

## Road to Nowhere?

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# BioScience

Organisms from Molecules to the Environment

American Institute of Biological Sciences

## Road to Nowhere?

Years ago, many of us slogged through exercises involving null hypotheses, postulates that some suspected effect does not exist. We showed that data were unlikely to have arisen if a null hypothesis were true, so we decided that the null hypothesis must have been false and that a more exciting alternative was supported. Some of us may even have used such notions in research, looking for ways to slice our data to make them reach the magical " $p < 0.05$ ." But, with due deference to Sir Ronald Fisher, how was the idea of a null hypothesis useful? Did it really move us toward discovery, as Sir Karl Popper's version of the scientific method would indicate?

The null is no stranger to controversy. Statisticians and philosophers of science have pointed out that it is typically rejected when it makes observed data seem unlikely, although a researcher might prefer to know what the observed data say about the unlikelihood of the null. Alas, that cannot be calculated without prior information, so the standard procedure calls for abandoning the null if the observed data reach some threshold of improbability.

The notion that science proceeds through falsifications has taken some major hits in recent decades, however. The critics agree that some unfalsified theories are very much better than others. It follows that the forking path of unfalsified hypotheses is no yellow brick road. In any case, ecologists know that data limitations often make the classic paradigm inapplicable to their problems. Yet thousands of book bags are still weighed down by null hypotheses.

In the Forum essay that begins on p. 778, Fred Singer advises educators to give up teaching about null hypotheses and instead concentrate on what researchers really do. They formulate research hypotheses, and they test the likelihood of the predictions that arise from them, given certain assumptions. Hypotheses are not typically abandoned if their predictions fall short of the statistical bliss point, nor should they be: the hypotheses are creatively refined. Singer suggests teaching that both scientific truth and techniques for testing ideas are probabilistic. He maintains that this approach will make it easier for students to understand how science is done.

Singer provides no data on the effectiveness of the strategy, so cautious educators will not immediately accept it as significant. But many biologists will recognize themselves in his descriptions of a researcher's attack on a problem.

In the July/August issue, Louis P. Elliott and Barry W. Brook (*BioScience* 57: 608–614) argued for greater acceptance of the method of multiple working hypotheses. They advocated this approach to science as realistic, particularly for problems addressed with data from multiple sources. Multiple hypotheses that may be simultaneously true are evaluated, but no null hypothesis ever appears.

The growing popularity of the multiple-hypotheses method may support Singer's plea that the null hypothesis be kept out of at least introductory classes. (Few critics seek to abolish the concept altogether.) I can't prove that this support for Singer is real, of course. But it seems like a reasonable working hypothesis.

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