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Simple Math may Solve Longstanding Problem of Parasite Energetics

Feeling faint from the flu? Is your cold causing you to collapse? Your infection is the most likely cause, and, according to a new study by UC Santa Barbara research scientist Ryan Hechinger, it may be possible to know just how much energy your bugs are taking from you. His findings are published in a recent issue of The American Naturalist.

"When we get sick –– particularly with infectious agents –– we often talk about having our ‘energy drained,' or of ‘having low energy,'" said Hechinger, an associate research biologist at UCSB's Marine Science Institute and Department of Ecology, Evolution and Marine Biology. "This common language highlights that energy may provide a useful currency to investigate how infectious agents, or parasites, impact their hosts."

Unfortunately, he added, there has been little research on the energetics of parasites and their hosts, largely because scientists have been stymied by the difficulty of measuring the energetics of parasites living inside their hosts.

However, it may be possible to predict how much energy parasites drain from their hosts, according to Hechinger, simply by modifying equations from the metabolic theory of ecology –– a theory that describes the relationships between metabolic rates, body temperatures, and sizes of organisms. Typically applied to animals and plants living in ecosystems, Hechinger said these equations could be used for parasites living in host bodies. Further, because a host's body is like an ecosystem for its parasites, applying the metabolic theory of ecology can provide unique ways to better understand the ecology of animals in larger ecosystems.

"We pretty much only need information on the host and parasite body sizes and temperatures –– which is easy information to get –– and we're good to go," Hechinger said. "With that info, we can go straight to energetics because we can estimate parasite and host metabolic rates –– how many calories they burn."

Initial tests supported the new theory. Hechinger analyzed data for parasitic worms in rats, including tapeworms, and for parasitic round worms infecting a wide range of mammal species. "The most important finding might be that there is a limit to how many worms you can cram into a host, and that limit is best reflected, not by the space available inside the host or by parasite biomass, but by host and parasite metabolic rates –– by energy," he said.

Energy as a currency is important, and, according to Hechinger, a more universal currency to describe parasitism than is the typical use of numbers. Using energy and the new equations might uncover universal rules about the nature of parasitism. "It may help us to not only measure, but also predict the influence of parasites in hosts and even entire ecosystems," Hechinger said. "This is especially important because ecology is increasingly documenting that parasites are major players in ecosystems –– just as important as predators and competitors."

"These equations may be particularly helpful when we deal with the real, complicated world where many types of parasites live within hosts, when it would be impossible, for instance, to directly measure the metabolic rates of each species," he said.

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