

Skeletal anatomy issues and the Teleost Anatomy Ontology

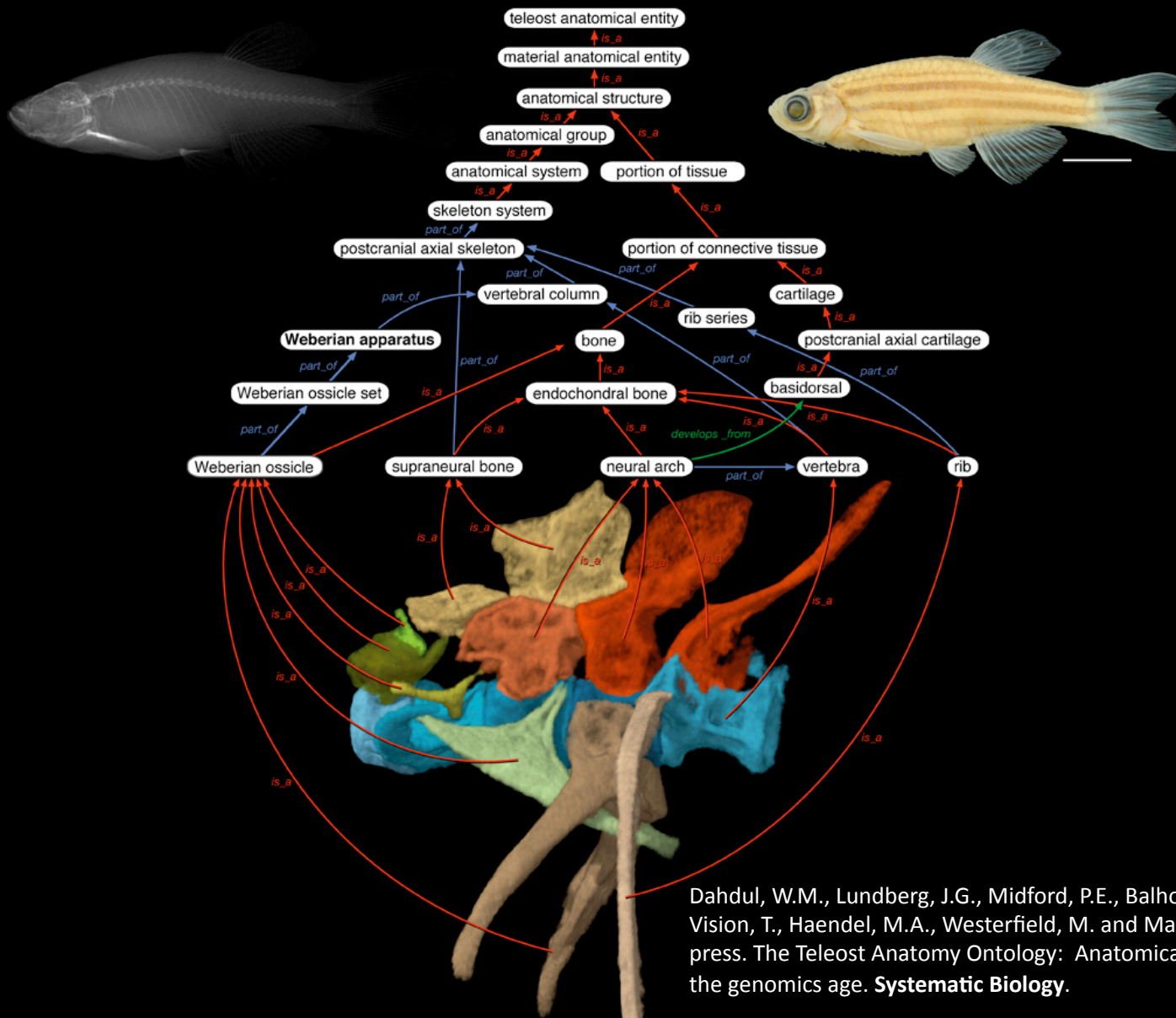
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Phenoscape Skeletal Anatomy Jamboree

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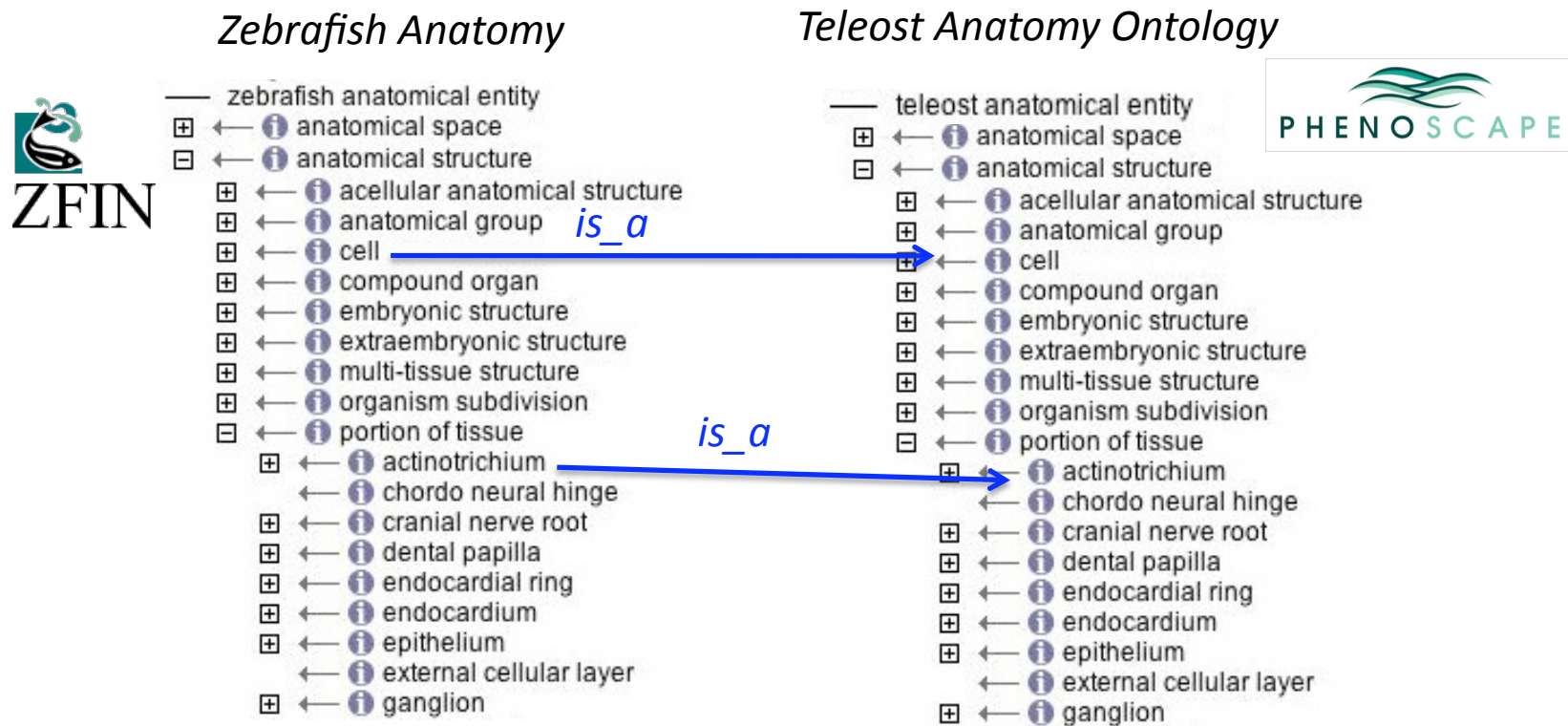
Teleost Anatomy Ontology



Dahdul, W.M., Lundberg, J.G., Midford, P.E., Balhoff, J.P., Lapp, H., Vision, T., Haendel, M.A., Westerfield, M. and Mabee, P.M. 2010 In press. The Teleost Anatomy Ontology: Anatomical representation for the genomics age. **Systematic Biology**.

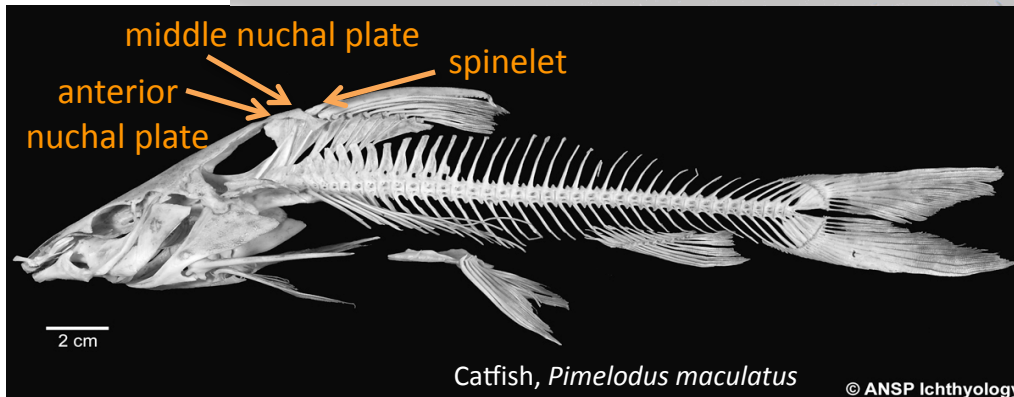
TAO cloned from ZFA

Zebrafish terms are *is_a* subtypes of teleost terms

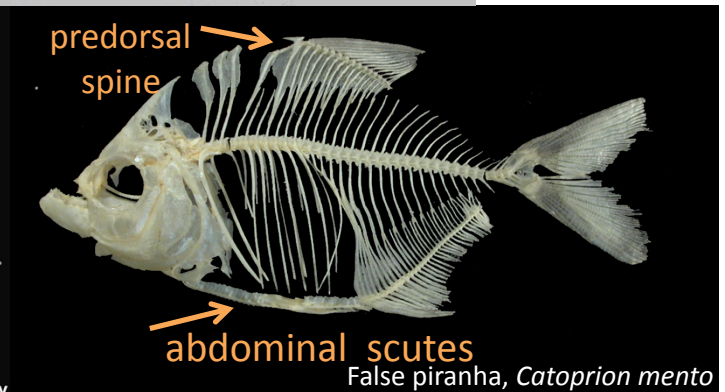


TAO: addition of new anatomical terms

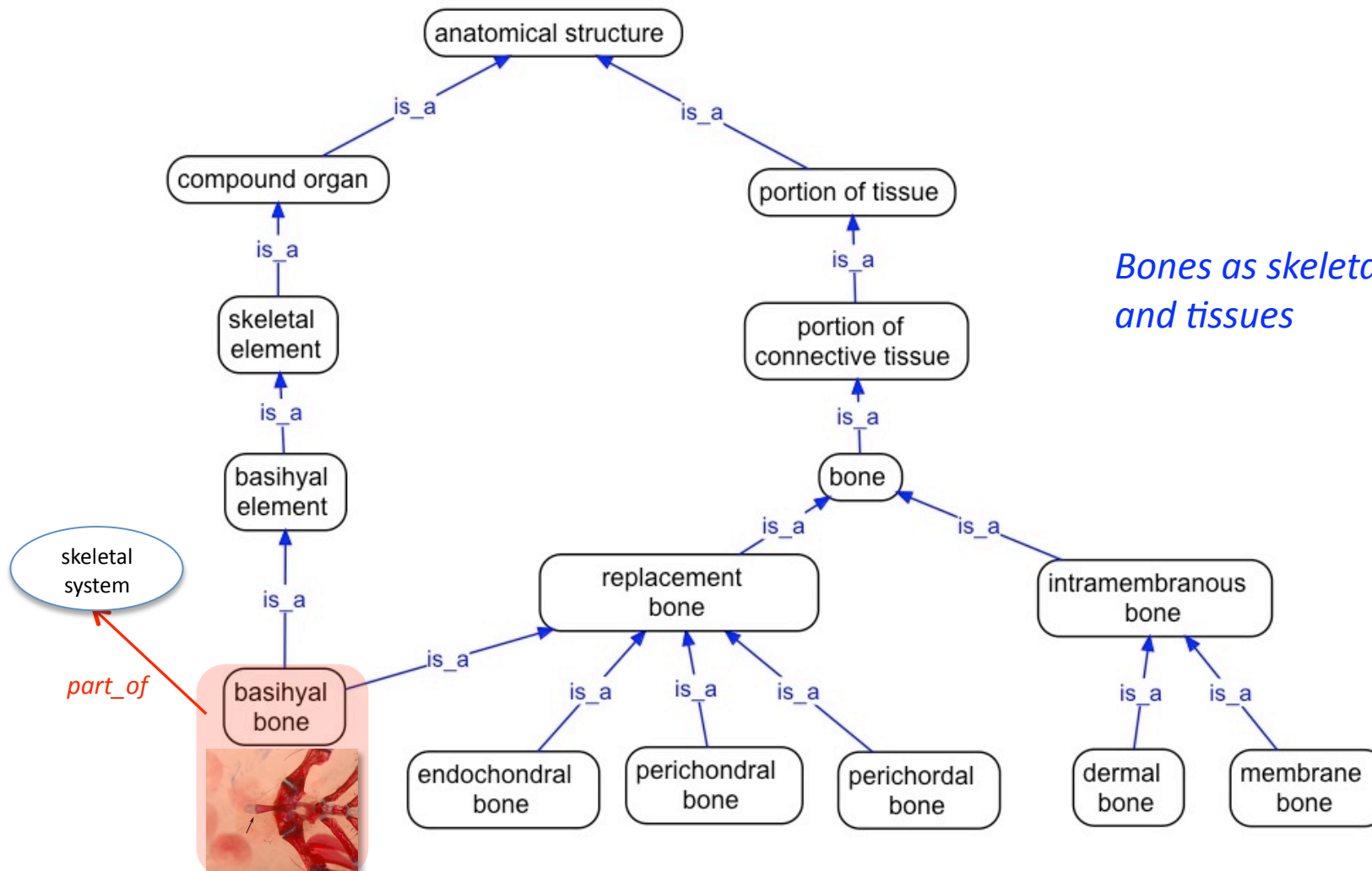
- Ontology growth driven by annotation
- Since cloning from Zebrafish Anatomy ontology in 2007, 686 ([391 skeletal](#)) new terms added; total = 2,662 terms



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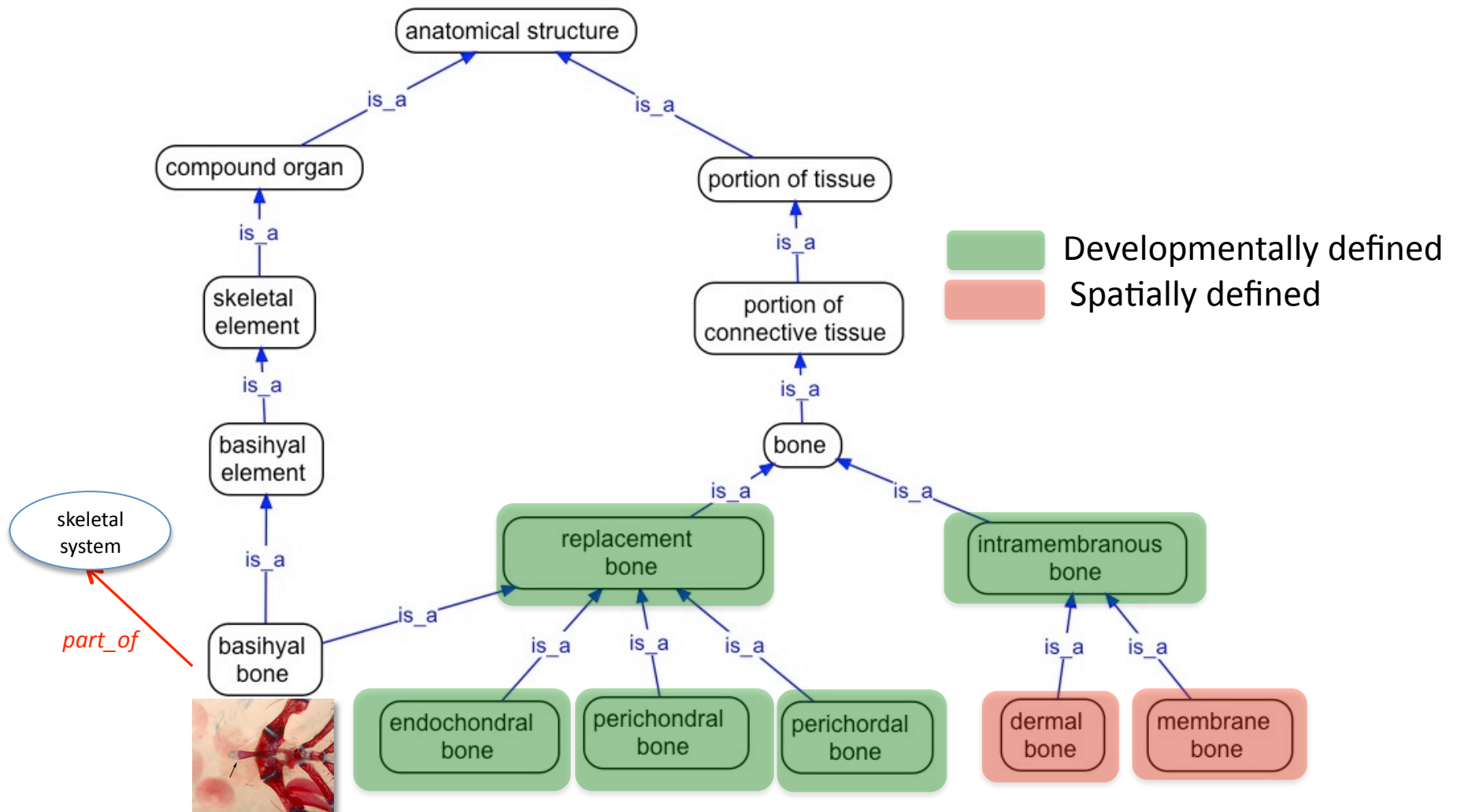


TAO skeletal classification



*Bones as skeletal elements
and tissues*

TAO skeletal classification



Ontology terms and definitions

[Term]

id: TAO:0000316

name: basihyal bone

def: "Basihyal bone is a replacement bone that is median and is the anterior-most bone of the ventral hyoid arch." [TAO:curator]

synonym: "basihyoid" EXACT []

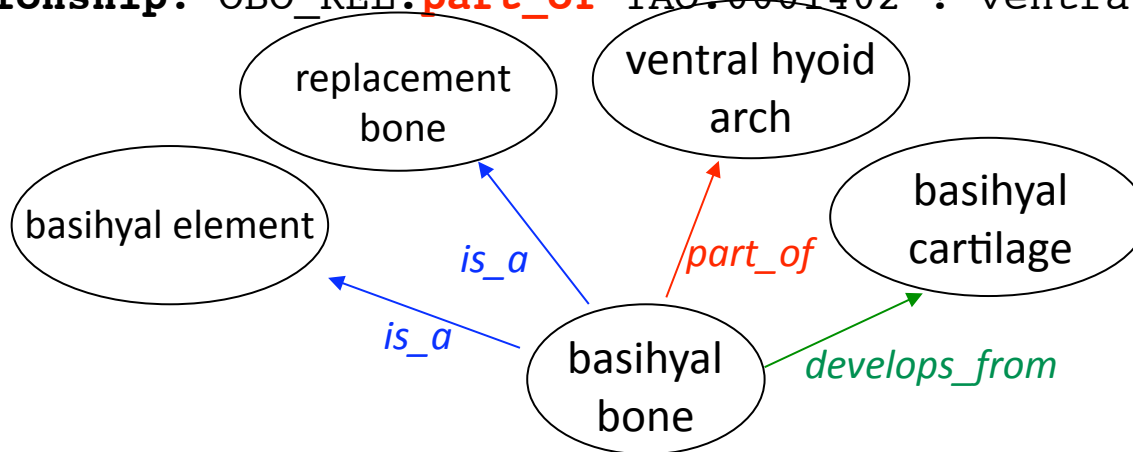
synonym: "glossohyal" EXACT []

is_a: TAO:0001637 ! replacement bone

is_a: TAO:0001891 ! basihyal element

relationship: **develops_from** TAO:0001510 ! basihyal cartilage

relationship: OBO_REL:**part_of** TAO:0001402 ! ventral hyoid arch



Genus-differentia definitions

An X is a G that D, where:

X: defined class

G: generic class

D: characteristics that distinguish X from its siblings

id: TAO:0000316

name: basihyal bone

def: "Basihyal bone is a replacement bone that is median and is the anterior-most bone of the ventral hyoid arch."

Universal definitions

Taxonomic information can be recorded in "comment" field

Criteria for creating definitions

- Position
- Composition (tissues, cells, chemical properties)
- Developmental process or origin
- Structure
- Function
- Qualities (shape, color, size etc)

Logical definitions

- Defines the sufficient conditions for a term to be considered a subclass of another term

“endochondral bone”

intersection_of: **is_a** bone

intersection_of: **develops_from** cartilage

- If a term **is_a** bone AND **develops_from** cartilage, it is by definition a subclass of endochondral bone

“basihyal bone”

relationship: **is_a** bone

relationship: **develops_from** basihyal cartilage

- Inferred relationship: **is_a** endochondral bone

Skeletal elements and tissues

- Distinction between bone as a **unit** (organ, skeletal element) and the **stuff** (tissue) that it is made of
- Classification in existing ontologies:
 - Distinction made in FMA, MA and TAO using terms for bone tissue and bone organ/skeletal element
 - Not distinguished only in AAO, XAO, ZFA

Bone development terms

Examples: endochondral ossification,
endochondral bone

- Higher level organization:
 - processes (GO)
 - “endochondral ossification”, “intramembranous ossification”
 - tissues (MA, TAO/ZFA)
 - “endochondral bone”, “intramembranous bone”
- Not represented (FMA, AAO, XAO)

Cell terms

Examples: osteocyte, chondrocyte

- discrepancies among ontologies:
 - Functional classification in CL: *osteocyte is_a secretory cell*
 - Location in FMA: *osteocyte is_a connective tissue cell*
 - replicated subset of Cell Ontology terms in TAO/ZFA
 - small flat list in XAO
 - Not represented in AAO and AMA

Workshop goals

Goal 1: name, define and relate the core vertebrate terms for

SKELETAL ELEMENTS

“units” = skeletal elements? bone organs, cartilage organs?

TISSUES

“stuff” = tissue? bone tissue, cartilage tissue, enamel...

CELLS

terminology; how do cells relate to tissues types?

Goal 2: Represent these terms using logical definitions in a vertebrate ontology framework