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HEAVY METAL BLUES

Mercury on the Brain

THE PREGNANT WOMEN did not worry about their food. They simply ate it: chunks of fresh whale meat and pounds of fish. They ate it because they were hungry. They ate it as their mothers had, as their ancestors had, for centuries. They did not know the meat carried an invisible poison that would damage their unborn babies' brains and disrupt the beating of their hearts.

Today those babies, born on the Danish Faroe Islands in the North Atlantic, are teenagers—and living testaments to mercury poisoning. In two recent papers published in the *Journal of Pediatrics*, Philippe Grandjean, adjunct professor of environmental health at the School of Public Health, has begun unraveling mercury's toxic effect on their brains.

His results confirm that children appear most at risk in the womb, where mercury seems to deform the brain's fragile architecture and upset the maturation and migration of brain cells. But Grandjean also found that mercury could threaten children's nervous systems well into adolescence. "What we are finding out is that mercury is very parallel to lead," Grandjean says. "Such pollutants are particularly worrisome because, once they've done the damage to the developing brain, the child will have to live with that for the rest of his life."

Grandjean's work, one of the first prospective studies of mercury-exposed children, began almost 20 years ago. He and colleagues from Europe and Japan identified 1,022 Faroese children who were particularly vulnerable to mercury because their mothers' diets included pilot whale meat, a traditional—and often highly contaminated—Faroese food. Researchers measured mercury in the pregnant women's hair before the children's births; some had up to 50 times more mercury than the average U.S. mother. When the children were seven years old, researchers measured mercury levels in their hair and blood, measured their heart rates, and tested developmental variables like the speed at which their brains responded to auditory signals. The examinations were repeated at age 14.

Grandjean reports that mercury seems to slow the brain's response to sound. Somewhere along the transmission line—from ear to auditory nerve to brain—the signal is delayed. Some children's autonomic systems also seem less able to regulate heart-rate variations. The changes seem irreparable, Grandjean says. "At age seven, we saw that the more mercury they were exposed to in the womb, the

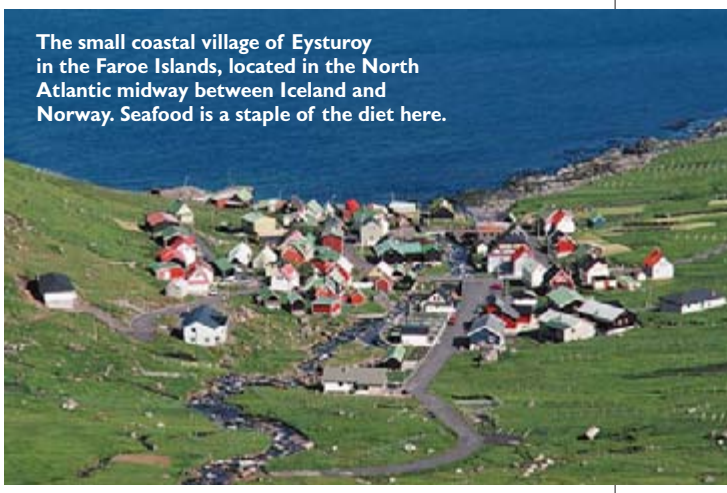
Swordfish and tuna steaks on sale in a supermarket. Ocean predators like these may concentrate mercury in their tissues.

worse they were off in terms of language skills, attention span, motor speed, things like that." Seven years later, there was no evidence that the children's bodies had recovered or compensated for the damage. What's more, the data suggest that as the children matured and began eating mercury-tainted whale meat and other seafood themselves, the brain damage continued—even at relatively low exposure levels. "Our concern is that we are now seeing evidence that the brain's susceptibility is not just limited to the fetal period," says Grandjean. "The brain is still vulnerable throughout childhood and into the teenage period. This is an entirely new observation."

In the United States and other nations, mercury's harmful effects have been known for years. It is outlawed in thermometers and regulated by environmental agencies; pregnant mothers are warned away from potentially contaminated seafood. Still, mercury hasn't fueled the same public outcry as lead, a neurotoxin with a devastating and well-documented legacy. In fact, critics of Grandjean's study charge that there is little cause for alarm because most of the rest of the world doesn't share the Faroese taste for whale.

Grandjean disagrees. First, he says, whales aren't the only animals that "bioaccumulate" the poison. Across the globe, for example, inorganic mercury is belched into the atmosphere in smoke from coal-fired electricity plants and garbage incinerators. (China, for example, fuels its booming economy with a mercury-rich form of coal and is one of the chief mercury polluters.) It returns to earth in rain, where microorganisms absorb it. Small fish graze on the microorganisms; larger fish, like mackerel, eat the grazers; and then top marine predators such as whales, sharks, tuna, and swordfish eat the mackerel. Because this grand digestive process doesn't reduce or expel mercury, it concentrates in fish at the apex of the food chain—where humans often dine. Freshwater fish also accumulate the heavy metal, especially in New England, which has become a landing zone for air-borne mercury from power plants in the Midwest.

Grandjean stresses that his research also underscores a more disturbing picture: of humans adrift in a sea of potentially brain-damaging chemicals they have manufactured but don't fully understand. "This is much more serious than telling pregnant women to avoid eating canned tuna fish," he says. "There are about 150 substances I can recite that are known to be toxic to the human brain. Out of those substances... we've looked at three—lead, mercury, and PCBs [polychlorinated biphenyls]."



The small coastal village of Eysturoy in the Faroe Islands, located in the North Atlantic midway between Iceland and Norway. Seafood is a staple of the diet here.

Grandjean believes other chemicals that haven't yet been thoroughly researched share mercury's toxic traits. He worries that governments and health organizations will be slow to realize new threats to young brains, and he speaks from experience. In the 1970s, as a medical student studying lead poisoning, he sat through government hearings as the United States faced a poison that seemed ubiquitous: in lead-based paints, gasoline, and leaded cans and pipes. It took nearly a decade before meaningful laws were passed phasing the metal out of such products. "There was tremendous resistance to regulating lead," Grandjean remembers. "I also see resistance to regulating mercury. Are we going to take another 20 years to look at another chemical? We have to find a way to use our best judgment and eliminate the types of exposures that can harm the nervous system. You don't get a second chance to build your brain."

—NEIL SHEA

PHILIPPE GRANDJEAN WEBSITE:
www.hsph.harvard.edu/faculty/PhilippeGrandjean.html

THE DAVINCI MODE

Ideas Rain In

In 1675 Isaac Newton suffered a mental breakdown—some modern psychiatrists diagnose him as a manic-depressive—and he was still recovering in 1679. But long before that, Newton had already invented calculus and formulated his law of gravitational attraction. Throughout history, genius and madness have often dwelled together: think of Vincent Van Gogh, William James, M.D. 1869, and, more recently, mathematician John Forbes Nash (portrayed in the book and film *A Beautiful Mind*). Delusional psychosis and inspired creativity, ostensible antipodes of human experience, ironically also seem to be next-door neighbors. Over the centuries, thinkers have wrestled with this enigma, usually on a purely speculative basis. Now, a new empirical study suggests a specific style of cognition shared by those who hear the Muse and those who merely hear voices. The research also suggests variables that distinguish the two groups.

In a paper published in the *Journal of Personality and Social Psychology,* lecturer on psychology Shelley Carson, Ph.D. '01, Harvard graduate student Daniel Higgins, and Jordan Peterson of the University of Toronto (formerly assistant professor of psychology at Harvard) focus on "latent inhibition," a cognitive mechanism discovered as a result of experiments with animals in the late 1950s. La-

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