Ecosystems Unto Ourselves: the concept "organism" in the age of individualized medicine, targeted therapies, and the microbiome.

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Abstract

Queller & Strassmann (2009) argued for a variable concept of "organismality" and Pepper & Herron (2008) suggested a plurality of potentially useful organism concepts, specifically arguing that the feedback between natural selection and functional integration leads to an "organism syndrome." But what causes this feedback and how is it altered by particular, micro-ecological differences? An accurate response is critical to many evolutionary relevant concepts (e.g., variation, fitness, and selection). Useful immunological answers [e.g, Pradeu & Carosella (2006), Pradeu (2010)] begin to address these difficulties by locating control of variation of lower-level phenomenon at the level of the heterogeneous organism. However, recent studies on the human microbiome demonstrate that "control" may be too strong a requirement. The bacterial, viral, and fungal components of the microbiome, both on and within humans, are far more numerous than previously thought, creating unique ecosystems that vary by individual. More importantly, the microbiome interacts with the human genome in dynamic ways where control is difficult to identify. To the extent that these billions of microbes work in concert or in competition with our own human genome, we differentially thrive or suffer (e.g., via allergic and autoimmune diseases). A clearer understanding of the dynamics of boundaries (including immunological and microbial-ecosystem ones) at work in constructing and maintaining an organism is necessary in order to assess: 1) whether immunological control is critically important at the level of heterogeneous individual organism, or 2) whether regular and persistent interspecies interactions may be the more relevant higher-level of selection.

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