

## Breakthroughs in Cancer Research Lead to Decline in Death Rates



By Elizabeth Pagel-Hogan

One person dies every minute, equaling 500,000 deaths annually from cancer. Thankfully, over the past fifteen years the rate of deaths for women and men have been decreasing. Much of this progress is due to drastic changes in treatment modalities resulting from breakthroughs in cancer research.

According to the National Institutes of Health director Francis S. Collins, M.D., Ph.D., in testimony before Congress in June 2010, "NIH-funded research has revolutionized how we think about cancer." Two decades ago, cancer treatment was organ-based and utilized "brute force toxic therapies."

Advancement in the understanding of cancer, and how best to develop targeted therapies, wouldn't be possible without an understanding of the structure of genes. In 1962, the James Watson and Francis Crick unlocked the chemical structure of DNA. Subsequent research showed that damage to genes, either through inherited damage or environmental damage, lead to mutated cells, which we call cancer.

Improved prevention techniques resulting from a better understanding of genetics haven't been overlooked by NIH. Three cancer prevention vaccines, one for Hepatitis B that could potentially prevent some forms of liver cancer and two to prevent human papillomavirus (HPV) and associated cancers like cervical cancer.

Cancer treatment focuses now on the genetic profile of each patient and each cancer. In his testimony, Collins referenced drugs like trastuzumab (brand name Herceptin). In NIH-sponsored clinical trials this drug made breast cancer tumors with certain genetic markers more susceptible to chemotherapy. The drug also reduced the risk of recurrence by 52%. Other drugs like Iressa and Tarceva, claimed Collins, made chemotherapy more effective in patients with lung cancer that had certain genetic signatures.

Collins, best known as director of the International Human Genome Project, is eager to push cancer research further into the realm of genetics. In an April 2011 of the Yale Journal of Medicine and Law, Collins stated that NIH hopes to develop inexpensive methods to decoding the genome of each patient.

Collins and NIH are now focused on The Cancer Genome Atlas, a project designed to build a comprehensive catalogue of key genomic changes in twenty major types and sub-types of cancer. This project will receive \$178 million from the over \$10 billion of The Recovery Act that was appropriated directly to NIH.

In his June 2010 testimony, Collins noted that "TCGA has produced a comprehensive molecular classification system for ovarian cancer and glioblastoma" and identified five new sub-types of glioblastoma. More importantly, researchers learned that responses to aggressive treatment therapies varied by sub-type. According to Collins, "These findings hold the promise that we can match the most appropriate therapies to individual brain cancer patients."

"Healthcare providers will use a person's genomic profile, along with information about his or her lifestyle and environment, to develop individualized strategies for preventing, detecting, and treating disease. Genomic information will also enable doctors to prescribe medications in safer and more effective ways, selecting for each patient the right drug at the right dose at the right time," said Collins. In 2012, NIH estimates the cost of sequencing the human genome can be reduced to \$15,000.

"One of our biggest goals is to cut the cost of sequencing an entire human genome to \$1,000 or less."

Biotechnology companies are aiming for this goal, too. Life Technologies acquired Ion Torrent, a company founded by Jonathon Rothberg, that has a device that sequence a genetic sample in a few hours. Rothberg, who has been featured in *Forbes* magazine, *The Wall Street Journal*, and *Carnegie* magazine, foresees a future where patients will have their genomes sequenced at their doctor's office as easy as they currently get x-rays.

Funding for the National Cancer Institute tops the list of agencies in the proposed 2012 budget at over \$5.1 billion. In fiscal year 2010, over 487,000 jobs resulted from NIH funding and nearly 1 million U.S. citizens were employed by the medical innovation sector. According to Collins' statement to Congress, in 2008, NIH funding led to \$84 billion in wages and salary.

While the idea of cancer drugs based on the unique DNA in a person's tumor, with limited toxicity to healthy cells, offers promise for those diagnosed, continuing medical innovation has an economic impact that can't be ignored. †

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