

New Developments in Global Health Technologies

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Peter B. Lillehoj, PhD¹

On behalf of the *Journal of Laboratory Automation* (JALA), it is with great pleasure that I present this special issue focused on recent technological developments in global health research.

In the past century, discoveries in science, medicine, and public health have led to major advancements in global health. For example, the development of new vaccines and drugs resulted in the eradication of smallpox as well as drastic reductions in the incidences of Poliomyelitis (polio) and Dracunculiasis (guinea worm disease). However, most of the developing world is still plagued by infectious diseases, which are the second leading cause of death worldwide and were responsible for the death of more than 8.7 million people in 2008.¹ In particular, six diseases account for 90% of all infectious disease deaths: respiratory infections (pneumonia), diarrheal diseases (cholera, typhoid fever, rotavirus), tuberculosis, malaria, measles, and HIV/AIDS. Several of these diseases have been eliminated in many parts of the world, thanks to effective public health campaigns, potent therapeutics, and contemporary diagnostics. Unfortunately, these resources are not readily available in most developing countries. Therefore, many researchers are increasing efforts to create new biomedical technologies that are directly applicable to resource-limited settings.

For these products to be effective, they need to meet several important criteria. First, they must be inexpensive (<\$1 per dose/test) to enable broad distribution and widespread availability. Second, they must accommodate the infrastructure challenges that exist in many developing countries, such as limited electricity and refrigeration, and unreliable transportation. Third, therapeutics and diagnostics need to be easily implemented with minimal training to enhance accessibility. Because of the magnitude of these challenges, nonprofit organizations such as the Bill and Melinda Gates Foundation, Burroughs Wellcome Fund, and others as well as governmental agencies such as the National Institutes of Health and US Agency for International Development are putting forth additional resources for the development and translation of novel technologies that can overcome these challenges. In addition, many researchers and scientists are becoming more aware of these issues and focusing their efforts on global health research.

Several promising avenues are being pursued. Thermostable vaccines that do not require refrigeration are being developed for infectious diseases, enabling easy storage and transportation,

making them more accessible to people in developing countries. Efforts are also under way to develop vaccines that can be administered orally or nasally, which are easier to deliver and preclude the need for needles, negating disposal concerns. Concurrently, the global health research community is exploring new strategies for rapid drug development, particularly for infectious diseases that have exhibited resistance to common antimicrobial agents, such as tuberculosis, malaria, typhoid fever, and influenza. The use of mathematical algorithms for generating optimal drug combinations and high-throughput screening techniques are just a few examples of promising new approaches. In regard to diagnostics, researchers are focusing their efforts on discovering unique biomarkers that are highly specific, temperature stable, and/or can be detected noninvasively in secreted bodily fluids, such as saliva, urine, and sweat. In addition, recent advancements in micro/nanotechnologies and biosensors have resulted in disposable point-of-care platforms that are faster, more sensitive, and less expensive compared with conventional benchtop diagnostics. Because of the similarities within certain diagnostic and therapeutic mechanisms, these technologies also provide new opportunities to diagnose and treat illnesses and conditions beyond the current focus of infectious diseases, such as cancers, hereditary diseases, and cardiovascular diseases. For this reason, these efforts offer immense potential to improve global health not only in developing nations but also in developed countries.

In this special issue, the JALA editorial team and I have assembled contributions from leading research institutions, nonprofit organizations, and biomedical companies that are focused on developing, validating, and implementing innovative technologies for the diagnosis and treatment of diseases with high global burden. We start this issue with two notable reviews that provide thorough backgrounds on the current state of point-of-care diagnostics for airborne biomarkers² as well as the future direction of point-of-care technologies for low-resources settings.³ Subsequent articles present recent developments in technologies for

¹Department of Mechanical Engineering, Michigan State University, East Lansing, Michigan, USA

Corresponding Author:

Peter B. Lillehoj, PhD, Department of Mechanical Engineering, Michigan State University, 428 S. Shaw Lane, Room 2461, East Lansing, MI 48824, USA.

Email: lillehoj@egr.msu.edu

various global health applications including neonatal care,⁴ point-of-care disease diagnosis,^{5–10} vaccine development,¹¹ and drug discovery.¹²

As you read through this issue, we hope you will share our excitement and enthusiasm for the work that is being done in global health research. Although there is still much to be done before we live in a world where health care is readily available and accessible to everyone, regardless of where they live, every technological advancement and scientific discovery brings us one step closer to achieving this goal.

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Peter B. Lillehoj, PhD
Michigan State University
East Lansing, Michigan, USA