
Book Review

Marcus Byrne and Helen Lunn, *Dance of the Dung Beetles: Their Role in our Changing World* (Johannesburg: Wits University Press, 2019), 228 pp., \$29.31 (pbk), ISBN: 9781776142347.

The book is an erudite, well-written romp through contemporary, post-genomic evolutionary theory, comparative (and history of) religion, experimental entomology, and development of scientific method and explanation, all focused rather sharply on dung beetles, which number around 6,000 species in the world and are found on six continents. The tie-in to religion specifically concerns the history of mostly Mediterranean thinking on the dung beetle, starting with its ancient Egyptian association to concepts of an afterlife, as with the god that had a human body with a scarab beetle head, Khepri. Because the dung beetle rolled its ball into the ground and then reappeared newly later, it was thought to have been resurrected, at least initially. And therefore, it became both a symbol of life after death as well as a necessary component of the Egyptian pantheon, being recruited to help ensure eternal life in the world of the dead for a mummified pharaoh.

The history of ideas—religious and then later museological and scientific—concerning dung beetles is put roughly into a framework of Mediterranean and Western thinking, as it progressed (in the authors' conceptualization) from magic and animism to monotheism and eventually to reason with the advent of the scientific revolution. In particular, the authors explicate the sometimes contradictory steps in the development of evolutionary biology—arriving finally at the contemporary, extended evolutionary synthesis. The writers well recognize that religious and irrational concepts can still be present in a modern society otherwise largely secular, scientific, and rational in its philosophies, technologies, and sciences, so it's not simply a course of cultural evolution that they trace here. History of the mythical, then scientific understanding of dung beetles—as well as other natural phenomena—is a well-designed thematic thread that runs throughout.

Explanation of animal behavior can be complex, of course, but the authors employ a refined positivist approach to propose, persuasively in my view, that if the pertinent animal behaviors are contextually comprehended in terms of a landscape that includes not only substrate and living fauna and flora and the genotypes and phenotypes of these, but also atmospheric conditions and astronomical phenomena, like sunlight, moonlight, and starlight, then insights into the interrelationships of scientific knowledge from diverse quarters can be gained. Applied results for the benefit of contemporary human society (like night cameras for automobiles based on insect night vision, use of insects that control other, harmful insects and diseases, and

ecosystem services more generally) can even be obtained through such advanced, enlightened comprehension of what otherwise might seem to be the mundane, even trivial ambulatory and flight behaviors of drab and seemingly useless bugs.

The writers come to their subject with considerable expertise in the study of African dung beetles, especially the fully nocturnal *Scarabaeus satyrus*, which they show experimentally can orient itself on a straight path with its dung ball using the light of the Milky Way. Other nocturnal dung beetles can navigate properly with the polarized light of the moon. When their large (relative to body size) eyes are experimentally covered with specially designed caps, or if the sky is cloudy, nocturnal dung beetles can't move on a straight path, and end up rolling their dung ball about in circles. The book here shows that dung beetles in spite of tiny brains are able to remember starlight patterns and the smell of dung in order to accomplish their nocturnal niche. In addition, epigenetic theory is more likely than genetics alone in deciphering this and other behaviors. The size of the male dung beetles' horns, which is relevant to sexual selection, is determined not merely by DNA, but by the randomly determined size of the brood ball in which the creature develops in the pupal stage, and this environmental condition affects fitness at a later point of the organism's development. Small horned male beetles, though, can still mate by outwitting the large horned ones that guard the opening to tunnels where females are located by tunneling into the sides of these and then surreptitiously mating with the females therein.

These behaviors help explain the continuation of variability in phenotypes of the dung beetle species involved, especially the bull-headed dung beetle from South Africa used as a biological control agent in Australia, where the introduced dung beetles remove the dung necessary for dung-breeding flies. Without them, the native dung beetles only could remove dung of marsupials, and therefore pastures with cattle were becoming degraded and full of undecomposed dung, with a plethora of flies irritating to both to cattle and humans, leading to continual degradation and expansion of cattle pastures. Dung beetles in Africa also are known to recycle the dung from the annual migration of more than a million wildebeest across the Serengeti plain. This recycling has the effect of re-fertilizing and restructuring the soil, whereby new grass will be available again for the migratory wildebeest.

In conclusion, Byrne and Lunn have written an instructive volume. It could be useful as a supplementary text or recommended reading in as varied a curriculum as introductory courses in entomology, evolutionary theory, agronomy, economics, philosophy, and comparative religion or history of world religions. It is well-illustrated, with the figures intelligently placed in the middle of the volume and not referenced per se in the text. The book brims with insight accomplished by the writing, since there are no tables and in-text citations are kept to a minimum without loss of information or data. The authors succeed in getting their points across through original phraseology that ranges from the droll to the sublime, and it's never boring.

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