

3rd Annual Town Hall Meeting
Translating Breast Cancer and Environmental Research into Action

The Role of the Scientific Method in Rational Decision Making

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Dr. Yaswen describes himself as “a basic researcher and avowed experimentalist” whose intention is to remove some of the mystery from the scientific method.

He began his presentation by observing that there are differences in the incidence of breast cancer among women of different ethnicities, socioeconomic status, and geographic location, which lead us to believe that there are environmental factors that influence this incidence. The questions we have are very basic. What are these factors? How do they influence breast cancer susceptibility? How can their effects be lessened?

To find the answers to such questions, Dr. Yaswen applies the scientific method, which includes the following steps:

- Making an observation
- Analyzing the observation
- Building a hypothesis
- Testing the hypothesis
- Coming up with a scientific theory

To demonstrate this, he used the analogy of childhood learning in which a child “bops” her sibling on the head and is scolded (observation and analysis of cause and effect), which leads her to build her hypothesis (if I bop him, I get scolded). It is then necessary to test the hypothesis (she bops him again and is scolded again). And from here she is able to predict the future (whenever I bop him on the head, I get yelled at).

Since breast cancer causality is a much more complicated problem than head bopping and can't be tested as directly, scientists are required to break it down into smaller, more manageable problems.

Dr. Yaswen uses cultured human mammary epithelial cells to assay or measure the effects of suspected carcinogens. He uses these cell cultures so that experiments can be performed in real time with the fewest uncontrolled variables and so that he can distinguish between local, direct effects and systemic effects. By using these cultured cells, scientists have been able to determine some of the effects of the chromosomal changes that occur, which he compared to “shuffling the genetic deck”. The effects of chromosomal changes are determined through studying each genetic aberration, one

by one, as well as by studying malignant growth patterns.

In response to the question of why scientists don't use already existing assays to assess the effects of suspected carcinogens in the environment, Dr Yaswen described a previous unsuccessful attempt to do just that using the Ames Test for Mutagenicity, which was originally heralded as a quick and easy assay for hazardous substances in our environment. As additional data on naturally occurring chemicals became available, the limitations of the test and the theory became evident.

Dr. Yaswen explained that carcinogenesis, or the growth of cancer cells, is very complicated. Cells are not all the same and may respond to malignant changes in different ways. The body's own defense system plays a role in modifying the effects of potential carcinogens. He emphasized that cancer is not a disease of individual cells; it involves how cells communicate with each other within and among organs.

By using experimental models, scientists can test hypotheses. One person in one laboratory does not do this alone. Research results are the synthesis of many approaches to answering the questions being studied, including epidemiology studies, cellular studies in mice or in humans, environmental studies, or genetic studies.

Dr. Yaswen emphasized the importance of using the scientific method rather than intuition to make decisions. We know we have succeeded if the models account for real world observations, are developed under experimentally controlled conditions, are predictive and provide confidence that the choices we make as a society are factually based.