Taxol Reshapes The War On Cancer

Florida State University

A Florida State University professor invents the process to make the best-selling cancer drug in history — and while he's at it, helps save the endangered Pacific Yew tree. Since the introduction of synthetic Taxol, more than 2 million women worldwide have taken the drug to fight ovarian and breast cancer.

The nurse points a flashlight in the patient's eyes and from miles away, Karen Curtin, an R.N. in electronic nursing, is helping examine the hospital patient. From Curtin's vantage point, sitting at a desk with six computer screens and monitoring 30 patients simultaneously at several Chicago area hospitals, life is magical. "Electronic nursing is an exciting area of medicine," says Curtin, who works in the intensive care unit with Provena Health Care and monitors critically ill patients via computer from a central location, "Every day I remind myself how lucky I am to be alive and be able to help others."

Four years ago, Curtin, a single mother with two children from Orland Park, Ill., was working as an intensive care nurse for St. Francis Hospital in Blue Island, Ill. In her free time she enjoyed all forms of exercise. She still tenses up when she

recalls Dec. 4, 2001, when she was running on a treadmill. “The running produced a pain in my left breast. Later, taking a shower, I felt a painful lump. I had been an ICU nurse for 13 years so I told myself, I’m 31, there’s no history of breast cancer in our family, so it’s probably nothing. But another voice inside knew something was wrong. Terribly wrong.”

A few days later, Curtin learned she had breast cancer. Last year the American Cancer Society estimated that more than 210,000 people would be diagnosed with breast cancer and that more than 40,000 of them would die. Curtin was proactive and immediately had an ultrasound, followed by a lumpectomy. Exactly a month after discovering the lump in her breast, she underwent nine hours of a mastectomy and tram-flap reconstructive surgery. “Eleven of my 30 lymph nodes were positive for cancer,” she says. “I found out I am her-2 positive, which is a very aggressive form of cancer.” During what Curtain calls her “big surgery,” her breast, including the nipple, was removed, and on the same day, she underwent reconstruction surgery that included abdominal muscle tunneled under the skin to support a new breast area. The recovery from the surgery took weeks, followed by several grueling rounds of drug therapy. In her characteristically understated manner, she says 2002 was probably the most difficult year of her life.

Reaching the Turning Point

When Curtin started cancer treatment — she had enrolled in a national drug therapy study — she underwent 12 weeks of chemotherapy, and four rounds each of Adriamycin and Cytoxan. “I was horribly ill through this process and when my medium-length hair fell out, my illness really hit home. My kids were supportive, but they were horrified. My son kept telling me to put my wig back on.”

But when Curtin started taking Taxol by IV drip once a week for 12 weeks, her life started to change. “Taxol was the turning point in getting my life back,” she says. “Compared to other drug therapies I had taken, it was a relief to take Taxol and not have side effects.” Curtin, one of the people who have reacted well to Taxol, says, “When I look back on the months of cancer-fighting treatment that I went through, I credit Taxol with being the milestone that started making a difference in my recovery.” After her Taxol treatments, Curtin had radiation treatments five days a week for 25 days.

Breakthrough Leads to Wide Availability

Though millions of people have heard of Taxol, chances are most do not know the connection to Florida State University and the phenomenal story behind the drug’s invention. The active compound that would become Taxol, or paclitaxel, which the National Cancer Institute described in 1990 as the most vitally important cancer drug in 15 years, was first discovered in the 1970s from the bark of the endangered, ancient Pacific Yew tree. But there was a problem. To produce a cancer treatment, the bark of the trees had to be harvested, and the harvesting killed the trees.

By 1988, NCI released results of Taxol’s Phase II trials of ovarian cancer. According to the report, at least three of every 10 persons found their tumors had shrunk using Taxol. The result was a huge demand for the drug. To offer it to all ovarian cancer sufferers in the U.S., doctors would have needed 240 pounds of Taxol. That production level would have required the harvesting of 360,000 Pacific Yew trees, the habitat of the spotted owl, also an endangered species.

Enter professor Robert Holton, a Florida State University chemist who had returned to FSU, his alma mater, in 1985 and was excited about seeking a solution to the Taxol supply problem. His work at FSU was deemed nationally significant when just two later, his laboratory was working with support from the U.S. National Cancer Institute.

There are many stories about Holton’s discovery, as well there should be. Holton’s work at FSU is legendary in the world of cancer-fighting technology. His breakthrough occurred with his 1991 invention of synthesizing paclitaxel using

compounds found in the needles and twigs of the common English Yew tree. Holton's perseverance paid off. His relentless determination to help cancer patients resulted in a synthesizing process that didn't kill the Yew tree. The process that started with needles and twigs and ended with a medical breakthrough is in some ways an expression of Holton's character.

"Professor Holton is a dynamo. He is driven to attack cancer," says John Fraser, director of the Office of Intellectual Property Development and Commercialization at Florida State University.

Holton's invention at FSU was subsequently licensed to Bristol-Myers Squibb, which introduced the drug as Taxol in early 1993 after it received approval from the U.S. Food and Drug Administration. Because of Holton's work at FSU, Taxol became the most important cancer fighting drug to come along in 15 years.

Impact Heard Around the World

> *When Bristol-Myers Squibb used the FSU semi-synthesis process in bringing the drug to the marketplace, it was a major step forward in fighting ovarian cancer.*

Though it is not effective for everyone, Taxol has had a far-reaching social and economic impact since its introduction. More than 2 million women worldwide have taken Taxol. By 1998, the FDA approved its use not only for first-line ovarian cancer therapy, but also for first-line metastic breast cancer therapy when used in combination with Herceptin. Today, it has extended use as a second-line treatment for AIDS-related Kaposi's sarcoma.

"When Taxol was first introduced, it was a golden bullet. It had a staggering impact on the treatment of cancer," says Fraser, a University of California, Berkeley-trained biochemist. "And years later, it still is a front-line therapy for treating breast cancer and ovarian cancer."

One of the offshoots of Holton's work is Taxolog Inc., a private company set up as an FSU startup with a technology transfer license to develop and bring to market other Taxol analogs invented at FSU.

Within months of her Taxol treatments, in October 2002, Curtin was back at work saving lives. While the computer pushes data at her, informing her about the critically ill patients she's monitoring, she recognizes how fortunate she is to be alive, thriving and helping others do the same.

There were many elements that played a part in her recovery, but without missing a beat, she says, "When I started taking Taxol, I felt more human again. It was Taxol that got me back to being a mom." — By Sharyn Alden

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