

Show Me the Data!

There is an unusual paper in this issue of the *Journal*. It is unusual in that it is labeled "Conjecture"; indeed, it was submitted with that label attached by the authors. One of its reviewers raised three concerns to be considered before recommending it be published. First, the reviewer questioned the value of writing and publishing conjectures at all, saying "I feel it is always better to do experiments rather than to pontificate." (Clearly this is not the person to ask to write guest Editorials.) Second, the reviewer felt that the basic premise of the paper—dual oscillators mediating photoperiodic and other effects—may not be needed or particularly useful to understand the phenomena under discussion. Third, the reviewer felt that the particular functional entities postulated may not be real. In short, and perhaps overstating the case, the reviewer suggested that the paper might be inappropriate, unnecessary, and wrong.

These are serious objections for any paper. Yet here it is—published. (Let me warn you that, should your paper be rejected on the grounds that the reviewers found it "inappropriate, unnecessary, and wrong," citing this Editorial will do you no good at all.) As a matter of editorial policy, it is the first question, whether and when it is appropriate to publish conjecture, that is most problematic. Conjecture has a long checkered history in scientific circles. Speculation, conjecture, and hypothesis—related words with varied meanings and usages—have been looked upon with suspicion ever since science clearly differentiated itself from other ways of knowing. Isaac Newton (1642-1727) said, "I frame no hypotheses, for . . . hypotheses . . . have no place in experimental philosophy." This view remains sufficiently strong and prevalent that papers may be rejected for presenting "unsubstantiated hypotheses" or "mere conjecture." What is the harm in conjecture? That it may be mistaken for knowledge. To minimize that risk, the Conjecture is immediately followed here by a Commentary, and is accompanied by an article presenting relevant new results.

At the same time, we value hypotheses and conjectures. Charles Darwin (1809-1882) said, "How odd it is that anyone should not see that all observation must be for or against some view if it is to be of any service!"

This view remains sufficiently strong and prevalent that papers and grant proposals may be rejected for not being "hypothesis driven." What, then, is the good in conjecture? That it may lead to knowledge via experiment. As science progresses, hypothesis and experiment leapfrog over each other, each providing the basis for the other to proceed fruitfully.

The two quotations are not as opposed as they may seem, for Newton defined "hypothesis" as "whatever is not deduced from the phenomena" (a definition that leaves considerable wiggle-room) and Darwin, elsewhere, said "An unverified hypothesis is of little or no value." It is facile speculation, lacking foundation and prediction, that they opposed. It is fertile hypothesis, leading to verification, that they supported. That second quote from Darwin says, more fully, "An unverified hypothesis is of little or no value. But if any one should hereafter be led to make observations by which some such hypothesis could be *established* [emphasis added], I shall have done good service, as an astonishing number of isolated facts can thus be connected together and rendered intelligible." From the perspective of scientific progress, it doesn't matter whether the same or different people provide the experiments and the hypotheses. Or which come first.

I believe that some conjectures merit publication, but not that any set of conjectures will do. Its ideas must be well-considered, clear, and important. These ideas should integrate new and old findings. They must be worth testing and debating, and there must be predictions and experiments to test them by. This view values contribution to the process of science as well as to its outcome. It obviates two of the reviewer's objections, for determining whether ideas worth taking seriously are necessary or wrong is one of the substrates of scientific progress. Thus, the editorial issue became whether consideration of the present Conjecture and the ideas it raises will promote scientific progress. I believe it will. The ideas presented need not turn out to be right in order to be useful. After all, the truly devastating criticism of a conjecture is the one hurled by Wolfgang Pauli (1900-1958): "It's not even wrong!"

Martin Zatz
Editor