

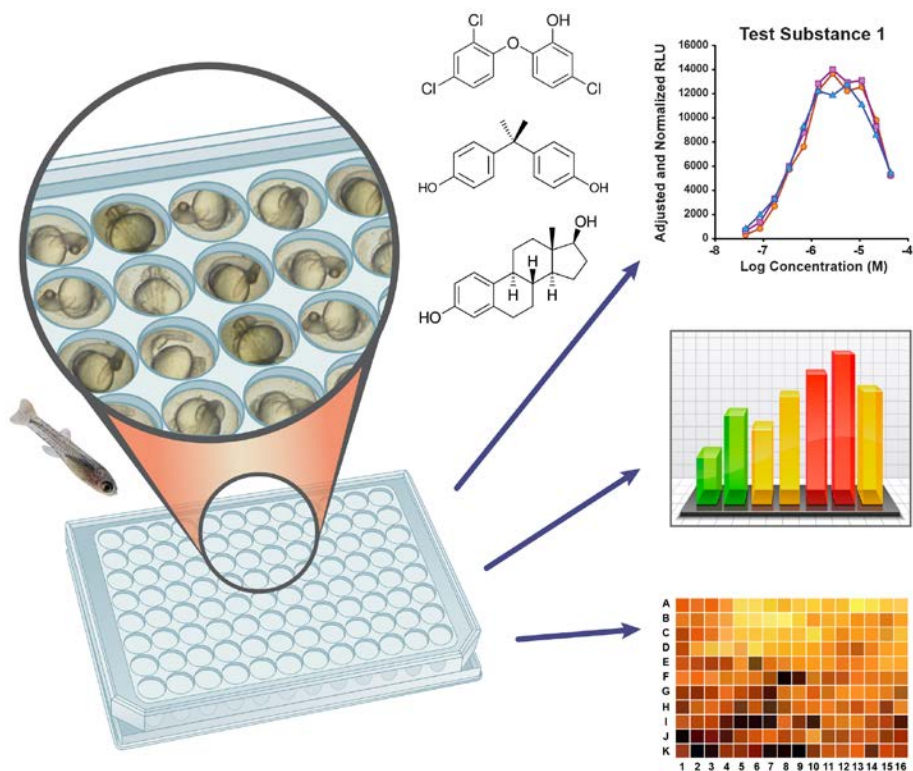
Zebrafish Ontologies for Toxicological Screening

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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

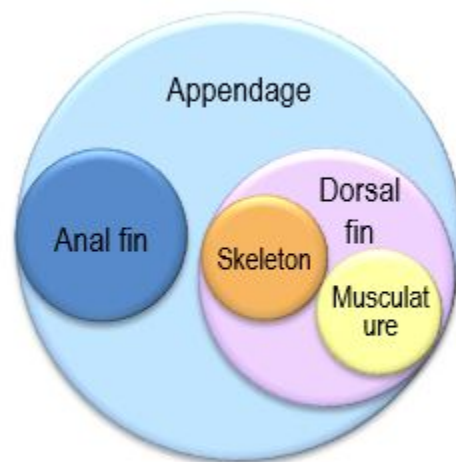
← I Caudal fin

☐ ← I Anal fin

☐ ← I Dorsal fin

← I Skeleton

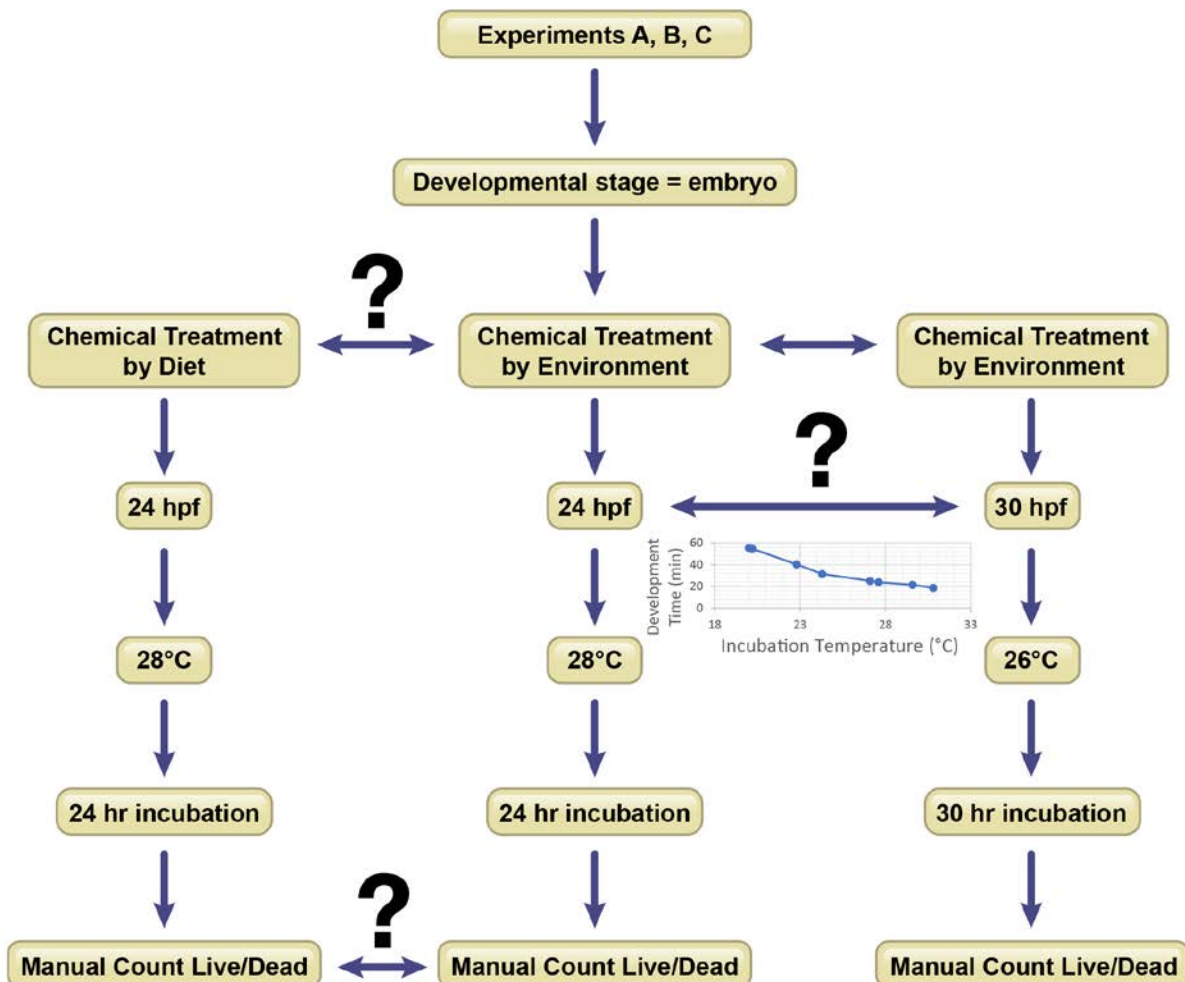
← I Musculature



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

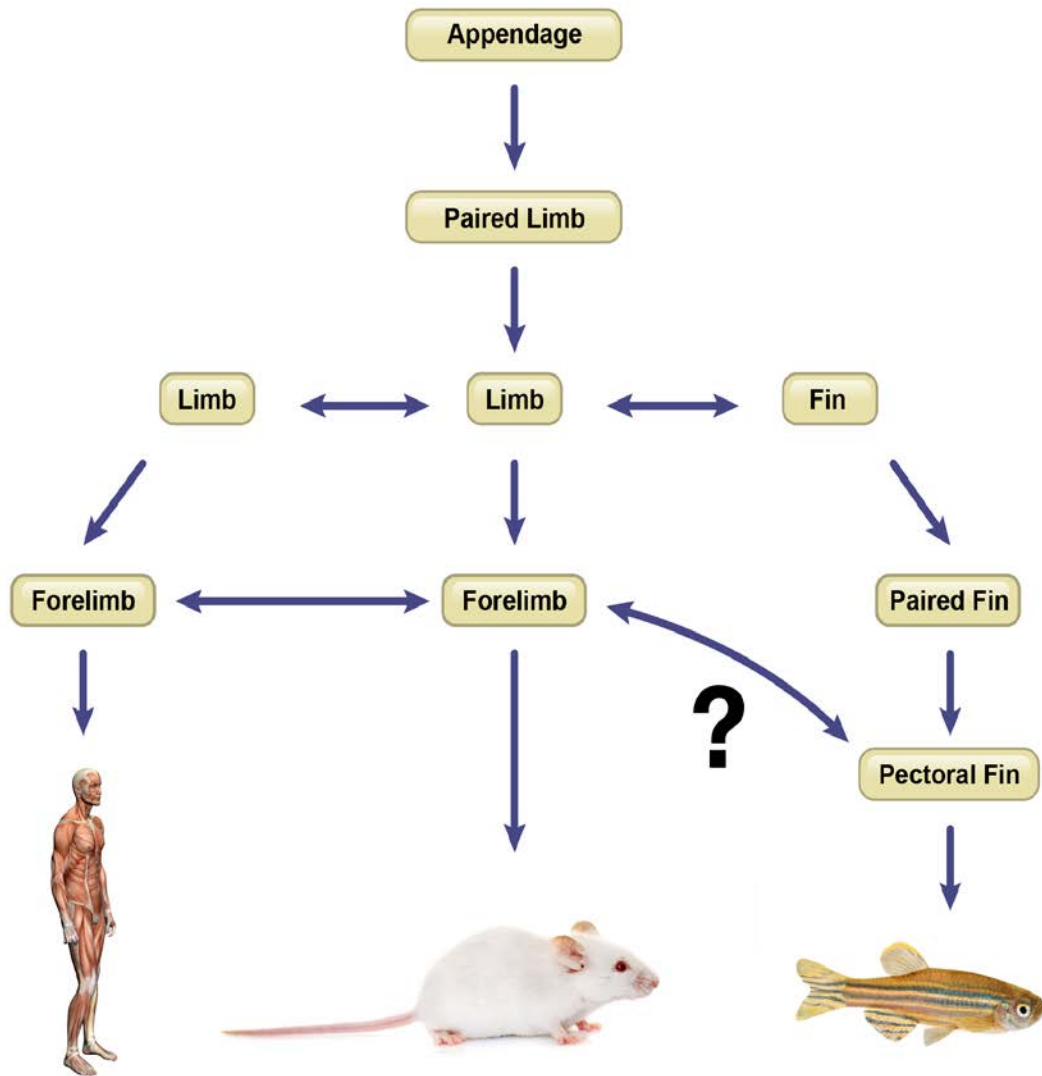
Ontologies Clarify Relationships

- 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.

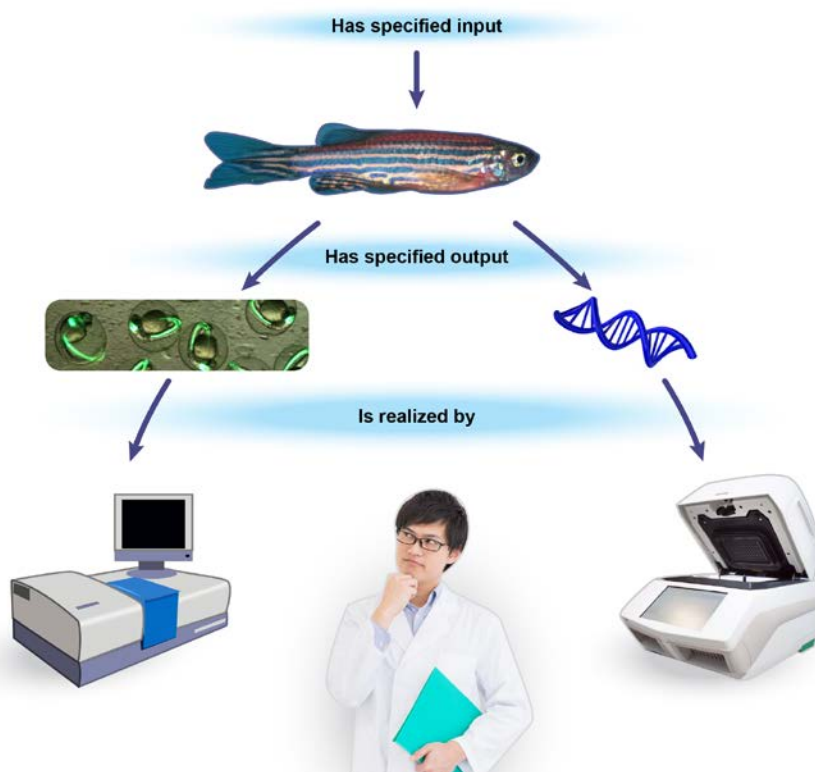


Ontology Use Roadblocks

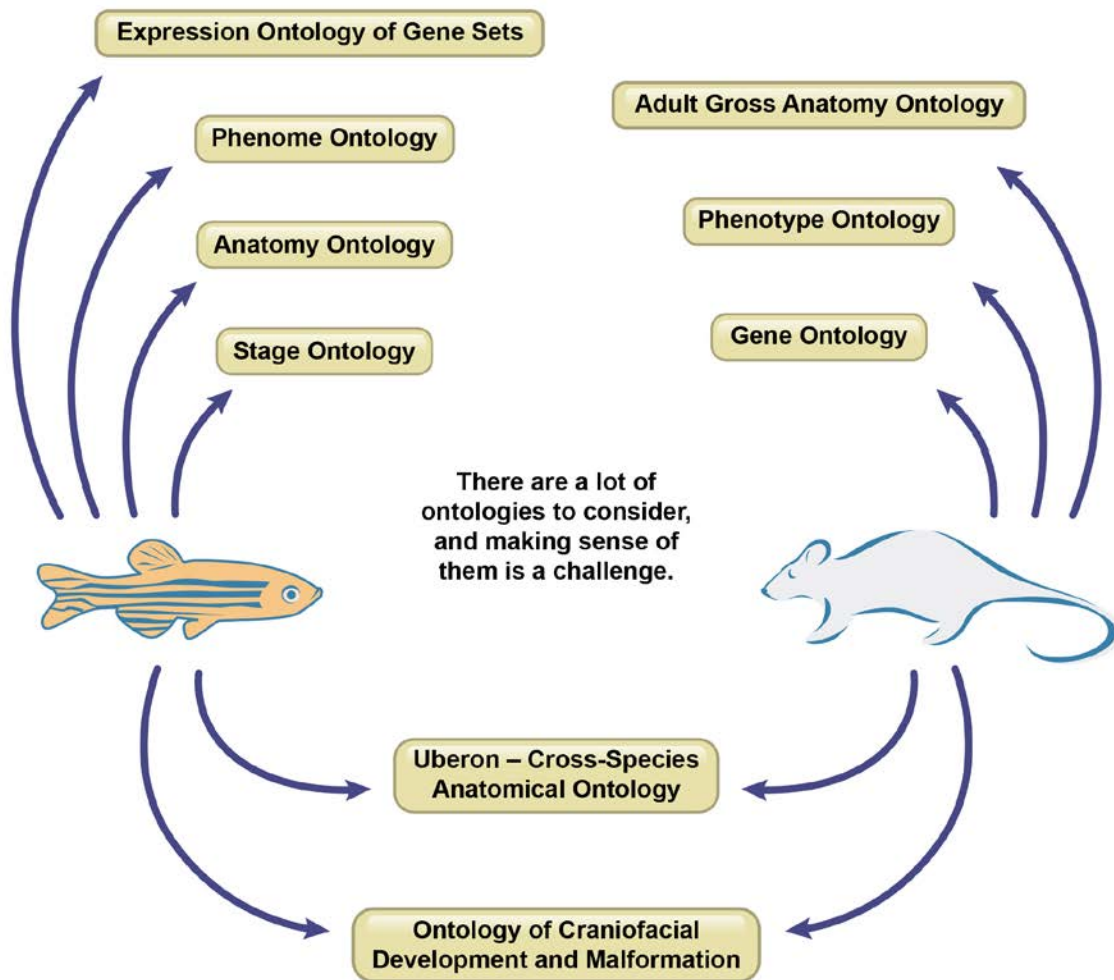


Several road blocks prevent wider adoption and use of ontologies. These include:

- 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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