MICROEVOLUTION TO MACROEVOLUTION

Presenting the Concept

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BACKGROUND

Microevolution is a term often applied to the process whereby a species (or a population) undergoes significant changes over time, such that certain new traits or groups of traits characterize the group sufficiently that it could be called a "sub-species", "race", or "variety" of the original species. This term may also be extended to include the formation of new species, the process of speciation. The mechanism currently considered to play a major role in microevolution is natural selection, but may also involve other elements.

Macroevolution refers generally to the formation of major groups of organisms from other groups that are distinctly different. For example, the evolution of mammals from earlier non-mammalian tetrapods, or the evolution of whales from terrestrial mammals. The mechanism for this process is generally considered to be the same as for microevolution, but carried on accumulatively over many millions of years, resulting in the ever-increasing diversity of life we see today.

As the evidence and examples of microevolution have become increasingly abundant and compelling, some people formerly opposed to the notion of evolution in general (usually for religious reasons) have more recently conceded that microevolution may be taking place, but they continue to insist that this cannot explain macroevolution.

The purpose of this teaching aid is to provide a strong visual explanation for **how** macroevolution could very easily result from microevolution over long periods of time.

PROCEDURE

1. An overhead transparency is prepared, showing a complete but simplified evolutionary tree, with a single vertical line at the bottom, splitting gradually into two branches, and each of these further up branching again, and so on, branching at 3-4 levels. A vertical time line is placed along one side, with "Long Ago" labeled at the bottom of the line, and "Now" labeled at the top of the line.

2. A piece of opaque paper is placed over the transparency, revealing only the single "trunk" of the tree at the bottom. The teacher points out that this "trunk" represents one species over some time. As the opaque paper is slowly slid upwards, the class will see the first branching come into view, representing two new species forming gradually from the splitting of the original species, over time. Be sure to say this as you do it, perhaps asking the class to suggest "how could these two species be produced from one", and waiting to get an answer like "natural selection" or "species-formation". Continuing the slow "advance of time" by slowly moving the opaque sheet even further up the page reveals each new branch splitting into two new branches, and so on, until the "Now" level is reached.

3. Students will see that some branches have stopped (gone extinct). Some have split more than others, but at any given point (e.g. "Now"), one finds groups of species very close together (reflecting their most recent branching), each group which we would classify as a "genus". There may be 2 or 3 such genera which are clearly closer to each other than to the others, reflecting a common branching somewhat earlier than the branchings which produced the genera, and from a common ancestry distinctly different from the ancestry of the other groups. We would classify them as members of one "family". Point out that this is greatly simplified for clarity.

4. It is vital that, after doing this routine (paragraphs 2 and 3), you point to the first branching (near the bottom) and ask the class "What process produced these two branches from the single species near the bottom?", looking for an answer like "natural selection" or "speciation" or "species-formation", and doing the same sort of review at each higher level, reinforcing the idea that speciation (microevolution) is working at each level.

5. Finally, by covering everything except the endpoints (species) at the "Now" level, showing how we would group them now, point out how what we would call two distinct "orders" (such as whales and rhinos) could result from repeated speciations over time: Macroevolution resulting from Microevolution.

6. This diagram also clearly shows the connections between evolution and how we classify living things.

EVOLUTIONARY TREES AND CLASSIFICATION