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Gary Gill Deputy Director
Environmental HealthAdministration
State of Hawaii Department of Health
HEER Office
P.O. Box 3378
Honolulu, HI 96801

Dear Mr. Gill:

Thank you for your letter of December 27, 2001. Your letter gives me great concern about the competency and intentions of the Department of Health.

You state that the DOH is "more convinced" that this use of caffeine will not pose a health threat to the people of Hawaii, and base this new confidence on the assumption that caffeine from the spray or its residues will not be absorbed by skin. Your letter provides no scientific justification for this higher level of comfort with caffeine spraying. Has the DOH performed any studies, or become aware of any studies, of the rate of caffeine absorption by human skin, particularly of the concentrations of caffeine being proposed? My guess is that there are no such studies, and your conclusions are, at best, wishful thinking.

Your new comfort seems to rely on the belief that skin is totally impermeable to caffeine. You erroneously state that, "In order to pass through the skin, a substance would have to be nonpolar, uncharged, and able to dissolve in fats or lipids, since a cell membrane is made of lipids. However, caffeine is polar, charged, and cannot dissolve in fats or lipids." You then conclude that caffeine can therefore not enter the skin, making people safe to residue exposure, a conclusion that even the EPA is not willing to make.

Ironically, the purpose of this spraying of caffeine is to kill frogs, which happens when the concentrated caffeine is absorbed through the frog's skin. According to your ridiculous argument, frog skin should be impermeable to the caffeine, which is clearly not the case.

These are your errors. Cell membranes are not only composed of lipids, but also contain proteins that span the cell membrane and form channels through which charged, polar particles can pass. Sodium, chloride, potassium and other charged ions are constantly moving across cell membranes via these channels, which are also called membrane pores. Water and other polar particles also move across membranes through pores. There are also transport proteins specific for certain molecules that regulate and facilitate their movement across the cell membrane. In short, your model of the cell membrane as an impermeable fat layer is completely against the modem conception of the cell membrane. Life could not be possible if cell membranes were as you describe them.

Secondly, we are not just talking about cell membranes, but of the skin being exposed to caffeine residues. The skin is composed of many pores, some leading to sweat glands, others leading down hair shafts. A solution of caffeine on the skin could easily work its way down these pores, reaching deeper layers of skin, and making possible the absorption of the caffeine into skin lymphatic vessels, which ultimately empty into the bloodstream.

You should realize that caffeine is an alkaloid, and has similar chemical properties to another alkaloid, nicotine. Like caffeine, nicotine is water-soluble. According to your faulty reasoning, nicotine should not be able to get across cell membranes, and, therefore, could not get into the skin. However, nicotine is used in dermal patches for smoking cessation, since it does, indeed, go through the skin. Caffeine does the same thing.

Of course, this applies to healthy and intact skin. If someone has a skin irritation or inflammatory disease, such as foot fungus or an open cut, the skin in contact with the caffeine residue would more easily absorb the caffeine. What you are (conveniently?) ignoring is that the absorption of substances across the skin relies, to a large extent, on the integrity of the skin barrier. As anyone in medicine should know, inflammatory and other disease processes of the skin increase the absorption of substances through the skin, including caffeine.

In addition, by your own admission, the concentration of caffeine used causes skin irritation, which is why applicators need to use protective clothing. Irritation is an inflammatory process. This means that caffeine irritation of the skin can itself increase the permeability of the skin to the caffeine. So your model of caffeine being completely excluded from the skin is extremely over simplistic and wrong. (By the way, in addition to my medical training at the University of Texas Medical Branch (UTMB) at Galveston, I have a Master's Degree in biochemistry from Duke University. The structure and biochemistry of the cell membrane was one of my specialties.)

We have ignored in the above conversation the concentration of caffeine being applied to the skin. The kinetics of absorption changes with concentration of substrate, so conclusions on low caffeine concentrations would not necessarily apply to high concentrations. This reflects the experimental nature of this caffeine proposal. Prior exposure of human skin to caffeine was limited to the occasional spilled coffee cup. Humans have never before had skin exposure to these toxic concentrations of caffeine, which are roughly 100 times more concentrated than in coffee. Perhaps you and other supporters of this caffeine experiment could volunteer to have your feet or hands soaked in concentrated caffeine solution to study the kinetics of its absorption. At least there would then be a scientific study behind your opinions, and all the research subjects could offer informed consent, something that the public is not being allowed in this process.

In addition to your misinformed view of the skin and cell membranes, you have expressed an alarming ignorance of now a poisonous substance can enter the body. You mention skin absorption through bare feet as the only way people can be exposed to the poison residues. You ignore the fact that caffeine residue can enter the mouth by way of the hands. When an animal, such as a dog, runs through a recently sprayed area, petting of the animal by its human owner, which could be a toddler, pregnant woman, senior citizen with heart disease, or other high risk person, could transfer the caffeine from the animal to the owner's hands. Any hand contact can lead to mouth contact and the ingestion of the caffeine. In fact, touching any object in the sprayed site potentially exposes humans to ingestion of the caffeine. Since this residue may consist of caffeine crystals, as you state, the

amount of poison thus consumed may be high enough to be life threatening, Your letter states that the EPA's restrictive spray zones protect those most at risk, such as pregnant women, toddlers,, infants and other sensitive groups from inhaling or swallowing the caffeine. I cannot see how these restrictions provide adequate protection. The allowed spray zones include parks and residential areas, which are frequented by the very population groups most at risk of caffeine poisoning, and allows public access after 24 hours, with residue still present. You have conveniently ignored my last letter's comment about this inadequate 24-hour limit and its arbitrariness, since no study proves 24 hours a safe limit for area quarantine. Even the EPA admits it does not know the length of time residues will pose a threat to human health.

You conclude your letter with the statement, "... caffeine that originates from this frog control project cannot enter the body and affect internal organs or cause nuitagenicity or teratogenicity." This statement is completely unfounded by scientific research and, as I have just explained, ignores other ways by which the caffeine can enter the body. It is a conclusion one could only draw after doing many carefully controlled experiments, and repeating them several times You cannot make this statement with the paucity of evidence available to date. And you cannot use the public as unwilling guinea pigs for these experiment, as is currently proposed.

I can understand, but not condone, your position if the DOH was somehow invested in this caffeine spraying. It still would not make your position scientifically or medically sound. But it would explain why you are trying so hard to justify a potentially disastrous experiment with the people of Hawaii. As I have said before the role of the DOH should be to prevent unnecessary health risks to the people of Hawaii. Your efforts to rationalize spraying, instead of insisting on public safety reflect, poorly on your department's intent, and your fallacious arguments make me seriously question your competency to serve as a health official.

Is this caffeine experiment a justified health risk for the people to assume, even without their consent? Keep in mind that this caffeine experiment is to simply try to control frog numbers, and will not eradicate them. In addition, the frogs are not a health threat. The fact that the frogs eat mosquitoes makes the frogs a health ally. Caffeine application however, is a health threat one even acknowledged by the EPA, regardless of whether your department has become comfortable with the risks.

If frog reduction is the goal of the DOA, then let them come up with a proven safe method that poses no threats to humans or the environment. Your role should he to safeguard human health. The DOH should stop holding hands with frog exterminators and begin defending the people of Hawaii from this ridiculous and dangerous experiment

Sincerely,

Sydney Ross Singer MedicalAnthropologist
Director, ISCD
Director CHIRP (Coqui Hawaiian Integration and Reeducation Project)