

Fogarty Fellow

studies novel malaria

detection device . . . p. 4



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NIH mobilizes research to address new coronavirus

The coronavirus outbreak that began in China in late 2019 has focused the world's attention on how best to slow transmission, diagnose and treat those with the illness, named COVID-19.

The WHO recently convened more than 300 scientists to help coordinate the research agenda. "I was very encouraged to see the energy and speed with which the global research community has taken up this challenge," said WHO Director-General Dr. Tedros Adhanom Ghebreyesus. Scientists are already addressing the most pressing issues such as creating quick and inexpensive diagnostics, discovering the best approaches for prevention, studying effectiveness of potential therapies and accelerating development of existing vaccine candidates, he said. In addition, researchers are trying to identify the source of the virus and prevent further transmission from animals to humans.

At NIH, scientists have been working since early January to develop a coronavirus vaccine and hope to have it ready for initial testing soon. "We are proceeding as if we will have to deploy a vaccine," said Dr. Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases. "We're looking at the worst scenario if this becomes a bigger outbreak."



U.S. government scientists are assisting in the global response to the coronavirus outbreak, and are studying potential vaccines and treatments.

NIAID is also investigating existing therapeutics that might help save lives immediately. For instance, the experimental antiviral remdesivir successfully prevented another type of coronavirus disease in rhesus macaques being studied by a scientific team at NIAID's Rocky Mountain Laboratories. Several clinical studies of the drug are now underway in

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NIH, Fogarty receive funding hikes for Fiscal Year 2020

The NIH budget was approved by Congress and signed into law by President Donald Trump in late December 2019, providing funding for Fiscal Year 2020, which began Oct. 1.

NIH received a \$2.6 billion rise over the previous year, with an appropriation of \$41.68 billion, an increase of 6.65%. Fogarty's allocation was boosted by 3.4%, bringing its total to \$80.76 million.

The 2020 NIH budget includes \$2.8 billion for Alzheimer's disease studies, \$3.1 billion for HIV/AIDS research, \$500 million for the BRAIN initiative and \$195 million for Cancer Moonshot initiatives.

More information is available at www.fic.nih.gov/About/Budget.

Photo by James Galhany/CDC

FOCUS



Fogarty program spurs innovative mHealth solutions

- Cellphone microscope enables early cancer detection
- Scientists develop app to diagnose, treat leishmaniasis
- Mobile tool designed to alleviate cancer pain

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NIH mobilizes research to address new coronavirus

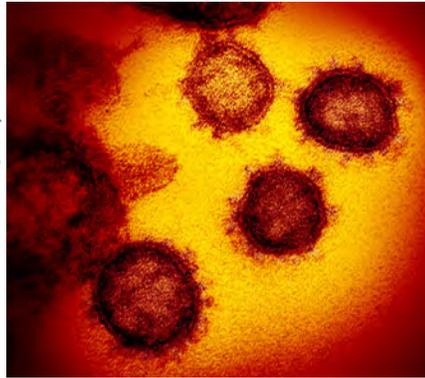
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China. Meanwhile, researchers in Thailand reported seeing improvement in several patients treated with HIV drugs lopinavir and ritonavir, in combination with the flu drug oseltamivir.

To encourage coronavirus research, NIAID has issued a funding call to current grantees whose work would benefit from a funding supplement.

At Fogarty, a team of disease modelers led by Dr. Cécile Viboud has been working around the clock to process and analyze initial publicly available data. An online community for Chinese physicians and health care professionals provides real-time situation reports of the outbreak, including cumulative case counts, outbreak maps and real-time streaming of health authority announcements.

Image courtesy of NIAID



The virus that causes COVID-19.

The data provide a snapshot of patient information in terms of age, gender and symptom onset.

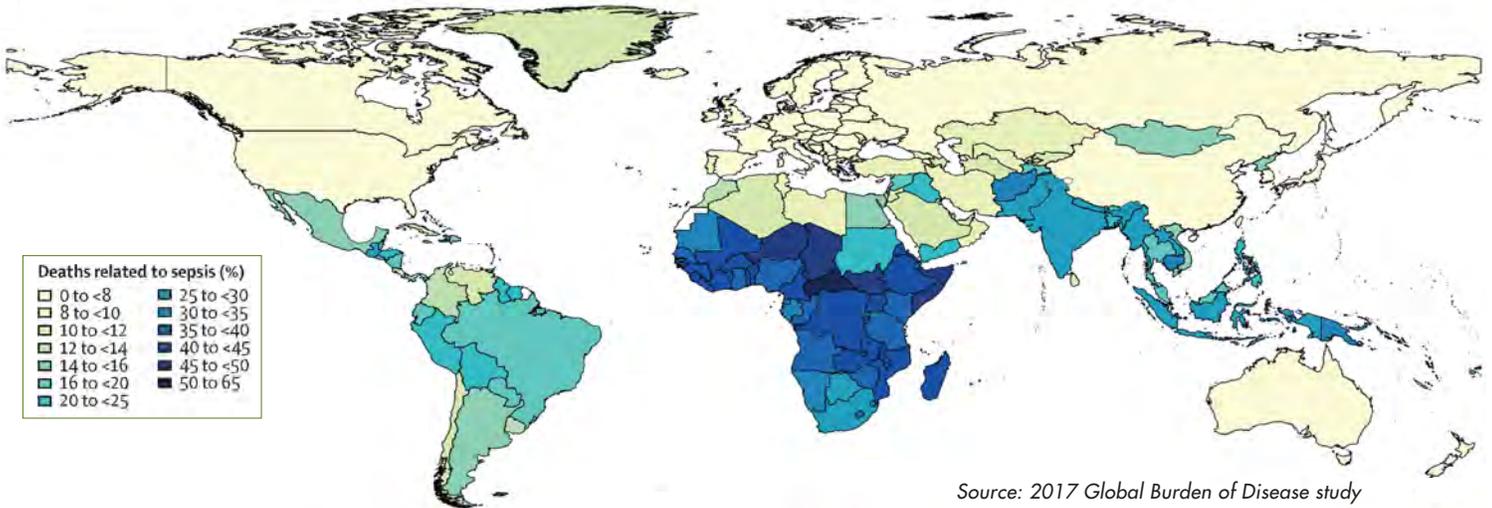
HHS has offered to send American experts to China to help with the response and the State Department has pledged \$100 million to aid China and other countries affected by COVID-19.

Considering early lessons from the outbreak, *The Lancet* editor Dr. Richard Horton encouraged policymakers to take note. “Research is sometimes seen as a luxury when countries are being urged to invest in primary health care,” Horton observed. “But the COVID-19 outbreak has shown the foundational importance of research for any effective public health response.”

RESOURCES

http://bit.ly/COVID19_info

Global sepsis burden is double previous estimates



Source: 2017 Global Burden of Disease study

Sepsis, a life-threatening organ dysfunction due to infection, occurs in nearly 50 million people each year and causes about 11 million deaths worldwide. The toll is double previous estimates, according to a recent article in *The Lancet*, based on data from the 2017 Global Burden of Disease study.

Diarrheal disease was the most common underlying cause of sepsis, among all ages, genders and locations. Road traffic injuries and maternal disorders were the

most frequent noncommunicable diseases complicated by sepsis. Sub-Saharan Africa was the region with the highest sepsis mortality rate.

Research and policy interventions targeting antimicrobial resistance, a key driver of sepsis, are “imperative,” the authors noted.

RESOURCES

http://bit.ly/sepsis_global

Scientist studies the moringa plant's medicinal, nutritional benefits

By January W. Payne

The moringa plant has been used for centuries throughout the tropics for medicinal purposes and to improve nutrition, especially in children. A Fogarty-funded researcher is helping to provide the scientific evidence behind the so-called “superfood,” as well as enabling farmers to increase their moringa crop yield and improve the purity of the end product, a powdered diet supplement.

A growing body of evidence suggests that moringa (*Moringa oleifera*) helps fight inflammation, a known contributor to chronic conditions such as cancer, diabetes and obesity. Dr. Carrie Waterman, a natural products chemist at the University of California, Davis, secured a five-year Fogarty International Research Scientist Development Award (IRSDA) to explore moringa's potential. The IRSDA provides support to advanced postdoctoral U.S. research scientists for an intensive, mentored research experience leading to an independent research career focused on global health.

She first became interested in moringa as a Peace Corps volunteer in 2002. “I was growing it, eating it and working with community gardens,” Waterman said. “It's got high nutritional value and also has polyphenols and antioxidants.”

Waterman—who holds a patent related to the processing of moringa and consults for several moringa companies—used her Fogarty grant to work with farmers in Kenya to determine the most effective cultivation and processing techniques. She compared planting strategies to find the ideal spacing between plants to produce the highest yield. By trying different fertilizers, Waterman showed that ground-up stems and discarded portions on the moringa plant worked as well as cow manure, which might help reduce costs for farmers. She discovered the purity of the product improved if leaves were crushed before drying. She also conducted an economic impact analysis to demonstrate net positive economic returns, encourage more farmers to start growing moringa, and lure more investment in moringa start-ups and community development.

In 2015, Waterman and colleagues published a study that showed feeding mice moringa extract could delay the onset of diabetes. Mice that ate a high-fat diet supplemented with 5% moringa concentrate had



With Fogarty funding, Dr. Carrie Waterman helped Kenyan farmers improve cultivation and processing of the moringa plant, known for its medicinal and nutritional properties.

Photo courtesy of Dr. Carrie Waterman

improved glucose tolerance and insulin signaling and didn't develop fatty liver disease. The moringa-fed mice also gained 18% less weight than the control group. In fact, the supplement nearly eliminated excess weight gain caused by a high-fat diet. The NIH supported this research through its National Center for Complementary and Integrative Health and its Office of Dietary Supplements.

With the Fogarty grant, Waterman said she was able to study basic moringa-related research questions, as well as the “whole value chain of not just what do these compounds do in a petri dish, but how does this help people on the ground who are facing nutritional and health issues?” Waterman's recent work in Kenya allowed her to interact with local communities. “I helped them improve their cultivation and processing of it, so that the powder they were making would have more nutrients and more phytochemicals,” she said.

The Fogarty funding has also inspired bidirectional learning. Cultivation, processing and consumption strategies used in Kenya have been shared with farmers in California and vice versa. “We have also built chimney solar dryers to process moringa in both Kenya and California,” said Waterman, who serves as an adviser for research funded by the California Department of Food and Agriculture to assist farmers in Fresno.

Waterman plans to apply for NIH and U.S. Department of Agriculture funding to support additional research into how consuming moringa can affect inflammation and chronic disease in humans. “It can both generate income for farmers, as well as provide food security,” she said. “I think moringa can be a smart tool in our toolbox of strategies to approach global health needs in an environmentally and socially conscious way.”

RESOURCES

<http://bit.ly/MoringaPlant>

PROFILE

Fogarty Fellow studies novel malaria detection device

By January W. Payne

For self-described “talker” Jillian Armstrong, learning to listen has been a key lesson of her current Fogarty fellowship in Cameroon. Living and working in a French-speaking country with no French background has been rewarding, but challenging. “Although I am learning French, I do not have a firm grasp of the language yet,” she said. “I have to listen incredibly carefully when others speak and choose my words wisely when I respond. This experience has helped me truly engage with the people and world around me.”

Armstrong, a Ph.D. student at Yale University, is working on a research project evaluating photoacoustic flow cytometry (PAFC) for the non-invasive detection of malaria-infected red blood cells in Cameroon. Fogarty’s Global Health Program for Fellows and Scholars provides doctoral and postdoctoral students like Armstrong with a year-long mentored research experience in a low- or middle-income country.

Armstrong and her colleagues believe the project is the first to use this technique to diagnose malaria. It’s funded by Fogarty and NIH’s National Institute of Biomedical Imaging and Bioengineering. Malaria is a significant problem in Cameroon where it accounts for nearly 20% of all deaths, according to the U.S. President’s Malaria Initiative. Current diagnostic tests lack sufficient sensitivity and specificity, and require a blood specimen. However, PAFC is a novel, non-invasive diagnostic method that can detect hemozoin, an iron-containing pigment that accumulates in malaria parasites.

PAFC has been demonstrated to be highly sensitive in animal studies, and it may offer benefits over other diagnostic tests, Armstrong said. Additionally, the real-time nature of PAFC means that it can also be used to study how drugs used to treat malaria work—especially important in children under 5, who are vulnerable for adverse malaria outcomes and may not receive the proper dose of medicine to fully clear infections.

The PAFC project is still in its implementation stage but Armstrong is optimistic. “We believe the findings will demonstrate that the PAFC device addresses many of the



Jillian Armstrong, M.S.

Fogarty Fellow:	2019-2020
Fellowship at:	University of Yaoundé, Cameroon
U.S. Institution:	Yale University
Research topic:	malaria diagnostics

limitations of current diagnostics and provides a cost-effective way to detect malaria in a non-invasive, real-time manner,” Armstrong said. “Our PAFC technology has the potential to improve access to highly-sensitive malaria detection in resource-limited settings.”

The experience has been “extremely influential” in helping Armstrong prepare for her dissertation, she said. It was her first experience in the lead role on a study and allowed her to see firsthand all that entails. “Working on a new project meant that I have been involved in everything—from the first conception of the project idea to the proposed analysis of data, and all of the hurdles in between,” she said. “I have learned how to write (and re-write) project proposals, calculate sample-sizes for study aims, and perform new data analysis and laboratory techniques.”

As she continues her work in Cameroon, Armstrong says she is grateful for lessons learned from facing challenges, such as the language barrier, as well as dealing with the unexpected—like how dust can affect her work. “You would be surprised how many biomedical devices and innovations do not take environmental dirt and dust into consideration, which can quickly affect a device,” she said.

The desire to overcome such difficulties is part of why Armstrong is so passionate about applying engineering innovations to global health problems. Listening to partners at every step of the research process is vital, she said. “I think it’s important to involve local researchers and communities in the research you conduct to make sure that it aligns with both the needs and the priorities of the people you’re trying to help.”

JEAN NACHEGA, MD, PHD, MPH

With more than 25 years of HIV/AIDS research experience, Dr. Jean Nachega was a principal investigator (PI) on the \$130 million Medical Education Partnership Initiative (MEPI), which was managed by Fogarty and funded by NIH and the President's Emergency Plan for AIDS Relief (PEPFAR). Nachega holds faculty positions at the University of Pittsburgh and Stellenbosch University in Cape Town, South Africa, and is an adjunct professor at Johns Hopkins University. He is now PI on the African Association for Health Professions Education and Research award, which supports AFREhealth, the leadership and convening organization intended to continue and strengthen the MEPI network.



What has MEPI's impact been?

MEPI was really a game changer. This was the first large program to award funds directly to African institutions. At Stellenbosch University, the MEPI team was able to strengthen our medical school curricula and increase the number of graduates in rural and remote locations where they were needed most. By establishing training programs in these underserved areas, we could recruit locally, which improved retention of trainees who would practice at home and give back to their local communities. MEPI was transformative not only for its ability to provide medical education to remote locations using innovative methods such as distance-learning tools and hands on information technology, but also because it offered opportunities to conduct local research so trainees didn't feel they were missing out. This was a great outcome and provided a fantastic return for their communities.

MEPI also provided a great opportunity to strengthen North-South partnerships, in collaboration with U.S. institutions. Even more important were the South-South relationships that formed. MEPI helped us look for new ways to share resources, establish a community of practice, and, innovatively, learn from those from diverse health profession backgrounds. Prior to MEPI, we had not had a tradition of partnership among medical schools in the South, but we now routinely work together to write grants and collaborate on many activities. That legacy lives on and is being scaled up in AFREhealth.

What are AFREhealth's goals?

AFREhealth is a pan-African initiative that is the child of MEPI. Just as when you give birth to a child you must nourish it to make sure it can grow and flourish, AFREhealth is a network of institutions that aims to work together to continue to strengthen medical education and research. Our challenge is to leverage the MEPI investments to continue to make progress. We are bringing together and embracing all health professionals—not just doctors and nurses—but also pharmacists, dentists, lab

scientists, community health workers, and others from allied health sciences. We hope to create a vibrant research environment and together tackle pressing research questions. As we are concerned about funding sustainability, we will be writing grant proposals to submit to NIH and other public and private organizations, as well as engaging with the African Union and governments throughout sub-Saharan Africa. We hope in the next 5 to 10 years that AFREhealth will have multiple stakeholders and supporters.

How are you building a knowledge base?

One thing we are doing is sharing our lessons learned. Fogarty's Center for Global Health Studies has convened the community to consider best practices from our HIV/AIDS treatment and prevention programs. One size does not fit all, but through an implementation science approach, we are studying what interventions are the most cost-effective and have the most impact in real-life practice. We are also exploring how to use the HIV care platform to better manage chronic conditions.

What are your research priorities?

Now that we are able to keep people alive longer with antiretroviral therapy (ART), we need to focus on the comorbidities and chronic diseases that occur with aging. We must conduct multi-disciplinary research to tackle the noncommunicable diseases (NCDs), which are now killing more people than AIDS. Cardiovascular disease and cancer have high mortality rates in Africa, especially among those living with HIV. We have discovered that even if the virus is suppressed with ART, there are higher than normal levels of ongoing inflammation that impact the heart, kidneys and other organs. Initially, we didn't appreciate the enormity of this problem. We would like to better understand hypertension and stroke, both of which are prevalent in Africa. We know the genetic aspects of these diseases play a significant role and need to work in partnership with the NIH-funded Human Heredity and Health in Africa initiative to better understand these links.

Developing mobile solutions to improve health

The speed of technological advances and the ubiquity of cellphones—even in low-resource settings—have created tremendous opportunities to deploy mobile health to advance research and improve health, especially in remote areas. The explosion of available health data, combined with advances in machine learning or artificial intelligence, provide great potential.

Since its inception in 2014, Fogarty's mHealth program has supported projects to catalyze innovation through multidisciplinary research that addresses global health problems. Through more than 60 grants, Fogarty is helping develop an evidence base for the use of mobile technology solutions to improve health, as well as to strengthen mHealth research capacity in low- and middle-income countries (LMICs).

A broad range of novel initiatives has been supported, such as portable diagnostic devices, apps to improve adherence to disease treatment protocols and text messaging programs to encourage healthy behaviors. The grants fund technology development, as well as rigorous feasibility and effectiveness studies.

A number of the projects are designed to overcome barriers to care that exist in many underserved LMIC communities, including lack of transportation to clinics, inadequate numbers of doctors and the chronic shortage of health care workers. By using cellphones to connect rural patients with knowledgeable care

Since 2014, Fogarty has provided funding to catalyze development of mobile health technologies and support research to study their effectiveness.

providers, diagnoses can be made and treatment recommendations can be given remotely. Also, mobile devices can provide front-line health care workers with access to current information, treatment guidelines and the ability to consult electronically with experts, when needed.

Other grantees have explored adapting and developing powerful yet inexpensive, portable microscopes and probes that can be connected to cellphones, bringing diagnostic capabilities to remote populations. With instant diagnoses, patients can begin treatment immediately, without the need to return later for test results. Projects are exploring mHealth technologies to screen for a variety of issues including breast and cervical cancer, anemia and hearing loss.

Text messaging programs are also being created and studied for their effectiveness at encouraging behavior change, such as smoking cessation, or promoting adherence to challenging treatment protocols including those required for people living with TB and HIV/AIDS. Other projects are exploring more effective ways of remotely managing gestational diabetes, providing support to breastfeeding mothers, and monitoring bipolar disorder and depression.

Several initiatives are examining best practices in using mHealth to promote distance learning, so that health care workers on the front lines can develop expertise in cancer and other specialized topics.

To help establish a community of practice among those studying potential mHealth solutions in LMICs, Fogarty's Center for Global Health Studies hosted a training institute on the NIH campus and has made the curriculum freely available on the Center's website.

In addition to Fogarty, mHealth program cosponsors at NIH include the National Cancer Institute, National Institute of Biomedical Imaging and Bioengineering, National Institute of Mental Health, NIH Office of Behavioral and Social Sciences Research, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institute on Deafness and Other Communication Disorders, National Institute of Neurological Disorders and Stroke, and NIH Office of Research on Women's Health.

Articles in this section by Susan Scutti.
Resources <http://bit.ly/MobileHealthSolutions>



Innovative microscope enables early cancer diagnoses

Smartphone microscopes are showing great potential for enabling instant and affordable diagnoses of certain cancers in low-resource settings. Fogarty grantee Dr. Dongkyun Kang has developed a new method of deploying confocal microscopy technology that provides instant images on a low-cost mobile device. In a pilot study in Uganda, the device was used to examine participants' skin lesions and samples to look for Kaposi's sarcoma (KS). Promising results led Kang to refine the prototype to improve image quality. He also has a second Fogarty grant to develop the confocal technology to produce and study an inexpensive smartphone endoscope to screen for cervical cancer.

"We're streamlining the process to enable onsite, real-time, single-visit diagnoses," says Kang, a biomedical engineering professor at the University of Arizona. "Now the patient doesn't have to come back to the rural clinic or hospital. We can catch them when they are there."

Although confocal microscope technology has been around for several decades, it's been cost prohibitive for use in low- and middle-income countries (LMICs). The materials for Kang's devices cost only about \$4,200, as compared to nearly \$100,000 for a commercial confocal microscope, he says. In addition, his latest prototype weighs only about 2 pounds, so it is portable and easy to hold with a single hand.

Improving access to and speed of diagnoses for cancer could have an enormous health impact. KS is the most common HIV-associated cancer among patients who live in sub-Saharan Africa. Survival rates are poor: In some African countries, only 30% of patients live even three years following diagnosis. The cervical cancer picture is equally bleak, with more than 80% of the world's diagnoses occurring in LMICs. In East Africa, the mortality rate is 27.6 per 100,000.

"The standard way of diagnosing any cancer is to take a little bit of tissue out of a patient and then process

it as a thin section slide that a pathologist takes a look at under the microscope," explains Kang. With his smartphone device, he is bringing the microscope to the tissue rather than the tissue to the microscope, saving the usual four-to-six weeks' processing time. Kang's device joins a smartphone with an optical attachment in a custom-built, optomechanical holder. It can generate two-dimensional pictures of suspected KS lesions by

using light plus a prism-like component—diffraction grating—and the image sensor in a smartphone.

His pilot study of the technology conducted at Makerere University in Kampala revealed issues with poor image quality, Kang confides. Based on these results, he refined the prototype, which now uses near-infrared (NIR) light and a new optics design. The NIR version, which can be used for biopsies as well as on living patients, "reduces the speckle noise significantly and will have better imaging performance," according to Kang, who is planning to test the new iteration of the device soon.

His newest invention, for diagnosing cervical cancer, filters light through a confocal module and sends this light through a fiber bundle within an endoscopic catheter to the cervix. The return-

ing light waves are then bent and focused to generate an image on the smartphone camera.

The endgame of his research is to develop an app powered by artificial intelligence to analyze images and either guide or provide a diagnosis. His work in Uganda has already established an mHealth knowledge base and a network of collaborating researchers in the country, which Kang believes will pave the way for future projects and innovations across Africa.

Not only will the smartphone confocal microscope make a difference in LMICs, it will also benefit Americans, says Kang, who has begun work with an Arizona clinic that provides health care to people who lack medical insurance. "The whole goal is to make an impact in the U.S. as well."



Photo courtesy of Makerere University

A smartphone confocal microscope, developed by a Fogarty grantee, shows promise in providing quick, inexpensive diagnoses of Kaposi's sarcoma lesions.

Scientists develop app to diagnose, treat leishmaniasis

Cutaneous leishmaniasis—caused by bites from infected sandflies—produces skin lesions that leave behind both scars and stigma that last a lifetime. Up to 1.2 million new cases are diagnosed each year across the 90 countries where the disease exists, including Colombia.

“Leishmaniasis happens where the medical system *isn't*,” says Dr. Elisha Aronoff-Spencer, a Fogarty mHealth grantee at the University of California, San Diego. He’s been working in rural Colombia to bridge the access gap between remote communities and the public health system, using a mobile tool that empowers community health workers to identify new cases of the disease and monitor treatment.

Aronoff-Spencer’s team adapted an existing informatics structure to serve as an end-to-end solution for diagnosis and management of the neglected tropical disease, and then ran a pilot study comparing mHealth-assisted care to standard care.

When considering how to design an mHealth solution for use in the city of Tumaco, he realized stakeholder input would be critical to ensuring the tool would be accepted. “We have so much implicit expectation of how these technologies work here in the U.S. and it’s not necessarily how they work there,” says Aronoff-Spencer. “We had to consider everything from the safety of using cellphones in a FARC-controlled, war-torn area, to how people there use cellphones and what their assumptions are.” A firm believer in participatory design, his app developers included the village leader, a variety of community volunteers and the region’s professional medical providers, in addition to the U.S. team.



An mHealth app developed and tested with Fogarty support helps a health worker evaluate patients with suspected leishmaniasis lesions.

The result? A mobile health app built for lower-cost Android phones that can be used by advanced medical practitioners, while also being accessible to community health workers and patients who have lower levels of education. The app allows for patient data and image input, and provides a validated decision-rule to help community health workers assess the possibility of a leishmaniasis diagnosis. Based on decisions made by health workers, the app then refers some patients for laboratory testing and, if a positive diagnosis is the result, the app monitors a patient throughout treatment. The team recruited 75 patients for a comparison study to see if the mHealth intervention was more effective than standard care. Despite poor access to mobile networks, the app remained completely functional throughout the study period. Results revealed that the app provided clear benefits over standard care, in both treatment adherence and followup.

Aronoff-Spencer is planning further enhancements. “It’s our intention to use machine learning and artificial intelligence to combine the pictures of lesions with history and prevalence in the area to come up with predictive models to automatically diagnose

leishmaniasis,” he says. Beyond that, the app might one day contribute to Colombia’s national registry for the neglected disease, though clear evidence is needed to prove the app is highly accurate, appropriately used and interoperable with Colombia’s public health systems.

Among the project team’s achievements was the provision of training to seven community health workers in villages with the highest incidence of cutaneous leishmaniasis. So far, they’ve published one scientific paper on how to build mHealth tools for neglected tropical diseases and are preparing others to detail the app’s performance and clinical outcomes.

It’s especially critical to provide active disease surveillance and management in low-resource settings since pathogens are not static, Aronoff-Spencer says. Diseases can move—from markets where animals and humans interact causing new respiratory viruses, from the jungle where Ebola sprung forth, and from the area south of the U.S. border where dengue and zika viruses circulate, he says. “We need to enable people in the communities where diseases are to be the first responders and even to carry the torch of research that helps us all.”

Mobile tool designed to alleviate late-stage cancer pain

Witnessing her late-stage cancer patients' horrific pain in rural Tanzania—and being helpless to control it—prompted oncologist Dr. Susan Miesfeldt to consider developing an mHealth solution to alleviate suffering where there is no access to care.

It's an enormous and growing problem. Sub-Saharan Africa currently experiences at least 500,000 cancer deaths each year. Estimates project a doubling of cancer mortality in the region within the next decade. In remote or underserved areas, Miesfeldt says cancer patients have few options for pain relief, beyond seeking assistance from a traditional healer.

There are significant barriers. Often, patients are not diagnosed so they remain unknown to health providers, while many lack the means to travel to and pay for care in a clinic or hospital. Add to that, the only available medicine is oral morphine, which is subject to restricted distribution, plus there's a general lack of awareness of palliative care, says Miesfeldt, an investigator at the Maine Medical Center.

Why not deploy mobile technology to fill these gaps? Miesfeldt and her team used Fogarty funding to produce and test an app, called the m-Palliative Care Link, that works as a three-way communication system.

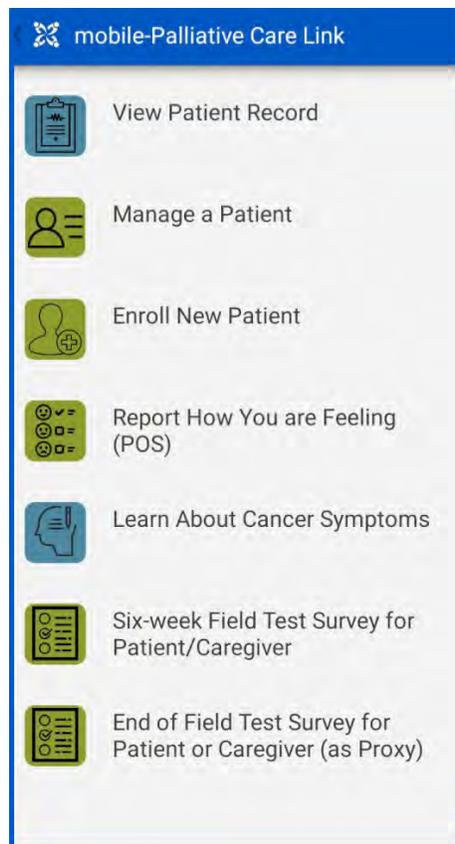
"It connects the oncology professionals with patients in their communities and also links in the local health worker. If the palliative care professionals can't get to the patient, the local health worker can support the assessment of pain and its management for that patient," says Miesfeldt. Among its virtues, the app allows for the collection of data and the delivery of information by way of a smartphone, tablet or PC, while possessing an intuitive

interface that is easy to follow by low-literacy users.

Miesfeldt's two year grant allowed her to design the new app in partnership with Tanzanian local researchers and specialists. Fogarty funding is also supporting field studies, including usability testing by multiple user groups and a comparison of outcomes among 45 late-stage cancer patients versus a control group receiving the usual care.



Nurse



A Fogarty-funded mobile app aims to reduce suffering among cancer patients, especially those living in remote areas without access to care.

Concerns accompanied the creation of her innovative mHealth device. Miesfeldt worried that developing a smartphone app—instead of a cellphone text message system—might be too advanced for Tanzania. Her tech-savvy team anticipated an increase in uptake of smartphones as the project rolls out, which, indeed, is occurring: Smartphone use has been climbing by almost 20% a year.

"I cannot stress enough the importance of assembling a multidisciplinary team and drawing on the unique expertise of each member so that the tool is both usable and adaptable as technology advances," says Miesfeldt, who adds her partners "provided tremendous insight" throughout the development process.

It's also crucial to build community trust to increase understanding of patient and health care workers' needs in LMICs, says Miesfeldt, who has cultivated relationships in Tanzania since her first visit 10 years ago.

Not only has the project resulted in a tool that might alleviate suffering, it has also provided training and mentoring to local investigators, including Dr. Mamsau Ngoma, a local oncologist, who played a key role in the analysis and reporting of project data. The importance of building research capacity in lower-income nations is not lost on Miesfeldt.

"Currently, a majority of cancer deaths globally take place in countries like Tanzania," she says, adding that this translates to a need for more research. Still, she emphasized that her team designed their innovative app to be generalizable and scalable to any country, no matter the income level, says Miesfeldt. She herself lives in Maine and can see using the mobile tool to reach remote patients in her state, as well as in other rural areas of the U.S.

Image courtesy of Dimag, Inc.

Building trust in vaccines is essential for global health



One of the terrible ironies in global health is that in many parts of the world, parents are desperate to secure lifesaving vaccines for their children, while here in the U.S. a significant number of wealthy parents spurn them.

This was on my mind recently, as I traveled to India to pay tribute to my late colleague,

Dr. Maharaj (Raj) K. Bhan, who lost his courageous battle with cancer in January. As I gathered my thoughts for his eulogy, I felt admiration for my close friend and collaborator of three decades, remembering all he had accomplished. Most significantly, we developed an Indian rotavirus vaccine—from an Indian strain, produced by an Indian company and embraced by the Indian government. This inexpensive vaccine has probably saved more than 50,000 lives in its first two years of use. In 2019, we celebrated delivery of its 125-millionth dose. What greater achievement could there be for a pediatrician but to save the lives of the world's most vulnerable children?

And yet, as fears of coronavirus sweep the globe, false rumors emerge that somehow the outbreak was caused by a vaccine attempt gone wrong. Meanwhile, researchers worldwide are working tirelessly to develop a vaccine that could halt the epidemic's spread.

Hysteria surrounds this new health threat but little attention is paid to influenza, which this season has already taken 14,000 lives, nearly 100 of them children. Many continue to avoid flu shots, despite the considerable body of evidence that shows the vaccine can offer significant protection.

This lack of faith in scientific evidence is also the reason why measles is once again an urgent public health threat. Infections have increased 30% globally and a

number of European countries have even lost their official measles elimination status. Here in the U.S., there were 1,282 cases of measles in 2019, the highest number in decades. Nearly 130 of these cases led to hospitalization and almost half had complications, including pneumonia and encephalitis. These are not trivial matters.

While the global community has given this a neutral and unexciting name—vaccine hesitancy—the WHO rightly claims this to be among the world's top 10 health problems! It is incredibly frustrating, since vaccination has long been one of our most powerful, cost-effective ways of preventing disease. Each year, as many as 3 million lives are saved by vaccination.



Dr. Raj Bhan was my longtime collaborator and close friend. His legacy endures in the lifesaving rotavirus vaccine he developed.

In our ongoing battle against cancer, we now have a vaccine that has been proven effective in preventing cervical cancer—one of the most difficult forms of cancer to detect at its earliest stages. About 570,000 cases were diagnosed globally in 2018 and 311,000 deaths occurred. Even so, many parents' irrational fears have kept them from having their children inoculated against the virus that causes this cancer—with only about half of American teens having received both recommended doses of the HPV vaccine.

For those of us who are old enough to remember successful elimination of the dreaded polio in the U.S. and eradication of smallpox worldwide—both through the miracle of vaccines—it is astonishing that

these achievements are disregarded and vaccines are now being shunned by some. We rely on herd immunity for vaccine-preventable diseases to be contained. As we've seen with measles, diseases can quickly reemerge when vaccine levels drop.

As I continue to grieve the loss of my friend, I take comfort in the knowledge his great achievement—the new rotavirus vaccine Rotavac—will save countless lives in the years to come. This new addition to the global arsenal of vaccines is an important tool to improve childhood survival among the world's most vulnerable and stands as Dr. Bhan's enduring legacy.

RESOURCES

<http://bit.ly/VaccineTrust>



NCI names new global health director

Former Fogarty grantee Dr. Satish Gopal has taken up his new role as director of the Center for Global Health at the NIH's National Cancer Institute. Gopal spent the last seven years in Malawi, where he was the country's only certified medical oncologist and oversaw a largely NIH-supported cancer research portfolio.



Hib conjugate vaccine developer dies

Dr. John Bennet Robbins, a former lab chief at the NIH, died in November. Robbins co-developed the process to conjugate polysaccharide's coating of bacteria to render them immunogenic, perhaps one of the most influential discoveries in recent vaccinology, which led to new vaccines for meningitis, typhoid and other diseases.



Hahn appointed as FDA commissioner

Dr. Stephen Hahn has been sworn in as FDA Commissioner. Hahn, a physician-scientist with training in oncology, was previously chief medical executive at the University of Texas MD Anderson Cancer Center. Dr. Ned Sharpless, who served as FDA Acting Commissioner, has returned to NIH as NCI Director.



Global Alliance for Chronic Diseases hires CEO

The Global Alliance for Chronic Diseases has selected Dr. Morven Roberts as its new CEO. Roberts previously managed the UK Medical Research Council's investments in topics including diabetes, cardiovascular diseases, clinical trials and global infections. She earned a Ph.D. in parasitology and her early research career included stints in Kenya and India.



Gates Foundation selects new CEO

Dr. Mark Suzman is the new CEO of the Bill and Melinda Gates Foundation. Originally from South Africa, Suzman joined the foundation in 2007 and has helped build its global presence in Africa, China, Europe and India. He holds a doctorate in international relations from Oxford University.



AAAS picks new CEO, executive publisher

The American Association for the Advancement of Science recently selected biochemist Dr. Sudip Parikh as its new CEO and executive publisher of the Science family of journals. Previously, Parikh was a senior vice president at the Drug Information Association and served on the staff of the U.S. Senate Appropriations Committee.



Indian rotavirus vaccine developer dies

Pediatrician and rotavirus vaccine developer Dr. Maharaj (Raj) K. Bhan died in January. Bhan and Fogarty Director Dr. Roger Glass spent 30 years collaborating to develop a rotavirus vaccine for India. Rotavac was licensed in 2014 and is being distributed by the Indian government, UNICEF and GAVI.

Analysis of research in higher ed released

WHO has published a study of data from higher education institutions in 178 countries that offer disciplines related to health research training. The information allows users to examine available capacity, as well as gaps in teaching and training opportunities, and to monitor progress over time. Full report: http://bit.ly/WHED_data

Ethics issues studied for research in crises

Better evidence about what works during global health emergencies is needed but gathering it poses a number of ethical challenges. A new report published by the Nuffield Council on Bioethics examines topics such as study design, collaborations and sample gathering. Several Fogarty staff contributed to the effort. Full report: http://bit.ly/bioethics_crises

CDC publishes global health security tips

A new report shares lessons learned from CDC and partners' work to help countries build core public health capacities to quickly identify and address health threats at their source. Articles highlight the value of effective partnerships, and the link between local and global health. Full report: http://bit.ly/CDC_security

G-FINDER report finds uneven progress

The twelfth annual G-FINDER report has been released, providing data on investments made on neglected disease research and development in 2018. In all, 262 organizations completed the survey, which covered 36 neglected diseases, all relevant product types and basic research. Full report: www.policycuresresearch.org/analysis

GHTC develops new fact sheets

The Global Health Technologies Coalition has unveiled a new fact sheet series that examines the role of research and development in driving progress across diseases and topics, including HIV/AIDS, malaria, TB and neglected tropical diseases. Fact sheets: http://bit.ly/GHTC_Facts

Many researchers fail to report results

A study of data in ClinicalTrials.gov published in *The Lancet* showed fewer than half of all trials are in full compliance with FDA regulations to report results within one year. By examining 4,209 registered trials, the authors found nearly 64% had reported some results but only 40% were fully compliant. Journal article: http://bit.ly/Lancet_CT

Funding Opportunity Announcement	Details	Deadline
International Research Scientist Development Award K01 Independent Clinical Trial Required K01 Independent Clinical Trial Not Allowed	http://bit.ly/IRSDAK01	Mar 6, 2020
Japan Society for the Promotion of Science (JSPS) Fellowships for U.S. Postdoctoral Scientists in Japan	http://bit.ly/JSPSforUS	Mar 31, 2020
International Bioethics Training R25 Clinical Trial Not Allowed D43 Clinical Trial Optional	http://bit.ly/BioethicsTraining	Jun 4, 2020
Fogarty HIV Research Training for LMIC Institutions D43 Clinical Trial Optional D71 Clinical Trial Not Allowed G11 Clinical Trial Not Allowed	http://bit.ly/NIHGlobalHIV	Aug 20, 2020
Mobile Health: Technology and Outcomes in LMICs R21/R33 - Clinical Trial Optional - non-AIDS applications	http://bit.ly/NIHmhealth	Sep 24, 2020

For more information, visit www.fic.nih.gov/funding

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China overtaking U.S. as global research leader

Average annual growth rate of domestic R&D expenditures: 2000-17

Country	Percent
Japan	3
France	4
United Kingdom	4
United States	4.5
EU	5
Germany	5.5
India (2000-15)	8
South Korea	10
China	17

U.S. scientific and engineering investment has dropped relative to the rest of the world, while spending has risen rapidly in a number of Asian countries, according to a new report from the National Science Board (NSB). China alone accounts for nearly a third of the increase in global research and development (R&D) growth since 2000, the NSB says, and is “on a path to soon become the world’s largest R&D performer.”

In assessing math and science test scores of elementary and secondary school students, the study found U.S. education is “mediocre and stagnant relative to other countries.” The U.S. has long relied on foreign-born talent for science and engineering (S&E) expertise, with more than a third of doctoral degrees going to international students. The report notes “a startling shift” in foreign student enrollment in U.S. colleges and universities, which has slowed since 2016.

Globally, R&D funding has tripled in the last 20 years, “which is good for humanity because science is not a zero-sum game,” said NSB Chair Diane Souvaine. “However, it also means that where once the U.S. was the uncontested leader in S&E, we now are playing a less dominant role in many areas.”

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Full report: http://bit.ly/NSB_2020