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Walk on Part of Zebrafish (*Danio Rerio*) as Human Vertebrate Model in Developing Research Field

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ABSTRACT
In the rapidly evolving scientific sector, a new study model is required for future research stages. There should be no or few ethical difficulties with these models. As a result, zebra fish share 80% of their genes with humans. As a result, it's a good substitute for human models in study. The zebra fish and its uses in scientific research are discussed in the following review.

Key Words; Zebrafish, Vertebral model, *Danio rerio*, scientific model.

INTRODUCTION

In medical research, zebrafish are the second most commonly utilised animal. They will have a head, a tail, and a beating heart within 24 hours after being born from a single cell. By 72 hours, their brains are operating, and their fins and trunks are twitching, and by five days, they are swimming, hunting, and completely living beings. In terms of investigating early development and employing high throughput or large-scale genetics to do so, this is ideal for both geneticists and developmental biologists.They feed on a wide variety of species such as insects, earthworms and zooplankton, and as omnivorous animals eat the debris of habitat plants. The blue stripes that run horizontally on both sides of the body are named zebrafish. Zebrafish are little fish that average 6 centimetres in length. Zebrafish have a mouth that forms somewhat upwards and a dorsally compressed head, in addition to a moderately elongated body that gives them the characteristic fish shape. Zebrafish have teeth attached to their fifth brachial arch, which consist of a dentine layer, an enamel coating, and a pulp core. They lack oral teeth (on their jaws), but they do have teeth linked to their fifth brachial arch. Zebrafish could be utilised in studies on eco-environmental monitoring and the evaluation of a wide range of pollutants, including hazardous heavy metals, endocrine disruptors, and organic pollutants. The rostal (nasal) barbels, which extend to the orbit's anterior boundary, and the lengthy maxillary barbels on either side of the mouth, which serve as taste buds and are also employed to look for food, are examples of these. These are some of the pigments that give Zebrafish their colour: The dark blue melanophores, iridescent iridophores, and gold xanthophores are responsible for the fish's blue stripes, as well as the pale yellow hue of the dorsal and belly parts. Male and female Zebrafish differ in the following ways, Male Zebrafish are more slender with a golden look on their belly, Males also have a golden appearance on their pelvic and ventral fins, whilst female Zebrafish are larger in size with a rounded belly (whitish in colour). In adult females, there is a tiny genital papilla in front of the anal fin. The most important stages in a Zebrafish's life cycle are Embryo, Larval stage, Juvenile, Adult. As the embryo progresses to the next phase, cell division may result in between 16 and 64 cells. Gastrulation is the next stage of development, which leads in the formation of three germ layers and consequently the organism's body plan. Gastrulation takes place between 5 and 10 hours after conception, whereas blastulation takes place between 2 and 5 hours. Before hatching, segmentation and the pharyngula stage are present. The organism's structures develop further in these two phases, with the head and tail becoming more prominent and noticeable. This makes the offspring ready to hatch. After fertilisation, it takes 48 to 72 hours for the eggs to hatch. The larvae goes through morphogenesis, which is the process of developing distinct anatomical structures. The creature is capable of swimming, moving its jaws, and even feeding on various food materials during the late larval stage (approximately 7 days after conception). The organism can devour small organisms such as small worms and shrimp when it is in its juvenile phase (between 2 and 10 weeks old). When they are in the latter stages of their juvenile phase, around 10 weeks of age, the juvenile can be housed with adult fish. They are ready to reproduce once they have reached maturity, and the life cycle begins.Live foods, such as Brine shrimp larva, are recommended instead of store-bought foods. Hard-boiled egg yolk crumbs, on the other hand, have been demonstrated to be an excellent fish meal. Zebrafish have been shown to have highly conserved orthologues in their genome that are similar to many of the genes linked to neurological diseases in humans.

EXPLANATION

Because of its tiny size, low cost, diverse adaptability, short breeding cycle, high fecundity, and transparent embryos, the zebrafish has been widely employed as a model organism in a variety of fields. Recent research has shown that zebrafish sensitivity can benefit in the monitoring of environmental toxins, particularly when transgenic technology is used. The current review summarises recent investigations using wild-type and transgenic zebrafish as a model system for toxicological monitoring of harmful heavy metals, endocrine disruptors, and organic contaminants. The authors discuss a novel direction of producing high-throughput detection of genetically modified transparent zebrafish to provide a new window for environmental pollution monitoring. The size, husbandry, and early morphogenesis of zebrafish make them an excellent toxicological model compared to other vertebrate species. Adult zebrafish, unlike other fish species such as trout, are just 1–1.5 inches long. This saves a lot of space and money on housing, and there are now several companies that specialise in zebrafish aquaria that can hold thousands of fish. Furthermore, because zebrafish has been used as a laboratory species for a long time, the ideal breeding and maintenance conditions have been thoroughly established.

Many gene duplications can be found in the Zebrafish genome. Sub-functionalization and neofunctionalization have been observed as a result of this. Zebrafish have been found to regenerate missing fins as well as a variety of lesioned organs, including the retina, spinal cord, and heart, among other tissues. Zebrafish are vertebrates, which means they have a lot in common with mammals, including humans, in terms of sequence and function. Fish research can provide valuable insight into human illness processes due to the conservation of cell biology and developmental processes across all vertebrates. Because zebrafish embryos and larvae are fully transparent, non-invasive imaging techniques can be used to track the effects of genetic alteration or pharmacological treatment. With zebrafish, ensuring a ready supply of animals for research is also easy. Zebrafish offspring grow and develop swiftly, with 200-300 obtained from fish. Zebrafish are a type of tropical freshwater fish that belongs to the minnow family. The horizontal blue stripes on each side of their bodies give them the name "zebrafish."

In zebrafish, 70% of human genes are found. Zebrafish have two eyes, a mouth, a brain, a spinal cord, an intestine, a pancreas, a liver, bile ducts, a kidney, an oesophagus, a heart, an oesophagus, an oesophagus, an oesophagus, an oesophagus, an oesophagus, an oesophagus, an esophag The embryos of zebrafish are transparent, allowing scientists to observe the fertilised eggs develop into fully formed baby fish under a microscope. Transgenic zebrafish embryos with fluorescently labelled organs can also be seen thanks to their transparency. Many of the genes and essential pathways required for the development of these characteristics are substantially conserved in humans and zebrafish.

They take up far less area and are less expensive to keep than mice. Adult zebrafish breed frequently (every 10 days or more) and can produce up to 300 eggs at a time. Zebrafish embryos are placed and fertilised outside of the body, allowing them to be easily controlled in a variety of ways. If necessary, in vitro fertilisation can be done. To create transgenic or knock-out zebrafish lines, the one-cell stage fertilised eggs can be simply injected with DNA or RNA to irreversibly modify their genetic makeup. Working on mice in this manner is far more difficult.Researchers can uncover and test new medications to treat the diseases being modelled by using zebrafish disease models to define human diseases. Zebrafish are particularly suitable for high throughput drug screening because they can develop a large number of embryos each time they breed. The severity and course of the human disease Duchenne muscular dystrophy are closely resembled when the dystrophin gene is knocked out in zebrafish. To generate a knock-in model, the most often found mutation in human melanomas—a single amino acid alteration in the gene BRAF—was established in zebrafish. Zebrafish are little freshwater fish that reach a length of 4-5 cm and live for around two years.

The Wellcome Trust Sanger Institute started a zebrafish genome-sequencing research in 2001, and it was discovered that the zebrafish genome contains 84 percent of genes linked to human disorders. Once a gene linked to a specific disease has been identified, zebrafish can be genetically engineered to create an animal model of the condition that scientists can use to test potential treatments. In just a few years, we can evaluate the long-term effects of an illness in zebrafish. Zebrafish also have a unique ability to heal damaged heart muscle following various sorts of heart injuries. Unless seclusion is required for a specific study or quarantine, zebrafish are maintained in groups in the laboratory. Zebrafish are kept in big aquariums with numerous small tanks. Live foods (small freshwater organisms) are fed to zebrafish in most laboratories since they are the healthiest and most natural form of food available. Environmental enrichment in the form of live or fake plants and rocks is considered good practise for zebrafish.

CONFLICTS OF INTEREST

The Authors mentioned in this review have no conflicts of interest.

CONCLUSION

Every study requires a low-cost model with scientific resemblance. The benefits of zebra fish over other scientific models are ease of upkeep, a short life cycle (total of 90 days), and good development. As a result, the best organism model now in use is the zebra fish.

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