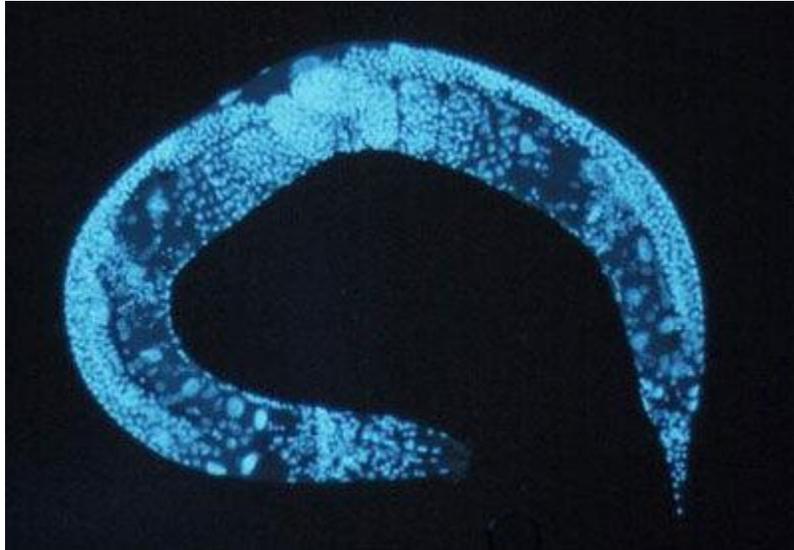


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What is a Model Organism?



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Introduction

A model organism is a species that has been widely studied, usually because it is easy to maintain and breed in a laboratory setting and has particular experimental advantages.

Over the years, a great deal of data has accumulated about such organisms and this in itself makes them more attractive to study. Model organisms are used to obtain information about other species – including humans – that are more difficult to study directly. We can distinguish three major types of model organism:

Genetic model organisms

These are species that are amenable to genetic analysis, i.e. they breed in large numbers and have a short generation time so large-scale crosses can be set up and followed over several generations. Many different mutants are generally available and highly detailed genetic maps can be created. Examples include baker's yeast (*Saccharomyces cerevisiae*), the fruit fly (*Drosophila melanogaster*) and the nematode worm (*Caenorhabditis elegans*).

1. Experimental model organisms

These species may not necessarily be genetically amenable (i.e. they may have long generation intervals and poor genetic maps) but they have other experimental advantages. For example, the chicken and the African clawed frog *Xenopus laevis* have many disadvantages in terms of genetics but they produce robust embryos that can be studied and manipulated with ease. These species are widely used model organisms in developmental biology.

2. Genomic model organisms

Regardless of their genetic or experimental advantages and disadvantages, certain species are chosen as model organisms because they occupy a pivotal position in the evolutionary tree or because some quality of their genome makes them ideal to study.

An example is the puffer fish (*Fugu rubripes*) which has a similar gene repertoire to humans but a much smaller genome (400 million base pairs instead of 3000 million). The difference in size is mainly due to the presence of more repetitive DNA, larger segments of DNA between genes and larger introns in the human genome.

Another consideration that must be addressed is the relevance of model organisms to humans. Surprisingly, over 60 per cent of the human disease genes that have been identified thus far have counterparts in the fly and worm, revealing a core of about 1500 gene families that is conserved in all animals.

Genes affecting more evolutionarily advanced features, such as our immune system, are less likely to have direct counterparts in simple animals. For these systems, we require closer models such as the mouse. A great deal has been learned about humans by mapping and isolating mouse genes and using these as a short cut to find corresponding human genes. The mouse genome is similarly organized to the human genome and large blocks of genes are even arranged in the same. Mice have been extensively used to establish disease models by mimicking the gene defects seen in humans, and these models can be used to test the efficacy of new drugs.

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