Model systems in biological research.

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Editorial

Although the development of a wide variety of a wide species has been studied at one time or another, a relatively small number of organisms provide most of our knowledge about developmental mechanisms. We can thus consider them as models for understanding the processes involved. A model organism is a non-human species that is extensively studied to understand particular biological process and concepts. These organisms are chosen because it is believed that discoveries made in the model organism will provide insight into the working of other organisms, including humans. Sea urchins and frogs were the main animals used for the first experimental investigations at the beginning of the century because of their developing embryos are both easy to obtain and, in the case of the frog, sufficiently large and robust for relatively easy experimental manipulation, even at quiet late stages. Among vertebrates frog, xenopus, mouse, chick and more recently zebrafish are taken into consideration for model system whereas among invertebrates *Drosophila* (Fruit Flies) and nematode worm *Caenorhabditis elegans* are presently the focus of most attention because of their well-studied developmental genetics and they can also be purposefully modified in genetic level.

The reasons for selecting them as model system are partly historical. Once a certain amount of research has been done on one animal it is more efficient to continue to study it rather than start at the beginning again with another species and partially a question of ease of study and biological interest. Each species has its advantages and disadvantages as a developmental model. The chick embryo, for example has long been studied as an example of vertebrate because fertile eggs are easily available, the embryo withstands experimental microsurgical manipulation very well, and it can be cultured outside the egg. A disadvantage, however is that very little is known about the genetics as compared to that of the mouse. Although the mouse is more difficult to study in some ways, as developmental mutations have been identified in the mouse, it is amenable to genetic modification by transgenic techniques. It is also the best experimental model we have for studying mammalian development, including humans. Genetically the human and the mouse are very similar, with many of the disease-related genes are approximately identical. The zebrafish is recently added to the list of vertebrate model systems because it is easy to breed in large numbers, the embryos are transparent and so cell divisions and tissue movements can be followed visually, and it has great potential for genetic investigations.

Although the genetics of the fruit fly *Drosophila melanogaster* have been studied since the beginning of this century, research on its development has come into light only in relatively recent times with the advent of molecular biological techniques. Studying *Drosophila melanogaster* as a model developmental system is even more recent. Due to simple morphology and less requirement of space and expense, fruit flies are most studied organisms in biological system.

Criteria for a model biological system:

- The organism used should be easy to maintain.
- Its operation size should be convenient.
- Should be inexpensive to maintain.
- The model organism used should have short life cycle.
- The organism used can be genetically manipulated.
- It should be potential to deliver economically important results.

By comparing developmental mechanisms in a variety of organisms it becomes possible to identify that mechanism among groups of organisms. Comparative studies suggest that, despite immense differences in the details, it is likely that the most basic mechanisms of development are similar in all animals and are derived from the earliest animal ancestors. Thus, the elucidation of a developmental process in one animal is often of great help in understanding development in another. One must first be familiar with the stages that embryos pass through. It's essential to understand clearly how their structure or morphology changes during development to give rise to the larval or adult form.

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