BIOMEDIN210, Homework #2

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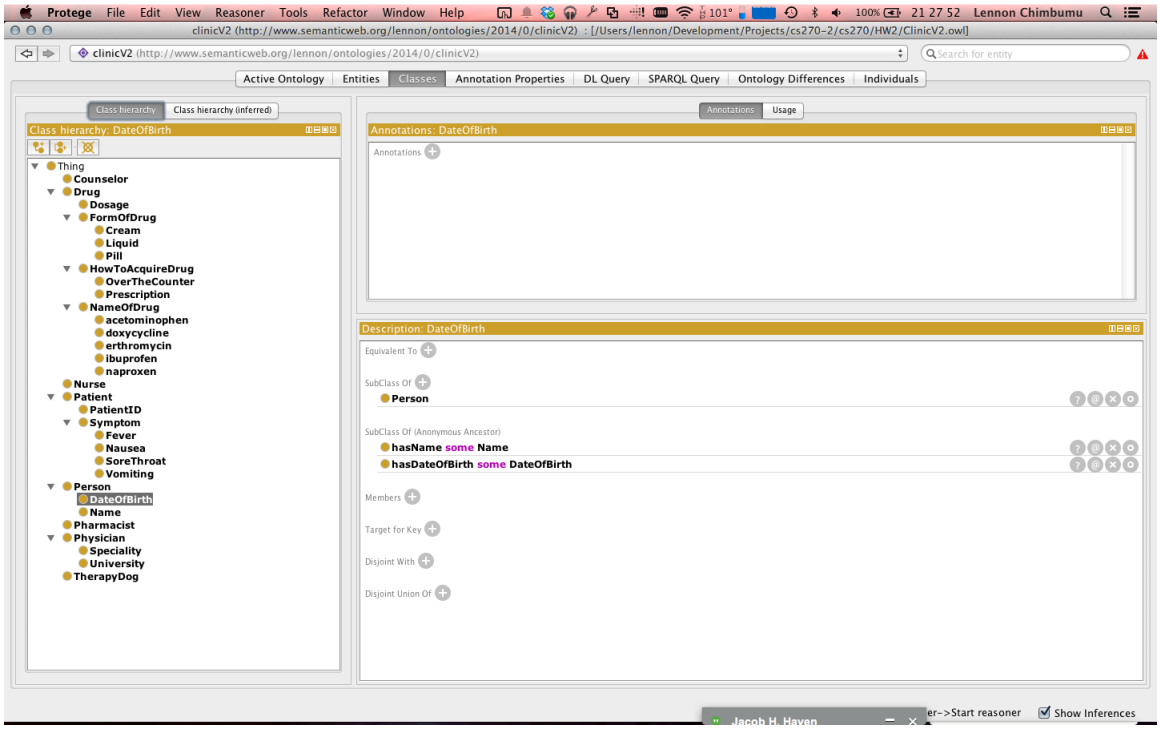
Problem 1 (Considerations in modeling)

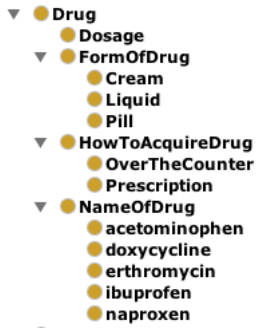
1. The closed-world assumption is that anything that is not known to be true must be considered false.
2. The open-world assumption is that failure to derive a conclusion does not mean the opposite is true.
3. The unique-name assumption in the assumption that different names refer to different entities.
4. In Frames, if two objects have different names, they are assumed to be different. So the unique name assumption applies to Frames.
5. The open-world assumption applies to OWL.
6. These assumptions affect the choice of ontological language we might choose in modeling a certain domain.
7. After discussion, we believe that both open and closed-world assumptions have their place. Take the simple example: if I do not have information about whether person X is a spy, it is not safe to assume that they are a spy (open), or that they are not a spy (closed). For the NSA, it is safer for them to assume that the world is "negative," as in, assume "everyone" is a spy and only trust those who have been specifically white-listed. Thus, it makes more sense for the NSA to use an open-world assumption, especially if they are interested in modeling who has contact with whom and who knows what information. It is "safer" for the NSA to assume that if no information is available, that there is contact between parties and that information is being transferred and thus to be conservative in their actions, which falls under an open-world assumption which states that under circumstances when a conclusion cannot be derived, we cannot assume that the opposite is true.

Problem 2 (Modeling with Protege)

1. The class structure for the data provided looks like:

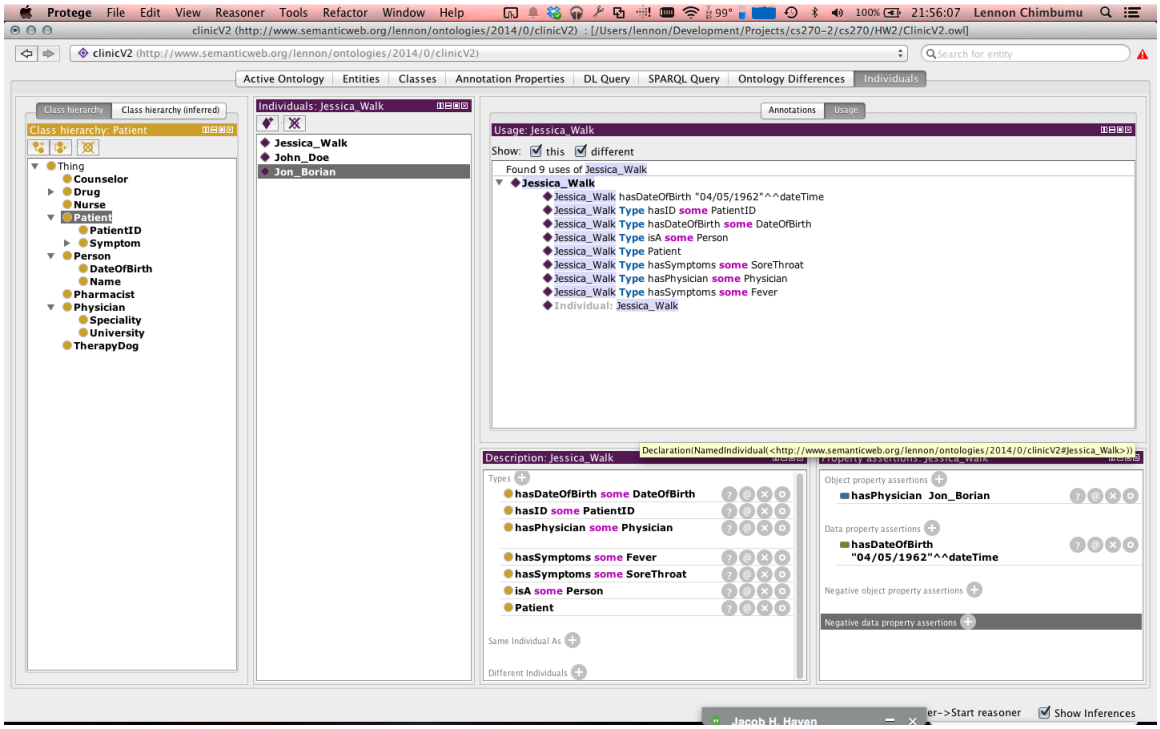


The **Drug** class looks like:

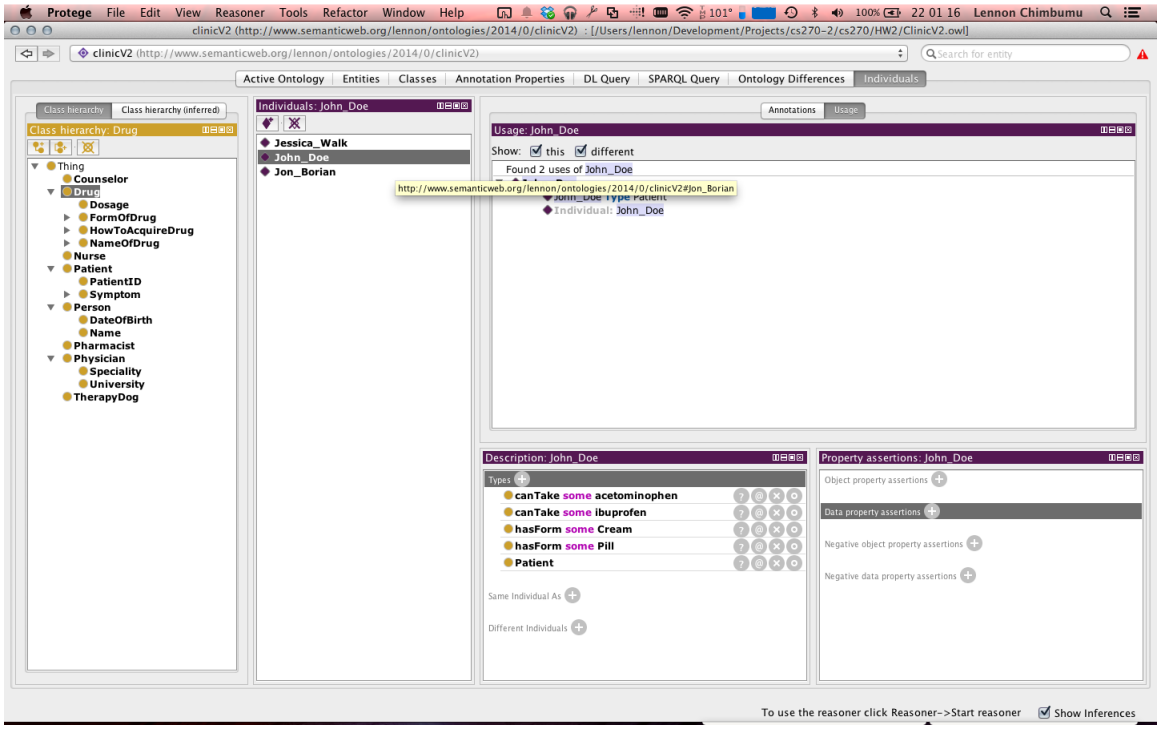


2. The Hierachy classifies sickle cell anemia as an **autosomal recessive disease** which is a subclass of **autosomal genetic disease** which is a subclass of **monogenetic disease** which is a subclass of **genetic disease** which is a subclass of **disease.** This hierachy may be useful for determining the best treatment for a disease. In the case of sickle cell anemia, we may want to use methods in gene therapy to try and treat it.

3. Jessica Walk's record looks like:



John Doe's record looks like:



Problem 3

1. A class is unsatisfiable if there is a contradiction in the ontology that implies that the class cannot have any instances. In OWL, such a class would entail to **owl:nothing.**

2. An ontology is inconsistent if it is impossible to interpret the axioms in the ontology such that there is at least one class which has an instance.

3. An ontology is incoherent if it contains at least one unsatisfiable class.

4. The OWL2 Profiles are: OWL 2 EL, OWL 2 QL and OWL 2 RL. **OWL 2 EL** was designed for biomedical ontologies because it can handle very large ontologies and has very fast reasoning capabilities, both of which are essential when dealing with biomedical ontologies.

5. An entailed axiom directly follows from an ontology because it has been explicitly asserted in that ontology. Inferred axioms arise from the relationships among the classes. These two are the same because OWL automatically maintains the relationships between classes as you enter them.

6. i. The **satisfiable** classes are: A, B, C and D. The only **unstatisfiable** class is E

   ii.

A SubClassOf D	entailed
A SubClassOf B	entailed
A SubClassOf B or D	entailed
E SubClassOf E	entailed
E SubClassOf B and not B	not entailed

Problem 4 (The Semantic Web)

1.
```
PREFIX actor: <http://data.linkedmdb.org/resource/actor/>
PREFIX movie: <http://data.linkedmdb.org/resource/movie/>
PREFIX country: <http://data.linkedmdb.org/resource/country/>
PREFIX capital: <http://data.linkedmdb.org/resource/movie/country_capital/>
SELECT distinct ?all_capitals
FROM <http://xmlns.com/foaf/0.1/> #not used
{
SERVICE <http://data.linkedmdb.org/sparql>
{
#replace Patrick Stewart with actor name
  ?all_actors movie:actor_name "Patrick Stewart".
  ?all_movies movie:actor ?all_actors.
  ?all_movies movie:country ?all_countries.
  ?all_countries movie:country_capital ?all_capitals.
}
}
```

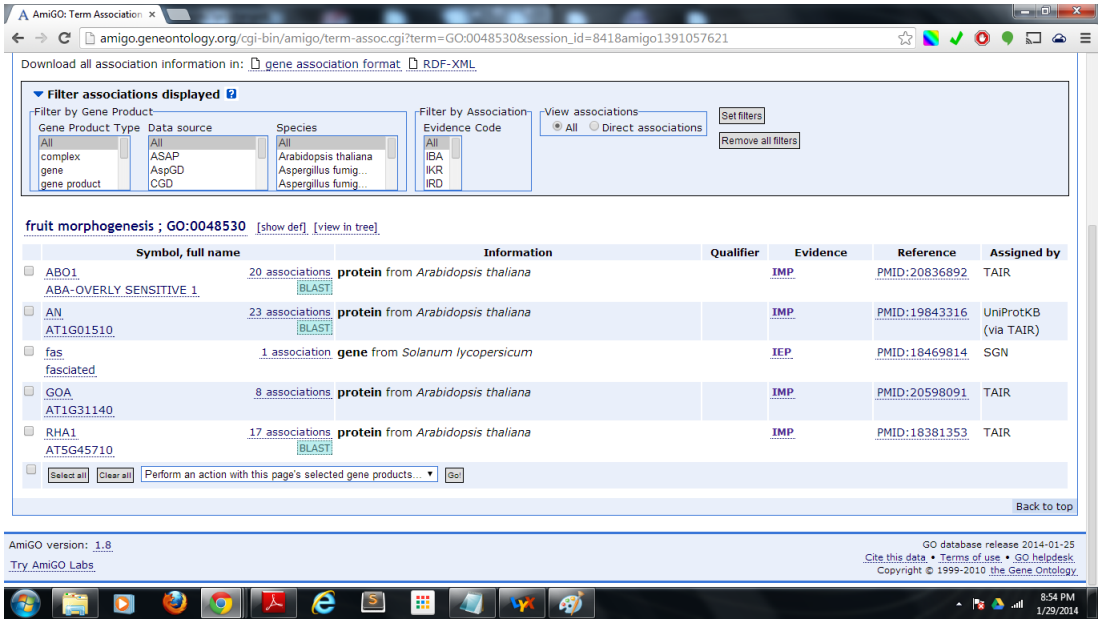
- Assume that all actors have starred in movies and all movies have actors.
- Assume that a movie is shot in a particular country.
- Assume that all countries have capitals.

Problem 5 (Ontology Applications)

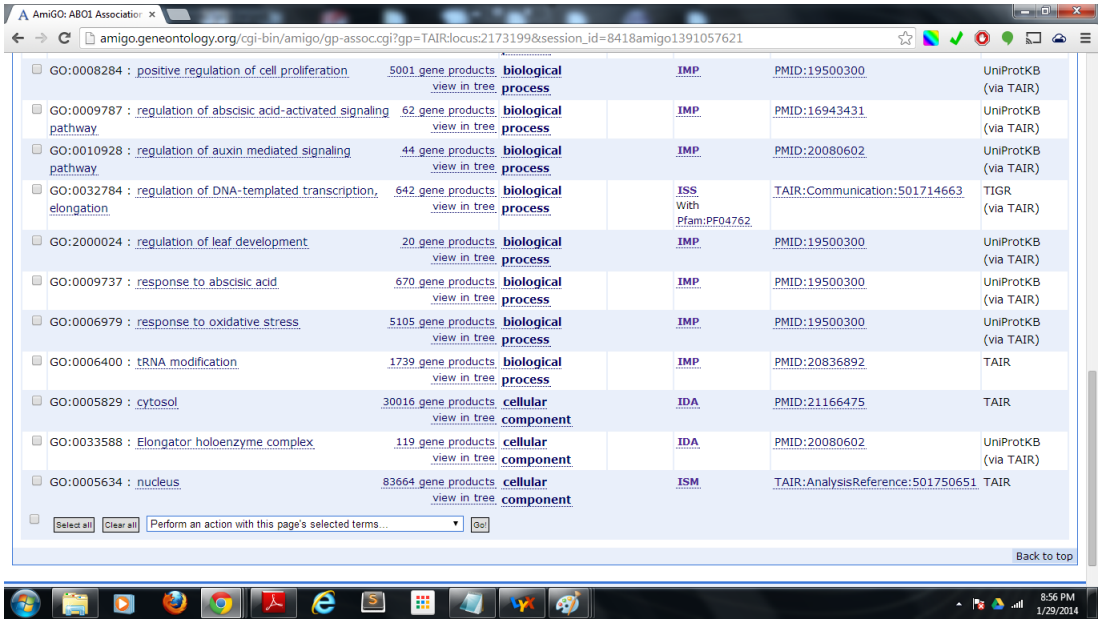
1.

Term	Domain
aerobic respiration	Biological Process
Epithelial Cell Differentiation	Biological Process
Enzyme Binding	Molecular Function
Synovial Bursa	Not Classified
Mad-Cow Disease	Not Classified
Endoplasmic Reticulum	Cellular Component

2. The 5 resulting products of fruit morphogenesis are in the screenshot below:



And the terms associated with **ABO1** are in the screenshots below



3. The Classification of interleukin-1 is in the diagram below:

- GO:0005488 binding [244065 gene products]
- GO:0003674 molecular_function [577197 gene products]
  - GO:0005515 protein binding [68359 gene products]
  - GO:0030545 receptor regulator activity [257 gene products]
    - GO:0005102 receptor binding [11404 gene products]
    - GO:0030547 receptor inhibitor activity [73 gene products]
      - GO:0005126 cytokine receptor binding [1781 gene products]
      - GO:0048019 receptor antagonist activity [53 gene products]
        - **GO:0005152 interleukin-1 receptor antagonist activity [15 gene products]**
          - GO:0045352 interleukin-1 Type I receptor antagonist activity [5 gene products]
          - GO:0045353 interleukin-1 Type II receptor antagonist activity [5 gene products]

Blocks the binding of interleukin-1 to the interleukin-1 receptor complex.