Oryzias latipes, Japanese medaka

Taxonomy


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

- 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**


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

**Websites and other references**

- Medakafish Home Page