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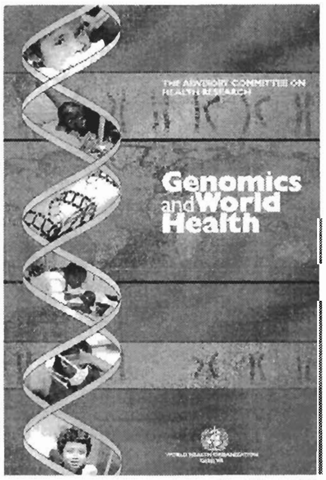
Genomics for all

Earlier this year, the Advisory Committee on Health Research of the World Health Organization (WHO) published a report entitled *Genomics and World Health*. Authored by David Weatherall, Dan Brock and Heng-Leng Chee, with the advice of a distinguished panel of scientific and policy experts, the report outlined the potential impact of advances in genomics on some of the developing world's major public health problems. Inspired by the WHO report, on page 229 of this issue[1], Abdallah Daar and colleagues present the consensus of 28 leading experts in global health as to the technologies that should take priority in the effort to bring the power of genomics and biotechnology to bear on the fight against communicable diseases. In light of this consensus, the WHO report deserves further comment.

Genomics and World Health is at once a sobering and a hopeful document. The authors forthrightly outline the scope of public health problems that plague—but are by no means limited to—developing countries: more than 11 million people were killed by infectious diseases in 1998, with more than 3 million dying from infections for which satisfactory vaccines already exist (hepatitis B, measles, *Haemophilus influenzae* type B, tetanus, cholera and others). It seems unlikely that superior technology will have a major impact on these diseases in the face of much larger political, economic and environmental problems—the conflict between intellectual property rights and access to inexpensive drugs, overcrowding, inadequate housing, limited access to education, lack of clean drinking water and sanitation, and the poor or corrupt governance that exacerbates many of these problems. Indeed, as has been noted elsewhere[2], the authors of the report take great pains to emphasize that greater investment in genomics in developing countries must not take the place of funding improvements in these basic areas.



And yet, within the context of a realistic assessment of what genomics can contribute to improvements in world health, the report's authors discuss a number of promising developments. To begin with, it is not entirely correct to say that the developed world's emphasis on the genetics of the complex diseases that accompany middle and old age—heart disease, cancer, diabetes—is irrelevant to poorer countries. As the economies of developing countries improve, their societies will go through a "demographic transition," and they too will be faced with the rising incidence of these diseases that are usually associated with relative affluence.

Of course there is no denying that infectious disease is the major health problem facing the developing world. Here, too, there are hopeful signs that genomics can make a difference. A bioinformatic analysis of the freely available, partially sequenced genome of the malaria parasite, *Plasmodium falciparum*, showed that it uses the DOXP pathway, a pathway that is absent in humans, to synthesize isoprenoids[3]. Results of clinical trials of fosmidomycin, an existing drug that blocks this pathway, have been encouraging. The complete sequence of the *P. falciparum* genome will no doubt yield additional drug targets.

Even more impressive are the indigenous efforts to create programs of genomics research in developing countries themselves. Scientists in the Brazilian Organization for Nucleotide Sequencing and Analysis (ONSA), launched by the state of Sao Paulo, successfully sequenced the genome of the citrus pathogen, *Xylella fastidiosa*[4], and an expanded version of ONSA is nearing completion of the sequence of the dangerous human pathogen, *Chromobacterium violaceum*, as well as launching genome projects on schistosomiasis and sugar cane. The contributions of Chinese scientists to the sequencing of the human genome have been well documented[5], and the Chinese National Human Genome Centre is collaborating on efforts to sequence the pig genome and the super-hybrid rice genome. These efforts, and others like them, are particularly important in light of the fact that most genomics research is carried out in a handful of wealthy countries whose priorities are often different. It is important to remember, however, that some developing countries look upon biotechnology with a great deal of skepticism; witness the decision by the Zambian government, many of whose people face starvation, to ban genetically modified crops. As recently reported in *The New York Times*, this ban includes a heartier strain of sweet potato developed by a Kenyan scientist, Florence Wambugu, in collaboration with others during a postdoctoral fellowship in St. Louis.

With the exception of the fortuitous case of fosmidomycin, most of these efforts are designed to pay off over decades. The report's authors emphasize, as do Daar *et al.*[2] in their commentary, that "affordable, simple diagnosis of infectious diseases" can have a significant impact in the short term. The WHO report proposes the establishment of a network of clinical genetics services in developing countries, where relatively simple PCR-based assays can be used to support population screening programs for both inherited and infectious diseases. One cited example is that of the high incidence of thalassemia in Cyprus, where screening programs led to a dramatic reduction in the number of babies born with the disorder.

In order for clinical genetics to take hold in developing countries, trained clinicians, technicians and counselors need to be in place. In the face of the "brain drain" that keeps many well-trained physicians, nurses and scientists from returning to their native countries, the report encourages the kinds of partnerships that have been successful in transferring technology and expertise between countries. A notable organization in this regard is the Sustainable Sciences Institute (SSI; http://www.ssilink.org), founded by Eva Harris, whose aim is to educate and train public health professionals in epidemiology and a no-frills molecular biological approach to diagnosing and controlling the infectious diseases that are most relevant to their communities. The SSI funnels equipment, technical advice and hands-on training to people in developing countries through its small staff and volunteers. It would seem a worthy goal to have a significantly greater number of graduate students and postdoctoral fellows spending portions of their training periods participating in such programs. One would hope that, despite the pressure on young scientists to learn their trade and to publish, there will be room for the idealists among them to take part, even briefly, in such efforts to improve global health. Universities that encourage (or even fund) such work will be sending an important signal about their global perspective both to prospective students and to the wider community.

1. Daar, A. *et al. Nature Genet.* **32**, 229–232 (2002).
2. http://www.scidev.net/archives/editorial/comment15.html
3. Jomaa, H. *et al. Science* **285**, 1573–1576 (1999).
4. Simpson, A.J. *et al. Nature* **406**, 151–157 (2000).
5. Li, H. *Science* **288**, 795–798 (2000).