

# *Bisphenol A Overview*

- Originally produced for use as a synthetic hormone in 1936, today Bisphenol A (BPA) is manufactured in excess of six billion pounds per year
- BPA is most commonly used as the building block of polycarbonate plastic for products such as baby bottles and water bottles, epoxy resins (coatings that line food containers), and white dental sealants
- It is also an additive in other types of plastic used to make children's toys.
- BPA molecules are bound by "ester bonds" to form a polymer used to make polycarbonate plastic. As the building block of polycarbonate, BPA is the primary chemical in polycarbonate, and it thus does not exist in only trace amounts
- While plastics are typically thought of as stable, scientists have known for many years that the chemical bond between BPA molecules is unstable. The bond is disrupted by heat and acidic or basic conditions that release BPA into food or beverages in contact with the plastics.
- Extensive scientific literature reporting adverse effects of BPA at doses lower than the current level considered safe by U.S. EPA
- A high rate of leaching of BPA from food and beverage containers, and evidence that the median BPA level in humans is higher than the level that causes adverse effects in lab studies

## *Children are Most at Risk*

- Growing children are particularly at risk to chemicals in their environment because they face greater exposure per pound of body weight and are physiologically more susceptible to them
- Children's exposures begin at conception, as chemicals, including BPA, cross the placenta in a pregnant woman's body and can affect the embryo or fetus during critical periods of development
- After birth, children's bodies remain immature, with underdeveloped detoxification mechanisms to protect them from BPA as well as drugs. Their brains and other organ systems are constantly developing, undergoing periods of particular sensitivity to damage or disruption.
- Growing children are particularly at risk from BPA exposure and adverse effects on intellectual ability, social behaviors, fertility, and potential for disease may take decades to detect, precautionary measures must be taken to protect children from exposure to products containing BPA that they use everyday

## *BPA Levels in Humans are above Harmful Levels Found in Studies*

- According to the U.S. Centers for Disease Control, 95% of Americans have detectable levels of Bisphenol-A in their bodies
- In a recent CDC study, the observed BPA levels detected—0.1 to 9 parts per billion (ppb)—were at and above the concentrations known to reliably cause adverse effects in laboratory experiments
- BPA is metabolized by the body but the findings provide strong evidence that exposure to BPA is very frequent or nearly continuous

## *Dangers of BPA are Confirmed*

**Bisphenol-A can alter the expression of several hundred genes with effects varying among specific tissues and also depending upon the timing of exposure. More than 130 studies suggest that BPA exposure at very low doses is linked to a staggering number of health problems, including prostate and breast cancer, obesity, attention deficit and hyperactivity disorder, brain damage, altered immune system, lowered sperm counts, and early puberty.**

Although the safe level of BPA exposure set by U.S. EPA based on experiments conducted prior to 1988 is 50 ppb, some examples of effects at significantly lower doses of BPA include:

- *Behavioral changes:* Many laboratory studies show that low-dose exposure to BPA causes behavioral effects, including hyperactivity (at 30 ppb); increase in aggression (at 2 to 40 ppb); changes in response to painful or fear-provoking stimuli (at 40 ppb); impaired learning (at 100 ppb); reversal of normal sex differences in the brain structure and elimination of sex differences in behavior (at 30 ppb); decreased maternal behavior such as reductions in time spent nursing, increases in time resting away from offspring, and increases in time spent out of the nest (at 10 ppb); altered play and other socio-sexual behaviors (at 40 ppb); and increased susceptibility to drug addiction (at 40-300 ppb).
- *Diabetes and obesity:* Low-level, chronic exposure to BPA causes insulin resistance in adult mice. Such insulin resistance leads to Type II diabetes in people as well as hypertension and cardiovascular disease. A recent study shows that even a single dose of BPA at levels currently found in humans can result in altered levels of blood glucose and insulin, and twice-daily exposure for just four days results in insulin resistance. Several studies show an increased rate of postnatal growth in both males and females as a result of maternal doses between 2.4 and 500 ppb per day, and accelerated postnatal growth is associated with obesity, insulin-resistant diabetes, hypertension, and heart disease.
- *Early puberty:* Low-dose exposure to BPA can affect the timing of the onset of puberty. Several studies reveal the early onset of sexual maturation in females occurring at maternal doses between 2.4 and 50 ppb per day.
- *Down Syndrome:* BPA exposure is linked to an error in cell division called aneuploidy, which causes 10-20% of all birth defects in people, including Down Syndrome. In studies with mice, BPA causes aneuploidy even at extremely low doses.
- *Reduced sperm count:* Several studies show that low-dose developmental or adult exposure at levels between 0.2 and 20 ppb reduces daily sperm production and fertility in males.(18) In one such study, low-dose exposure to male rats caused decreased sperm count and affected testicular weight and structure.(19) The authors concluded that "BPA alter[s] spermatogenesis in a linear manner in a dose range which is perhaps relevant to the daily level of exposure in man." An important aspect of this finding is that BPA decreases the levels of testosterone in males.
- *Breast cancer:* Studies show that low-dose BPA exposure stimulates mammary gland development.(20) In one study, scientists exposed mouse fetuses to a daily dose of 250 nanograms per kilogram of their body weight—less than 1% the amount deemed safe for humans in the U.S—causing increased breast tissue development. Higher density breast tissue is a risk factor for cancer. One study author, Dr. Ana Soto, indicated the results lead her to believe that BPA likely increases the risk of breast cancer in humans.
- *Prostate disease and cancer:* Low-dose exposure to BPA can significantly increase prostate size. Several studies show an increase in prostate size due to hyperplasia in male mouse offspring at very low maternal doses. Another study shows extremely low doses of BPA initiate the proliferation of human prostate cancer cells. In addition, exposure to a very low dose of BPA for just a few days after birth predisposes male rats to develop prostate cancer in adulthood.
- *Impaired immune function:* Studies show altered immune function occurring at BPA doses between 2.5 and 30 ppb.
- *Decreased anti-oxidant enzyme levels:* A decrease in antioxidant enzymes (required to protect against cell damage) occurred at the very low dose of 200 parts per trillion (ppt) in adult male rats.
- *Brain damage:* Low doses of BPA can disrupt important effects of estrogen in the developing brain, causing brain damage. In most studies, BPA has been found to mimic the actions of estrogen in developing neurons, but in specific areas of the brain, BPA can have the paradoxical effect of inhibiting the activity of estrogen, which normally increases the growth and regulates the viability of

connections between neurons. The concern relating to this finding is that this type of disruption is associated with impaired learning and memory.

- *Changes in brain chemistry:* Low-dose exposure to BPA causes changes in the brain, including an increase in progesterone receptor mRNA levels at 400 ppb of BPA, increase in estrogen receptor alpha mRNA levels at 40 ppb of BPA, increase in estrogen receptor beta mRNA levels at 25 ppb of BPA, and a change in brain somatostatin receptors at 400 ppb of BPA. These receptors are involved in regulating the brain control systems that coordinate the functioning of the reproductive system as well as reproductive and other social behaviors.

### *Polycarbonate Plastic Breaks Down and Leaches BPA*

- Numerous studies show that polycarbonate plastics break down and leach BPA into food or beverages in contact with the plastic.
- BPA leaching was detected in 12 polycarbonate baby bottles after **dishwashing, brushing, and boiling**. Levels of BPA detected in liquid held in these bottles exceeded 8 ppb.

### **Sources**

<http://www.environmentcalifornia.org/environmental-health/stop-toxic-toys/bisphenol-a-overview%20>