

**Title:** Environment and Health Basics

**Author:** Barbara Sattler, RN, DrPH, FAAN, Professor and Director of the Environmental Health Education Center, University of Maryland School of Nursing,  
www.enviRN.umaryland.edu

We have begun a series of articles on the relationship between the environment and our health. It may be time to cover some basic concepts regarding the study of environmental health. In this article, toxicology, a key scientific discipline in the study of environmental health, will be briefly described. This explanation will provide a foundation for a better understanding of some of the future articles in which specific chemicals or products will be discussed.

When we or our family members are diagnosed with a serious disease, we want to understand the “etiology” of the disease or “how we got it.” This is certainly true when the disease is cancer. We ask our family members about the incidence within our immediate and extended families in order to determine whether family genes played a role. We look at our diet and lifestyle. And some of us look at our environments – the air quality in our communities, water quality, and even the products that we use.

It’s likely that no “smoking gun” will appear, but rather that a complex set of factors has contributed to the development of the disease, particularly cancer – and even more particularly with breast cancer. There are several sciences that we rely on to help us understand the many contributing factors that can effect cancer’s development.

To understand the potential environmental contribution to disease we depend on two branches of health science: toxicology and epidemiology. Toxicology is sometimes called the “study of poisons”. Toxicologists work with live animals and also with individual cells and tissues. It would be unethical to perform toxicological methods on humans so we use animals and cells as proxies.

Toxicology has a fair degree of precision because scientists can control for almost everything and introduce a single chemical in order to study its specific effect. In the case of mice, scientists can control their genetic make-up by choosing genetically identical mice. They then can control their air, food and water, even their exercise. They also can choose the age at which they will give a dose of a chemical – they can dose a pregnant mouse to see the effects on her pups; dose baby or adolescent mice, or adult mice. (Though in practice, the vast majority of toxicological tests are done on adult mice.) The results of toxicological studies help us to understand the likelihood of a health effect (i.e. cell, tissue, or organ change or damage) with different doses of the chemical being studied.

With this “dose-response” information, scientists then must make a leap in order to predict the potential significance to humans. This leap is called extrapolation. The process of extrapolation would be a lot easier if humans all had the same genetic make-up, ate the same foods, never smoked or drank alcohol. But we’re not very cooperative

when it comes to that. Instead, we all have hundreds of different “exposures” every day based on our diets, our choices of personal care products, the air we breathe both indoors and out, and so on. Nonetheless, the potential impact on humans is estimated.

If you wanted to find a list of the animal studies that have been done regarding the carcinogenicity of many of the products that you or your family members use on a daily basis, you might be very surprised to find out that very few have actually been tested and how virtually none will have been tested to determine whether exposures early in life will predict cancers later in life. You would also be hard-pressed to find studies that have explored the effects of two or more simultaneous exposures. Finally, you might be very surprised to know that it is not the responsibility of the manufacturer to do any kind of health testing before they bring their products to market (unless the product is a pharmaceutical).

While there are clearly some limitations to making accurate human risk statements regarding any individual chemicals, it would nonetheless be helpful to have more information to draw upon. Of the 80,000 or more chemical that we may be exposed to in our daily lives, less than 7% have been tested for their potential toxic effects, including their potential to cause or promote the development of cancers.

In Europe, they have recently passed a law that requires companies to test their products before they bring them to market – including toxicological studies. In the US, Komen has been a champion of breast cancer research. In addition to supporting basic and applied research, we certainly might want to promote the requirement that manufacturers do pre-market toxicological testing of their products, so that we might have an understanding of the potential risks associated with their use. Armed with such information, we would be able to make more informed choices.

\* \* \*

There is a new bill in Congress, called the Kids Safe Chemical Act that calls for pre-market testing of chemicals. While the title implies just kids’ safety, in truth when we protect our children, we protect everyone. This is especially true given the emerging science about increased risk of adult onset of diseases from exposures early in life, especially prenatal and early childhood.

#### Major Components of the Kids Safe Chemical Act 2008

***Require Basic Data on Industrial Chemicals***

Chemical companies must demonstrate the safety of their products, backed up with credible evidence. Chemicals that lack minimum data could not be legally manufactured in or imported into the United States. [Section 505]

***Place the Burden on Industry to Demonstrate Safety***

EPA must systematically review whether industry has met this burden of proof for all industrial chemicals within 15 years of adoption. [Section 503]

***Restrict the Use of Dangerous Chemicals Found in Newborn Babies***

Hazardous chemicals detected in human cord blood would be immediately targeted for restrictions on their use. [Section 504]

***Use New Scientific Evidence to Protect Health***

EPA must consider and is authorized to require additional testing as new science and new testing methods emerge, including for health effects at low doses or during fetal or infant development and for nanomaterials. [Section 503]

***Establish National Program to Assess Human Exposure***

The federal government's Center for Disease Control and Prevention (CDC) is to expand existing analysis of pollutants in people to help identify chemicals that threaten the health of children, workers, or other vulnerable populations. [Section 505]

***Expand the Public Right to Know on Toxic Chemicals***

New, Internet-accessible public database on chemical hazards and uses will inform companies, communities, and consumers. EPA is to rein in excessive industry claims of confidentiality. [Sections 511 and 512]

***Invest in Long-Term Solutions***

New funding and incentives are provided for development of safer alternatives and technical assistance in "green chemistry." [Section 508]

**For more information about the Kids Safe Chemical Act, see:  
<http://www.ewg.org/kidsafe>**