



A report offers recommendations to the U.S. president for mitigating the effects of climate change on human health.

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Evolution of anatomy illustration traced by Lane Library archivist

By Kris Newby

Drew Bourn, PhD, the historical curator at Lane Library's Medical History Center, gently placed his favorite book in front of a group of art students. It was one of the last surviving volumes of *The Comprehensive Book in the Art of Medicine*, written by the famous Arab physician Ibn al-Nafis in the 13th century.

As Bourn turned its yellowed and frayed pages, he told the students that it was written after most of the world's medical knowledge had been destroyed in the 1258 Mongol siege of the city of Bagdad, which at the time was an intellectual center for astronomy, mathematics and medicine. If al-Nafis hadn't dedicated the rest of his life to re-documented this medical information, it would've been lost forever, historians say.

This is the eighth year that Gail Wight, MFA, an associate professor of art and art history, has brought students in her Art and Biology course down to the archive reading room in the basement of the School of Medicine's Lane Medical Library, a bookish catacomb where Bourn curates the center's more than 7,000 rare publications.

Wight originally called Bourn to see if he'd show her students at the time the archive's first edition of *De humani corporis fabrica*, the groundbreaking book on human anatomy written by the Flemish anatomist-physician Andreas Vesalius in 1543. But Bourne expanded his lecture to tell stories about the other important anatomical works in the collection, and to discuss how the depiction of the human body has changed with the evolution of imaging technologies and artistic styles.



KRIS NEWBY

Drew Bourn shows students in Art and Biology a first-edition copy of *De humani corporis fabrica*, the groundbreaking book on anatomy written in 1543 by the Flemish anatomist-physician Andreas Vesalius.

"I believe that historical stories can have a big impact on people's lives," said Bourn, who comes from a family of historians and librarians.

Changed how medicine was taught

Speaking to the current group of students, Bourn told them that Vesalius' *Fabrica* was more than an anatomy textbook; it changed the way medicine was taught. In 1537, Vesalius graduated with what was then a classical European

medical education. In anatomy courses, his professors would read straight from the works of the ancient Greek physician Galen, who was born in 129, while an assistant dissected a cadaver to illustrate the structures discussed in the text. Galen's teachings were considered the gold standard for more than 1,000 years, and they were above reproach.

Then Vesalius moved to Padua University to teach surgery. And after he began dissecting

See ANATOMY, page 6

In-home care of dementia patients falls mainly on women, experts say

By Tracie White

The responsibility of providing care to the vast number of patients with dementia expected over the next 20 years will disproportionately fall on working women, according to researchers at the School of Medicine.

"The best long-term care insurance in our country is a conscientious daughter," the authors wrote in a perspective piece published today in *JAMA Neurology*. The article points to a lack of affordable in-home care options in the United States other than unpaid family members, primarily women.

As more baby boomers reach retirement age, experts predict a corresponding surge in cases of dementia: By 2030, an estimated 8.4 million Americans are expected to be suffering from some form of the disease.

Today, most of the care for these patients — 83 percent — is provided by unpaid family members, two-thirds of whom are women, the authors wrote.

"Wives are more likely to care for husbands than vice versa, and daughters are 28 percent more likely to care for a parent than sons," the authors wrote, adding that

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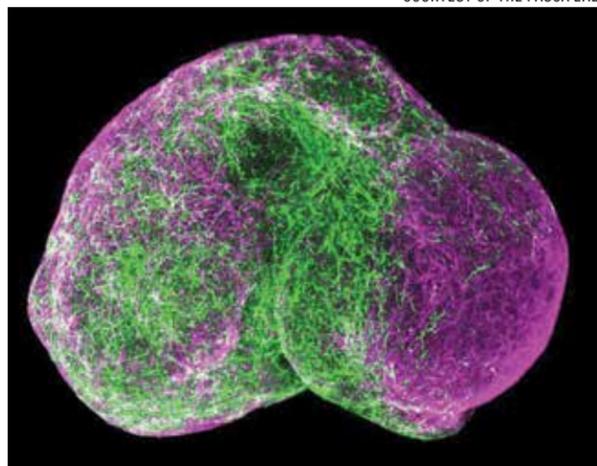


Scientists assemble working human forebrain circuits in lab dish

By Bruce Goldman

Peering into laboratory glassware, School of Medicine researchers have watched stem-cell-derived nerve cells arising in a specific region of the human brain migrate into another brain region. This process recapitu-

COURTESY OF THE PASCA LAB



After spheroids representing two different brain regions fuse in a dish, neurons from one spheroid (green) migrate into the second and forge connections with neurons residing there.

lates what's been believed to occur in a developing fetus, but has never previously been viewed in real time.

The findings, and the techniques used to obtain them, carry potential for the personalized study of individuals' psychiatric disorders. The investigators saw the migrating nerve cells, or neurons, hook up with other neurons in the target region to form functioning circuits characteristic of the cerebral cortex.

These observations also showcase neuroscientists' newfound ability to monitor, assemble and manipulate so-called neural spheroids, generated from human induced pluripotent stem cells, to study the normal development of the human forebrain during late pregnancy.

"We've never been able to recapitulate these human-brain developmental events in a dish before," said the study's senior author, Sergiu Pasca, MD, assistant professor of psychiatry and behavioral sciences. "The process happens in the second half of pregnancy, so viewing it live is challenging. Our method lets us see the entire movie, not just snapshots."

In the study, published online April 26 in *Nature*, the scientists were able to attribute, for the first time, defects in neuronal migration to Timothy syndrome, a rare condition that predisposes people to autism, epilepsy and cardiac malfunction. Postdoctoral scholars Fikri Birey, PhD, Jimena Andersen, PhD, and Chris

Makinson, PhD, share lead authorship.

Culturing neurons in a lab dish is old hat. But the two-dimensional character of life lived atop a flat glass coverslip doesn't sit well with cells designed for three-dimensional existence. Neurons cultured in monolayers mature only partially, tend to die fairly quickly and interact suboptimally.

The need for 3-D models

In a 2015 study, Pasca and his colleagues described their method for producing neural spheroids. Neural precursor cells generated from iPS cells are placed in culture dishes whose bottoms are coated to make it impossible for neurons to attach. The cells float freely in a nutrient-rich broth, ultimately developing into hundreds of almost perfectly round balls approaching 1/16 of an inch in diameter and consisting of over 1 million cells each. These neurons can live for up to two years, and they mature fully.

The spheroids created in the 2015 study recapitulated the human cerebral cortex's six-layer-thick architecture, and the neurons they contained were of the type that arise in and dominate the cerebral cortex. They're called glutamatergic neurons because they secrete the excitatory chemical glutamate.

But the cerebral cortex's gluta- **See BRAINS, page 7**

Students present projects at 34th annual research symposium

PAUL SAKUMA

By Tracie White

Over the three years that Stanford medical student Kimberly Souza worked on her research project, which entailed traveling back and forth to burn wards in Nepalese hospitals, she got to know the story of one of the children in her study well.

"I met him when he was 4. His arms were burned and both hands," said Souza, who presented her project May 4 at the 34th Annual Medical Student Research Symposium at the Li Ka Shing Center for Learning and Knowledge. "When he was 2 years old he was walking in his mom's shoes and tripped and fell in the fire where she was cooking."

Souza's project resulted in the Handhero, a \$20 retractable hand splint that she and her colleague Jana Lim, a PhD student in neurosurgery, hope to market to nonprofit health care agencies working in developing countries. The low-cost medical device is designed to prevent contracture of the fingers of post-surgery burn patients.

The annual symposium showcases medical student research. Faculty and staff judges select the 10 best poster presentations, of which Souza's was one. (For a complete list, see the online version of this story at <http://med.stanford.edu/news/>.)

This year's event featured nearly 50 projects from medical students whose work

reached across a variety of fields of medicine, from oncology to neurology to heart disease. Projects delved into such topics as stem cell research, health care policy, bioinformatics and global health. They explored diseases such as pulmonary arterial hypertension, sepsis and carcinomas.

"The range of projects is terrific," said Laurence Baker, PhD, director of the Scholarly Concentration Program, a required program of study for medical students that promotes in-depth learning and scholarship. Each Stanford medical student is required to complete at least one quarter's worth of research, but most do more, he said. Some, like Souza, take a research year away from medical school to work on their projects.

Fire hazard

Souza's research showed that the most common burn wounds in rural Nepal were to the hands of small children, who often fall into open fires used for cooking. Usually it's years before the children get surgery to repair the deformities to their fingers, which curl up into fists as the wounds heal. The hand splint successfully keeps the fingers from retracting again in the months following surgery.

The 4-year-old who fell while playing in his mother's shoes successfully recovered 100 percent of the use of his hands using the hand splint post-surgery, Souza said.

"I took a year off to research this," said Souza, who is now headed into her last year of medical school. "I've always had an inclination toward global health. There's such a huge disparity globally. I believe health care is a human right."

For their projects, the students work with faculty members, who provide mentorship and guidance through the potential pitfalls and successes of medical research. "Many of these projects will eventually be published," Baker said. "Our goal is to make research part

of the medical school experience at Stanford."

'Not black and white'

Kuo-Kai Chin, a second-year medical student, chose to explore a new area for him: health policy. For his project he ventured into the world of epidemiology and statistical analysis. "It's been a big learning experience," said Chin, a self-described math and science guy, laughing about the ups and downs of the journey. "I've learned that research is not black and white."

Chin set out to investigate the use of two anti-seizure medications, gabapentin and pregabalin, that have been shown to work well as possible alternatives to opioids as post-surgery pain medications.

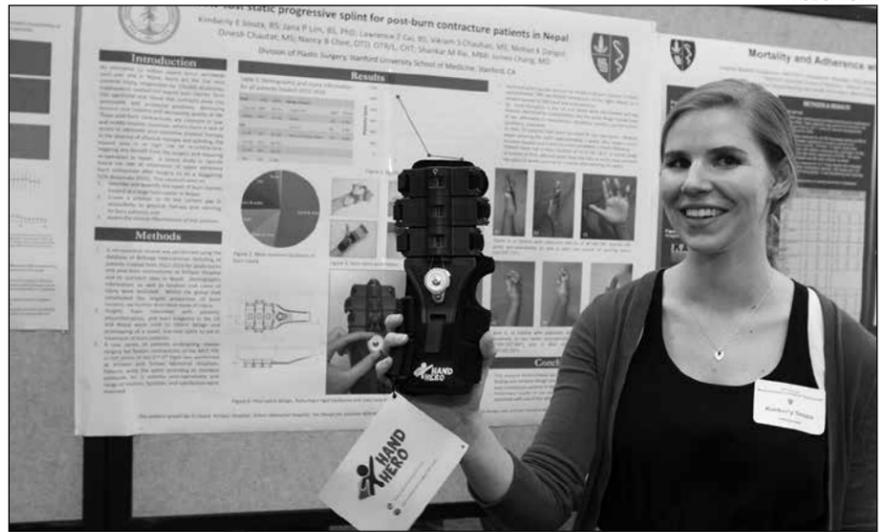
"Everyone knows about the opioid epidemic," Chin said. His project set out to discover whether use of these adjuvant analgesics instead of morphine after knee replacement surgeries was increasing at Stanford as concerns about the national opioid epidemic increased.

His results showed that from 2008-15, the use of these drugs did, in fact, increase significantly.

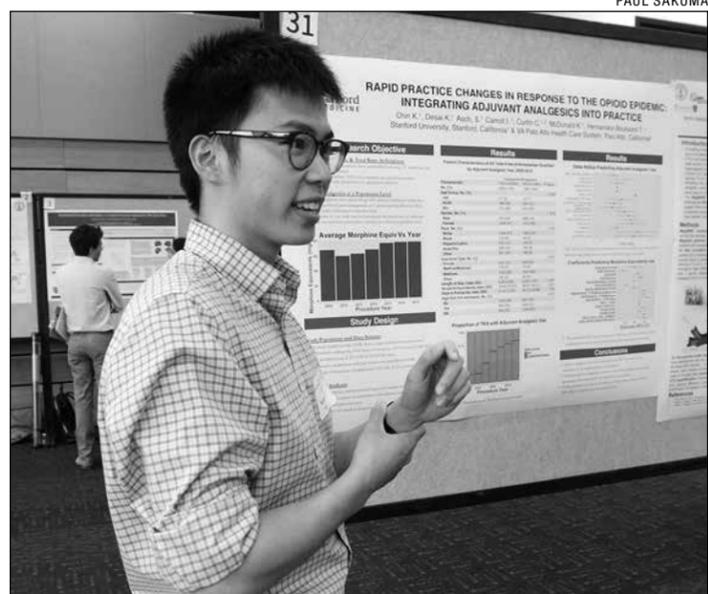
"Physicians are thinking about the opioid crisis and about what alternatives are available," said Chin, who will be presenting results of the study at a health policy conference in New Orleans this summer.

Combining research and medical school at the same time is a challenge, Chin said.

"There are a lot of dead ends. School sometimes gets in the way, but I've learned a lot about research." ISM



For her research project, Kimberly Souza helped develop a low-cost hand splint for post-surgery burn victims. She was one of the winners at this year's Medical Student Research Symposium.



PAUL SAKUMA

Kuo-Kai Chin gave a poster presentation about his research on the use of two anti-seizure drugs as post-surgery pain medications.

California handgun sales spiked after two mass shootings, study finds

By Beth Duff-Brown

After the 2012 mass shooting of children and teachers at Sandy Hook Elementary School in Connecticut, a leader of the National Rifle Association proclaimed, "The only thing that stops a bad guy with a gun is a good guy with a gun."

It would seem that many Californians agreed, according to a new study by researchers at Stanford and two other universities.

In the six weeks after the Newtown shootings — when a young man fatally gunned down 20 children and six adults

— handgun acquisitions in California rose by 53 percent over expected levels, the study said.

In the six weeks after a couple armed with semiautomatic weapons killed 14 people at an event held by the San Bernardino County Department of Public Health in 2015, handgun purchase rates were 85 percent higher than expected among residents of the city of San Bernardino and adjacent neighborhoods, and 35 percent higher elsewhere in California, the study found.

The study was published May 1 in the *Annals of Internal Medicine*. The lead author is David Studdert, a professor of

medicine and of law at Stanford. The senior author is Garen Wintemute, MD, MPH, professor of emergency medicine at UC-Davis.

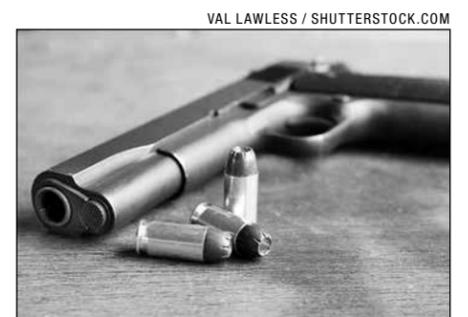
The researchers write that their findings have implications for public health, given that firearm ownership is a risk factor for firearm-related suicide and homicide.

"For some, a gruesome mass shooting may induce repulsion at the idea of owning a weapon," the authors wrote. "For others, it may motivate acquisition. Mass shootings are likely to boost sales if they heighten concerns over personal security, because self-protection is the most commonly cited reason for owning a firearm."

Gun deaths top 32,000 a year

More than 32,000 people die of gunshot wounds in the United States each year, according to the Centers for Disease Control and Prevention. While mass shootings account for less than 1 percent of those deaths, they are the most visible form of firearm violence because of the extensive broadcast and social media coverage that surround them.

Using detailed, individual-level information on firearm transactions in California between 2007 and 2016, the researchers analyzed acquisition patterns after two of the highest-profile mass shootings in U.S. history. They



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found large and significant spikes occurred among whites and Hispanics, and among individuals who had no record of having previously acquired a handgun.

Although these spikes in handgun purchases after both mass shootings were large, they were also short-lived and accounted for less than 10 percent of annual handgun purchases statewide.

"Concerns about firearm violence and the public health risks of firearm ownership should stay focused on the much larger volume of weapons that routinely changes hands, and the immense stock that already sits in households," the researchers wrote.

"On the other hand, the cumulative effect of such 'shocks' as Newtown and San Bernardino shootings on firearm prevalence may be substantial," they wrote. "Moreover, firearm acquisitions seem to be sensitive to a range of other events that are also **See HANDGUN, page 3**

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5 QUESTIONS

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

Samuel So on stamping out viral hepatitis in U.S.

The United States could be free of viral hepatitis as a public health problem by 2030, but support from the highest levels of government would be needed, according to a recently published report from the National Academies of Sciences, Engineering and Medicine.

Though not widely seen as a major problem, viral hepatitis causes more than 20,000 deaths in the United States annually and more than 1.4 million worldwide, mostly due to infection with either the hepatitis B virus or the hepatitis C virus. Often symptomless at first, these infections can lead to liver damage and cancer.

Samuel So, MD, a professor of surgery and the Lui Hac Minh Professor in the School of Medicine, served on the committee that wrote the report, "A National Strategy for the Elimination of Hepatitis B and C," which was published March 28. An expert on chronic hepatitis B and primary liver cancer prevention, research, treatment and health policy, So established the Asian Liver Center at Stanford in 1996 to address the especially high rates of chronic hepatitis B infection and liver cancer in Asians and Asian-Americans. He also leads several health-promotion campaigns to fight the disease. Recently, writer Rosanne Spector asked him some questions about fighting the diseases.

1 Why does it make sense to try to eliminate hepatitis B and C by 2030?

SO: Because millions of deaths could be averted. As many people die of liver cancer and liver cirrhosis caused by chronic hepatitis B and C as HIV/AIDS in the world each year. In the United States, annual deaths from hepatitis B and C are greater than deaths from all the infectious diseases combined and is three times higher than deaths from HIV/AIDS.

Although eradication is rarely possible, in 2016 the World Health Assembly passed a resolution to set a goal to eliminate viral hepatitis as a major public health problem by 2030, and asked each nation to develop national strategies for elimination.

Our committee believes it is feasible to eliminate hepatitis B and C as a public health problem in the United States by ending transmission and preventing the morbidity and mortality among people with chronic infection. Similar global elimination efforts have been mounted against neonatal tetanus and trachoma, an infection that causes blindness.

There is no better time to act. With the new hepatitis C medications, over 95 percent of people with chronic hepatitis C are cured after only two to three months of treatment. Hepatitis B is preventable with vaccination, and hepatitis B antiviral treatment — although not curative — can prevent disease progression and most of the related deaths. Our report found that if diagnosis, care and treatment of chronic hepatitis B and C are increased, 90,000 deaths in the United States would be averted by 2030, and new hepatitis C infections would drop by 90 percent.

2 Why hasn't eliminating hepatitis B and C in the United States been a priority?

SO: It's unfortunate that most people, including policymakers, philanthropic foundations and many leaders in academic medicine and global health, are not knowl-

edgeable or aware of the prevalence and seriousness of chronic hepatitis B and C infections, their link to rising rates of liver cancer and the opportunities for elimination. Despite being a major national and international public health problem, viral hepatitis receives less than 1 percent of the National Institutes of Health research budget.

Through research, outreach and advocating for changes in national policies and guidelines, our center has worked diligently in collaboration with leaders in national governments, the Centers for Disease Control and Prevention, the World Health Organization and donors to build the case for elimination. So, I am really excited that we are finally talking about national and global elimination of hepatitis B and C.

3 What are a few of the biggest challenges you see?

SO: Chronic viral hepatitis is a silent disease and most of the infected have no symptoms. In the United States, an estimated two-thirds of people infected with hepatitis B and half of those with hepatitis C are not aware they are infected.

Among the biggest challenges are diagnosing people who are living with chronic hepatitis B and C and providing them with access to care and antiviral treatment. Although screening is covered by the Affordable Care Act and by Medicare, health care providers rarely suggest it. And most primary care providers have not been trained to screen and provide care and treatment for patients with chronic viral hepatitis.

A major challenge in hepatitis C elimination is access to treatment, due to the cost of the most effective medication. As a result, only few of the estimated 700,000 hepatitis C patients on Medicaid, in correctional facilities or covered by Indian Health Services have received treatment. The report discussed possible ways to pro-

cure drugs at a lower cost to treat these neglected populations, including purchase of a drug's patent or license by the government.

4 What would it take to eliminate these diseases?

SO: It would require our government to recognize elimination of hepatitis B and C as a national priority and to oversee a coordinated, funded effort that includes eliminating mother-to-child hepatitis B transmission; increasing access to adult hepatitis B immunization; increasing chronic hepatitis B and C screening, vaccination, care and treatment in primary care and correctional facilities; eliminating restrictions for hepatitis C treatments; expanding needle exchange and opioid-agonist therapy; and finding a source of sustainable financing to overcome the costs of hepatitis C medications.

5 What can individuals do to help?

SO: Protect you and your family, and contact your national and local elected representatives to support the development and funding of hepatitis B and C prevention, vaccination, screening, treatment and research programs. If you were born abroad, except from western Europe, or your parents were born in Asia or Africa, you should ask your doctor for a one-time blood test for hepatitis B. If you were born between 1945 and 1965 or had a transfusion of blood or blood products before 1992, or have injected drugs even once, ask your doctor for a one-time test for hepatitis C. If you are running a clinic or are a health care professional, make sure your patients are offered hepatitis B and C screening and hepatitis B vaccination according to the ACA and Medicare guidelines, and build hepatitis screening, care and treatment into the electronic medical system you use so it's a no-brainer. **ISM**



Samuel So

Researchers seek adults with peanut allergies for two studies

By Emma Hiolski

Researchers at the School of Medicine are seeking adults with peanut allergies to participate in two clinical trials of drugs that may reduce the severity of allergic reactions.

One is a phase-1 trial that will test the tolerability of a vaccine-based treatment intended to lessen the severity of allergic responses. The other is a phase-2 trial examining the effectiveness of an antibody drug aimed at reducing the inflammatory response.

Millions of people in the United States are allergic to peanuts, one of the most common and deadly food allergies. There is no pharmaceutical treatment for this allergy. Oral immunotherapy, in which patients consume tiny amounts of the food allergen, such as peanut proteins, may help desensitize the immune system — but the approach requires regular exposure to the allergen. The goal of these new treatments is to mitigate allergic responses to peanuts and other food allergens.

"It will be exciting to see what effects these drugs have in food-allergic patients and if it is different compared with oral immunotherapy," said lead investigator Sharon Chinthrajah, MD, a clinical assistant professor of pulmonary and critical care medicine and of pediatric allergy and clinical immunology.

A new type of DNA vaccine

The vaccine, ASP0892, is a new type of DNA vaccine intended to desensitize the immune system to allergens, including peanut proteins. Unlike preventive vaccines that train the immune system to recognize foreign invaders, this drug could help train the immune system to scale back inflammatory responses to allergens and ease the associated symptoms. Instead of exposing the immune system directly to allergens such as peanut proteins, DNA vaccines bring the code for the protein into immune cells, which then produce it within the cells, according to Astellas Pharma Global Development Inc., which is developing the vaccine.

Stanford is one of seven sites in the United States conducting this phase-1 clinical trial sponsored by Astellas. Stanford is recruiting up to 10 participants: Adults aged 18 to 55 with a diagnosed peanut allergy, with no history of severe anaphylaxis, are eligible to enroll. Participants will visit Stanford once every two weeks for a total of four treatments over the course of a year.

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Assessing efficacy, tolerability of antibody

The other Stanford study is a phase-2 clinical trial of an antibody drug, ANB020. The trial will assess the efficacy and tolerability of the compound, which is believed to reduce the immune response to allergens, like peanut proteins. The antibody targets an important molecular node in the inflammation response pathway to reduce sensitivity to multiple allergen types, according to the drug developer, AnaptysBio Inc.

For the trial of the antibody drug, Stanford is recruiting up to 20 adults aged 18 and older with a diagnosed peanut allergy and no history of life-threatening anaphylactic reactions. Participation will span about 60 days, and participants will undergo an allergy response

test before and after the treatment. This trial is sponsored by AnaptysBio Inc. A phase-1 clinical trial has already been completed in Australia.

In both trials, participants will be randomized to receive either the treatment or a placebo and will not know which compound they receive until the treatment period is over.

For more information, email snpcenterallergy.inquiry@stanford.edu, or visit ClinicalTrials.gov. At ClinicalTrials.gov, the identifier for the vaccine (ASP0892) trial is NCT02851277; the identifier for the antibody (AND020) trial is NCT02920021. **ISM**

Handgun

continued from page 2

common, such as federal elections, new firearm safety laws and terrorist attacks."

Urging further research

Taken as a whole, these events may drive significant increases in overall firearm prevalence, which may in turn increase the risk for firearm-related morbidity and mortality in the long run, they wrote. The authors urged further research to explore the cumulative effects and temporary shifts in acquisition patterns, their causes, and their implications for public health, crime and social cohesion.

Other Stanford co-authors are researcher Yifan Zhang, PhD, and Jonathan Rodden, PhD, professor of political science.

A researcher at Monash University in Australia also co-authored the study.

Stanford's Department of Medicine supported the work. **ISM**

Report offers recommendations to U.S. president on m

By Jennie Dusheck

A farmworker dies in 109-degree heat in a lemon orchard in California, in 2015. In Missouri, hospitalizations for heat-related illnesses skyrocket in 2006, a year of unusually high temperatures.

And since the arrival of Asian tiger mosquitoes in Memphis in 1983, the insects — capable of spreading Zika, dengue and West Nile Virus — have invaded 37 states. In the densely populated Northeast, Asian tiger mosquitoes are poised to triple their range before 2045 — doubling the number of people potentially exposed to these diseases from 18 million to more than 30 million.

In every case, the root cause is climate change.

But we're not helpless against such threats, according to a recent report co-authored by researchers at Stanford University. A few weeks before the 2016 election, the authors presented the report to the two presidential transition teams. Titled "Health: The Human Face of Climate Change, Perspective and Recommendations for the Next U.S. President," the report recommended that a future administration initiate a formal, decade-long emergency response to climate change, managed by the U.S. State Department, and frame climate change as a global health security issue — in other words, an acute public health threat to populations across the globe.

"The Human Face of Climate Change" report was one of a series of 14 climate reports that came out of a 2016 conference at Stanford titled "Setting the Climate Agenda for the Next U.S. President."

One of the report's three authors, Katherine Burke, MM, MSc, who is deputy director of the Center for Innovation in Global Health at Stanford, said that when she and her co-authors set out to write the report, they believed

it was an extraordinary opportunity to make an impact. Her co-authors are Michele Barry MD, a Stanford professor of medicine and director of the Center for Innovation in Global Health; and Diana Chapman Walsh, PhD, senior adviser to the Center for Innovation in Global Health and president emerita of Wellesley College.

Although the report has received no response from President Trump or his administration, the advice it contains still provides a valuable framework for tackling climate change and health, said Walsh.

Defining the problem

Experts agree that the Earth is warming dangerously and that this warming is due to the burning of fossil fuels and other human activities. The damage in ecosystem disruptions, rising sea levels and ever-more intense storms are all well-documented. So, increasingly, are the rapidly changing climate's effects on human health.

Both greater average temperature and searing heat waves have immediate effects on morbidity and mortality through heat-related illnesses such as heat stroke and heat exhaustion. "The single thing that's clearest is the impact

of rising ambient temperature," said Mark Cullen, MD, professor of medicine and of biomedical data science "With every

degree centigrade rise in summer high temperatures, there's a predictable increase in total mortality."

Added Cullen, who did not contribute to the report but is an expert on population health, "Most of it is a 'reaping function' like influenza, which is to say, it's less often completely healthy people who suffer or die; it's people with other chronic diseases who are at risk of dying sooner during heat waves."

In addition, healthy people who normally work outdoors during the heat of the day can be sickened or even killed by extreme heat. Farm workers, road workers and roofers are among those

at risk. In a warmer world, the number of days when it's too hot to safely work outside are expected to increase dramatically. Places like Texas, which once had 10 to 20 days a year of temperatures greater than 100 degrees, might see more than 100 a year by the end of the century, according to the National Oceanic and Atmospheric Administration.

Infectious disease will also get worse, as disease vectors such as mosquitoes and ticks grow in numbers and spread. And climate change has hundreds of other indirect effects on health. For example, our cattle and chickens are as vulnerable as we are to 100-plus-degree temperatures that increasingly persist for days or weeks.

Ocean warming and acidification are together killing coral reefs and collapsing marine fisheries, the primary food for some 2 billion people in Asia and the Pacific. Valuable agricultural lands around the world are threatened by drought or, in places such as Bangladesh, inundation from rising seas and flooding.

"If your food basket isn't producing, then your city is going to be in serious trouble," said Burke.

The consequences of shattered food supplies spread outward, causing economic privation, social upheaval, food shortages and the displacement and forced migration of millions. These in turn lead to violence, trauma and physical and mental health disability.

For example, an extreme drought in Syria between 2006 and 2009 — which experts believe was due to climate change — caused massive crop failures, which, in turn, triggered the migration of 1.5 million people from farms to cities. Such displacement played a role in the subsequent uprising against President Bashar al-Assad in 2011, experts have argued.

What is being done?

The health care community already

recognizes that tracking, studying and addressing the health impacts of climate change are critically important to strengthening the resilience of societies around the world.

Many institutions have begun integrated programs to consolidate what is known and what questions need to be answered. For example, The Lancet, a medical journal, has instituted an international research collaboration called "Lancet Countdown: tracking progress on health and climate change."

The American Public Health Association — a 25,000-member organization of public health professionals — designated 2017 the year of climate change and health. And in March, The New England Journal of Medicine published an appeal to the administration to stay the course on climate change and health.

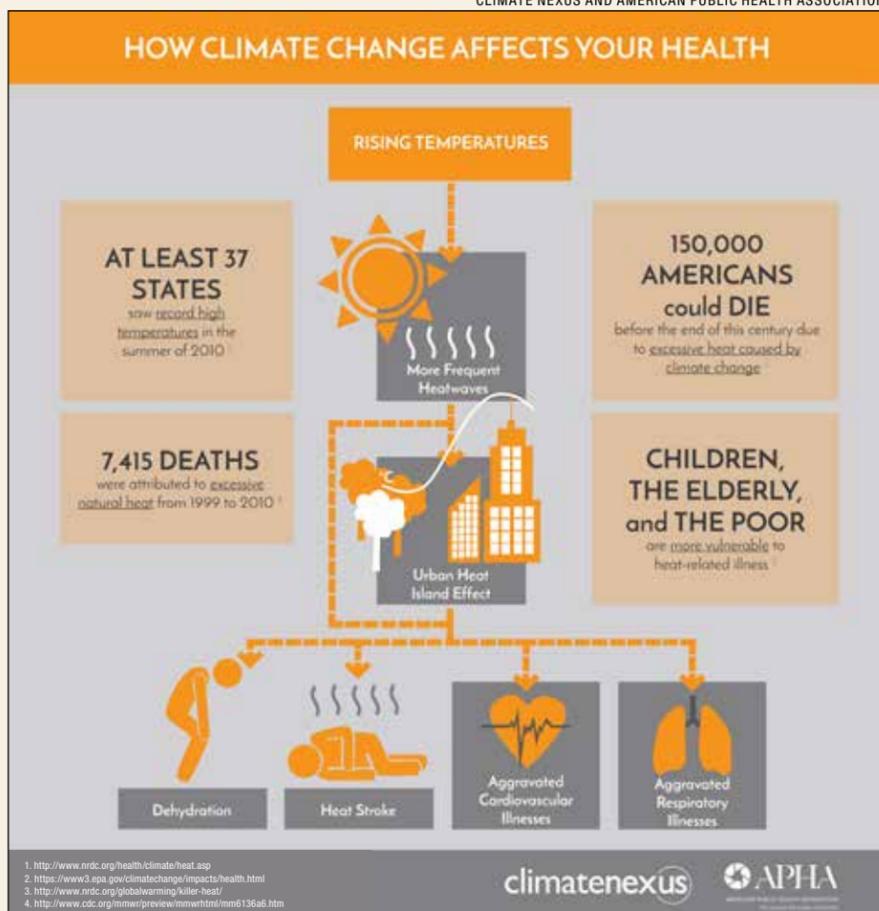
The Stanford report recommends the establishment of a State Department-based Presidential Emergency Response to Climate Change, conceptually similar to the 2003 Presidential Emergency Plan for AIDS Relief, which has saved millions of lives. Climate change's impacts on human health compare to that of the AIDS epidemic, said Walsh, one of the report's three co-authors. "Climate change is a huge threat to humanity, a threat to world security and a threat to health security. We have to see it on that scale," she said.

With a \$90 billion budget over 10 years, the report's authors suggested, a federal climate change and health program could develop initiatives including a global climate health surveillance system; vulnerability maps and tools to create projections and early warning programs; plans for adapting to climate change; the integration of health science and climate science; and ways to increase the resilience of at-risk countries to infectious diseases and water insecurity.

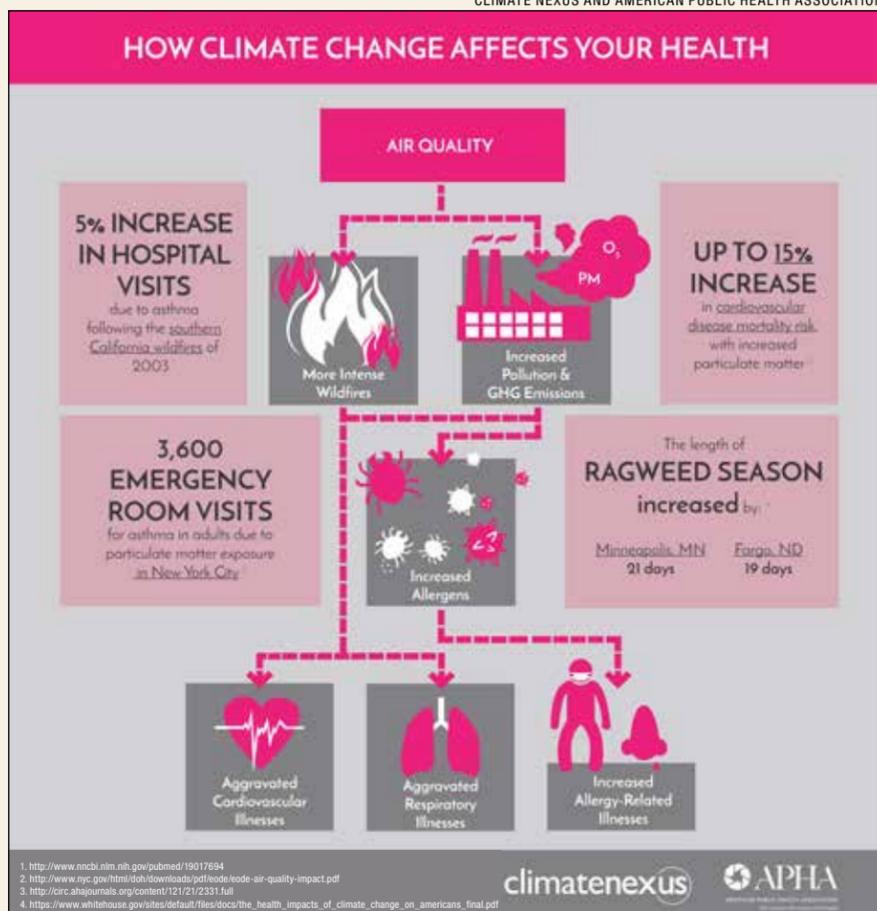
Moving to renewable energy is on

"Climate change is a huge threat to humanity."

CLIMATE NEXUS AND AMERICAN PUBLIC HEALTH ASSOCIATION

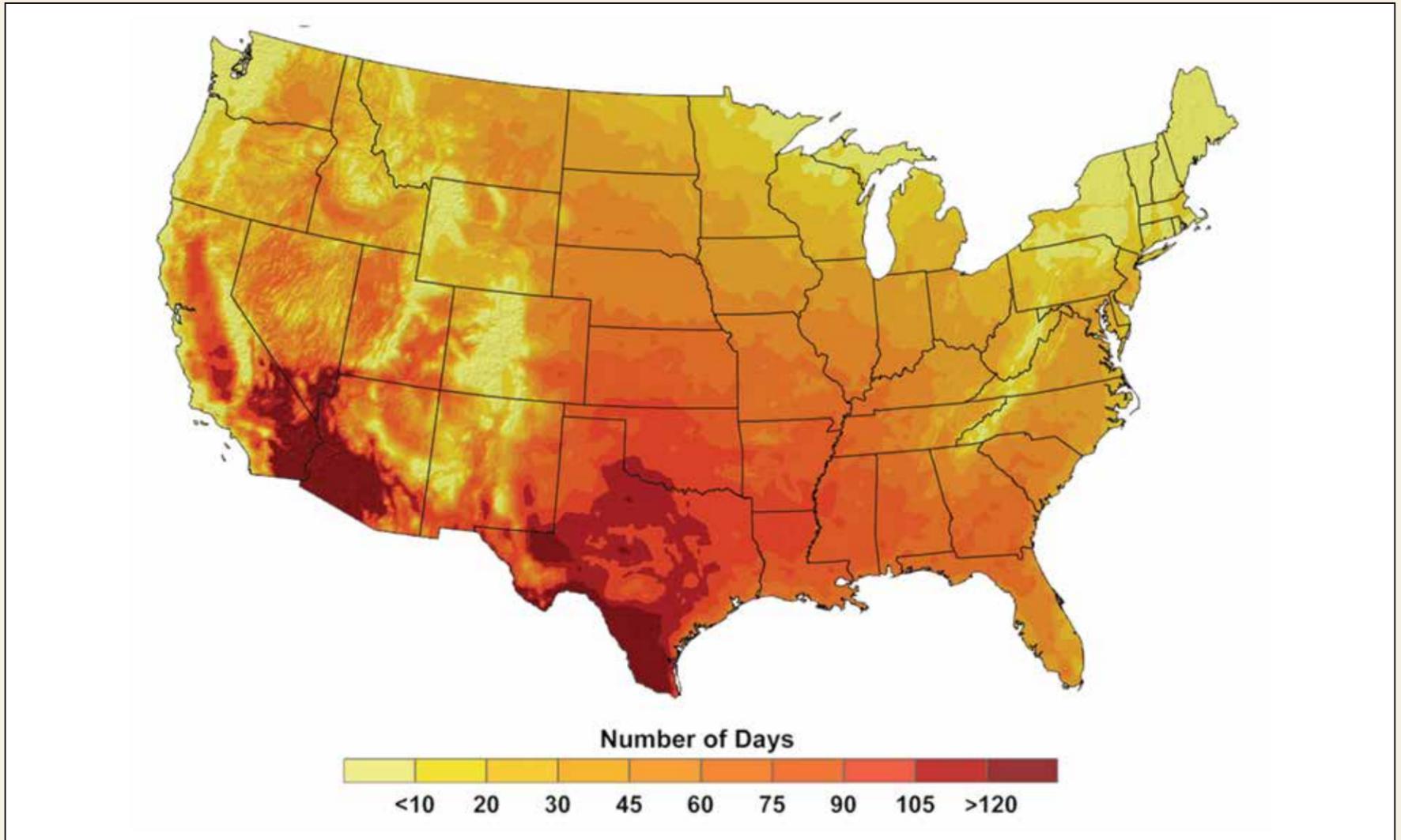


CLIMATE NEXUS AND AMERICAN PUBLIC HEALTH ASSOCIATION



Mitigating effects of climate change on human health

U.S. GLOBAL CHANGE RESEARCH PROGRAM



The map depicts an estimate of the number of days that various parts of the United States can expect temperatures topping 100 degrees by 2100 if greenhouse gas emissions continue to increase unabated.

the table, too. Hospitals in the United States are second only to restaurants in the intensity of their energy use. The Stanford report recommended reducing the health sector's carbon emissions by powering it with renewable energy and increasing energy efficiency, as well as making hospitals and clinics more resilient to storms.

The human face of climate change

The report also recommended framing climate change as a human health issue — partly because it is a health issue and partly to better engage the pub-

lic and the health care community in action that will slow the root cause.

Americans recognize that climate change is a major threat, said Burke. But the subject lacks immediacy, and it's often low on people's lists of concerns. Talking about current impacts on health is a way to engage the public's support for action. "It's no longer an abstract thing" — not vaguely about the health of future generations, Burke said. "It's now. It's our own children and grandchildren; they are growing up in a very different world."

At a recent climate policy meeting,

Emily Wimberger, chief economist at the California Air Resources Board, said that when it comes to action, people respond most readily to direct threats to human health and security. People who don't necessarily want to talk about climate change, she said, will pay more attention to the problem when it's framed as a matter of keeping everyone healthy. For instance, as California reduces fossil fuel use, CARB frames the issue as both a way to slow climate change and also a health-centric reduction in smog — one that lowers population risks for asthma, heart disease and dementia.

Looking forward

Experts agree that addressing the health aspects of climate change needn't depend on the federal government; it can happen at the level of cities, states, local governments, businesses or institutions, as well as through regional collaborations. "It's not game over; it's game on," said Wimberger.

Hospitals and health care systems have some specific challenges to tackle, according to the Stanford report. "When a crisis such as a deadly heat wave or a hurricane occurs in a community, two things happen," said Walsh. "First of all, it puts stress on the health care system when the system needs to be able to respond quickly and effectively. But secondly, it's the place that people turn to. It can be a kind of resource. It's a 24/7 organization that is still there and still running when everything else is uncertain."

"Hospitals can be a kind of beacon in a community, a place people can turn to," she added.

Need resilient health systems

Health care systems need to be

especially resilient in times of crisis. Hospitals may need to be able to withstand Katrina-type hurricanes, floods and heat waves. For example, in recent decades, hospitals in Chicago and New Orleans have had to deal with patients developing heat stroke while in hospital beds because of insufficient air conditioning. Staff reportedly couldn't distinguish patients who were suffering from overheating from those who had fevers from infections. Organizationally, a health care system needs to be able to continue to function effectively when things are at their worst.

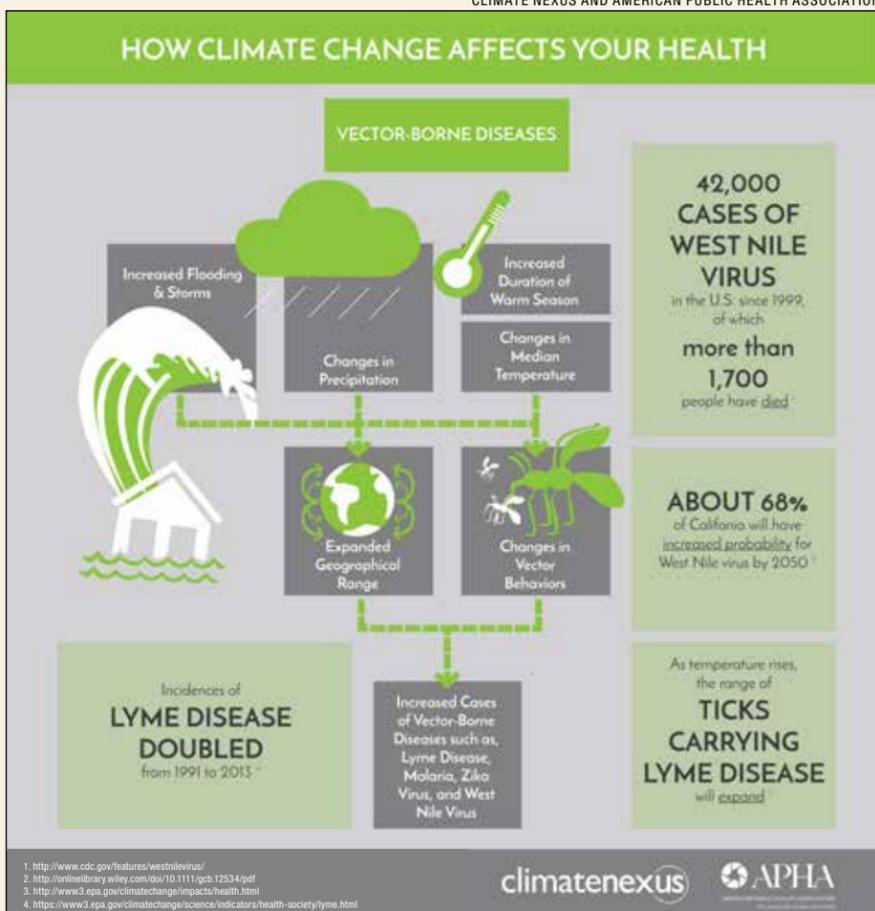
Some of the solutions will come from the technology sector, others from an understanding of how organizations work and how people function during crisis. Just establishing what the questions are will take research.

Cities also need to think ahead. Cullen, who is also a professor of health research and policy, said that the effects of heat waves can be anticipated and mitigated. "For example, some big cities, like Chicago, have developed air conditioning shelters for elderly people in urban areas to deal with heat waves," he said. Chicago also has cooling buses that can pick people up wherever they live.

Walsh said that while she was doing research prior to the election, contacts at the U.S. State Department told her that they "liked the idea in our report of a big coordinated effort that would bring together all these pieces — the data and trying to define more precisely where the vulnerabilities are, including which populations are most at risk and what those risks are."

"And that's a big-data, population problem, something that Stanford does well. This could be a place where Stanford could lead," she said. **ISM**

CLIMATE NEXUS AND AMERICAN PUBLIC HEALTH ASSOCIATION

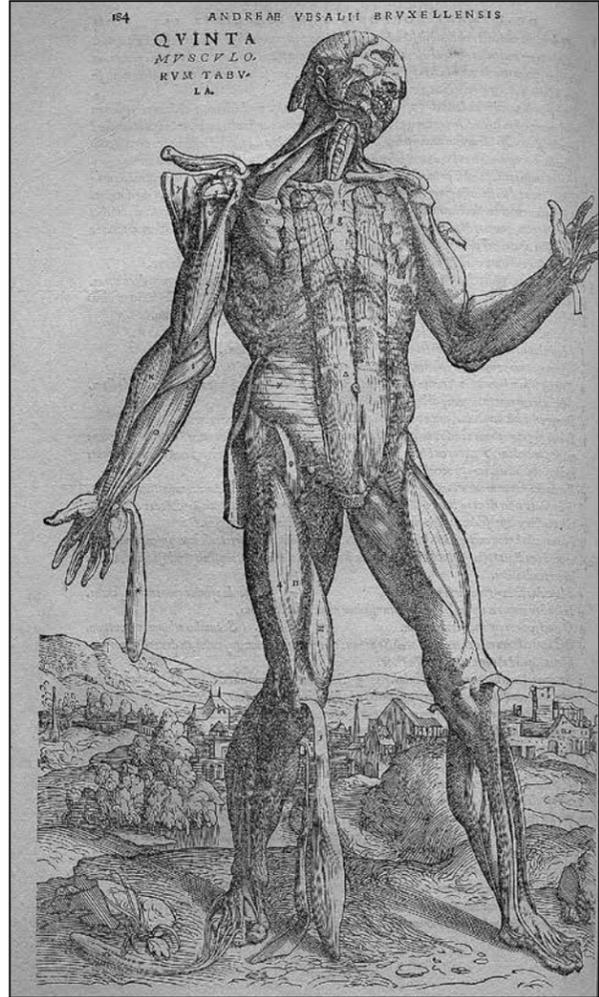


Anatomy

continued from page 1

his own cadavers, he made a shocking discovery: Some of Galen's "facts" were inaccurate because, for religious reasons, he'd never dissected a human body — only pigs, oxen, dogs and monkeys.

So, at age 23, Vesalius meticulously began separating fact from fiction in Galen's anatomical works. For example, he discovered that the human jaw is one bone, not two, and the breastbone has three segments, not seven.



An illustration from *De humani corporis fabrica*, by Andreas Vesalius.

This information wasn't well-received by the medical establishment; so to overcome resistance, Vesalius held public dissections, built skeletal models and published *Fabrica*, with its 600 anatomical charts and illustrations. (To keep up with Vesalius' demand for cadavers, students and Padua city officials often had to "repurpose" bodies from cemeteries and the hangman's noose.)

Vesalius' work raised anatomical illustration to a new level of accuracy and artistry. Because he lived in northern Italy during the Renaissance, he had access to some of the most talented artists of the times. Historians believe that he outsourced the illustrations in *Fabrica* to artists working in master painter Titian's studio. The resulting woodcuts were both amazing works of art and disturbing, showing cadavers staged in dramatic poses with layers of skin peeling off to reveal muscle and bone, often drawn with bucolic Italian landscapes in the background. They looked more like storyboard sketches for a zombie apocalypse movie than scientific illustrations.

Woodcuts 'convey complex attitudes'

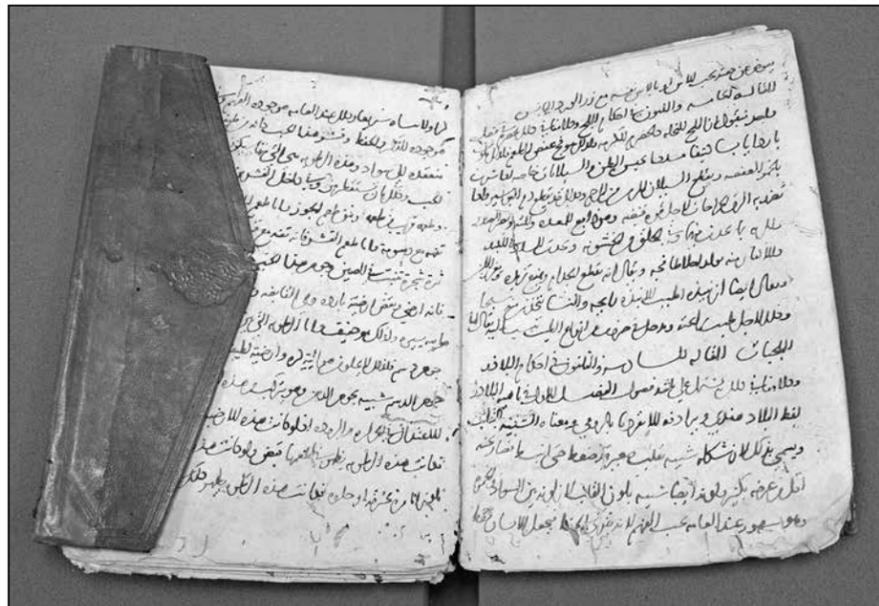
"Artists are still referring to *Fabrica* today, primarily through restaging these now iconic poses in a contemporary context," said Wight, a new-media artist who

is drawn to the intersection of biology, neurology and technology. The woodcuts in *Fabrica* convey essential information about anatomy, yes, but they also convey complex attitudes about the human condition and their reflection in human culture."

But Vesalius did more than publish an updated anatomy book: He convinced a critical number of medical educators that the only way physicians could truly understand how the body worked was by rolling up their sleeves and doing hands-on dissections of human bodies.

At the end of the lecture, Bourn pulled out a View-Master, one of those red-plastic stereoscopic toys used in the mid-20th century to view photographic slides in simulated 3-D. The students took turns looking through it at colorful photographic dissection images of the human body, holding it like an ancient artifact. Photographed in the 1950s and 1960s by Stanford anatomy instructor David Lee Bassett, the 1,554 image slides were captured with Kodachrome film, a medium that is practically obsolete with the advent of digital photography.

The View-Master is a reminder of how fast the media on which we store human knowledge changes, and why Bourn's job, as curator of these informational treas-



One of the last surviving volumes of *The Comprehensive Book in the Art of Medicine*, written by the famous Arab physician Ibn al-Nafis in the 13th century, is held by Lane Medical Library.

asures, is essential in protecting it from all sorts of unseen disasters — from wars to earthquakes to solar flares.

Wight will teach a special variation on her Art and Biology class during the winter quarter of 2018, as part of Stanford's Frankenstein@200 celebration. The course, which usually includes a short section on monsters, will focus entirely on the biological, cultural, mythological and medical conceptions of all things monstrous.

Lane Library's Medical History Center is open to the Stanford community and the public. Contact Bourn at dbourn@stanford.edu for research assistance or to schedule a visit. ISM

Dementia

continued from page 1

because women now make up almost 50 percent of the workforce, these burgeoning demands will disproportionately fall on them — and put them at higher risk for lowering or exiting their career trajectory.

"Hard-fought gains toward equality in the workplace are at risk," they wrote.

Health care dilemma

Concern about this troubling health care dilemma grew out of research by a team of design fellows at Stanford's Clinical Excellence Research Center. They were investigating ways to provide better care at lower costs for patients with dementia and other cognitive disorders.

"As our CERC fellows dug below the surface of dementia care, they detected a growing threat to health equity and tangible opportunities for action by policymakers and clinicians," said co-author Arnold Milstein, MD, professor of medicine and director of CERC.

"I have a very personal history with this topic," said Clifford Shekter, MD, a CERC fellow and co-author of the article. "My grandmother, my mom's mom, got dementia when I was in college at UCLA. I remember my mom having to leave work two to three times a day to come home — whether my grandma had taken a fall or was calling my mom on the phone and screaming,

it was relentless. It was so hard on my mom."

The authors noted that while caregiving for loved ones with dementia can certainly be meaningful, the amount of time required — an average of 171 hours per month, according to the article — combined with the unpredictability of the job's demands and unrelenting tasks, such as toileting and bathing, can be overwhelming. The article also asserts that "it's not likely that men will step up and share in the caregiving anytime soon."

If nothing is done to plan for this shift in caregiving demands, not only will women and their families suffer, an increase in costs will fall on employers from absenteeism, productivity loss, stress-related disability claims and health benefits plan spending, the article said.

"I come in contact with these patients often," said co-author Nicholas Bott, PsyD, a neuropsychologist and CERC fellow. "When you're working with a patient who has this disease, you are also working with the family. It raises tensions for the entire family unit. It causes friction in the relationships. You end up doing a lot of triage for the family members."

Raising awareness

The article was written to sensitize

physicians to the demands on family members caring for patients with dementia, the need to educate families about what will be required and the importance of referring them to caregiver support service, Milstein said.

"We hope to help clinicians see what kind of change in policy their advocacy might enable," he said.

The authors also pointed to the role that employers could play in alleviating the strain of caregiving demands by adopting family-leave

policies similar to Deloitte LLP, an international accounting and consulting firm that in August began offering employees up to 16 fully paid weeks to care for a family member, including aging family members.

"A six-week paid leave provided by employers, similar to family leave for new parents, would help caregivers to adjust to the new situation," Bott said. Federal tax subsidies allowing corporations to deduct the period of paid family leave may further help incentivize employers, the authors wrote.

Shekter said with more support — from physicians, social services and particularly his mother's employer — perhaps his grandmother could have continued to live at home. But eventually, overwhelmed by caregiving and work demands, his mother was forced to put his grandmother into a long-term care home, where she passed away.

"It's kind of sad, but in our country we don't do anything about caregiving for patients with dementia," he said. ISM



Arnold Milstein

Taube Philanthropies gives \$3 million for Huntington's disease research

Scientists at the School of Medicine and the Gladstone Institutes have received a \$3 million gift from Taube Philanthropies to fund Huntington's disease research.

The donation will support the first efforts to use gene editing and stem cell therapies to ameliorate Huntington's disease, a progressive, inherited neurodegenerative disease that presently lacks approved drugs to slow its progress and for which there is no cure.

The research team is composed of Matthew Porteus, MD, PhD, associate professor of pediatrics at the School of Medicine, who will lead the work; Frank Longo, MD, PhD, professor of neurology at the School of Medicine; and Steve Finkbeiner, MD, PhD, of the Gladstone Institutes' Taube-Koret Center for Neurodegenerative Disease Research.

The team will also collaborate with clinical efforts at the UCSF Memory and Aging Center.

Tad Taube, founder and chairman of Taube Philanthropies, has contributed to research on neurodegenerative diseases in the past.

Approximately 30,000 people in the United States now have symptoms of Huntington's disease, and another 200,000 people are at risk of developing it. ISM

Brains

continued from page 1

matergic neurons don't remain alone for long. During fetal development, they are eventually joined by neurons of another type that originate in a slightly deeper region of the developing forebrain. These neurons secrete a neuromodulatory — and usually inhibitory — substance called GABA, so they're deemed GABAergic. It's known that GABAergic cells migrate from their region of origin to the cortex, where they interlace with its resident glutamatergic cells and with one another to form the circuitry responsible for the brain's most advanced cognitive activities. But no one had been able to watch this happen with human cells in a dish.

In the new study, the researchers separated their spheroids into two batches and coaxed them to become different regions of the human brain. They cultured one batch in a medium that induces cortexlike spheroids containing glutamatergic neurons. They placed the second batch in dishes whose broth steers the spheroids toward resembling the underlying brain region where GABAergic neurons originate.

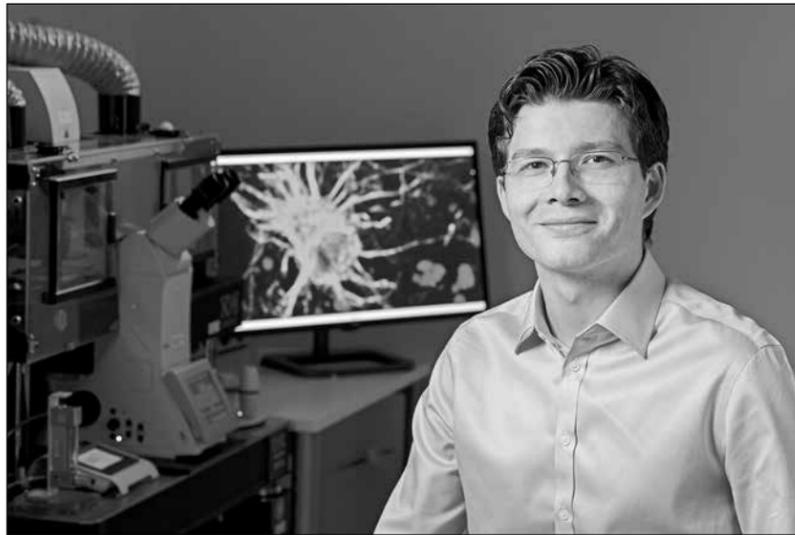
Then, the investigators juxtaposed the two distinct types of spheroids. Within three days, the two spheroids fused, and GABAergic neurons from one spheroid began migrating into the glutamatergic-neuron-rich spheroid. Their migration pattern, the scientists noted, was halting: They would move toward the target spheroid for a little while, then stop for an extended period, then start up again in stuttering jumps.

On reaching their destination, the GABAergic travelers underwent a transformation, sprouting dendrites — branching, foliagelike “tails” that receive inputs from other neurons — and forming working connections with the glutamatergic neurons. Electrophysiological tests revealed that GABAergic and glutamatergic neurons were successfully forming circuits and signaling to one another.

Insight into Timothy syndrome

The scientists had access to tissue samples from patients with Timothy syndrome, an extremely rare and

historically lethal condition caused by a mutation in the gene coding for a type of calcium channel — a protein containing a pore that responds to different voltage levels by opening or closing, respectively permitting or blocking the flow of calcium across otherwise impermeable membranes. Such calcium channels are essential to many cellular processes. Timothy syndrome patients'



Sergiu Pasca and his colleagues created neural spheroids in a lab dish and then watched as one formed connections with another — a process that takes place in the human forebrain during late pregnancy.

severe cardiac abnormalities once spelled ultra-short life expectancies, but now can be ameliorated with pacemakers. However, survivors usually have autism and frequently have epilepsy.

The investigators generated both types of neural spheroids from their Timothy-syndrome tissue samples, fused them and watched to see what would happen. What they saw was this: The GABAergic neurons, which seemed to develop normally, exhibited aberrant start-and-stop migration patterns. Their forward movements were more frequent, but far less efficient, than those of normal neurons.

The mutation behind Timothy syndrome increases the likelihood that the calcium channel for which it codes will let calcium ions flow through it. So, the researchers reasoned, a drug impeding the channel's activity might reverse the aberration. Indeed, two different

drugs that block this type of calcium channel restored normal migratory activity to the Timothy-syndrome-derived GABAergic neurons.

Diverse variants in the same gene responsible for Timothy syndrome are associated with schizophrenia, other forms of autism spectrum disorder and bipolar disorder. Pasca said he suspects these variants may affect GABAergic neurons' integration with cortical glutamatergic neurons, resulting in a cognition-altering imbalance between excitation and inhibition in the cortex and laying the groundwork for these disorders.

“Our method of assembling and carefully characterizing neuronal circuits in a dish is opening up new windows through which we can view the normal development of the fetal human brain,” said Pasca. “More importantly, it will help us see how this goes awry in individual patients.”

Stanford's Office of Technology Licensing has filed for a patent on the intellectual property involving the generation of brain-region-specific neural spheroids and their assembly for studying development and disease.

Other Stanford study co-authors are postdoctoral scholars Saiful Islam, PhD, and Nina Huber, PhD; senior research scientists Nancy O'Rourke, PhD, and Wu Wei, PhD; high school lab intern Nicholas Thom; Lars Steinmetz, PhD, professor of genetics; Jonathan Bernstein, MD, PhD, associate professor of pediatrics; Joachim Hallmayer, MD, professor of psychiatry and behavioral sciences; and John Huguenard, PhD, professor of neurology and of neurosurgery.

The study was funded by the National Institutes of Health, the California Institute for Regenerative Medicine, the MQ Foundation, the Donald E. and Delia B. Baxter Foundation, the Kwan Research Fund, the Stanford Child Research Health Institute, the Wishes for Elliot Foundation, a Walter V. and Idun Berry Postdoctoral Fellowship, the Stanford School of Medicine Dean's Office, the UC-San Francisco Program for Breakthrough Biomedical Research and the Sandler Foundation.

Stanford's Department of Psychiatry and Behavioral Sciences and the Stanford Center for Sleep Sciences and Medicine also supported the work. **ISM**

VANTAGE POINT

one in an occasional series of essays
by members of the Stanford Medicine community

By Christopher Dawes

Children's health is paramount to the success and stability of our nation's future. However, often in health care policy discussions, the child population is overshadowed by the much larger expenditures generated by adults.

While the proposed American Health Care Act remains unresolved, members of Congress and citizens alike must recognize the importance of Medicaid for children's health. It directly impacts all children and the collective health system's ability to deliver uncompromised access to excellent care for everyone.

Our message to Congress about the importance of children's health is threefold:

1. Children are not small adults. They have unique health care needs.
2. Medicaid, the Children's Health Insurance Program and the Children's Hospital Graduate Medical Education program are the foundation of the entire child health care system. Cuts to these programs impact all children.
3. Collaboration with pediatric experts improves systems of care for all children, and investing in systems now reduces costs in the future.

U.S. Rep. Jamie Herrera Beutler demonstrated her commitment to championing children's health in her

Threat to Medicaid is threat to children's health

call for an amendment to the AHCA to strengthen the Medicaid safety net for the children and adolescents who are dependent on it. When the amendment was not adopted, Beutler expressed in a March 23 press release her resolve to ensure protection of vulnerable children.

As we continue to review proposals that will be introduced by members of Congress in the coming weeks, the lens that children's health advocates will be using is simple: Does this protect children covered by both Medicaid and private insurance? Will it help them to be as healthy as possible at a manageable cost?

Underpinning entire children's health system

Medicaid covers more than 30 million children, and another 6 million are covered by the Children's Health Insurance Program — nearly 40 percent of children in the nation and 54 percent of children in California. The cost of care for children on Medicaid accounts for less than 20 percent of the Medicaid budget. Therefore, reductions to Medicaid disproportionately impact children.

If Medicaid funding is compromised, it destabilizes the entire children's health care system on two fronts: It reduces care providers' ability to of-

fer specialty programs for chronically ill children, and it ignores the critical role of preventive and wellness care for all kids.

Because chronic illness in children is relatively rare, cases must be concentrated into specialty care centers to ensure high-quality care. The combination of a current national shortage of pediatric specialists with the fact that a relatively small population of children needs specialized care results in the need for a regionalized health care model serving both Medicaid-funded and privately insured patients. Historically, when Medicaid has been cut in California, we've seen a reduction of programs that provide specialty services, which reduces access to that care for all patients.

Medicaid also provides vital access to the foundation of preventive primary care for conditions like obesity and asthma, access to immunizations and the detection of serious conditions, which reduces medical costs down the road.

What children can't afford to lose

Under the Affordable Care Act, children with chronic conditions have protections in place to sustain long-

term care that are expressly important for the acute population in children's hospitals:

- No refusal of coverage for pre-existing conditions.
- Eliminating annual and lifetime caps on insurance coverage. (Many high-acuity patients would surpass lifetime caps in a couple of years.)
- Allowing children to remain on their parents' insurance up to age 26.

In Northern California, we will continue to work with local representatives and join other children's hospitals across the nation to remain vigorous advocates for children's health coverage and access. I encourage the community to connect with elected officials and voice the need to maintain the funding

of Medicaid, the Children's Health Insurance Program and the Children's Hospital Graduate Medical Education program to ensure all children have affordable access to quality health care. **ISM**

A version of this article was originally published April 26 in HuffPost.

Christopher Dawes is president and CEO of Stanford Children's Health.



Christopher Dawes

For 40 years, creating sock monkeys for pediatric patients

By Kate DeTrempe

Forty years ago, flyers appeared around town calling on volunteers to join in some “Monkey Business” to benefit young patients at Children’s Hospital at Stanford, as Lucile Packard Children’s Hospital Stanford was then known. The advertisement read:

The Los Altos Senior Citizens Drop-in Center is forming a new group to sew “Monkey Toys” to be given to the children at Children’s Hospital at Stanford.

Prewashed old hose, bits of yarn and scraps of material will be used for stuffing. If you have some to contribute, please drop off at the Center any Monday, Wednesday or Friday from 10:00 a.m. to 3:00 p.m. or bring it with you on Monday, April 25th, 1977.

Won’t you please come and help us out on this project?

Volunteers arrived at the Los Altos Senior Center that day with sewing and embroidery thread, needles and scissors, and have been coming back ever since to create sock monkeys for the patients at Packard Children’s.

Monday gatherings

On Monday mornings, volunteers gather to create the toys, which are made

from red-heeled work socks, nylon hose, yarn and red ribbons. The volunteers add individual characteristics to each doll as they put on the finishing touches, including unique faces, ribbons and pom-pom decorations.

Over the past four decades, volunteers have created about 12,000 sock monkey toys, which have become widely recognized and loved by Packard Children’s patients and their families. The toys have never been sold but instead are given as gifts to young patients who need a little extra TLC while staying at the hospital.

Marge Filson, a 95-year-old volunteer, has been a self-proclaimed “monkey toy lady” for the past 28 years. For her, hearing families tell about the joy their toy monkeys bring them is what it’s all about. “You see these kids receive monkeys, and they are so excited,” she said. “Anyone who has received a monkey has been very, very happy. I love seeing the response.”

Filson had a special moment while shopping for monkey toy supplies about 15 years ago. After explaining to the woman behind the counter that the socks she was buying would be turned into monkey toys, she was met with great

enthusiasm. “She told me she had always wanted to talk to a monkey toy lady,” Filson said. “She had spent much of her childhood as a patient at Packard Children’s, where she received her own sock monkey toy, and she had always wanted to meet someone who made them to say thank you.”

‘A sense of comfort’

Every month, the sock monkeys are picked up at the Los Altos Senior Center and distributed to patients at Packard Children’s by Joe Manfrey, a 90-year-old volunteer who has dedicated more than 25 years to the hospital.

“After four decades, the handmade sock monkeys continue to bring a sense of comfort to our patients as they go through a difficult time in their life,” said Maryellen Brady, the hospital’s director of volunteer services. “We are fortunate to have built a long-lasting relationship with the volunteers of the Los Altos Se-

nior Center, and we are grateful for their dedication to the families who receive these special gifts.”

“Here I am almost 100 years old, and I’ve been at it for over 25 years. It’s very much a joy for me to be involved,” Filson said. “It’s such a wonderful program. I’ve put all my life into it.” ISM



Over four decades, volunteers have made about 12,000 sock monkeys for patients at Lucile Packard Children’s Hospital Stanford.

OF NOTE

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

BECKY BLANKENBURG, MD; LAUREN DESTINO, MD, and JENNIFER EVERHART, MD, are part of a nationwide group of faculty that was awarded the 2016 John M. Eisenberg Award for Innovation in Patient Safety and Quality. The honor, given by The Joint Commission and the National Quality Forum, recognizes national groundbreaking initiatives to improve patient safety and health care quality. Blankenburg, Destino and Everhart are part of the I-PASS Study Group, which won the award. The group works to improve patient safety by reducing communication failures during patient transitions between care providers. Blankenburg is a clinical associate professor of pediatrics, the director of the pediatric residency program and associate chair of education for the Department of Pediatrics; Destino is a clinical associate professor of pediatrics and the associate medical director of the pediatric hospital medicine division; and Everhart is a clinical assistant professor of pediatrics.



Becky Blankenburg

WALDO CONCEPCION, MD, professor of surgery and of pediatrics, has received the 2017 Excellence in Healthcare Award from the American Liver Foundation. He is the chief of clinical transplantation.

UTKAN DEMIRCI, PhD, was promoted to professor of radiology, effective

April 1. He creates micro- and nanoscale platform technologies to diagnose and monitor diseases, and he develops microfluidic devices and biosensors for point-of-care diagnostics and for additive biomanufacturing.

WILLIAM GREENLEAF, PhD, was promoted to associate professor of genetics, effective April 1. His research focuses on developing methods to examine the structure and function of RNA and proteins and on the physical compaction and folding of the genome.

KATHLEEN HORST, MD, was promoted to associate professor of radiation oncology, effective April 1. She is a clinical trialist whose interests include breast cancer and radiation therapy.

CAROLYN LEE, MD, PhD, assistant professor of dermatology, was awarded a two-year, \$200,000 grant from the Sidney Kimmel Foundation as part of its Kimmel Scholars Program. The program, which is in its final year, was created to jump-start the careers of promising, creative researchers investigating cancer. Lee’s focus is on the discovery and characterization of genetic contributors to skin cancer.

JIANGHONG RAO, PhD, was promoted to professor of radiology, effective March 1. In his research, he aims to design, synthesize and evaluate molecular probes for imaging or to manipulate molecules, to develop biosensors and to improve drug screening and drug delivery.

PETER TASS, MD, PhD, was appointed professor of neurosurgery, effective March 1. His research interests include computational neuroscience and therapeutic neurophysiology. He develops invasive and noninvasive stimulation techniques, including deep brain and sensory stimulation, for the treatment of brain disorders. ISM



Lauren Destino



Jennifer Everhart



Waldo Concepcion



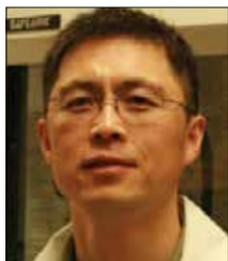
Utkan Demirci



William Greenleaf



Carolyn Lee



Jianghong Rao



Peter Tass

Faculty elected to National Academy of Sciences

Three Stanford researchers are among the 84 newly elected members of the National Academy of Sciences.

The new members from Stanford are Dominique Bergmann, PhD, professor of biology; John Pringle, PhD, professor of genetics; and Anne Villeneuve, PhD, professor of developmental biology and of genetics.

Bergmann, who is also a Howard Hughes Medical Institute investigator, began efforts as a postdoctoral scholar at Stanford to establish stomatal cells as a model for developmental studies in plants. Her lab now focuses on these cells to learn about cell fate, stem-cell self-renewal and cell specialization.

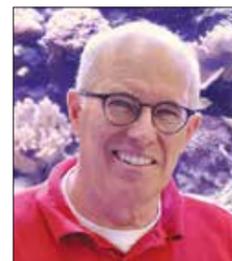
Pringle uses yeast genetics to discover general principles of cell-polarity development, cytokinesis and the septin cytoskeleton. He and his group study cell-cycle control, cellular morphogenesis, and cell-division mechanisms in yeast and other simple eukaryotic model organisms.

Villeneuve investigates the mechanisms underlying the faithful inheritance of eukaryotic chromosomes. Her primary focus is on elucidating the events required for orderly segregation of homologous chromosomes during meiosis, the crucial process that reduces the number of chromosomes in a parent cell by half and produces four gamete cells.

The academy is a private, nonprofit institution that was created in 1863 to advise the nation on issues related to science and technology. Scholars are elected in recognition of their outstanding contributions to research. This year’s election brings the total of active academy members to 2,290. ISM



Dominique Bergmann



John Pringle



Anne Villeneuve

Students named HHMI medical research fellows

Four Stanford medical students have been named medical research fellows by the Howard Hughes Medical Institute. The program provides \$43,000 of grant support to allow promising medical, veterinary and dental students to spend a year conducting biomedical research. This year, 79 fellows were selected.

The Stanford recipients, and the locations of their fellowships, are:

- Heather desJardins-Park — Stanford
- Mollie Friedlander — Stanford
- Erica Storm — Stanford
- Steven Zhang — University of California-San Francisco

In addition, Alyssa Flores, a second-year student at the Geisel School of Medicine at Dartmouth, will spend a year conducting research at Stanford. ISM