

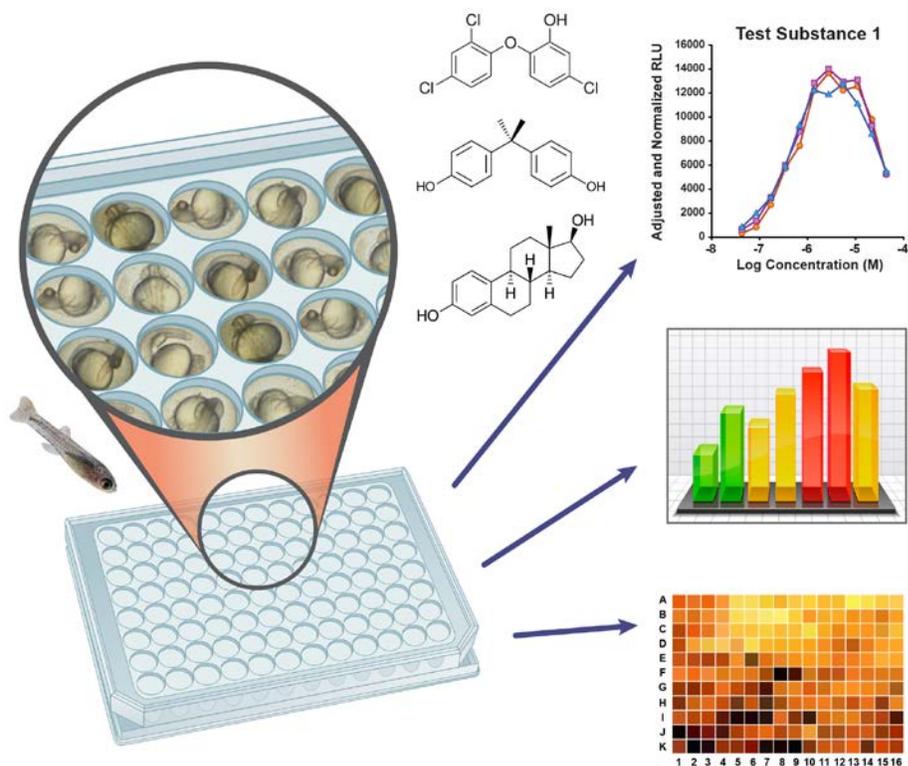
## Zebrafish Ontologies for Toxicological Screening

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### Why Zebrafish?

- Zebrafish are small tropical fish that are transparent through a large part of their rapid development.
- They can be reared in 96- or 386-well tissue culture plates. This makes them an attractive alternative to traditional mammalian reproductive and developmental toxicology test methods.
- However, the widespread use and acceptance of zebrafish data is hampered by:
  - Lack of harmonization in the labeling and annotation of data collected by laboratories
  - Limited ontological support for translating findings in the fish to the species of interest



## What are Ontologies?

Ontologies use a controlled vocabulary to define the relationships between terms.

### **Controlled Vocabulary:**

**Appendage:** a projecting part of an invertebrate or other living organism, with a distinct appearance or function.

**Anal fin:** an unpaired fin located on the underside of a fish posterior to the anus

### Ontology:

☐ Classes

☐ — Appendage

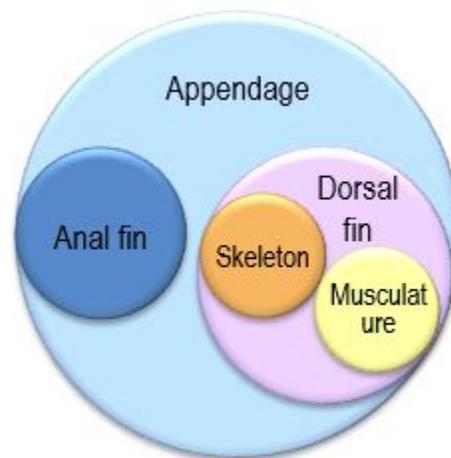
← I Caudal fin

☐ ← I Anal fin

☐ ← I Dorsal fin

← I Skeleton

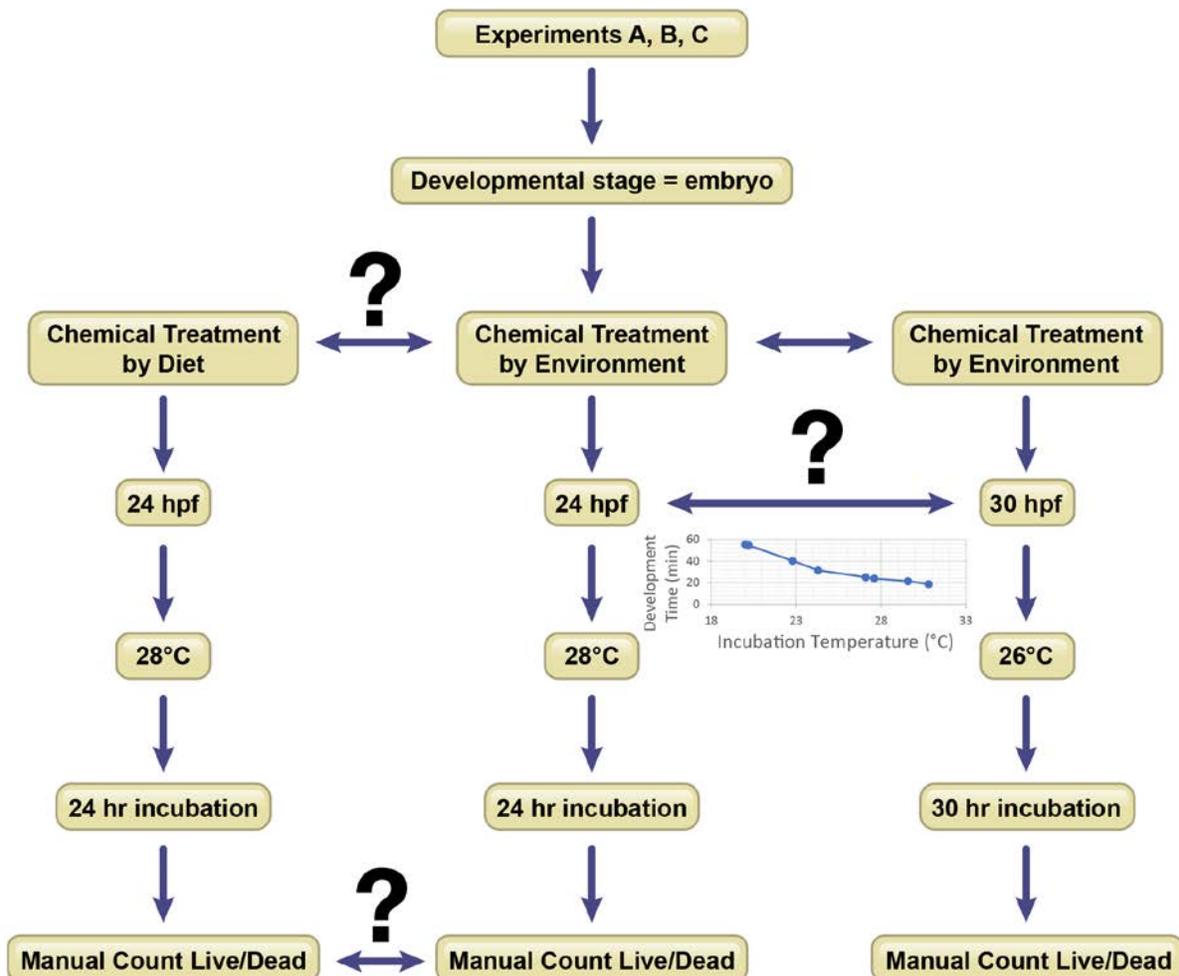
← I Musculature



Adapted from: Melissa Haendel, An Introduction to Anatomy Ontologies.  
<http://slideplayer.com/slide/3461901/>

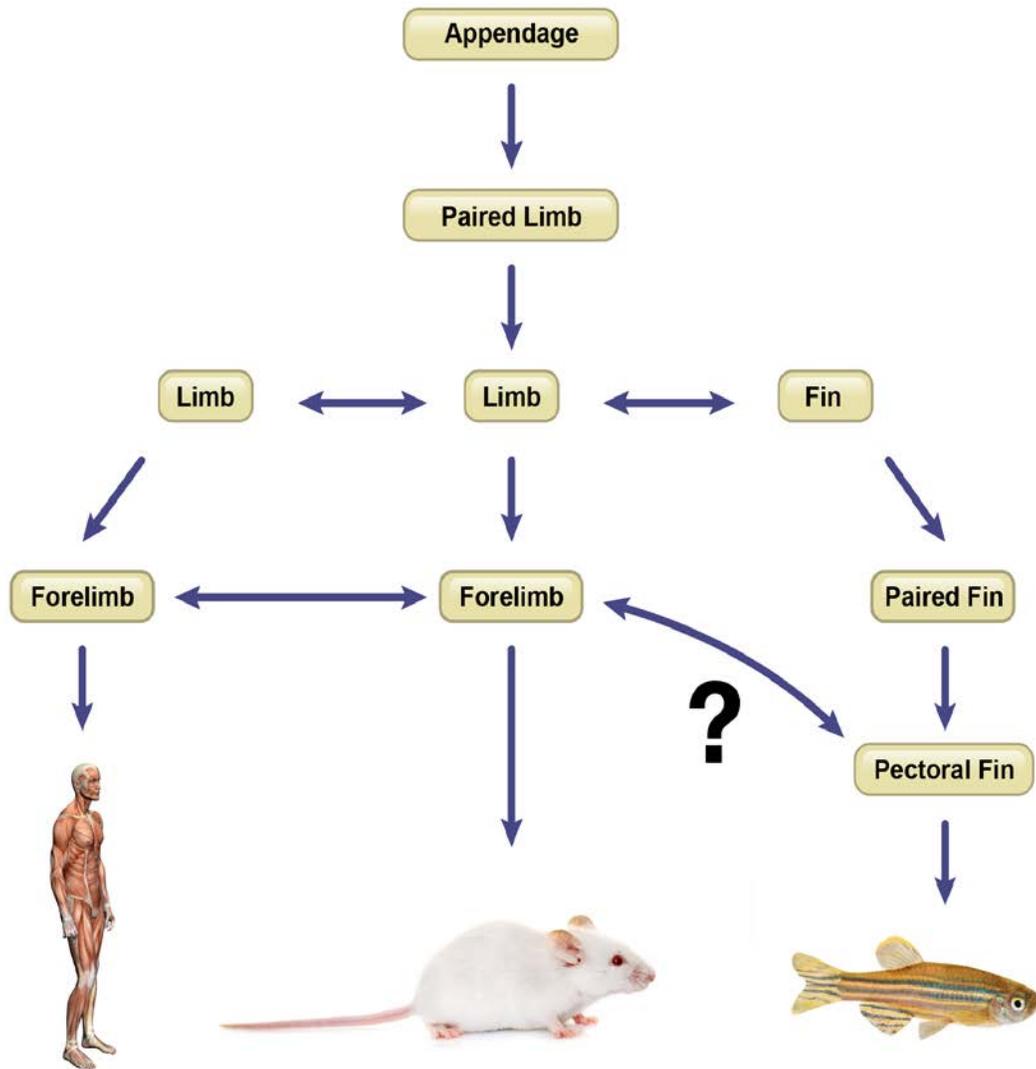
## Ontologies Clarify Relationships

- Experimental ontologies contain a controlled vocabulary encompassing minimum data elements necessary to describe an experiment.
- The vocabulary clarifies how the data elements are related to each other, allowing for improved data storage, mining, and analysis.
- In this way, ontologies help investigators relate one experiment to another.



## Comparing Across Species

Phenotype and other species-specific ontologies can be used to compare relationships within and between species. This allows for evaluation and extrapolation between different organisms.



## Ontology Use Roadblocks

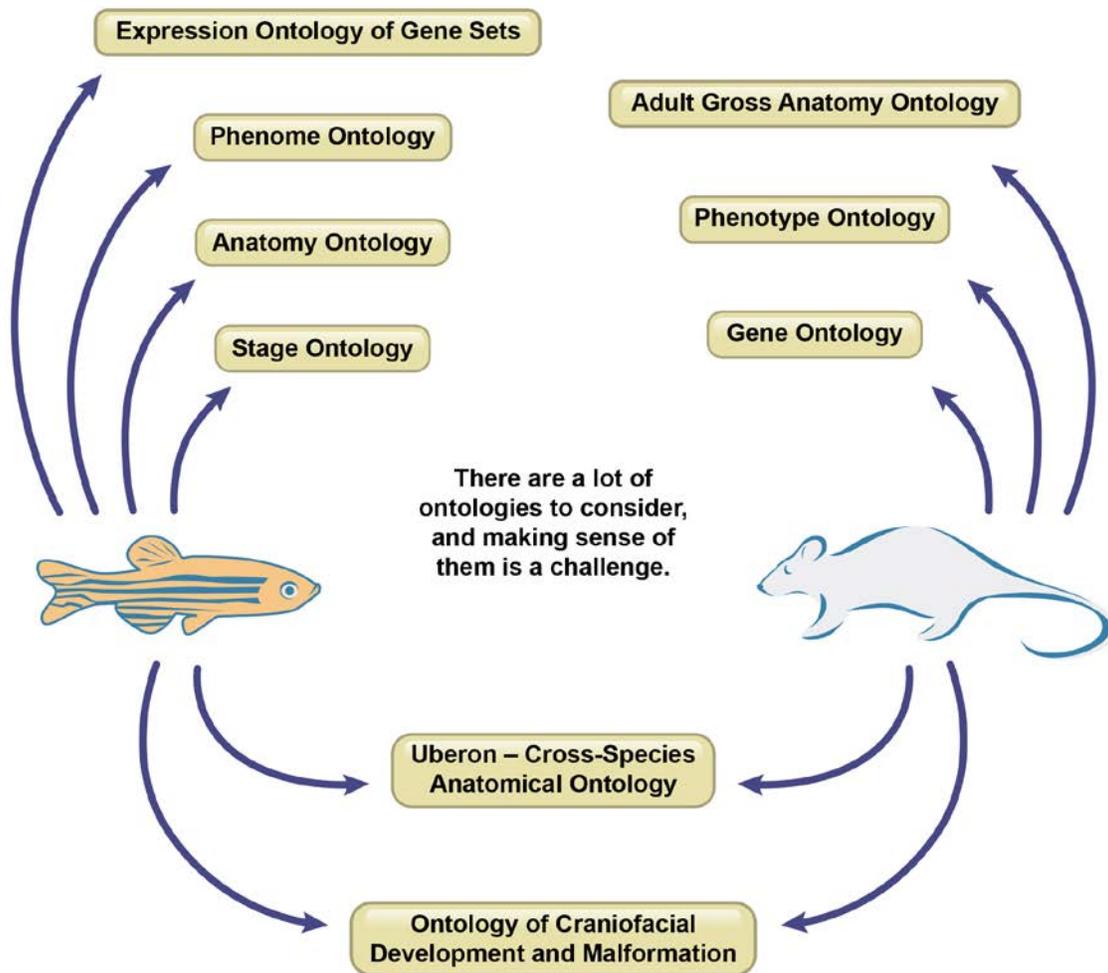


Several road blocks prevent wider adoption and use of ontologies. These include:

- Lack of familiarity with ontologies and how they work
- Unclear instructions/protocols for applying ontologies
- Differing ontology languages, each developed for different purposes
- Poorly documented or confusing ontology tools
- No formal requirements for the use of ontologies



## Comparing Between Ontologies is Challenging



## Encouraging Use



Ontology use by researchers can be encouraged by:

- Providing plain language descriptions of ontologies and their use
- Working with researchers to demonstrate usefulness
- Developing bridging tools to enhance cross-ontology communication
- Working with ontology developers to facilitate tools and usability

## Conclusions

- Zebrafish are an attractive potential alternative species for reproductive and developmental toxicity tests.
- However, model development is hampered by:
  - A lack of harmonization in experimental data annotation and reporting
  - Limited familiarity with ontologies and how to use them
  - Confusion as to which ontologies and ontology tools should be used
  - Lack of bridging ontologies to enhance cross-ontology communication
- Making better ontology tools will help to encourage the use of ontologies.
- This will enhance buy-in for zebrafish models by facilitating comparison to data from existing in vivo models and/or vitro data. Better ontological support is needed to make that happen.

### **Acknowledgements and More Information**

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