

Model organisms

Model organisms are in fact species of plants, animals, or microorganisms which are being studied to make a better understanding of fundamental biological processes. These organisms are chosen strategically depending on their characteristics which make them ideal for research. They are also known for their capacity to offer relevant information which can later be expanded to other organisms, even for the human body.

Why do we need model organisms?

Life on Earth is already very complex and it makes it impossible to study it in detail. Additionally, multiple organisms are very difficult to grow in a laboratory, they have long life cycles, or are simply just too complex for basic science experiments. Thus, researchers have selected some species that present practical advantages for scientific research.

Main criteria for selecting model organisms include:

- ➔ reduced sizes and easy to maintain
- ➔ short life cycles and rapid reproduction rates
- ➔ a large number of descendants
- ➔ relatively simple genomes
- ➔ evolutionary relevance for species of interest

Their role in science

Model organisms serve as experimental systems that help in investigating diverse biological processes. They help researchers obtain knowledge about fundamental mechanisms of life in a controlled environment. This knowledge can later be applied to understand other similar phenomena in more complex organisms.

In genetics, model organisms have always been essential to deciphering the genetic code and understanding the gene expression. In developmental biology, they helped to understand the processes in which a single zygote turns into a complex multicellular organism. In neurobiology, they contributed to the understanding of how the nervous system works, and in immunology, they are what allowed the study of immune responses.

The research made on model organisms has led to multiple discoveries that revolutionized modern medicine. A lot of treatments for genetic diseases, cancers, and metabolic illnesses, were initially developed based on knowledge gained from studies on model organisms. Additionally, testing drugs on these organisms is an essential step in developing new therapies.

Extending the results and limitations

One of the fundamental premises of the use of model organisms is that many biological processes are evolutionarily conserved between different species. This means that the discoveries made in a simple organism can offer valuable information about similar processes in more complex organisms, including the human body.

However, there are some important limitations with this approach. Not all biological processes are conserved between the species, and model organisms cannot always reproduce the entire complexity of human systems. Genetic, metabolic, and physiological differences between organisms can limit the direct applicability of these results.

Impact in bioinformatics

In the current genomic era, model organisms have gained even greater importance. The complete sequencing of the genomes of several model organisms has created valuable resources for bioinformatics. This data allows for genomic comparisons, the identification of conserved genes, and the understanding of evolutionary relations between species.

By combining traditional experimental approaches with advanced bioinformatic analysis, researches can obtain a more profound understanding of fundamental biological processes. In this way, model organisms continue to play a central role in advancing our knowledge of life, from the molecular level to the whole organism level.