and our ability to do that starts with basic science.”

**Biochemical Smoke**

Divya’s ongoing treatment includes a cocktail of five dietary supplements—special antioxidants designed to eliminate dangerous free radicals in her system that are the byproduct of her faulty metabolism. “If your car doesn’t work right, you make a lot of smoke in the tailpipe,” explains Enns. “If your mitochondria don’t work right, you make what I call biochemical smoke—large quantities of charged oxygen atoms, called free radicals, which the body can’t eliminate.”

In 2009, Enns, Cowan, and their Stanford colleagues conducted a landmark study confirming that people with a variety of mitochondrial diseases have significantly lower levels of glutathione, the body’s main antioxidant defense. It was the first study to hold out the possibility that a natural biomarker, in this case glutathione, could eventually be useful in diagnosing these disorders, which are too complex for routine newborn screening.
To determine if patients like Divya are responding to therapy, Enns hopes to develop another test that measures excess free radicals in the blood, a state known as oxidative stress, that is also involved in Parkinson disease, diabetes, Alzheimer’s disease, and cancer. “So these rare genetic diseases will give insight into more common disorders, and affect future treatment for many illnesses,” he says.

Enns and his colleagues also are conducting clinical trials of potential enzyme replacement therapies for lysosomal storage diseases—metabolic disorders that occur because the body is unable to produce an enzyme that allows the cell’s recycling plant, called the lysosome, to function properly. Without the enzyme, the lysosome gets clogged with discarded bits of cellular material that normally would be recycled. Over time, this can damage the brain, heart, and skeletal muscles.

“The problem is that enzyme replacement therapy is very expensive,” says Hudgins. “It can cost up to $400,000 a year. And an enzyme infusion can’t cross the blood-brain barrier, so while these kids’ hearts may function more appropriately, they’re not necessarily decreasing their cognitive impairment. Families might ask, is it really worth it?”

One Day at a Time

Today, Divya appears to be responding well to therapy. For example, her glutathione levels have gone up, an indication that the antioxidant cocktails may be having an effect. She continues to build her strength by swimming once a week and exercising daily. And Enns is considering enrolling her in a clinical trial of a promising new drug being developed by a local pharmaceutical company. But it’s unclear whether any of these treatments will work in the long run.

“Any kind of breakthrough would be a miracle, so we have to live on hope,” says Mahesh. “From our experience, we know that Packard Children’s is moving in the right direction to unravel these mysteries,” he adds. “Families like ours who are directly impacted by this live life one day at a time. Who knows, one fine day we may have a cure.”

Grateful Family Helps Others

The Stanford Clinical Biochemical Genetics Laboratory, opened in 2003, was the brainchild of George and Liz Pavlov, whose daughter, Madeline, was born at Packard Children’s in 2000 with abnormally high levels of ammonia in her system. Her doctor, Greg Enns, MD, suspected a urea cycle disease that had to be treated quickly to prevent neurological damage.

Time was of the essence for the Pavlov family. But there was a problem. “Back then, we couldn’t make a rapid diagnosis here, so we had to send Madeline’s blood samples to a lab in Los Angeles, which meant a two-week turnaround time,” recalls Louanne Hudgins, MD.

To ensure that other Bay Area families avoid agonizing waits for test results, the Pavlovs made a generous gift—and inspired support from their friends and colleagues—to build a new lab at Stanford.

Today, technicians at the Biochemical Genetics Lab are able to confirm or rule out urea cycle disease and other metabolic disorders within a few days or even in a matter of hours, using tandem mass spectrometers and other sophisticated instruments capable of rapidly analyzing hundreds of metabolites in a drop of blood.

“We’re fortunate to have the only biochemical genetics laboratory in Northern California,” says Hudgins, “thanks to the kind efforts of a grateful patient family.”
Kevin Chao, MD, and Avi Roop, fellows in Stanford’s Biodesign Innovation program, have collaborated to develop an improved pediatric surgical device.
n the fall of 2008, Stanford neurosurgery resident Kevin Chao stopped by Lucile Packard Children’s Hospital to observe an unusual operation. Pediatric surgeon Sanjeev Dutta, MD, removed a young girl’s spleen—through her belly button. Using minimally invasive tools and cameras, Dutta performed the entire complex procedure through a single small umbilical incision, leaving no visible scar.

It was a masterful performance. But as Chao left the operating room that day, he couldn’t help wishing that the surgical tools were better. “When you have to do a procedure like that through one incision, there’s a lot of crowding of instruments,” he notes. “Children are small, and any time you use one instrument, all the others move at the same time.”

Luckily, Chao is in the position of being able to do something about improving those tools. In addition to being a surgeon, he is a senior fellow in Stanford University’s pioneering Biodesign Innovation program. Shortly after viewing the Packard operation, Chao shared his concerns with three of his teammates at Stanford’s James H. Clark Center. Six months later the group had developed a prototype for a laparoscopic tool kit that gives the surgeon a bit more room to maneuver—and still doesn’t leave scars.

The new Engage surgical system is just one of many valuable products to come out of the Biodesign Innovation program. Over the past decade, graduates have filed some 50 invention disclosures and patents for devices ranging from low-cost ventilators to improved epidural catheters and fetal monitors. More than 20,000 patients have been treated by devices that originated in the program. Several biodesign teams have won major technology development awards, and no less than 10 startup companies are in the works.

Equally impressive are the experts the program has produced: 57 alumni who’ve been trained to go forth and create useful devices that address major clinical and surgical needs. “What I like most about Biodesign Innovation is that it’s not just about making one gadget,” says program co-director Thomas Krummel, MD, the Susan B. Ford Surgeon-In-Chief at Packard Children’s. “It’s about training a generation of researchers to rethink gadgets and devices entirely.”
Silicon Valley Success Story

Like many Silicon Valley success stories, the Biodesign program began with a meeting of minds over breakfast. Paul Yock, MD, professor of bioengineering and medicine, was looking to develop a postgraduate training program in medical technology innovation as part of Bio-X, Stanford’s university-wide biosciences initiative. Josh Makower was a medical technology entrepreneur who had created a model innovation training program at Pfizer. The two agreed that Stanford’s Silicon Valley campus was perfectly situated for such an enterprise. It was surrounded by hundreds of med-tech companies and venture capitalists. Its faculty already had a distinguished track record of medical innovation, and its students were among the brightest and most entrepreneurial in the world.

The program began in 2000 with just a few faculty members and limited staff support. Today, Stanford Biodesign includes 15 faculty members, 6 staff, and numerous events held throughout the year. Highly popular graduate courses provide students with hands-on experiences in medical device innovation.

The program also sponsors two multidisciplinary fellowship teams per year, each consisting of four postgraduate engineers, business professionals, bioscientists, and physicians. Roughly a hundred candidates apply for the handful of openings. “Many are business folks who’ve worked in the medical device industry as product managers or in sales and marketing,” says fellowship director Todd Brinton, MD, clinical assistant professor of medicine. “Some went to business school and then to medical school. Others studied or worked in engineering before attending medical school. The main thing we’re looking for is a knack for innovation: the ability to see a problem, observe it, understand it, and dig into it.”

From Inspiration to Realization

Ellis Garai and Pedram Afshar, MD, PhD, are typical of the students in this year’s program. Garai is a UCLA- and Stanford-trained mechanical engineer who spent years in the medical device industry. Afshar attended medical school at the University of Pittsburgh, and also earned a doctorate in robotics and biomedical engineering from Carnegie Mellon. “Coming here was a tough decision for me,” Afshar explains. “Most MD/PhDs practice as clinician-scientists, where they can practice medicine and also perform research. Though I found it intellectually stimulating, primary research may take decades to reach patients. I’m interested in developing technology that can more immediately improve people’s lives.”

Like all Innovation fellows, Garai and Afshar began their Stanford training last summer in a six-week “boot camp” that gave them an overview of a specialty focus area (this year’s topic: cardiovascular...
medicine), along with a deep understanding of the innovation process. They attended 40-50 lectures given by some of the nation’s top physicians, intellectual property lawyers, venture capitalists, and med-tech CEOs. Then they headed next door to the Medical Center and Packard Children’s, where they spent weeks going on rounds, observing procedures, and talking with doctors, nurses, and patients—always looking for gaps in medical care.

Now it’s a foggy morning in January 2010, and they’re back in the brainstorming room at the Clark Center, thinking about ways to fill those gaps with medical technology. The walls are paneled with white boards covered with scribbled drawings. Behind them, a shelf holds a collection of inspirational odds and ends: LEGOS, bits of wire and rubber tubing, construction paper and modeling clay. “We take trips to Ace Hardware all the time for concept generation,” Afshar explains. “A lot of time you can borrow inspirational ideas from cookware, hardware, and plumbing. The human body isn’t so different.”

Going through their hospital notes, the students determine which patient needs would be the best ones to address, given the regulatory hurdles they’re likely to face, as well as the size of their potential market. Each team will pick out a specific challenge to meet it. They’ll rough out their models in a more sophisticated lab next door and refine them further in the Product Realization Laboratory at the nearby School of Engineering. Finally, they’ll write a business plan for the device’s development, covering everything from clinical trials to venture capital and staffing needs.

**Kids a Tough Sell**

So far most of the gadgets created by the Stanford Innovation fellows have been for adults—it tends to be like that in the world of medical technology. Children constitute only 20 percent of the health care market, and investors are wary of getting involved in such a small industry. “And if you think it’s hard to get a device approved for adult use, just tell the regulators that you’re going to put it in newborn babies,” Krummel notes. “Suddenly the hair on the back of their necks stands on end, and they say, ‘Oh. That’s going to be very difficult to approve.’”

To encourage more pediatric technology innovation, the Ewing Marion Kauffman Foundation of Kansas City, Mo., recently funded a fellowship, matching a Stanford Department of Surgery fellowship, for

Ellis Garai and Pedram Afshar, MD, PhD, began their Stanford training with a six-week “boot camp” in cardiovascular medicine.
The two also would like to see better braces for youngsters with hip dysplasia or scoliosis. With hip dysplasia, in particular, “Children have to wear a harness that makes them walk splay-legged until their bones grow and the socket takes the right shape,” Chao observes. “If you ask most clinicians, they’ll say ‘Oh, the brace works just fine.’ But when I see pictures of these kids learning to walk like crabs, I think, ‘This could be better.’”

Perhaps the team’s most exciting initiative is an effort to harness the Internet for pediatric innovation. Earlier this spring, in collaboration with the Kauffman Foundation, they initiated an eight-week online “idea campaign” to encourage collaborations to meet the growing medical needs of children.

The idea, Roop says, was to create something like Wikipedia: a website where clinicians, parents, scientists, engineers, manufacturers, and philanthropic organizations could come together, in a global online community, to discuss children’s medical needs and brainstorm solutions. “Our goal second-year Biodesign students to focus on the needs of children. One of this year’s Kauffman fellows is Chao, the neurosurgery resident who helped create the new laparoscopic tool kit. The other is Avi Roop, a University of Minnesota-educated mechanical engineer and industry veteran who worked with Chao on that project.

Now they’re roaming the halls of Packard Children’s again—this time focusing on the needs of young patients in the orthopedics department. Already they’ve come up with a long list of things that could be better, starting with the dreaded cast room. “Think about it,” says Chao. “You’re 5 years old. You have to have a cast removed, and people in white coats and masks come at you with a saw. And cast saws are really loud and scary, even though they won’t injure soft tissue—yet nobody thinks about making a quieter saw. Or about figuring out a different way to take off casts, or even how to immobilize fractures without casting them at all.”

A team of fellows in the Biodesign Innovation program has developed an early prototype of a new Engage surgical device. The laparoscopic tool gives a pediatric surgeon more room to maneuver—without leaving scars.
was to harness the creativity and collaboration of groups of people,” he explains, “and to shorten the time it takes to get solutions to market.”

Participation in the idea campaign was free, and the online community offered transparent access to post, view, vote, and comment on ideas. The eight-week initiative ended on April 21. Roop and Chao are eagerly analyzing the results.

“Our goal was to harness the creativity and collaboration of groups of people, and to shorten the time it takes to get solutions to market.”

Avi Roop, Kauffman Fellow

freely,” says Chao. “This is a radical departure from what people are used to in the business or medical world. By leveraging people’s collective passion, genius, and creativity we can hope to achieve something worthwhile.”

After his fellowship year is over, Chao plans to continue his full-time neurosurgery residency at Stanford School of Medicine. But he’ll still be working with Roop to make that laparoscopic tool kit a reality. Their startup company, Miret Surgical, was a finalist last year in the Santa Clara University Boomers Business Plan Competition.

Endowed Fellowships

Lucile Packard Children’s Hospital, in conjunction with the Stanford University School of Medicine, is building the nation’s most prestigious training program in children’s health. Under the guidance of experienced faculty, a talented group of fellows is carrying out pioneering research.

Fellows spend up to three years focused on research to apply new discoveries to the clinical issues facing sick children. These esteemed honors are designed to attract talented individuals and prepare them for careers in academic medicine.

The program, a vital component of the Breaking New Ground Campaign, creates a pipeline of future leaders to advance children’s health.

The Bass Challenge Match

In support of this work, Anne and Robert Bass have generously established the Bass Challenge Match, which recognizes the importance of training and education to ensure continued advances in pediatric medicine.

The Bass Challenge Match is available to donors who endow fellowships or faculty scholar awards. The Basses’ pledge is intended to stimulate new first-time gifts at the seven-figure level. Qualifying gifts will be matched one dollar for every two donated dollars.

To learn more about earning the Bass Challenge Match, please call (650) 498-7641 or email campaign@lpfch.org.
At the
Collaborative Stem Cell Studies Promise to Revolutionize Pediatric Medicine

By Ruth Schechter

Heart of it All

Michael Longaker, MD, FACS, and Joseph Wu, MD, PhD, are leading groundbreaking stem cell research that one day may address many of childhood’s most devastating diseases.
What if, for the one in 100 babies born with some form of birth defect, there were an alternative to medication, surgery, and long-term care? What if doctors could grow a new organ from an infant’s own genetic material, reversing the malformation? Or intervene at exactly the right moment to prevent the problem from even taking place?

“Imagine if we could take a defective heart valve, for example, and grow a new one out of existing tissue,” says Daniel Bernstein, MD, the Alfred Woodley Salter and Mabel G. Salter Endowed Professor in Pediatrics and chief of pediatric cardiology at Lucile Packard Children’s Hospital. “There would be no chance of rejection since it would be derived from the patient’s own cells. And, because it would be living tissue, it would grow as the child grows, avoiding the need for replacement surgery later on.”

Just a few years ago, such feats were the stuff of science fiction. Today, innovations in stem cell research could hold the key to an amazing array of new therapies for pediatric ailments ranging from congenital heart disease to spina bifida, cerebral palsy, diabetes, and even cancer.

A Big Step Forward

The most exciting potential use for stem cells may be regenerative medicine—treating disease by replacing damaged tissue with cells that have the remarkable capacity to produce differentiated kidney, spinal cord, heart, and brain cells. Currently, donor organs must be transplanted to replace those that are damaged; a regenerative approach would reduce the need for transplants and their related medical complications. But first scientists must identify a reliable system for creating stem cell lines.

Recently, Packard and Stanford physician scientists working in several different disciplines choreographed a new method of creating induced pluripotent stem cells (iPS)—adult cells that have been genetically reprogrammed to revert back to stem cells. In a groundbreaking paper published in February in the scientific journal, *Nature Methods*, Joseph Wu, MD, PhD, assistant professor of cardiology, derived iPS cells from human fat, and then coaxed them into becoming different specialized cell types.

It’s a big step forward in accessing and controlling stem cells, says Michael Longaker, MD, FACS, the Deane P. and Louise Mitchell Professor and director of the Hagey Laboratory for Pediatric Regenerative Medicine, and holds

Induced pluripotent stem cells—adult cells genetically reprogrammed to revert back to stem cells—hold great promise for someday treating a range of pediatric disorders.
great promise for tracking—and someday treating—a range of pediatric disorders.

Says Wu, “iPS enables us to understand the molecular mechanisms of disease development, and may lead to techniques that will change how we treat heart problems. In a patient with a congenital heart disease, for example, we could take their fat cells, reprogram them into iPS, and then into a cardiac cell. That would give us a platform to study the cells and compare them to normal cells to see why they change, how they behave, and to create a model to test drugs.”

Wu’s research is collaborative by nature, and his study incorporated wide-ranging expertise in stem cell biology, gene therapy, cardiology, and other fields.

For instance, he used minicircles—minute rings of DNA—to derive the iPS cells. The small size of the minicircles allows them to enter a cell more easily than other delivery systems and, because they don’t replicate, they cannot alter the cell’s genetic makeup, an ongoing aftereffect that can affect therapeutic applications.

The minicircles technique was developed by Mark Kay, MD, PhD, the Dennis Farrey Family Professor and director of the Program in Human Gene Therapy, as a way to eliminate the complications caused by traditional methods of using viruses to introduce genes into a cell.

“It’s a safe, simple process,” says Kay, “and appears to be an important direction to pursue for basic science investigations as well as for preclinical studies. This project is a great illustration of where gene therapy and stem cell biology come together. It’s a model for how we can move forward.”
Pushing Forward

iPS also holds great promise for studying upwards of 5,000 diseases scientists have identified that are caused by single gene defects. These diseases affect the quality of life of newborns and children, and their families. Stem cells may allow researchers to create scenarios that duplicate these diseases to learn about process and intervention—and how to overcome faulty genetic programming.

“We can ask questions in ways we could never ask before, helping us to identify the most promising avenues for therapy.”

—Kenneth Weinberg, MD, Anne T. and Robert M. Bass Professor in Pediatric Cancer and Blood Diseases

“We don’t know yet what the gene does during development because the process has been unavailable for study,” he says. “Using iPS will allow us to watch both normal and abnormal development side by side, and to observe the process, not only the result.”

Innovation and Information

Many other important advances have originated at Packard and Stanford thanks in large part to a research culture that encourages translational medicine—a close interrelationship between basic science investigators and the surgeons and physicians working directly with patients. Together they are addressing some of the great challenges of stem cells.

For example, as stem cell breakthroughs accelerate at full throttle, scientists are generating a barrage of new biomedical information. All of these data need to be organized in a way that allows researchers to access and analyze ongoing findings, whether it is to study how normal stem cell activities are altered in different disease states or to identify the effect of environmental conditions on cellular response.

“There’s been a virtual fire hose of information,” says Atul Butte, MD, PhD, assistant professor of pediatrics and medical informatics, who oversees complex computational efforts at Stanford that analyze and interpret biomedical data. “Our system allows basic scientists to access a wealth of existing information. We’re able to organize and reorganize it to help spark new research questions.”

Today, Butte and his team are coordinating algorithms using findings from 1,500 stem cell microarrays around...
Cutting edge research conducted at academic medical centers such as Stanford helps to spur improvements in pediatric clinical care. Research into pediatric illnesses and conditions can also yield prevention and treatment discoveries for adult diseases that begin in childhood, such as osteoporosis, diabetes, and obesity.

Nowhere else in the world do science and technology converge as they do within the Silicon Valley and at Stanford University. This wealth of interdisciplinary expertise, unmatched by any other institution in the nation, drives progress in translational research, and positions Stanford and Packard Children’s to achieve preeminence in pediatric medicine.

Philanthropy can be the spark that ignites research breakthroughs. For example, the Bio-X innovation grant program at Stanford has leveraged initial private funding of $6 million into more than $69 million in government grants for bioengineering.

Innovation grants allow faculty to engage in genuinely novel research, establish a body of data, and demonstrate the preliminary results needed to secure government or foundation funding.

Such donor support can be the driving force behind child health research at Stanford, and is a critical component of the Breaking New Ground Campaign. To learn more, please call (650) 498-7641 or email campaign@lpfch.org.

Partners in Progress

Packard and Stanford physician scientists agree that breakthroughs will continue to take place where there are close collaborations among researchers who are dedicated to advancing stem cell science and building a foundation for the future of regenerative medicine.

“There remain many fundamental questions to be resolved, but we’re positioned for rapid success because of how easily different perspectives can work together here,” says Michael Longaker. “Packard’s alignment with the University places it right at the heart of where these breakthroughs will come from. There’s a network in place that was formed to bridge the gap between scientific research and real-life medical applications, to truly go from ‘bench to bedside’ for the benefit of children’s health.”

It’s important to pursue many different avenues of stem cell research, he adds, because findings in one discipline may relate to a seemingly unrelated investigation, adding to the promise for understanding and treating a range of childhood diseases. Almost every aspect of pediatric medicine may be affected by better understanding and control of stem cells, and by developing a system of accessing reliable stem cell lines for study and potential application.

“Stem cells will be the big innovation in pediatric cardiology,” predicts Dan Bernstein. “There may come a day when we can avoid transplanting a child’s organ altogether by using cell transplants to fix the one that’s already there.”

the world to identify a certain cell receptor—taking only a fraction of the time such a comparison might have taken in the past. “We can study in a new way virtually everything that’s been measured in the past,” he says. “We do medicine from a data-driven perspective.”

This access to reams of data will help researchers address the many unanswered questions of stem cell biology: How can stem cells be instructed to become a specific cell type? What causes them to differentiate? How can they be regulated to restore tissue function or replace a malfunctioning part?
Christopher Dawes, president and CEO of Packard Children’s, was elected chairman of the Board of Trustees for the National Association of Children’s Hospitals and Related Institutions (NACHRI) and the National Association of Children’s Hospitals (NACH) in October.

Founded in 1968, NACHRI improves the health and well-being of children and families through support of clinical care, education, research, and advocacy. NACH is its public policy affiliate.

As chairman, Dawes will lead efforts designed to strengthen the ability of children’s hospitals and health systems to influence public policy makers, affect federal and state policy issues, and advance access and quality of health care for all children.

Geaghan to Chair Research Society

Sharon Geaghan, MD, associate professor of pediatrics and pathology, is the new chair-elect for the Pediatric and Maternal-Fetal Division (PMF) of the American Association of Clinical Chemistry. Founded in 1948, the association has more than 9,000 members and is headquartered in Washington, DC. The PMF division provides a forum for the dissemination of information about methods of analysis and encourages research in specialized areas of pediatric, maternal, and fetal clinical chemistry.

Geaghan will begin her term as chair in 2012.

Donaldson Appointed to Leadership Council

Nancy Donaldson, DNSc, RN, was appointed to the National Advisory Council for Healthcare Research and Quality in December.

Koret and Taube Support New Autism Center

The Koret Foundation and the Taube Family Foundation have made matching pledges of $100,000 to support the launch of the Stanford Autism Center at Packard Children’s Hospital. The new Center will integrate existing clinical programs in autism, improving ease of navigation for patients and families. Startup funding from Koret and Taube will help boost interdisciplinary research on the causes of autism and the best methods for diagnosing and treating the disorder.

Located in the San Francisco Bay Area, the Koret Foundation adds to the region’s vitality by promoting educational opportunity, contributing to a diverse cultural landscape, and bolstering organizations that develop innovative approaches to meeting community needs. The Taube Family Foundation supports educational, cultural, and civic nonprofit organizations, focused primarily on the Greater Bay Area.
Link Tapped to Head Society of Clinical Oncology

Michael Link, MD, the Lydia J. Lee Professor of Pediatric Oncology, has been elected president of the American Society of Clinical Oncology (ASCO). The 27,000-member society works to improve cancer prevention and treatment.

Link will take office as president-elect at ASCO’s annual meeting in June, and will serve a one-year term. He is the first pediatric oncologist elected to the presidency in the organization’s 45-year history, and will lead efforts to advance cancer research and improve health policy for oncology patients.

Ronald Ariagno, MD, director of the Pediatric Pulmonary Lab at Packard Children’s Hospital, received the Neonatal Education Award in October from the American Academy of Pediatrics (AAP). The prize is given annually in recognition of outstanding contributions to education in neonatal-perinatal medicine.

Ariagno is an expert in infant sleep and respiration, and internationally recognized for his clinical expertise in circadian and thermoregulatory development, infant lung function, and sudden infant death syndrome (SIDS).

Cowan and Cherry to Lead Genetics Society

Tina Cowan, PhD, and Athena Cherry, PhD, both associate professors of pathology and of pediatric medical genetics, were elected into leadership roles at the American Board of Medical Genetics (ABMG). Cowan was elected vice president for 2010 and will be president in 2011, while Cherry was elected secretary for a term of two years.

The ABMG is the certifying agency for approximately 2,000 professionals in the field of human genetics, as well as the accreditation agency for the approximately 44 training programs in this field in the U.S.

Auxiliary Throws “Head to Town” Event

Anthropologie of Burlingame hosted a high-energy party on October 1 to launch “Head to Town,” a new fundraiser organized by the San Mateo-Burlingame Auxiliary. Week-long promotions were offered by Classic Kids Photography, Trio Hair Salon, Just Kids Cuts, Gumshoe, Valentino’s, J’me, and Talbot’s Toyland. The week wrapped up with Family Night on Broadway, with special offerings at Village Host Pizza, Preston’s Ice Cream, Il Piccolo, Nuts for Candy, and Elie Boutique.

San Mateo-Burlingame Auxiliary members (left to right): Lynn Tuthill, Claire Trimble, Dawnell Moore, Ahnna Dudley, and Kristen Braccia, at the launch party for Head to Town.
Barth Leads U.S. First in Prenatal Imaging

In a case believed to be a U.S. first, the radiology team at Packard Children’s, led by Radiologist-in-Chief Richard Barth, MD, used prenatal magnetic resonance imaging (MRI) to detect an often-misdiagnosed genetic disease. The disorder, congenital chloride diarrhea (CCD), can cause severe dehydration and serious metabolic disturbances in newborns if not treated quickly. CCD is so rare, with only about 250 total cases reported worldwide, that infants with the disease are often erroneously treated for other diarrhea-causing ailments. The diagnosis is one of only four known cases of CCD diagnosis ever made via prenatal MRI. A scientific report on the four cases, including Barth’s case and three from France, was published in the journal Ultrasound in Obstetrics & Gynecology in December.

Study: Acupuncture Effective in Reducing Pregnancy Depression

New research, lead by Rachel Manber, PhD, professor of psychiatry and behavioral sciences, and Deirdre Lyell, MD, assistant professor of obstetrics and gynecology, finds that acupuncture appears to be an effective way to reduce depression symptoms during pregnancy. In the first-of-its kind study, published in March in Obstetrics & Gynecology, researchers tested alternative treatments for pregnant women and found that acupuncture specifically designed to treat depression is a potential substitute for antidepressants.

Ongoing Support for Patients in Need

Generous commitments from Southwest Airlines and the Change a Life Foundation will help Packard’s Social Services team support patient families during what can be an overwhelming and stressful time.

Southwest Airlines has provided complimentary air travel, valued at $32,000, through its Medical Transportation Grant Program. Partnering with Southwest’s national philanthropic program will allow Packard social workers to allocate 80 round-trip tickets to patients and patient families with financial need so that they can receive medical transportation to and from the Hospital.

The Change a Life Foundation of Irvine, Calif., has made a grant of $10,000 to help patient families purchase medical equipment and prescription medications, in addition to over $40,000 of ongoing support in 2009 for Packard’s Social Services department. Change a Life provides direct assistance to individuals and families who have experienced an injury, illness, or catastrophic life event, and who are suffering financial hardship.

The Hospital’s array of social services, including psychosocial support, care coordination, and resource assistance, helps keep patient families from feeling overwhelmed by the financial pressures that accompany serious illness. As a result, families feel less burdened, and critically ill children can come to Packard Children’s to receive the treatment they need.
Dear Friends,

In 2009, Lucile Packard Children’s Hospital provided children and expectant mothers with the best pediatric and obstetric care available, and laid important groundwork for the evolution of our medical facility.

As many of you know, Packard Children’s serves an ever-growing community and dedicates significant time and effort to meeting increasing demand. Last year, we made excellent progress in our planned expansion. We refined our design vision, made our case to the city of Palo Alto and surrounding communities, and saw a big return on our fundraising efforts. We are excited to watch as Packard’s cutting-edge and compassionate care takes root in new facilities designed to manifest our greatest potential.

As we move forward, we continue to work every day to make children’s lives healthier and happier. On the following page, you will find a few of the past year’s highlights. Staff members at Packard Children’s are conducting groundbreaking research, performing pioneering medical procedures, and leading important outreach programs that safeguard our community’s health. Underlying these activities is a deep commitment to the patients and families we serve.

Thank you, once again, for your role in making all of this possible. We are fortunate to have a generous family of supporters who share our vision of a healthy future for children.

Sincerely,

Christopher G. Dawes
President and Chief Executive Officer
Lucile Packard Children’s Hospital

Christopher Dawes, President and CEO, Lucile Packard Children’s Hospital
2009 Highlights

- Packard Children's was once again ranked among the nation's best pediatric medical centers. In its annual “America’s Best Children’s Hospitals” issue, *U.S. News & World Report* placed Packard #5 in neonatal care and heart and heart surgery. Additionally, six other programs, including cancer and neurosurgery, made the *U.S. News* Top 20.

- According to the United Network for Organ Sharing, in 2009 Packard Children’s was among the highest-volume pediatric liver transplant centers in the nation. Packard researchers also identified biomarkers that allow doctors to predict which children who have received a liver transplant can withdraw from immunosuppressive drugs safely. The team’s bench-to-bedside expertise has made them a national leader in pediatric liver transplant.

- After Mark Blinder was diagnosed with a rare bone cancer at age 3, orthopedic surgeon Lawrence Rinsky, MD, performed a limb-preserving surgery that had never been attempted in a toddler. Nearly a year later, Mark is thriving with a surgically implanted artificial humerus inside his cancer-free right arm. He’s believed to be the first small child ever to receive a high-tech, telescoping prosthesis to replace the entire upper arm bone.

- Researchers at Packard and the Stanford School of Medicine shed light on the neural basis of memory defects in Down syndrome, suggesting a new strategy for treating kids with the condition. A study by Ahmad Saliehi, MD, PhD, found that boosting norepinephrine signaling may improve mental cognition. This finding suggests that if doctors intervene early enough, they may be able to help kids with Down syndrome to better collect and modulate information.

- In May, the Maggie Adalyn Otto Safely Home Car Seat Fitting Station at Packard Children’s reached a major milestone: installing its 10,000th car seat. Car seat specialists run the station seven days a week, free of charge. Their expert guidance ensures that families get the help they need to keep their kids safe on the road.

- Adolescent medicine specialist Sophia Yen, MD, identified the top six teen sexual health myths perpetuated by 35 well-trafficked health websites. Yen’s study found that myths about birth control, sexually transmitted diseases, and health exams are not dispelled even on several sites reviewed by physicians. Media coverage of the study helped correct misinformation and brought attention to problems with finding sexual health answers online.

- Plans for our upcoming facilities expansion got a big boost this year when the David and Lucile Packard Foundation announced that it intends to commit up to $100 million for the expansion of Packard Children's Hospital. This will be the lead gift in the Hospital's campaign to add more than 100 new beds to our facility and expand access to state-of-the-art treatments for local children.
2009 Lucile Packard Children’s Hospital Report

Statement of Operations
For years ended August 31, 2009 and 2008 (in thousands)

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenues</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net patient service revenue</td>
<td>$ 695,915</td>
<td>$ 630,444</td>
</tr>
<tr>
<td>Other revenue</td>
<td>27,847</td>
<td>27,838</td>
</tr>
<tr>
<td>Contributions used for operations</td>
<td>29,272</td>
<td>28,620</td>
</tr>
<tr>
<td><strong>Total revenues, gains, and other support</strong></td>
<td>753,034</td>
<td>686,902</td>
</tr>
<tr>
<td><strong>Expenses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaries and benefits</td>
<td>$ 307,359</td>
<td>$ 286,668</td>
</tr>
<tr>
<td>Other operating expenses</td>
<td>393,193</td>
<td>358,602</td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td>700,552</td>
<td>645,270</td>
</tr>
<tr>
<td><strong>Excess of revenues over expenses</strong></td>
<td>$ 52,482</td>
<td>$ 41,632</td>
</tr>
</tbody>
</table>

Statistics
Fiscal Year 2009

- Medical Staff: 824
- Employees: 2,725
- Volunteers: 704
- Auxiliary Members: 1,324
- Licensed Beds: 312
- Obstetric: 52
- Pediatric: 260
- Inpatient Days: 80,304
- Clinic Visits: 139,329
- Discharges: 12,815
- Births: 4,759

Sources of Private Support
Fiscal Year 2009

- Corporations and Foundations 4%
- Auxiliaries and Benefits 2%
- Individuals 94%

Includes gifts to Lucile Packard Children’s Hospital and the child health programs of Stanford University School of Medicine.
Breaking Through

Stem Cell Therapies
Surgical Innovation
Genetic Screening

2009 Donor Roll Inside