Ancient Chinese Medicine Not Magical, Nobel Prize or Not

By Josh Bloom — October 7, 2015

Dr. Tu Youyou was honored this week, sharing the Nobel Prize in Physiology or Medicine for her discovery of artemisinin, a critically important drug in the very small arsenal of drugs that are useful against malaria. The disease is still the scourge of Africa, despite considerable progress made over the past decade.

The mainstream media tells a wonderful narrative: Modern medicine fails, but ancient Chinese medicine comes to the rescue!

The only problem is that this narrative is completely false. But you wouldn't know that from reading the news. Many in the press are telling their own story, facts be damned.

It's hard to argue with the committee's decision. Dr. Tu's discovery has saved hundreds of thousands of lives, and it took some very clever science to accomplish what she did. But, it wasn't Chinese medicine. It was a well-known and long-used branch of drug discovery called natural products chemistry. The only thing Chinese about the discovery was the scientist, and the country in which it was done.

Natural products chemistry consists of:

1. Assembling a large collection of plants and herbs
2. Making a crude extract, usually by grinding up the plant and using different solvents to extract the chemical components of the plant.
3. Testing the extracts against... you name it. Bacteria, cancer....
4. If the extract does something interesting, this is where the "fun" begins, as chemists try to identify the component or components of the complex mixture that are responsible for the biological activity.
5. This can be a nightmare. Sometimes there is only a minuscule quantity of the bioactive chemical in the complex mixture, and it is very difficult to separate it from all the other junk. (The "junk" is by far the main component of any extract.)
6. When the compound is isolated the chemical structure must be elucidated. Not infrequently, natural products chemists find that what they've spent months, even years, isolating is an already-
known compound or drug. This is profoundly annoying.

7. Once the chemical structure is solved, synthetic organic chemists take over, and must make enough of it for additional tests. Both the structure elucidation and chemical synthesis can be absolute nightmares. Either (or both) processes can take years.

The above protocol describes exactly what Dr. Tu did. An outstanding job using standard western science. If this gets people screaming at me, so be it. It won't be the first time or the last.

Dr. Marta Henson, an associate professor of history of medicine at Johns Hopkins University, writing in *Fortune Magazine* [1], certainly understands.

"Traditional medical knowledge anywhere in the world has not even been on the radar for Nobel Prize prospects," she writes. "Until now, that is. So how should we interpret this arguably seismic shift in international attention on traditional Chinese medicine?

"So is this Nobel Prize for Tu's discovery," she adds, "a signal that Western science has changed how it perceives alternative systems of medicine? Perhaps, but only slightly. ... Don't underestimate the sophisticated methods Tu used to extract the active artemisinin compound from *Artemisia annua*, another one of the panelists concluded."

*That's why Dr. Tu won the prize. She solved a really tough problem using modern chemistry techniques on an herb that was found in China. This is not Chinese medicine. This is work by a very smart medicinal chemist who happens to be Chinese.*

And she had plenty of help. Dr. Tu wrote about this in a *Nature* article [2] from 2011.

"During the first stage of our work, we investigated more than 2,000 Chinese herb preparations and identified 640 hits that had possible antimalarial activities," she wrote. "More than 380 extracts obtained from ~200 Chinese herbs were evaluated against a mouse model of malaria. However, progress was not smooth, and no significant results emerged easily."

The last sentence, which I've italicized for emphasis, sums up the field of natural products chemistry quite well.

 Furthermore, the techniques that were used to solve the structure were anything but ancient, as Dr. Tu states. "The stereo-structure of artemisinin, a sesquiterpene lactone, was determined with the assistance of a team at the Institute of Biophysics, Chinese Academy of Sciences."

This is done using sophisticated techniques such as mass spectrometry, nuclear magnetic resonance spectroscopy, liquid chromatography, many others.

It is interesting to contrast this with some of the headlines.

*South China Press*: "Herbal remedy: China's Nobel Prize winner Tu Youyou drew on traditional Chinese medicine to help put a lid on malaria"

*Quartz*: "How traditional Chinese medicine finally won its Nobel Prize"

*The Telegraph*: "Nobel Prize for Chinese traditional medicine expert who developed malaria cure"

*CNN.com* is especially problematic. "Nobel Prize winner Tu Youyou combed ancient Chinese texts
for malaria cure" (The headline is technically correct but irrelevant and thoroughly misleading.)

As is the rest of the CNN.com story:

"Dr. Tu screened many herbal remedies in malaria-infected animals and extracted a promising agent from Artemisia annua. Because of inconsistencies in test results, she turned to ancient texts and discovered clues to identify and extract the active component of the Artemisia herb. In ancient times, people soaked the herb in water and boiled it. She realized that boiling could destroy the active ingredient and used other techniques to isolate it."

Nonsense. She could have just as well have turned to Archie comics. Any chemist with a P, H, or D can tell you that heating something is a terrific way to decompose it. Dr. Tu would have found some way to isolate the active components using any number of extraction methods. This was the easy part. The work that she did after this was where it got rough. This is why she won the prize.

Vox [3], the online media site, makes this perfectly clear.

"Tu realized that their method of preparation, boiling up the wormwood, might have damaged the active ingredient," it reported. "So she made another preparation using an ether solvent, which boils at 35 °C."

In case you don't know anything about chemistry, this is beyond obvious. It is the equivalent of saying that Bob Vila discovered that a hammer is a better tool for a pounding a nail than an electric toothbrush.

Why am I making a stink about this?

Because if the take-home message from this award is that people should forgo western medicine and buy Chinese herbs, it will merely be just another case of the use of untested supplements. People who are suspicious of modern medicine in the first place will dig their heels in even further. Maybe Dr. Oz will take advantage of this opportunity to create a special "Asian Magic Pill" page to add to his magic pills section of his personal medical library.

It's become very popular to criticize western medicine for what it cannot do (which is plenty). But this does not mean that an answer exists elsewhere a very common flaw of logic.

The fact that something has been done for a long time in another country means nothing. Thousands of years ago, people, used mercury as a laxative. Diseases were thought to be caused by evil spirits. Holes were drilled in people's skulls to relieve headaches.

Interesting aside: Because of its rarity, when mercury was used as a laxative, it was recovered. Just in case you think *your* job sucks.

I'd like to see that headline on CNN.

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