Environmental Case Study

Environmental Estrogens

What might alligators in Florida, seals in the North Sea, salmon in the Great Lakes, and you have in common? All are at the top of their respective food chains and all appear to be accumulating threatening levels of toxic environmental chemicals in their body tissues. One of the most frightening possible effects of those chemicals is that they seem to be able to disrupt endocrine hormones that regulate many important bodily functions. Evidence for this seems quite convincing in some wildlife populations, but whether it also is true for humans is one of the most contentious and important questions in environmental toxicology today.

One of the first examples of hormone-disrupting chemicals in the environment was a dramatic decline in alligators a decade ago in Florida's Lake Apopka. Surveys showed that 90 percent of the alligator eggs laid each year were infertile and that of the few that hatched, only about half survived more than two weeks. Male hatchlings had shrunken penises and unusually low levels of the male hormone testosterone. Female alligators, meanwhile, had highly elevated estrogen levels and abnormal ovaries. The explanation seems to be that a DDT spill in the lake in the 1980s, along with pesticide-laden runoff from adjacent farm fields, has led to high levels of DDE (a persistent breakdown product of DDT) in the reptiles' tissues and eggs. Because of a similarity in chemical structure, DDE appears to interfere with the action of androgens and estrogens, the normal sex hormones.

Researchers have begun to suspect that mysterious outbreaks of health and reproductive problems in other wildlife populations may have similar origins. Immune-system failures that killed thousands of seals along the coast of Europe and Scandinavia in 1992, for instance, are thought to have been caused by high levels of pesticides, PCBs, dioxins, and other toxins in their diet. Similarly, reproductive failures in fish and bird populations in the Great Lakes, fewer turtle hatchlings in farm ponds, abnormal thyroids and dramatic increases in tumors in fish, all are now thought to be related to hormone disturbances by exogenous chemicals.

But are humans affected as well? It is quite clear that people everywhere in the world have accumulated many of these same toxic chemicals in their bodies. Women who eat lots of fish from contaminated waters have been shown to have babies with elevated rates of mental, developmental, and behavioral disorders. Studies of women with estrogen-sensitive breast and vaginal cancers were found to have higher than normal levels of pesticides such as DDE in their tissues. Sperm counts in men appear to have decreased by about 50 percent over the past fifty years, while testicular and prostate cancers have increased dramatically during that same time.

Good evidence exists from controlled laboratory experiments that rats and mice exposed in utero or through mother's milk to very low levels of estrogen-like compounds develop physical, reproductive, and behavioral problems. We know that some of these chemicals act as synthetic hormones, others are antagonists that block normal hormone function. Furthermore, there can be striking synergy between some compounds. When endosulfan and DDT or chlordane are applied together, for example, the combination is 1600 times more estrogenic than either chemical alone.

The question is whether these chemicals are linked to human health problems. Many of these compounds are hundreds or thousands of times less active than normal hormones, leading skeptics to doubt that they have any noticeable effects except in animals exposed to extremely high levels from a chemical spill. Since some effects are positive while others are negative, they could cancel each other out. Furthermore, we may have protective mechanisms that are lacking in highly inbred laboratory rodents, and we can eat a highly varied diet that includes protective factors as well as toxins.

The bottom line is that we don't know (and we may never know for sure) whether falling sperm counts, increasing cancers, birth defects, immune diseases, and behavioral disorders in humans are
caused by endocrine-disrupting environmental chemicals. Of course, we should do more research and testing of the physiological actions of these chemicals. In 1996, the EPA ordered pesticide manufacturers to begin testing for disrupting effects. Given the continuing uncertainty about the dangers we face, what more do you think we should do? Is this threat serious enough to warrant drastic steps to reduce our risk? If you were head of the Environmental Protection Agency or the Food and Drug Administration, how much certainty would you demand before acting to protect our environment and ourselves from this frightening potential threat?