

with bumblebee workers that forage and have to stay in flight (3). However, our experimental paradigm is the inverse: We activated the immune system and observed the consequences (survival). Therefore, this paradigm does not necessarily require that the immune response is lower under starvation, only that the consequence of the activated immune response is to shorten life-span when the organism is starved. Our data do not allow a direct check of whether starvation leads to a down-regulated immune response.

Lord *et al.* raise the interesting perspective that the evolution of an expensive immune defense, such as cognate immunity in mammals, might be coupled with the evolution of physiological mechanisms that ensure appropriate down-regulation in case of resource shortage, as is achieved through the actions of leptin in mammals (4). In insects, there is no comparable cognate response. Antibacterial peptides (as induced by lipopolysaccharides) are primarily expressed in cells of the fat body that also serves as a major energy storage organ for the organism (5). Whether this innate response is regulated in a similar way to mammals is not known, but the answer would be of major interest for understanding the evolution of immunity.

Finally, Lord *et al.* appear to assume that energy, rather than anything else, is the limiting resource for the expression of the immune defense. We think this is an open question, but the fact that the only difference between our starved and control groups was indeed the availability of sugars is at least supportive for this view in insects. More generally, it still remains to be empirically tested whether the cognate immune response in mammals is costly in the sense as shown by us, and whether the cognate response is indeed much more costly in fitness terms than the innate response.

YANNICK MORET,*
PAUL SCHMID-HEMPEL

Department of Experimental Ecology, ETH-Zentrum, NW, ETH-Zurich, Zurich CH-8092, Switzerland.

*To whom correspondence should be addressed.
E-mail: moret@eco.umnw.ethz.ch

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A Metaphor for the Map

VARIOUS METAPHORS HAVE BEEN USED TO describe the importance of sequencing the human genome (1): finding the Rosetta Stone, walking on the moon, and discovering nuclear fission are among them.

Rather tame stuff. A better comparison is the discovery of the use of fire. This set us humans on the path toward control of energy and, subsequently, control of the environment outside our bodies. Sequencing the human genome sets us on the path toward control of the environment inside our bodies. It should be an interesting journey.

WILLIAM P. SCHRADER

7385 Timberline Trail, Arena, WI 53503, USA; e-mail: redcedar@execpc.com

References and Notes

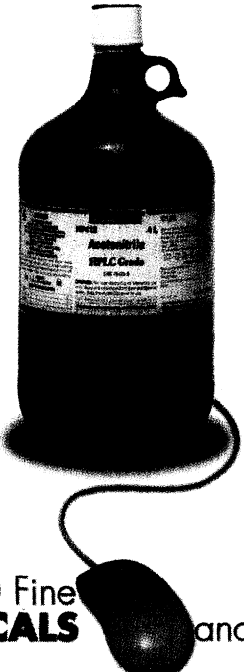
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CORRECTIONS AND CLARIFICATIONS

PERSPECTIVES: "The risk of extinction—what you don't know will hurt you" by J. L. Gittleman and M. E. Gompper (9 Feb., p. 997). In the first paragraph, "Falkland Island wolf" was in error. It should have read "Chiloe Island wolf."

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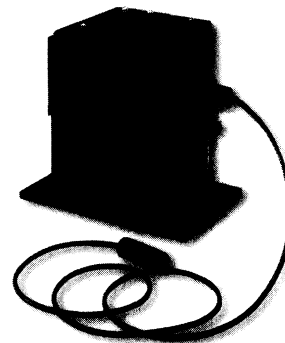


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