

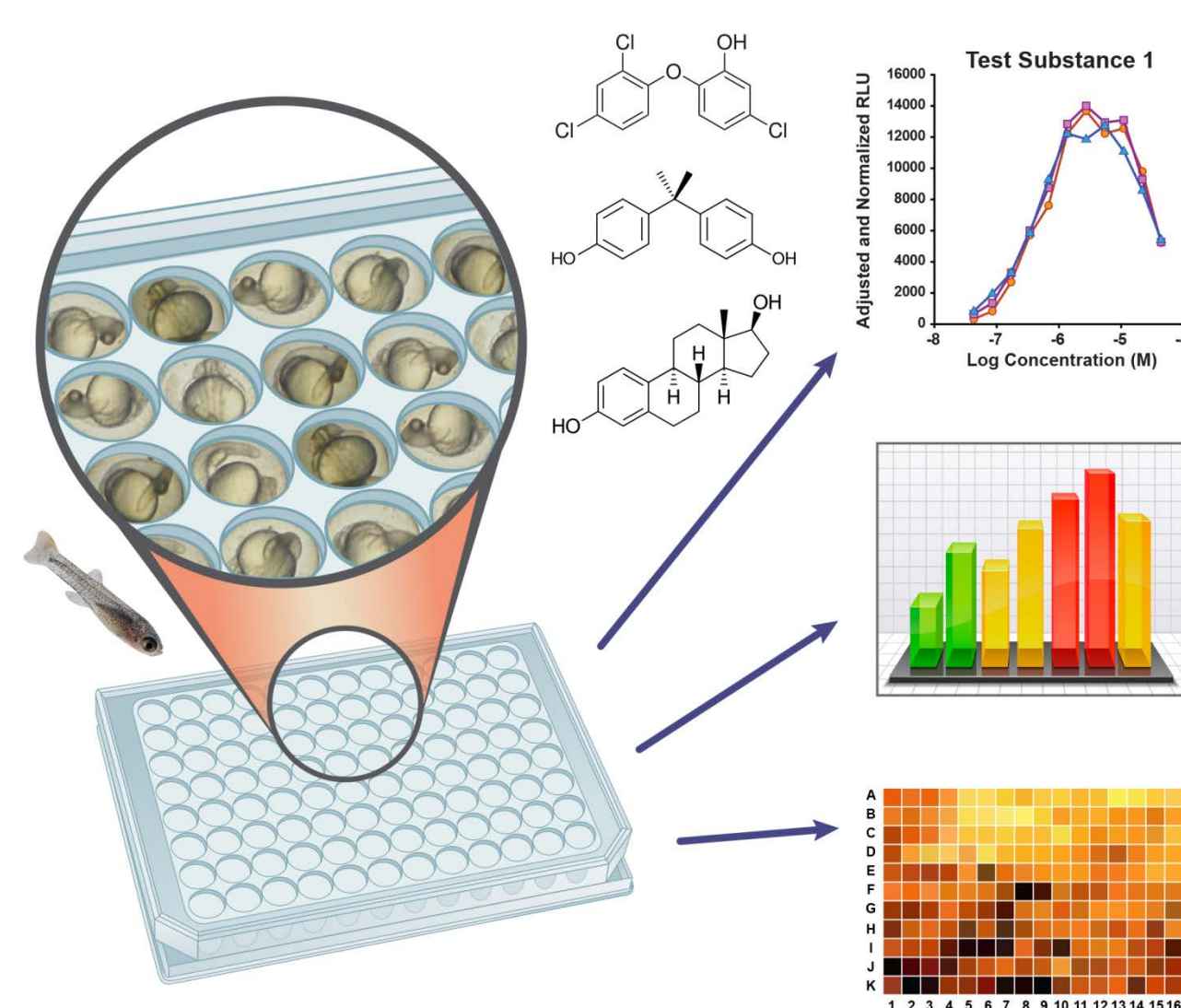
# Zebrafish Ontologies for Toxicological Screening

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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

## Ontologies

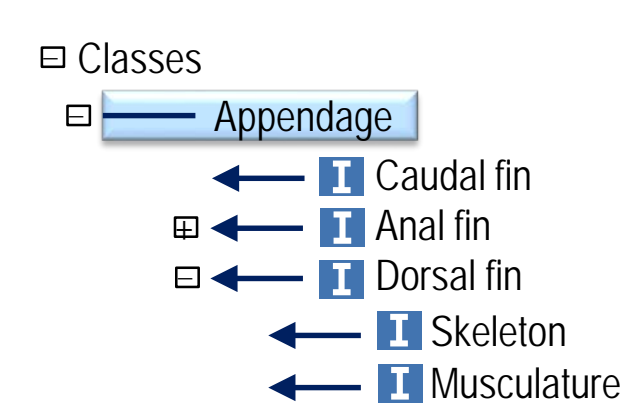
Ontologies use a controlled vocabulary to define the relationships between terms.

### 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

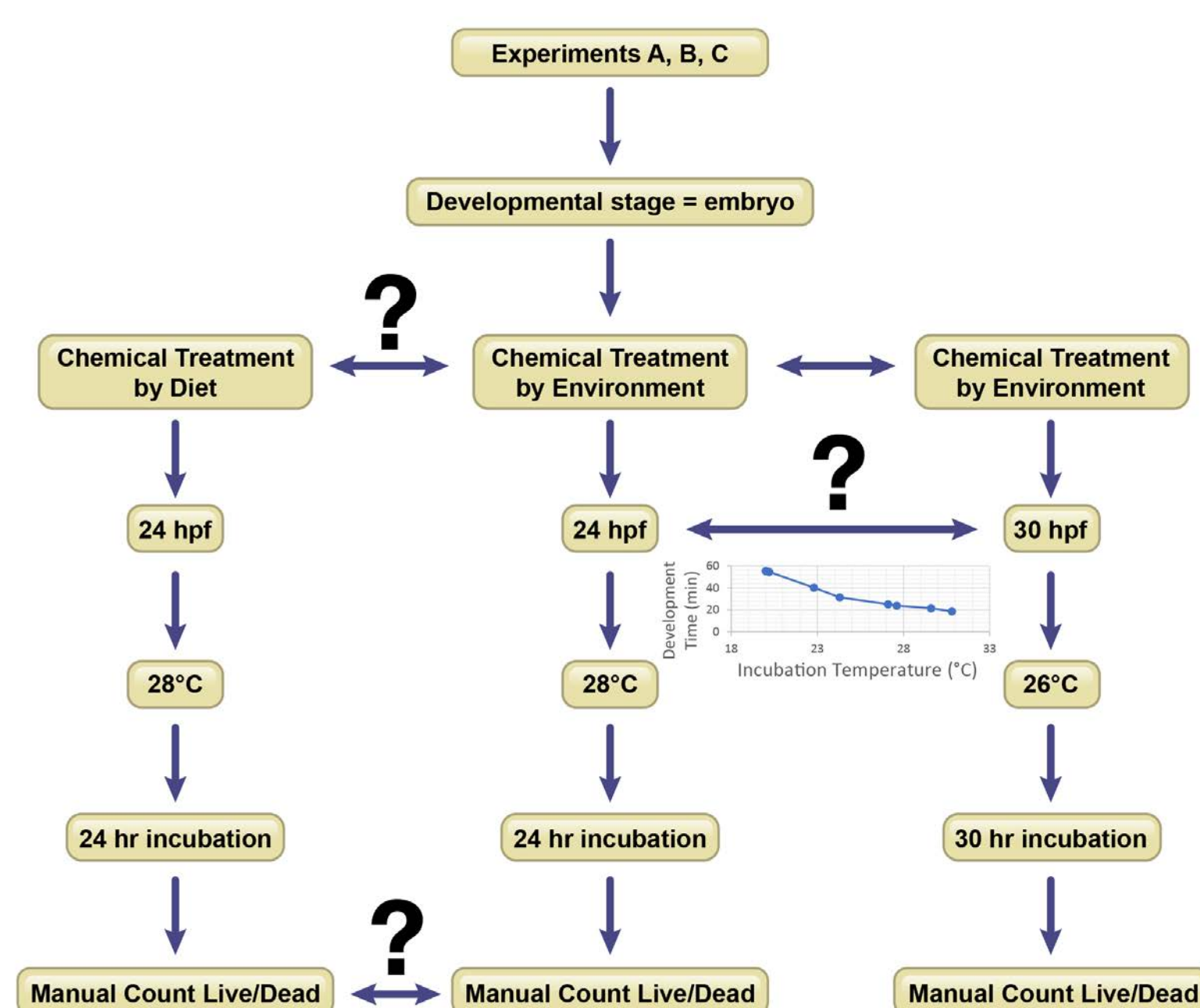
### Ontology:



Adapted from: Melissa Haendel, An Introduction to Anatomy Ontologies. <http://slidespaper.com/slide/34815901/>

## Ontologies Clarify Relationships

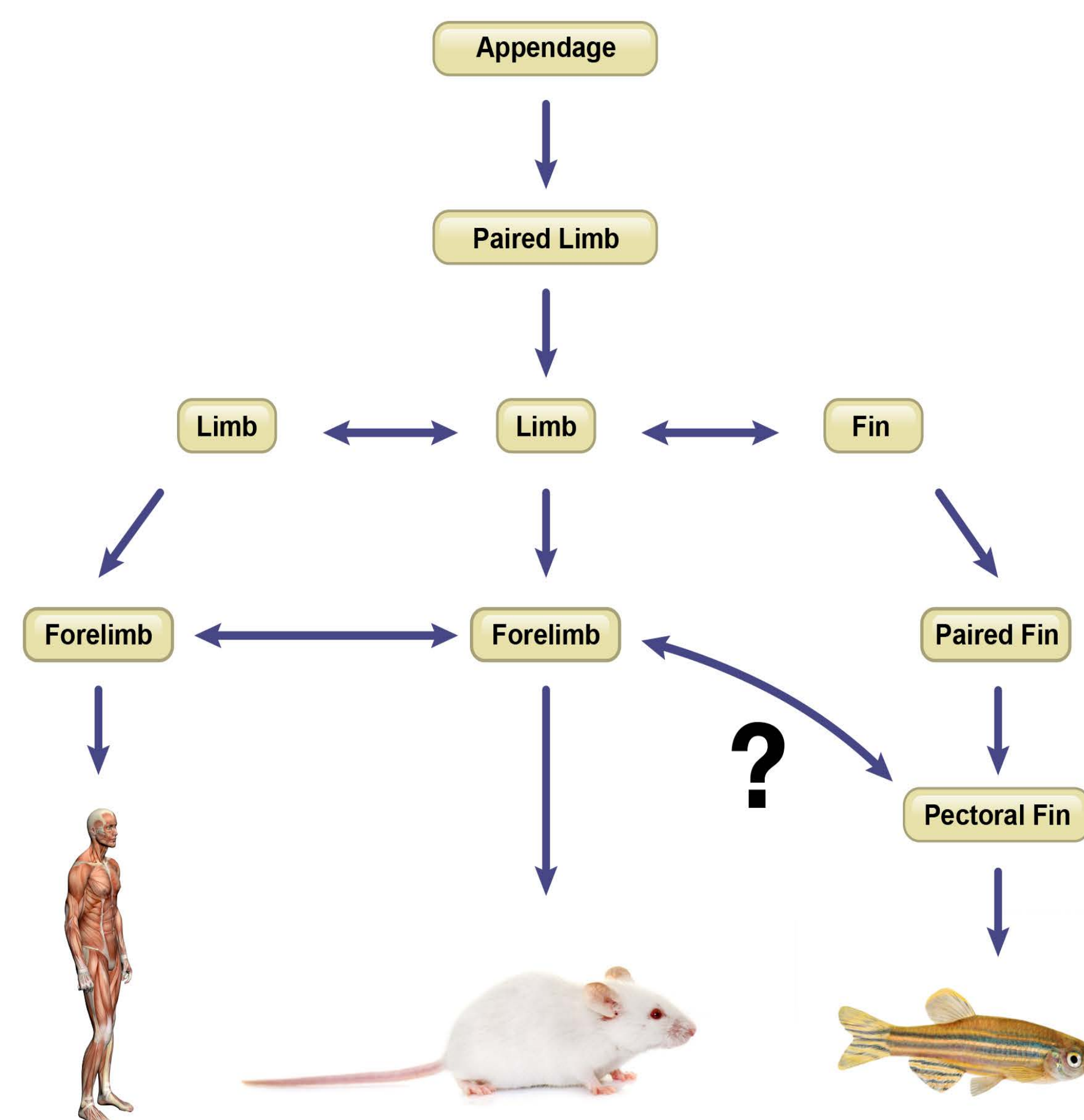
- Experimental ontologies contain a controlled vocabulary encompassing minimum data elements necessary to describe an experiment.
- This vocabulary clarifies how the data elements are related to each other, allowing for improved data storage, mining, and analysis.
- In this way, ontologies help investigators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



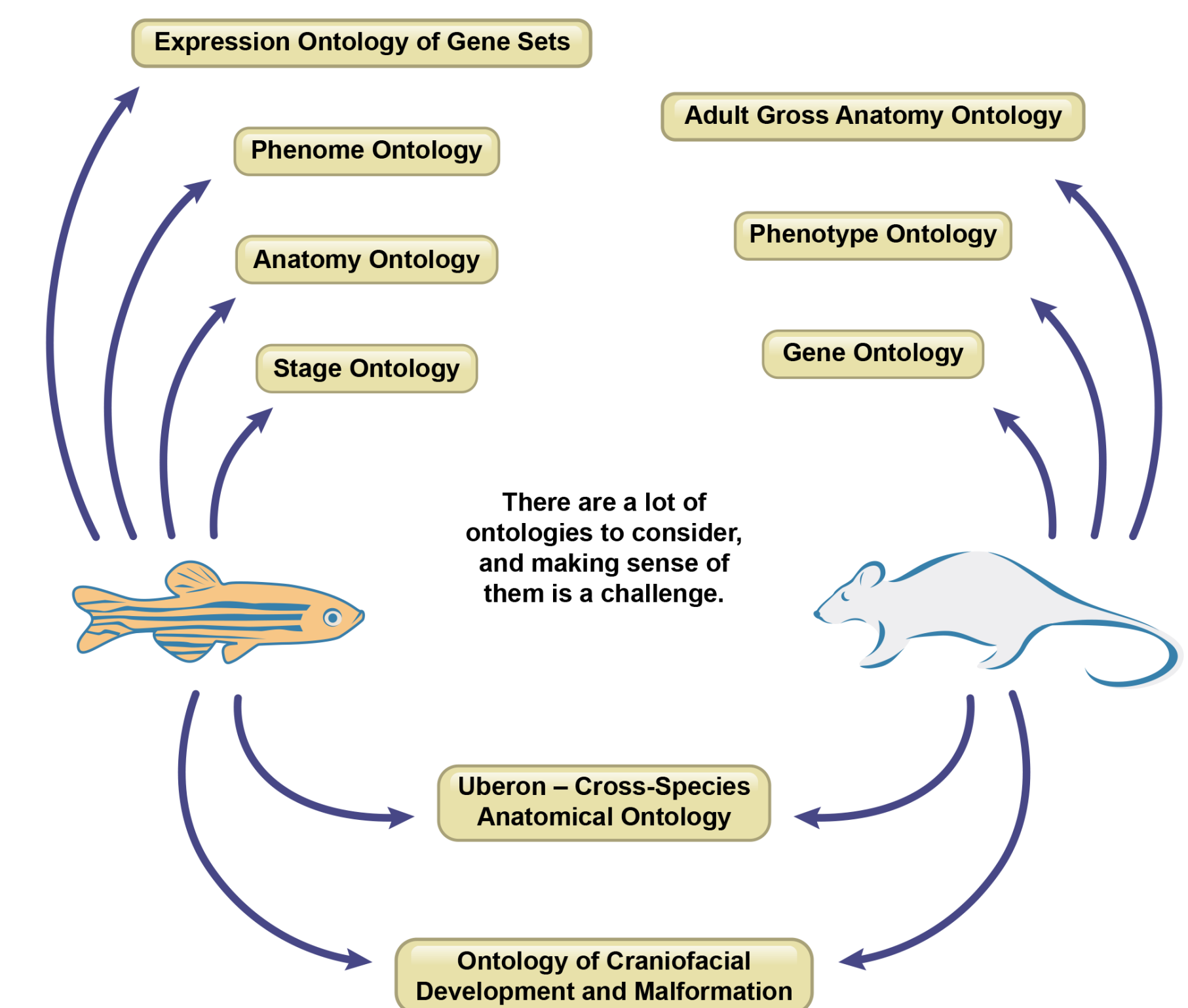
Graph adapted from: Schröter et al. (2008) Dynamics of zebrafish somitogenesis.

## 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.



## 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

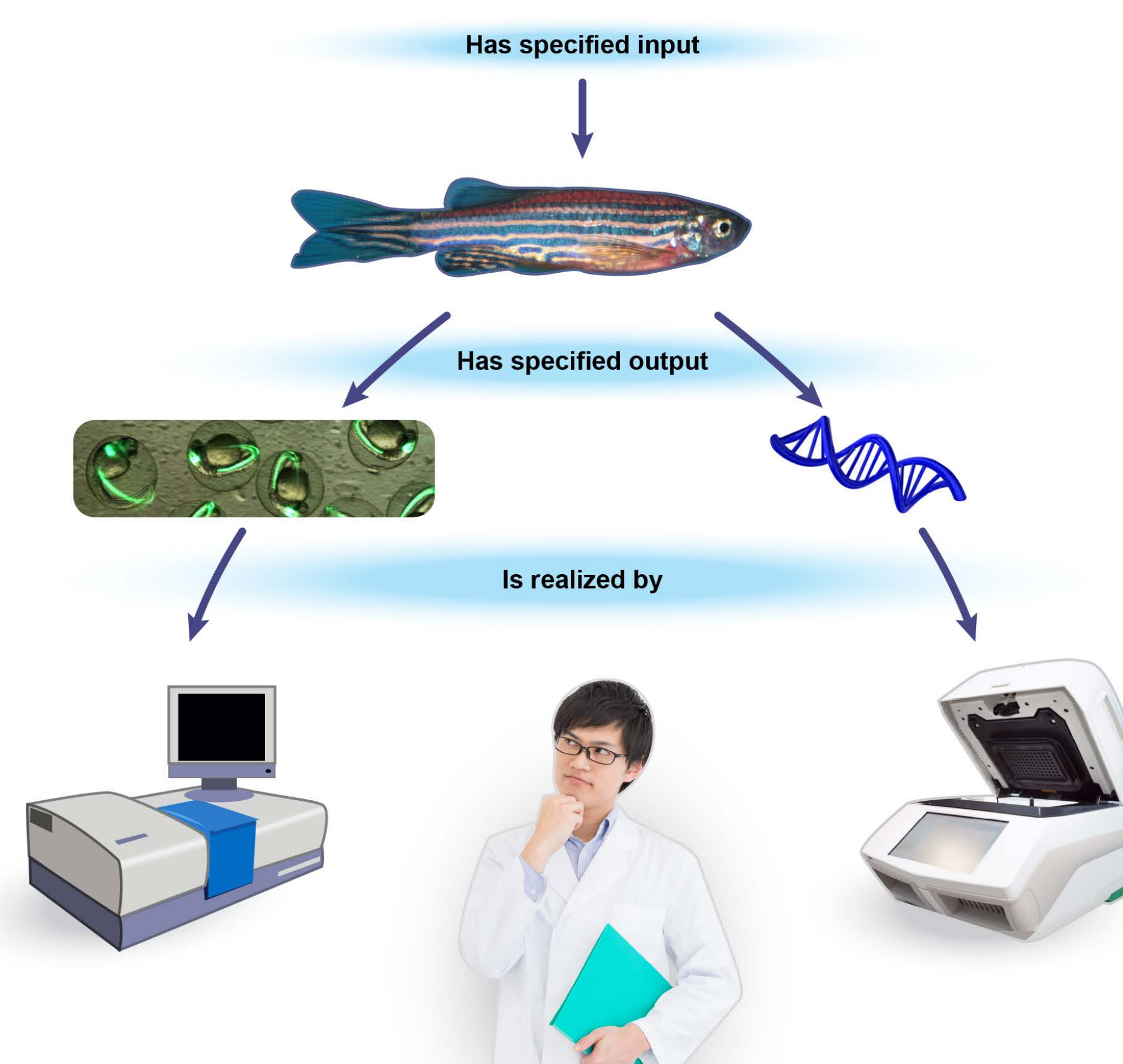


## Ontology Use Roadblocks

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



## 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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