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Classical and Molecular Biology Homology

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Description

The three tests that can be used to evaluate a homology hypothesis are congruence, conjunction, and similarity. These tests allow us to examine the different types of homologous and nonhomologous relations in classical and molecular biology. In both morphology and molecular comparisons, the same three criteria are used to distinguish between eight different types of relationships. These different connections are described and contrasted. In morphology, the adult or life cycle is used as the unit or benchmark for comparison, but in molecular biology, the haploid genome is used. While the molecular sequence data similarity test is the deciding factor in morphology, the congruence test is decisive in differentiating homology and non-homology. Since there may be a greater relationship between molecular sequences, molecular homology may indicate either species phylogeny. The use of the term homology in molecular sequence comparisons has recently generated "a terminology confusion and a route out of it," according to a recent multiauthored letter to the editor of Cell. There, the term "having a common evolutionary origin" was used to define homology. The term "muddle" was used loosely to denote to resemblance, and the ensuing "muddy writing" or "muddy thinking" was the result. The letter generated enough popular attention for a page of commentary in Science's editorial section. Such misunderstandings won't happen in Molecular Biology and Evolution because the usage guidelines provided to contributors are clear: homology should be used to refer to "inferred common ancestry" because observed similarities between sequences may have "been acquired by convergence rather than retained after divergence" [1,2].

This highlights the difference between theoretical definitions of terms-which may be created by custom or fiat, may change over time, and need not be operational-and the possible empirical criteria that could be used to assess whether a given definition is met. Since homologies are speculative, how can we test them given that one goal of science is to test hypotheses? How can we determine whether an apparent similarity is a reliable indication of shared ancestry? If similarity must be distinguished from homology, then testing a homology hypothesis is not always the same as similarity being assessed. My goal is to examine the parallels and discrepancies between the various classifications of homology and homoplasy in molecular biology and classical morphology. Congruence, conjunction, and similarity serve as the three homology tests. The classic approach to comparative morphology is testing for similarity, which has been used at least since Aristotle. In Owen's original definition of homology, similarity is the only criterion mentioned. The normal standards are topographic correspondence and ontogenetic transformation, and correspondences that pass these tests are entitled to the same name. According to what I've mentioned, morphological similarity almost ever puts a notion of homology to the test, but rather confirms that it should be tested or assesses its internal coherence. In contrast, "similarity is the factor that drives us to postulate homology," or, in Stevens' words, "without some similarity, we should not even conceive of homology," according to Cracraft, since nonhomology also requires similarity [1-3].

Homonomy differs from homology in that it fails the conjunction test since the homologue occurs more than once in a single person; this is the difference between anatomical singulars and plurals. A further comment on these two categories—and, in particular, on the significance of the life cycle—is provided by Patterson. The complement relation is the presence of a homology versus its absence, and "two homologies" means two occurring in the same organism so that the conjunction test is failed. Parallelism and convergence are different in the similarity test because convergences are "not really the same" thus fail similarity as well. Parallelisms are rejected as homologies since they do not characterise monophyletic groups. Since determining if convergence happens in molecular sequence data is one of the goals of this paper. According to their definition of parallelism, taxa start off in the same situation and separately go through the same changes, therefore the final product will have characters that are similar to one another or "the same." According to Gosliner and Ghiselin's definition of convergence, taxa start out with different conditions and travel down different paths to reach a similar condition. Since they accept that convergence between cephalopod and vertebrate eyes exhibits "important differences resulting from remoteness of initial conditions," it is obvious that the final product of convergence will include distinguishable characters. To summarise this review, it should be noted that it is not required to interpret the final products or the observed characters because parallelism and convergence reflect different theoretical notions [4,5].

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Conflict of Interest

The author reported no potential conflict of interest.

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