Reviews

Dalrymple, Dana G. 2012, *Artemisia annua, Artemisinin, ACTs & Malaria Control in Africa: Tradition, Science and Public Policy*, Washington DC: Politics & Prose Bookstore. Pp. 254. \$18.00 ISBN: 978-0-615-61599-8

Malaria is one of the most debilitating diseases occurring in tropical and subtropical countries. It affects many millions of people throughout the world and kills at least one million children a year in Africa alone. Its eradication, or at least its control, has been the aim of world health authorities for many decades but without conspicuous success. At one time there existed the almost perfect drug for the treatment of malaria: chloroquine. It was developed by the Americans during the war against Japan and was cheap to produce, highly effective, and had few adverse side effects. Most importantly, it was effective against the most deadly form of malaria: falciparum malaria. During the 1970s it became apparent that chloroquine had lost its curative power. The malarial parasite had mutated and could now resist the toxic effect of chloroquine. For the Chinese army, fighting a war in the jungles of Vietnam where more fatalities could result from malaria than from combat, this was a disastrous development. In 1967 the Chinese government took decisive action and established Project 523, a large team of scientists from many scientific disciplines, to seek a new drug for the treatment of malaria. By the early 1970s they had discovered artemisinin, based on the old Chinese herbal remedy of *Artemisia annua* (qinghao 青蒿). Large-scale trials were undertaken in 1974, and in 1979 full details were published in China.

With the ending of the Cultural Revolution, news of the Chinese achievement reached the West and generated great interest amongst malariologists, but also considerable scepticism. Previous Chinese claims had often proved exaggerated when examined by Western scientists. However, with regard to artemisinin, almost every claim made by Chinese scientists proved to be accurate. This was particularly important with regard to the proposed chemical structure of the artemisin molecule as it contains a number of very unusual features. Suddenly the world health authorities had a new and powerful weapon in the fight to defeat malaria. It seemed a simple step to obtain artemisinin in bulk and then distribute it to countries that needed it in the fight against malaria. But the path from drug discovery to widespread distribution and use of the drug is always long, complex, and tortuous. In the case of artemisinin, this path is comprehensibly told in Dana Dalrymple's admirable book, which is the outcome of around 10 years of involvement and research.

After an introduction, the book is formed of six sections. They deal with the current impact of malaria in the world, particularly Africa, the discovery of artemisinin in China and its emergence, growing *Artemisia annua*, the extraction of artemisinin, and the implementation of artemisinin therapy in Africa. There is an important section on the macroeconomics of artemisinin production and the final section deals with a number of policy issues. For a much fuller account of Project 523 and the subsequent development of artemisinin in China, it is better to consult Li Yingbian 2007, *Qinghaosu yanjiu* (Discovery and Development of New Antimalarial Drug Qianghaosu [Artemisinin], Shanghai: Shanghai kexue jishu chubanshe), partly in English and partly in Chinese.

Because artemisinin is extracted from a plant, rather than synthesised in the laboratory, the plant has to be grown in large quantities and land has to be set aside for this purpose. Also the economics have to be right, as the land is no longer available for food production. Dalrymple is an agricultural economist by vocation (even if historian by avocation) and has used his expertise to unravel the complexities of the efforts made to encourage the large-scale production of *Artemisia annua*. The extraction of artemisinin from the plant is not a particularly difficult process but quality control of the material obtained provides a challenge for the authorities. Even if these hurdles are successfully overcome, it is still not possible to distribute the drug where it is needed. To prevent resistance developing, as happened with chloroquine, artemisinin is always given in combination with other antimalarial drugs (artemisinin combination therapy or ACT). The multinational drug companies were responsible for researching the best combinations and they, of course, wanted to make a profit from the sale of the drug. The inevitable high cost of the drug poses an enormous problem as it is beyond the resources of many countries plagued by malaria. At this stage a number of international agencies with unhelpful sets of initials (such as GF, MMV, USAID) and, of course, the Gates Foundation, sought to bring the drug within the buying power of such countries.

Dalrymple describes all these matters with great clarity and he provides a sharp but kindly critique of these agencies. The prose is clear so that those without a scientific background will have no difficulty in following the text. There is no strong historical narrative; rather it reads like a well-written government report. For anyone concerned with the development of drugs for the treatment of the diseases of the Developing World this book is required reading. If one's interest is solely in Chinese Traditional Medicine, then there is not much of interest here. However, the book does give the definitive account of the emergence of artemisinin on to the world scene. It also leads one to ponder the following question: if Chinese science, when it was very poorly equipped and lacked contact with the larger world scientific community, could produce something as significant as artemisinin, what then can it achieve now that it can afford the very best equipment and has a highly trained and ambitious scientific community?

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