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Anthropomorphism in science

Julian Davies

It is a common characteristic of our species to assign human emotion and behaviour to other creatures and even inanimate objects—just ask any car owner. Common examples of such anthropomorphisms involve animals and pets, especially dogs and cats. These domesticated species are sometimes considered to behave like us and think like us, becoming pseudo-human.

One might think that such sentimental anthropomorphism would be unlikely to spill over into the biological sciences, but this is not so. Microbiology seems particularly susceptible and the literature is littered with examples of bacteria having to ‘make a choice to use a particular substrate’ or a ‘decision to make a compound’ and even ‘needing something’. When bacterial conjugation was discovered in the 1950s, bacteria were even classified as males and females participating in sexual mating. I am sure that many of you will be able to come up with examples from other fields.

I would argue that in a number of instances anthropomorphic thinking has misdirected biological enquiry. It is often assumed that microbes in their natural environments are in a constant war of attrition for space and nutrients. Many publications speak of battlefields and the production of chemical weapons to permit one or more organisms to successfully exploit a particular environment. Does ascribing human militaristic means and ends to bacteria make sense? There is enormous diversity in microbial phyla and the biosphere is an extraordinarily complex collection of distinct organisms. A given soil sample might contain 10^9 microbes per gram with a thousand or more species living happily together (an

anthropomorphic statement if ever there was one). In the human gut, microbes number many trillions with upwards of 1,000 phylotypes; are they all engaged in lethal conflict with each other? Despite the fact that small molecules with antibiotic activity can be isolated from gut bacteria grown in the laboratory, there is no *in situ* evidence that they actually play such roles in the intestinal tract; it is equally likely that these molecules are mediating interactions with mucosal cells lining the gut. However, our ignorance of the workings of microbial communities in these environments is profound and remains tainted by our anthropomorphism.

The isolation of antibacterial small molecules from natural sources has completely changed the face of infectious disease treatment. Not surprisingly, the antibiotic activities of these compounds were assumed to be their natural roles and they were labelled on the basis of militaristic function. Yet, there is increasing support for the notion that these compounds play many different roles as modulators of transcription and physiological regulators/signalling agents. In all probability, many other examples of anthropomorphic and anthropocentric thinking have biased biological studies; although no one has yet thought to claim that willow trees produce aspirin just for our benefit!

Humans seem able to make a ‘pet’ of almost anything; researchers working with *E. coli* or *S. cerevisiae* might well develop an affinity for their subjects. It has even been reported that microbiologists in a German sewage plant play Mozart to their hard-working microbes to enhance their efficiency in biodegradation. Given that humans harbor large numbers of bacteria and that they

are integral to so many of our functions, is it so strange to imagine that microbes might behave like us? My tongue-in-cheek comments can best be given serious consideration in the light of the proposal that the human gut flora are a forgotten organ (O’Hara & Shanahan, 2006); they are a critical part of the whole.

If we accept the essential roles of microbes in our evolution and existence, should they be afforded some rights akin to UN charters? After all, I assume that we are concerned about protecting all living things; except, of course, malicious creatures like mosquitoes. Bacteria are essential to the life of every eukaryotic organism on Earth; without bacteria we would have defective immune systems, malfunctioning digestive systems and no plants or flowers. The bacterial denizens of humans are certainly not new players, but it is only recently that science has demonstrated their critical roles.

Some thoughtful people have taken the question of bacterial rights seriously. In 2004, Charles Cockell proposed that microbial communities and ecosystems should be protected. He argued that since microbes enable all other life forms, they should have some constitutional rights. Whether this proposal is reasonable and achievable is a topic for discussion, although I think the suggestion is ridiculous. Nevertheless, I am concerned that given the universality of bacterial–eukaryote interdependence, biological conservation efforts continue to ignore the microbial world. Diversitas and similar biodiversity programmes barely mention bacterial diversity in their manifestos. Why protect insects and not microbes? Conversely, it is hard to make a case for the rights of deadly human pathogens, but then again, they don’t seem to need our protection.

The burgeoning knowledge of the vital importance of microbes to all things human will undoubtedly have a considerable influence on the treatment of many diseases. Yet, however fond or fearful we are of bacteria, we must accept that bacteriophages—the most abundant life forms in the biosphere—generally wipe out around 50% of the world’s bacterial population every few days, so why worry?

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