



Mom's voice lights up children's brains

By Erin Digitale

Children's brains are far more engaged by their mother's voice than by voices of women they do not know, a new study from the School of Medicine has found.

Brain regions that respond more strongly to the mother's voice extend beyond auditory areas to include those involved in emotion and reward processing, social functions, detection of what is personally relevant and face recognition.

The study, which is the first to evaluate brain scans of children listening to their mothers' voices, was published May 16 in the *Proceedings of the National Academy of Sciences*. The strength of connections between the brain regions activated by the voice of a child's own mother predicted that child's social communication abilities, the study also found.

"Many of our social, language and emotional processes are learned by listening to our mom's voice," said lead author Daniel Abrams, PhD, instructor in psychiatry and behavioral sciences. "But surprisingly little is

known about how the brain organizes itself around this very important sound source. We didn't realize that a mother's voice would have such quick access to so many different brain systems."

Preference for mom's voice

Decades of research have shown that children prefer their mother's voices: In one classic study, 1-day-old babies sucked harder on a pacifier when they heard the sound of their mom's voice, as opposed to the voices of other women. However, the mechanism behind this preference had never been defined.

"Nobody had really looked at the brain circuits that might be engaged," senior author Vinod Menon, PhD, professor of psychiatry and behavioral sciences, said. "We wanted to know: Is it just auditory and voice-selective areas that respond differently, or is it more broad in terms of engagement, emotional reactivity and detection of salient stimuli?"

The study examined 24 children ages 7 to 12. All had IQs of at least 80, none had any developmental disorders, and all were being raised by their biological mothers. Parents answered a standard questionnaire about their child's ability to interact and relate with others. And before the brain scans, each child's mother was recorded saying three nonsense words.

"In this age range, where most children have good language skills, we didn't want to use words that had meaning because that would have engaged a whole different set of circuitry in the brain," said Menon, who is the Rachael L. and Walter F. Nichols, MD, Professor.

Two mothers whose children were not being studied, and who had never met any of the children in the study, were also recorded saying the three nonsense words. These recordings were used as controls.

MRI scanning

The children's brains were scanned via magnetic resonance imaging while they listened to short clips of the nonsense-word recordings, some produced by their own mother and some by the control mothers. Even from very short clips, less than a second long, the children could identify their own

See VOICE, page 7



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A far wider swath of brain areas is activated when children hear their mother's voice than when they hear other voices, a new study finds.

Folate fortification appears not to have slowed some birth defect rates

By Erin Digitale

Fortifying the U.S. food supply with folic acid was not associated with a decline in certain birth defects that researchers expected to see in California, according to a new study from the School of Medicine.

The new findings are likely to contribute to an ongoing debate about the future of the fortification program.

The study of more than 1.3 million California births and pregnancies spanning two decades was published online May 18 in *Birth Defects* See FOLATE, page 6



Gary Shaw

How nanotechnology could detect and treat cancer

By Krista Conger

The crew of the Proteus has one desperate chance to save a man's life. Shrank to the size of a large bacterium, the submarine contains a team of scientists and physicians racing to destroy a blood clot in the brain of a Soviet defector. The group journeys through the body, evading giant white blood cells and tiny antibodies while traveling through the heart, the inner ear and the brain to reach and destroy the blockage.

Although events in the film *Fantastic Voyage* were far-fetched when it was released in 1966, they're now being realized every day in labs around the world, particularly in cancer treatment. A growing field called nanotechnology is allowing researchers to manipulate molecules and structures much smaller than a single cell to enhance our ability to see, monitor and destroy cancer cells in the body.

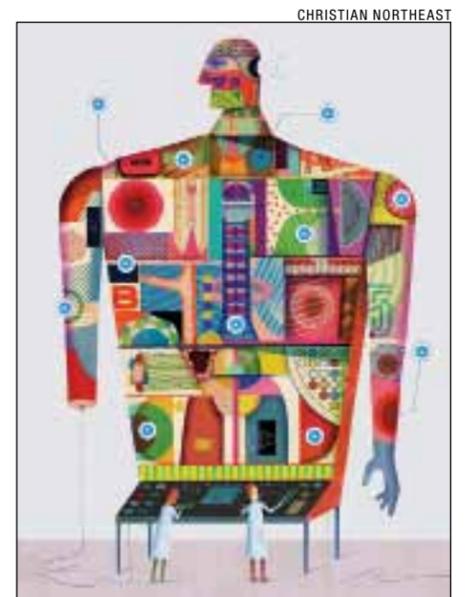
Tens of thousands of patients have already received chemotherapy drugs delivered by nanoparticles called liposomes,

and dozens of other approaches are currently in clinical trials. Within the next five to 10 years, our bodies' biggest defenders may be tinier than we could have ever imagined.

'Exquisite sensitivity and precision'

"Nanotechnology offers an exquisite sensitivity and precision that is difficult to match with any other technology," says Sam Gambhir, MD, PhD, professor and chair of radiology at the School of Medicine. "Within the next decade, nanomedicine will change the path of cancer diagnosis and treatment in this country."

The field has some big backers: The National Cancer Institute now spends about \$150 million each year on nanotechnology research and training to combat the disease; other institutes and centers at the National Institutes of Health spend an additional \$300 million on nanotechnology research for cancer and other disorders. And a national alliance created by the NCI in 2004 to bring together researchers from biology



CHRISTIAN NORTHEAST

to computer science to chemistry to engineering is now bearing fruit — in the form of dozens of clinical trials — at campuses and companies across the country, including Stanford.

"We can now detect just a few cancer-associated molecules or circulating tumor cells in the body in just a few milliliters of blood or saliva, or map the boundaries of a brain tumor within millimeters to assess its response to therapy or to plan See NANOTECH, page 7

Nancy Lonhart, 'expert negotiator' and 'quiet achiever,' wins Amy J. Blue Award

L.A. CICERO

By Kathleen Sullivan

When Nancy Lonhart arrives at her office in Encina Commons, she is ready to hit the ground running while maintaining a patient and understanding demeanor with everyone — faculty, researchers, fellows, students, staff, visiting VIPs, the janitor and the UPS delivery person.

She is the calm at the center of the storm for the 70 people working at the Center for Health Policy at the Freeman Spogli Institute for International Studies and the Center for Primary Care & Outcomes Research in the Department of Medicine at the School of Medicine.

The two centers, which are part of a multidisciplinary enterprise known as Stanford Health Policy, conduct rigorous research to lay the foundation for better domestic and international health policy and health care in the United States and around the world.

Lonhart is associate director of the Center for Health Policy and division manager of the Center for Primary Care & Outcomes Research. She provides administrative and financial leadership, guidance and oversight to the centers, including strategic planning and development, finance and research administration, human resources and student affairs.

"My goal is to make everyone's life, work and research run as smoothly and as efficiently as possible," said Lonhart, who joined the organization in 2007.

Lonhart is one of this year's winners of the Amy J. Blue Award, which honors university staff members who are exceptionally dedicated, supportive of colleagues and passionate about their work.

The other two winners are Lynn Dixon, faculty data systems specialist in Faculty Affairs, which is part of the Office of the Provost; and Jörg Grawert, a lead maintenance multicraft trade technician in Student Housing, which is part of Residential & Dining Enterprises.

Work, family, life

After graduating from UC-Davis, Lonhart said she "followed her heart" to the Bay Area for her boyfriend, Hal, now her husband of 32 years. She landed a job in nursing administration at Stanford Hospital, then known as Stanford Health Services.

In 1992, after a 12-year battle with kidney disease, a routine blood test revealed that her kidneys were failing. Four months later, Lonhart received a kidney from her brother, Bill.

"When it came time for the transplant surgery, all I had to do was walk downstairs and check myself into C-2, the transplant unit at the time," Lonhart said with a laugh. "It's been a glorious 23-year journey since then to become who I am and what I am — much of it thanks to

the people and the profound sense of community I have here at Stanford."

Lonhart and her husband have two daughters, Rita and Julia.

In 2001, Lonhart became the administrator for the Department of Anthropological Sciences and moved into an office on the Main Quad. Six years later, she joined Stanford Health Policy.

Lonhart, who was a member of the track team in high school, still puts on her running shoes — and her swimsuit — for the Transplant Games of America, a multi-sport event for individuals who have undergone lifesaving transplant surgeries. She has competed in the 100-, 200- and 400-meter races, the long jump and in swimming events. In 1998, she was named "Female Athlete of the Games." She also competed in the Summer World Transplant Games in France in 2003.

"We took the girls all over the United States and Europe — that's what made the games so much fun," Lonhart said. "Of course, the games are much more than the competitions. They are the chance to share your story with people who have struggled through the common, everyday motions of life. At the games you hear about dreams. You hear about hope. You talk with families who made the extraordinary decision to save a life through donation. It is an incredibly powerful, indescribable experience. Those years were a beautiful and wonderful journey we shared with the girls as they were growing up."

Praise from colleagues

Colleagues said Lonhart has an "unwavering can-do attitude" and inspires the best in everyone who works at the center. In addition, colleagues said Lonhart is always looking for ways to enhance the skills and further the careers of her staff.

Kathryn McDonald, executive director and senior scholar at the Center for Primary Care & Outcomes Research, said Lonhart works many hours — tirelessly — because she cares so deeply about the work and the people.

"When Nancy asks, 'How are you?' her earnestness elicits how I am really doing," McDonald said. "It opens up exchanges that we need to have — and work problems get solved. She does this with everyone. She is grounded, and



Nancy Lonhart is associate director of the Center for Health Policy and division manager of the Center for Primary Care & Outcomes Research.

ever so capable in knowing just what is needed to work in a customized fashion with each and every person she works with. Nancy is the heart, soul and engine of our centers. Many people look to our centers and wonder how it is possible to have such a great work environment with such incredible faculty productivity. Nancy. She makes it all possible, in an incredibly humble way."

David Studdert, LLB, ScD, MPH, professor of medicine and of law, said Lonhart has been instrumental in helping Stanford Health Policy to grow over the last decade into "one of the best, most vibrant places in the world" to do health policy research and teaching. He said Lonhart has played an important role in creating the atmosphere of collaboration and intellectual excitement that characterizes the Center for Health Policy.

"Nancy is calm, unfailingly positive and amazingly good at what she does," he said. "She is a patient teacher who understands the way university administration works — no small feat. She is a diplomat and expert negotiator. She believes very strongly in the mission and work of the center, and this belief clearly shapes the way she approaches her job."

Despite all of this talent and accomplishment, Nancy seeks no limelight. She is a quiet achiever."

Douglas Owens, MD, professor of medicine and director of the Center for Primary Care & Outcomes Research and the Center for Health Policy, said Lonhart has been instrumental in helping develop and implement the strategic plan for the centers, and for assessing and guiding their progress.

"Nancy works with all of the faculty in the two centers daily, managing a broad range of issues with the Department of Medicine, the Department of Pediatrics and other campus research groups," Owens said.

"The skill and talent she brings to her work with the faculty is reflected in the universal acclaim our faculty have for Nancy's work. She manages exceptionally complex grants, contracts and human resources both in the School of Medicine and on the main campus, particularly in the Freeman Spogli Institute for International Studies. Nancy's work has contributed immeasurably to the mission of our centers, to the success of our faculty and to building a truly extraordinary staff. She is richly deserving of the Amy J. Blue Award." ISM

"Nancy is the heart, soul and engine of our centers."

Stem cell agency awards nearly \$4 million to researchers

Albert Wong, MD, professor of neurosurgery at the School of Medicine, was awarded \$2.9 million on May 19 by the California Institute for Regenerative Medicine to study the use of a vaccine to treat glioblastoma, a common and often-deadly brain tumor.

The vaccine is meant to stimulate a patient's immune system to recognize and attack cancer cells. The award was made through the state stem cell agency's Partnering Opportunity for Translational Research Projects program.

In addition, four School of Medicine researchers received Inception Awards of about \$240,000 each through the agency's Partnering Opportunity for Discovery Stage Research Projects program. These awards provide seed funding to support the exploration of transformational ideas that hold the potential to greatly impact the field of human stem

cell research.

Recipients include Bertha Chen, MD, professor of obstetrics and gynecology, to investigate ways to treat radiation-induced bladder injury; Jeffrey Goldberg, MD, PhD, professor of ophthalmology, to explore the use of embryonic stem cells to treat corneal endothelial degeneration; Phillip Yang, MD, associate professor of medicine, to study how to activate patient-specific endogenous myocardial repair; and Philip Beachy, PhD, professor of developmental biology, to learn whether bladder cancer can be treated by replacing the corrupted urothelial lining.

In total, 19 Discovery Stage Research awards and one Translational Research award were granted for a total of \$7 million. With these awards, Stanford has received roughly \$307 million from CIRM. ISM

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Winners of Spirit, Leadership awards announced

By Ruth Schechter

The School of Medicine has announced the winners of the annual Anne G. Crowe Spirit Award and Inspiring Change Leadership Award.

Spirit Award winners are selected for their outstanding dedication, initiative, motivation, positive attitude and customer service. This year's recipients are Tacy Abbott Framhein, a program coordinator in the Department of Genetics, and Charlene Rotandi, fellowship coordinator in the Department of Pediatrics.

The Inspiring Change Leadership Award, which goes to staff members who have implemented processes that improve the school, was given to Teresa "Tracy" Burk, an administrative associate in the Department of Radiology, and Jacqueline Genovese, assistant director of the Medicine & the Muse Program.

Each winner will receive \$3,000.

Tacy Framhein

Framhein really does need to be in two places at once. Balancing a position split between two programs means that she has to juggle two job descriptions in different locations while serving as point person for faculty, students and staff. She tends to the needs of 16 master's degree students in the Human Genetics and Genetic Counseling Program from admission through commencement. And she recently switched to a 30 percent assignment as a program coordinator for the Medicine & the Muse Program in the Stanford Center for Biomedical Ethics.

"It's both challenging and rewarding to be assigned a percentage of time for each position," said Framhein. "It requires a lot of flexibility, because there are so many people who require different things for so many different projects."

Framhein's duties are nothing if not diverse, working at both the front lines and behind the scenes. She pulled together the pieces for a large National Institutes of Health grant and helped students launch the Stanford Genetic Counseling Student Interest Group by showcasing the group on the genetic counseling program website, coordinating an email account and booking rooms for regular meetings. Over the past four years, her job has involved coordinating schedules, organizing events and preparing educational material and documents for students.

"Tacy makes my job so much easier," said Kelly Ormond, MS, professor of genetics and director of the master's degree program. "She always thinks ahead and has great follow-up. She takes full responsibility for everything she does, taking the initiative and dedicating herself to delivering high-quality service."

"Working with faculty and students who are involved in helping patients and improving medicine is incredibly satisfying," Framhein said. "I'm proud to be part of something bigger."

Charlene Rotandi

Many hematology/oncology fellows in the Department of Pediatrics are surprised by the amount of paperwork they need to do and accreditation details they need to follow. There are forms for credentialing, tracking hours, verifications, grant submissions, taxes, even vacations. Happily for the fellows, Rotandi knows the ropes. Not only does she manage their schedules and track their professional prog-



Tacy Framhein



Charlene Rotandi



Teresa Burk



Jacqueline Genovese

ress, she also monitors their emotional health.

"Working with children with cancer in the Bass Center can take a toll," said Rotandi, who has been the department's fellowship coordinator for three-and-a-half years. "Part of my role is to make sure they take adequate time for themselves and maintain a work-life balance. It's an important part of helping them become physicians."

Her day-to-day demands range from clarifying policies to ensuring attendance at educational conferences and smoothing the way for visiting professors. She also helps to facilitate new fellowship training initiatives, schedule educational conferences, measure milestones and track the scholarly oversight committee process. Her primary concern, she said, is making the accreditation process meaningful for fellows — not just a set of hurdles to surmount.

"Charlene is a tireless supporter of graduate medical education both locally and nationally," said Allison Guerin, director of education programs administration in the Department of Pediatrics. "She is a constant resource of knowledge and does everything she can to improve our programs to better support our faculty, staff and trainees. She is the glue that holds everything together."

"There's lots of oversight and tracking involved," Rotandi said. "But I've learned to create schedules to anticipate and prepare for potential issues and then look for opportunities to improve upon them. It's like a big puzzle: You have to see the big picture but also take care of all the minutiae. And that's easier when all the parts are in place."

Teresa Burk

It started last spring with a series of classes about how to identify problems and measure change. An administrative associate in the Department of Radiology, Burk was asked to help improve the high turnover and low morale among her fellow support staff members. A survey distributed to the department's 40 support staff showed an average satisfaction rate of only 5 on a scale of 1 to 10.

"People felt that there was no access to resources and that they didn't know what was going on in the department," said Burk, who worked at an environmental engineering company and taught sculpture before joining the department three years ago. "Support staff concerns were seen as an important issue to address."

Over the next four months, Burk led efforts to raise that satisfaction score, building a system based on shared information and networking. She introduced a website called Rad Hub, which lists step-by-step protocols for everything from ordering lab coats to booking a conference room to acquiring a travel visa. The website was launched as a work in progress and continues to be updated on a regular basis.

"Tracy holds her team together through her exem-

plary optimism, undying energy and sincere desire for teamwork," said Jake Mickelsen, interim quality improvement manager for Stanford Medicine. "She strives to understand the problem and creates deliverables that are well-thought-out and polished."

Based on feedback from former radiology support staff, Burk established a "Rad Guru" program, in which staff members volunteer as go-to experts in specific areas, such as reimbursement, graphic design or site tours. Monthly team huddles allow different groups to take turns on project updates. Burk continues to distribute satisfaction surveys, and responses now average a solid 8.

"I can't overstate how much of this is a team effort," she said. "I think it works because the changes are based on peers helping peers. It helps keep the focus on what's important to the support staff."

Jacqueline Genovese

For Genovese, sharing a personal story can be as therapeutic as prescription medicine. As assistant director of the Medicine & the Muse Program at the Stanford Center for Biomedical Ethics, she creates, coordinates and teaches numerous courses, workshops and events to encourage medical school faculty, students, residents and staff to use the humanities as a tool for personal expression and better health care.

"The arts are a powerful tool for promoting better understanding between physicians and patients and a way to gain fresh perspective on health and medicine," said Genovese, who joined the program almost three years ago after serving as associate vice president for communications and faculty relations at University of Texas Medical Branch, where she also received her master's degree in medical humanities.

She manages academic courses, teaches writing and literature for Stanford students who are veterans or in the military, and leads a literature and medicine series for physicians at Stanford Health Care and for health professionals at San Francisco Veterans Affairs Health Care System.

She spearheaded a number of initiatives focusing on military-affiliated students and veterans, including Honoring the Ghosts, which featured campus-wide events focusing on war and health, and she brought the Telling Project to Stanford, which featured students, alumni and staff with military experience. She also manages the Pegasus Writers Forum, in which physicians read works of poetry, nonfiction and fiction about their experience as physicians.

"She is a tireless advocate for the impact of the arts and humanities on our understanding of medicine," said Audrey Shafer, MD, professor of anesthesiology, perioperative and pain medicine at the medical school and at the Palo Alto VA Health Care System. "She is a powerful agent for change, an inspiration to those around her and a leader in new, impactful initiatives." ISM

Honor roll: Longtime staff members mark work anniversaries

Each year, the School of Medicine recognizes employees who have reached their five, 10, 15, 20, 25, 30, 35, 40 and 45 years of service. All university employees celebrating 30 years or more years of service at Stanford will be honored May 26 at the Multicultural Springfest.

School of Medicine employees with 45 years of service:

- Timothy Gadus, Office of Facilities Planning and Management

Those with 40 years of service:

- Marilyn Masek, Department of Pathology
- Cecele Quaintance, Department of Pediatrics

- Bach-Hong Tran, Institute for Immunity, Transplantation and Infection

Those with 35 years of service:

- Samuel Brain, Department of Radiation Oncology
- Donna Fullington, Human Resources Group
- Maryse Gascard, Lane Medical Library
- Adriana Krauss, Department of Medicine
- David Kunis, Department of Neurosurgery
- Susan Leamons, Department of Pediatrics
- Douglas Monica, Educational Programs and Services

- Philip Ritter, Department of Medicine
- Corrine Sanchez, Department of Cardiothoracic Surgery
- Valerie Scott, Department of Medicine

Those with 30 years of service:

- Karen Denny, Department of Orthopaedics
- Stephanie Edelman, Department of Surgery
- Maria Fabian, Department of Neurobiology
- Teresa Hinkle, Department of Radiation Oncology
- Brooke Hollak, Department of Medicine
- Donna Jones, Department of Pa-

- thology
- John Reuling, Information Resources and Technology
- Judith Roberts, Department of Ophthalmology
- Dawna Robinson, Stanford Cancer Institute
- Evangelina Salazar, Department of Anesthesiology, Perioperative and Pain Medicine
- Grete Sonderstrup, Department of Microbiology and Immunology
- Marilyn Tinsley, Lane Medical Library
- Virginia Tse, Department of Anesthesiology, Perioperative and Pain Medicine
- Samson Tu, Department of Medicine

Lucile Packard Children's Hospital Stanford celebrates 25 years

By Robert Dicks

From the beginning, Lucile Packard Children's Hospital Stanford stood out. When it opened on June 10, 1991, it was one of very few children's hospitals in the nation to incorporate both pediatrics and labor and delivery in one building.

Now, 25 years later, the hospital is the centerpiece of a preeminent pediatric and obstetric health system that has 65 locations in the Bay Area. Since 1991, the hospital and health system have logged more than 3 million clinic visits, 1,600 solid organ transplants, 110,000 births — and found a permanent place on the *U.S. News & World Report* annual list of America's best children's hospitals.

The silver anniversary in June is a perfect time to look back on a remarkable period of extraordinary care, and look ahead to the 2017 premiere of a new main building for the pediatric and obstetric medical campus.

"From the start, our goal has been to fulfill the vision of Lucile Salter Packard, our generous founder and visionary for children's health," said Christopher Dawes, president and CEO, who has led the hospital and enterprise since 1997 and was previously chief operating officer. "She planned a very nurturing environment, one that would make possible medical breakthroughs for our children, our grandchildren and the children of the future."

Major achievements

"I remember opening day just like it was yesterday," recalled neonatologist David Stevenson, MD, professor of pediatrics at the School of Medicine. Stevenson helped plan and open

the hospital, where he's still treating and saving premature infants. "It was really exciting to see the whole community come out to celebrate. Their support has played a huge role in our tremendous impact."

Lucile Packard, long an advocate for the health of children and expectant mothers, died before the hospital's debut. She and husband David Packard founded the hospital with a \$40 million donation in 1986. "Her magnificent spirit still guides everything we do," said Dawes. "She would have loved this place and all we've achieved."

Those achievements include a series of notable breakthroughs in academic and clinical excellence. Some highlights:

- Launch of the first mobile clinic program in America specifically targeting underserved adolescents.
- Development of a nonsteroidal, immune-suppressing drug regimen for organ transplant recipients.
- Open-heart surgery on the youngest and smallest infant ever to undergo such an operation.
- Groundbreaking improvements in pregnancy and newborn care.
- Leadership in preterm birth research.
- Pioneering food allergy research.
- Studies focused on eradicating disease for children around the world.
- Recognition as being No. 1 in the United States in solid organ transplant volume.

Becoming one of the nation's elite children's hospitals has long been a collaborative effort with the School of Medicine, Stanford University and the top minds in Silicon Valley, all "tremendous

drivers of our innovation and achievements," Dawes said.

Saluting donors

Dawes also saluted the unwavering generosity of donors through the Lucile Packard Foundation for Children's Health, and the support of the David and Lucile Packard Foundation. "They've helped propel every element of our success," he said. And through aggressive outreach and advocacy, the hospital and health system have become leaders in community service, providing care regardless of a family's ability to pay.

"I know my mother would be extraordinarily proud of everything Lucile Packard Children's Hospital stands for," said Susan Packard Orr, vice chair of the hospital's board of directors. "The breakthrough discoveries, the community service, the family-centered approach and such great care are exactly what she wanted this hospital to be."

Expanding access to meet demand

"Major advances in patient care mean that more children today are living into adulthood with serious and chronic diseases that would have been fatal 15 to 25 years ago," said Christy Sandborg, MD, pediatric rheumatologist and professor of pediatrics at the School of Medicine. "There's an increasing demand for more space to care for these kids and families."

That's why the hospital plans to debut a new centerpiece for the pediatric and obstetric medical campus — a \$1.1 billion expansion, adding 521,000 square feet of building space and 149 patient beds — in the summer of 2017. The project will create the nation's most technologically advanced, family-friendly and environmentally sustainable hospital for children and expectant mothers, Dawes said.

"The hospital's expansion signals its continued dedication to the sickest patients, and illustrates the essential role children's hospitals play in our health-care system," said Mark Wietecha, president and CEO of the Children's Hospital Association in Washington, D.C.

The hospital's influence expanded further in 2012, and in a way few could have predicted back in 1991. "We launched a new, integrated network called Stanford Children's Health," said Dawes. The network, with the hospital

as its centerpiece, now has 65 locations in Northern California and 100 locations in the western United States. "It was our response to a changing health-care environment and consumers' increased demand for high-quality services, like those at Stanford Medicine, to be available closer to their homes."

That model, providing everything from routine checkups to advanced treatment, has been a runaway success. Together with the hospital, this comprehensive health system receives more than 500,000 clinic visits a year.

The next 25

As the pediatric and obstetric teaching hospital of the School of Medicine, Lucile Packard Children's Hospital Stanford will continue to have access to the top minds in science, research and innovation.

"For the past 25 years, Lucile Packard Children's Hospital Stanford has helped to lead the world in advancing pediatric research, care and training for the benefit of countless children," said Lloyd Minor, MD, dean of the School of Medicine. "As an integral part of Stanford Medicine, the hospital will remain indispensable to our overarching vision for precision health, through which we hope to win the race against childhood and adult disease before it even begins — preventing conditions before they strike and curing them decisively if they do."

Those cures are poignantly illustrated in stories of lives saved. For instance, 6-month-old Liam Luna of San Jose, California, recently became the first baby in the world successfully treated with prenatal maternal hyper-oxygenation for his rare heart defect. His parents were thrilled to take him home with a great prognosis.

And the family of Elliot Loh, age 7, is so happy that he was successfully treated for a brain tumor at Packard Children's that they return to the United States every year from China for a reunion with their care team.

"In the end, it's stories like these that best represent how our staff is fulfilling the vision of our beloved founder," Dawes said. "Lucile Packard inspires our past, present and future, and we think she'd be very proud of everything we done." ISM

LUCILE PACKARD CHILDREN'S HOSPITAL STANFORD



(Left) Lucile Packard Children's Hospital Stanford celebrates its opening on June 10, 1991. (Below) A rendering of the hospital's new main building, which is expected to open in the summer of 2017.

LUCILE PACKARD CHILDREN'S HOSPITAL STANFORD





Ronald McDonald House at Stanford celebrates opening of new residence

(Top left) A ribbon-cutting ceremony was held May 10 for a newly constructed, 52,000-square-foot residential building designed to house families with children hospitalized at Lucile Packard Children's Hospital Stanford. The new building, on Sand Hill Road, has 67 private family suites. It's part of Ronald McDonald House at Stanford, which previously comprised just one residence with 47 suites. The addition of the new residence, which is next door to the original one, is expected to alleviate the nightly waiting list of 40-50 families seeking accommodations at Ronald McDonald House at Stanford. There are 357 Ronald McDonald Houses worldwide, providing families with a place to stay near hospitals where their children are being treated. (Top right) The new building features age-specific activity rooms, including this recreational area for teens, as well as kitchen and dining areas, laundry rooms, a fitness center and a rehabilitation room. (Bottom right) Tenasha Carter and Samuel Akpan have an 11-month-old son, Ajani, hospitalized at Packard Children's. The couple, along with Ajani's three siblings, will be staying at the new residence. (Bottom left) A room in one of the family suites. ISM

New issue of *Stanford Medicine* magazine explores how relationships influence health

By Rosanne Spector

Ron Davis, PhD, has built a career solving biochemical puzzles — and now his son is desperately ill due to a biochemical puzzle of his own. So Davis, a professor of biochemistry and of genetics at Stanford, has taken on a new scientific challenge: sussing out the molecular cause of chronic fatigue syndrome, the disease afflicting his son.

The story of this quest appears in the spring issue of *Stanford Medicine* magazine as part of a special report, "Relationships: Ties that heal."

As the article explains, for Davis, "Each day has become a race to unravel the mystery of chronic fatigue syndrome, the disease that is killing his 32-year-old son, a freelance photographer who was forced to move into his childhood home five years ago when he was no longer able to care for himself. It's a puzzle that Davis ruminates over day after day, his mind humming along in high gear, constantly shifting through data, hypothesizing, analyzing."

It's no surprise that a loved one's dire need inspires zeal for finding solutions. In the medical realm, as in every area of life, relationships play a huge role.

Influencing our health

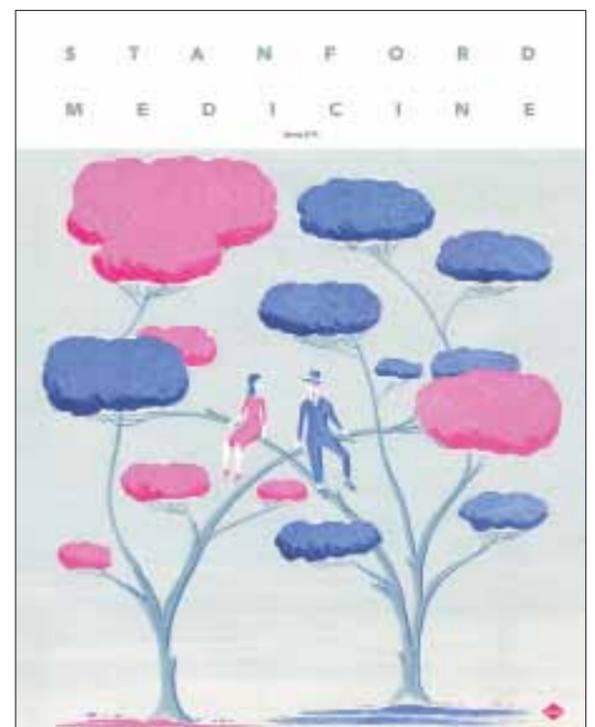
Not only do relationships help determine what re-

search is conducted, they influence our physical well-being. Connections with others affect the production of hormones, the actions of immune cells and the pattern of our sleep cycles. Researchers are finding that relationships are a crucial, though difficult-to-measure, ingredient for health.

The magazine also includes a Q&A with actress Glenn Close and her sister Jessie about their family's experience with mental illness and their fight to end stigma against the mentally ill. The online version of the magazine includes audio of the interviews.

- Additional highlights of the special report include:
- An article about the benefits of supportive relationships for physical health.
 - A piece about urinary incontinence and how the condition interferes with relationships and can change your relationship with yourself.
 - A feature about the beneficial bond that can form between at-risk teens and their doctors.
 - An essay about the unexpected joy of raising a child with cerebral palsy.
 - A story about the love between one of the world's leading experts on narcolepsy and his narcoleptic pet Chihuahua.

Additional articles include a story about the decline in the diversity of our gut microbes and what we can do



about it, and an essay by a Stanford psychiatrist about returning to his home state of West Virginia to help fight the drug problem there.

The magazine is available online. Print copies are being sent to subscribers. Others can request a copy at 723-6911 or by sending an email to medmag@stanford.edu. ISM

Folate

continued from page 1

Research Part A. The research examines neural tube defects, which affect a baby's brain and spine, and which were the intended target of fortification with folic acid, a B vitamin. However, neural tube defects were already becoming less common before fortification began, and their decline slowed substantially after fortification was introduced, the study found.

"We did not see what we would have expected to see, and that's a concern," said the study's senior author, Gary Shaw, PhD, professor of pediatrics at Stanford.

The effect of fortification on two other categories of birth defects was also studied, with unclear results.

Risk factor for birth defects

Lower levels of folic acid intake are known to increase the risk for neural tube defects, including anencephaly, in which a baby's brain does not develop, and spina bifida, in which the tube enclosing the spinal cord is open at birth. Anencephaly is usually fatal in the first few days of life, and spina bifida often causes lifelong paralysis. Because these birth defects occur early in gestation, often before a woman realizes she is pregnant, folic acid fortification was introduced in the late 1990s to try to raise everyone's blood level of the vitamin and thus prevent NTDs. It is now added to cereals, flour and other refined grain products. Natural folates are present in many foods, such as leafy green vegetables, whole grains, citrus fruits and beans.

The new study examined newborns and reports of

pregnancies affected by birth defects in eight Central California counties from 1989 to 2010. The overall rate of neural tube defects for the entire study period was 87.8 cases per 100,000 births. From 1989 to 1996, before fortification started, NTDs declined by 8.7 cases per 100,000 births per year.

"The downward trend in neural tube defects started probably in the late 1960s or early 1970s; it was happening even before folic acid was likely added to multivitamin supplements or certain foods," Shaw said. The reason for the pre-fortification decline is unknown.

Slower decline

However, after fortification was fully implemented, between 1999 and 2010, NTDs declined more slowly, by 1.7 cases per 100,000 births per year, the study found.

The study also looked at birth defects that were not originally intended as targets of folate fortification: orofacial clefts, which include cleft lip and palate, and cleft palate alone; and gastroschisis, a birth defect in which a baby is born with some of its intestines outside the body. Effective surgical treatments exist for orofacial clefts and gastroschisis, whereas anencephaly has no treatment and spina bifida often causes lifelong disability.

Before fortification began, rates of cleft lip and palate and cleft palate alone were increasing slightly, by 0.2 and 1.2 cases per 100,000 per year, respectively. (These defects are more common than NTDs, affecting a combined total of around 180 babies per 100,000 births per year over the entire study.) After fortification, rates of orofacial clefts decreased by about 2 cases per

100,000 per year. Gastroschisis cases increased for the entire study period, but increased more slowly after fortification.

The study does not exclude the possibility that other factors could be responsible for changes in birth defect rates, Shaw noted. For instance, maternal obesity rates were increasing between 1989 and 2010, and higher-weight mothers are at lower risk of delivering babies with gastroschisis.

Ongoing debate

The findings will add to the ongoing debate about whether and how folic acid fortification should be modified in the future, Shaw said. Some experts have suggested that fortification should be increased to prevent more neural tube defects, while others are concerned about the potential side effects of such a change. "An increase in colorectal adenomas has been observed in some countries with folic acid fortification," Shaw said.

Although the findings may contribute to changes in fortification programs that affect the whole population, advice about folic acid for pregnant women and women planning pregnancies remains unchanged, Shaw added. "For women who are planning to become pregnant or are already pregnant, it is still important to take a multivitamin supplement containing folic acid," he said.

The study's other authors are Wei Yang, MS, data analyst in pediatrics; and Suzan Carmichael, PhD, professor of pediatrics. Shaw and Carmichael are members of Stanford's Child Health Research Institute.

The research was funded by the U.S. Centers for Disease Control and Prevention. Stanford's Department of Pediatrics also supported the work. **ISM**

For 30 years, Trauma Service has treated the most gravely injured

By Sara Wykes

Jerry Hynes had just left his favorite Santa Cruz bookstore on Dec. 23, 2013, when he was run over by the bus he was rushing to catch.

The driver stopped the bus, but until he understood what the vehicle had hit, its full weight remained on the legs of the 76-year-old retiree. The injuries list that later documented Hynes' damaged body parts was four pages long. Almost 2½ years and many arduous hours of rehabilitation later, "I go for a walk outside each day, I go to the gym, I go to the library," Hynes said. "Considering how what I call my new life began, it's all been grace."

Hynes credits the Stanford Health Care Trauma Service for saving his life and preserving his leg function. "I could have ended up as a permanent invalid," he said. "Thanks to the amazing work of the Stanford trauma team, I came through intact."

The story of Hynes' against-the-odds recovery is one of many in the 30-year history of the Stanford Trauma Service. On May 14, as part of Stanford Medicine's Health Matters community education event, the service will celebrate three decades of providing this special form of medical care that depends on a precisely practiced choreography to urgently treat severe injuries.

Trauma care is taken for granted these days, but this wasn't always so, according to trauma surgeon David Gregg, MD, clinical associate professor of surgery, who led the service from 1986 to 2001. Until the late 1960s, when trauma care began to be organized around special skills and personnel, "the way trauma care had been managed in most local hospitals was in an emergency room that would also be open to take trauma patients," Gregg said. The lack of training, national standards and verification processes, he said, was failing patients.

Ranked by level of services

Using national standards now determined by the American College of Surgeons, trauma programs are

ranked by their level of services and available medical expertise. Since 1998, SHC's trauma service has been verified as a Level 1 provider, the highest level of trauma care recognized by the American College of Surgeons. It's one of just 12 Level 1 adult trauma programs in the state and the only one between San Francisco and San Jose. It also serves as one of three Level 1 pediatric trauma services in Northern California. Last year, SHC's trauma team treated more than 2,600 patients from its coverage area of the Peninsula's 2.6 million residents, as well as patients flown in from elsewhere in Northern and Central California.

Trauma care is part of emergency medicine, but traumatic injuries are distinctive in their severity. They may include penetrating and blunt force injuries, airway obstruction, fractures, paralysis — or all of the above. A trauma team's paramount goal, said trauma nurse coordinator Denise Greci Robinson, is to keep bleeding under control and airways clear for breathing.

Rapid identification and treatment of injuries is accomplished through the collaboration of emergency medicine doctors, trauma surgeons, specialized nurses, advanced practice providers, imaging technicians and care coordinators, Greci Robinson said. When needed, specialists in orthopaedics, neurosurgery and other areas will come quickly to assist.

"We have a standardized approach to identify injuries quickly and get those treated in a timely manner. Sometimes people will go immediately to the OR, sometimes to the ICU," said Shelly Woodfall, SHC's trauma program manager.

How the team operates

Each trauma team member has a clear role. One doctor acts as the captain of the team, directing the specifics of care; a nurse does the same for the nursing team — but neither one will touch the patient. Another doctor is in charge of calling out all the injuries observed in the patient, a third is expert in clearing a patient's airways to insert a breathing tube. Technicians also have designated jobs — to operate equipment or monitor it. Trauma specialists like orthopaedic surgeons and general surgeons assess and repair damage.

In the limited space of a treatment room, where more than a dozen people might be coming in and out, preparing to manage stress is critical, said Greci Robinson. "When you're in the middle of it, so focused on doing your job, emotions don't surface." If the noise level rises too high, the doctor in charge will call out, "One voice!"

As a Level 1 trauma center, SHC provides a complete package of services, from



David Gregg led the trauma service from 1986 to 2001.

community education on injury prevention to rehabilitation to research that advances trauma care. "We pride ourselves on trying to figure out better ways to take care of our patients," said David Spain, the Carol and Ned Spieker Professor and professor of surgery, who has been director of the trauma service since 2001. He has guided many improvements, including new technologies for imaging and information sharing, ways for SHC to be a resource for trauma patients throughout the state and novel approaches to care based on outcomes analysis.

Asiana Airlines crash

"We are constantly reviewing data about our performance," Spain said, "and we've been recruiting people who are committed to doing trauma care."

The program's greatest test was the 2013 Asiana Airlines crash at San Francisco International Airport. There were 307 people aboard the flight, and SHC was the only nearby Level 1 trauma center with a helipad. Within 30 minutes of the crash, SHC's trauma service had paged the staff: More than 150 trauma and emergency medicine specialists would be engaged in treating 55 patients.

The team aimed to treat as many people as possible within the "golden hour," said Patrice Callagy, director of emergency nursing services. She has been at SHC for nearly 25 years and well knows that starting treatment within the first hour after injury boosts the odds of survival. "We also know that if you are treated at a Level 1 trauma center, you have a 25 percent greater chance of survival," Callagy said.

The trauma team's research on care improvement continues, said team surgeon Thomas Weiser, MD, assistant professor of surgery. "We have to be prepared for what happens not just today, but five or 10 years from now." **ISM**



Trauma nurse coordinator Jo Ann Schumaker-Watt and trauma service director David Spain.

Voice

continued from page 1

mothers' voices with greater than 97 percent accuracy.

The brain regions that were more engaged by the voices of the children's own mothers than by the control voices included auditory regions, such as the primary auditory cortex; regions of the brain that handle emotions, such as the amygdala; brain regions that detect and assign value to rewarding stimuli, such as the mesolimbic reward pathway and medial prefrontal cortex; regions that process information about the self, including the default mode network; and areas involved in perceiving and processing the sight of faces.

"The extent of the regions that were

engaged was really quite surprising," Menon said.

"We know that hearing mother's voice can be an important source of emotional comfort to children," Abrams added. "Here, we're showing the biological circuitry underlying that."

Children whose brains showed a stronger degree of connection between all these regions when hearing their mom's voice also had the strongest social communication ability, suggesting that increased brain connectivity between the regions is a neural fingerprint for greater social communication abilities in children.

'An important new template'

"This is an important new template for investigating social communication

deficits in children with disorders such as autism," Menon said. His team plans to conduct similar studies in children with autism, and is also in the process of investigating how adolescents respond to their mother's voice to see whether the brain responses change as people mature into adulthood.

"Voice is one of the most important social communication cues," Menon said. "It's exciting to see that the echo of one's mother's voice lives on in so many brain systems."

Other Stanford authors of the study are Tianwen Chen, research associate; clinical research coordinators Paola Odriozola, Katherine Cheng and



Vinod Menon

Amanda Baker; Aarth Padmanabhan, PhD, postdoctoral scholar in psychiatry and behavioral sciences; Srikanth Ryali, PhD, instructor in psychiatry and behavioral sciences; John Kochalka, research assistant; and Carl Feinstein, MD, professor emeritus of psychiatry and behavioral

sciences. Menon and Feinstein are members of Stanford's Child Health Research Institute.

The study was funded by the National Institutes of Health, as well as by the Singer Foundation and the Simons Foundation. Stanford's Department of Psychiatry and Behavioral Sciences also supported the work. **ISM**

Nanotech

continued from page 1

a surgery," Gambhir said. "We've specially designed nanoparticles that can send back a massively amplified, whopping signal when they bind to cancer cells in the colon, and we're working on ways to trigger the self-assembly of nanoparticles when they enter a cancer cell. The field has advanced tremendously in the past 10 to 15 years."

Gambhir, the Virginia and D.K. Ludwig Professor for Clinical Investigation in Cancer Research, co-directs the NCI-funded Stanford Center for Cancer Nanotechnology and Excellence for Translational Diagnostics with Shan Wang, PhD, a professor of materials science and engineering and of electrical engineering.

The ability to diagnose the very earliest signs of trouble is crucial for efforts to stop disease in its tracks before symptoms or complications arise — which is a key component of what's known as precision health.

"Early diagnosis is absolutely critical, and requires an entirely different type of approach and technology than we've relied on in the past," Gambhir said. "Without nanomedicine, we wouldn't have a chance of accomplishing our primary goal: to keep our hospitals empty."

A matter of scale

So what's so special about nanotechnology? As you might guess, it's a matter of scale. A nanometer is one-billionth of a meter. A human hair is about 100,000 nanometers in diameter. An average cell, about 10,000. The Proteus, in *The Fantastic Voyage*, was about 1,000 nanometers long, and the antibodies that attacked its passengers were about 10 nanometers in size.

Nanoparticles for medical use are defined as molecules or structures no larger than about 100 nanometers — comparable in size to the tens of thousands of molecules in the body that slip in and out of intact cells and wiggle harmlessly through blood vessel walls and into tissues. Like the Proteus and its crew, they can seek out and interact with individual cells and their contents. But the rules of engagement have changed, as has the possible magnitude of the visitors' effect.

Molecules on the nanometer scale operate in a dusky netherworld where the laws of physics wobble at the edge of a quantum galaxy. Electrons behave strangely on such a tiny stage. As a result, the nanoparticles' essential properties, including their color, melting points, fluorescence, conductivity and chemical reactivity, can vary according to their size.

Nanoscale particles also sport tremendous amounts of surface area as compared with larger particles. A cube of gold with sides 1 centimeter long has a total surface area of 6 square centimeters. But the same volume filled with gold nanospheres with diameters of 1 nanometer has a surface area greater than half a football field.

'Tuning' nanoparticles

Researchers like Gambhir and his colleagues have learned how to capitalize on many of these properties in their quests to seek out and destroy cancer cells in the body, or to collect them from a blood sample for further study. By changing the size of the particles, the scientists can "tune" the nanoparticles to behave in specific ways — fluorescing varying colors for imaging purposes, for example, or grabbing onto and then releasing cancer cells for study. Some can be engineered to absorb light energy to power tiny acoustic vibrations that signal the

presence of a tumor or to release heat to kill the cells from inside.

Researchers also capitalize on the particles' vast surface area, coating them with antibodies or proteins that home to cancer cells, or with signaling molecules that are released by the tens of thousands when a cancer cell is located.

Gambhir believes nanotechnology will be particularly helpful in early diagnosis and treatment. "It's not that our therapies are poor — it's that we apply them too late," he said. "Nanotechnology has the potential to detect and even kill early cancer cells present in the hundreds or thousands versus the billions already present in currently diagnosable tumors."

He and his colleagues envision a day in the not-too-distant future when nanosensors implanted in our bodies, or even in household appliances like the toilet, can alert us to the first signs of trouble — often without our conscious participation. He compares the approach to that of piloting a jet airplane.

"An airplane's engine is constantly monitored, and information is sent to a global portal to diagnose problems in real time," he said. "We're missing that in health care today."

But maybe not for long.

'Swallowing the doctor'

The concept of miniature medical minions isn't new. In 1959, noted physicist Richard Feynman, PhD, discussed the possibility of "swallowing the doctor" in a talk at the California Institute of Technology, and British researchers first realized the potential of liposomes for drug delivery in 1961. These spheres can be engineered to contain water-soluble drugs in their interior, while also squirreling away hydrophobic, or insoluble, drugs in their fatty membrane. Careful engineering can result in liposome-based structures that deliver multiple drugs in precise ratios and at high levels without the toxicities that can occur when delivering the medicines without these structures. They accumulate naturally in tumor tissue, or can be targeted to specific cell types by the addition of antibodies or other molecules to their surface.

The technique was first approved by the U.S. Food and Drug Administration in 1995 to deliver the chemotherapy drug doxorubicin to patients with AIDS-related Kaposi's sarcoma. There are now more than a dozen liposomally packaged drugs on the marketplace, and researchers have begun to explore ways to use other types of nanoparticles to deliver not just drugs, but also small RNA molecules to block the expression of specific genes, or a payload of radioactivity to kill the cell.

"From a practical perspective, nano-based techniques aren't the wave of the future. This is the now," said Heather Wakelee, MD, an associate professor of medicine at Stanford who focuses on the treatment of lung cancer patients. "And it's changing how we treat patients in the clinic."

Nanosensing technology

Researchers are working on technology for use outside the body to identify and characterize tumor cells present at minuscule levels in all manner of bodily fluids — tracking the course of a known disease or even pinpointing its inception long before symptoms arise.

Wakelee has worked with center co-director Wang to design a kind of "magnetic sifter" that quickly sorts cancer cells from normal blood, based on magnetic nanotags engineered to coat the cancer cells' surface. A

key component of the technique is the ability to swiftly release the bound, living cells for further study. Another approach, also launched in Wang's lab, involves a magneto-nanosensor — a silicon-based chip smaller than a dime that can detect and quantify magnetic nanotags on cancer cells or cancer-associated DNA or protein molecules based on changes in the chip's external magnetic field.

This approach is being tested in clinical trials by MagArray, a company based in Milpitas, California, for its ability to detect multiple lung and prostate cancer biomarkers in patients' blood. Like other nanotechnology, it is exquisitely sensitive.

'Toward a simple blood draw'

These techniques may allow researchers to not just count the circulating tumor cells in a patient, but also to sequence cells' genomes or assess the levels of expression of cancer-associated proteins on their surfaces. Wakelee is also working with colleagues to develop ways to capture and sequence tumor DNA that circulates freely in the blood of cancer patients.

"We're looking for specific gene mutations that could change therapy," she said. "In this way, we're moving away from invasive biopsies for our patients and toward a simple blood draw to learn more about an individual's specific cancer."

Gambhir is working to design gold and silica nanoparticles for use inside the body to detect colon cancer. The particles, which would be swallowed as pills, coat pockets of tumor cells that would normally be invisible during a colonoscopy, and can be visualized with a special endoscope designed by the team. The technique is under review by the FDA.

"Cancer is a very difficult disease to treat, and it's also difficult to diagnose early," said Piotr Grodzinski, PhD, who directs the NCI's nanotechnology for cancer programs. "The alliance was created to bring together engineers and materials scientists, for example, with biologists and oncologists to understand, first, how nanoparticles interact with biological systems and, second, how they interact with cancer cells and what they can do to the tumor."

"Stanford, in the heart of Silicon Valley, is a unique place for this kind of technology to develop," said Gambhir. "The collaborative atmosphere brings together people to solve specific problems in cancer diagnosis and detection."

The crew on the Proteus managed to band together to save the defector — in the nick of time, of course — escaping through a tear duct after destroying the blood clot in his brain just before ballooning back to normal size. Nanomedicine for future patients will likely be less fraught with urgency, but the outcome will be more important. After all, the patient could be you. **ISM**

A longer version of this article first appeared in the winter 2016 issue of Stanford Medicine magazine.

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5 QUESTIONS

an occasional feature in which an expert answers five questions on a science or policy topic

Desiree LaBeaud on the risks of the Zika virus

The warm weather of summer is an invitation to mosquitoes, which may carry the risk of disease, such as Zika virus. Desiree LaBeaud, MD, is an associate professor of pediatric infectious disease who has focused her efforts on understanding the risk factors

and long-term health consequences of arboviral infections, including Zika. She recently shared her thoughts about the local risks of contracting the virus, what precautions residents can take, as well as what travelers outside the United States should do to avoid infection with the virus.

1 What kind of risks could Zika pose this summer to Bay Area residents?

LABEAUD: While there is currently a minimal risk of Zika virus spreading to the Bay Area, there are a number of factors that could contribute to a local outbreak. The vector that transmits Zika virus and many other viruses are *Aedes* mosquitoes. *Aedes* mosquitoes have been found in many areas of California, including Menlo Park, Atherton, San Mateo and Hayward. Without exposure to the virus, these mosquitoes cannot transmit Zika virus.

People returning from summer vacations in areas of South and Central America or the Caribbean may be infected with Zika virus without experiencing any symptoms of Zika disease. There is a very low risk of a recent traveler starting a local outbreak in the Bay Area. The traveler would have to have an active infection, which occurs within two to seven days after initially being bitten by an infected mosquito, and would then have to be bitten by another *Aedes* mosquito in the Bay Area that could pass along the infection. The *Aedes* mosquito density is much lower in the Bay Area than it is in South and Central America and other tropical regions of the world. Also, we spend more time indoors here, decreasing outbreak risk.

2 Are there specific precautions people should take to protect themselves from the virus?

LABEAUD: The Centers for Disease Control suggests avoiding travel to areas affected by the current outbreak. For those who are planning on traveling to Latin America or the Caribbean, we highly suggest mosquito repellent. Pack clothing that will provide adequate coverage (long sleeves and long pants), treat your clothing with mosquito repellent (like permethrin) before traveling, and apply mosquito repellent (DEET, picaridin) liberally and often. Avoiding the mosquito vector is your best chance of minimizing

your risk of infection.

If you are concerned about being exposed at home despite there being a low risk for local exposure, be sure to survey your house and yard for containers that collect water. Standing water in small containers — cups, flowerpots, bird baths, garden fixtures, children's toys or play structures, for example — is the preferred environment for *Aedes* mosquito breeding. Dumping out standing water will reduce mosquito breeding around your home.

3 What are the known health risks associated with Zika?

LABEAUD: Typically, Zika virus can cause a broad range of symptoms that have been described as “dengue-like syndrome.” Symptoms may include fever, headache, rash, muscle and arthritic joint pain, conjunctivitis (red eyes), and eye pain. These symptoms are usually mild and only last a few days. About 80 percent of people who have been infected experience no symptoms. Symptoms of infection may be worse in children or people with compromised immune systems.

There are some severe disease presentations that may be linked to Zika virus, including microcephaly in newborns — children born with unusually small brains — and a severe neurologic disorder known as Guillain-Barré syndrome. The CDC is currently performing an extensive investigation to determine whether microcephaly and Guillain-Barré syndrome are linked to Zika virus and what may increase a patient's likelihood of experiencing these serious problems. During a previous Zika virus outbreak in French Polynesia, the incidence of Guillain-Barré syndrome increased 20 times.

Some researchers believe that people in these regions may have a genetic or physiological susceptibility to a more severe form of Zika disease. Others believe that the strain of virus that is causing the current outbreak has mutated to be particularly virulent. Another

thought is that previous exposure or co-infection with another virus — such as dengue virus, that is endemic in currently affected regions — may increase one's risk for severe Zika disease.

4 Are there Zika-prone areas of the world that travelers should avoid?

LABEAUD: The current outbreak has been reported in 33 countries across South and Central America and throughout the Caribbean islands. Brazil has experienced a significantly large outbreak since May 2015. Zika virus transmission was documented in a total of 57 countries and territories. Six countries — Argentina, Chile, France, Italy, New Zealand and the United States of America — have now reported locally acquired infection through sexual transmission. Vietnam is the country to most recently report mosquito-borne Zika virus transmission.

5 There are certain species of mosquito that are vectors for transmitting the virus. What makes these particular mosquitoes such powerful transmitters of Zika?

LABEAUD: *Aedes* mosquitoes, specifically *Aedes aegypti* and *Aedes albopictus*, are the vectors for Zika virus and many other viruses. The female mosquitoes take blood meals from larger mammals in order to stimulate the development of eggs. These mosquitoes are anthropophilic, which means they prefer to feed on people. These mosquitoes specifically bite during the day, making people more susceptible to bites.

Aedes mosquitoes breed near the home environment. There are often containers with small amounts of rainwater or other pooled water located near the home, such as tires, containers specifically used for water collection, empty planters and bowls. Breeding near the home makes them more likely to bite humans, as they do not need to travel far for a blood meal.

Aedes aegypti females are also nervous feeders, so any movement during feeding will make them fly off. This means that it takes on average four or five human feedings for them to have a full blood meal to lay eggs, and the mosquito infects all of them. That means she can transmit viruses very efficiently! **ISM**



Desiree LaBeaud



RYAN K. MORRIS AND THE NATIONAL SCIENCE & TECHNOLOGY MEDALS FOUNDATION

Stanley Falkow at the White House

Stanley Falkow, PhD, professor emeritus of microbiology and immunology and a member of the Stanford Cancer Institute, was presented with the 2015 National Medal of Science by President Barack Obama at the White House on May 19. Falkow was recognized for his pioneering work in studying how bacteria can cause human disease and how antibiotic resistance spreads. He is well-known for his work on extrachromosomal elements called plasmids and their role in antibiotic resistance and pathogenicity in humans and animals. Early in his career, he learned the biochemical and microbiological techniques necessary to deduce how bacteria transmit antibiotic resistance to one another. When Falkow arrived at Stanford in 1981, he set aside his study of plasmids to concentrate on how organisms as diverse as cholera, plague and whooping cough cause disease in humans. **ISM**

OF NOTE

reports on significant honors and awards for faculty, staff and students

WILLIAM KENNEDY, MD, was promoted

to professor of urology, effective Nov. 1. He specializes in pediatric urology and in digital health. His telemedicine clinics have allowed more than 600 families in the Stanford Children's Health network to meet with him remotely before their child's surgery.



William Kennedy

RONALD LEVY, MD, the Robert K. and Helen K. Summy Professor and professor of oncology, has been awarded the American Association for Cancer Research-Cancer Research Institute Lloyd J. Old Award in Cancer Immunology. The award recognizes a scientist whose



Ronald Levy

outstanding and innovative research in cancer immunology has had a significant effect on the field. Levy received a \$10,000 honorarium and gave a lecture in Washington, D.C., in April. His research focuses on lymphocytes and lymphoma.

JOSÉ MALDONADO, MD, was promoted

to professor of psychiatry and behavioral sciences, effective Dec. 1. He is the chair-elect of the School of Medicine's Faculty Senate and president-elect of the American Delirium Society.



José Maldonado

His research focuses on the assessment and management of delirium; prediction and management of alcohol withdrawal in the ill; psychosocial aspects of solid organ transplantation; the neuropsychiatric effects of traumatic brain injury; and post-traumatic stress disorder and suicide.



Laura Roberts

LAURA ROBERTS, MD, professor and chair of psychiatry and behavioral sciences, has been named the editor-in-chief of books for the American Psychiatric Association's publishing unit. She has served as the deputy editor of books for American Psychiatric Publishing Inc. since 2007. The association publishes the Diagnostic and Statistical Manual of Mental Disorders, among other publications. Roberts is the Katharine Dexter McCormick and Stanley McCormick Memorial Professor. **ISM**