Hormone Mimics (Endocrine Disruptors) In Our Food

Should We Worry?

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Might chemicals that mimic hormones be harming the human endocrine system? From top to bottom: the pituitary gland; the thyroid and parathyroid glands; the adrenal glands atop the kidneys, with the pancreas in between; and the testes (ovaries, in women). The intestines secrete hormones as well.

There has been a scattering of disturbing news reports in the last year or so about abnormalities in animals-- male fish with female sex organs, for instance, and frogs with extra legs. In their search for a cause, scientists are focusing on a class of chemicals called endocrine disrupters. Such chemicals seem to interfere with or mimic the action of hormones and thus may upset the normal growth, behavior, and reproduction of wildlife.

If these compounds are harming animals, scientists ask, are they harming people, too? Some researchers have concluded that they might be. In the past two years, dozens of conferences have focused on the effects of endocrine disrupters. The debate will only get louder with the expected release this summer of the National Academy of Sciences' long-awaited report on endocrine disrupters. Whatever the report finds, Congress has already mandated that, by August, the Environmental Protection Agency present recommendations for screening tens of thousands of chemicals for endocrine-disruptive activity and limiting human exposure to those that pose a problem.

More than a dozen federal agencies and institutes are planning nearly 400 research projects on endocrine disrupters. The chemical industry is funding studies, too. Are endocrine disrupters something to worry about or just another false alarm, like those warnings about a killer asteroid? Here's what scientists know so far, plus our tests of two types of product in which suspected endocrine disrupters are apt to hide--plastic wraps and baby foods.

The ABCs of EDs (Edocrine Disruptors)

Some endocrine disrupters, such as dioxins, PCBs, and various relatives of DDT, are already infamous for the other problems they've created. (See "Prime Suspects," on page 55.) PCBs and DDT were banned in the U.S. in the 1970s, but dioxins are still being released-- they're byproducts of combustion and other processes. All these compounds persist at low levels virtually everywhere--in air, water, and soil. From there, they can enter the food chain, working their way into animals and, eventually, people.

They accumulate in fatty tissue, from which they are released very slowly. Other hormone mimics, less well known, are found in some plastics. To understand how these chemicals work their mischief, it helps to know a bit about the endocrine system, which has the same basic function in animals and humans. It's a complex network of glands (the thyroid, the ovaries or testes, and others) and organ tissues (the intestines) that secrete hormones. Hormones act as chemical messengers, traveling through the bloodstream to affect growth, metabolism, reproduction, and other functions elsewhere in the body.

The endocrine system is finely tuned through delicate checks and balances. Disrupters can throw off the system by sending the wrong signals or blocking the right signals. The effect is often temporary in adults, whose systems are fully developed and fairly stable. Babies and small children are more

vulnerable. And there can be permanent effects on a fetus, whose normal development requires certain amounts of hormones at precise times. Change the amount or the timing, and the individual may suffer problems in behavior, immune function, neurological development, or gender development. As a link between endocrine disrupters and humans is being debated, evidence of a connection between disrupters and animals is mounting.

Animal evidence

Here are some of the bizarre things that have happened to animals:

- In a 1981 laboratory study done at the University of California, Davis, male gulls with a feminized reproductive tract emerged from eggs exposed to levels of DDT and other synthetic chemicals similar to levels found in the wild. Similar gender- bending oddities are today being found in terns off Massachusetts and are likely due, researchers say, to as-yet-unidentified pollutants.
- In 1992, 12 years after the DDT relative dicofol spilled into Florida's Lake Apopka, testosterone levels in the lake's male alligators were just one-quarter to one- half their normal level, and the alligators had shrunken genitals, according to a research team led by Louis Guillette, a University of Florida zoologist. What's more, the lake's female alligators had higher-than-average estrogen levels. "Their eggs were weird looking," says Guillette, "and they didn't hatch, or the young died within the first two weeks." Guillette's team has found a new abnormality in alligators from lakes Apopka and Okeechobee--an alteration in thyroid hormones, which are linked to growth and metabolism. Guillette considers the findings important because scientists think of alligators as a "sentinel" species: Their health reflects the health of their ecosystem.
- In 1995, schoolchildren in a nature- studies class discovered frogs with five legs and other deformities in a pond near Henderson, Minn. Because frogs are another sentinel species, scientists around the country took notice. Subsequent searches turned up frogs with extra or missing legs and grossly deformed webbing elsewhere in Minnesota and in several other states. In Anacortes, Wash., a frog had an eye sprouting from behind its front leg.

Endocrine-disrupting pesticides may be the culprit--or, as some researchers have suggested, the defects might have resulted from exposure to excessive amounts of retinoids, vitamin A-like chemicals that might have come from a natural source like plants in the lake.

Of Mice--and Men?

Given the similarities between animal and human endocrine systems, it's tempting to think that what seems to be harming animals may harm people. "We have to bite the bullet," says Ana Soto, associate professor in cellular biology at the Tufts University School of Medicine. "Whatever we're finding in animals, I think we have to assume that it's very relevant to what is going on in humans." Others are much more skeptical. "I'm not saying let's dismiss everything," Texas A&M toxicologist Stephen Safe told our reporter. "I'm saying, hey, let's back up. The evidence isn't there. Should we do more work? Sure, but let's not go bananas."

mindfully.org note: Safe is an industry sponsored scientist, and very supportive of industry's point of view.

Indeed, there's no proof yet that routine exposure to these chemicals is disrupting the human endocrine system. And conclusive proof may not come. Because people aren't lab rats, researchers may never be able to rule out other possible explanations for any effects they observe. But researchers must keep asking questions. Among them:

Do endocrine disrupters affect intelligence?

When we spoke to scientists and others who believe chemicals are disrupting the human endocrine system, they often cited the work of Joseph and Sandra Jacobson, psychologists at Wayne State University. The Jacobsons have been tracking the developmental and intellectual performance of

children whose mothers regularly consumed Lake Michigan fish before and during pregnancy. Those fish contain elevated levels of PCBs and other contaminants. In September 1996, the Jacobsons reported that the children of fish-eaters showed persistent, measurable intellectual impairment. This finding was highlighted in "Our Stolen Future," the 1996 best-seller that helped kick off public interest in endocrine disruption. But Joseph Jacobson has drawn no conclusion about what particular mechanism might have caused the impairment. In an interview, he called the idea that PCBs disrupted hormone function in the brain before birth "pure speculation." Early brain development, he said, is "such a complex process, and so many things could go wrong, that we just don't have any basis for concluding that it's endocrine related."

Do endocrine disrupters cause genital birth defects?

Quite possibly, say researchers at the national Centers for Disease Control and Prevention. They reported last November that hypospadias, a birth defect in males in which the urinary opening is mislocated--on the underside of the penis or even on the scrotum--doubled between 1968 and 1993, and now afflicts nearly 1 of 100 newborn boys nationwide. "That makes it the most common specific type of birth defect among males," says lead researcher Len Paulozzi.

The defect is thought to result from an inadequate surge of the male hormone testosterone between 9 and 12 weeks after conception. "As you block the fetus's own testosterone, the fetus cannot masculinize itself," Paulozzi explains, "and you wind up getting these various states of feminization of the fetus, of which hypospadias is a mild form." Suspected causes include a fungicide and DDE, a breakdown product of DDT. Also possible, Paulozzi says, is that doctors have simply become better trained at recognizing and reporting less severe forms of the defect.

Do endocrine disrupters cause prostate problems?

Frederick vom Saal, of the University of Missouri, Columbia, exposed mouse fetuses to tiny doses of the estrogen-like chemical bisphenol A, found in plastic dental sealants and food- can linings. The mice that emerged had enlarged prostates overburdened with receptors for testosterone as well as testes that produced fewer sperm than usual. Based on these studies, vom Saal hypothesizes that a corresponding overload in men could lead to increased vulnerability to prostate enlargement and perhaps to a decline in sperm count.

Do endocrine disrupters lower sperm counts?

In 1992, Danish endocrinologist Niels Skakkebaek determined that sperm counts had declined by 50 percent worldwide from 1938 to 1990. He later suggested that PCBs and pesticides, including DDT, may have been the cause. But sperm counts are not down everywhere, said Harry Fisch of Columbia University's College of Physicians and Surgeons in 1996. They varied greatly in different areas, and hadn't declined at all in 25 years in the three U.S. cities he analyzed.

Yet when Shanna Swan of the California Department of Health Services recently reanalyzed Skakkebaek's data, adjusting for regional variations including the type Fisch had found, she discovered an even steeper global decline. Of all the explanations offered so far, Swan says, endocrine disruption seems the "most coherent and best supported by animal data." Over the next few years, Swan, with researchers in Europe and Africa, will be analyzing regional differences in semen quality. They will compare the sperm count of fathers-to-be with their level of sex hormones, steroids, and the time it took their wives to conceive, a sensitive marker of fertility. Stay tuned.

Do endocrine disrupters increase the risk of breast cancer?

In 1995, British investigators reported that some plasticizers, called phthalates, acted as estrogens, enhancing the growth of breast-cancer cells in lab studies. Two years earlier, Mary Wolff, a professor at New York City's Mount Sinai School of Medicine, had studied 58 women and found that the higher the levels of DDE in the blood, the greater a woman's risk of breast cancer.

But follow-up studies failed to find such strong correlation. Last year, Wolff teamed up with Harvard researchers to examine DDE and PCB levels in a larger sample of women. This time, she found no evidence that exposure to those chemicals increased the risk of breast cancer. Now a study has come

out suggesting an association between PCBs and breast cancer--but only for women who have never lactated. Wolff's reaction: "I don't know. Nature's never, never simple." In search of better data The conflicting reports may mean that these compounds don't harm people. More plausibly, they may mean that the scientific tools available are too crude to see any harm that's there.

Indeed, the several studies that have looked for broad, population-wide effects have a built-in limitation: Even people in remote locations, such as Canada's Baffin Island, harbor traces of PCBs, DDT, and dioxins. There are no unexposed "controls" to help highlight the effects of exposure. But research, especially on possible effects in humans, continues.

Soto of Tufts is joining researchers at the University of Granada in Spain to develop precise ways to measure patients' blood and fat for total estrogens, including those originating outside the body, such as from chemical pesticides and plastics. Her team is testing two groups of patients--boys with undescended testes and women with breast cancer--to see whether exposure to environmental estrogens correlates with birth defects or disease. The National Institutes of Health and the Centers for Disease Control and Prevention hope to begin clinical tests that would help them estimate how many Americans harbor traces of chemicals that could mimic hormones.

What's more, the Chemical Manufacturers Association is investing some $4 million to study endocrine disrupters. "We're taking this very seriously," says Jon Holtzman, CMA's vice president for communications. "When a plausible theory is proposed and consumers are depending on the safety of the products we produce, we can't walk away." More work lies ahead--rigorous research on everything from how endocrine disrupters affect individual cells to whether they affect groups of people. Because science progresses by the slow accretion of innumerable facts, a tidy explanation is not likely anytime soon.

Recommendations

Although research indicates that manmade chemicals may be causing problems in wildlife, at least in localized areas, it's too soon to tell whether hormone mimics pose health risks for people. But should we ignore warning signs and simply hope the news will eventually be good?

It makes more sense for government, industry, and individuals to take reasonable steps to limit exposure. The EPA and industry should modify processes that release dioxins, for instance, and the FDA and industry should phase out the use of plasticizers suspected of causing endocrine problems. Such a phase-out is certainly possible: Some plastic wraps already contain no plasticizers. If in the face of all that is still uncertain, you want to reduce your ingestion of the suspect compounds, here are several low-cost strategies that may help: Consider using alternatives to pesticides and insecticides on lawn and pets. Wash fruits and vegetables thoroughly or, better yet, buy organic foods. Limit your ingestion of fatty foods (where the compounds can accumulate). Heed official advisories about fish contamination. And if you reheat food wrapped in plastic, make sure the wrap does not touch the food. The attitude that may serve us all best is one of prudent caution, not blissful ignorance.

Tests of plastic wraps, baby foods

Which suspected endocrine disruptors are in our foods, and at what hat levels? One category: certain plasticizers, which add flexibility to plastic food wraps among other products. Plasticizers can migrate from wraps into foods, especially fatty ones like hamburgers and cheese. We tested four endocrine disruptors in a variety of plastic wraps--both the kind you use at home and the kind store-bought foods come wrapped in--and in wrapped food. We tested a few plastic bowls, too. We also tested meat-based

baby foods for persistent pollutants like dioxins and PCBs. Although adult foods are known to contain these endocrine disruptors, virtually no data have been published on amounts in baby foods--an odd data gap, considering that exposure during infancy could he important.

mindfully.org note: *Please note that the chemicals found mimic hormones which are active in our bodies down to concentrations in the parts-per-trillion range while the testing done by Consumer Reports was at parts-per-million.*
That is a difference of six orders of magnitude or six zeros.

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1 million  = 1,000,000
1 trillion = 1,000,000,000,000
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Wraps: Some Mull problem plasticizers

Of seven national and store brands Of plastic wrap we analyzed *America's Choice*, Dow brands *Saran Wrap, Duane Reade, Foodtown, Glad Crystal Clear Polyethylene, Reynolds Wrap*, and *White Rose*--only *Reynolds Wrap* and *Saran Wrap* contained any of the five plasticizers we looked for.

Would a cooked hamburger that was wrapped in plastic *Reynolds Wrap* or *Saran Wrap* and reheated in a microwave oven absorb plasticizers? Yes, a little bit, our tests showed, but only where the fat contacted the wrap.

It's impossible to say whether a tiny serving of plasticizers is risky. If you want to play it safe, buy one of the wraps we found to be free of suspect plasticizers, or buy any polyethylene wrap. (Polyethylene lacks plasticizers; the product's label should say what it's made of.)

In any case, do as some wrap makers recommended and leave a gap between wrap and food when heating. In fact, that's sound advice at any temperature. Studies have indicated that some migration of plasticizers can occur with refrigerated food, too. That's what we found when we analyzed 14 national and local brands of grocery- store and deli cheese wrapped in six types of plastic. The wraps themselves had a wide range of concentrations of two families of problematic plasticizers, adipates and phthalates. In the cheeses, we found:

- Very heavy migration (50 to 160 parts per million) of the adipate plasticizer DEHA into cheeses in deli cling wrap. People who ate several ounces of this cheese every day could get doses nearly as high as those linked to a host of health problems in lab animals.
- Moderate migration (I to 4 parts per million of the most common phthalate, DEHP, into some of the shrink-wrapped cheeses and into two waxed cheeses with clear plastic overwrap.
- Little to no migration into individually wrapped slices of American cheese or blocks of cheddar in laminated foil wrap.
  Very heavy migration (50 to

We found no plasticizers at all in eight new microwavable Rubbermaid and Tupperware bowls.

Baby foods: No worse than other foods but ...

We tested about 2 dozen meat and poultry baby foods made by Gerber, Beech-Nut, and Heinz for dioxins, PCBs, and related compounds. Like "adult" meats, these baby foods contained substantial traces of the pollutants. The EPA has published what amounts to a limit for dioxin exposure. That guideline is based on the EPA's definition of a negligible cancer risk posed by daily intake over a lifetime, not on any understanding of the potential endocrine-disrupting effects of these chemicals, and it does not account for the likely need for an extra safety margin to protect infants.

Nevertheless, a baby who ate one jar--just 2.5 ounces--of an average meat-based baby food on a given day would consume around 100 times the EPA's daily limit of dioxins. No brand was significantly more contaminated than another.

Does that mean babies shouldn't eat meat baby food?

It's not that simple. Other foods babies might eat instead--even fruits and contain dioxins. Breast milk actually has higher levels than meat baby food--and because most babies drink 2 pints or more of milk a day but eat just an ounce or two of processed baby food, mother's milk is overwhelmingly their largest source of these pollutants.

mindfully.org note: *some studies have found that the mother's breast is still the best source for milk, and that it can reduce the chances of some diseases. In spite of the benefits still outweighing the risk, this is no reason to feel comfortable. Every effort should be made to put pressure on our regulatory agencies to ensure that this vital source of sustenance be made pure as it was once just a few years ago.*

No one would suggest that babies not be breast-fed --the benefits of breast feeding far outweigh the risk involved. But. that doesn't mean the risk is nil. It's becoming clear that babies--who, with fetuses, are thought to beat the highest risk of endocrine-disrupting effects--can't avoid consuming rather startlingly high doses of these compounds. The health consequences of that intake, if any, are unknown. Our results suggest why research on endocrine disruptors, and expanded efforts to keep them out of our foods, deserve to be national priorities.

Reference website: http://www.mindfully.org/Pesticide/Hormone-Mimics-In-Food.htm