

## *Oryzias latipes*, Japanese medaka

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### Taxonomy

cellular organisms - Eukaryota - Fungi/Metazoa group - Metazoa - Eumetazoa - Bilateria - Coelomata - Deuterostomia - Chordata - Craniata - Vertebrata - Gnathostomata - Teleostomi - Euteleostomi - Actinopterygii - Actinopteri - Neopterygii - Teleostei - Elopocephala - Clupeocephala - Euteleostei - Neognathi - Neoteleostei - Eurypterygii - Ctenosquamata - Acanthomorpha - Euacanthomorpha - Holacanthopterygii - Acanthopterygii - Euacanthopterygii - Percomorpha - Smegmamorpha - Atherinomorpha - Beloniformes - Adrianichthyoidei - Adrianichthyidae - Oryziinae - *Oryzias* - *Oryzias latipes*

### Brief facts

- The Japanese Medaka fish is a small (2-4 cm) fish commonly found in flooded rice paddies in Japan, Taiwan, and other areas of southeast Asia.
- The name *Oryzias latipes* reflects the preferred habitat of medaka - the rice (*Oryza sativa*) fields. This habitat also gave rise to the common English name of medaka - ricefish.
- Medakas are remarkable for the number of eggs produced by females - around 3,000 in a single breeding season.
- Medaka has many attributes that make it a model laboratory organism, among them the clarity of its eggs, hardiness, and lack of aggression.

# The potential of medaka as a genetic model

- Medaka has relatively small genome (~800 Mb, half the size of the zebrafish genome).
- Medaka is more closely related to the fugu (*Takifugu* and *Tetraodon*) than to zebrafish.
- In contrast with zebrafish, medaka has clearly defined sex chromosomes, and sex determination is intensively studied.
- Medaka is hardier than zebrafish and less susceptible to disease. Embryonic development can proceed at a wide range of temperatures (6-40 degrees Celsius) - a trait that increases a chance of isolating temperature-sensitive mutants.
- For decades, medaka was an important test system for environmental research. It is widely used for carcinogenesis studies and for testing endocrine disruptors in ecotoxicology.
- Unlike in other lower vertebrate genetic systems, inbred and highly fertile strains of medaka are available. Many very important mutant phenotypes of medaka do not have analogs in zebrafish.

## Developmental stages

### Life Cycle Stages

Under laboratory conditions, generation time is between 6 and 8 weeks for medaka, compared with 8 and 10 weeks for zebrafish.

- egg

egg development stages are given as observed at 26°C

- unfertilized egg

Iwamatsu stage 0

- activated egg

egg is stimulated by spermatozoon;  
fertilization; Iwamatsu stage 1

- o fertilized egg

- germinal disc MeSH

Iwamatsu stage 2; blastodisc stage;  
zygote

- embryo MeSH

- cleavage MeSH

Iwamatsu stages 3-7; 1 h 5 min -  
3 h 30 min  
post-fertilization; 2-32 cell embryo

- morula MeSH

Iwamatsu stages 8-9

- early morula

Iwamatsu stage 8; 4 h 5  
min  
post-fertilization; the cells  
are  
arranged in 3-4 layers but  
are  
still easily dissociated from  
each other

- late morula

Iwamatsu stage 9; 5 h 15  
min  
post-fertilization; the  
blastodermal  
cells now form 4-5 layers

- **blastula MeSH**

Iwamatsu stages 10-11; 6 h 30 min - 10 h 20 min post-fertilization

- **gastrula MeSH**

Iwamatsu stages 12-16

- **neurula**

Iwamatsu stages 17-18; 1 day 1 h - 1 day 2 h post-fertilization; head formation and optic bud formation

- **segmentation**

Iwamatsu stages 19-32; 1 day 3 h 30 min - 4 days 5 h post-fertilization; somites stages (2-30 somites); brain regionalization and optic vesicle formation; tubular heart development

- **organogenesis**

Iwamatsu stages 32-38; 4 days 5 h - 9 days post-fertilization; development of heart; formation pectoral fin; blood vessel development; spleen and other organs development

- **hatching**

Iwamatsu stage 39; 9-10 days post-fertilization; the

embryos dissolve the inner layers of the chorion, tear the single outer layer by moving the body and escape from the chorion tail-first

- **larva MeSH**

fry; Iwamatsu stage 40; period of **morphogenesis**; this period extends from hatching until fin rays appear in the caudal and pectoral fins (0-6 days after hatching)

- **juvenile**

young immature fish, until 7-50 days after hatching

- **adult**

medaka that reached sexual maturity (at about 2 months under laboratory conditions); maximal longevity of medaka is about 5 years

## References

### PubMed articles

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- **Free full-text articles in PubMed: major topic "Oryzias"**

### Websites and other references

- **Medakafish Home Page**
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