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“Individuality is conventionally thought to be a defining attribute of the organism, so much so that there is an assumed equivalence between the two: individuals exist as organisms, and organisms can only exist as individuals.” (p. 219, Scott Turner, “Social Insect Assemblage”).

Most biologists, as well as the public, will identify organisms with individuals; that is, organisms are the individuals in the world of life. Upon reflection, matters may not be so simple. Cells might be considered as genuine biological individuals. We know that cells can exist individually, such as bacteria and protozoa. Moreover, as Claude Bernard would have it already (1878), organisms may be seen as “instruments” at the service of cells, which are the “real” individuals. Come to think of it, what about genes? Richard Dawkins famously propounded (1976) that genes are the individual units that count; and so that genes are “selfish,” promoting their own interests, even at the expense of the cell or the organism.

In the opposite direction of complexity, the philosopher David Hull argued (1976), following Michael Ghiselin’s (1974) “radical solution to the species problem,” that species are individuals, since species are entities undergoing selection, a proposition that engaged the interest of other philosophers, such as Elliott Sober and Philip Kitcher, but motivated another philosopher, Mario Bunge (1981) to contend that “biopopulations, not biospecies, are individuals and evolve.” Ernst Mayr (1987) pointed out that species are “classes” (and so are genera, families, etc.), but species have continuity through time and evolve, and that there are other properties that can be predicated of “species-as-individuals.”

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The philosophical issue of species as individuals is not a primary concern of *From Groups to Individuals*. Rather, its focus is set in the Introduction: “Contemporary biology recognizes that the living world displays a hierarchy of individuals at various levels, from genes to chromosomes, cells, organisms, colonies, social groups, species, communities, and ecosystems” (p. 2).

Part I, “Organisms and Individuality” includes four chapters. Most surprising to me is chapter 4 “Immunity and the Emergence of Individuality,” where Thomas Pradeu insists on the role of the immune system in the definition of biological individuality, based on two main arguments. First, “the immune system, because it rejects some entities and accepts others, plays an important role in establishing the boundaries of the organism.” Second, “the immune system is [...] one of the main mechanisms by which a high-level individual ... prevents the emergence of variants having a different fitness at a lower level” (p. 77).

Part II, “Adaptation and Complex Individuals.” Andy Gardner (ch. 5) writes: “The conventional view is to regard biological adaptation as occurring at the level of the individual organism [...]. However, in recent years there has been a resurgence of interest in group adaptationism, which regards social groups as designed entities that function to maximize their own fitness” (p. 99, “Adaptation of Individuals and Groups”). The topic of group selection versus individual self-interest pervades chapters 6 and 7. Minus van Baalen takes issue with Dawkins’ “idea that ‘selfish genes’ may pursue their own interest to the detriment of their carriers” and points out that much confusion has arisen from different considerations of the “units of selection” as genes, individuals, groups, and families. He proposes “to use the concept of ‘unit adaptation’ to refer to those structures that benefit from an adaptation” (p. 129). Chapter 7, by Philippe Huneman, is a helpful discussion of the “research program” focused on the concept of “evolutionary transitions,” notably associated with J. Maynard Smith and E. Szathmáry (1995), which was initiated by L.W. Buss (1987) and much developed by R. Michod (1999 and 2005). “In these transitions, each level corresponds to a kind of individual, as well as to a potential bearer of fitness: genes, chromosomes, multicellular organisms, colonies, and so on” (p. 141).

Additional levels of complexity are explored in Part III, “Groups and Collectives as Individuals.” In chapter 10, Scott Turner acknowledges that kin selection theory “provides a tidy explanation for the evolution of the social insect superorganism [...]. Unlike in bees, however, sex determination in termites is by conventional heterogametic sex chromosomes” (pp. 220–221). Moreover, there is an additional “class of organism-like social systems: symbiotic ‘organisms’ [...] social assemblages that comprise phylogenetically distant members that have very low coefficient of relatedness” (p. 223). According to Turner, explanations of these higher order complex associations must go beyond kin selection, and “distinguish a social assemblage that is cognizant of itself as something distinct from its environment” (p. 224). “What is a Symbiotic Superindividual and How Do You Measure Its Fitness” is the title of the final chapter 11 by Frédéric Bouchard. Termites and their mounds are the main topic of the chapter. But come to think of it, symbiosis is pervasive through the plant and animal world. “Indeed, human survival depends on the bacteria-transforming resources in our intestines” (p. 255). A new

perspective becomes necessary: “functional integration instead of genetic identity is essential, because these bacteria are acquired intragenerationally from the environment” (p. 256). Yet more, Bouchard sees multispecies assemblages as superindividuals and thus, once again, a “reason to emphasize the functional aspect of individuality” (p. 256). The final sentence of Bouchard’s chapter, which is also the book’s final sentence, is a research “manifesto”: “Focusing on individuals and how they sometimes evolve into superindividuals is the way forward in our messy multispecies world” (p. 261).

There is much that is original and insightful in *From Groups to Individuals. Evolution and Emerging Individuality*. A good read!