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Biology's Models

It's a motley collection of creatures: They fly, swim, wiggle, scurry, or just blow in the wind. But to the scientific community, this compilation has been elevated above all other species. They are the model organisms.

What organisms comprise this collection? Just why, and when—and by whom—were they selected? What contributions have they made to the understanding of life processes?

We explore these questions here, in this first-ever supplement to *The Scientist*.

Of the many species that could claim to be model organisms, we concentrate on the eight most used and most useful. Our collection covers *Escherichia coli*, a common intestinal bacterium that can cause diarrheal disease; *Saccharomyces cerevisiae* and *Schizosaccharomyces pombe*, a pair of single-cell eukaryotes, both yeasts but distant cousins known for their roles in bread and beer production; *Caenorhabditis elegans*, the tiny, soil-dwelling worm; *Drosophila melanogaster*, the ubiquitous fruit fly; *Danio rerio*, known as the zebrafish to aquarium owners everywhere; *Arabidopsis thaliana*, the unprepossessing little weed that models for the entire plant kingdom; and the once-humble house mouse, *Mus musculus*, now breeding a \$200 million (US) per year business.

Researchers selected this weird and wonderful assortment from tens of millions of possibilities because they have common attributes as well as unique characteristics. They're practical: A model must be cheap and plentiful; be inexpensive to house; be straightforward to propagate; have short gestation periods that produce large numbers of offspring; be easy to manipulate in the lab; and boast a fairly small and (relatively) uncomplicated genome. This type of tractability is a feature of all well-used models.

But they also have long-lasting utility; *C. elegans* proves the point. The worm, chosen as a model in the early 1960s, is genetically amenable and transparent, so that every cell division and differentiation event can be followed directly under the microscope. To quote the 2002 Nobel Prize presentation speech: *C. elegans* is

"loaded with features." Newly discovered attributes have helped maintain its supermodel status, such as the ease with which genes can be switched off by adding interfering RNAs to its food.

To ice the cake, these tiny worms are hardy: They can survive storage by freezing, and the ones taken on the doomed space shuttle Columbia were found alive nearly four months after the crash.

Each model organism is distinctively suited, in its guise as a simplified model, to the study of complex aspects of biology. Researchers are repeatedly surprised that discoveries in simple organisms are relevant to human biology, which encourages transposition of results from one model system to another, and highlighting the extent of conservation and commonality of life forms. The differences hold value as well, as they provide important insights to understanding cell physiology and pathology.

The Supplement comprises a series of articles demonstrating how model organisms are being used to investigate some of the hottest areas in biological research. Double-page spreads provide the history, the important research, the vital databases, the curriculum vitae, the players, and even a glimpse into the future.

In the wild, these models will continue to fly, swim, wiggle, scurry, and blow in the wind. In the lab, however, their contributions promise a different type of movement—one that will continue progressing towards a better understanding of the biological world.

Christine Bahls
Jonathan Weitzman
Richard Gallagher

We owe thanks to many people, but especially to Sam Jaffe and Karen Schindler, for their assistance and technical expertise.

Need more copies?

Additional copies of this supplement, and the series of six posters on model organisms, can be purchased from *The Scientist*. E-mail info@the-scientist.com for details.

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