Discussion

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My comments are limited to the section on adaptation and paradaptation. I find the discussion of adaptation to be confusing because of imprecise use of words and apparent circular reasoning. For example, Bock states that all features existing for long periods of time, or used in the classification of animals, are adaptive. He follows this premise with the statement that in a survey he could find no characters used in avian classification that were not clearly adaptive. If the same definition of adaptation applies to the two sentences, the second is tautological; yet it is presented as support for the premise. Throughout the discussion, one is unable to determine what definition is adopted at a given moment. Bock strongly implies that he views adaptation as state of being, a viewpoint that I vigorously reject, but he may be attempting to make a point essential to the development of his argument. Certainly if every feature that exists is adaptive, nothing else can be used in
classification, and discussion of the usefulness of adaptive charac-
ters in classification is reduced to the level of absurdity, as Bock
correctly states. To me, however, the absurdity occurs at the point
at which adaptation is essentially equated with state of being. In
my view, features that increase the reproductive potential of
organisms are adaptive; if they do not do so, they simply exist.
Certainly, we have sufficient information from such fields as de-
velopmental biology and genetics to indicate that nonadaptive
(features of my definition) features are maintained in populations by
such phenomena as canalization, and it appears that Bock has
attempted to avoid biological facts by directing attention to the
semantic arguments.

I am equally unhappy with the discussion of paradaptation,
which appears to me to be an attempt to add yet another name
to what has long been recognized as the opportunistic nature of
evolutionary processes. Bock groups various factors, such as
mutation and recombination, features of the ancestral group, and
timing, as “chance-based” evolutionary mechanisms and phenom-
enas, and he states that these give rise to paradaptations. These
factors are important in determining what change will or can
occur, but they are hardly evolutionary mechanisms. Placing
emphasis on such factors, rather than on the results of selective
processes, seems strikingly close to mutationism. To me, mutation
and recombination are sources of raw material on which evolu-
tionary mechanisms act, and to place emphasis on opportunism of
occurrence rather than selection seems a step backwards. How-
ever, the main point is that while Bock suggests that the paradap-
tive properties of characters determine the taxonomic usefulness
of the various characters, he presents neither a rigorous nor even
an operational definition of paradaptation. If paradaptations
cannot be consistently and objectively identified, they cannot be
used. When Bock uses the word “paradaptation,” one could as
well substitute “character” or even “thing.” As it stands, the
concept of paradaptation is highly subjective and cannot be used
in building classifications or in other systematic work.

Features are said to be paradaptive and, at the same time,
adaptive or nonadaptive, relative to different selection forces.
This would seem to place too much emphasis on isolated parts of
the organism and not enough on the whole organism, including its
full ontogeny and its populational and environmental relationships.
However, I think that Bock’s object in this paper is to make a plea
for more careful character analysis with close attention paid to the
origin and meaning of various morphological features. I certainly
support him in this.

In my view, one ought to be very broadly comparative within
groups—to study all members of the group being analyzed and all
aspects of their morphology, as well as utilizing ontogenetic and
developmental information—rather than emphasizing single func-
tional units. My work on lower vertebrates indicates to me that
comparative morphologists must develop an awareness of the de-
velopmental state of species at maturity. This is particularly
crucial in lower vertebrates where paedomorphic and geronto-
morphic modes of evolution are so prevalent.

Finally, I suggest that classifications be built on the basis of
total available information, as we have heard again and again at
this conference. Thus, when considering morphology, we should
consider all parts and all stages of development. We must, as
morphologists, remember that it is populations, not parts, of
organisms that evolve. The parts are important, of course, and I
consider careful and objective character analysis to be an important
task of the comparative morphologist, and logical use of the derived
information the most important task of the taxonomist. I prefer
to build classifications on the basis of high correlation of special-
ized or derived (and adaptive, in my sense of the term) character
states, which carry information concerning change and community
of descent. By adopting rigorous methodological approaches and
applying consistency tests to the results of the analysis of large
bodies of data from different systems, problems resulting from
convergence can now be readily surmounted. The most important
role of comparative morphology to the taxonomist of the future
will be in the area of character analysis, an activity that lies at the
base of all taxonomic work and that has been approached too
often in a superficial manner in the past. It is at this point
that the morphologist, with his functional, ontogenetic, and com-
parative approaches, can make his most meaningful contribution
to taxonomy.