

Wormwood

ANCIENT CHINESE FOLK REMEDY MAY HOLD KEY TO NON-TOXIC CANCER TREATMENT

Two bioengineering researchers at the **University of Washington** have discovered a promising potential treatment for cancer among the ancient arts of Chinese folk medicine. Research Professor Henry Lai and assistant research Professor Narendra Singh have exploited the chemical properties of a wormwood derivative to target breast cancer cells, with surprisingly effective results. A study in the latest issue of the journal *Life Sciences* describes how the derivative killed virtually all human breast cancer cells exposed to it within 16 hours. “Not only does it appear to be effective, but it’s very selective,” Lai said. “It’s highly toxic to the cancer cells, but has a marginal impact on normal breast cells.”

The compound, **artemisinin**, isn’t new. It apparently was extracted from the plant *Artemisia annua* L., commonly known as wormwood, thousands of years ago by the Chinese, who used it to combat malaria. However, the treatment was lost over time. Artemisinin was rediscovered during an archaeological dig in the 1970s that unearthed recipes for ancient medical remedies, and has become widely used in modern Asia and Africa to fight the mosquito-borne disease.

The compound helps control malaria because it reacts with the high iron concentrations found in the malaria parasite. When artemisinin comes into contact with iron, a chemical reaction ensues, spawning charged atoms that chemists call “free radicals.” The **free radicals** attack cell membranes, breaking them apart and killing the single-cell parasite. About seven years ago, Lai began to hypothesize that the process might work with cancer, too.

“Cancer cells need a lot of iron to replicate DNA when they divide,” Lai explained. “As a result, cancer cells have much higher iron concentrations than normal cells. When we began to understand how artemisinin worked, I started wondering if we could use that knowledge to target cancer cells.” Lai devised a potential method and began to look for funding, obtaining a grant from the Breast Cancer Fund in San Francisco. Meanwhile, the UW patented his idea.

The thrust of the idea, according to Lai and Singh, was to pump up the cancer cells with maximum iron concentrations, then introduce artemisinin to selectively kill the cancer. To accommodate a rate of iron intake greater than normal cells, cancer cell surfaces feature greater concentrations of transferrin receptors – cellular pathways that allow iron into a cell. Breast cancer cells are no exception. They have five to 15 times more transferrin receptors on their surface than normal breast cells.

In the current study, the researchers subjected sets of breast cancer cells and normal breast cells to doses of holotransferrin (which binds with transferrin receptors to transport iron into cells), dihydroartemisinin (a more water-soluble form of artemisinin) and a combination of both compounds. Cells exposed to just one of the compounds showed no appreciable effect. Normal breast cells, exposed to both compounds, exhibited a minimal effect. But the response by cancer cells when hit with first holotransferrin, then dihydroartemisinin, was dramatic. After eight hours, just 25 percent of the cancer cells remained. By the time 16 hours had passed, nearly all the cells were dead.

An earlier study involving leukemia cells yielded even more impressive results. Those cells were eliminated within eight hours. A possible explanation might be the level of iron in the leukemia cells. “They have one of the highest iron concentrations among cancer cells,” Lai explained. “Leukemia cells can have more than 1,000 times the concentration of iron that normal cells have.”

The next step, according to Lai, is animal testing. Limited tests have been done in that area. In an earlier study, a dog with bone cancer so severe it couldn’t walk made a complete recovery in five days after receiving the treatment. But more rigorous testing is needed.

If the process lives up to its early promise, it could revolutionize the way some cancers are approached, Lai said. The goal would be a treatment that could be taken orally, on an outpatient basis. “That would be very easy”, Lai said. “The cost is another plus – at \$2 a dose, it’s very cheap. And, with the millions of people who have already taken artemisinin for malaria, we have a track record showing that it’s safe.” Whatever happens, Lai said, a portion of the credit will have to go to unknown medical practitioners, long gone now. “The fascinating thing is that this was something the Chinese used thousands of years ago,” he said. “We simply found a different application.”