

Jean suggested you might be interested in my experiences with Dow Chemical Company.

The following will describe what the bruhaha. In a follow-up email I'll describe subsequent developments and my vindication.

The bruhaha.

This story is about how I ran afoul of a major chemical company by showing their animal models for human exposure to chemicals were inaccurate---dogs, cats, and rats pee but they don't sweat. If that intrigues you please read on.

In 1979 I worked as a chemist with the United States Department Agriculture, Agricultural Research Service (ARS) in Albany, CA, and I was thrilled when I was selected to manage a project to study agricultural worker exposure to a widely used herbicide called 2,4 D. The project was based at an ARS lab in Yakima, WA and during a preliminary meeting there with staff from D.C. I was told that my mission was to show that 2,4 D is safe to use. This was the first and only time I was given a mandate on the results of a research project, and I vowed to ignore it.

While studying aerial applicator exposure to the chemical a pilot told me that after his evening shower his wife said he smelled fishy like the amine salt of 2,4 D he sprayed. His statement intrigued me. When I returned to the lab, I put a minuscule amount of that chemical on my palm and had a coworker swab the back of my neck periodically over a time course. Analysis of the swabs showed that the chemical was being excreted through my skin within minutes of the exposure. I repeated this and similar experiments over the next few months until I was convinced that the results were valid. Literature at the time, mostly from the manufacturer, claimed dermal exposure was excreted in the urine but their research was based on non-perspiring animals such as rats, dogs, and cats. The only animals that perspire to a significant extent are the higher primates.

This finding was newsworthy, so I decided to present the results at the 1982 American Chemical Society (ACS) meeting. Approvals to give the presentation were quickly granted by the ARS and within days they attempted to revoke them. Apparently, the manufacturer got wind of what I was going say and brought pressure on the ARS to stop me. Their wish to suppress this information was understandable because 2,4 D is a component of Agent Orange which was heavily litigated by Vietnam Veterans at that time. Fortunately for me they were unsuccessful because a synopsis of the meeting had been published and it would have been too embarrassing to deny me the right to speak. The schedule for the ACS meeting was surreptitiously altered, however, so that I gave the last presentation on the last day of the meeting. When I returned to the laboratory my project had been canceled and I was told that I could not publish the results in a scientific journal. I very nearly lost my job.

In the intervening decades I often wondered why other scientists haven't reported on this phenomenon but now I finally feel vindicated. A number of scientific studies in recent years have identified sweat as a major pathway for the eliminating of toxins from the human body.

Ron Sell  
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## Subsequent developments

The internet is replete with articles arguing that sweat does not remove either toxins or toxicants from the human body. These claims are tenuous at best because they aren't specific about their analytical methods or the chemicals they looked for and defined as toxins. I question whether these researchers have the specialized equipment and training necessary to analyze for a broad range of chemicals that could be called toxins. Analysis of chlorinated pesticides in sweat, for example, requires analytical equipment and training that medical laboratories might lack. As I've stated in my previous email, the following authors have shown that chlorinated pesticides are found in higher concentrations in sweat than in urine or blood.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5069380/>

A recent online article indicates that sweat can play a major role in eliminating toxic elements from the human body.

<https://pubmed.ncbi.nlm.nih.gov/21057782/>

Quote from this article: *“Many toxic elements appeared to be preferentially excreted through sweat. Presumably stored in tissues, some toxic elements readily identified in the perspiration of some participants were not found in their serum. Induced sweating appears to be a potential method for elimination of many toxic elements from the human body. Biomonitoring for toxic elements through blood and/or urine testing may underestimate the total body burden of such toxicants. Sweat analysis should be considered as an additional method for monitoring bioaccumulation of toxic elements in humans.”*

More recent research studies have shown that phthalates and bisphenol A, which are used to make plastics, were found in higher concentrations in sweat than in urine.

<https://pubmed.ncbi.nlm.nih.gov/23213291/>

Quote from this article: *“Some parent phthalates as well as their metabolites were excreted into sweat. All patients had MEHP (mono(2-ethylhexyl) phthalate) in their blood, sweat, and urine samples, suggesting widespread phthalate exposure. In several individuals, DEHP (di (2-ethylhexyl) phthalate) was found in sweat but not in serum, suggesting the possibility of phthalate retention and bioaccumulation. On average, MEHP concentration in sweat was more than twice as high as urine levels.”*

<https://pubmed.ncbi.nlm.nih.gov/22253637/>

Quote from this article: *“BPA was found to differing degrees in each of blood, urine, and sweat. In 16 of 20 participants, BPA was identified in sweat, even in some individuals with no BPA detected in their serum or urine samples. Biomonitoring of BPA through blood and/or urine testing may underestimate the total body burden of this potential toxicant. Sweat analysis should be considered as an additional method for monitoring bioaccumulation of BPA in humans. Induced sweating appears to be a potential method for elimination of BPA.”*

It's understandable that pesticide manufacturers and pharmaceutical companies might be uninterested in pursuing this avenue of research. They have spent decades creating pharmacokinetic models of their pesticide or drug that are based on animals that pant and don't sweat. These models were then

extrapolated to humans, and their research might be called into question if sweat is found to be a major excretion route for their products.

I hope future research will shed more light on the relative importance of sweat for ridding the human body of toxins. It might be possible to find compounds (biomarkers) in a skin swab that could be correlated to the presence of a disease. For example, chloride has been determined to be the sweat biomarker for the diagnosis of cystic fibrosis. More biomarkers might be identified through the careful analysis of the compounds in the sweat from patients with specific diseases. A summary of recent research in this area can be found in the following article.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6773238/#:~:text=Eccline%20sweat%20is%20mostly%20water,and%20the%20eccline%20gland%20itself.>

Quote from this article: *“There has been considerable interest recently in the use of sweat as a non-invasive alternative to blood analysis to provide insights to human physiology, health, and performance. The development of wearable devices and sensing techniques for sweat diagnostics is an expanding field. Perhaps the best example of a sweat biomarker is the use of sweat [Cl] for the diagnosis of cystic fibrosis, although this practice is not new.*

*In summary, while the notion of a non-invasive tool for real-time hydration, nutrition, and health monitoring is attractive, more research is needed to determine the utility of sweat composition as a biomarker for human physiological status.”*