Applying Ontology Design Patterns in bio-ontologies

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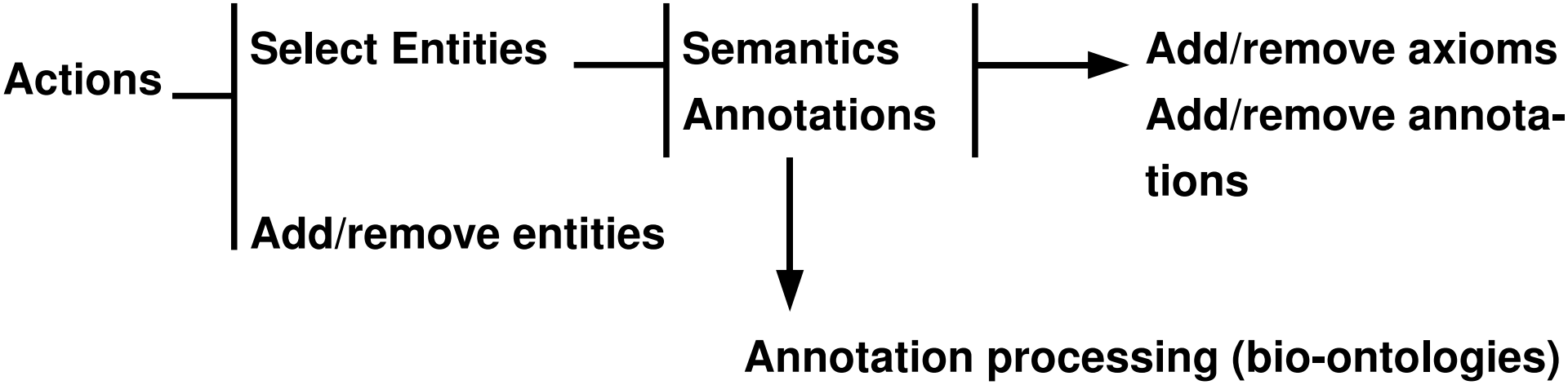
ONTOLOGY PREPROCESSOR LANGUAGE (OPPL)

High level scripting language for OWL.



Asserted/inferred mode (Pellet, FaCT++, any DIG reasoner).

Currently two versions:

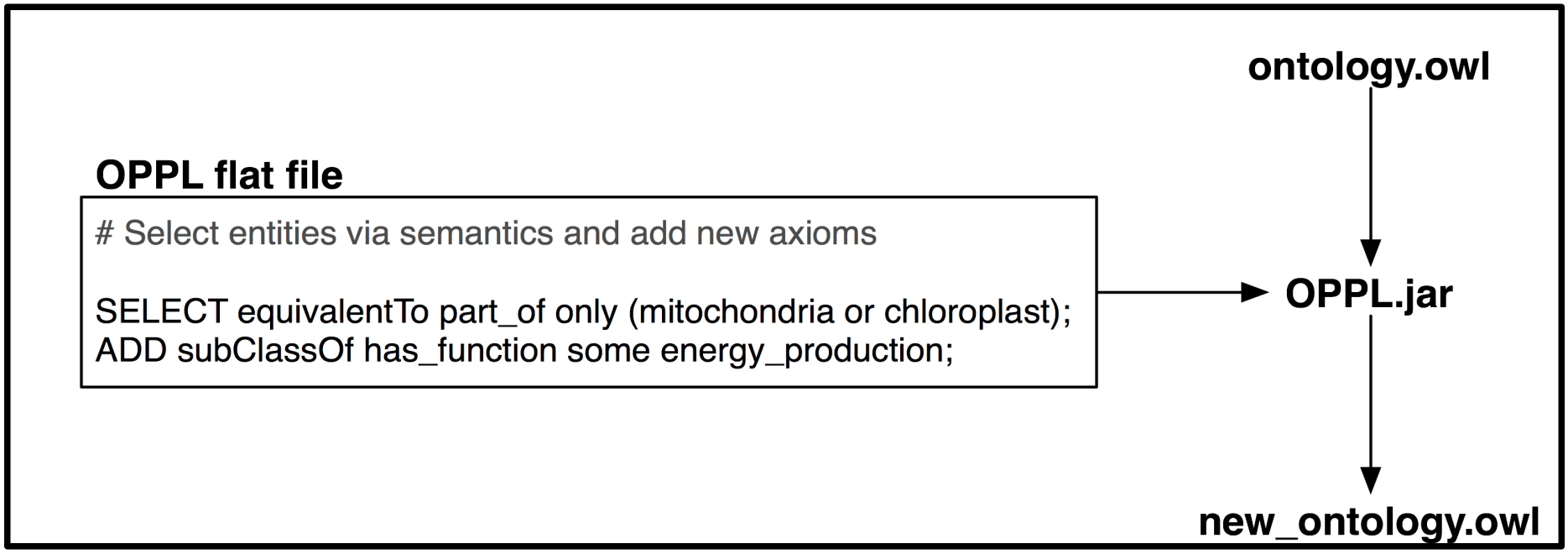
- **OPPL 1 (http://oppl.sf.net/)**
- **OPPL 2 (http://www.cs.man.ac.uk/~iannonel/oppl/)**

ONTOLOGY PREPROCESSOR LANGUAGE (OPPL)

OPPL syntax (Manchester OWL Syntax + OPPL keywords)

```
SELECT equivalentTo part_of only (mitochondria or chloroplast);
ADD subClassOf has_function some energy_production;
```

OPPL software (java)



ONTOLOGY PREPROCESSOR LANGUAGE (OPPL)

Store and share complex modelling for consistent application:

- **by different ontologists**
- **at different stages**
- **in different parts of the ontology (via queries)**

Documented and explicit modelling: trace modelling.

Try complex modelling easily, then decide: prototypes.

Ontology cleansing/enrichment.

Ontology cleansing/enrichment in pipelines (e.g. CCO http://www.cellcycleontology.org/).

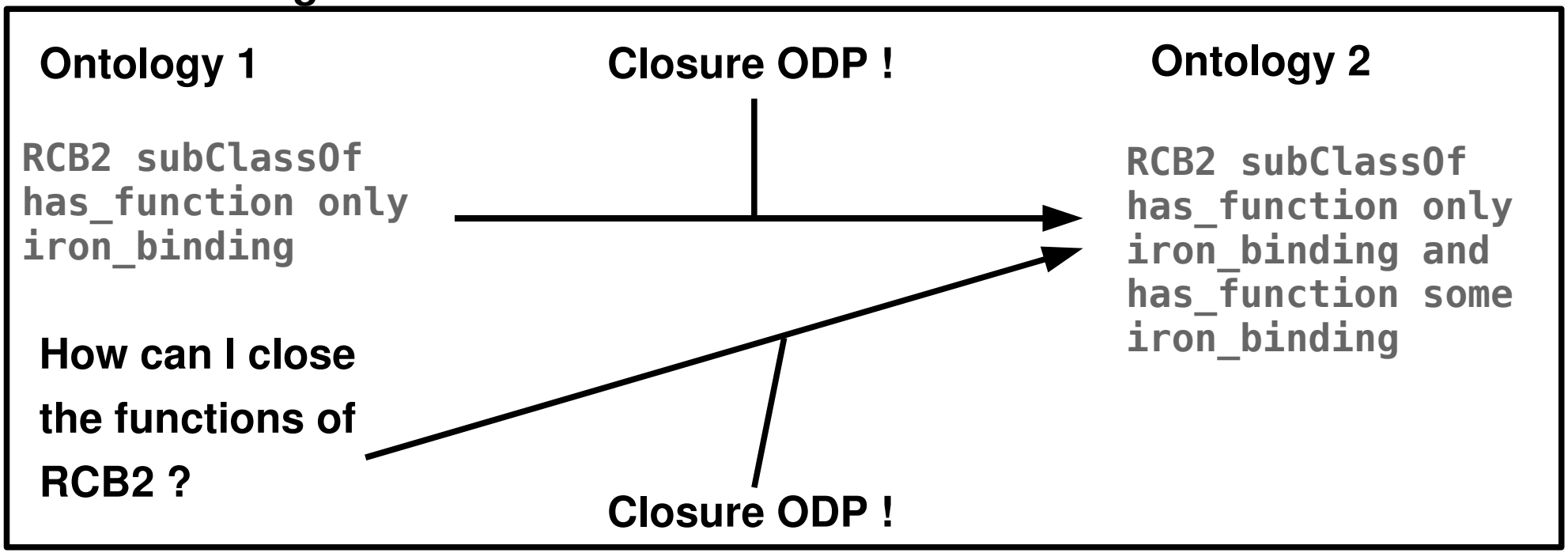
Automated modification/querying of big ontologies.

OPPL FOR ONTOLOGY DESIGN PATTERNS (ODPs)

Ontology Design Patterns (ODPs): encapsulate complex semantics, easier modelling.

e.g. Closure ODP: `prop only filler and prop some filler`

Bio-ontologies: lean axiomisation



OPPL FOR ONTOLOGY DESIGN PATTERNS (ODPs)

OPPL: store (flat files) and apply ODPs in OWL ontologies.

ODPs for modifiers	**Entity-Quality ODP (E-Q ODP)** **Entity-Property-Quality ODP (E-P-Q ODP)** **Entity-Feature-Value ODP (E-F-V ODP)**

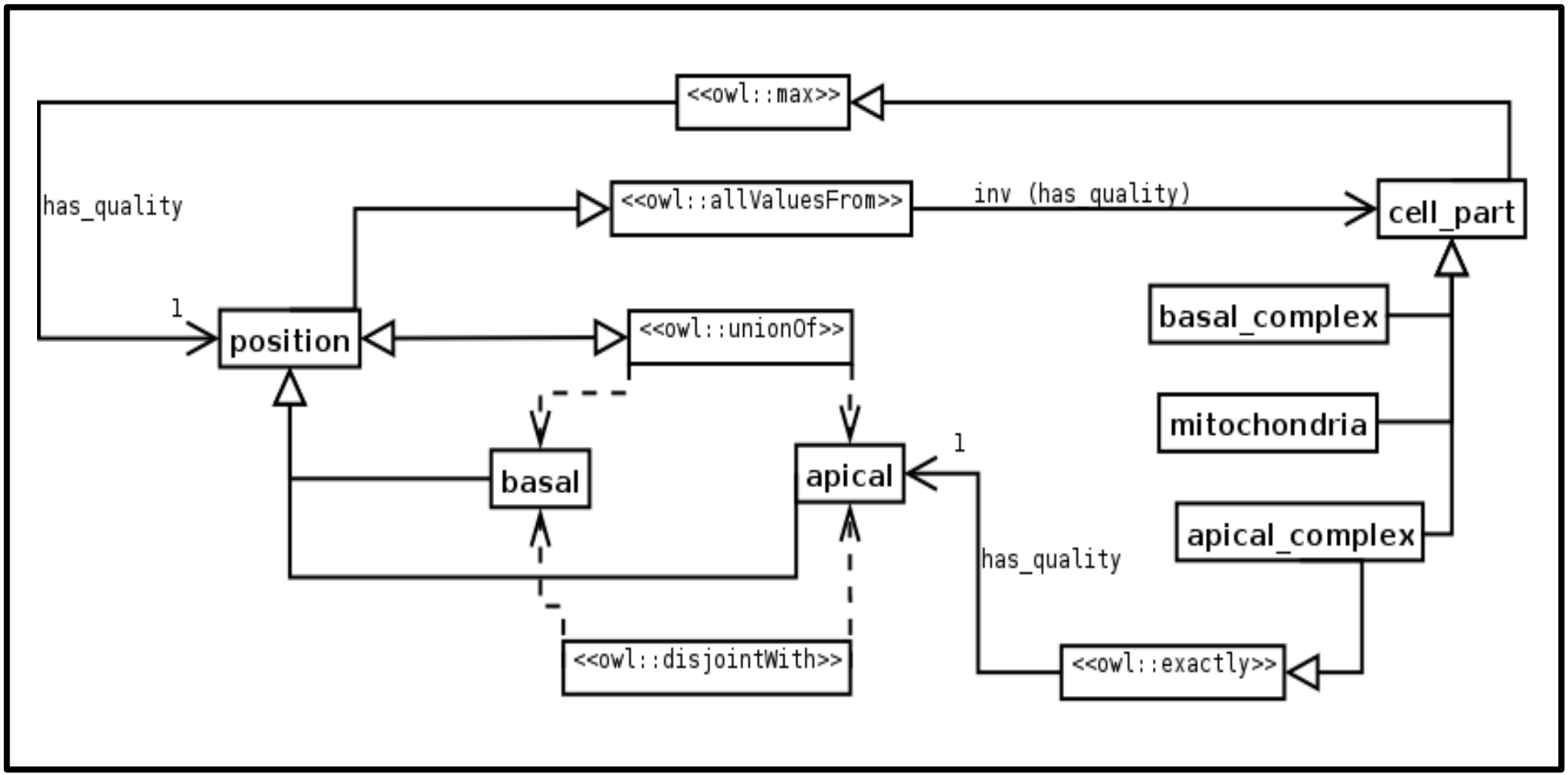
Try E-Q, E-P-Q, E-F-V, and then decide.

E-Q ODP in the Gene Ontology (GO): position of cell parts (e.g. the position of "apical complex" is the apical side of the cell).

Apply E-Q in GO via annotation query and processing with OPPL: 24/20,000.

Local vs global ODPs.

Entity-Quality ODP (E-Q ODP)



E-Q ODP applied in GO (OWL version) via OPPL script (flat file)

```
# Quality values

ADD Class: modifier;
ADD ObjectProperty: has_quality;
ADD Class: position;ADD subClassOf modifier;REMOVE subClassOf Thing;
ADD Class: apical;ADD subClassOf position;REMOVE subClassOf Thing;
ADD Class: basal;ADD subClassOf position;ADD disjointWith apical;
SELECT Class: position;ADD equivalentTo apical or basal;

# Constrain the quality values to the entities (CCO_C0001882 = cell part)

SELECT Class: position;ADD subClassOf inv (has_quality) only CCO_C0001882;

# Not having a position is legal

SELECT Class: CCO_C0001882;ADD subClassOf has_quality max 1 position;

# Add position values to actual cell parts

SELECT label "(basallapical) (.+?)";ADD subClassOf has_quality exactly 1 <1>;
```

ONTOLOGY PREPROCESSOR LANGUAGE 2

Developed by Luigi Iannone (BioHealth Informatics Group, University of Manchester).

Axiom centric, not entity centric: closer to OWL semantics.

Protégé plugin (autocomplete, ...).

Variables (e.g. Closure ODP)

```
?x:CLASS, ?z:CLASS SELECT ?x SubClassOf has_function only ?z
BEGIN ADD ?x SubClassOf has_function some ?z END;
```

Decidability: variables only to be bound by named entities, not expressions (Class, ObjectProperty, DataProperty, Individual, Constant).

CONCLUSION

OPPL: easy “programmatic” manipulation of OWL ontologies.

ODPs: semantic encapsulation; ease modelling.

OPPL for efficiently and consistently applying ODPs.

ODPs succesfully applied in the CCO with OPPL:

Mikel Egaña Aranguren, Erick Antezana, Martin Kuiper, Robert Stevens. Ontology Design Patterns for bio-ontologies: a case study on the Cell Cycle Ontology. BMC bioinformatics 2008, 9(Suppl 5):S1. http://www.biomedcentral.com/1471-2105/9/S5/S1

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Manchester OWL Syntax.

OWL API (http://owlapi.sf.net).

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