Tu Youyou And The Nobel Prize

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A victory for Traditional Chinese Medicine?

By Daniel Liang

Daniel Liang looks at a familiar world in an unfamiliar way - through a skeptical lens. Every month he peeks under the hood of a meme, myth, bias, or news article. Disclaimer: the opinions expressed do not represent the magazine, advertisers, employer, or the Nobel Foundation.

Artemisia annua
Artemisia is a plant from which artemisinin, the most effective drug to treat malaria, is extracted.

Tu Youyou And The Nobel Prize

On October 5th, the 2015 Nobel Prize in Physiology or Medicine was awarded to Tu Youyou for her discovery of artemisinin; a novel therapy against malaria. Technically, she was awarded only half of the prize (the other half went to Campbell and Omura), but as tradition dictates when counting accomplishments, we round up to the nearest Nobel Prize.

Immediately following the announcement, Chinese media was flooded with the usual congratulatory back-patting and chest thumping. The narrative was clear: Traditional Chinese Medicine (TCM), a priceless gift that is so underappreciated by western society, has finally received the international recognition it deserved. In a congratulatory letter, Chinese Premier Li Keqiang wrote, "Tu's winning the prize …. marks a great contribution of Traditional Chinese medicine (TCM) to the cause of human health…." Is this really an accurate portrayal of TCM's contribution? Let's take a closer look.

Tu Youyou
2015 Nobel Prize Winner in Physiology or Medicine

Some Background

Malaria is a deadly parasitic disease, and despite all the progress made so far, it still kills hundreds of thousands a year. Tu's work on malaria started from a military initiative called Project 523. She screened hundreds of candidate raw materials from ancient TCM texts, which included a wide range of "medicines" such as pangolin, arsenic disulfide, shed snakeskin, and egg membrane.

She was particularly drawn to an extract from Artemisia annua, which showed potential but was rather unstable. After reading a passage in a book from 340 BCE about an unusual preparation method, which used cold steeping instead of the usual cooking, she tried to use a low temperature solvent (ether) for extraction. The method worked, and in 1972 she eventually succeeded in scientifically identifying, purifying, and isolating the active ingredient, and named it artemisinin.

Unfortunately, artemisinin itself is not very effective in humans. It is difficult to absorb and has a brief shelf life. Today, the treatment that has saved millions of

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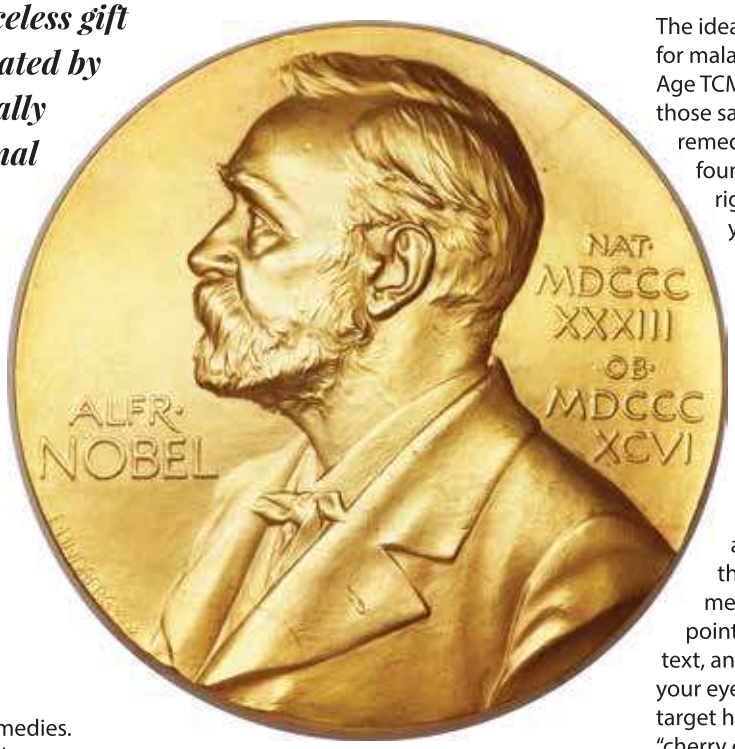

lives is an artemisinin-based combination therapy (ACT), which consists of an artemisinin derivative and an unrelated drug.

The Naturalistic Fallacy

TCM relies heavily on "natural" remedies. This is emotionally appealing to those holding the "Mother Nature knows best" worldview, in which nature is anthropomorphized and seen as warm and benevolent. Some go even further and believe that nature provides resources specifically for the benefit of humans – a dangerous mindset (drill, baby, drill!). This teleological narrative says that Mother Nature provides the best remedies, and gweilos in lab coats are just too arrogant to look at the ancient wisdom offered by TCM. Nice try, but far from reality.

Plants produce an amazing array of chemicals, some of which have biological effects in humans. Some heal, some kill, and some can be recreational. These plants evolved the chemicals to help them survive, e.g., to attract insects for pollination or to avoid being chomped on. However, instead of a natural explanation, some think that these chemicals were made expressly for our benefit. It takes a special kind of imagined self-importance to come up with that romantic delusion. In reality, Mother Nature is utterly indifferent.

Humans and even animals have long turned to the environment for their medical needs. Contrary to the narrative that scientists are too arrogant to look outside the lab, nature is actually a major source from which new drugs are discovered – it's called pharmacognosy.

Dosage – a Fundamental Problem

As far back as 2400 years ago, Hippocrates treated headaches with willow bark, which contains Salicylic acid, better known as the active ingredient of aspirin. Yet nowadays, few people chew bark after a night of hard drinking. Taste and cleanliness aside, we take pills because we know how much of the active ingredient we are getting. Just like some apples are sweeter than others, some bark is simply more potent. Artemisinin has the same problem. Tu discovered that the artemisinin content varied significantly between plants from northern and southern China, and even by the season.

The only way to produce medicine with precise and consistent dosing is to identify and isolate the active ingredient. Traditional Chinese medicine lacks this scientific rigor. The herbs and medicines used may weigh the same, yet the amount of active ingredients could be very different. Since the dose makes the poison, the stakes are high. Some drugs have an effective dose (ED50) fairly close to the lethal dose (LD50). For these drugs, correct dosing is more than the difference between being effective and ineffective; it is the difference between life and death.

TCM contribution?

The idea to look into Artemisia annua for malaria did in fact come from Iron Age TCM texts. What also came from those same texts, are hundreds of remedies claimed to be effective, yet found to be worthless when tested rigorously. These failures are real, yet conveniently unmentioned.

Surely the "cherry on top", the ancient passage that inspired Tu to try low temperature extraction, has to be credited to TCM, right? Not so fast. Cold extraction was one method of preparation, mentioned in one ancient book. There were mountains of other books that advised a hot preparation. In the end, it didn't matter which method worked. One can simply point to the corresponding ancient text, and hey, inspiration. You can close your eyes and throw the dart when your target has nothing but bulls-eyes. The "cherry on top" is really just an example of cherry picking.

Conclusion

The journey may have started with an ancient book, but more importantly, it took perseverance and hardcore science to arrive at the Nobel Prize. TCM provided the haystack, and modern science found the needle with a magnet. The actual scientific discovery of artemisinin is about as far removed from TCM as possible. Juleen Zierath, Chairman of the Nobel Committee for Physiology or Medicine said, "…what was really critical was that Tu Youyou identified the active agent in that plant extract….there was a lot of modern chemistry, bio-chemistry attached to this to bring forward this new drug."

Is the Nobel Prize an overdue, resounding validation of TCM? Well, whatever makes you feel better. Round your achievements upwards.