

IN THEIR OWN WORDS

Have We Ever Been Individuals? *Continued*

need to reconceptualize human reproduction as “holobiont birth,” in which individual persons and their symbiotic communities are all involved. Thus, they write, “There is never an autonomous mammal. . . . Symbiosis is a necessary condition for continued life. From the symbiotic perspective, birth is a transition from one symbiotic state to another. Remarkably, this transition appears to be mediated by the mother” (2015, 195). Indeed, they identify four processes through which “the mother creates conditions suitable for her own reproduction and the reproduction of symbiotic microbes” (2015, 196): the physiology of the pregnant women, including hormone levels, modify populations of helpful microbes in her gut and vagina; the mother transfers helpful bacteria to her fetus during gestation; further helpful bacteria are transferred to the infant during vaginal birth; and additional helpful bacteria are transferred to nursing infants via the mother’s milk.

Recognizing the symbiotic relationships that characterize holobionts cannot be missed unless biologists pay close attention to developmental processes over time. In the case of holobiont birth, paying attention to processes requires rethinking the relationship between the human host and the multiple symbiotic communities of bacteria that live within it. That is, it is incorrect to conceive of the host as a static, self-interested, independent “habitat” colonized by static, self-interested, independent species.

Rather, from the perspective of biological process, it becomes clear that different symbionts provide different niches for one another over time; that symbionts therefore support the ongoing life processes of one another. Even though each individual symbiont does not support every other symbiont all of the time, the overall network of interactions among all symbionts together supports and sustains the ongoing life process of the holobiont.

And this has implications for how we understand human reproduction. Rather than conceiving of the relationship between father, mother, and offspring (or between their genes) as competition for limited resources, the birth of the holobiont highlights the heterogeneous connections among host, symbionts, and offspring. As Chiu and Gilbert conclude,

The past decade has brought about remarkable new discoveries about relationships between and within organisms. One of the most revolutionary of these discoveries has been the importance of symbiotic signals used to build, maintain, and protect a holobiont. Developmental symbiosis merges embryology and ecology in interspecies webs of mutual and reciprocal communication. Birth is seen not as the origin of a new individual, but as the perpetuation of these organizing webs of signals between animals and microbes. (2015, 205)

on which the Phylogenetic Species Concept is based (Tattersall and DeSalle 2011, 50). For example, prior to the rise of the great ancient civilizations, the human species was made up of widely scattered populations. Those populations living in North America had been separated from populations in Europe for thousands of years, until the European explorations of the Americas began in the fifteenth century. However, when Europeans and the native peoples of North America did come into contact, they were able to interbreed and produce viable, fertile offspring. From the perspective of the Biological Species Concept, this ability to interbreed and produce fertile offspring indicates that members of these different populations belong to the same reproductive community and hence the same species. Proponents of the Phylogenetic Species Concept can specify the set of unique features that distinguish all successfully interbreeding populations of the human species from populations of other, related species.

Finally, Darwinian population thinking requires biologists to recognize the distinctiveness of each individual *organism* that belongs to a particular population of a given species. It is variation among individual organisms in particular populations, in particular environmental circumstances, that engenders the Darwinian struggle for existence. To follow arguments made by evolutionary biologists, therefore, these three nesting concepts—*species made up of populations made up of organisms*—must be kept distinct from one another. It is also important to remember that even if individual *organisms* from *populations* of different *species* occasionally mate with one another, such matings do not necessarily dissolve the species boundary. For instance, horses and donkeys can interbreed to produce mules, but mules are infertile, so the *species boundary* between horses and donkeys is unaffected by these matings.

Neo-Darwinians were also concerned about the genetic makeup of species. They introduced the concept