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## Is the World Making You Sick?

The chemicals in our everyday lives are, argues immunologist

**Claudia Miller.**

By Jill Neimark July 24, 2014

In 1962, physicist and historian Thomas Kuhn proposed that science makes progress not just through the gradual accumulation and analysis of knowledge, but also through periodic revolutions in perspective. Anomalies and incongruities that may have been initially ignored drive a field into crisis, he argued, and eventually force a new scientific framework. Copernicus, Darwin, Newton, Galileo, Pasteur—all have spearheaded what Kuhn has called a “paradigm shift.”

Thomas Kuhn is Claudia Miller’s hero. An immunologist and environmental health expert at the University of Texas School of Medicine in San Antonio, and a visiting senior scientist at Harvard University, Miller lives by Kuhn’s maxim that “the scientist who embraces a new paradigm is like the man wearing inverting lenses...[he] has undergone a revolutionary transformation of vision.”

Miller has spent 30 years hammering out a theory to explain the contemporary surge in perplexing, multi-symptom illnesses—from autism to Gulf War Syndrome—which represent a Kuhnian shift in medicine. She calls her theory “TILT,” short for Toxicant Induced Loss of Tolerance.

TILT posits that a surprising range of today’s most common chronic conditions are linked to daily exposure to very low doses of synthetic chemicals that have been in mass production

since World War II. These include organophosphate pesticides, flame-retardants, formaldehyde, benzene, and tens of thousands of other chemicals.

### *TILT shows how a person can have a toxic exposure and never recover.*

TILT, says Miller, is a two-step process. Genetically susceptible individuals get sick after a toxic exposure or series of exposures. Instead of recovering, their neurological and immune systems become “tilted.” Then, they lose tolerance to a wide range of chemicals commonly found at low doses in everyday life and develop ongoing illnesses.

Along with Nicholas Ashford,<sup>1</sup> professor of policy and technology at the Massachusetts Institute of Technology, Miller co-authored *Chemical Exposures: Low Levels and High Stakes*. In 2012, Miller and her colleagues published a study in the family practice journal *Annals of Family Medicine*. They reported that 20.3 percent of individuals with chronic health issues suffer from some degree of chemical intolerance. That’s one in five—and, says Miller, they become vulnerable to TILT if they endure too much toxic exposure.

Miller is currently working with scientists at Harvard to inform a new generation of studies to document TILT. Her theory has been controversial, particularly for its idea that low-dose exposures, below the accepted toxic threshold, can be disabling. Yet in conversation with *Nautilus*, Miller was open and friendly, never defensive, even when presented with her critics.

### **You state TILT is the third major theory of human illness, after the germ and immune theories. That’s a bold conjecture. What exactly do you mean by that?**

The germ theory is an example of a “Kuhnian” revolution in science. Because of germ theory, we changed the way we conduct surgery, prepare and preserve foods, treat wounds, or even cover our mouths when we cough. We have a unifying explanation for a stunning variety of symptoms, all caused by different germs with different propensities.

But many illnesses remained that couldn’t be explained by germs alone. The next revolution was immune theory. We discovered antibodies, antigens, and immunoglobulin. Antigens are molecules, such as microbes or pollens, which provoke an immune response. Antibodies are the molecules your body crafts to bind to and inactivate those antigens. Once we discovered them, we gained new insight into conditions like rheumatoid arthritis or asthma.

Today, a novel class of illnesses is on the rise, and neither theory sufficiently explains it. TILT shows how a person can have a toxic exposure and never recover. Exposures trigger a bewildering array of symptoms that many people never trace back to synthetic chemicals in their daily life.

They may experience cardiac and neurological abnormalities, headaches, flu-like symptoms, bladder dysfunction, asthma, depression, anxiety, pain, cognitive dysfunction, and sleep disorders.

**Even if your theory makes sense, what proof is there? Germs can be seen and studied and treated, and the immune system's different products can be measured and tweaked as well.**

There are several types of proof. Nick Ashford and I observed the same patterns of inexplicable new-onset intolerances across very different toxic exposures in over a dozen countries. Sheep dippers using organophosphate pesticides in rural areas of Europe, radiology workers inhaling chemicals while developing films in New Zealand, Gulf War veterans, EPA workers in a remodeled and poorly ventilated office building in 1987, cleanup crews breathing fumes after oil spills. Many would get ill, and a small percentage never recovered. They became exquisitely sensitized, as well as disabled. The second type of proof is what happens when TILT-ed individuals avoid exposures. They begin to get better, even if they don't completely recover.

**How do we know chemicals wreak havoc with our immune systems, especially at low doses?**

There are studies in rats bred to be uniquely sensitive to organophosphates, which are extremely potent pesticides. After exposure they exhibit abnormal sleep and increased sensitivity to many other chemicals. There might be humans who are like those rats—genetically susceptible to organophosphate poisoning.

There is also good evidence that toxicants like solvents, pesticides, or volatile molecules from oil spills can travel straight into the brain via the olfactory receptors studding the inner lining of our nose. Animal studies show that intermittent lower-dose exposures can be as toxic as a single higher-dose exposure. If an individual has had too much exposure, sensitization could possibly lead to permanently increased reactivity to chemicals via the limbic system in the brain.

*It literally blew my mind. There would be depression, vomiting, and cognitive dysfunction.*

There might well be changes in gene expression and cell receptor sensitivity due to ongoing chemical exposure, but while those are very plausible, we don't really know for sure yet. It remains an open question for research. In terms of discovering the underlying mechanism of TILT, we are at a very early stage of understanding.

**If we are sensitive to such low doses of common chemicals, how can we ever manage to avoid them all?**

Let me tell you the story of the EMU, and how it changed my life and set me on this path. EMU is short for Environmental Medical Unit, a term coined by a heretical genius, allergist Theron Randolph. He would put patients on an allergy elimination diet and have them stay in an EMU he'd constructed, a non-toxic room with highly filtered air. He invited me to sit in and observe patients with him. Over the course of days, the patients' symptoms would melt away, and once they felt better, he'd start introducing foods or chemicals, blinded, one at a time. The responses completely shocked me. He would put copy paper in a jar and the exposure level would be so low, and it literally blew my mind that low exposures like that could cause symptoms. There would be depression, vomiting, and cognitive dysfunction. It was as if the whole picture of the disease returned. Once the patients knew what they were sensitive to, they could avoid those foods and chemicals.

### **Is there a link between pollution, chemical sensitivity, and increased allergies?**

Research shows a link between chemical exposure and increased allergic response. In guinea pigs, short term exposure to sulfur dioxide, an air pollutant, increased allergic sensitization of the airways. And the Japanese have found that diesel exhaust increases the production of a type of immunoglobulin called IgE, which binds to allergens and plays a major role in allergic disease. There are numerous studies on that, and anecdotal evidence that the widespread, debilitating Japanese cedar pollen allergies we see now did not really show up until the 1960s, as diesel pollution rose.

*Doctors ask about sexual history, smoking, drinking, but never about chemical exposures.*

### **What's a possible mechanism for this?**

Diesel contains ultrafine particles that don't just get into the lungs: They actually are taken up by the olfactory bulb in the nose, which has neurons feeding directly into the limbic system of the brain. As I mentioned before, that kind of constant chemical assault may turn the gain up on the limbic system's "amplifier." Perhaps that sets it to fire more easily in response to pollens as well.

**The idea that one can be "allergic" to chemicals, or experience hypersensitivity responses to extremely low dose exposures, hasn't been well received by your peers.**

Actually, there have been two waves of responses. The initial response was very negative. But that's understandable. When IgE was first discovered, it put science into allergy. Until that time the academic world looked at allergy shots as voodoo medicine or witchcraft. The original definition of allergy was very broad: It was simply altered reactivity, of whatever origin. Then antigens and antibodies were discovered. That was when allergists gained credibility. So allergists

were very leery of losing that credibility. But lately, I haven't heard the same dissent. There seems to be a new generation of allergists and other physicians who are more accepting of the role chemical exposures play in health.

### **Many of us today live or work in cities with diesel pollution and all kinds of chemical exposures. What are we to do, short of setting sail for the nearest desert island?**

The best treatment is avoidance, which I realize is extremely difficult to carry out. Once a person is TILT-ed, they may always be vulnerable, and may never fully recover. We have introduced innumerable chemicals since World War II and many of us are not able to adapt fast enough.

However, we can take steps to prevent it. We live 90 percent of our lives indoors, inside homes, offices, and cars. And indoor air is far more polluted than outdoor air. So we can begin with our home and office, by reducing chemicals there. Reduce scented products, reduce or eliminate indoor pesticides. If you're remodeling, you can use no-VOC paints, and tile or wood instead of carpet. Make sure you have good air circulation. Don't be enamored of that "new car" smell—a car a few years old is much healthier. And go outdoors; try to get into nature, even if a city park. Outdoor air is usually better for you.

I know that's not enough of an answer, of course. Sometimes I get very discouraged when I see the suffering out there. I get so many inquiries from patients, but I do not treat patients, and I have very few physicians to refer them on to. The best I can do is try to increase awareness, especially among physicians, because there is good evidence that early in the process, TILT *can* be reversed. I have developed [a validated questionnaire](#) that physicians can give patients. I believe a history of chemical exposures should be part of the patient consult. Doctors ask about sexual history, smoking, drinking, but never about chemical exposures. If they did, they might end up wearing Kuhn's magical inverting lenses, and see their patients' medical histories in an entirely new way.

*Jill Neimark is an award-winning science writer based in Atlanta, and a contributing editor at Discover magazine. Her most recent non-fiction book, co-authored with bioethicist Stephen Post, is Why Good Things Happen to Good People.*