

Stem Cells and Breast Cancer

Advocates for people with breast cancer hold great hope that stem cell advances could aid in the treatment of the disease. Researchers have showed that stem cells are involved in the development of the breast and its ability to produce milk, and may provide clues as to the development of breast cancer.

Zero Breast Cancer, a nonprofit based in Marin County, co-sponsored the conference, and believes the general public should be part of the process when it comes to research.

Dr. Martha Nelson, dean of the School of Arts and Sciences at Dominican University of California, recalled when Zero Breast Cancer was founded as Marin Breast Cancer Watch in 1995 by Francine Levien with a small but committed group of women, all with breast cancer, who were concerned about the high incidence rates of invasive breast cancer in Marin County. "From its roots as an activist group, it has matured into a valued community partner," Nelson said. With its name change last year, she said, its "goal is clear to us all: Zero Breast Cancer."

Zero Breast Cancer's work has spread, not only to focus on why the San Francisco Bay Area has higher than normal rates of breast cancer, but also as national advocates for prevention of breast cancer. "We find current rates unacceptable," said Janice Barlow, the executive director. "We are looking to find causes through community participation in the research process."

The organization's Web site declares: "Community-based research is a process by which members of a community identify a problem, engage outside researchers in a collaborative that promotes co-learning, and achieve a balance between research and action."

"We want to share this information with the women in our community who have breast cancer," Barlow said.

"There are tremendous benefits to involving students, community members and scientists from different disciplines early and often in the research process," Barlow said. "We want you to be able to use research and understand it in a way that helps you make decisions, and in a way that helps us make relevant public policy."

Barlow expects that Zero Breast Cancer will sponsor more conferences like the one at Dominican in February "to keep people up to date on the progress of stem cell research in these various diseases."

"Our vision is to make zero breast cancer a reality for the next generation," she said. "We're passing on a huge economic deficit. We're also passing on our genes. We as adults have a huge responsibility not to pass on these diseases without having a better understanding, and better treatment. We have to understand how to prevent these diseases and to better treat them."

Barlow said Zero Breast Cancer is involved in a major research initiative looking at whether there are periods of vulnerability in the development of the mammary gland that environmental factors may impact on future breast cancer risk.

"I had always just thought of stem cell research as being useful in studying the effects of aging, or on spinal cord injuries," Barlow said. "I now know developments in

stem cell research will contribute significantly in increasing our understanding of the causes of breast cancer.”

Among the researchers Zero Breast Cancer is collaborating with is Dr. Mary Helen Barcellos-Hoff, PhD, a senior scientist and deputy director of the Life Sciences Division at Lawrence Berkeley National Laboratory, who spoke at the conference. Barcellos-Hoff is looking for the cellular processes that cause breast cancer, studying mammary gland development, the development of aberrant tissue architecture during cancer, and how a carcinogen such as radiation promotes cancer progression.

“There is an interesting link between cancer in the breast and the origin of stem cells,” Barcellos-Hoff said.

Barcellos-Hoff said she studies mammary development in mice, because in both mice and humans the tissue in the breast – the epithelium -- “develops post-natally under hormones of puberty.

“The mammary gland is unique in that regard,” she said.

When a woman (or a mouse) has a baby, she said, “there’s a huge expansion of the epithelium. Those epithelial cells now can make milk.”

When the baby is weaned, those go away, and the breast returns to its original state. “This cycle of differentiation and involution can occur over and over again,” she said.

“How do we know it’s because of stem cells?” she asked. “With mice we can manipulate cells.”

Researchers can cut out the epithelial cells from one animal and implant some from another, over several generations. Through this work, they can see a “reservoir of stem cell activity in the breast that’s quite profound,” Barcellos-Hoff said.

“We’re interested in whether or not these cells are the origin of cancer,” she said. “Women who are exposed to radiation, which is a known carcinogen of human breasts, if they’re exposed during puberty, have a much higher risk of breast cancer later in life.”

Barcellos-Hoff said her team is investigating two hypotheses. One is that the cancer cells are the result of carcinogen-induced alterations in the stem cells,” she said.

“Or, it’s also possible that the radiation affects the signals needed for stem cells to self-renew and that’s why we see the commonality with radiation in puberty. Intriguingly, some of the signals that regulate stem cell growth, and regulate the decision to proliferate or not to proliferate – are the same for cancer cells.”

That leads to a question: “Are stem cells in tumors comparable to stem cells in tissues?”

Barcellos-Hoff described “one of the most stimulating, most provocative experiments of recent years, one that led to a different view of how we might treat cancer.”

A group at the University of Michigan took breast cancer cells from different women and injected them into the mammary fat pads of immune-compromised mice. Only certain cells actually formed tumors in the mice, she said, revealing an “important determinant,” that “certain aspects of stem cell biology may be recapitulated in cancer development.”

If they can prove that hypothesis, she said, then maybe “we could exploit it as a means of controlling cancer.”

In treating breast cancer today, doctors typically try to kill all of the tumor's cells. "But if the stem cell hypothesis is true, then we only have to control (focus on?) the cancer cells," she said. The other cells are not as relevant. Killing the non-stem cell like tumor cells will bring "regression but not a cure."

And the cure is what she, and other researchers, are after.

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