

# Genomics: making a world of difference

## global health at duke: part VI of a series

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Less than a decade ago, the completion of the Human Genome Project signaled that the genome revolution was here to stay and symbolized its promise-that knowing the DNA sequence of our genome and those of hundreds of other organisms would allow us to take on the greatest challenges of human health and alleviate human suffering, both at home and around the globe. A big promise-so how are we doing?

In Durham and across this country, there is growing momentum toward using the fruits of the genome sequence to guide health care, ushering in the early stages of a new form of personalized and prospective health care. At Duke, championed by the Institute for Genome Sciences and Policy, the genome revolution is evident across campus, from bold plans for transforming medicine at the Duke University Health System to the student-run Prospective Health Care Club.

Yet, millions around the world remain afflicted today by HIV/AIDS, malaria and a host of other infectious diseases. So what does the genome revolution offer them?

Genomics plays a significant role in the search for vaccines and cures to control HIV/AIDS. Recently, Duke researchers reported significant discoveries about how human genetic variation plays a role in determining the viral load of HIV patients during infection. The study identified genes that are likely to be involved in HIV control and that may be targets for future vaccine and drug development, research that is possible because Duke has one of the largest facilities of its kind for measuring DNA variation at millions of sites around the genome simultaneously.

In the last decade, genomic research on microbes that cause diseases endemic to low- and middle-income countries has grown at a steady pace. The example of malaria perhaps best illustrates the immense potential of genomics. In 2002, the genome sequences of the malarial parasite and the mosquito vector were published. Combined with our own genome sequence, this trio of genomes has provided a wealth of valuable information that researchers worldwide are using in their search for novel strategies for disease treatment and prevention. For example, ongoing research at Duke uses genomic approaches to study malarial resistance in sickle cell disease. These studies hope to uncover new pathways to malaria treatment.

Chronic diseases also present a significant global health problem. Developing countries suffer a "double hit"-countries with emerging economies like China, India and Brazil not only have a high incidence of infectious diseases but also suffer from a rising tide of

cardiovascular disease, cancer and diabetes.

Studying genetic variation associated with these common diseases in different populations, and how people differ in their responses and reactions to drugs, is an area of active research at Duke. In addition, using genomic approaches, IGSP researchers have identified molecular "signatures" for several common cancers. These significant breakthroughs will help physicians predict the chance of recurrence for a tumor and how well the patient will respond to certain treatments, allowing the design of more effective and individualized therapies.

The influence of genomics on global health certainly extends well beyond our ability to better diagnose, prevent and treat human disease.

Genomic research on agricultural crops and livestock could help provide solutions to nutritional deficiencies widespread in several low- and middle-income countries. Genomic analysis of plant, animal and microbial species may also offer insights into how we might better utilize our natural resources to prevent, limit and even reverse environmental damage.

Science alone will have little impact on global health without policies to foster its use. The 2002 World Health Organization report on Genomics and Global Health, while affirming the importance of genomics, also warned of a "genomic divide"-poor countries may be unable to share the benefits of genomic research, thus further exacerbating the inequities in global health. Researchers at the IGSP's Center for Genome Ethics, Law and Policy have come together with colleagues across the Duke campus to investigate how policies effect the dissemination of and access to genomic technologies and information. They hope to inform institutions about practices and policies that will help new diagnostics, therapies and vaccines reach people who need them the most, faster.

Big challenges, to be sure. At the IGSP we strive to "Ask Big" as we harness powerful genomic tools to drive the engine of discovery and, with our partners across the Duke campus, seek out interdisciplinary and innovative solutions to, yes, the "big" problems of global health.

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