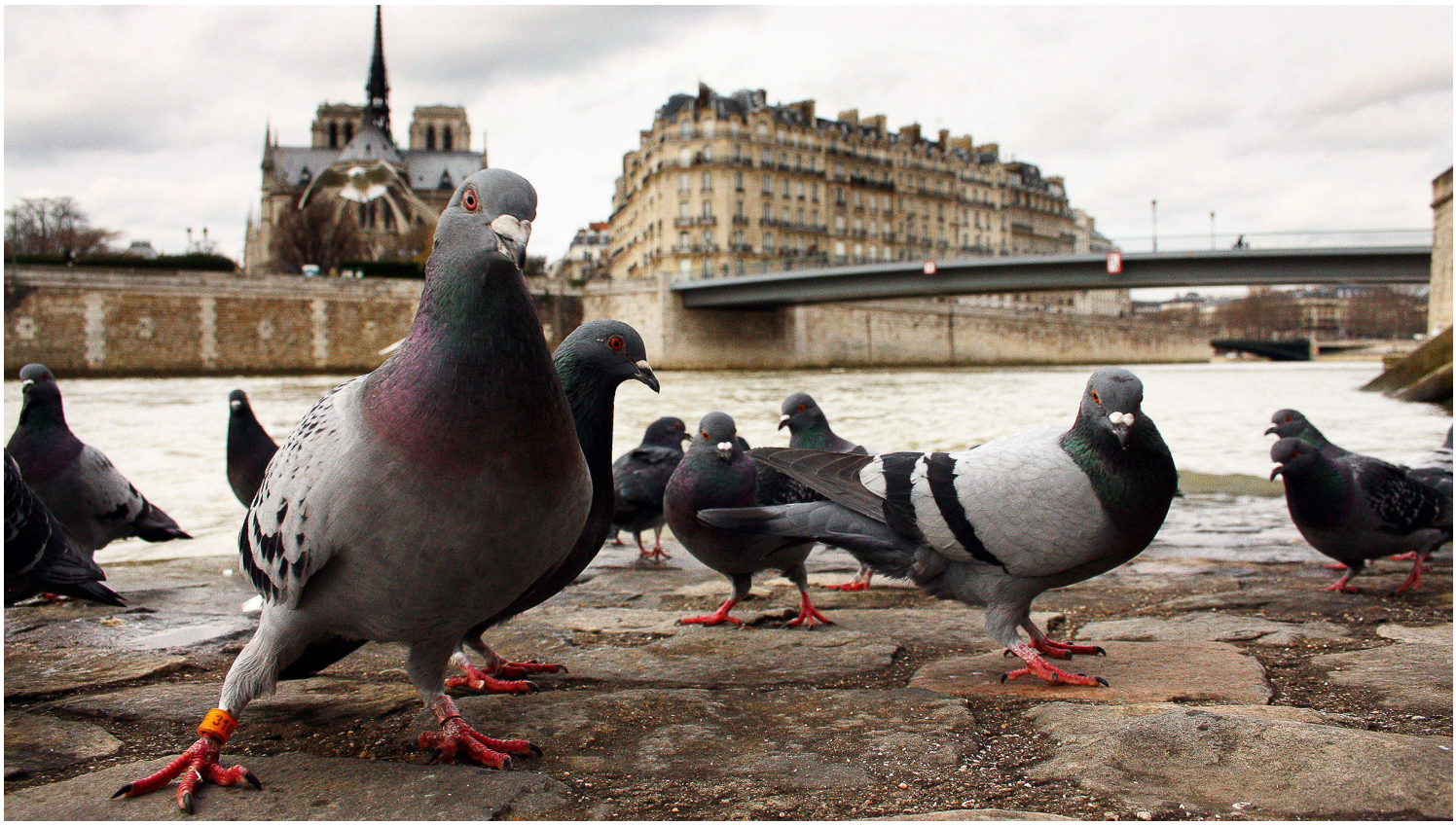

Rock Pigeons on the Seine river in Paris. Photo: Olivier Ortelpa/Flickr CC (BY-NC-ND 2.0)

Science

Are Tanner Birds More Immune to Poisons?

A new study unveils how Parisian pigeons could be using their feathers to ward off trace metals in the environment.

By Jason G. Goldman
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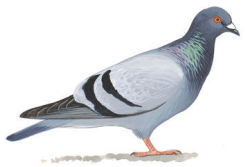
Birds in This Story



Rock Pigeon

Columba livia

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If you spend as much time watching pigeons as Marion Chatelain, you might notice something different. To the untrained eye, they may look like pinheaded blobs—but to Chatelain, there's much more nuance between them. Over the years, the ecologist at Pierre and Marie Curie University discovered that pigeons living in the heart of Paris tend to have slightly darker plumage than those living in the suburbs. Other scientists have noted this trend, Chatelain says, but no one has been able to fully explain it. So, she decided to launch her own study—the results of which will be published in next month's issue of *Global Change Biology*.

Chatelain hypothesized that birds with darker feathers would test higher for trace metals than birds with paler plumage—a pattern previously observed in White-tailed Eagles and in Barn Owls. Pigeons get their grayness from a molecule called melanin, which produces blacks, browns, and every shade in between. But melanin is far more than just a pigment: Scientists think it serves as an antidote against toxic trace metals in birds.

Here's how it works. Melanin molecules have a special biochemical structure that allows them to bind to tiny metal ions that invade the blood stream. The metals are then driven out to the bird's feathers, where they're eventually shed through wear and molting. Additionally, genes that result in the creation of melanin are related to ones that produce adrenaline, meaning that feather coloration and stress-response systems are tightly coupled. If a population is exposed to a taxing urban environment, its adrenalin levels may adjust over many years, leading to changes in coloration as well. Chatelain believed that this was how the pigeons in Paris developed their darker plumes. Now, she just had to prove it.

During the winter of 2013, Chatelain and her colleagues trapped 96 adult feral pigeons from several flocks in Paris and transferred them to outdoor aviaries at a nearby research station. The researchers assessed the birds' coloration, and then randomly separated them into four groups. One sample was given plain tap water, a second was given water with trace amounts of lead (1 part per million), a third was given water with trace amounts of zinc (10 parts per million), and a fourth was given water with traces amounts of both metals. (The solutions were all non-lethal.)

In some ways, the results were unsurprising. Darker birds that drank the tainted water tested higher for the two metals. The real question, however, was whether melanin-rich birds fared better after being exposed to lead. In general, lead contamination caused pigeons to lay eggs with thinner shells, and lowered fledging rates among chicks. On the other hand, zinc exposure made birds healthier: Their eggs had thicker, sturdier shells, and their chicks were born with increased levels of white blood cells.

But there was one twist: Darker adults that were exposed to lead weren't any healthier than lighter ones. In fact, the only birds that showed better survival rates

were darker juveniles—borne from wild-caught parents—that were part of the lead-tested groups. The reason, Chatelain says, could be because juveniles shed their plumage several times a year, while adults only replenish theirs once. “Feather renewal may not be sufficient to decrease trace metal level in blood and organs [of adults] when trace metal exposure is high," she says. Another possibility is that only pigeons that can withstand some lead poisoning make it to adulthood. This could level the survival advantage among birds, regardless of how much melanin they have in their feathers.

Chatelain also points out that lead isn’t the only toxin that threatens urban birds. The animals are often forced to contend with a cocktail of trace metals—some poisonous and some not; the elements can even cancel each other out. Indeed, in Chatelain’s experiment, zinc was found to mitigate some of the negative effects of lead.

Yet even if the link between darker feathers and lead resistance seems strong, “it doesn't mean that melanism evolved for this purpose," says Lausanne University biologist Alexandre Roulin, who was not involved in the study. "But it can give us a prediction of how animal populations might evolve in the future. We could expect that animals might become blacker, because they are better able to cope with a diversity of stressful factors, such as pollution."

So ultimately, are darker birds better at surviving in urban cesspools? That’s a question that still needs to be examined further. But it’s evident that trace metals can be detrimental to wild animals, even at very low concentrations, Chatelain says. Built-in defenses don’t kick in right away; it takes generations of evolution to develop the winning reaction.

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