

## Broadening Biology

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# BioScience

Organisms from Molecules to the Environment  
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## Broadening Biology

Those of us who once learned that genes are entities that propagate and manifest themselves within species may find their conceptual categories stretched beyond the breaking point if they dare read the overview of progress in metagenomics on p. 102 by W. Ford Doolittle and Olga Zhaxybayeva. Together with the similarly challenging Feature by Karen Hopkin published in December (*BioScience* 59: 928–931), their article reminds us, if reminding were needed, that there is still a great deal still to be understood about how and where, exactly, natural selection acts on DNA. Critical analysis of new data makes clear that, among the bacteria and archaea that are Doolittle and Zhaxybayeva's focus, the concept of species may hamper the appreciation of more fundamental categories: communities of interacting genes. Moreover, as Hopkin explained, the functioning of genes is not as straightforward as it once appeared. At least in eukaryotes, it is becoming more difficult to define precisely what a "gene" is. And as if this iconoclasm were not enough, biologists are becoming more aware of the importance for evolution of processes that do not principally involve heritable variations in DNA sequences.

Advancing insights into the complexity of life processes do not take anything away from the truths that previous generations of biologists have established. The colors of crossed pea plants can still be predicted using the laws of segregation and independent assortment, and innumerable experiments have confirmed the value of principles of population genetics established a century ago. But Gregor Mendel, G. H. Hardy, and Wilhelm Weinberg considered carefully selected cases amenable to analysis with the tools they had available. It is unsurprising that today, with vastly more powerful tools, we can see realities they could scarcely have been aware of. A sort of selection process will doubtless determine how useful some older concepts will remain.

It's fascinating to consider the extent to which the biologists of the next century, or for that matter, of the coming decade, will rely on ideas familiar today. It would be arrogant to suppose that they will find them sufficient. It would likewise be arrogant to imagine that better understanding will make evolution in the real world predictable in detail. There are good reasons to believe that will remain impossible, which may be comforting to those who fear science's influence.

Yet the most basic biological insight of all—that repeated, controlled experiments can elucidate comprehensible and general mechanisms that constitute life—has come through with flying colors. The understanding of life is deepening, not disintegrating, and explanation is not going out of style, despite the attempts of evolution-deniers to muddy the waters. People who want to see science contribute to solving escalating environmental problems can be grateful: The enlightenment is not repealed. The potential for biology to help has never been greater.

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