Comparative Social Evolution

Darwin famously described special difficulties in explaining social evolution in insects. More than a century later, the evolution of sociality – defined broadly as cooperative group living – remains one of the most intriguing problems in biology. Providing a unique perspective on the study of social evolution, this volume synthesizes the features of animal social life across the principle taxonomic groups in which sociality has evolved. The chapters explore sociality in a range of species, from ants to primates, highlighting key natural and life history data and providing a comparative view across animal societies. In establishing a single framework for a common, trait-based approach towards social synthesis, this volume will enable students and investigators new to the field to systematically compare taxonomic groups and reinvigorate comparative approaches to studying animal social evolution.

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Foreword

W. D. Hamilton deeply admired Ronald Fisher's fundamental theorem, and developed one of his own, usually crystallized as $rB - c > 0$, that now serves as a core conceptual framework for understanding the evolution of social behavior. Unlike Fisher, Hamilton was a keen natural historian as well as a maths aficionado, not just admiring natural diversity but also using it as raw material for developing his theories of eusociality, sex ratios, asexuality, senescence, and beyond. Hamilton's theories were, and still are, general and inspirational. But are they fundamental enough to be predictive?

I was academically bred as a behavioral ecologist, orbiting both Hamilton and Richard Alexander at the University of Michigan in the 1980s. The behavioral ecological paradigm, at least back then, was the prediction of behavioral from ecological variation, for mating systems, social systems, and any other systems one cared to study. On one hand, the paradigm was hugely successful, as the ideas of Hamilton, Alexander, and others such as Robert Trivers motivated test after successful empirical test. On the other hand, or rather dropped from its grasp, the paradigm may be failing. More than three decades later, we still cannot truly predict social systems from ecology, can we, with any substantial degree of confidence? If we try, what specific set of predictors are, or should we, be using? Despite much work on social evolution since then, we still do not really have an answer to this question.

For the study of social evolution, we have as data sets far-flung convergences, between for example, social thrips and aphids or naked mole rats and sweat bees, and data on the correlates of social divergences between closely related species. This book brings convergences, divergences, and social diversity to the fore, and will certainly serve as a leaping-off point, but to where? I am hoping to a more predictive social behavioral ecology, where we at least try to determine what collection of life historical, demographic, morphological, physiological, functional genetic, and genetic structural data can best, and quantitatively, predict among species patterns of social diversity, from humans to slime molds. Experts in each social taxon, who are well-represented in this book, have the components of such prediction in their brains and their publications, but reaching across taxa becomes more and more difficult as our accumulated knowledge of social biodiversity deepens and broadens – enough to drown anyone but a next Hamilton, Alexander, or Trivers.

Hamilton started with genes "for" social behavior, torn from the frayed social academic fabric of post-Nazi eugenics. Researchers are now finding such genes, for example, in honeybees, *Polistes* wasps, and even *Homo sapiens*. Can these genes, or

genome-wide patterns of expression and variation, be leveraged to help make social behavioral ecology a predictive science? I fear, and reason, that for some decades genomes will remain far too complex and too far from social systems for any tight connections to be drawn. But perhaps we can begin to focus more upon specific genes and their pathways, social hormones, and social neurobiology across disparate taxa to fill and connect the gaps.

Indeed, neural and reproductive hormones may connect nicely with genes from below, and components of life history from above. And perhaps such interdisciplinary work that combines proximate with ultimate approaches, adding the spirit of Tinbergen to our pantheon, can link with bottom-up approaches guided by the taxa in this book. At this point, I can only exhort younger readers to become experts in specific social taxa, cognizant of other social taxa much more generally, and integrative in their methods of data collection. Scientifically, I have loved nothing more than learning about the social thrips of Australia, hearing about remarkable new discoveries of social cooperation in shrimps, aphids, or parasitic wasps, and collecting new forms of data on such creatures. I think this is all because we, as so-social humans, see echoes of ourselves among other social animals, each with their own amazing stories to tell.

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