

Open Questions in Evolutionary Biology

Seminar veranstaltet von
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Teilnehmer: Patrick Bateson (Cambridge), William D. Hamilton (Oxford), Erkki Haukioija (Turku), Eva Jablonka (Tel-Aviv/London), Stephen C. Stearns (Basel), Gunther S. Stent (Berkeley).

Evolutionary theory occupies a unique place in present-day biology— and this for at least four reasons. First, whether one speaks of conceptual content, of methodology, or of epistemology, evolution distinguishes biology categorically from the physical sciences. Which is to say, biology is characterised by the presence of the contingent — the results of particular historical antecedents and accidents — in every attempt at explanation. Thus, second, questions of evolution necessarily bear upon every other aspect and level of biology, from the biochemistry and molecular biology of nucleic acids and proteins, the anatomy of cells, the differentiation of tissues, organs, and limbs, to the functional adaptations of organisms, their social behavior, and their interactions in ecosystems and, ultimately, the biosphere. Third, evolution is the one part of biology that boasts a substantial theoretical component — and, indeed, scientists who can be called theorists. Fourth, the study of evolution has been robust and productive, the theories hotly contentious, for a decade and more.

The Wissenschaftskolleg was host to a seminar whose aim was to survey open questions in the theory of evolution — to assess their interrelations, their relative importance, and their immediate promise. I convened the seminar in the first place because I am writing a book about the present state of evolutionary theory, but also because discussions with the directorate of the Wissenschaftskolleg have made it clear that evolutionary biology is a science that the institute may wish to support extensively in coming years. The invited participants were: Patrick Bateson, who is an ethologist and Provost of Kings College, Cambridge; William D. Hamilton, who is professor in the department of zoology in the University of Oxford; Erkki Haukioija, who is professor of zoology in the

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University of Turku, Finland; Eva Jablonka, who is from Tel-Aviv University and, most recently, the Medical Research Council Mammalian Development Unit, London; Stephen C. Stearns, who is professor in the Zoologisches Institut of the University of Basel; Gunther S. Stent, who is professor of molecular biology at the University of California, Berkeley, and a fellow of the Wissenschaftskolleg; and myself. Several interested biologists in Berlin dropped in for parts of the meeting, as well as other fellows of the Wissenschaftskolleg. We kept the meeting informal, with no papers to be read; a loose working agenda was constructed by the participants on Sunday afternoon.

Arguably the liveliest fields in evolutionary theory today lie near the extreme biological levels, that is, evolution at the level of molecules and molecular genetics and evolution of the behavior of higher organisms. In this seminar, although several of us — Stent and Jablonka (and I as historian) — come from backgrounds in molecular biology, the interests of the participants converged on questions of the evolution of whole organisms, particularly of their behavior. Bateson raised at the start the fundamental problem — as he sees it — of the metaphorical character of the Darwinian term "selection". This problem leads directly to the vexed question of what the units or biological entities are upon which selection operates — individual organisms, as most evolutionists think, of species, as some argue can be the case, or individual genes and related groups of genes, as a few (notably Richard Dawkins, at Oxford) contend. More subtly, Bateson's problem is with the passivity of the process the Darwinian metaphor envisages: he raises in contrast the active role that organisms play in their own evolution, a role he sees as increasing markedly in birds and mammals, especially primates.

By this point, we had broached the full range of open questions. One line of these begins with the rates at which evolution goes on — the question of what is called, following George Gaylord Simpson, "tempo and mode". This in turn implicates the question of evolution by saltations, or relatively large, coordinated jumps in form and function — which in *its* turn drives the discussion to the molecular level, after all, with the problem of mutations in the control processes that determine how the successive actions of genes are coordinated in the development of the organism from fertilized ovum to adult. Another line picks up from the active role of the organism in evolution to consider the Darwinian problem of the evolution of behavior — and in the extreme, the ways that behavior itself may drive the evolution of form and function. Since the emergence of sociobiology in the mid-1970s, the evolution of behavior has been notoriously controversial. William Hamilton, in his mathematical treatment of kin selection, is the author of the fundamental theorem of sociobiol-

ogy. Bateson as a leading ethologist has seen his science transformed in the past twenty years by the systematic insistence upon the evolutionary dimension in the explanation of animal behavior. Stent has written polemics on certain issues raised by sociobiology. The controversies around sociobiology are the starting point of my book. Our discussion of recent development in sociobiology and of its present status was vigorous, and took surprising twists. A central open question is the origin and maintenance of sexual recombination. As one aspect of this, Hamilton has recently been investigating the possibility that defense against microparasites, including disease organisms, may give creatures that reproduce sexually a great selective advantage over parthenogenetic competitors. One of Haukioija's interests is the ecology of birch forests in the palearctic, particularly the group response of the trees to attacks by parasites on one or a few of them; he, Stearns, and Hamilton sketched experiments that might determine whether kin selection takes place in plants.

By mid-morning on Tuesday, the group had stepped back from details to consider three related general issues: the politics of evolutionary theory, the relation of evolutionary theory to the structure of biological thought, and the present organization of evolutionary biology in the Anglo-American scientific community and on the Continent. One tangible result of the seminar is the vigorous endorsement of the proposal that the Wissenschaftskolleg, with its unique standing, organization, and resources, lead a revival of evolutionary biology in Germany and on the Continent more generally.

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