Entering the Clinic
Before these constructs can be used clinically, investigators must overcome considerable challenges in loading them, protecting them from degradation or excretion, and targeting them to specific tissues or cells. “Recently we’ve validated a cationic polymer coating that provides significant protection for DNA nanostructures against low-salt denaturation and nuclease digestion,” said Shih.

Although DNA and protein origami is not yet ready for use in patients, a more immediate impact may lie in its potential as custom instruments for answering biological questions. For example, constructs may be formed to hold proteins in positions and orientations to help scientists image them with various microscopy techniques, and Shih’s use of DNA-based springs can help researchers measure the speed and properties of protein motors. Still others have fashioned origami into nanoscale pores that can provide information on molecules that pass through them. These might be used to help characterize protein-DNA and protein-protein interactions involved in normal or aberrant cellular processes.

“All of these are not direct clinical applications but rather enable fundamental biological science that will eventually end up in the clinic,” said Rothemund.

## The JAMA Forum
The Fogarty International Center, a National Treasure for Global Health

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If you travel in global health circles, you might see prominent researchers wearing a green bracelet with the inscription “Fogarty International Center: Advancing Science for Global Health.” The reason is that President Trump’s March budget blueprint called for drastic cuts and a “major reorganization” of the National Institutes of Health (NIH), entirely eliminating its smallest center, the Fogarty International Center.

The Fogarty Center, created in 1968, honors the vision of Rep John Edward Fogarty, a bricklayer from Rhode Island, who imagined a world driven by health innovation, capacity building, and research for the global common good. He understood that the United States is stronger and safer when it exercises “smart” global health diplomacy, lifting individuals from ill health and poverty. That shared bipartisan consensus is rapidly vanishing, just as the Fogarty Center is planning its 50th anniversary next year, led by Roger Glass, MD, PhD—a widely admired scientist and humanitarian.

A National Treasure

The prospect of losing the Fogarty Center—a national treasure symbolizing US global health and humanitarian leadership—has alarmed global health advocates, ranging from the American Society of Tropical Medicine and Hygiene and Infectious Diseases Society of America to the Consortium of Universities for Global Health and Research!America. The center has a budget of just $69.1 million, and the return on investment is impressive.

The center serves as a bridge between NIH and the global health community, facilitating exchanges among investigators and building partnerships. It supports promising basic, clinical, and applied research for US and foreign investigators working in low- and middle-income countries.

Fogarty programs have enabled 6000 scientists worldwide to receive research training in partnership with scientific institutions in the United States. The center funds more than 500 projects involving about 100 US universities. US scientists collaborate with colleagues in countries that often have weak health systems and research facilities. Fogarty also convenes the best scientific minds to work on critical global health research, including polio eradication, pandemic response, and strengthening research capacity.

Mission for the Global Common Good

Nothing symbolizes US humanitarian values more than the President’s Emergency Plan for AIDS Relief (PEPFAR), the largest commitment by any nation to combat a single disease in human history. President George W. Bush captured our collective values, saying, “There is no way to quantify PEPFAR’s greatest achievement: the spread of hope.... And spreading hope is in our moral interests—because we believe that to whom much is given, much is required.” Fogarty projects, for a small fraction of the cost of PEPFAR, use the United States’ greatest strength—scientific research—to empower
countries and health professionals, working hand-in-hand with US investigators, Fogarty builds domestic capacities to study the diseases most affecting local populations. Its training grant recipients improve the quality of local health systems, serving people who have great need. Is reducing suffering in poor countries by building local capacities for research and health care worth it? The Fogarty Center costs each person in the United States just more than 20 cents per year.

A Mission in US National Interests
The Fogarty Center’s enduring presence is vital not merely because it is the right thing to do, but also because it reduces suffering and fosters peace and prosperity throughout the world. Just as important, it is decidedly in US national security interests.

Although we sometimes view national security in terms of military might, strengthening health systems outside the United States can do as much, or more, to keep us safe. Few wars would have the same cost in human lives and treasure as a pandemic. At the 2017 Munich Security Conference, Bill Gates observed:

"Whether it occurs by a quirk of nature or at the hand of a terrorist, epidemiologists say a fast-moving airborne pathogen could kill more than 30 million people in less than a year. And they say there is a reasonable probability the world will experience such an outbreak in the next 10 to 15 years."

The West African Ebola epidemic took more than 11,000 lives in 3 countries with the weakest health systems in the world. Four major global commissions identified strong health system capacities as the surest defense against emerging infectious diseases. The World Health Organization’s International Health Regulations (IHRs) require all 196 States Parties to develop the capacity to rapidly detect, report, and respond to novel pathogens with pandemic potential. The regulations similarly direct richer countries to help build health capacities in lower-income countries.

Fogarty's work in training and partnering with foreign scientists helps fulfill America’s legal and moral pledge. It does so in the best way possible—not by parachuting in to “rescue” countries during health emergencies, but by enabling those countries to contain outbreaks before they become a crisis. Congress had to authorize more than $2 billion for the response to the Ebola and Zika Outbreaks. As Rep Tom Cole (R, Oklahoma) has suggested, “I’d rather fight Ebola in West Africa than in West Dallas.” Fogarty programs are now doing just that.

The costs will likely only grow; the Commission on a Global Health Risk Framework estimated a global tab of $6 trillion this century from pandemics. From containing pandemics to addressing their domestic effects, the United States will shoulder a significant share of that cost. The Fogarty Center is one of our sharpest tools for reducing that cost, and eliminating it is one of the surest ways of incurring the full human and economic costs.

Global health diplomacy has other benefits to the United States, in the form of its strong national interest in stability and prosperity across the globe. Countries experiencing health crises, or the drumbeat of everyday disease, are likely to be less stable and less reliable trading partners, as well as more likely to harbor terrorism. Importantly, there is no better way for the United States to project its values and make friends around the world than through health diplomacy. We might think that providing military assistance to or stationing US troops in a fragile or vulnerable country best defends our interests. But training scientists and health workers, providing grants for scientific research, and fostering partnerships with US scientists, can do so much more to achieve peace and security. Consider this: the additional military spending President Trump proposed for this year alone would fund the Fogarty Center for more than three-quarters of a century.

Finally, scientific research in Africa and other regions can help NIH find solutions not only to novel infections but also to diseases that are common in the United States and globally, such as HIV/AIDS, tuberculosis, and noncommunicable diseases, including Alzheimer disease and other neurodegenerative diseases. Fogarty grants have supported research in all of these areas, with potentially enormous health and economic benefits to US residents.

As an investment in the United States’ core values of compassion and humanitarianism, global leadership in biomedical research, and its national economic and security interests, the Fogarty Center is a sure bet. It has a proven record for nearly half a century of sparking innovation and opening hearts and minds to the possibility of a better and more secure world. At about 20 cents per US resident per year, why would we eliminate this national treasure?

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