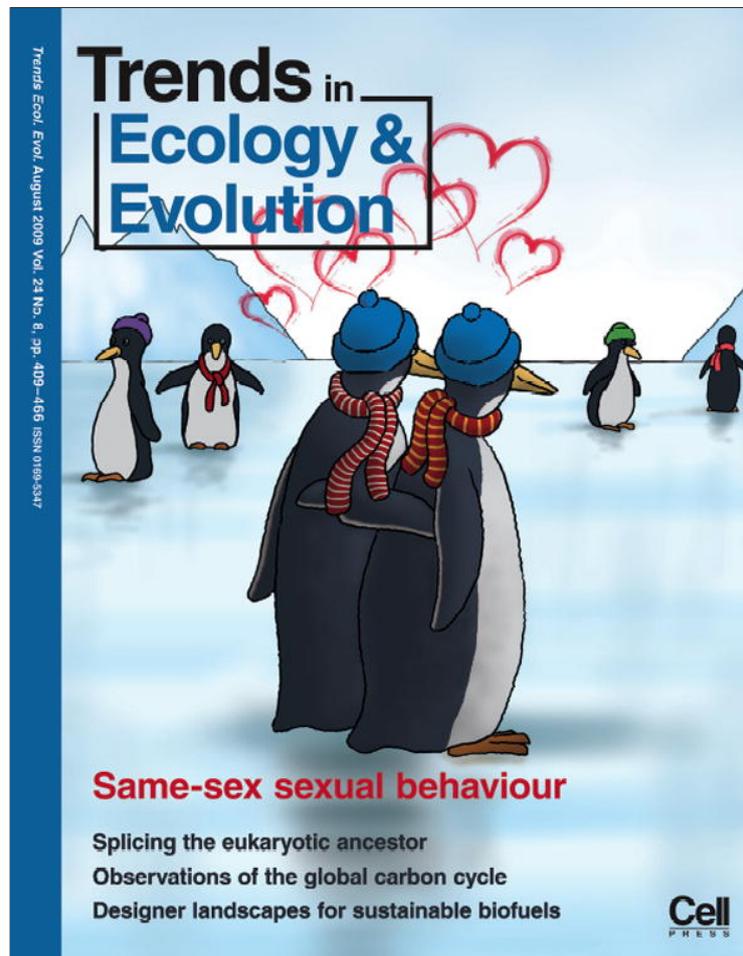


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guide to the game of Mafaotyof (my oldest fossil is older than your oldest fossil)].

Despite the eventual designation of the Cambrian boundary in Newfoundland, and many other advances, there is much still to learn. Chemical changes in Ediacaran oceans have been documented by studies of carbon and sulfur isotopes, revealing a substantial increase in oxygen levels. Developmental biologists have shown that even simple cnidarians share many regulatory genes with flies and mice (mostly mice, curiously enough). But quite rightly, I think, Brasier finds the explanation for the

remarkable events of the Cambrian in the dynamic interactions between these animals. How these environmental, genetic and ecological changes interacted remains a mystery. In *Darwin's Lost World*, Brasier brings to life the scientists and their interactions and beautifully documents the latest fieldwork devoted to understanding the world of the Cambrian.

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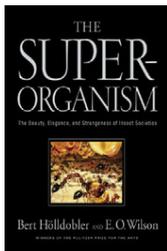
Book review

Altruists since life began: the superorganism view of life

The Superorganism: The Beauty, Elegance, and Strangeness of Insect Societies by Bert Hölldobler and Edward O. Wilson. W.W. Norton 2008. £30.00 hbk (576 pages) ISBN 978 0 393 06704 0

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Certain books create a stir and generate a level of interest even before they are read. The importance of the author(s) or the timing of its arrival is often more important than the content. The new book by Bert Hölldobler and Ed Wilson is a case in point. Entitled *The Superorganism: The Beauty, Elegance and Strangeness of Insect Societies*, it is a fascinating, wonderfully referenced account of the lives of

large social insect societies and how the major evolutionary transition that lead to such wonderful products of organic evolution has impacted terrestrial ecosystems in multiple ways. Packed with such quality, and penned by two highly influential biologists, one might ask why should this book create a stir?

The first reason is that it is a successor to Hölldobler and Wilson's hugely successful, Pulitzer-prize winning book, *The Ants* [1]. (One of two Pulitzers that Wilson has won in an impressive career that has seen him publish 21 books). The second reason is because, in terms of scope and breadth, these two authors are among the most important researchers of social insects in the second half of 20th century. Their empirical, theoretical and synthetic works have touched all fields of social insect research and created a few along the way. Wilson himself is another reason to take note of this book. He is a scientist whose impact on 20th-century evolutionary biology, ecology and environmental science is nothing short of Herculean. Not only has he shaped social insect research, but he also invented sociobiology and, along with Robert McArthur, the field of island biogeography; Wilson has also been enormously important in discovering and

conserving biodiversity (a term he probably also coined). However, by far the most important reason to take note of *The Superorganism* is that, in recent years, the pair, and Wilson particularly, have, to use an expression from their study organisms, stirred up the ants' nest, by claiming it was group selection rather than kin selection that was the formative force in the evolution of eusocial colonies and altruistic behaviour [2–4].

This has created quite a debate [5,6]. Arguments against a group selectionist view of social evolution are essentially that, although group selection is feasible, it is preferable in most cases to work with an individual or kin selection framework so as to avoid confusion [6]. Group selection can occur but it was probably less important in the evolution of societies than was kin selection [5]. My own opinion is that the debate is distracting for two reasons. First, we must remember that selection is at the genic and not the organismic or superorganismic level [7,8].

The second reason is the phenotype. A genetic cost-benefit focus promotes an organismal-level thought process (e.g. ant A sacrifices reproduction for ant B) and this shapes how we view the raw material of natural selection, the phenotype. However, phenotypes are not merely properties of the unitary organism but can be sub-organismal [9], extended [8] or super. *The Superorganism* documents an impressive array of phenotypes that function at the group level, and only the group level; examples include ants building bridges, making nests, constructing rafts and coordinating defence reactions. Superorganism phenotypes function to lever ant genes into the next generation in just the same way that the extended phenotype of the physical nest does. Adopting the superorganism view can lead to novel insights in ways that an organismal approach cannot [10].

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If one can step beyond the group versus kin selection debate that, Hydra-like, stifles progress, then *The Superorganism* can be recognized as a tour de force that should inspire a great deal of novel research. The ten chapters and 500-plus pages review almost 400 years of empirical social insect research in wonderful detail (these two authors excel at such work). Although the book has its own synthetic statements and conceptual views, it is mainly a refreshingly accessible overview of a huge literature on what are surely among the most fascinating organisms to have evolved on this planet. The arrangement of the book with footnotes and the themed chapters that act as stand-alone reviews of key topics (e.g. communication or division of labor) means that it can be dipped into with ease.

The Superorganism should be read, especially, I hope, by those who are either new or unfamiliar with social insect research. It should be recognized as advocacy of the superorganism view and, with that in mind, I believe the wonderful examples collected together will stimulate new thinking and approaches that can complement the important advances made through the kin selection framework over the past 45 years. It will probably not garner another Pulitzer but will undoubtedly go down in the annals as a

significant and original contribution; one among many from this inspiring duo.

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