Model Organism

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Model organisms are organisms used for testing different theories/products that haven’t been yet tested on humans. As inferred by the previous sentence, model organisms are not humans, they are organisms that are easy to maintain and breed. These organisms are used for various experiments and, for that reason, some of them have a high genetic similarity with humans. For better context, the most common exponents are:

* Mouses
* Fruit fly
* Yeast
* E. Coli
* Western clawed frog
* Nematode worm
* Zebrafish

These organisms are especially valuable due to their large breeding numbers and short period between being born and being ready to reproduce again. This combination of qualities makes it easy for the scientists to study a large array of theories at once.

The reasoning behind the usage of model organisms is that some experiments related to medications or diseases are not viable nor ethical to be tested on humans due to the unpredictable repercussions. For example, when it comes to diseases, researchers are able to understand the process and to develop medication without harming humans.

However, no amount of animal testing can ensure the safety of a substance when it comes to administrating it to humans. One of the most well-known examples is the drug TGN1412. Six men took the drug and they suffered disastrous side effects (including organ failure and brain swelling) in no more than two hours since the administration of the drug. The exact same drug has been tested on monkeys that received a 500-fold higher dose. These monkeys didn’t show any side effects from the medication, so the doctors proceeded with the administration to humans. After this incident, human based toxicity tests have been invented. In this test, TGN1412 has been shown to be extremely toxic.

Aside from avoiding unnecessary human experimentation, model organisms are used for exploring the relationships between genes, evolution and similarities between humans and other species. The study of organisms that are important in the evolutionary tree and that are easy to study has been helping the scientists to understand more about the genesis of the humans and the direction in which we are going as a species. However, it is important not to limit research to model organisms. There may be times when the experimentation must be conducted on other species similar to humans and these said species may not be too suitable from a breeding standpoint. In such cases it is efficient to follow the following three principles:

* Refinement – Making sure that at the end of the day, the animal is as healthy as possible
* Replacement – Making sure that there are no other productive ways of testing before resorting to animal testing
* Reduction – Making sure that the experiment is conducted with the minimum amount of animals

Despite all of the advantages presented by the usage of model organisms, some disadvantages may occur depending on certain conditions. For example, some rats that are raised in captivity may become sedentary, glucose intolerant or obese. This can impact the way they process drugs or diseases because their dietary energy intake and physical activity levels are out of balance. On the other hand, there might be slightly different results between mice and humans as, for example, mice are known to be more resistant than humans to various toxins and are known to have an immature immune system.

1.Attarwala, H. (2010) TGN1412: From discovery to disaster J Young Pharm. 2(3):332-6. <http://www.ncbi.nlm.nih.gov/pubmed/21042496>

2. Ahmed, S. et al (2014) The use of human (non-3D equivalent) skin assays (SkimuneTM) for detection of adverse reactions, sensitization, potency and efficacy <http://www.animalreplacementscience.com/poster-abstracts/>

3. yourgenome, (2017). Copyright information. [online] Available at: <https://www.yourgenome.org/theme/what-are-model-organisms/> [Accessed 2 April 2024].