

Darwinizing Gaia

Darwinists have problems conceiving of communities and ecosystems as “units of selection” because most often these do not reproduce as collectives, which traditional formulations of evolution by natural selection (ENS) most often seem to require. So Lovelock’s “Gaia Hypothesis” has fared poorly in traditionalist Darwinists’ hands, as has the much more recent proposal that we and our microbiomes, as “holobionts”, are single units of selection. Here we consider three ways to work around this – ways to legitimize, if not prove – such hypotheses. Two entail accepting that differential persistence as well as differential reproduction can give rise to or be an outcome of ENS, while the third is David Hull’s replicator/interactor framework, writ very large. (1) The first workaround is to argue that it is not the individuals or even all the taxa that make up a community or ecosystem that is the unit of selection, but the pattern of interactions (the “process”) that they collectively implement – “the song, not the singers”. Arguably, interaction patterns are re-produced (recur) but don’t reproduce, and it’s the ongoing evolutionary recruitment of taxa perpetuating such processes that defines persistent lineages. (2) The second workaround addresses clades (or analogously, clones, as in a chemostat). Although clades don’t reproduce, at any given time a clade (or a clone) consists of units (‘species’ or cells) only some of which will have progeny in future. Thus clades always generate populations *in which* and *between which* ENS by differential persistence can act, addressing clade-level traits like species richness, ecological diversity, geographic dispersal or intra-clade cooperation. The most inclusive clade would be LUCA (the Last Universal Common Ancestor) and all its descendants – all of Life on Earth in other words. Whether or not there are populations of “Gaias” on other planets, there *is* a terrestrial population that this clade itself continuously generates. (3) Hull’s framework sees recurring but non-reproducing communities as interactors whose differential success differentially perpetuates the replicators that determine their properties. The replicators might be genes, “selfish” in Dawkins’ sense, but with phenotypes at the level of communities and ecosystems, of which Gaia is the most inclusive. Thinking about lateral gene transfer encourages the view that some genes are perpetuated *because* they are represented in many disparate species, thanks to transfer. Genes serving the global nitrogen cycle might be seen in this way. So might nitrogen fixing organisms and species, since, with respect to communities as “interactors”, these too are “replicators”.