



## Summary of *Animal Mammary Gland Carcinogens*

### Chemicals causing mammary gland tumors in animals signal new directions for epidemiology, chemicals testing, and risk assessment for breast cancer prevention

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#### Introduction

Testing chemicals in animal studies is currently the primary means of identifying chemicals that might cause cancer in humans. Animal studies are used to identify health risks from pollution in much the same way they are used to test drugs before they are tested on humans. All known human carcinogens that have been tested on animals have been found to cause cancer in animals as well. Scientists evaluate the strength of evidence from animal studies as an indication of how likely it is that the chemical will also cause cancer in humans.

Animal studies are a particularly important resource for understanding environmental pollutants and breast cancer, because there are only a limited number of human studies and those are hampered by difficulties in estimating relevant exposures, especially exposures years ago when a woman's cancer first began. Results of animal studies can inform actions by individuals, government agencies, and industry to reduce exposure. They also suggest ideas for future human studies.

Sometimes, people question whether the relatively high doses of chemicals are relevant to typical human exposures. Scientists use high doses so they don't need to study a very large number of animals to find chemical risks of public health importance. In addition, research suggests that low levels of exposure to many chemicals also can have negative health effects.

#### Methodology

To make information on chemical mammary gland carcinogens readily accessible, we developed a database of exposure and carcinogenicity data. The database is the most comprehensive of its kind and is available at [www.silentspring.org/sciencereview](http://www.silentspring.org/sciencereview) and at [www.komen.org/environment](http://www.komen.org/environment).

The database includes chemicals identified as mammary gland carcinogens in at least one study reported in one of the following sources: Carcinogenic Potency Database (CPDB), International Agency for Research on Chemicals (IARC) Monographs summaries, National Toxicology Program (NTP) Technical Reports, NTP 11<sup>th</sup> Report on Carcinogens (11<sup>th</sup> ROC), and Chemical Carcinogenesis Research Information Service (CCRIS). In the absence of conflicting information, positive results in a single well-conducted study are generally considered sufficient to identify a chemical as a potential human carcinogen.

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## Results and Discussion

The study identified 216 chemicals that have been associated with increased mammary tumors in at least one animal study. Exposure is likely to be widespread, since 29 of the chemicals are produced in the US at rate of more than 1 million pounds/year, 35 are air pollutants, 25 have involved occupational exposures to greater than 5,000 women, 10 are food additives, and 73 are or have historically been present in consumer products or as contaminants of food. The identified chemicals include 36 industrial chemicals, 6 chlorinated solvents, 18 products of combustion, 10 pesticides, 18 dyes, four types of radiation, one drinking water disinfection byproduct, 47 pharmaceuticals, 17 hormones (some of which are pharmaceuticals), five natural products, and 54 unclassified chemicals.

Regulators have not paid much attention to potential mammary carcinogens. For example, US EPA uses animal tumor data to develop estimates of the potency of carcinogens so they can evaluate regulatory options for various exposure scenarios, but they have developed potency factors for only 20 of the 216 chemicals on the mammary carcinogens list. In addition, OSHA requires medical surveillance for workers exposed to 11 of the chemicals on our list, but does not require breast cancer screening.

The list of 216 chemicals is incomplete, because only a small fraction of the estimated 80,000 chemicals registered in the U.S. for commercial use have been tested to see if they cause cancer in animals.

Almost all of the chemicals identified as mammary carcinogens were mutagenic (they damage DNA) and caused tumors in multiple organs and species; these characteristics are generally thought to indicate likely carcinogenicity in humans, even at lower exposure levels. However, some aspects of the animal studies make them difficult to interpret, so future research to better understand relationships between animal and human breast cancers will be helpful.

Some of the mammary gland carcinogens with particularly widespread exposure include PAHs, present in auto and diesel exhaust; MX, a byproduct of chlorine disinfection of drinking water; and chlorinated solvents, which can be drinking water contaminants, gasoline additives, and in some consumer products such as paint strippers or spot removers. Human studies of chlorinated solvents and PAHs both suggest a possible association with breast cancer, while not enough research has been done to evaluate a potential association between drinking water chlorination and breast cancer. Despite these findings, major governmental reports on health effects of these common pollutants do not discuss potential associations with breast cancer.

## Recommendations

Future human studies should target more of the chemicals associated with mammary tumors in animal studies. In the meantime, we need to rely on animal models for public health purposes such as developing regulations to limit chemical exposures or reformulating products to reduce use of these chemicals.

The results of research to date on mammary carcinogens warrants increased attention from regulators, manufacturers, and nonprofit organizations. Efforts should be made to develop better testing methods, test additional chemicals, make better use of testing information in setting health policies, and establish workplace and national monitoring of exposure to suspect chemicals.