Book Reviews

Zealous Advocates

The Case of the Midwife Toad. ARTHUR KOESTLER. Random House, New York, 1972. 188 pp. + plates. $5.95.

Like Keats's Madeline, we are often "asleep in lap of legends old." From *Darkness at Noon* to *The Ghost in the Machine*, Arthur Koestler has spent a career labeling as legend the cherished beliefs of idealists and intellectuals. In recent years, this gadfly has been shifting his attention from politics to science; now, he has alighted upon the midwife toad in an attempt to vindicate Paul Kammerer and tilt at the orthodoxies of modern Darwinism.

In 1926, Paul Kammerer shot himself on an Austrian mountain path. He had devoted his scientific career to supporting the Lamarckian postulate that characters acquired by parents during their own lives can be passed on to their offspring. He experimented with a variety of animals and claimed success with all, from the siphons of tunicates to the colors of salamanders. But the midwife toad, *Alytes obstetricans*, was both his triumph and his undoing. Most toads and frogs mate in water. In order to grasp and hold the slippery female, males develop "nuptial pads" on their palms and fingers during the mating season. But the midwife toad, breeding on land where the female's skin remains rough and dry, never develops these characteristic blackish swellings with their small, horny spines. Kammerer induced the midwife toad to breed in water and claimed that, after several generations, males produced nuptial pads and transmitted them to their sons. His results inspired determined opposition from disciples of the new Mendelian genetics, particularly from its spokesman William Bateson. After years of exhausting controversy, Kammerer allowed the American herpetologist G. K. Noble to examine his last specimen of modified *Alytes*. The toad had no nuptial pads; moreover, the black coloration on its left hand had been produced (or at least enhanced) by the injection of India ink. Seven weeks after the publication of Noble's report Kammerer killed himself. This seeming admission of guilt created his legend with its obvious moral on the dangers of zealous advocacy.

Koestler, with his usual richness of style and intelligence, has convinced me that this common reading is, indeed, legend in the derogatory sense. He combines an analysis of published sources, the testimony of living witnesses, and even some scientific experimentation of his own to argue (i) that the injection was more likely performed by one of Kammerer's numerous enemies than by Kammerer himself; (ii) that, in any case, it was done after Kammerer's famous demonstration of the specimen in England in 1923 (*1*); (iii) that Kammerer probably succeeded in producing nuptial pads in his water-bred *Alytes* (though Koestler seems unaware that, as I shall mention later, this provides no confirmation of Lamarckian inheritance); and (iv) that Kammerer's suicide was due as much to the mundane passions of unrequited love and economic failure as to the burden of tragic deceit. Moreover, Koestler has drawn an inference from the debate that is profoundly disturbing because it is probably of general application: the mistrust that established professionals felt for Kammerer arose more from his unconventional personality—his "artistic" temperament, his verbal ability, his unpopular politics—than from any legitimate doubt about the validity of his methods. Kammerer did not observe *les règles du jeu*. (And yet I must confess some lingering doubts about Kammerer. Why did he have Midas's touch to "succeed" in every attempt to verify the inheritance of acquired characters where so many others had failed? Also, after reading some of his popular works, particularly his defense of Steinach's method of "rejuvenation" [*2*], I am not convinced that his critical facility matched his penetrating intelligence.)

Still, I regard this book as a failure because Kammerer's case cannot carry the universality that Koestler tries so hard to impart. Kammerer was a fascinating man and a dedicated worker (one can only commend the zeal of a herpetologist who named his daughter Lacerta); but he was not a great scientist. Koestler tries to circumvent his protagonist's lack of eminence by universalizing his situation, by treating it as an exemplar of the courageous individual in conflict with a self-assured, crushing orthodoxy—by casting Kammerer as Galileo and a supposedly smug Darwinism as the Catholic church. For, in such a context, Kammerer can still be a tragic hero: if he lacks the grandeur of Oedipus, he can at least claim the universality of Willy Loman.

But such a view of evolutionary theory in the first 30 years of this century is simply false. There was no evolutionary orthodoxy in Kammerer's day, only confusion. Koestler believes that the rediscovery of Mendel's laws in 1900 had the following impact upon a previously inadequate theory:

> By an unexpected and almost melodramatic turn of events, the crisis was resolved, the clouds vanished, and Darwinism became transformed into neo-Darwinism [pp. 52–53].

Precisely the opposite occurred. The Mendelians, with their insistence upon large mutations as the agent of evolutionary change, undercut the Darwinian assumption of insensibly graded variation and introduced more conflict into evolutionary theory than had ever existed before. (This was not resolved until after Kammerer's death, when in the 1930's population geneticists recognized micromutation as the raw material of evolutionary change and equated it with Darwinian variability.) Thus, Kammerer was not fearlessly fighting an established orthodoxy; he was battling with one school of biologists, the Mendelians. Koestler clearly shows that Bateson was the play's villain—by refusing to examine the specimen when he had a chance, arguing by insinuation, and opposing authority to empirical evidence. But this carries no general message about how establishments crush individuals. It merely shows that William Bateson was a very nasty man. (Indeed, in the honesty of his youth, he had written to his mother [*3*], "I never get on with anybody for long.") Not only was Bateson not a Darwinian, he even ended his career in utter confusion on how new species arise. In a famous

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article, published exactly 50 years ago in this journal, Bateson wrote:

> Less and less was heard about evolution in genetical circles, and now the topic is dropped. When students of other sciences ask us what is now currently believed about the origin of species we have no clear answer to give. Faith has given place to agnosticism [*4*, p. 57].

Moreover, Kammerer's Lamarckian views did not place him among an embattled minority. Among naturalists, belief in the inheritance of acquired characters was, in Kammerer's time, a majority opinion (*5*).

This perspective vitiates the ulterior motive of Koestler's book—to support his own battle against neo-Darwinism (*6*). For Koestler's conception of modern evolutionary theory is as misinformed as his view of its history. Were Koestler's characterization correct, we would all have to paraphrase Marx and deny that we were Darwinians. To Koestler, modern Darwinism is a mean, heartless, rigid, niggardly theory encompassing all the worst features of an uncompromising 19th-century mechanism. To us, it seems generous, flexible, and expansive (it has certainly attracted the allegiance of field after field, from cytogenetics to ethology—precisely what is meant by calling it the "modern synthetic theory"). Like many other critics, Koestler has failed to understand the creative role of natural selection—that by constantly accumulating small, favorable variants from a random pool of variation, it slowly builds adaptation. Koestler sees natural selection only as a negative force, as an executioner, an eliminator of the unfit. If this were true, then Koestler would be justified, for how could random mutation ever lead to the wondrous complexity of life? Some other directing force would be needed, and the attractive (but apparently untrue) Lamarckian hypothesis—a mechanism for *directed* variability—might arise once again as a resolution devoutly to be wished. Thus, Koestler writes:

> Neo-Darwinism does indeed carry the nineteenth-century brand of materialism to its extreme limits—to the proverbial monkey at the typewriter, hitting by pure chance on the proper keys to produce a Shakespeare sonnet [p. 30].

The simile is hoary enough, but it is utterly inappropriate. Rather, our monkeys must be allowed to keep all the correct letters after each trial. "Fortune and men's eyes" will soon arise. (I do not know—and it fills me with great

sadness—why we have been so singularly unsuccessful in conveying our understanding of natural selection to interested nonscientists, for Koestler's confusion is shared by most critics in the humanities and constitutes the greatest gulf between the two cultures' understanding of evolutionary theory. And it must be our fault.) Moreover, Koestler's narrow view of modern Darwinism leads him to see as exceptions to it a large set of phenomena—the "Baldwin effect" and pedomorphosis, for example—that comfortably reside within it.

A man cannot wear the mantle of Galileo simply because he stands against an establishment that treats him badly; he must also be right, or at least brilliant. If he isn't, his story will probably become the farce that Marx recognized as the historical repetition of tragedy—Galileo the tragedy, Velikovsky the farce.

I must end by citing two ironies:

1) Even if we accept Kammerer's experiments on the midwife toad—and I do—they constitute no case of Lamarckian inheritance. Few Lamarckians would claim that so complex a structure as the nuptial pads could arise from nothing in so few generations. Since nuptial pads occur in more primitive, related species and even, occasionally, in the midwife toad itself under natural conditions (p. 167), their appearance in Kammerer's experiments represents the fixation of an atavism—that is, the genetic potential for forming nuptial pads already existed in natural populations of *Alytes obstetricans*. Kammerer performed a good Darwinian experiment and unconsciously selected for them in the following way: He took hundreds of eggs from females and tried to raise them in an unnatural aqueous environment. Only a few percent survived (pp. 155–56). He then repeated this procedure over several generations. In other words, in each generation he imposed a powerful selection for whatever genetic factors allow an egg to develop successfully in water. His final population differed markedly from natural ones in its progressive accumulation of genes conferring success in aqueous habitats. Is it then surprising that the nuptial pads—an aqueous adaptation—gained expression where they had before remained latent? This phenomenon—the gradual fixation by selection of traits that first appear as adaptations acquired during life—is well known to modern Darwinians and has been termed "genetic assimilation" by Waddington. Koestler's plea for a repetition of Kammerer's experiment should be heeded, but its interpretation will probably be in this context. If *all* eggs survived in water and all offspring contributed an equal number of eggs to the next generation, and if the nuptial pads still appeared and attained hereditary fixation, then that would be a different, and indeed a Lamarckian, matter.

2) Kammerer was an ardent socialist. His Lamarckian views were motivated as much by a vision of the perfectibility of man as by any empirical consideration, a point Koestler fails to make. Kammerer's a prioris were as rigid as the staunchest Mendelian's. Kammerer's suicide prevented his assuming the research position he had accepted at the Moscow Academy of Sciences. His case became the basis for a slightly fictionalized, full-length Soviet propaganda film, directed by the Commissar for Education himself. Kammerer became a hero of Lysenkoist biology. How ironic that Arthur Koestler, contributor to *The God That Failed* and author of *Darkness at Noon*, should now take for his hero the delight of his former enemies. Dubious science, it seems, makes as strange bedfellows as dubious politics. Poor Rubashov must be spinning in his grave.

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References and Notes

1. Nonetheless, as Derek Freeman notes (*New Scientist*, 2 March 1972, p. 509), eyewitness H. Graham Cannon reported in his *Lamarck and Modern Genetics* that Bateson, during a cursory examination of the specimen, mumbled to him, "It looks to me like a spot of black ink." This needn't mean much, since Bateson was notoriously unfair during the whole debate and didn't even bother to remove the specimen from its jar on this occasion. Still, I am puzzled by Koestler's silence on this statement, since he claims that he "quoted all available eyewitness reports, without omissions" (p. 105). Koestler must have encountered it, for, as Freeman remarks, he cites Cannon's work frequently and even "makes polemical use of quotations taken from the opening and closing sections of the very paragraph in which Professor Cannon's report is located."
2. P. Kammerer, *Rejuvenation and the Prolongation of Human Efficiency* (Boni and Liveright, New York, 1923).
3. W. B. Provine, *The Origins of Theoretical Population Genetics* (Univ. of Chicago Press, Chicago, 1971), p. 36.
4. W. Bateson, "Evolutionary faith and modern doubts," *Science* **55**, 55–61 (1922).
5. E. Mayr, personal communication.
6. A. Koestler, *The Act of Creation* (Macmillan, New York, 1964) and *The Ghost in the Machine* (Macmillan, New York, 1967).

The Evolution of Communication

Non-verbal Communication. R. A. HINDE, Ed. Cambridge University Press, New York, 1972. xiv, 444 pp. + plates. $17.50.

The study of animal communication is enlivened by the faith, first generated in 1872 by Charles Darwin in *The Expression of the Emotions in Man and Animals*, that its findings will illuminate the evolutionary origins of human communication. The human side of the link is most likely to be provided by "paralinguistics," that bewildering array of facial expressions, eye movements, hand waving, postures, variation in pitch and loudness of voice, and other nonverbal signals used to mediate a substantial portion of communication in all human cultures. The evolutionist routinely asks: Are these signals primitive? If primitive, are they homologous with signals in lower animals, representing in some fashion the precursors of our own unique, verbal speech?

At the same time that zoologists have begun a sustained effort to extend their concepts to the study of human communication, a few social scientists are trying to adapt zoological techniques to their vastly richer and more difficult data. The ultimate goal of this combined effort is the elucidation of human speech and social behavior within the framework of evolutionary theory. In H. L. Teuber's words,

> It has become clear . . . that linguists are ethologists, working with man as their species for study, and ethologists linguists, working with non-verbalizing species.

From 1965 to 1969 a study group sponsored by the Royal Society met on 12 occasions to explore the subject in depth. Prior to the 13th and final meeting, in September 1970, drafts of chapters based on the earlier conferences were circulated among the members for criticism. The result is *Non-verbal Communication*, a valuable book that draws together an exceptionally difficult and heterogeneous subject. Much of the credit for superior organization must go to W. H. Thorpe, who chaired the meetings and wrote three of the more