

NEWS AND VIEWS

Youyou Tu honored by the Lasker award

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In September this year, the Lasker Foundation decided to grant the 2011 Lasker-DeBakey Clinical Medical Research Award to a Chinese scientist, Youyou Tu, of the China Academy of Chinese Medical Sciences in Beijing. In the past 20 years, 28 of the Lasker awardees also won the Nobel Prize, which has been coveted by Chinese scientists for generations. In awarding her this honor, the Lasker Foundation cited Youyou Tu's distinguished contribution to the discovery of artemisinin, Qinghaosu in Chinese, a therapeutic drug of malaria, which has saved millions of lives throughout the world.

Malaria is a blood-borne parasitic disease frequently transmitted through mosquitos in tropical and subtropical countries, such as those in sub-Saharan Africa. Each year hundreds of millions are caught up by the infection and about one million will succumb to it, mostly in developing countries. Since the discovery of malaria pathogen, *plasmodia*, in the 1880s, tremendous effort has been taken, hoping to prevent, treat, and eventually eradicate this scrooge. For a better part of the 20th century, chloroquine was heralded as a cure, but resistance quickly developed. Other medications and approaches including mosquito control, indoor spraying of insecticides, physical quarantine from mosquito infestation, and vaccination all failed miserably in controlling the disease.

Youyou Tu entered a military project sectioned by the Chinese government aiming to conquer the chloroquine-resistant malaria. This project was launched in secrecy during the tumultuous period of the Cultural Revolution on May 23, 1967, and thus was code-named Project 523. The Chinese government hoped to eradicate malaria not only because it was a significant medical problem domestically, the Vietnamese government also asked for help. Vietnam was at war at that time and malaria has devastated its civilian and military populations. Trained in Western biopharmaceutical science in the prestigious Peking University but also had been baptized in traditional Chinese medicine, Youyou Tu was appointed the head of the Project 523 in her institute. Tu's team sieved through over 2000 traditional Chinese medicine recipes, and came up with several hundred extracts that showed promising anti-malarial capacity. One of these extracts was from Qinghao, but its effect was irreproducible. The malaria-healing effect of Qinghao was recorded in ancient Chinese

medical documents. Youyou Tu went through these ancient literatures and found a passage that literally described soaking Qinghao with cold water. This gave Youyou Tu a hint that the effective agent might be labile at high temperature. So, she modified the extraction methods and used ether to extract under room temperature instead of using boiling water as most traditional Chinese medicines were prepared. The new extract worked remarkably both in animal models as well as in patients. In 1972, the pure substance was obtained and named Qinghaosu, which literally means the essence of Qinghao. In Western medicine, the drug was commonly called artemisinin. Later, Youyou Tu and her colleagues solved the structure of artemisinin and proved that it is a sesquiterpene lactone with a peroxide group. This is a completely different structure from previously available anti-malarial drugs, and the peroxide group is essential for the therapeutic activity of the drug. Derivatives of artemisinin with higher potency and lower side effects were also identified in ensuing days.

Today, the World Health Organization (WHO) has listed artemisinin on the "Essential Medicines" category. To avoid developing resistance, other drugs are frequently recommended together with artemisinin or its derivatives. Now, artemisinin-based drug combinations have become the standard regimen for malaria treatment and millions of people who would otherwise die have been saved. The development of artemisinin therapy is a success story of discovering and isolating pure active ingredients using modern scientific approaches from traditional Chinese herbal medicines. Although the story itself is a government-sponsored team effort that involved scores of scientists across many disciplines of medicinal research, Youyou Tu was recognized for her original contribution of concretely linking Qinghaosu or artemisinin to anti-malaria efficacy. In choosing Youyou Tu as the representative of that large team effort, the Lasker Foundation seems also to send a subtle hint to the Chinese research enterprise since none of the Project 523 team members were inducted as academicians of the all-powerful Chinese Academy of Sciences or Chinese Academy of Engineering. For the Chinese research enterprise to move forward in leaps and bounds toward innovation, perhaps one has to rethink its funding and rewarding mechanism.