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Genes, Selection, and Behavior: Response to Laurenti's Commentary

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Chapter 6
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No one knows how the eukaryote cell came to exist, but a possible scenario may be offered. Suppose a phagocytic (ameba-like) prokaryote ingested another prokaryote but failed to digest it entirely because of a fault in the genetic material that would normally result in effective digestive enzymes. That fault (mutation) might be advantageous if it resulted in a mutualism between the two prokaryotes—ingesting and ingested. For example, if the ingested prokaryote was aerobic or photosynthetic, it would supply energy to the ingesting prokaryote, which in its turn would at least provide protection to them both. Together they might better escape predation and better utilize resources in the environment. Such a beneficial mutualism would result in a proliferation of such complex cells in competition with simpler ones.

Multicellular organisms may have resulted from a similar sort of mutualism between eukaryote cells. If two or more cells stick together as a result of glue excreted by one of them, and the whole is, for example, less subject to predation, then genes that facilitate the glue excretion would be favored by existing in such an organism and would be selected in competition with single cells and other organisms.

This last scenario may be thought of as an example of the Baldwin effect, which points to the possibility that a gene that normally has no effect on phenotype—a cryptic gene—may become advantaged in the face of a change in the environment. The gene that makes for glue excretion might do nothing until the cell happens to collide with another cell. Another example would occur among multicellular organisms if the environment changed from wet to dry. Genes that were ineffective in the wet environment might now become helpful for survival in the dry environment and be selected in the dry environment. When a drought hit the Galapagos Islands, finches with beaks that enabled them to exploit hard seeds were advantaged relative to competitors, and seed-cracking beaks were selected (Lamichhaney et al., 2016). This kind of selection occurs in the face of rare and unsystematic variation in the

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environment. When the environment varies in systematic ways, such effects permit phenotypic plasticity—variation in phenotype, for example, according to the season.

All of these scenarios involving environmental effects on genes and selection nevertheless place genetic variation and genetic inheritance at the center. To acknowledge other modes of inheritance besides genetic inheritance in no way excludes the centrality of genetic inheritance. Even in the evolution of cultural practices, which might seem to occur independently of genes, genetic selection plays an ultimate role (Baum, 2017a, 2017b, 2017c). For example, at present, most countries around the world have experienced a decline in birth rate. With few exceptions, people the world over are having fewer children, seeming to fly in the face of natural selection. If the trend continues, the world human population will soon begin to decline, because already many countries have a birth rate lower than the death rate, and more countries are going this way all the time. If the trend were to continue, the human race would eventually cease to exist. This extinction is extremely unlikely, however, because as population declines the advantages of having children will grow, and natural selection will begin to take effect. Already some countries, such as Denmark and Russia, have begun to employ incentives for couples and women to have children. Cultural practices will evolve to advantage those who have children.

All of this is to say that I don't think that "gene-centered" thinking is wrong. To acknowledge niche construction as an outcome of an organism's interactions with the environment that benefits progeny in no way denies the centrality of genetic inheritance and genetic selection. Genes that support the behavior of niche construction will be selected. If we recognize four different modes of inheritance, we do not then discard the most fundamental one of them in favor of the other three, no matter how important we think the other three are.

Acknowledging the role of natural selection in leading to the existence of organisms and their behavior gives no warrant for denying the importance of behavior. Without behavior—the organism's interactions with the environment—natural selection would be impossible. Interpreting the multiscale molar view as proposing that behavior is a "symptom" of the genes is to misread it entirely.

The multiscale molar view may be looked upon as "selectionist" thinking; that is true to an extent. It is not defined by selectionist thinking, however. The ontological and epistemological claims set it apart not only from Skinner's molecular view but also from Tolman's "molar" view. Tolman and Skinner both made moves in the direction of this multiscale molar view. Tolman's idea of "emergence" bears some relation to the recognition that behavior consists of activities that are (ontologically) processes and integrated wholes. For all his selectionism, Skinner never gave up on contiguity as the fundamental reinforcement relation, despite evidence to the contrary. Response-reinforcer contiguity, in turn, implies discrete events at moments in time. "The operant"—a noun—was a class of discrete events. Hence, I use "operant" only as an adjective, as in "operant activity."

An operant activity is an integrated whole that serves a certain function. Comparing such a behavioral whole to a Gestalt might give a sense of the "wholeness" of an activity. As an integrated whole, an activity should not be called an "aggregate." That word suggests a collection, rather than a whole with parts (Baum,

2002). From the longest time scale to the shortest time scale, every activity is a whole with parts that are themselves activities, on a smaller time scale. The part-whole relations are key.

The point I may have failed to make clear is that the selection of organism-making genes, which drove a proliferation of organisms, fundamentally affects our view of behavior. The function of an organism, as a result of that selection, is to reproduce. In this sense, it serves its genes. For behavior analysis, however, the key insight is that surviving and reproducing are the largest scale activities of the organism. Their parts are smaller-scale activities like gaining resources and maintaining health. Those activities also have smaller-scale parts and so on. Scale may be as small or as large as required.

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