Plagues and peoples revisited

Basic and strategic research for infectious disease control at the interface of the life, health and social sciences

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Twenty-five years after historian William McNeill's landmark publication *Plagues and Peoples* (McNeill, 1976) examined the impact of infectious diseases throughout the ages, it is clear that these scourges have not been relegated to the history books. Contrary to hopes and assumptions spawned by the dawn of the antibiotic era, infectious diseases are still lurking among us and are resurging at an alarming rate. Plagues and people are, and remain, inextricably linked. Tropical diseases used to be studied in isolation, but social, economic, cultural and political factors are emerging as major contributors to their success. It is now acceptable to argue that such diverse events as ecosystem change and urbanization, as well as poverty, inequality, gender relations and many other factors, are decisive issues in the transmission of infectious diseases, and that epidemics are both social and biological events. This article presents an overview of an infectious disease research agenda at the interface of the life and social sciences and of some of the current initiatives within the World Health Organization (WHO)'s Special Programme for Research and Training in Tropical Diseases (TDR).

There is indeed a growing awareness of the interrelations between biotic and social factors in the emergence and persistence of infectious diseases. Molecular events such as the acquisition of multidrug resistance are clearly induced by social factors (Farmer *et al.*, 2001). At the other side of the spectrum, bioterrorism not only has potentially catastrophic biological consequences but is also the result of complex social, economic and political dynamics. Over the past decade, several attempts have been made to link biotic and social domains in health and infectious disease research (Wilson *et al.*, 1994), and different umbrella notions have been used to characterize such a perspective, such as eco-social (Levins & Lopez, 1999; Krieger, 2001), biosocial (Farmer, 1999; Farmer *et al.*, 2001; Farmer & Becerra, 2001) or ecosystem-to-health (Waltner-Toews, 2001) approaches. Whatever the terminology, it leads to a shift from social science research being a 'handmaiden' (McKinlay, 1998) for biomedical, downstream (micro-level) interventions to a model in which health-related social science research informs future policies through multi-level, contextualized research (for example, see Ogden, 2000).

Leading textbooks in tropical medicine and public health have already noted this shift, and have adapted their contents appropriately. In the recently published 21st edition, 105 years after the first publication, *Manson's Tropical Diseases* contains a whole section entitled "Underlying factors in tropical medicine", which includes chapters on primary care, the epidemiology of disease, traditional medicine, genetics, immunology, economics and ethics (Cook & Zumla, 2003). This update reflects the contemporary debate surrounding a conceptual shift from research on disease—the pathogenic paradigm—to research on health—the salutogenic paradigm (see Porter *et al.*, 1999). Concurrently, there is a shift towards upstream (macro) levels of disease analysis that examine the broader context of infectious diseases, their persistence and re-emergence, and focuses on such forces as macro-economic, social and political change, social inequalities and conflict. These are, to a large extent, transnational, and are central to the transmission dynamics of infectious disease, in which macro-social forces act on micro-level outcomes (Farmer, 1999).

Traditionally, social, economic, socio-economic, political, political–economic, behavioural and cultural factors have been dealt with in social science subdisciplines such as medical anthropology, medical sociology, health economics, medical geography or the political economy of health, without any cross-disciplinary links to the life sciences. But such social, economic and behavioural (SEB) research can be useful

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at various levels of the disease control spectrum. At a basic scientific level, it illuminates social, economic and political contingencies that make certain social groups more vulnerable than others, and highlights the extent to which various forms of inequality magnify these vulnerabilities and how these affect the patterns of the spread of disease in specific contexts. Through multi-site comparative research, SEB is able to define health-care approaches that are better suited to bridging the access gap in terms of horizontal and vertical equity and to elucidating the impact of macro-political and macro-economic processes, such as structural adjustment policies, health-sector reform and global health initiatives to control infectious diseases.

At the disease level, SEB research can identify bottlenecks in health services and suggest pathways for the more efficient distribution of antimicrobial therapies. It can suggest policies to reduce the access barrier of cost for the most vulnerable groups, such as women, children and the very poor, and can elucidate social and economic forces that affect biological events such as drug resistance. These include inadequate health services and suboptimal drug supply mechanisms, combined with non-adherence to treatment schedules and falsification of pharmaceutical products. Furthermore, SEB research can illuminate inequalities in relationships between men and women that increase the vulnerability of women to poverty and infectious diseases, such as AIDS and tuberculosis (TB), and can be used to formulate gender-specific approaches to disease control.

At a conceptual level, SEB research can investigate new approaches for public health action, which are sorely needed. Current efforts are grounded in a certain way of thinking and talking about the

health of the public. Basic notions such as 'risk group', 'patient compliance' and 'community' may not grasp the social, cultural and economic reality of marginalized populations. SEB research helps to deconstruct these notions and develops new modes of thinking about the health of the public.

New knowledge and new research are clearly essential to enhance diagnostics, vaccines, pharmaceuticals and biotechnology. Many of the tools for infectious-disease control that are now under development, such as genetically modified disease vectors, diagnostic tests, drugs and vaccines, have ethical, legal, social and economic implications. The development of these tools is not an autonomous process, but is moulded by diverse factors, such as national or international regulation, social acceptance, knowledge, understanding and perception of risk, and ethical considerations for distribution. Historically grounded social studies of science can be illuminating and informative, for example, on the social context of molecular biology (Abir-Am, 2001; Lynch, 2002), before such new methods of control are introduced.

Even so, it is often not the lack of tools but the lack of an appropriate health infrastructure and implementation capacity that handicaps disease control. In this regard, we need to advance trans-disciplinary research. Indeed, this paradigm shift is embodied in a chapter of *Manson's Tropical Diseases* entitled "Ethics and tropical diseases: some global considerations." It is a plea for trans-disciplinary research that is usually unheard of in textbooks on tropical medicine: "developing solutions to tropical diseases requires trans-disciplinary attention to the social conditions that determine the burden of tropical diseases that science and medicine alone cannot address" (Benatar, 2003). Trans-disciplinary research has been defined as the "process of synthesizing diverse fields of knowledge in the quest for a creative understanding of the problem", and the health–social sciences as "transdisciplinary application of social and behavioural science theories and methods, in active partnership with complementary knowledge from biomedical and health sciences (including epidemiology and biostatistics) to gain a comprehensive understanding of a health problem" (Higginbotham *et al.*, 2001). But it is not yet clear what conditions are needed for such a paradigm shift in health research to ensure that new knowledge will be generated in a context of application and not necessarily be confined to the limits and divisions of labour of university-based and disciplinary modes of inquiry (van Manen, 2001).

Nevertheless, the TDR, as part of the WHO's Programme on Communicable Diseases, is committed to pursuing this innovative paradigm shift and offers unique opportunities for trans-disciplinary research into African trypanosomiasis, Chagas disease, dengue fever, lymphatic filariasis, leishmaniasis, leprosy, malaria, onchocerciasis, schistosomiasis and TB. TDR's Basic and Strategic Research (STR) unit focuses on the biological, social, economic and behavioural determinants, health systems and other factors of importance for the effective control of infectious diseases. Contrary to current academic divisions of labour, the unit regroups the following three steering committees under the umbrella of basic and strategic research.

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The Steering Committee for Social, Economic and Behavioural Research (SEB) is based on the premise that despite significant global efforts over the past 50 years, communicable diseases continue to obstruct social and economic development in developing countries, and disproportionately affect the poorest and most marginalized populations. A better understanding of how social, behavioural, political, economic and health system factors operate to affect disease patterns and disease control efforts is considered important for identifying future needs, opportunities and innovations for the improved control of TDR diseases. The SEB Committee aims at strengthening social research along the lines mentioned above.

The Steering Committee for Pathogenesis and Applied Genomics (PAG) promotes novel approaches that take advantage of recent advances in molecular

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biology, immunology, gene technology and genomic structure in elucidating important host–parasite/virus relationships. In addition, the Committee supports and participates in organizing training workshops in bioinformatics and applied genomics for investigators in disease-endemic countries, with support for regional training centres in Africa, Asia and Latin America. The Committee places emphasis on the use of advances in functional genomics in understanding the mechanisms leading to clinical disease in hosts and those essential for the survival of parasites or viruses.

The Committee for Molecular Entomology (BCV) focuses its activities on malaria and dengue research. Its long-term goal is to develop tools to replace the natural mosquito vectors in the wild with genetically modified mosquitoes that are unable to transfer the malaria parasite or dengue virus. The technical feasibility of genetically transforming mosquitoes has been shown recently with *Anopheles stephensi*, which was made refractory to the growth and transmission of *Plasmodium berghei* (Ito *et al.*, 2002), and with *Aedes aegypti*, which was made resistant to the replication and transmission of the DEN-2 virus (Olson *et al.*, 1996). However, biotechnological challenges, such as devising suitable gene driver systems and developing and evaluating appropriate effector gene constructs, still need to be addressed. Moreover, there is also the need to predict the ethical, legal and social implications of this new biotechnology and its transfer into disease-endemic countries, notably issues related to public perception and acceptability, and also to demonstrate proof of efficacy and safety for humans and the environment as bases for deciding policies (Macer, 2003).

Activities bridging the life sciences and the social sciences within STR-driven research currently include a portfolio examining the ethical, legal and social issues in biotechnology transfer and a research initiative into the social and economic forces that influence the emergence and transmission of drug-resistant TB. Potential future research areas now

being explored include the ethical, legal and social issues of recombinant DNA vaccines and their transfer into resource-poor settings, the public understanding of pathogen genomics, the societal benefits of or harm caused by genetic information, intellectual property rights, the eco-bio-social dynamics of Chagas' disease and malaria resurgence in the Amazon, and genome-research issues in resource-poor settings. The challenge of infectious disease control falls between the biotic and social levels of reality; the analysis needs to be comprehensive and holistic and can be called biosocial or eco-bio-social. The TDR Programme, with its unit for Basic and Strategic Research, is committed to furthering this task.

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