QUESTION: "Explain why we use model organisms for research."

Model organisms are a group of species of organisms that have been studied extensively, largely because they are easy to maintain under controlled laboratory conditions. The reason for them being studied is usually because they possess a number of experimental advantages. "The word model has many meanings, but in science, a model is a simplified system that is accessible and easily manipulated. A model organism is an animal, plant or microbe that can be used to study certain biological processes" (NIGMs, 2017).

These organisms are non-human species and they are used by scientists so that they can better understand the human biological systems so as to help solve current challenges that are being faced with human health. For example, scientists are using primates to study HIV, rabbits to study immunological behaviours of humans while mice are used to study aging processes in humans. As well as that, most of the drugs that are now available on the market go through rigorous clinical trials starting with isolated cell lines, then organisms like mice and monkeys and after the testing and sacrificing of many such organisms the drug will get approved for trials in human beings.

"There are different types of model organisms including: Genetic, Genomic and Experimental. Genetic model organisms are species amenable to genetic analysis and allow large scale genetic crosses. Genomic model organisms occupy a special position in evolution or have a particular genomic size or composition which can be used for reference e.g. the puffer fish. Experimental model organisms may not be genetically amenable but have certain other positives, specific to the experiment and what characteristics are being looked for" (Wikipedia, 2017). Some of the commonly used model organisms include; ***Escherichia Coli (E. coli),Saccharomyces Cerervisiae (S. cerervisiae), Schizosaccharomyces (S. pombe), Drosophila melanogaster, Caenorhabditis elegans (C. elegans), Zebrafish, Mus Musculus (mice), Amphibians and Birds***.

Important notable characteristics of model organisms include developing to maturity rapidly, the ability to be easily manipulated, having a short life span, producing a large number of offspring and having a sequenced genome as well as being well understood. Model organisms, if possible, need to have cheap sources and be cheap and easy to store in a laboratory as well as being non-pathogenic. Physiological and biochemical similarities to human cells are also useful characteristics in model organisms.

The answer as to why model organisms are used in research has strong links to the characteristics of these organisms. Because of the experimental advantages and their many characteristics mentioned in afore paragraph, model organisms are used in research. The following few numbered points however add flesh to these characteristics.

1. While the natural course of disease in human beings may take long time, using simple organisms that can develop that same disease, for example HIV/ AIDS, to get the trends of the disease or any related symptoms can give better understanding of the disease in a matter of months or a few years. This can be more effective in controlling the disease as the search for treatment and cure is still being worked upon.
2. Another reason is that model organisms do not only produce rapidly in a short time but also produce very many off-springs which can give researchers enough samples to work with. This will also result in wide range of results because the experiment is being done on multiple organisms. This is effective for example in genetic variation studies. An example of such organisms includes the fruit fly which Morgan Hunt and friends used to better understand genetics.
3. Model organisms are cheap to work with because they can be breed easily under controlled conditions. This is unlike using human samples because human beings are not sold or bought.
4. While there are rights for model organisms, their use in research is not as restricted as the use of human subjects that have many rights and a variety of ethical concerns that surround them. This is the reason why cloning is allowed in animals but not in humans. In 1996, June 6, Dolly the sheep hit records as being the first animal to be cloned. Since then scientists have tried cloning more animals and plants but human cloning has never been legalized.
5. Another advantage that makes model organisms usable in research is because of the close similarities in physiological and anatomical biochemistry. For example, dogs are used for cardiovascular and endocrinology studies because the cardiovascular and endocrine systems have striking similarities to that of human beings.
6. Model organisms act as surrogates that enable experiments to be carried out under a more favorable environment than would be available in the original system (Rosenblueth & Wiener, 1945).

The use of human subjects in research only arises due to the notable limitations of model organisms. This then makes it important to note that while model organisms are used for wide variety of research areas they too have limitations. For example, there are some diseases that will require the use of human subjects and not model organisms. This is generally because at this point model organisms do not possess such experimental advantages. An example of a disease is breast cancer. To fully understand this disease it will require studying it from the affected individuals themselves. Model organisms do not have mammary glands to follow understand this disease. Thus in such a situation human subjects are inevitable.

By the wide study in research using model organisms, scientists have and are learning more about how the brain functions and what drives behaviors like eating, sleeping, sex and even aggression. This foundation of knowledge has led to new methods for maintaining health and for diagnosing and treating disease in humans. Fundamental properties of how cells grow and divide and how organisms store and use energy have also been understood by use of model organisms.

References

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