

PATHWAYS



of

PROMISE

THE CAMPAIGN FOR
UMASS MEDICAL SCHOOL

UMMS GLOBAL IMPACT: Optimizing global health through host-pathogen research, precision medicine and elimination of health disparities

The UMass Medical School Office of Global Health (OGH) was founded in 2009 with the goal of harnessing UMMS' clinical, scientific and educational strengths to solve the world's most pressing health problems, improve the health of its citizens and train the next generation of innovators in global health.

For the past seven years, OGH leadership, pilot grants and operational support have fostered the establishment and growth of programs in several countries (Brazil, China, India, Kenya, Liberia, Nicaragua and Vietnam), which has expanded the impact of our clinical, research and educational programs in the global arena. In FY16, OGH supported \$17 million in grants with foreign components, the majority of which (73 percent) are funded by the NIH or CDC.

To build our global health programs, OGH has employed a highly successful strategy of fostering trans-disciplinary partnerships with governmental and academic institutions. For example, UMMS garnered \$25.5 million in funding during the past decade for strengthening the Liberian health system as the country emerged from decades of conflict. Addressing a critical need for training more doctors, a USAID-funded partnership with the University of Liberia AM Dogliotti Medical College (\$3 million, 2011-2014) supported faculty mentorship, innovative curriculum revisions, restoration of the medical library and the installation of an electronic learning system, which have contributed to increasing the numbers of graduating medical students in Liberia from approximately 10 to the current 50 per year. Partnership with the Liberian Post-Graduate Medical Council has created new residency programs in pediatrics, medicine, surgery, and OB-GYN; more than 100 faculty from UMMS and other U.S., Australian and African institutions have provided clinical mentorship to Liberian medical students and residents. During the recent Ebola crisis, a \$7.5 million grant from the Paul G. Allen Family Foundation enabled us to provide much-needed protective equipment along with infection prevention and control training to more than 2,000 health workers, and to establish molecular diagnostic labs for Ebola and other infectious disease. Additional funding from the CDC (\$15 million) is supporting the establishment of a system of public health laboratories across Liberia. Molecular Ebola virus lab testing for the Liberian Men's Health Screening Program has provided some of the first data, which was recently published in *The Lancet Global Health*, indicating prolonged persistence (> 500 days) of Ebola virus in the semen of survivors. Going forward, we are pursuing funding that will allow further integration of infectious disease laboratory research into clinical care and public health outreach. We expect that this will allow improved capacity to detect and control future outbreaks, change clinical care, strengthen public health practice and provide novel training opportunities for our trainees and young Liberians.

A recent collaboration with Charutar Arogya Mandal (CAM), a charitable trust that operates a hospital, medical school and nursing school in Gujarat, India, supports research focused on understanding predictors of maternal and child health. Work by Soni Apurv, a MD-PhD candidate at UMMS, focuses on understanding the epidemiology, predictors and consequences of child undernutrition, which afflicts one in three children in India. Additional research focuses on characterizing the prevalence of worm infestation, anti-helminthic drug resistance and the gut microbiome in school-aged children in India, a particular expertise of Raffi V. Aroian, PhD, professor of molecular medicine; improving trauma outcomes (led by UMMS faculty Heena Santry, MD, associate professor of surgery; and Jeroan Allison, MD, MS, professor of quantitative health sciences); and the use of mobile technology to screen for undiagnosed atrial fibrillation in rural settings (David McManus, MD, MPH, associate professor of medicine).

Key strategic areas for the Pathways of Promise campaign support include:

1. Eliminating infectious diseases and preventing future pandemics

Infectious diseases are a major cause of global morbidity and mortality, particularly among children under the age of 5. In addition to well-recognized viral and bacterial (encapsulated bacteria, staph, GNR, TB) pathogens and parasites (malaria, intestinal worms), multiple new pathogens have been identified during the past few decades. Many of these new pathogens are microbes that are commonly found in animals and that become adapted for infection and spread in humans. Examples of these include HIV, Ebola, SARS coronavirus, Middle East respiratory syndrome virus (MERS) and Zika viruses. Inadequate preventive or curative medicines for the majority of these infections as well as an emerging anti-microbial resistance are eroding the efficacy of the small armamentarium of available drugs.

Preventing or controlling future pandemics is particularly important. Epidemics of infectious disease have killed an estimated 500 million people during the past century; the 1918 influenza pandemic killed an estimated 50 million and the HIV epidemic has claimed the lives of at least 40 million. In addition, these epidemics resulted in tremendous social and economic disruption; recent modeling estimates that the aggregate cost of global pandemics in the 21st century could exceed \$6 trillion (\$6 billion per year). A recent Commission on a Global Health Risk Framework for the Future led by the U.S. National Academy of Medicine provided several recommendations to reduce the risk of infectious diseases, and in particular epidemics/pandemics, through increased support for research and development, and for strengthening public health systems.

> Host-pathogen interactions: Driving discoveries and novel product development

UMMS faculty have extensive expertise in the genomics and evolutionary biology of pathogens and in the investigation of host factors that contribute to disease (genetics of host susceptibility to disease, host cell restriction factors, innate and adaptive immune responses), along with expertise in Bioinformatics and Systems Biology. As a result, they are providing novel insights into host-pathogen interactions that result in common infectious diseases (TB, malaria, HIV, intestinal worms) and outbreaks (influenza, Dengue fever, Ebola). Unique institutional translational resources, including the Small Molecule Screening/Structure-Based Design Core and MassBiologics, are facilitating the development of drugs and biologics based on these discoveries. Rapid, point-of-care diagnostic devices are particularly helpful in stemming epidemics and our collaborative initiative with UMass Lowell is a unique resource that could speed their development. Expansion of pilot research funding and funding for pre-clinical development ("proof of concept" funding) in the OGH and the UMass Center for Clinical and Translational Science could markedly enhance our efforts to bring new products and approaches to populations that need them most. It could also contribute to our educational efforts in entrepreneurship and product development.

2. Strengthening health systems: In the recent West African Ebola epidemic, Ebola infected only 0.25 percent of the populations of Liberia and Sierra Leone and less than 0.05 percent of the population of Guinea—yet 28,652 cases and 15,261 deaths were reported. The economic impact in 2014 and 2015 was estimated at approximately 10 percent of the aggregate GDPs of these countries. As with many other diseases, low socioeconomic and marginalized populations were disproportionately affected. Directly improving population health and enhancing our ability to prevent or control epidemics will strengthen health systems, which will reduce the likelihood of catastrophic economic events that may further de-stabilize global economies and fragile states.

> Elimination of health disparities and improving global public health infrastructure:

With expertise in health disparities research, our faculty have launched international research programs focused on better understanding and reducing health disparities (e.g., J. Allison and S. Apurv, "Understanding Predictors of Maternal and Child Health in Rural Western India"; D. Chiriboga, MD, Sustainable Health Equity and Social Justice). In addition, our strengths in epidemiology, molecular diagnostics and interprofessional education have direct relevance for the development of disease surveillance systems, laboratory networks, and education of the medical and public health workforces. Altogether, these programs are highly complementary to our domestic programs and represent a strong research continuum, as well as an outstanding training ground for medical students and new investigators.

3. The **Precision Medicine Initiative (PMI)** at UMass Medical School seeks to reap the benefits of decades of work on the fundamental molecular mechanisms of diseases to precisely target the offending genes, proteins and pathways responsible for human disease. While other institutions have used this approach exclusively in the field of cancer, UMMS aspires to expand the PMI approach to emerging public health burdens. Almost one third of the world's population is obese, and obesity-related diseases are fast becoming major causes of global morbidity and mortality. Our growing capacity for global health research, along with our singular ability to involve populations not traditionally engaged in research, will undoubtedly facilitate the translation of precision medicine to the world.

> **Global cardiometabolic disease initiative:** As obesity becomes a dominant problem both in the U.S. and around the world, our researchers are conducting pioneering basic discovery and translational research to solve the problems of diseases caused by obesity. These include type 2 diabetes and heart disease, as well as non-alcoholic fatty liver disease (NAFLD), which represents the most common cause of serious liver disease in the U.S. Ongoing and future studies in cohorts around the world (e.g., the Hanoi Heart Attack Study, R. Goldberg, PhD; Use of smart phones for remote detection of Atrial Fibrillation, D. McManus, MD, CAM, India) are helping us to better understand the epidemiology of obesity and cardiometabolic disease, along with the potential genetic and environmental factors contributing to them. Coupled with our strong translational research program, this work will enable us to develop innovative approaches and cures to all around the world who might benefit.

4. **Global Health Scholars Program:** Sustaining our commitment to global health requires training the next generation of leaders in global health research. The Global Health Scholars Program will provide support as our trainees—fellows, residents, medical students—participate in degree programs (MSCI, MD-PhD, Millenium PhD) as well as mentored, high-impact global health research. Support for translation of our scientific discoveries into cost effective solutions for limited resource settings will undoubtedly allow our students to understand and harness the power of “reverse innovation” to create inventive solutions to our most pressing domestic and global health problems.