Integrated programme is key to malaria control

Genome publication must not divert attention from basic science and public-health goals.

Sir — After decades of relative neglect, malaria control is again high on the international research and public-health agenda. The exciting simultaneous publication of the sequence and functional analysis of the genomes of two malaria parasites, *Plasmodium falciparum* and *P. yoelii*, in this issue of *Nature*[1], and mosquito vector *Anopheles gambiae* in *Science*[2] should facilitate accelerated development of new drugs, insecticides, vaccine candidates and engineering of malaria-resistant mosquitoes.

The future availability of such powerful tools is a captivating prospect, but their allure must not divert attention from potential basic science and public-health goals that remain grossly underdeveloped. Our understanding of malaria-transmission ecology lags well behind our understanding of climate change or biodiversity loss. Most worrying of all is the absence of proven environmental interventions where they are most needed, in particular in sub-Saharan Africa.

Although the effectiveness of preventing mosquito proliferation in Asia, Europe and the Americas has been well known for 80 years (see, for example, ref. 3), spectacular historical successes against tropical African vectors should not be ignored. Successful programmes to control malaria transmission by *A. gambiae* — the predominant vector in sub-Saharan Africa — were initiated in the 1930s and 1940s and their effects sustained for two decades or more in Brazil, Egypt and Zambia[4,5]. There were three common features to these outstanding successes: they had integrated control, emphasizing environmental management and regular insecticidal suppression of larval stages of the vector; they used rigorous surveillance and adaptive tuning of the intervention package over time; and they employed multisectoral programme staff with expertise in clinical, ecological, entomological and epidemiological aspects of malaria, and in land and water management. The challenge now is sub-Saharan Africa itself, where the frequency of infectious bites means that vector control has not so far worked.

We are concerned that the current global malaria control campaigns (see, for example, ref. 6 for an overview), and in particular the emphasis on genomics and vaccine development likely to be stimulated by the new results, may delay the re-adoption of integrated methods, as happened with the euphoria that greeted the introduction of DDT as a control method decades ago. In addition to laboratory-derived tools, integrated malaria control in Africa will rely on basic and applied environmental science *in situ*.

None of these skills or tools can be applied without the essential infra-structure embodied by the second and third criteria outlined above. This is where contemporary public–private partnerships could make a profound difference in supporting and facilitating integrated malaria control, as in the successful programmes of the past. The Global Health Initiative of the World Economic Forum is playing an important role in fostering such partnerships[7]. The corporate sector — for example, Exxon-Mobil in Cameroon and Chad; British Petroleum in Angola; and Konkola copper mine in Zambia — is implementing integrated malaria control today.

Consequently, a detailed business plan is required for malaria control on a broader scale, analagous to that produced earlier this year by WHO for tuberculosis. The strengthening of human resources and infrastructure in Africa, together with the increased public funding available for malaria research and control initiatives, will enable successful re-adoption of proven approaches from the past while we eagerly await the benefits of the genomics revolution.

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How serendipity led to an early treatment

Sir — In her review of Mark Honigsbaum's book *The Fever Trail* (*Nature* **418,** 820–821; 2002), Sandra Knapp asks how the *Cinchona* tree's properties came to be discovered, given that malaria did not exist in the New World until the Europeans arrived there. The book does not answer this question.

Several species of the *Cinchona* tree (which was called "quina-quina" by the Indians) grow on the warm, moist slopes of the Andes above 1,500 metres, where the *Anopheles* mosquito does not survive. The quina-quina trees were thought by some people to be poisonous, owing to the bitter taste of the bark. Yet plants that are unpleasant to the taste or even harmful if taken unwisely may be used, in the right form and dosage, as medicines.

Therefore it is plausible to suppose that the bark of quina-quina trees has also been used therapeutically by South American Indians since pre-Columbian times for chills and fevers. (One legend tells of an Indian who, burning with fever, drank from a jungle pool despite the bitter taste that revealed it was contaminated by the neighbouring quina-quina trees, and whose fever then abated.) The Jesuits probably learned about the anti-fever properties of this bark from the Indians and tried it, successfully, to treat malaria — hence the remedy's popular name of 'Jesuit's bark'.

According to a story that is widely accepted in Western countries, the use of the bark for malaria is a case of serendipity (see R. M. Roberts, *Serendipity: Accidental Discoveries in Science*, 6–10; Wiley, New York, 1989). The Countess of Chinchon (1576–1639), wife of the Viceroy of Peru, was said to have been cured of malaria by taking an extract from the bark of a Peruvian tree. She was also said to have carried some bark back with her to Spain in 1638, thereby introducing its use in Europe. This part of the story, at least, is false, because the Countess died in Cartagena de Indias, Colombia, without ever returning to Spain — though she was immortalized by Linnaeus when he gave the tree its botanical name.

In 1633, the monk Calancha, who accompanied the Spanish conquistadors, introduced the use of the remedy *Cinchona* to Europe (for more information, d see R. B. Silverman, *The Organic Chemistry of Drug Design and Drug Action*, 1–2; Academic, San Diego, 1992).

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