

'MORE SHOTS ON GOAL' Prizes, Challenges Spur Innovation, Tap Global Talent

BY RICH MCMANUS

If you want to get something done in this world, and your current workforce isn't exactly delivering the mail, open up your challenge to the crowd; you might just find cheaper, faster, more powerful solutions, especially if the problem involves bludgeoning big data with sharper algorithms.

That was the take-home message at an NIH symposium on challenges held Sept. 30 in the Porter Neuroscience Research Center, sponsored by the Office of the Associate Director for Data Science.

The usefulness of the carrot as motivation

was presented from two angles: Tom Kalil, deputy director for technology and innovation at the White House's Office of Science and Technology Policy, outlined the long history of challenges as a road to innovation and explained why the Obama administration has backed the America COMPETES Act and launched its own Strategy for American Innovation. Dr. Karim Lakhani, professor of business administration at Harvard Business School, who runs a Crowd Innovation Lab, offered astonishing examples of the success of global crowd-sourcing, especially for data science problems.

Finally, an NIH panel offered home-grown examples of challenges involving NHLBI, NCI, NIBIB, NEI and NINDS. "NIH has run about two dozen challenges since 2010," said session moderator Elizabeth Kittrie of OD. More than 700 incentive prizes have been established government-wide;

SEE CHALLENGES, PAGE 8



Dr. Karim Lakhani of Harvard Business School thinks it might not be a bad idea to go to the crowd first for solutions to tech problems.

IMPROVING FUNCTION, LOWERING COSTS? Evidence Grows of Tai Chi's Benefits, Including for Seniors

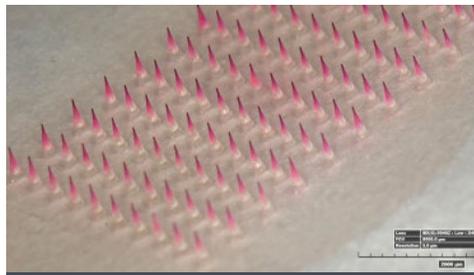
BY ELLEN O'DONNELL

It's surprisingly difficult for anyone to walk and think—let alone chew gum—at the same time. For seniors, walking and mental processes can become even more difficult, with falls and cognitive decline often major fears as well as high public-health burdens. One nondrug complementary approach being studied for healthier, safer aging is tai chi. In a recent



Dr. Peter Wayne

SEE TAI CHI, PAGE 4



A dissolving microneedle patch encapsulating a model vaccine (colored pink). Each microneedle is 700 µm tall.

PHOTO: DEVIN MCALLISTER/GEORGIA TECH

NIBIB Grantee Tests Efficacy, Appeal of Flu Vaccine Patch

BY RAYMOND MACDOUGALL

A dime-sized patch of tiny, dissolvable microneedles could be the biomedical advance that expands the reach of vaccines to remote parts of the world and overcomes fear that prevents many from getting a flu shot each year. Dr. Mark Prausnitz, Regents

SEE MICRONEEDLE, PAGE 6



Out-of-this-world DNA sequencing? See p. 12.

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NIAMS Community Health Clinic staff with Dr. Richard Siegel (seated, r), NIAMS clinical director, and Dr. James Katz (seated, c), chief of the NIAMS Rheumatology Fellowship and Training Branch

NIAMS Community Health Clinic Moves to Campus

Fifteen years ago, NIAMS established its Community Health Clinic (CHC) as an extension of the NIH Rheumatology Clinical Research Program to better understand diseases such as rheumatoid arthritis and lupus and gain insights about why these and other rheumatic diseases disproportionately affect people in certain minority groups. The full-service rheumatology clinic, which has enrolled more than 2,500 patients and provided nearly 17,000 patient visits since its inception, recently relocated to the Clinical Center, enabling individuals enrolled in the “Natural History of Rheumatic Diseases in Minority Communities” protocol to receive patient care services from a centralized state-of-the-art facility.

When it opened its doors in 2001 in a medical suite at Unity Health Care Inc.’s Upper Cardozo Health Center in Northwest Washington, D.C., the CHC had already been several years in the making. Years of coordination and planning with city officials, local organizations and NIAMS and Clinical Center staff helped ensure that the clinical program was established in a way that served numerous interests all at the same time. Partners advised NIAMS on local community needs and concerns about medical research, helped reduce barriers to minority participation in clinical studies and promoted the program to the larger metro area. NIAMS, in turn, provided underserved area residents access to cutting-edge specialty care, clinical studies and health information. In addition, the CHC served as a research training facility offering rheumatology fellows across NIH a community-based learning experience in rheumatic diseases.

“The CHC has been beneficial on multiple levels,” said Dr. Richard Siegel, clinical director at NIAMS. “We have been able to serve the community while also furthering our research and training new clinician scientists. I’m pleased we have been able to keep the center active for so many years.”

Ten years after its establishment in Upper Cardozo, the CHC moved to the Spanish Catholic Center, Cardinal McCarrick Center of Catholic Charities in Silver Spring. This location enabled NIAMS

to continue serving the diverse, multilingual population in the DC/VA/MD metropolitan area. Almost half of the patients speak only Spanish and three-quarters are foreign-born from more than 40 countries. The majority of the foreign-born patients are from Central America, South America or the Middle East. “We have been able to serve many people who normally would not have had access to adequate rheumatological care,” said Dr. James Katz, chief of the Rheumatology Fellowship and Training Branch, NIAMS.

Now, 5 years later, the CHC has relocated to the Clinical Center. The CHC hopes to continue to grow its program on campus while staying connected to its community roots through ongoing partnerships with primary care providers. A centralized location for clinical services allows patients easy access to the laboratory, radiology department and special consultants. And with a bilingual staff, the CHC hopes to create an atmosphere where patients feel welcome and at home at the Clinical Center.—

Mimi Lising

Farmer To Give Barmes Global Health Lecture

Nov. 16

Dr. Paul Farmer, a founding director and chief strategist of the international nonprofit Partners In Health, will deliver the 2016 David E. Barmes Global Health Lecture at NIH on Nov. 16 at noon in Masur Auditorium, Bldg. 10. A medical anthropologist and physician, Farmer conducts research, provides health care services and advocates on behalf of those who are sick and living in poverty. The title of his talk is “Against Balkanization: Research + Training + Care = Global Health Equity.”



Farmer is the Kolokotronis University professor and chair of the department of global health and social medicine at Harvard Medical School, chief of the division of global health equity at Brigham and Women’s Hospital in Boston and United Nations special advisor to the secretary-general on community-based medicine and lessons from Haiti. Farmer holds an M.D. and Ph.D. from Harvard University.

The lecture honors the late Dr. David Barmes, a public health dentist and epidemiologist, for his career spent improving health in low- and middle-income countries. The National Institute of Dental and Craniofacial Research and the Fogarty International Center are co-sponsors.

NIH director Dr. Francis Collins will give introductory remarks. The lecture will be videocast. For more information, visit <https://www.nidcr.nih.gov/NewsAndFeatures/Announcements/>.

Starbucks Marketplace Coming to CC

A Starbucks Marketplace café is slated to replace the Au Bon Pain store in the atrium of the Clinical Center in February 2017, according to Eurest. It will continue to offer fresh-baked pastries, muffins and cookies, ABP’s signature soups and a full complement of hot and cold beverages. Enhancements include a heated air screen for on-the-go hot meals and healthier snacking, including a variety of natural, organic and gluten-free options. Multiple full-service registers and the addition of self-service kiosks will provide speedy service for appetites in a hurry.

The 3-month project will begin in November, with the Starbucks Marketplace grand opening slated for next February. Together with the team at the Office of Research Services, Division of Amenities and Transportation Services, Eurest has created a temporary solution to limit the disruption to guests during construction, which will begin at the end of business on Tuesday, Nov. 22. The temporary services, located directly in front of the current ABP location, will begin on Monday, Nov. 28. With some limitations to its coffee services, the coffee bar will continue to offer a full selection of baked goods, hot morning cereal and soups for lunch, as well as on-the-go entree items and fresh sushi made daily. Customers will also have opportunities to sample new items and take advantage of promotions and contests to win free lunches, gift cards and other treats.

Eurest regional vice president Jeff Robertson and his NIH team are looking forward to the grand opening in February: “We are so excited to be able to introduce this new concept into our service portfolio, as this program will drive great guest participation and satisfaction. We are confident that this move will provide significantly better options to meet the needs of the NIH community.”

For more information, contact John Crawford, director of food services, retail and concession programs, ORS/DATS, at (301) 402-8180. **R**

NIH Observes Disability Employment Awareness Month

BY ERIC BOCK

Focus on what people with disabilities can do, rather than their limitations. That was the take-away message at the 2016 National Disability Employment Awareness Month kickoff in Bldg. 1's Wilson Hall on Oct. 5.

Dr. Maureen Gormley, NINDS deputy director for management, gave the keynote address. She spoke about her experience hiring employees with intellectual disabilities (IDs) at the Clinical Center, where she served as chief operating officer in recent years. The event also featured brief presentations from NIH employees with disabilities.



Dr. Maureen Gormley

"People with disabilities have a 30 percent lower national employment rate," Gormley said. It's especially problematic for those who are 18 to 21 years old with ID as they transition from school to the workforce.

Several years ago, Gormley, then at the CC, received an email from Ivymount School, a Rockville education center for children with learning and

intellectual disabilities, speech and language disorders and autism spectrum disorders.

The email asked if the CC would be interested in hosting interns through Project SEARCH, "a school-to-work transition program that helps kids with ID." The program is supported by Ivymount and SEEC, a Silver Spring nonprofit that provides community-based employment support to transitioning youth and adults. The project was first developed at Cincinnati Children's Hospital Medical Center in 1996. Gormley said the project is now active in more than 300 sites across the United States and Canada, England, Scotland, Ireland and Australia.

After a presentation by Ivymount staff, Gormley and one of her colleagues, Denise Ford, agreed to partner with Project SEARCH. They found CC departments that needed help and matched interns with jobs based on their skill and ability. She noted that the jobs are complex and require the ability to focus.

"It took some convincing on our part," she said. "However, once people agreed, they seemed to have this match made in heaven. We were seeing it over and over again."



CIT's Phil Cummings and Pixel, his service dog. Pixel is trained in cancer scent detection and seizure alerting. Cummings has neuropathy and visual, vascular and muscular issues as a result of radiation and chemotherapy. "I have physical challenges and diverse abilities," he said.

PHOTOS: BILL BRANSON

At the time, Gormley was obtaining her doctoral degree. She wrote her dissertation about workplace stigma toward employees with disability because of her experiences with the project. She interviewed individuals from 14 organizations around the country that implemented Project SEARCH and asked co-workers about their perceptions before, during and after the organizations hired interns.

Before the internships began, Gormley found many employers skeptical of their ability to mentor someone with an intellectual disability. Employers also had concerns about how long it would take to teach participants and their ability to communicate effectively.

"People don't necessarily presume that people with ID are going to be successful in the workplace," she noted. "And that leads to negative co-worker perceptions before they even meet the individuals."

Over time, however, perceptions changed. At the end of the internships, employers had favorable opinions of the interns. Many of their concerns were unfounded; 93 percent of comments were positive. Gormley noted, "It wasn't just the kids who got trained. It was us [the employers] who changed." They came to see the interns "as valuable employees with remarkable abilities."

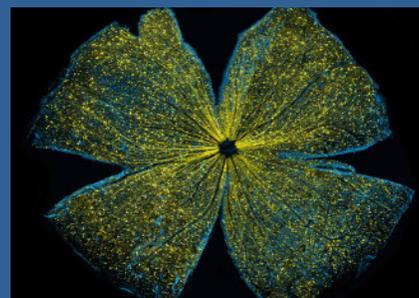
At NIH, the interns spend 1 hour per day in a classroom. Afterwards, they work for 5 hours at their job sites. The internship consists of 3 10-week rotations. At the CC, for example, interns might

help out with data entry, supply management, patient bar coding or hand hygiene.

Since Project SEARCH first began at the CC in 2010, it has expanded to 17 institutes and centers; 64 students have completed internships. Of those, 42 have gone on to become full-time employees. Only four employees have left. Gormley called the project "one of the most rewarding things I have ever worked on at NIH."

After her address, CIT's Phil Cummings, NIDCD's Dr. Rita Das, NHLBI's John Gillon and NHGRI's Dr. Maximilian Muenke spoke about how they contribute to NIH's mission despite their disabilities.

NIDCD's David Rice gave closing remarks. "Being a deaf person is who I am," he said. "But I am an employee here and what defines me is my work, striving to make this place better for the future. Don't pity someone for what they can't do. Instead recognize someone for what they can do." **R**



ON THE COVER: *Mouse retina snipped to lay flat and sparkling with fluorescent molecules. 2016 CFC Beauty of Science 1st place entry by NIGMS*

IMAGE: KENYOUNG KIM, WONKYU JU & MARK ELLISMAN, ALL OF THE NATIONAL CENTER FOR MICROSCOPY & IMAGING AT UCSD

The NIH Record

Since 1949, the *NIH Record* has been published biweekly by the Editorial Operations Branch, Office of Communications and Public Liaison, National Institutes of Health, Department of Health and Human Services. For editorial policies, email editor or phone (301) 496-2125.

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Tai Chi

CONTINUED FROM PAGE 1

NIH lecture, Dr. Peter Wayne discussed the overall evidence on tai chi's use for medical purposes, as well as some of his team's studies on its use to prevent falls and protect cognitive function in older people.

Wayne is an associate professor of medicine at Harvard Medical School, research director for the Osher Center for Integrative Medicine in Boston, an NIH grantee and a tai chi teacher. He gave his talk as part of NCCIH's Integrative Medicine Lecture Series.

Tai chi (short for tai chi chuan) comes from various Asian traditions, including the martial arts and traditional Chinese medicine. Wayne described tai chi as a mind and body therapy that's "multimodal, integrative and ecological," and, in contrast to most Western medical care, moves toward unifying rather than treating separately the mind and body and the different organ systems.

Tai chi has many styles, but all have certain "active ingredients" in common, he added. These include slow exercise movements that are moderately aerobic, muscle-strengthening, weight-bearing and flexibility-enhancing; cognitive training, e.g., in mental focus and heightened body awareness; breathing patterns; and social and philosophical dimensions.

There is preliminary evidence, including from systematic reviews and meta-analyses, Wayne said, of tai chi's benefit in a number of health problems in older adults. Examples include balance issues, falls prevention, chronic heart failure, osteoporosis, osteoarthritis, COPD, asthma, Parkinson's disease, stroke, depression, cognitive function, cancer symptoms and pain (a relatively new research topic). "[Overall] the evidence is growing, promising and suggestive," he said, "but we also need to be careful how far we go in interpreting these data," owing to quality issues (an issue not unique to this field). One encouraging trend, he noted, is that the proportion of studies on tai chi that are randomized controlled trials has steadily risen in recent years.

Wayne has been a principal or co-principal investigator on grants from NCCIH to study tai chi in older people—for example, to improve balance, gait (manner of walking)

and physical function and to determine whether it might reduce health care utilization and costs. Among his published studies so far: he and his team found preliminary support in tai chi for improvements in executive function, mainly in healthy older adults, and in global cognitive function, mainly in older adults who already had mild cognitive impairment. His team has also seen tai chi interrupt and even

reverse the "vicious cycle" of older adults becoming so afraid of falling that their lives become increasingly restricted, which leads to even worse health. Tai chi also appeared to increase self-efficacy, or the belief and confidence that one can do things—one reason that Wayne calls it "a gateway exercise."

"There's a burgeoning body of literature that [motor and cognitive] functions are interdependent," Wayne noted. For example, in work pioneered by Dr. Joe Verghese at Einstein School of Medicine, a slower-than-normal gait for one's age could place one at a higher risk for dementia than a peer with a more normal gait speed.

These "complex cognitive-neuromuscular interactions" are of interest in Wayne's current NCCIH-funded trial of whether tai chi shows benefit in healthy people at least 60 years old when challenged to "dual task"—to perform a walking task and a cognitive task (such as counting backward by 7's) at the same time. The three study groups consist of healthy people new to tai chi who receive 6 months of instruction in it, along with usual care; matched controls receiving usual care only; and expert tai chi practitioners.

Wayne's group is collaborating with the Motion Analysis Laboratory at Spaulding Rehabilitation Hospital in Boston. By attaching markers to the body and using 3-D motion-capture technology, the researchers are able to quantify and create advanced models of tai chi movement with respect



Wayne speaks with lecture attendees after his recent NCCIH talk.

PHOTOS: LISA HELFERT

to biomechanics, joint movement, postural sway, balance and other variables. The team is also studying cognitive outcomes and biological markers of aging.

Wayne described unique challenges in studying complex mind-and-body therapies—such as teasing out "specific" from "non-specific" effects (the latter arising not from an intervention but rather from factors such as the study environment or attention from a professional), what to use as a control group and the right "dosage" of the therapy. Among the ways investigators are taking on these challenges are pragmatic study designs, new metrics and technology. For example, he and his colleagues are developing a smartphone program that can guide a tai chi study member in attaching sensors to his or her body for daily practice and then take measurements of the practice.

Wayne concluded, "I think it's fair to say that tai chi is a promising intervention for preserving and enhancing a number of domains of health, especially in older adults. There's enough here to make us want to keep looking." It's also generally safe; in his 2014 systematic review of adverse events reported from tai chi clinical trials, he found the only side effects to be occasional aches and pains typical of exercise.

The entire lecture is available at <https://videocast.nih.gov/Summary.asp?Live=19669&bhcp=1>. 



Dr. Charlene Le Fauve (l), deputy director of NIMH's Office of Research on Disparities and Global Mental Health, describes research to bridge the divide in unequal access to and quality of mental health care. At center, Dan Aune of Mental Health America of Montana discusses efforts to increase access to mental health care for Native American/American Indian communities. Stacie Hiramoto (r) of Mental Health America of California describes statewide policy efforts to reduce racial disparities in access to care among racial and ethnic minority communities.

NIHM's Partners Target Disparities In Access to Care

Persistent disparities in accessing mental health care were high on the agenda as representatives of grassroots organizations from every state recently gathered at NIH for the 16th annual meeting of the National Institute of Mental Health Outreach Partnership Program. They heard about the latest mental health research and talked with NIMH leadership about some of the most pressing mental health issues affecting their communities. The OPP supports a nationwide network of 55 state mental health organizations—the NIMH Outreach Partners—that aims to increase the public's access to science-based mental health information.

Some 55 percent of U.S. counties have no psychiatrists, psychologists or clinical social workers. This shortage of mental health specialists is especially challenging in minority communities. Dr. Charlene Le Fauve, chief of mental health disparities research and deputy director of NIMH's Office of Research on Disparities and Global Mental Health, described interventions to improve access to care. She highlighted the NIMH-funded Community Partners in Care, a unique collaboration between researchers at the University of California, Los Angeles, and RAND Corp. and partners from more than two dozen community agencies to improve depression care in under-resourced African-American communities.

Dan Aune of Mental Health America of Montana, the NIMH Outreach Partner for Montana, described MHA MT's work to bring sustainable and culturally appropriate mental health services to tribal communities. American Indian and Alaska Native (AI/AN) communities experience significantly higher rates of historical and intergenerational trauma, mental distress and suicide compared to the rest of the U.S. population. Staffing issues and shortages of highly skilled providers limit AI/AN access to mental health services at Indian Health Service and tribal health care facilities. MHA MT trains tribes on how to offer services with the right people, with the right process at the right place. This means adopting a treatment model that is person- and

family-centered and trauma-informed. The right process refers to approaches such as integration of cultural healing practices, regular treatment team meetings and supervision. The right place means meeting clients where they are, whether it's at home, school, a cultural activity or by phone.

Stacie Hiramoto, director of the Racial and Ethnic Mental Health Disparities Coalition at Mental Health America of California, described this statewide policy effort to reduce disparities in access to care among racial and ethnic minority communities in California. REMHDCO, funded through Proposition 63—the State Mental Health Services Act—is part of

the California Reducing Disparities Project, which focuses on prevention and early intervention strategies. Five special population reports have been developed for African-American, Latino, Asian/Pacific Islander, Native American and lesbian, gay, bisexual, transgender and questioning communities to highlight community-defined approaches. REMHDCO also produced short reports and fact sheets on Armenian, deaf and hard-of-hearing, Russian speaking, Middle Eastern and Southwest Asian, refugee and asylum-seeking and developmentally disabled communities. **R**



Etzioni To Give Next 'Mind the Gap' Seminar

Dr. Ruth B. Etzioni, chair, scientific steering committee, Hutch Data Commonwealth Division of Public Health Sciences, will present "Overdiagnosis in Cancer Screening: Overcoming Challenges, Avoiding Mistakes" at the next Medicine: Mind the Gap Seminar. The seminar is the final presentation of a 3-part series on disease prevention screening. It will be held Friday, Nov. 18 from 1 to 2 p.m. via NIH Videocast, <http://videocast.nih.gov>.

Etzioni will examine how overdiagnosis arises and will discuss what it takes to validly estimate its frequency. She is a biostatistician and full member in the Division of Public Health Sciences at the Fred Hutchinson Cancer Research Center. Her research focuses on the development of innovative statistical and computer models to learn about the latent process of cancer progression from observed data on disease incidence and mortality.

Register for the seminar at <https://prevention.nih.gov/programs-events/medicine-mind-the-gap/registration>. Etzioni will accept questions about her presentation during her talk via email at prevention@mail.nih.gov and on Twitter with #NIHMTG.

Use or Donate Reminder

Have you accrued annual leave this year that you are unable use? If you aren't able to use it, don't let it go to waste. Employees unable to take that time off could donate it to co-workers in need of paid time off due to personal or family medical emergencies. Check your leave balance in ITAS or on your leave and earnings statement (LES) now. If you have excess annual leave this year, don't lose it—use it or donate it. Last year, the NIH community lost more than 88,000 hours of excess annual leave—that is 11,000 work days.

Employees have two options for donating leave to colleagues who have exhausted their own leave and have a medical emergency that prevents them from working. Consider making a donation through the NIH Leave Bank or to a participant of the Voluntary Leave Transfer Program. Both of these donations can be made in ITAS. If you or your supervisor have questions about "use or donate" leave, contact your administrative officer.



A microneedle patch being applied to the arm

PHOTO: ROB FELT/GEORGIA TECH

Microneedle

CONTINUED FROM PAGE 1

professor and J. Erskine Love chair in chemical and biomolecular engineering, Georgia Institute of Technology, presented the microneedle technology and results from his research leading up to a phase 1 clinical trial during a recent seminar at the National Institute of Biomedical Imaging and Bioengineering.

Prausnitz receives funding from NIBIB, including a special Quantum grant, a mechanism for profound advances in biomedical engineering technologies that address major diseases or national public health problems.

The Food and Drug Administration granted investigational new drug status for the vaccine and novel administration method, allowing Prausnitz and collaborators at Emory University School of Medicine to conduct a study that started last fall using the microneedle patch. They assessed the safety of the engineered device, how the body's immune system responded to the vaccine delivered through a patch and participants' opinions about using the patch. Researchers from the international health organization PATH evaluated policy implications around a vaccine that just about anyone could deliver.

The vaccine patch consists of 100 solid, water-soluble needles that are just long

enough to penetrate the skin. Adhesive helps grip the skin during the administration of the vaccine, which is encapsulated in the needles and is released as the needle tips dissolve. In the clinical trial, the researchers allowed 20 minutes for the needles to dissolve in the skin, but are aiming for 5-minute stick times in the future. The patch is peeled away and discarded like a used bandage strip.

Then researchers offered four choices for future vaccination: take a patch home and self-administer the vaccine, have a health practitioner supervise the patch vaccination, have the health practitioner administer the patch, or the standard injection. The large majority of volunteers wanted to use the patch and to administer the vaccine themselves. Some of the participants who



“We think if we build it they will come. We wanted to find out if it’s true that people would like to get their flu vaccine using a microneedle patch.”

-DR. MARK PRAUSNITZ



The patient or a minimally trained person can administer the microneedle vaccine patch, applied at the wrist with thumb pressure. In order to have minimally trained personnel apply the vaccine in the trial, bioengineers designed a simple feedback mechanism to indicate sufficient pressure. The feedback is provided in the form of a click that can be felt and heard.

“We think if we build it they will come,” Prausnitz said. “We wanted to find out if it’s true that people would like to get their flu vaccine using a microneedle patch.”

Nearly 100 adult participants were enrolled in the study to assess the appeal of flu vaccination using microneedle patches. In a figure that aligns closely with the wider U.S. population, 46 percent of the study participants had intentions to get a flu vaccine. Each got to experience administration of a patch as well as a syringe injection, neither of which contained vaccine.

hadn’t planned to get a flu vaccine had a change of heart; 35 percent of them opted to be vaccinated once given the choice of the microneedle patch.

Prausnitz says that in addition to patients preferring microneedle patches, these skin patches may enable flu vaccine to be more effective because it interacts with the skin, rather than the muscle layer beneath the skin. “The skin is an immune surveillance organ,” he said. “It’s our interface with the



Dr. Mark Prausnitz (r) provides NIBIB staff members with the opportunity to handle a prototype of the microneedle patch. Observing are (from l) NIBIB’s David George, Jill Heemskerck and David Rampulla.

PHOTOS: NIBIB



Prausnitz says the patches may enable flu vaccine to be more effective because it interacts with the skin, rather than the muscle layer beneath the skin.

outside world, so it's very well equipped to detect a pathogen and mount an immune response against it."

The prospective vaccine technology offers economic and manufacturing advantages too, according to Prausnitz. The manufacturing cost for the patch is expected to be competitive with prefilled syringe costs.

The patch, however,

can dramatically reduce the cost of vaccination, since self-administration can eliminate the need to have health workers oversee the process. It can be easily packaged for transportation, requires no refrigeration and is stable. The researchers saw no degradation of the vaccine in microneedle patches after a year stored at room temperature.

Data from the clinical trial of flu vaccination using microneedle patches, which is the culmination of Prausnitz' Quantum grant, are currently being analyzed. Publication in a scientific journal is expected soon. **B**

NIH Celebrates America Recycles Day

America Recycles Day (ARD) is Tuesday, Nov. 15. The Division of Environmental Protection will partner with the ORS Division of Logistics Services, sustainable lab practices working group, green team leads council and sustainability partners to host information and recycling activities Monday, Nov. 14 through Friday, Nov. 18.

ARD is a nationwide endeavor to celebrate recycling efforts, increase recycling awareness and further promote recycling initiatives. Stop by an information table from 11 a.m. to 2 p.m. during ARD week to take the NIH Recycling Pledge and pick up recycling information at the following cafeteria locations: Bldgs. 10 (B1 and 2nd floor), 31, 35, 38 and 45.

Containers will be located in the lobbies of Bldgs. 1, 10 South, 13, 31A, 35, 38A, 40, 45 and 50 to collect non-accountable items (e.g., electronics, floppy disks, CDs, cords, microwaves, coffee makers, monitor stands, metal staplers, hole punchers) from the beginning of ARD week until Friday at 2 p.m.

The Shady Grove, Baltimore and Research Triangle Park campuses will also host activities. For more information, email the 2016 ARD coordinators, Jaie McGauley (jacquelyn.mcgale@nih.gov) or Tierra Robinson (tierra.robinson-morgan@nih.gov). Updated information will also be posted to the ARD link on <https://nems.nih.gov/Pages/default.aspx>.

NIH Scientists Uncover Genetic Explanation for Vexing Syndrome

Scientists at NIH have identified a genetic explanation for a syndrome characterized by multiple vexing and difficult-to-treat symptoms, including dizziness and lightheadedness, skin flushing and itching, gastrointestinal complaints, chronic pain and bone and joint problems. Some people who experience these diverse symptoms have elevated levels of tryptase—a protein in the blood often associated with allergic reactions. Multiple copies of the alpha tryptase gene drive these tryptase elevations and may contribute to the symptoms, according to a new study led by investigators at NIAID.

Other studies have indicated that 4 to 6 percent of the general public has high tryptase levels. While not all of these people experience symptoms, many do, raising the possibility that this mildly prevalent trait in some cases drives the symptoms, although how it does so remains unclear.

"This work suggests that multiple alpha tryptase gene copies might underlie health issues that affect a substantial number of people," said NIAID director Dr. Anthony Fauci. "Identifying one genetic cause for high tryptase opens the door for us to develop strategies for diagnosing and treating people carrying this genetic change."

The study appeared online in *Nature Genetics* Oct. 17.

Women Report Vaginal Ring for Preventing HIV Had Little Effect On Sexual Intercourse

Most women who used an experimental vaginal ring for HIV prevention report that the physical act of sex was largely unaffected by using the product, which is inserted monthly for continuous wear. This finding is among several insights gleaned about experiences of women who used the ring during the ASPIRE study, announced Oct. 18 at the HIV Research for Prevention meeting in Chicago.

ASPIRE evaluated whether the ring, which continuously releases the anti-HIV drug dapivirine, could safely reduce HIV infection among 2,629 women ages 18–45 years in Malawi, South Africa, Uganda and Zimbabwe. Among participants randomized to receive the ring, risk of HIV infection fell by 27 percent. A further analysis found that the ring reduced the risk of HIV infection by at least 56 percent among women who used it with greater frequency, and up to 75 percent or higher among those who



IMAGE: INTERNATIONAL PARTNERSHIP FOR MICROBICIDES

used it consistently. Further exploration of the ring's clinical potential began in July 2016 through the large-scale HOPE study. ASPIRE, HOPE and their ancillary studies were primarily funded by NIAID. The nonprofit International Partnership for Microbicides developed the dapivirine ring and supplied it for the studies.

"Women need an HIV prevention modality that offers safe, effective protection and is practical for use in their daily lives," said NIAID director Dr. Anthony Fauci. "Women enrolled in the ASPIRE study reported that the experimental vaginal ring generally did not interfere with sexual intercourse, which is an encouraging sign that this product could appeal to a larger group of women at risk for HIV infection."

The potential for women to suffer social harm and violence by sexual partners, along with other qualitative data from HIV prevention studies, suggest that some women may prefer methods of HIV protection undetectable by sexual partners.

Weight Loss Leads to Strong Increase in Appetite

Analysis of a trial that used the drug canagliflozin found that as people lost weight, their appetite

increased proportionately, leading to consumption of more calories and weight loss plateau (leveling off). The findings provide the first measurement in people of how strongly appetite counters weight loss as part of

the body's feedback control system regulating weight. Results were published in *Obesity* during Obesity Week 2016 (Oct. 31–Nov. 4).

A team led by NIDDK analyzed data from a year-long, placebo-controlled, double-blind trial in people with type 2 diabetes who could eat and drink without restriction. Of the 242 participants, 153 received canagliflozin, a drug that caused a substantial increase in the amount of glucose excreted in their urine. Those people were not directly aware of that calorie loss, which caused a gradual decrease in weight averaging about 8 pounds.

The team used a validated math model to calculate the changes in the amount of calories consumed during the study. They found no long-term calorie intake changes in the 89 people who got a placebo. However, for every pound of lost weight, the people treated with canagliflozin consumed about 50 calories per day more than they were eating before the study. This increase in appetite and calorie intake led to slowing of weight loss after about 6 months.



Study provided clues of how strongly appetite counters weight loss.

Challenges

CONTINUED FROM PAGE 1

visit www.challenge.gov, a site administered by the General Services Administration, for a complete list.

“The use of challenges and prizes is not a new idea,” said Kalil; the British Parliament in the 1700s offered a prize for solving the longitude problem “because they were sick of losing ships.” The first X Prize, in 1996, offered \$10 million to a team that could rocket the equivalent of 3 people into space and bring them back safely twice within 2 weeks. “They have demonstrated that space is not just for governments anymore,” he noted.

When DARPA held a self-driving car competition, the CEO of Google was at the

citing Sun Microsystems co-founder Bill Joy’s dictum, “No matter who you are, most of the smartest people work for someone else.”

“All agencies have been given the authority to sponsor prizes, up to \$50 million [with larger prizes dependent on congressional approval],” Kalil said, “and the ability to do public/private partnerships.”

Kalil urged NIH to make prizes and challenges part of its investment strategy, given the “explosion of data in the biomedical area.” He cited advances in artificial intelligence and machine learning that already show promise in breast cancer diagnosis.

“We need to take this field [of incentive prizes] from the craft, the artisanal and the boutique to more like ordering a laptop online,” he said.



“The models for organizing creative effort are changing.”

—DR. KARIM LAKHANI



finish line, to acquire the winning team, Kalil reported.

“One of the big advantages [of challenges] is that the sponsor only pays if someone is successful,” Kalil explained. “The sponsor simply sets a goal and is agnostic about what approaches are used.”

He recalled that Charles Lindbergh’s successful solo trans-Atlantic flight was spurred by a \$25,000 purse offered by a New York hotelier. “Everyone thought [Lindbergh] was crazy.”

Challenges “broaden the pool of expertise” to address problems, Kalil explained,

Kalil suggested several next steps for NIH to consider, such as providing professional development on incentive prizes for program managers, investing in a team similar to the NASA Tournament Lab that could help NIH and NIH-funded principal investigators design and manage prizes, and making it easier for the NIH community to access “innovation marketplaces” such as Kaggle and TopCoder.

Kalil also encouraged NIH to replicate NEI’s Audacious Goals Initiative. “I think a great question to pose to the research community would be, ‘What



Lora Kutkat, senior advisor, OD, has formulated policy on challenges at NIH since 2011.

data sets would accelerate progress in the application of AI and machine learning to biomedical research?”

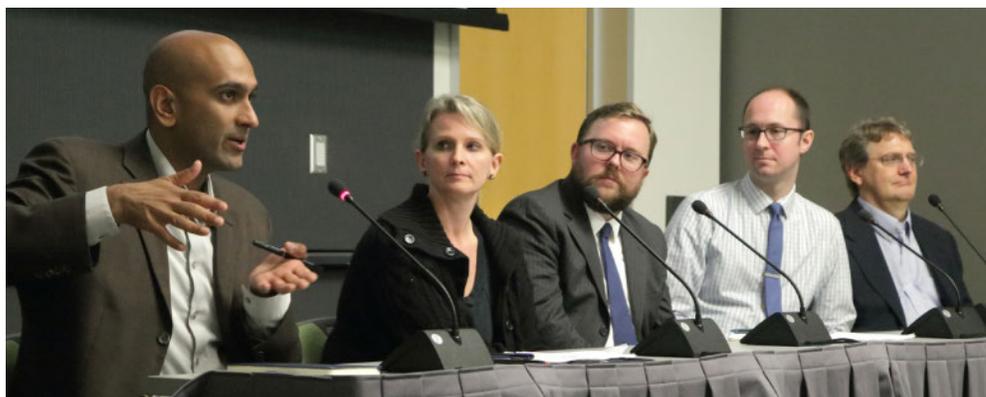
Lakhani said he became an academic when customers while he was employed at GE Medical were out-innovating GE engineers; he was keen to know if the best solutions were hiding somewhere out of reach. His research at Harvard has proven that crowds often provide cheaper, faster and better solutions than those created internally, and that a “crowd” can be as small as two dozen people.

Like Kalil, he cited historical evidence for the value of crowd-sourcing: it resulted in construction of Il Duomo (The Dome) in Florence, Italy, in 1418, and the development of canned food, which Napoleon commissioned, in order to feed distant armies.

Lakhani’s lab works with NASA, Harvard Medical School, the Broad Institute and a 1-million-member online platform called TopCoder and has been involved in more than 700 contests in the past 7 years, for a variety of software applications. Of 20 challenges involving computational algorithms, 18 submissions exceeded benchmarks, he said.

Three years ago, his lab ran a 3-week contest with NASA to find a way to power the International Space Station more efficiently. The prize? “Decimal dust,” said Lakhani—\$30,000. Four-hundred fifty-nine people from around the world submitted solutions, more than half of which met or exceeded the NASA solution. Ten prizes were awarded.

“We were stunned,” said Lakhani. “This works.” NASA now has a Center of Excellence for Collaborative Innovation that uses task orders to run contests, he said.



The panel on challenges included (from l) Sandeep Patel; Kutkat; Chris Nelson, assistant director for open innovation, OSTP; Dave Miller, program director, NCI; and Ned Talley, NINDS program manager.

PHOTOS: BILL BRANSON



Patel, open innovation manager, HHS, described advantages of running challenges.

transformational speed, and economic impact, he used a personal example: As a kid growing up in Toronto, he convinced his parents to buy him the *Encyclopedia Britannica*, which cost about \$2,000 and is updated every 10 years. Only a few years later, Microsoft introduced Encarta, which cost \$100 and is updated annually. Then came Wikipedia, which is free, and is updated continuously.

“The models for organizing creative effort are changing,” Lakhani said, noting that the *Britannica* stopped publishing in 2012.

Five years ago, his group wondered, “Are crowds smarter than Harvard Medical School?” A 2-week competition offering a \$6,000 prize drew 654 submissions from 122 coders. “Thirty-four exceeded the state of the art by orders of magnitude,” Lakhani said. Eighty-nine different ways to solve the challenge—annotating 10 million sequences in under 3 minutes, and 0.25 billion sequences in less than an hour on a laptop—arrived from Russia, France, Egypt, Belgium and the U.S.

A genomic data processing challenge involving the Broad pitted one of its premier scientists—“a highly skeptical participant,” Lakhani noted—lasted 3 weeks and offered a \$20,000 prize. Twelve hundred people registered, 96 solutions were submitted and the contest was won on its first day by a person who exceeded the benchmark by 87 percent, increased the speed of the computation 15-fold and boosted accuracy from 91 to 97 percent.

“Incentives in academia are not set up to produce this kind of result,” Lakhani observed.

He offered more examples of the power of crowds; interestingly, winners and top finishers included high school students, the unemployed, and people whose study of biology ended in high school. Learning was a crucial motivation for participating, along with enjoyment and a taste for problem-solving. “It’s a big, big driver,” Lakhani said. Cash, prestige and job-seeking were lesser factors, he noted.

In sum, contests provide incentives of varying weight, along with parallel search, with the result that “we get more shots on goal,” said Lakhani. “It goes back to STAT 101—you get extreme value if you do it a lot of times.”

He concluded, “Maybe we should start with the crowd first, not last. It is a cheap, efficient and fast way to uncover the frontier.” NIH and its grantees should have access to the crowd, too, he said.

During the panel session, all agreed that contests should augment, but not take the place of, grants and contracts; they are not a substitute for internal efforts. “We pick winners before the job is done with traditional grants and contracts,” said Sandeep Patel of the HHS Idea Lab. “With contests, it’s hard to predict where the solution will come from.”

Each IC at NIH has challenge managers, said Lora Kutkat, who has formulated NIH policy on challenges since 2011. Current prizes here range from \$500 to \$20 million, for the Anti-Microbial Resistance Challenge, she said. Reaching non-traditional audiences, the so-called “solvers and seekers,” is her favorite aspect of the mechanism. She cautioned, however, that NIH’ers can’t compete, either on or off-duty, in NIH-sponsored challenges.

“The best starting point,” said Kutkat, “is to clearly define the problem and the kind of solution you’d like.”

Said Chris Nelson of OSTP, “Challenges are a way to bring unusual suspects into this game.”

Quoting an economist, Lakhani noted, “We all have what is known as ‘cognitive surplus’—from the person doing Sudoku on the Metro to the guy watching *Game of Thrones*...there are many ways to spend it. I wouldn’t see [challenge participation] as a waste of time or leisure...These platforms are hungry for demand.” 

[And on Oct. 11, the NASA Tournament Lab announced the “Space Poop Challenge,” which offers \$30,000 in prizes to anyone who can develop a system inside a space suit that collects human waste for up to 144 hours and routes it away from the body, without the use of hands.]

The life sciences are ripe for crowd-sourcing due to a data explosion that is “already in place,” said Lakhani. “We are moving from petabytes (10^{15}) to exabytes (10^{18}) of information. The Broad is already generating 25 terabytes of information per day...I tell my students we are never going to be in a world with less data.”

Lakhani said the labor market is already short 1.8 million data scientists. “There is a war for talent, intense competition, from places like Uber and Lyft to space exploration...With the rise of deep learning, we need new approaches to solve data challenges.”

To illustrate technology’s

Symposium on Open Data, Prize

The NIH Big Data to Knowledge (BD2K) Initiative and the Office of the Associate Director for Data Science will hold an Open Data Science Symposium on Dec. 1. Big data is an underutilized resource for innovation and discovery in biomedical research and NIH is committed to unleashing its full potential by making it an open and easily accessible resource. The Open Data Science Symposium will feature discussions with the leaders in big data, open science and biomedical research while also showcasing the finalists of the Open Science Prize, a worldwide competition to harness the innovative power of open data.

Speakers include: NIH director Dr. Francis Collins; former NIH and NCI director Dr. Harold Varmus; John Wilbanks, Sage Bionetworks

chief commons officer; Peter Goodhand, Global Alliance for Genomics and Health executive director; Niklas Blomberg, founding director of Elixir; and Robert Kiley, head of digital services at the Wellcome Library.

The six Open Science Prize finalists will demonstrate prototypes of big data tools currently under development that utilize publicly available datasets in environmental, epidemiological and health sciences to improve the health of individuals worldwide.

The event will be held from 8:30 a.m. to 4 p.m. at the Bethesda North Marriott Conference Center, 5701 Marinelli Rd., North Bethesda. For registration and agenda, visit <http://event.capconcorp.com/wp/bd2k-odss/>.



Dr. Jean L. Flagg-Newton

Flagg-Newton Retires from NIH

Dr. Jean L. Flagg-Newton, a longtime NIH administrator who was instrumental in helping to establish the National Institute on Minority Health and Health Disparities, retired at the end of September.

Flagg-Newton spent most of her 28-year career at NIH, most recently as acting director of the Office of Health Equity at the National Institute of Child Health and Human Development. She also served as a scientific review officer at the National Institute of General Medical Sciences; program officer for the Research Collaborative Awards Program and the Minority International Research Training Program of the Fogarty International Center; coordinator of the Minority Health Initiative and deputy director of the Office of Research on Minority Health; and deputy director and chief of the Office of Research in the National Center on Minority Health and Health Disparities, the precursor to NIMHD. While at NCMHD, Flagg-Newton implemented its first Centers of Excellence Program and Research Endowment Program.

“Building it from the ground up and launching the first programs was very rewarding,” she said.

Dr. Catherine Spong, NICHD acting director, thanked Flagg-Newton for her unfailing commitment and dedication to NIH at a Sept. 21 NICHD advisory council meeting.

“You have been a tremendous asset to our institute and all of NIH,” said Spong. “We thank you for your many contributions. We will miss you greatly.”

Behind all the titles is a soft-spoken, determined woman who didn’t distinguish her day job from her life’s mission. “On most days throughout my career, coming to work has not been like coming to work,” she said with a quick smile. “There has been an excitement about it, a passion.”

That passion will continue in her ancestral home. She plans to move to South Carolina to help develop the infrastructure of Daufuskie Island,

a small sea island not much bigger than the NIH campus, located between Savannah, Ga., and Hilton Head Island, S.C. It is the home of her grandmother and great-grandparents, members of the native Gullah community.

The late author Pat Conroy fictionalized the island in his novel *The Water is Wide*. Flagg-Newton intends to use her leadership skills to help build a park and bring an island-owned boat and other basic amenities to the local Gullah community.—

Meredith Daly

NINDS’s Roll-Mecak Is 2016 Blavatnik Finalist

Dr. Antonina Roll-Mecak, chief of NINDS’s cell biology and biophysics unit, was recently named one of 31 finalists for the 2016 Blavatnik National Awards for Young Scientists. The awards celebrate exceptional young researchers who drive the next generation of scientific innovation by answering the most complex scientific questions of today. The awards were established by the Blavatnik Family Foundation in 2007 and are administered by the New York Academy of Sciences.

Thirty-one finalists were selected among 3 categories—life sciences, physical sciences and engineering, and chemistry—from more than 300 nominations of outstanding faculty-rank researchers from 148 of the nation’s leading academic and research institutions. Roll-Mecak was one of 10 finalists selected in the life sciences category. According to the foundation, she and her fellow finalists are addressing difficult scientific questions with transformative insight, innovative strategies and revolutionary technologies.

Roll-Mecak’s laboratory studies intracellular organization and movement, with a primary interest in microtubules. Microtubules are components of the cytoskeleton and serve as the structural “scaffold” or platform of all cells. She was recognized for her

key contributions and discoveries in understanding cytoskeletal regulation, mechanisms of microtubule dynamics and laying the groundwork for deciphering the complexities of the tubulin code.

The finalists competed for three spots as 2016 Blavatnik National Laureates. Laureates and finalists were honored at an annual awards ceremony Sept. 12 at the American Museum of Natural History in New York City.

Roll-Mecak earned her undergraduate degree in chemical engineering from the Cooper Union for the Advancement of Science and Art in New York City in 1996, and earned her Ph.D. in molecular biophysics from the Rockefeller University in 2002. She conducted her postdoctoral studies with Dr. Ron Vale at the University of California, San Francisco, in the department of cellular and molecular pharmacology. She joined NINDS in 2009.

NINR Welcomes New Members To Advisory Council

NINR director Dr. Patricia Grady recently welcomed six new members to the National Advisory Council for Nursing Research:

Dr. Kathryn H. Bowles is the vanAmeringen professor in nursing excellence at the University of Pennsylvania School of Nursing and vice president and director of the Center for Home Care Policy and Research at the Visiting Nurse Service of New York. Her program of research examines decision-making supported by information technology to improve care for older adults.

Dr. Aaron G. Buseh is professor of nursing and director of the Ph.D. program at the University of Wisconsin-Milwaukee, College of Nursing. His program of research focuses on conducting population-based, multidisciplinary studies aimed at reducing the effects of health disparities within ethnic minority communities.



At left, Dr. Antonina Roll-Mecak of NINDS presents at the third annual Blavatnik Science Symposium, which featured research of the 2016 national finalists and honorees from previous years. At right, Roll-Mecak is joined by NHLBI senior investigator Dr. Adrian Ferré-D'Amaré, who represented NIH director Dr. Francis Collins at the award ceremony.



NINR director Dr. Patricia Grady (third from l) welcomes new council members (from l) Dr. Rita Pickler, Dr. George Demiris, Dr. Aaron Buseh, Dr. Deborah Koniak-Griffin, Lt. Col. Jennifer Hatzfeld and Dr. Kathryn Bowles.

Dr. George Demiris is the alumni endowed professor in nursing at the School of Nursing and Biomedical and Health Informatics at the School of Medicine, University of Washington. His research interests include the design and evaluation of home-based technologies for older adults and patients with chronic conditions and disabilities and the use of informatics to support patients and caregivers in home care and hospice.

Lt. Col. Jennifer Hatzfeld is a research scientist in the U.S. Air Force. She is currently executive director of the TriService Nursing Research Program at the Uniformed Services University of Health Sciences.

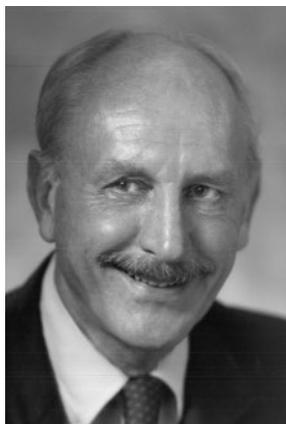
Dr. Deborah Koniak-Griffin is professor and Audrienne H. Moseley endowed chair in women's health research and associate dean for diversity, equity and inclusion at the University of California, Los Angeles School of Nursing. Her work is advancing understanding of methods to eliminate health disparities through health promotion interventions with vulnerable populations, including pregnant/parenting adolescents and Latina women.

Dr. Rita H. Pickler is the FloAnn Sours Easton professor of child and adolescent health and director of the Ph.D. and M.S. in nursing science programs at Ohio State University College of Nursing. Her research focuses on the care of the preterm infant with a focus on improving neurodevelopmental outcomes.

STRUCTURAL BIOLOGY PIONEER NIDDK Scientist Emeritus Davies Mourned

Dr. David Davies, NIDDK scientist emeritus, died Sept. 1 from medical complications following hospitalization. He was 89.

Davies was a founding member of the intramural NIDDK Laboratory of Molecular Biology (LMB) and chief of the lab's section on molecular structure.



NIDDK scientist emeritus
Dr. David Davies
(circa 1987)

PHOTO: BROOKS PHOTOGRAPHY

His work greatly enhanced biomedical understanding, identifying targets for therapy by uncovering the molecular details of protein and nucleic acid interactions needed for processes that cells undergo.

"David epitomized scientific excellence and collegiality," said Dr. Michael Krause, NIDDK scientific director and LMB chief at the time of Davies' retirement.

"His genuine excitement about science was infectious and touched everyone fortunate enough to share time with him."

Davies grew up in Pontardulais, Wales. The first in his family to attend college, he graduated from Oxford University and received a doctorate in 1952. In 1955, he joined NIMH and moved to NIDDK 6 years later. He retired from NIDDK in 2012 after 57 years of federal service and transitioned to an active scientist emeritus.

Among the earliest researchers to characterize nucleotides and important classes of proteins, Davies was closely connected to some of the most important advances on the NIH campus throughout his long and fruitful career, including discovering the first three-stranded helical nucleic acid molecule.

Passionate to foster the next generation of scientists, he recruited and mentored dozens of young scientists who developed successful research careers of their own.

Davies published a brief memoir titled "A Quiet Life with Proteins" in 2004 (see <http://bit.ly/2bGuTs8>). In it, he observed, "When I came to the NIH in 1955

• • •

"David epitomized scientific excellence and collegiality. His genuine excitement about science was infectious and touched everyone fortunate enough to share time with him."

-DR. MICHAEL KRAUSE

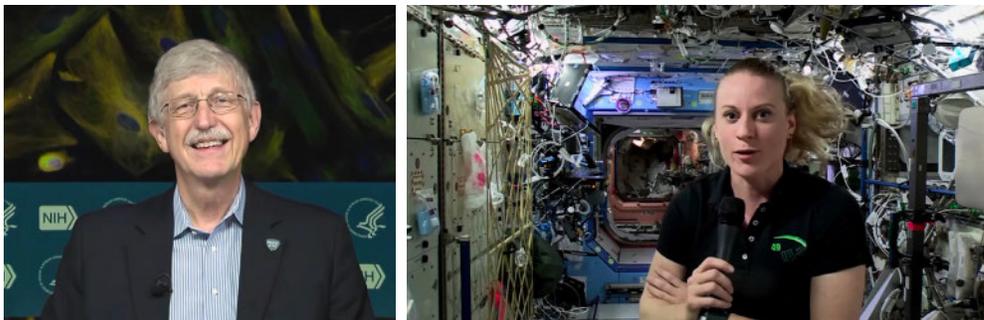
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I never thought that I would stay so long. It was only gradually that I realized what a superb place it is to do research and how many outstanding scientists there are in such a variety of disciplines."

Davies' myriad recognitions include election to the National Academy of Sciences in 1978 and receipt of the Stein & Moore Award from the Protein Society in 1998.

"Dr. Davies was a true pioneer in the field of structural biology," said NIDDK director Dr. Griffin Rodgers. "The scientific community is indebted to both his foundational contributions and integral role in cultivating a world-class research program at the NIH."

Davies is survived by his wife, Monica, and his two daughters, Helen and Sally Davies. **R**



NIH director Dr. Francis Collins, in a multimedia studio in Bldg. 10, talks with NASA astronaut and fellow DNA sequencer Dr. Kate Rubins while she's orbiting Earth aboard the International Space Station.

DNA SEQUENCING BEYOND EARTH'S ATMOSPHERE

SpaceChat Checks In on Science in the 'Final Frontier'

BY CARLA GARNETT

With one scientist planted firmly on planet Earth and another scientist in orbit 220 miles away on the International Space Station, NIH and NASA joined forces Oct. 18 for a live "SpaceChat" about DNA sequencing, the human genome and other topics related to conducting biomedical research in the "final frontier."

NIH director Dr. Francis Collins, on terra firma in a multimedia studio in the Clinical Center, talked for about 20 minutes with NASA astronaut and fellow DNA sequencer Dr. Kate Rubins, who is finishing a 4-month mission aboard the ISS. Their conversation—an extraterrestrial videoconference, if you will—occurred via satellite links between Mission Control Houston, NIH and the ISS.

The event, during which Collins posed queries to Rubins from viewers in real time and asked questions of his own, was carried on several social media outlets, including Facebook and Twitter.

"It's been 13 years since I had the privilege of leading the Human Genome Project that read out that very first reference sequence of a human genome," said Collins, "and now here we are

'rocketing forward' with lots of other advances that take advantage of our ability to read out DNA and RNA."

In August, Rubins and her team made history. They sequenced DNA in space for the first time ever, using a portable biomolecule sequencer device that is about the size of a TV remote control. Scientists wanted to see whether such decoding of the human genome could be accomplished under microgravity conditions.

"This was truly an experiment in all senses of the word," Rubins said. "We did not know if it was going to work the first time we were doing sequencing in space. Like every lab experiment, you put your pipetter down and you give it a try... It actually was a fantastic technology demonstration... We were able to show we can successfully do sequencing in space and we've sequenced over a billion base pairs at this point."

The ability to sequence DNA in space opens a whole new world—quite literally—of opportunity for researchers, who hope one day to be able to identify organisms, diagnose diseases and detect

potential health threats while outside Earth's atmosphere. Rubins said the research also has implications for getting health advances and the latest medical technology to remote and underserved areas on this planet.

Beyond studies of the effects of weightlessness, "the radiation environment is the second major factor on the space station," she pointed out.

"We just can't simulate the low-Earth orbit environment on Earth," Rubins explained. "The beams and accelerators that we have on Earth don't give us the same mix of particles that are currently bombarding human physiology in low-Earth orbit. So, we can study that up here. We've had longstanding partnerships with NIH to understand what's going on with cell physiology [in] orbit. And we can study this on the cellular level."

The chat marked the first time NIH has teamed up on Facebook Live with the International Space Station.

"It worked well logistically," noted the event's chief organizer, Kim Seigfreid of NIH's Office of Communications and Public Liaison. "NASA took our signal and the signal from the ISS and fed it to NASA TV. From there, the signal was pushed to FB Live."

The chat garnered about 58,000 live views, with 225,200 additional views (and still growing), 1.8 million impressions on Facebook and more than 93,464,630 impressions on Twitter.

"We had viewers from all over the United States and more than 53 countries," Seigfreid said. "The amount of viewers from other countries was the most surprising."

Worldwide watchers included our closest neighbors Canada and Mexico as well as those farther afield such as Algeria, India, Pakistan, Turkey, Iceland, Vietnam, Kosovo, Taiwan, Tunisia, Malaysia, the Netherlands, Argentina, Tibet, Sudan and Kurdistan.

You can see the entire chat online at <http://bit.ly/2ekYNo0>.



BEHIND THE SCENES: "Ground Control NIH." At left, one team and many monitors and a load of equipment work in sync to make the extraterrestrial videoconference happen. At right, Collins, with the NIH science screen behind him, prepares for a live chat off-planet, as the tech crew makes final adjustments.

PHOTOS: ERNIE BRANSON