



# Use of Zebrafish and Zoonoses

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## Abstract

*Culturing of zebrafish is generally a low risk research activity for immunocompetent staff. The risk of infection can be further reduced with a sound educational policy.*

## Introduction

Interest in the use of zebrafish (*Danio rerio*) to answer genetic questions is growing. The Zebrafish Information Network web site ([www.zfin.org](http://www.zfin.org)) currently lists 302 laboratories in 25 countries that are using this model (Sprague, 2001). Zebrafish have several advantages over mice as an experimental model, including the low cost of their care and the ease of studying the large, translucent embryos. Over 2,000 mutations are available for use in developmental and other studies (Sprague, 2001).

Since the Animal Care and Use Committee at Dana Farber Cancer Institute reviews protocols using this model, I researched the zoonoses related to zebrafish handling. A very comprehensive reference on the microbial risk of fish culture is available (Durborow, 1999). Not surprisingly, food poisoning is a concern if hand washing does not follow contact with aquarium water (Durborow, 1999).

An infectious agent of particular interest is *Mycobacterium marinum*, a known zoonotic agent of fish colonies. *M. marinum* grows preferentially at 30°C, not 37°C, and generally infects preexisting wounds (Durborow, 1999). Progression to serious infection normally occurs only in immunocompromised hosts (Durborow, 1999). Figure 2 shows a *M. marinum* infection that developed in the hand of a pregnant woman

(High, 2001). In this case, a wound obtained while cutting tomatoes became infected with *M. marinum* from activities in the home, which included maintaining an aquarium and gardening. The wound showed marked improvement after 12 weeks of antibiotic therapy, initiated after the delivery of a healthy child.

For assistance in developing a policy with an appropriate risk assessment, the senior author contacted the Zebrafish International Resource Center at the University of Oregon in Eugene, Oregon (Sprague, 2001). Its mission is to provide a central repository for wild-type and mutant strains of zebrafish and for materials and information about zebrafish research. Dr. Jennifer Matthews agreed to share the University of Oregon policy that follows after reminding me that no policy should be adopted without onsite review by the Occupational Health Services and the Animal Care and Use Committee.

## Policy for the Use of Zebrafish at the University of Oregon

The Occupational Health and Safety Program is designed to inform individuals who work with animals about potential zoonoses (diseases of animals transmissible to humans), personal hygiene, and other potential hazards associated with animal exposure. This information sheet is directed toward those involved in the care and use of laboratory zebrafish (*Danio rerio*).

## Potential Zoonotic Diseases

Aside from food poisonings, the overall incidence of transmission of disease-producing agents from fish to

humans is low. However, a number of agents found in fish and aquarium water do have the potential to be transmitted to humans. In general, humans contract fish-borne disease through ingestion of infected fish tissues or aquarium water, or by contamination of lacerated or abraded skin. An important feature of many bacterial and protozoal organisms is their opportunistic nature. The development of disease in the human host often requires a preexisting state that compromises the immune system. If you have an immune-compromising medical condition or you are taking medications that impair your immune system (steroids, immunosuppressive drugs, or chemotherapy), you are at-risk for contracting a fish-borne disease and should consult your physician.

Following is a list of known and potential fish-borne zoonoses.

### **Mycobacterium**

Atypical (nontuberculosis) *Mycobacterium* species are nonmotile, acid-fast rods that are ubiquitous in the environment. Multiple species (*M. marinum*, *M. fortuitum*, *M. chelonae*, *M. abscessus*) are recognized pathogens of laboratory zebrafish. Humans are typically infected by contamination of lacerated or abraded skin with aquarium water or fish contact. A localized granulomatous nodule may form at the site of infection, most commonly on hands or fingers. The granulomas usually appear approximately 6 to 8 weeks after exposure to the organism. They initially appear as reddish bumps (papules) that slowly enlarge into purplish nodules. The infection can spread to nearby lymph nodes. More disseminated forms of the disease are likely in immunocompromised individuals. It is possible for these species of mycobacterium to cause some degree of positive reaction to the tuberculin skin test.

### **Aeromonas spp.**

Aeromonad organisms are facultative anaerobic, gram-negative rods. These organisms can produce septicemia in infected fish. The species most commonly isolated is *A. hydrophilia*. It is found worldwide in tropical fresh water and is considered part of the normal intestinal microflora of healthy fish. Humans infected with *Aeromonas* may show a variety of clinical signs, but the two most common syndromes are gastroenteritis and

localized wound infections. Again, infections are more common and serious in the immunocompromised individual.

### **Other Bacteria and Protozoa**

Below is a list of additional zoonotic organisms that have been documented in fish or aquarium water. Human infections are typically acquired through ingestion of contaminated water resulting in gastroenteritis symptoms or from wound contamination.

1. **Gram-negative organisms:** *Plesiomonas shigelloides*, *Pseudomonas fluorescens*, *Escherichia coli*, *Salmonella* spp., *Klebsiella* spp., *Edwardsiella tarda*
2. **Gram-positive organisms:** *Streptococcus* spp., *Staphylococcus* spp., *Clostridium* spp., *Erysipelothrix* spp., *Nocardia* spp.
3. **Protozoa:** *Cryptosporidium* spp.

### **Allergic Reactions to Zebrafish**

Human sensitivity to fish proteins in the laboratory setting is rare. It remains possible, however, to become sensitized to fish proteins through inhalation or skin contact.

#### **How to Protect Yourself**

- **Wash your hands.** The single most effective preventative measure that can be taken is thorough, regular hand washing. Wash hands and arms after handling fish and aquarium water. Never smoke, drink, or eat in the animal rooms or before washing your hands.
- **Wear gloves.** If you will spend a significant amount of time with your hands immersed in water or if you have any cuts or abrasions on your hands or arms, wear sturdy, impervious gloves.
- **Seek medical attention promptly.** If you are injured on the job, promptly report the accident to your supervisor even if it seems relatively minor. Minor cuts and abrasions should be immediately cleansed with antibacterial soap and then protected from exposure to fish and aquarium water. For more serious injuries or if there is any question, report to the University Health Center or your physician for evaluation.
- **Tell your physician you work with fish.** Whenever you are ill, even if you're not certain that the ill-

ness is work-related, always mention to your physician that you work with fish. Many zoonotic diseases have flu-like symptoms and would not normally be suspected. Your physician needs this information to make an accurate diagnosis. Questions regarding personal human health should be answered by your physician.

## References

Sprague, J., Doerry, E., Douglas, S., & Westerfield, M. (2001). The Zebrafish Information Network (ZFIN): A resource for genetic, genomic, and developmental research. *Nucleic Acids Research*, 29, 87-90.

Durborow, R. M. (1999). Health and safety concerns in fisheries and aquaculture. In R. L. Langley (Ed). *Occupational medicine: State of the art reviews* (pp. 373-406). Philadelphia: Handley & Belfus, Inc.

High, W., Houpt, K. R., Ehrwig, T., & Cockerell, C. J. (November 30, 2001). Slowly enlarging mass of the dorsal right hand in a pregnant woman. Case report. *Medscape General Medicine*. At: [www.medscape.com/viewarticle/429961](http://www.medscape.com/viewarticle/429961) (accessed 9/9/02).

### Figure 1

Zebrafish: Exciting Genetic Model.

Zebrafish reprinted with permission from ZFIN (Zebrafish Network) <http://www.zfin.org>.



### Figure 2

Plaque on dorsum of right hand. Reprinted with permission from Medscape at <http://www.medscape.com/content/2001/00/42/99/429961/art-mgm1130.01.fig1.jpg>.

