

## BISPHENOL-A

Cancer is a disease in which cells multiply out of control. Most scientists believe this happens when something acts on the cell to cause a mutation. Ana Soto and Carlos Sonnenschein are anatomy and cellular biology professors who have a theory that cancer's rapid multiplication of cells happens when a chemical inhibitor is prevented from acting on the cells. Instead of looking for chemicals that cause cancer cells to multiply, they look for what is blocking this action and for chemicals that interfere with this inhibitor. In pursuing this line of reasoning, they stumbled upon a very important discovery.



Ana Soto and Carlos Sonnenschein

Soto and Sonnenschein designed an experiment to isolate breast cancer cells from the inhibitor. Without the inhibitor, the cancer cells multiplied rapidly. When the inhibitor was added, the cells stopped reproducing. They concluded that any substance added to the sample that caused the cells to multiply must be blocking the inhibitor from acting. When estrogen was added to the sample, the cells began to reproduce rapidly, leading to the conclusion that estrogen blocks the inhibitor. Having developed a successful theory, the researchers set about accumulating data to support their theory. After several years of successful tests, something very strange happened—the cells were proliferating with or without the inhibitor. This sudden change could only mean one thing: the samples were contaminated with something that behaved like estrogen.

The researchers began with a review of their protocol—nothing had changed. Next, they began a meticulous analysis of every piece of equipment in the lab. Four months later, they determined that one set of test tubes was responsible for the contamination. They contacted the manufacturer and tested several sets of test tubes supplied by them to confirm their suspicions. The manufacturer confirmed that they had recently tweaked their recipe for the plastic but refused to divulge the nature of the change, citing trade secrets. Soto and Sonnenschein were shocked: according to their study, the chemical added to the plastic was encouraging cancer cells to reproduce and yet the manufacturer refused to work with them. It took the researchers about a year to get the plastic samples analysed by colleagues in the chemistry department and identify the culprit—a simple molecule called n-nonylphenol.

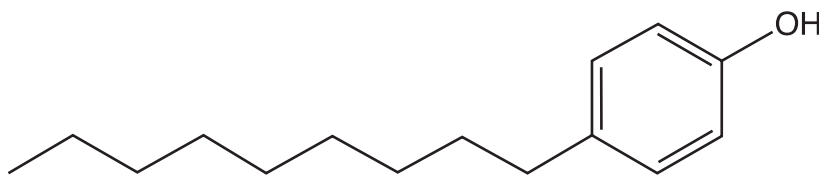


Diagram of n-nonylphenol

Soto and Sonnenschein published their results in 1990. Their work was quickly accepted by the community of researchers interested in the effects of chemicals in the environment. The fact that their experiment was able to reveal the estrogen-like properties of nonylphenol at very low concentrations meant that it could also be used to test for estrogen-like properties in other substances so they adapted their experiment into a screening protocol called E-SCREEN. This screening protocol led to the discovery of many other estrogen-like substances.

The researchers were alarmed by the fact that their work showed that a commonly used substance was acting like estrogen. They refocused their research on the impact that estrogenic substances have on organisms. They decided to study bisphenol-A (BPA) because it was already known to be estrogen-like and it was a common ingredient in plastics. The researchers exposed animals to very low doses of BPA, similar to what would be in the environment and observed several responses: reproductive issues, obesity, behavioural problems, and cancer. Clearly, low doses of BPA have a negative effect on organisms and their offspring. These findings have been confirmed by other researchers and have resulted in many governments moving to control the use of substances like BPA.

*“These chemicals are ubiquitous in modern life and thus very difficult to avoid, even with conscious effort.”*

– Ana Soto

**Understanding Content:**

1. Soto and Sonnenschein believe that cancer is caused by:
  - a. a bacterial infection.
  - b. the lack of a chemical inhibitor.
  - c. exposure to a something that causes mutations.
  - d. faulty genetic information.
2. According to Soto and Sonnenschein, estrogen promotes cancer growth because:
  - a. it is a synthetic substance.
  - b. it is a naturally occurring hormone.
  - c. it blocks the chemical inhibitor.
  - d. it causes the cells to mutate.
3. The sudden change in cell growth was caused by:
  - a. a dirty pipette.
  - b. a radioactive sample.
  - c. poor experimental technique.
  - d. using new test tubes.
4. Soto and Sonnenschein decided to study BPA because:
  - a. it was a common ingredient in plastics.
  - b. it was easy to manufacture.
  - c. nobody else had studied it.
  - d. it could only be detected in large amounts.
5. Write a paragraph describing the effects of BPA on animals.

**Exploring Context:**

1. Would Soto and Sonnenschein have discovered the estrogen-like properties of nonylphenol if they had been looking for cancer-causing agents like everyone else?
2. What do you think about a company that refuses to divulge information that would help cancer researchers?
3. How did collaboration with other scientists change the direction of their research?
4. How were they able to turn a contaminated experiment into a useful tool?
5. Research has indicated that most people have a measureable quantity of BPA in their system. Why should this concern you?