

To fight disease, animals, like plants, can tolerate parasites

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Animals, like plants, can build tolerance to infections at a genetic level, and these findings could provide a better understanding of the epidemiology and evolution of infectious disease, according to evolutionary biologists.

Plant pathologists have long known that plants deal with parasites by either developing resistance to the bugs, or by becoming more tolerant to disease. So plants that are tolerant do not get sick as fast as plants that are not tolerant, even when the number of parasites is doubled.

"Think of an aircraft carrier under enemy fire," said Andrew Read, professor of biology and entomology at Penn State, the Eberly College of Science Distinguished Senior Scholar and an associate of the University's Center for Infectious Disease Dynamics. "Resistance is trying to repel the incoming shells before they hit." Tolerance, he added, is the number of shells the carrier can withstand before keeling over.

Read and his colleagues Lars Raberg, assistant professor at the University of Lund, and Derek Sim, senior research assistant at Penn State, used the same approach to study tolerance in animals.

They exposed five different strains of mice to malaria, and monitored the rate at which the mice lost weight and red blood cells, a common feature of malarial infections.

The team found that the number of days it took for the parasites to reach

peak density – when parasite numbers are at a maximum – differed in the five mouse strains, indicating varying levels of resistance.

When the researchers analyzed density of red blood cells and minimum weight against the peak density of parasites, they found that as the parasites increased, some mice got sicker more slowly than the others.

"This was the one big a-ha moment, suggesting to us that disease tolerance was at work," said Read, whose findings appear on Nov. 2 in the journal *Science*.

Researchers were also surprised to find that tolerance and resistance are negatively related. The mice can either kill parasites or tolerate them, but they cannot do both.

Resistance and tolerance are both part of an evolutionary game plan that plants and animals adopt in response to infections, says the Penn State researcher. And in both cases, there is a trade-off.

Resistant hosts are successful in preventing disease but over time the bugs learn to beat them, forcing the hosts to build a stronger resistance. It is a never-ending arms race, noted Read, whose work is funded by the Wellcome Trust and the Swedish Research Council.

"But in the case of tolerance, the host is no longer trying to harm the pathogen, and the arms race stops," he added. Plants and animals simply learn to live with the pathogens.

The Penn State researcher cautions against generalizing the findings but points out that results from the study will provide a better picture of the progression of disease in animals.

While it is not yet clear whether one is better than the other, researchers

say that an understanding of disease tolerance and disease resistance could help in picking optimal selection strategies in the breeding of agricultural animals.

Source: Penn State

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