

Tradition versus modernity in biomedical research: the choices for India

In 2015, the Nobel Prize in Physiology or Medicine was awarded to three scientists. Two of them, William Campbell and Satoshi Omura received it for discoveries in the treatment of roundworm. The third recipient, the Chinese Tu Youyou received the Prize for the discovery of artemisinin, the antimalarial drug isolated from the plant *Artemisia annua* (sweet wormwood). The discovery of artemisinin has been considered by some as the ‘most significant breakthrough in tropical medicine in the 20th century’. The Nobel Prize to Youyou was an incredible achievement in many ways. It was China’s first Nobel Prize in Physiology or Medicine; Youyou is a woman scientist with no Ph D, no training overseas, and has had no academy membership (often referred to, therefore, as ‘the professor of three noes’), and the discovery itself for which she was awarded the Nobel Prize was first published in a Chinese journal (in Chinese) in the 1970s, that came to be known to the world only much later.

The story leading to the discovery of artemisinin is also remarkable. It begins with the time of the US–Vietnam war that lasted from 1955 to 1975. Thousands of soldiers, both Vietnamese and US came down with malaria while fighting in the jungles of Vietnam, and a very large number, on both sides, also lost their lives as a result of infection. The US government started a massive search for new antimalarial drugs in their laboratories. The Vietnamese lacked these resources, and their leader, Ho Chi Minh, approached the Chinese Premier Zhou En Lai for help to come up with some new antimalarial medication. Lai was able to convince Chairman Mao about such a need (since China also had many malaria-infected provinces), and this led to the ‘Project 523’ which was started on 23 May (hence the name 523) 1967. This was during the period of the Cultural Revolution in China, when universities were closed and intellectuals were sent to labour camps. Students of medicine were required to learn about indigenous medicines, and associate with indigenous practitioners of medicine. Tu Youyou, a chemist by training, became one of the project leaders. Her focus was on tapping the old Chinese texts on these medicines, perhaps under the influence of the Chinese Cultural Revolution and the resurgent interest in indigenous and traditional medicines. The plant *Artemisia* was known to be important for treating fevers. However, her initial efforts at obtaining an antimalarial drug from hot alcoholic and

aqueous extracts with this plant were unsuccessful. She re-read an old text of the famous Chinese physician Geng Ho (AD 284–365), where it had been recorded ‘To soak the plant in cold water and take out the juice, ingest in its entirety’, Youyou made cold extracts of the plant that had an isolate which was effective in the treatment of malaria. The findings were made in the early 1970s and published in an obscure Chinese journal in 1972. It was only several years later, in 1979, after an abstract in English was published in the *Chinese Medical Journal* (‘Antimalaria studies on Qinghaosu’) did the Western world come to know of this remarkable discovery. Youyou went on to make some more derivatives of the same molecule, and also deciphered its structure. She was then lost to the world. It was only many years later that Youyou was pulled out of oblivion with first the Lasker Prize, and then the Nobel Prize (Elisabeth Hsu, Reflections on the history of Qinghao. *Br. J. Pharmacol.*, 2006, **61**, 666).

The Chinese government, in part, perhaps encouraged by this recent recognition that came from delving into its ancient medicines, has come up with a policy that traditional medicines do not have to go through the regular trials before being put in use, if they are prepared exactly according to the traditional procedures. (A policy that a *Nature* editorial has criticized: ‘More scrutiny for herbal remedies’, *Nature*, 2017, **551**, 541). Apart from putting its weight behind Chinese traditional medicine, top-down, this decision has been taken by the Chinese government to ensure that traditional medicines and methods of treatment play a more prominent role in the Chinese health system. The China goal is to increase the number of doctors of traditional Chinese medicine and also increase the sales of traditional medicines (‘China to ease regulations on traditional medicine’, *Nature*, 2017, **551**, 552–553).

However, alongside these initiatives in traditional medicine, China is making a mega push for modern sciences. The fastest computer is now the Chinese supercomputer ‘Sunway TaihuLight’. And in medicine, China has given a huge push in all areas of modern biology, including the futuristic precision medicine, a multibillion dollar programme that is comparable to a similar initiative in the US. In the forefront of this initiative is the Beijing Genome Institute (BGI) in Shenzhen, China. The massive investment in BGI by the Chinese government has made that country a sequencing superpower in almost no time

(‘From standing start to sequencing superpower’, *Science*, 2002, **36**, 296). A few years ago, BGI catered to almost 50% of the world’s sequencing requirements. With increasing competition, this proportion has reduced; but even now BGI caters to about 20–30% of the world’s sequencing requirements. However, gradually, BGI has shifted to focusing on medical applications of genome sequencing, including many new exciting initiatives for predicting foetal outcomes, and futuristic precision medicine.

What lessons do these initiatives in Chinese medicine have for Indian scientists, and Indian science and health policy makers? Like China, India has an old tradition and culture, and a strong tradition of alternative systems of medicine that include Ayurveda, Naturopathy, Siddha, Yoga, Unani, Tibetan systems of medicine and Homoeopathy. These have prevailed over a long period, some dating back to the BCs, with only Homoeopathy being relatively recent having been discovered by the German physician, Samuel Hahneman towards the end of the 18th century. Despite this, owing perhaps to the country’s long colonial influence, in the first National Health Policy of India (1946), declared just prior to our independence, there was no mention of these traditional and alternative forms of medicine, with the focus given only on allopathic or modern medicine. This, however, was soon rectified, and in 1958 the Udupa Committee (chaired by K. N. Udupa, trained both in Ayurveda in India, and a Master’s in Surgery in the US) came up with its recommendations to strengthen Ayurveda and indigenous systems of medicine. Eventually in 1995, within the Ministry of Health and Family Welfare, Government of India (GoI), Department of AYUSH (Ayurveda, Yoga, Unani, Siddha and Homeopathy) was set up to study these alternative forms of medicine. In 2014, AYUSH was made into a full-fledged ministry by the Government in a strong push for these alternative medicines. And in making these pushes, although the exaggerated claims made by some proponents of ancient Indian systems of medicine need to be properly corrected, we also need to ensure that we ‘do not throw out the baby with the bathwater’.

If alternative medicine is to contribute to addressing itself to the immense health burden of the country, we need to see how best this can be done (Ayurveda: the time to experiment, Valiathan, M. S. and Thatte, U., *Int. J. Ayurveda Res.*, 2010, **3**, 1). Are there safety and regulatory issues? What regulatory mechanisms are needed, since currently these medicines do not require the strict regulations like those of allopathic or modern medicines? If one promotes these indigenous forms of treatment and medicines, should one take the route the Chinese have done, or have proper trials also included? Do we need to go beyond the statistical approaches that are the basis of ‘evidence-based medicine’, by also looking at individualized cases that are carefully documented? Should we encourage rigour in documentation and also in research in these areas? How can we ensure educating large numbers of doctors as qualified practitioners of indigenous and

alternative forms of medicines, so that they can contribute to the health system? Are there risks associated with some alternative approaches that need to be examined? These are some questions and issues we need to address, and awareness of the shortcomings of alternative medicines (Singh, S. and Ernst, E., *Trick or Treatment*, Bantam Press, London, UK, 2008) would be of great value in sifting out truths from untruths.

GoI had recently tabled the National Medical Commission Bill to replace the current Medical Council of India. Many aspects of the Bill are controversial, but there is one clause that pertains to alternative medicines which seems relevant to the current discussion. The proposed Commission is expected ‘to enhance the interface between Homoeopathy, Indian Systems of Medicine and modern systems of medicine’. The Commission can ‘decide on approving specific bridge course that may be introduced for the practitioners of Homoeopathy and of the Indian systems of Medicine to enable AYUSH practitioners to prescribe such modern medicines at such level as may be prescribed’. This provision of bridge course in allopathic medicine was to help AYUSH practitioners also practice allopathic medicine. This seems to undermine both the allopathic and alternative systems of medicines; rather than strengthening any of these disciplines, it weakens all of them. Following protests by the Indian Medical Association, this clause has now rightfully been dropped and a modified Bill is likely to be soon tabled in parliament.

At the ground level, what is required instead is an increasing recognition and awareness. Initiatives that can encourage the appreciation of these traditional medicines by scientists and practitioners of modern medicine and vice versa are bound to be rewarding. It will also encourage new ways of looking at health and medicine. Along with any push for traditional and alternative medicines, there is a strong need to recognize and support the rapid advances in the sciences that are impacting medicine. Our understanding of biological systems is advancing at a breath-taking pace aided by advances in computer science, materials science and optics. These areas require massive investments – most would have to come from the Government – and one would have to pull out all stops to be able to work at the boundaries of biological sciences so that we can be at the frontiers. Ultimately, while it might be important to uncover and build on truths that have been recognized in our past – we have to sieve out untruths and put the truths on firmer foundations – it is even more important to delve deep and unearth newer truths that only sustained investment in the sciences can yield.

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