

Recognizing Adaptation

Adaptive explanation - How can we recognize adaptations?

Recognizing adaptive characters

The study of adaptation could be made foolproof if we had a criterion to distinguish in advance between adaptive and non-adaptive characters.

General rules for recognizing adaptations:

- Adaptations can be recognized as characters that appear to be too well fitted to their environment for the fit to have arisen by chance.
- Adaptations are characters that help their bearers to survive and reproduce.
- Adaptations are purposive and often complex: the sorts of characters that before Darwin would have suggested the existence of God.

There is no doubt that some adaptations, such as the camouflage of stick insects like this mantid opposite, easily fit this definition but there can be problems with doubtful borderline cases: especially problematic, for instance, is the small differences in a character in different species.

Finally, you should be aware that the issue of adaptation is a controversial one in evolutionary biology. The information in this tutorial should provide you with enough background information to follow the arguments, some of which are covered in the classic texts available.

As a taste of this, the biologist Richard Lewontin attacks the entire concept of an adaptation.

Adaptive explanation - How can we recognize adaptations?

"The whole concept of an adaptation is the notion that there is a pre-existing problem and an organism solves it by adapting to the problem. For example, fins are an adaptation for swimming, so what we mean is swimming was a problem before fish had fins. The problem with looking at evolution in that way is swimming is a problem for trees too!

Things only start to find these problems and adapt when they begin to interact with the world. So adaptation cannot be a case of organisms going into pre-existing problems because organisms make the problems by their very existence and change. The real issue in evolution is that organisms are in constant construction of their own worlds, posing the problems which they then have to solve.

Natural selection does not cause adaptations to solve problems given by nature. Natural selection means the improvement in the way in which organisms interact in the world when they've already started to interact in that way."--Richard Lewontin

Problems recognizing adaptation (an "onerous" concept):

- A. An adaptation may not appear to result in better performance with respect to the environment
 - 1. Adaptation increases *relative* fitness, not necessarily absolute fitness (relative to what?)
 - 2. Better competition with other genotypes may not result in increased population size (why?)
- B. A variation of a structure could simply be neutral
- C. Adaptations may not have evolved for purposes for which they now appear to be useful
- D. A trait might not be determined genetically, but be a direct consequence of environment or learning
- E. A trait might be a simple consequence of chemical or physical "laws"
- F. A trait may have evolved by genetic drift
- G. A trait may have evolved as a pleiotropic consequence of allelic differences that evolved for other selective reasons or by genetic drift
- H. Different species may have (neutral) variation for the same adaptive feature merely because of different ancestry; e.g., although a pattern that provides good camouflage is likely to be an adaptive trait, alternative patterns that also provide good camouflage may work just as well (i.e., although the camouflage is adaptive, particularities of the pattern might have resulted from arbitrary historical "choices")
- I. Many variations that appear may be "constrained" by the developmental system or the genome (e.g., that tetrapods have 4 limbs may not be an adaptation--why couldn't 6 work just as well?--but this number depends on what is allowed by the developmental mechanisms that pattern the organism and on the ancestry of the genome)
- J. Any trait is likely to be anachronistic, since the conditions under which a feature evolved existed in the past