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OBSERVATORY

## Chlorinated Paintings

By [HENRY FOUNTAIN](#)

There's nothing like a good layer of volcanic ash to preserve things. In Pompeii, which was buried by the eruption of Vesuvius in A.D. 79, even loaves of bread have been found beneath the pumice.

But once items are excavated, deterioration can begin. That's the case with many of Pompeii's wall paintings, particularly those made with cinnabar, a deep red pigment containing mercury sulfide. Since being exposed to the air in the past several decades, cinnabar frescoes have darkened considerably.

Art preservationists have been uncertain why the degradation occurs, but have suspected that sunlight causes the mercury sulfide to change crystalline phases, to a form called metacinnabar.

But [an analysis](#) using the European Synchrotron Radiation Facility in Grenoble, France, shows that there is no metacinnabar to be found. Instead, Marine Cotte of the synchrotron facility and colleagues found two other degradation processes at work, probably caused at least in part by chlorine.

The researchers had not intended to study Pompeiiian frescoes, but had reserved seven days on the synchrotron for another project. They finished after one day, however, so they had extra time. "One of the Italian researchers had some samples from Pompeii, so we decided to make an analysis," Dr. Cotte said.

The technique uses X-rays to cause the samples to fluoresce, and these emissions are analyzed using a spectroscope to determine the samples' composition. The researchers, whose findings were reported in the journal *Analytical Chemistry*, found that chlorine had combined with mercury to create various grayish compounds. But they also found gypsum, or calcium sulfate, in black areas of the samples. It may have formed from the calcium in the mortar, combined with sulfur released by the action of the chlorine on the pigment.

Dr. Cotte said the chlorine itself probably came from the Mediterranean salt air or from "punic wax," beeswax boiled with seawater that Pompeiiians used to coat the paintings.

Cleaning the paintings will be difficult, Dr. Cotte said, but at least conservators now know how to proceed. And she said she was glad the original project had taken so little time, allowing her team to study the Pompeiiian work. "This was scientifically much more interesting," she said, "because the answer was very difficult to get."

### Courtship With a Twist

When it comes to courting, the males of many species are show-offs. They like to flaunt some attribute like a colorful fan of plumage or a puffed-out throat — the kind of thing that says "choose me" to a potential mate.

But some courtship displays are not so straightforward. And that of the northern swordtail, a small freshwater fish, is especially perplexing, researchers have found. It's not meant for a female at all, they say, but for other males.

During courtship, a male swordtail swims alongside a female and raises a large sail-like fin on its back. But Heidi S. Fisher and Gil G. Rosenthal of [Boston University](#) discovered that in experiments, most females were actually attracted to males with small fins.

So why would males go to all the trouble of displaying something that potential mates wouldn't like? The answer, the researchers [report](#) in the journal *Biology Letters*, lies in the effect on potential competitors. Other males became intimidated in the presence of a male displaying a large fin.

Given that females find large fins unattractive, another option for the male would be to keep its fin completely under wraps. But the researchers suggest a reason they don't: swordtails live in close proximity, with hundreds of males and females in a small area, so it's worthwhile for a male to raise his fin to keep the competition at bay.

Then again, if males with larger fins are more dominant than other males, why aren't females attracted to them? Although a large-finned male may be more successful in competing against other males, that doesn't necessarily translate into advantages for the female. Male swordtails don't care for the offspring and don't hold territory that might be useful for a female to have. And mating with a more aggressive, competitive male may increase the female's risk of being harmed.

### Built-In Mosquito Repellent

For many frog species in the tropics, the first line of defense against predators is poisonous secretions in the skin. Among these alkaloid compounds are a group known as pumiliotoxins that appear to work on contact. Ants and spiders that bite a frog with the toxin let go immediately.

But what about bugs that fly and bite? Paul J. Weldon of the [Smithsonian Institution](#)'s Conservation and Research Center in Front Royal, Va., and colleagues have now shown that pumiliotoxins function as mosquito repellents, too.

In lab tests reported in *The Proceedings of the National Academy of Sciences*, the researchers found that a pumiliotoxin called PTX 251D applied to a silicone membrane reduced landing and feeding by *Aedes aegypti*, the mosquito that carries the yellow fever virus. For those mosquitoes that had the misfortune to land, the compound had a toxic effect: they failed to fly off again.

The researchers found that this compound worked at very low concentrations, as low as one-tenth of a microgram per square centimeter. This, they calculate, is well below the level found on the skin of most poisonous frogs.

### Barbiturates in the Water

People of a certain age may remember when barbiturates were the drug of choice for use as sedatives and anticonvulsants. Over the past four decades they have been all but swept aside by safer alternatives like

Valium.

But barbiturates can still be found — in surface water, according to researchers in Germany.

Thomas P. Knepper and colleagues at Europa University of Applied Sciences in Idstein developed a method to detect traces of barbiturates in water. They sampled water from several German rivers and found barbiturates in only one, the Mulde, near Leipzig in the east. The findings were reported in the journal *Environmental Science and Technology*.

The researchers are unsure how the barbiturates came to be there, but suggest a couple of possibilities. Barbiturates are still manufactured, mostly for veterinary use, so the source could be an industrial one. The compounds also do not degrade very quickly, so they may come from an old contaminated site.

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