Capacity of DEB to successfully model temperature-dependent disease dynamics, specifically Schistosoma infection

DEB Tele-Course 2015

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Environmental factors can strongly influence traits such as host susceptibility and parasite reproduction, survival, and infectivity. Given the influence of temperature on these traits[1], global climate change may be a major driving force in the current unprecedented rate of infectious disease emergences[2,3]. As a result, it may be increasingly important to quantify the net effects of temperature on host and parasite thermal physiology. For example, the optimal temperature for malaria was found to be 6 °C lower when the nonlinear responses of vector and parasite to temperature were considered[4]. Host-parasite systems exhibit similar trade-offs across temperatures. In snail-trematode host-parasite systems, for example, higher temperatures increase parasite production but also shorten parasite and host life span. Thus, a mechanistic approach that can integrate such nonlinear, counteracting, and reinforcing effects of climate on parasite transmission will help us more accurately predict when and where disease outbreaks will be problematic. It may also yield deeper, more general insights for the consequences and management of parasitism in the field. Given recent literature[6], Dynamic Energy Budget (DEB) contains the strongest framework to model how temperature variation affects parasite transmission in the *Schistosoma mansoni*-snail-human system.

Within this system, eggs from adult trematodes typically enter water bodies from an endothermic definitive host. Miracidia then hatch from eggs to infect snails. The trematode reproduces asexually and the second larval stage, cercariae, emerges from snails to search for the definitive host, humans, to complete their life cycle. In the context of DEB theory, the traits of definitive hosts, adult trematodes, and egg input may initially be assumed as temperature independent. The application of DEB theory to this system appears ideal because it links individual physiology, such as the rate at which an individual obtains and utilizes energy for maintenance, growth, development, and reproduction, to population-level dynamics[5]. It has already been used to successfully predict parasite transmission[7]. Due to DEB's incorporation of energy fluxes, it is entirely possible to parameterize life history traits of an organism and subsequently predict how allocations of reserve change in response to varying conditions (e.g. food availability, temperature). Thus, the development of a DEB model for this system will aid disease ecologists in better grasping the disease dynamics of *S. mansoni* infection.

References: **(1)** Rohr, J.R. 2013. *Conservation Physiology*, 1 **(2)** Epstein, P.R. 2001. *Microbes and infection/ Institut Pasteur*, 3, 747-754 **(3)** Patz, J.A., *et al.* 2005. *Nature*, 438, 310-317 **(4)** Mordecai, E.A. et al. 2013. *Ecology Letters*, 16, 22-30. **(5)** Nisbet, R.M. *et al.* 2000. *Journal of Animal Ecology*, 69, 913-926, **(6)** Civitello D.J. and Rohr J.R. 2014. *Journal of Animal Ecology*, 83, 1379-1386 **(7)** Spencer, R.H. et al. 2009. *The American Naturalist*.