BIOLOGY

Malaria may accelerate aging in birds

Infection erodes telomeres and life spans—hinting that there are no benign parasites

By **Gretchen Vogel**

Malaria is a scourge of humankind, but many birds seem to shrug it off. Although they are chronically infected with malaria parasites, their behavior seems unaffected, and they mostly reproduce and raise young just as well as noninfected birds. That was a puzzle not just for ornithologists but also for evolutionary biologists, who have long theorized that parasites inevitably take a toll on fitness.

The birds' healthy appearance turns out to be deceiving, however. Drawing on data from a 3-decade study of great reed warblers in southern Sweden, researchers report on page 436 that long-term infection with malaria significantly shortened the birds' lives. The analysis also revealed a possible explanation: The blood cells of infected birds had shorter telomeres, stretches of DNA that cap the ends of chromosomes and protect them during cell division. In many species, shorter telomeres are associated with aging and shorter life span.

Malaria doesn't affect the great reed warbler's care for its chicks, but does cut its lifetime number of offspring.

The work "is an almost deceptively simple study that puts the nail in the coffin of the idea of benign parasites," says Marlene Zuk, an evolutionary biologist at the University of Minnesota, Twin Cities. And although it's not clear exactly how malaria infection influences telomere length, the study raises the question of whether other mild, but chronic, infections have similar hidden costs in different animals, even humans.

Evolutionary biologists have been arguing for more than a century about the long-term costs of nonlethal diseases to fitness and reproductive success. It is famously difficult, however, to tease out the effects of disease from all the other variables that affect a wild animal's ability to reproduce. The problem is compounded by small sample sizes in most studies of wild populations, says evolutionary ecologist Ben Sheldon of the University of Oxford in the United Kingdom.

In 1983, two biology students at Lund University in Sweden, Dennis Hasselquist and Staffan Bensch, began collecting data on great reed warblers nesting at nearby Lake Kvismaren. Dozens of the brown-and-white birds with a loud, raspy song visit the lake each summer to breed, and most come back to the nesting site where they were born. Bensch and Hasselquist, now both professors at Lund, still spend summers at the lake, and with colleagues keep track of which warblers return, who mates with whom, and how many offspring each bird raises. The scientists also take blood samples from hatchlings and adults.

Roughly 40% of the birds that nest at the site are infected with one or more species of malaria parasites picked up in their winter habitat, which ranges across sub-Saharan Africa. After an initial acute phase of the disease, in which birds are anemic, lethargic, and lose their appetite, survivors recover but often remain infected, with a low level of parasites in their blood. Many seem to do just fine nonetheless. In a 17-year study, for example, the research team found no significant differences in annual breeding success and survival to the next year of infected and uninfected birds.

Then came the telomere clue. Muhammad Asghar, a Ph.D. student in Bensch's group, recently measured their lengths in the blood samples using a PCR technique pioneered for birds by Pat Monaghan's group at the University of Glasgow. "Some amazing patterns started to emerge," Bensch says: Infected birds had significantly shorter telomeres, and those with more intense infections showed more dramatic telomere loss.

That could have been because birds with shorter telomeres were more susceptible to malaria. But in an earlier study, the group had deliberately infected captive warblers. Examining the birds' stored blood, the researchers found that the telomeres shrank in a direct response to the infection. "The combination of comparative and experimental results makes for a very strong case," says Robert Fleischer, an evolutionary geneticist at the Smithsonian Institution's National Zoological Park in Washington, D.C.

Infection shortened life spans as well as telomeres—by about a year, the lake records showed. That stole breeding opportunities. On average, uninfected birds lived 2.5 years and raised more than eight offspring to fledglings. Infected birds lived an average of 1.6 years and raised just four offspring. "It's a different kind of cost" than researchers expected, Hasselquist says.

It isn't clear if the shorter telomeres are a result of the extra red blood cells infected birds have to make—telomeres typically shrink with every cell division—or whether they are a more general consequence of the body's efforts to fight the infection. But the authors and others suggest it's worth looking more closely at chronic infections in birds and elsewhere, perhaps even in people with asymptomatic malaria. "Maybe we underestimate what 'mild' disease is," Hasselquist says. "Like herpesvirus. We have it, and we don't think there are any problems. But the potential is there at least" that it could carry some hidden long-term costs. ■

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