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Asking endosymbionts to do an enzyme's job

Sriram G. Garg and William F. Martin

PNAS May 15, 2018, 115 (20) E4543-E4544; published ahead of print May 3, 2018. <https://doi.org/10.1073/pnas.1804397115>

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Zachar et al. (1) present a mathematical model for the origin of mitochondria in which the initial role of the mitochondrial symbiont was that of a food particle for its host. In their model, the bacterial endosymbiont can be freely acquired by a phagocytosing, amitochondriate host cell [an archezoan, in the words of Zachar et al. (1)] and can reproduce in the cytosol at a cost to the host. The core of their model is that symbionts can proliferate intracellularly and that during times of abundant external food supplies, this leads to the accumulation of food reserves (cytosolic bacteria) in the host's cytosol, while during leaner times, the host can harvest accrued food supply by digesting endosymbionts. From the standpoint of the host, the interaction with symbionts is akin to the interaction between humans and pigs, a kind of farming: "Farming is a form of bet hedging: the host applies different strategies in good and hard times to minimize its overall risk of extinction" (1). There are two problems with the Zachar et al. study.

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Uygulamalar

LETTER

Asking endosymbionts to do an enzyme's job

Sriram G. Garg* and William F. Martin*¹

Present a mathematical model for the origin of mitochondria in which the initial role of the mitochondrial symbiont was that of a food particle for its host. In their model, the bacterial endosymbiont can be freely acquired by a phagocytosing, amitochondriate host cell [an archezoan, in the words of Zachar et al. (1)] and can reproduce in the cytosol at a cost to the host. The core of their model is that symbionts can proliferate intracellularly and that during times of abundant external food supplies, this leads to the accumulation of food reserves (cytosolic bacteria) in the host's cytosol, while during leaner times, the host can harvest accrued food supply by digesting endosymbionts. From the standpoint of the host, the interaction with symbionts is akin to the interaction between humans and pigs, a kind of farming: "Farming is a form of bet hedging: the host applies different strategies in good and hard times to minimize its overall risk of extinction" (1). There are two problems with the Zachar et al. study.

It comes to food supply. That is, natural selection can bring forth a trophic strategy in which cells use good times to accumulate food reserves that can be set aside, left untouched, and accessed on demand in bad times, thereby providing insurance against food supply extremes. Most microbes have been affected by, and have responded to, selection for food storage during evolution. The typical evolutionary response selected in nature is not endosymbiont farming, however, but expression and regulation of a handful of cytosolic enzymes for synthesis and mobilization of carbon and energy storage compounds (5-9). Carbon and energy storage compounds are generally ubiquitous among archaea and bacteria, including photosynthesizers (6), typically consisting of glycogen, polyhydroxyalkanoates, or lipids (5-9). Eukaryotes are no different, routinely storing glycogen, lipids, or starch (10). Enzymatic control of intracellular carbon and energy storage deposits varies from

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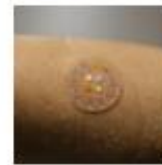


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Emily E. Bray, Mary D. Sammel, Dorothy L. Cheney, James A. Serpell, and Robert M. Seyfarth

PNAS August 22, 2017. 114 (34) 9128-9133; published ahead of print August 7, 2017. https://doi.org/10.1073/pnas.1704303114

...control, and problem solving, are also beneficial in other species, including our own. However, despite being bred and raised with the specific aim of becoming guide dogs, only 70% of dogs that enter training ultimately succeed in the program. In dogs, high levels of maternal care have been linked ~~~

Horizontal transfer of retrotransposons between bivalves and other aquatic species of multiple phyla

Michael J. Metzger, Ashley N. Paynter, Mark E. Siddall, and Stephen P. Goff

PNAS May 1, 2018. 115 (18) E4227-E4235; published ahead of print April 18, 2018. https://doi.org/10.1073/pnas.1717227115

...of bivalves and genome databases and found evidence of horizontal transfer of Steamer-like transposons from one species to another, with jumps between bivalves and even between animals of completely different phyla. Some events were ancient, but some (in particular, those between bivalves) appear to be recent ~~~

Importance of a species' socioecology: Wolves outperform dogs in a

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