When and Why to use a Classifier?

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with acknowledgement to

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When to use a classifier

1. **At author time: As a compiler**
   - **Ontologies will be *delivered* as "pre-coordinated" ontologies to be used without a reasoner**
   - **To make extensions and additions quick, easy, and responsive, distri but developments, empower users to make changes**
   - **Part of an *ontology life cycle***
2. **At delivery time: As a service:**
   - **Many fixed ontologies are too big and too small**
     - **Too big to find things; too small to contain what you need**
       - **Create them on the fly**
   - ***Part of an ontology service***
3. **At application time: as a reasoner**
   - **Decision support, query optimisation, schema integration, …, …, …**
   - ***Part of a reasoning service***

When to use a classifier 1: Pre-coordinated delivery classifier as compiler

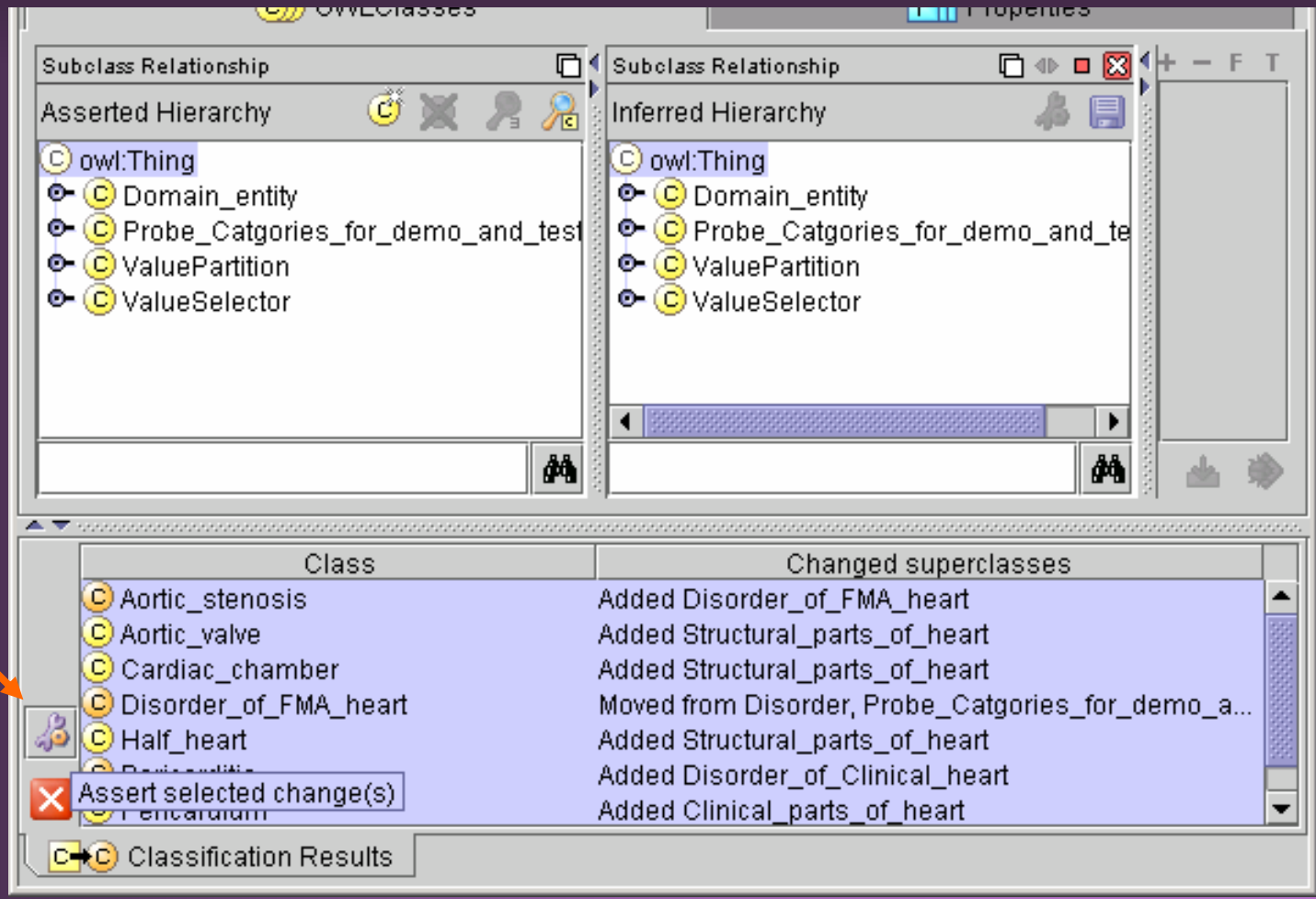
- **The life cycle**
  - **Gather requirements, sketch, experiment**
  - **Establish patterns – design a "language"**
    - **Criteria for success: What a subject domain expert can learn in a few days**
  - **Bulk authoring**
  - **Classification**
  - **Quality assurance**

Development & evolution

  - **Commit classifier results to a pre-coordinated ontology & deliver**
    - **Polyhierarchies (Protégé, DAG-Edit, OWL-Lite, RDF(S), Topic Maps, …**
      - **Query and use with you favourite tool**

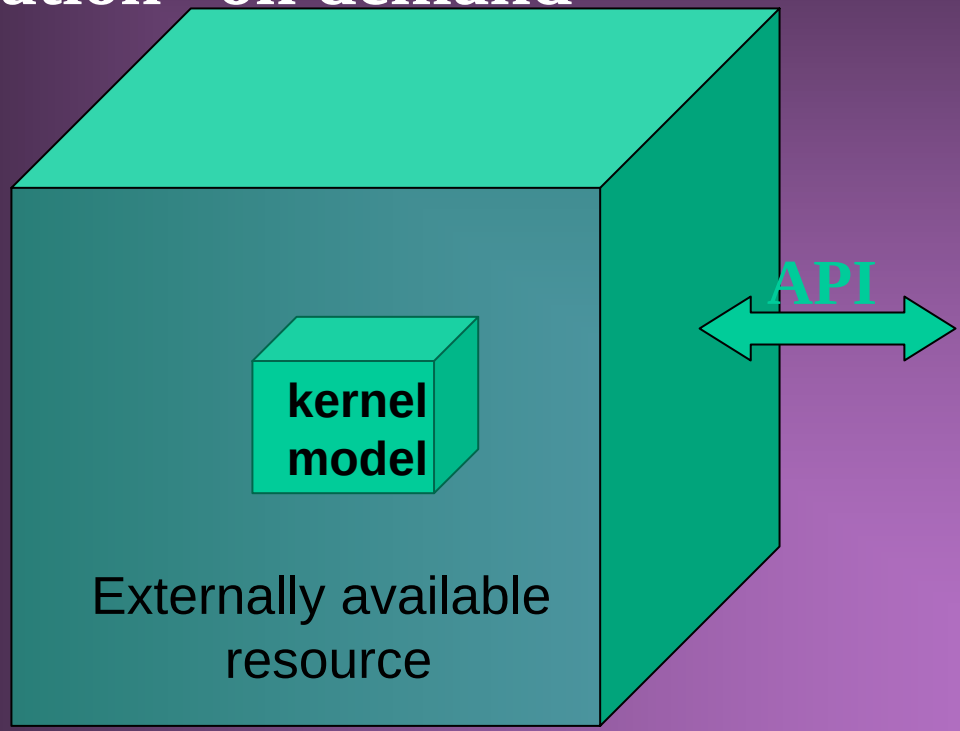
Commit Results to a Pre-Coordinated Ontology

Assert ("Commit") changes inferred by classifier



When to use a classifier 2:
Post Coordination
Classifier as an inference engine

- **When the ontology too big – "Lazy classification" on demand**



Big on the outside: small kernel on the inside

Often combined with other services: Example - the GALEN Server

Client

Client Applications Users

Ontology Services

Service API

- Multilingual Module
  - Multilingual Lexicons
- Ontology Module
  - Ontologies & Classifier
- External Resources & "Coding" Module
  - Resource References

Run time classifier

…but… Why use a Classifier?

- To *compose* concepts
  - Allow *conceptual lego*
- To manage *polyhierarchies*
  - Adding abstractions (“axes”) as needed
  - *Normalisation*
    - Untangling
      - labelling of “kinds of is-a”
- To avoid *combinatorial explosions*
  - Keep bicycles from exploding
- To manage *context*
  - Cross species, Cross disciplines, Cross studies
- To check *consistency* and *help users find errors*

Logic-based Ontologies: Conceptual Lego

hand

extremity

body

chronic

acute

abnormal

normal

ischaemic

deletion

polymorphism

gene

protein

cell

expression

Lung

inflammation

infection

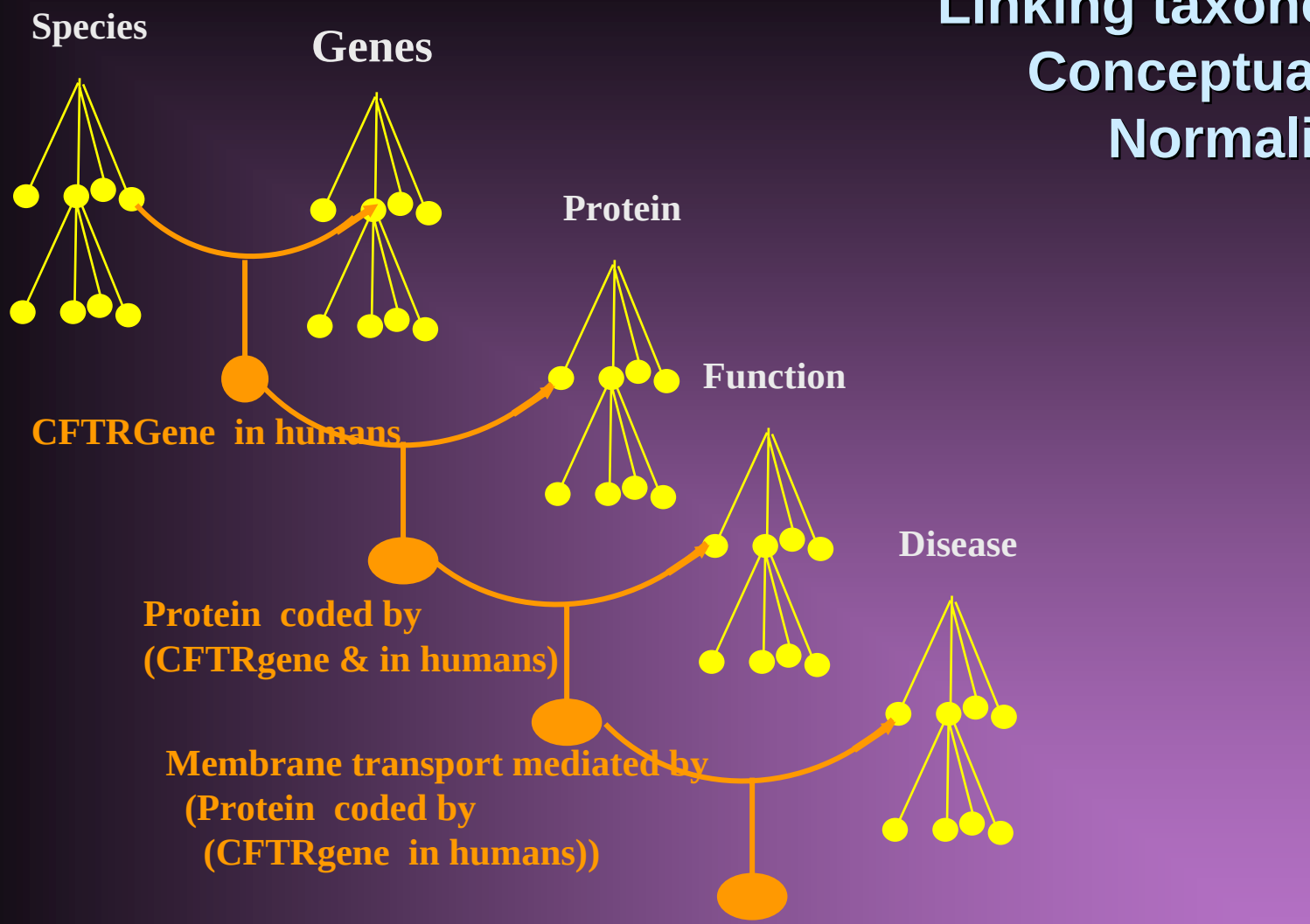
bacterial

Logic-based Ontologies: Conceptual Lego

"SNPolymorphism of CFTRGene causing Defect in MembraneTransport of ChlorideIon causing Increase in Viscosity of Mucus in CysticFibrosis…"

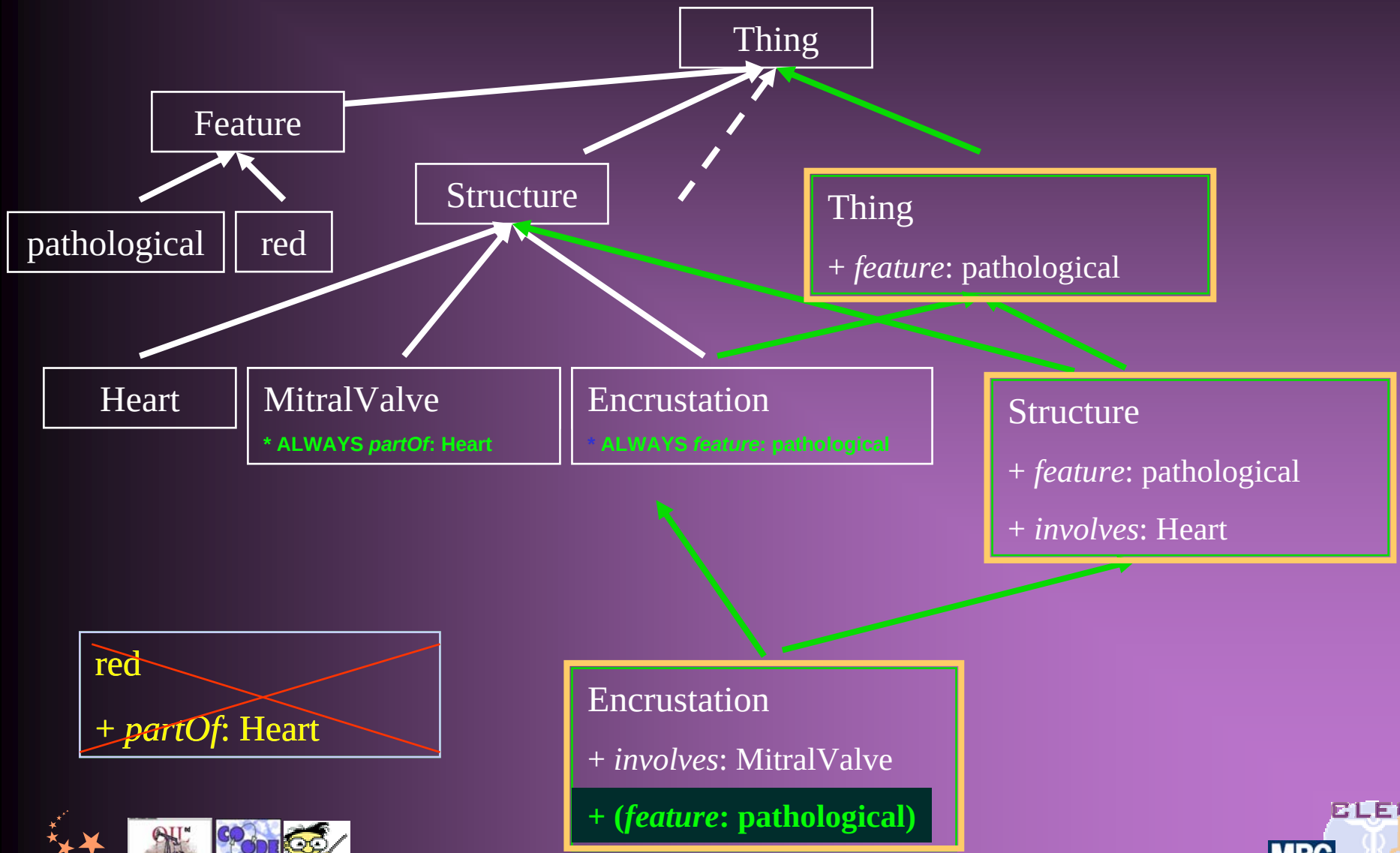
"Hand which is anatomically normal"

Linking taxonomies: Conceptual Lego Normalisation

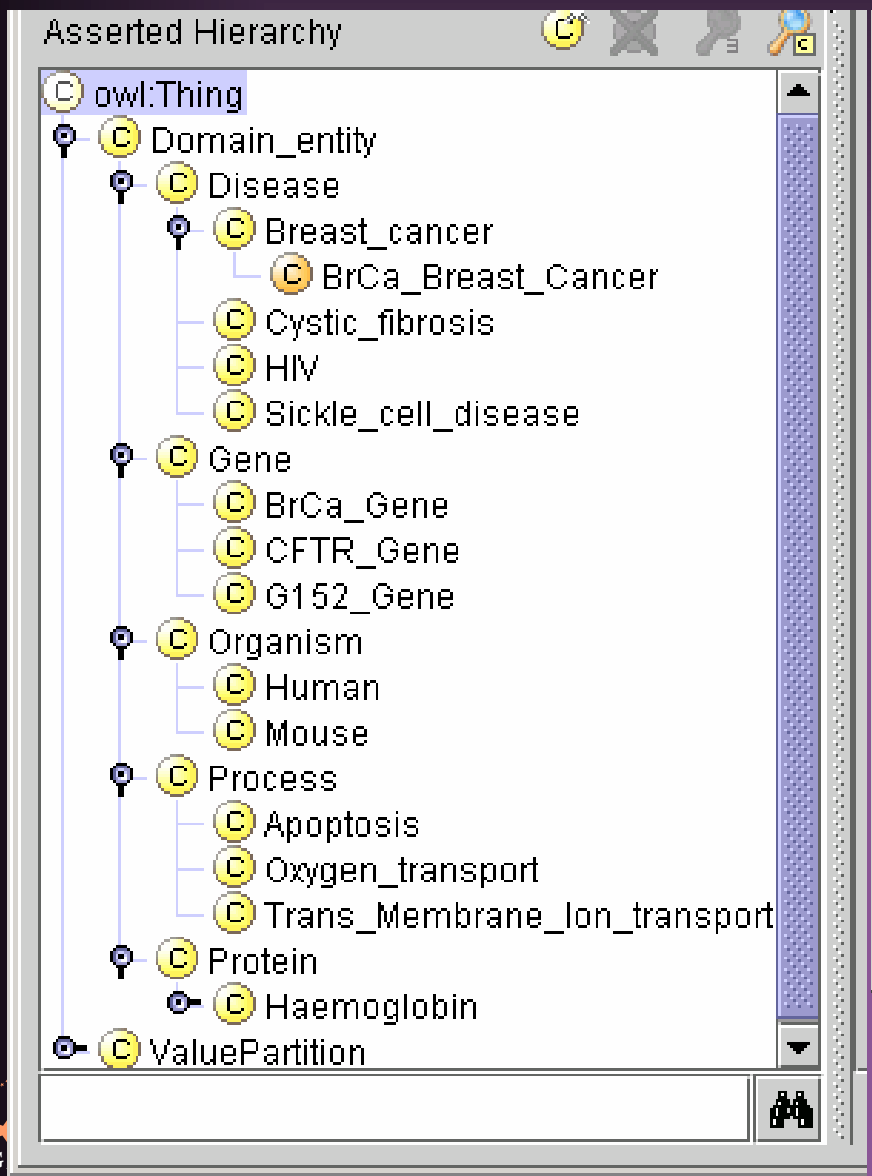


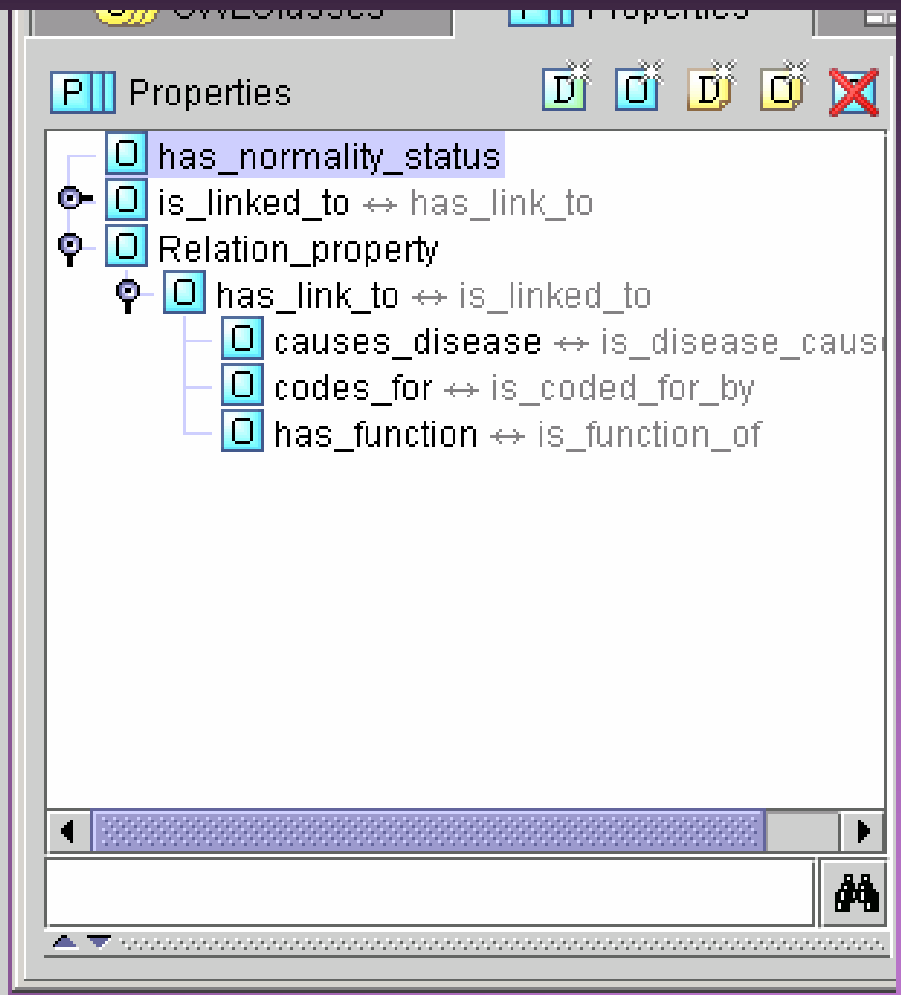
Logic Based Ontologies: The basics

Primitives **Descriptions** **Definitions** **Reasoning** **Validating (constraining cross products)**

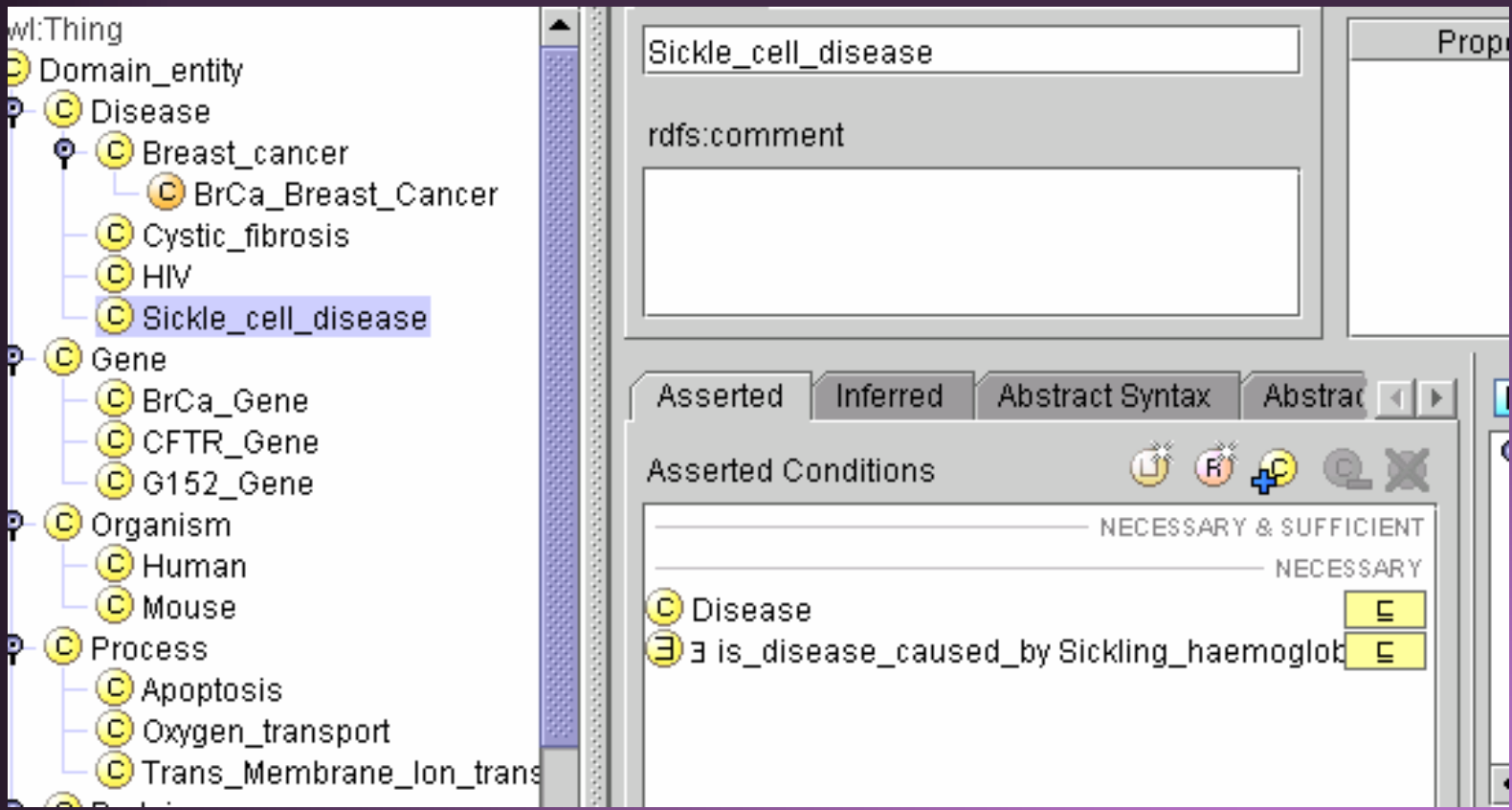


Example demonstrations:
Take a Few Simple Concepts & Properties



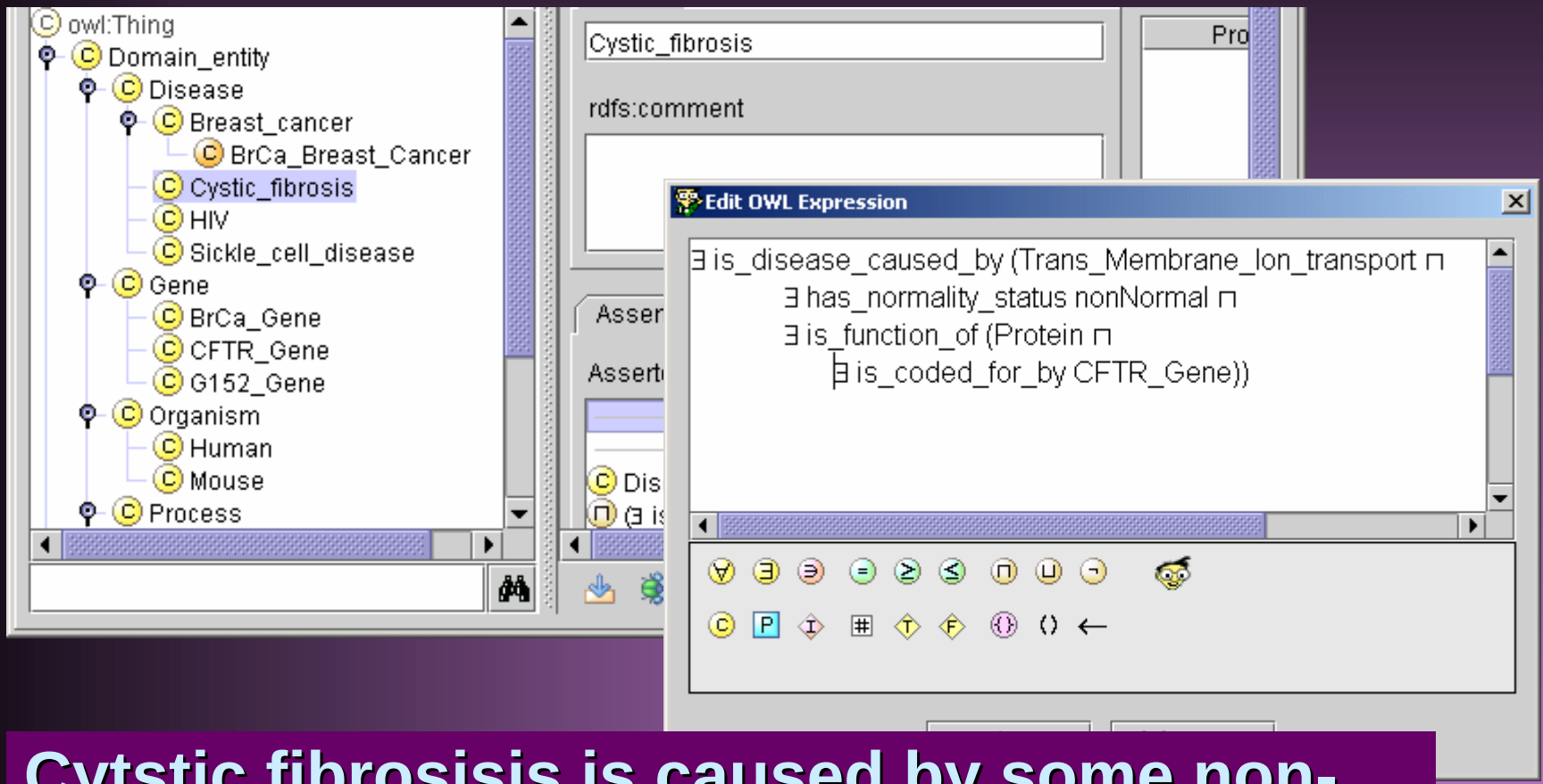


Combine them in Descriptions which can be simple….



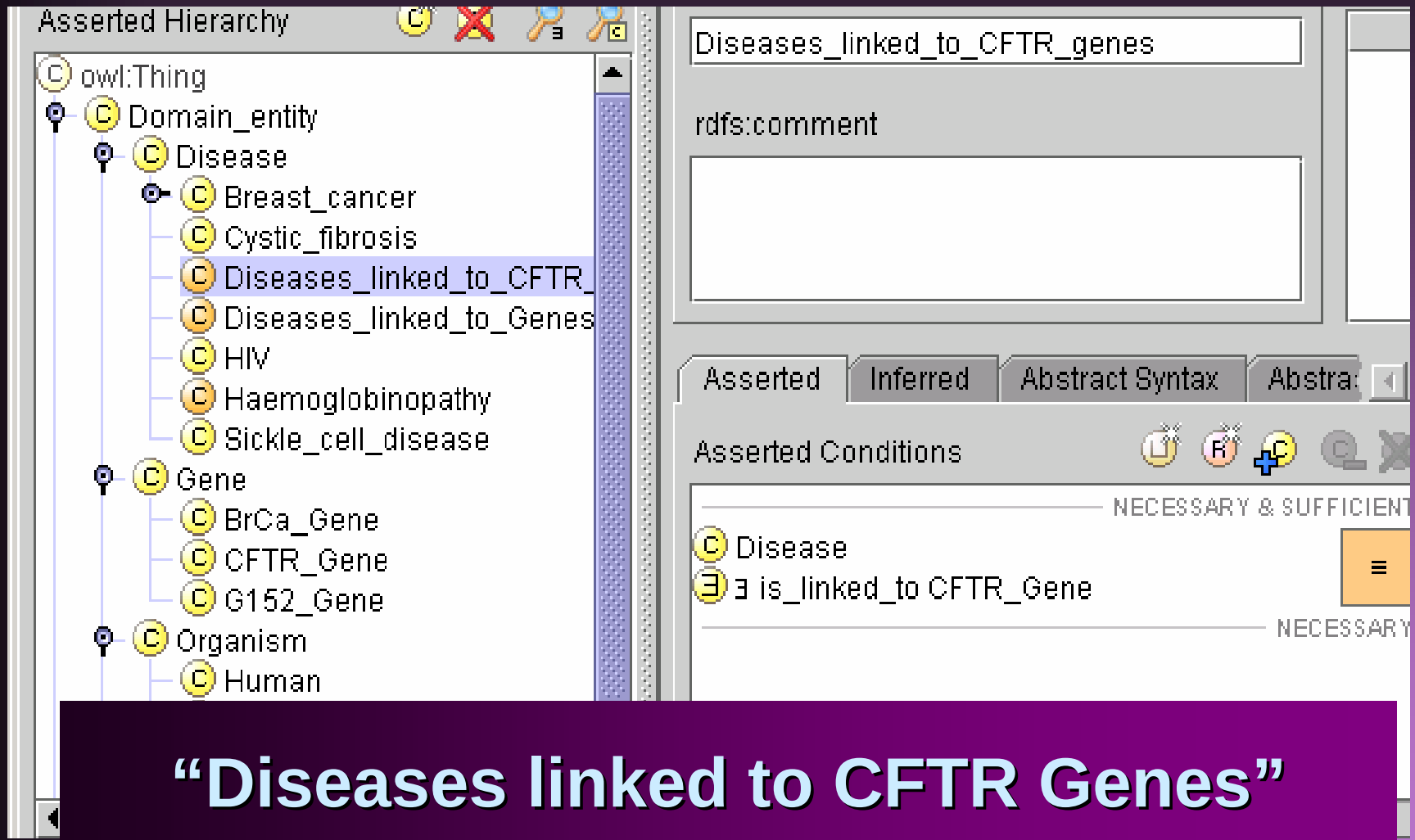
Sickle cell disease is a disease caused *some* sickling haemoglobin

or which can be as complex as you like



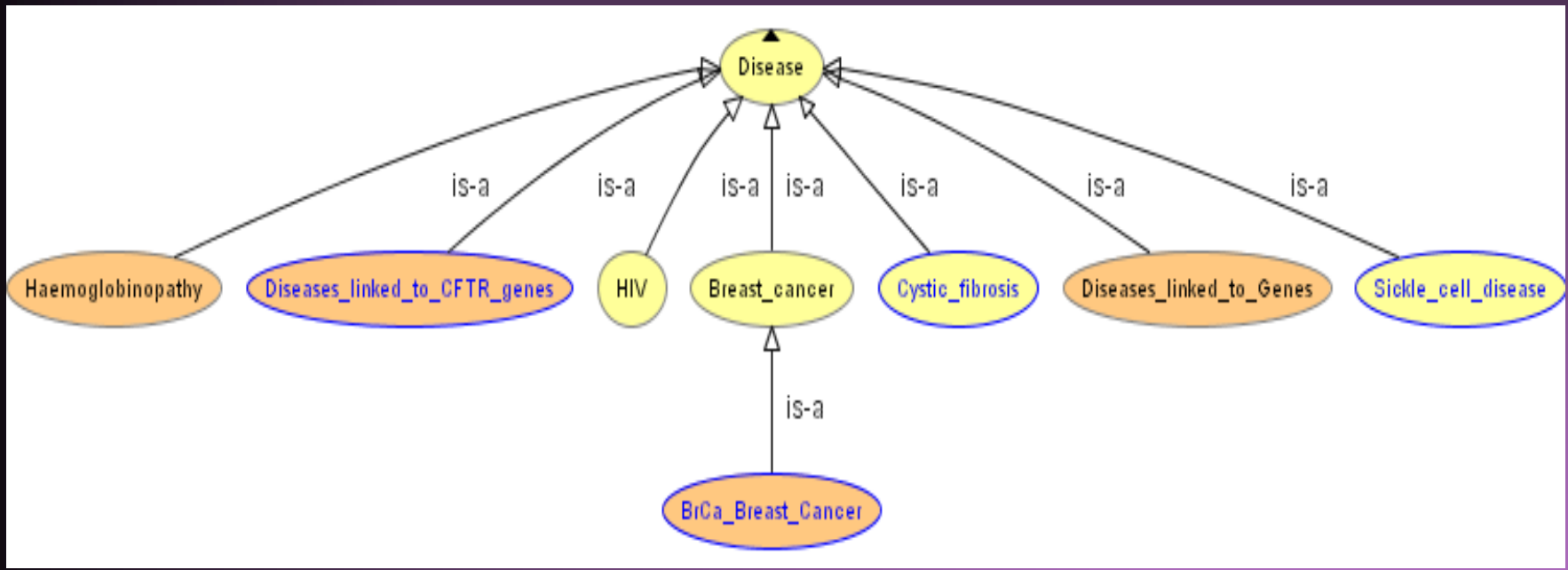
Cytstic fibrosisis is caused by some non-normal ion transport that is the function of a protein coded for by a CFTR gene

Add some definitions



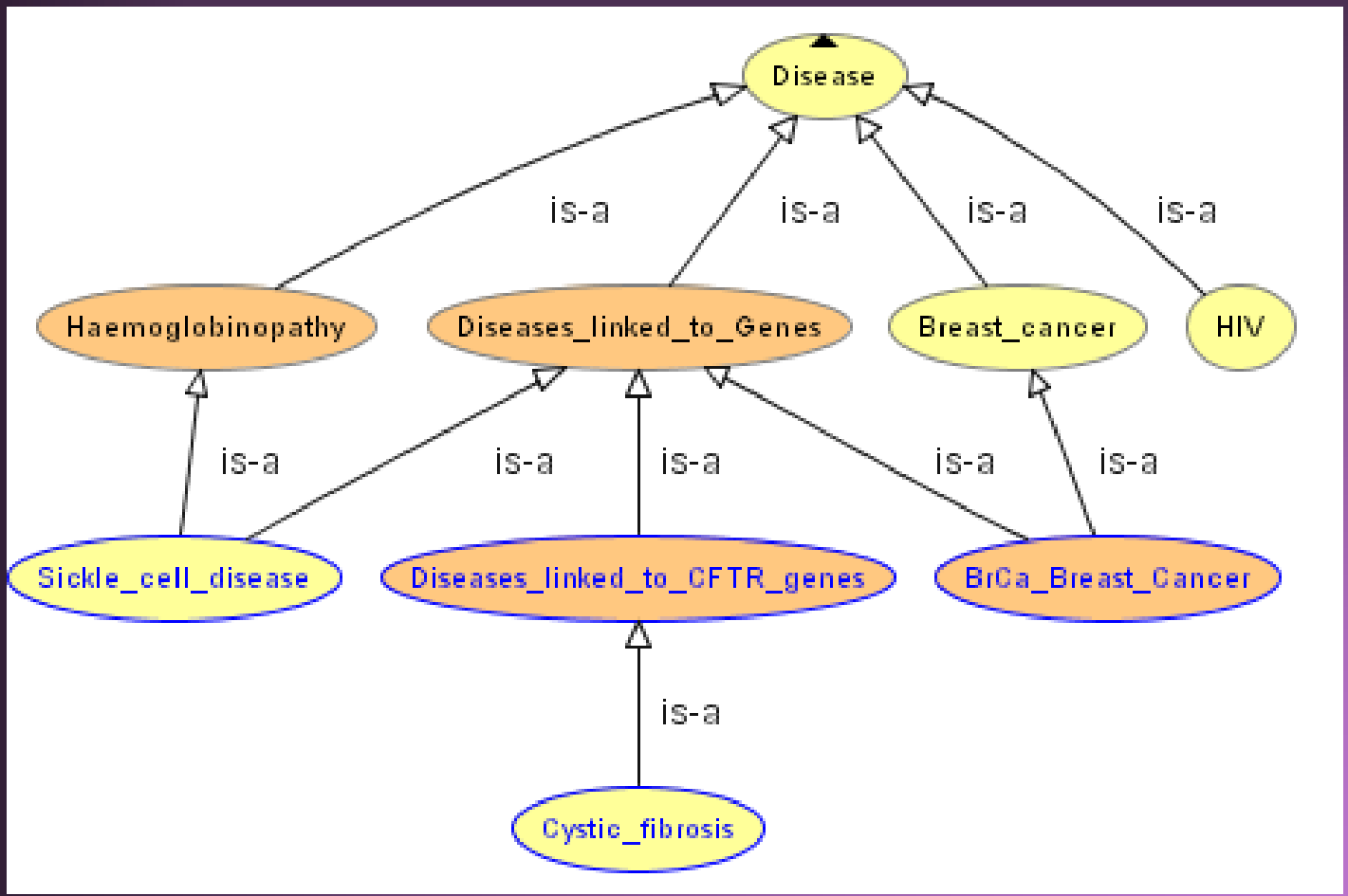
“Diseases linked to CFTR Genes”

We have built a simple tree

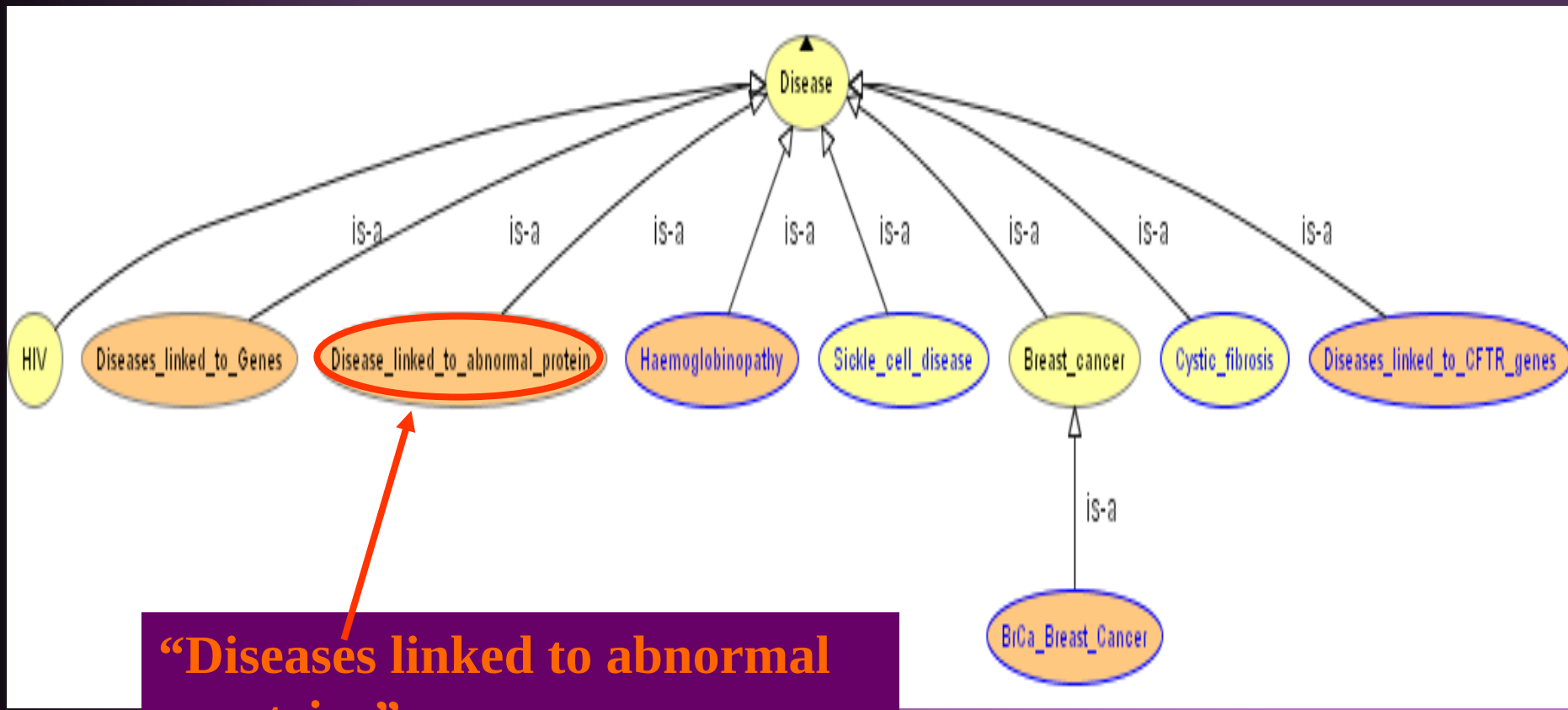


easy to maintain

Let the classifier organise it

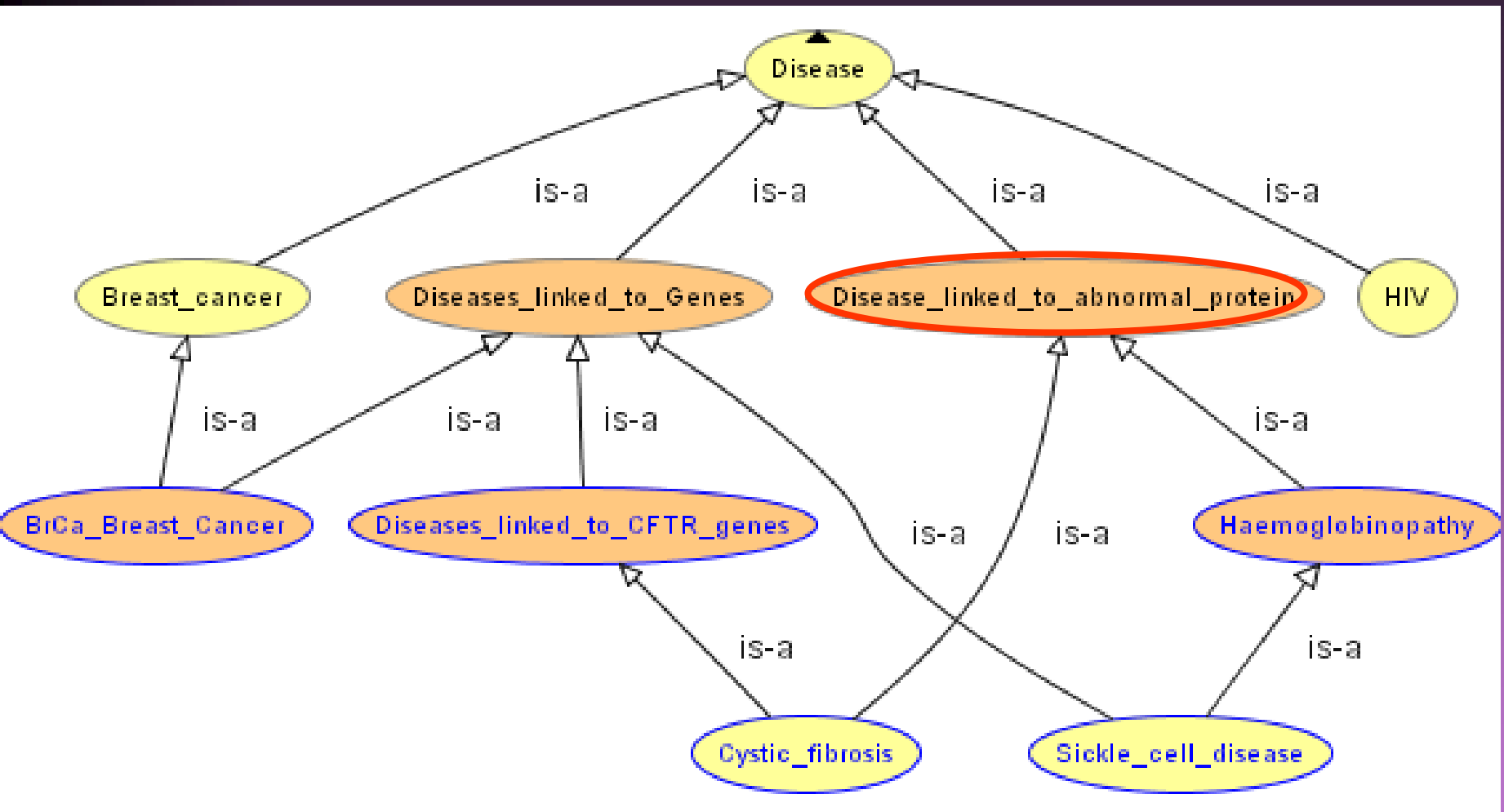


If you want more abstractions, just add new definitions
(re-use existing data)

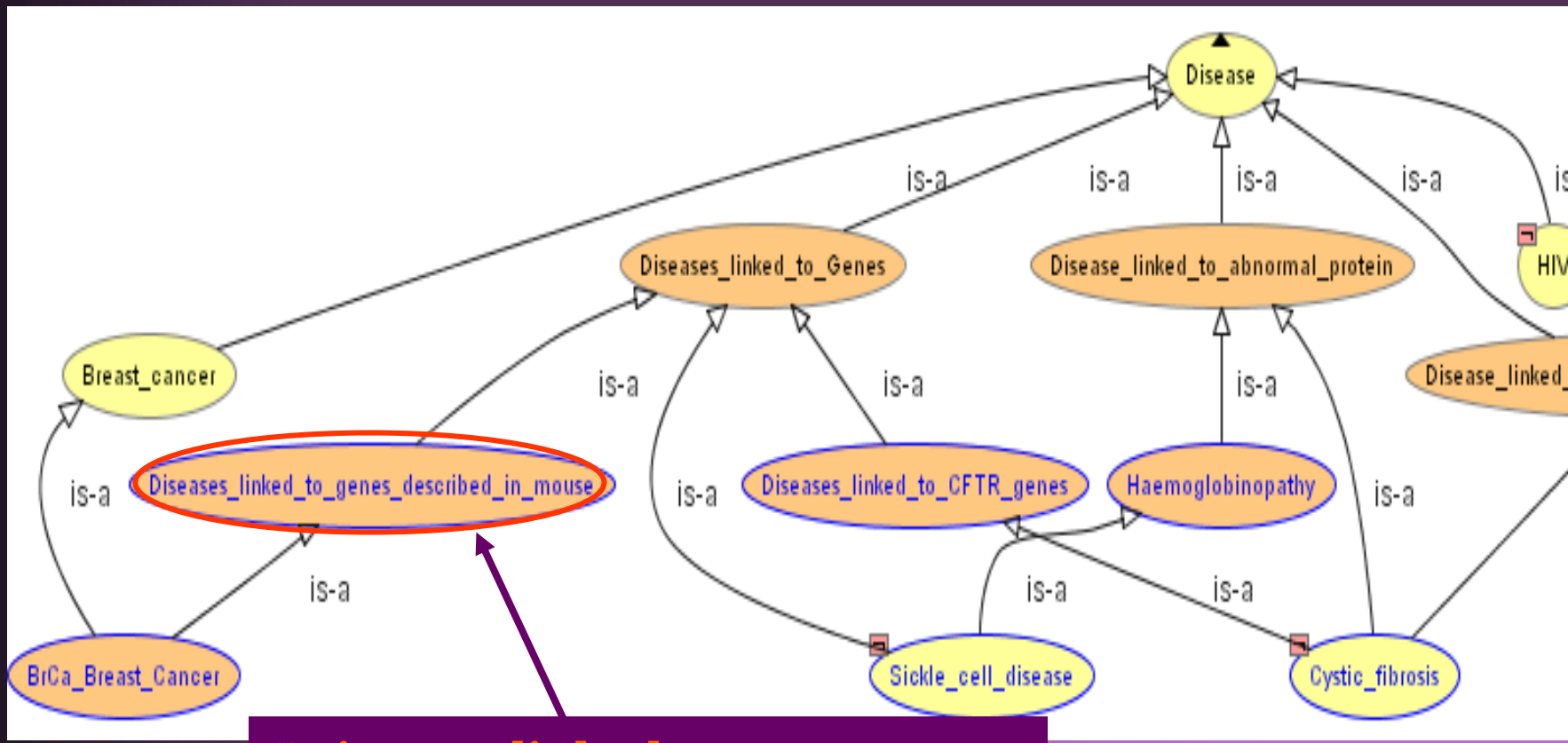


"Diseases linked to abnormal proteins"

And let the classifier work again

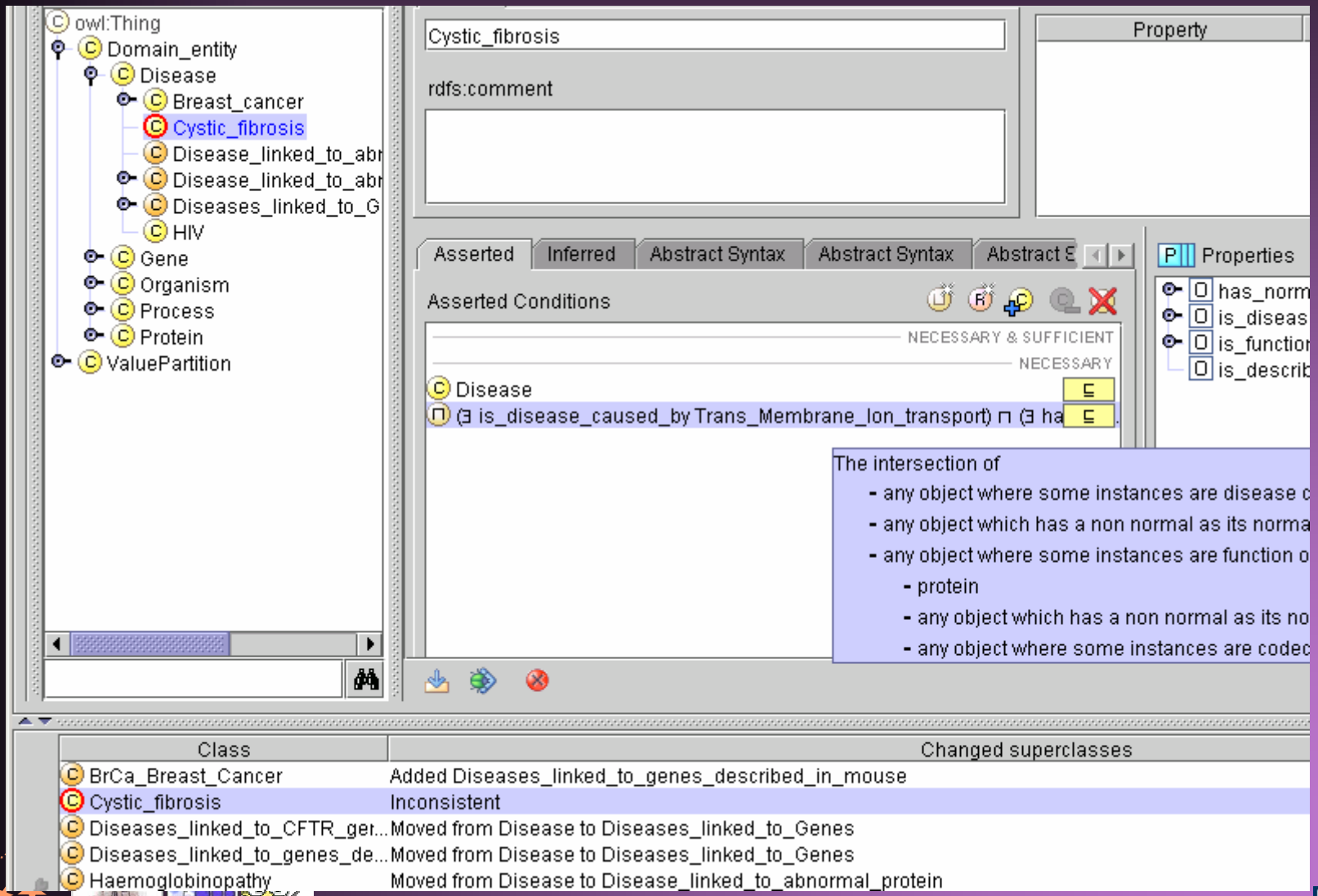


And again – even for a quite different category

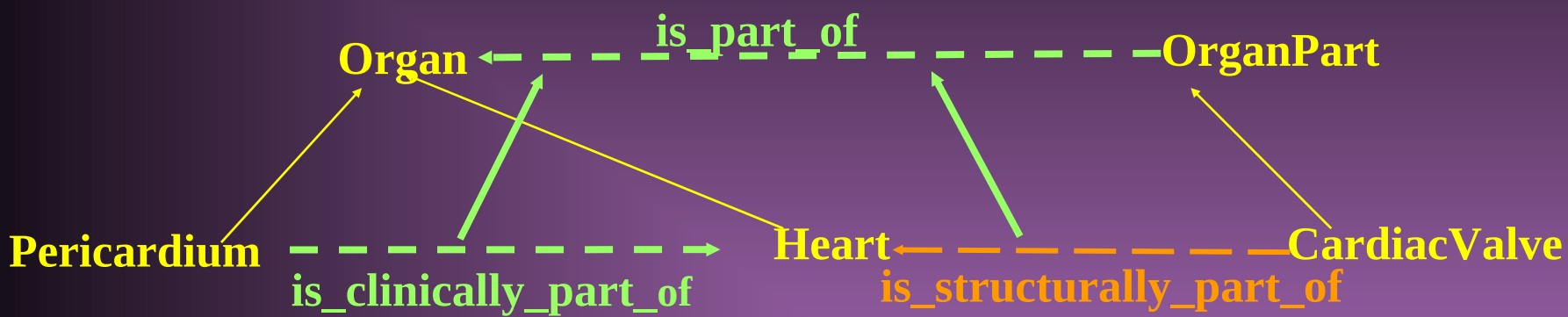


"Diseases linked genes described in the mouse"

And let classifier check consistency
(My first try wasn't)



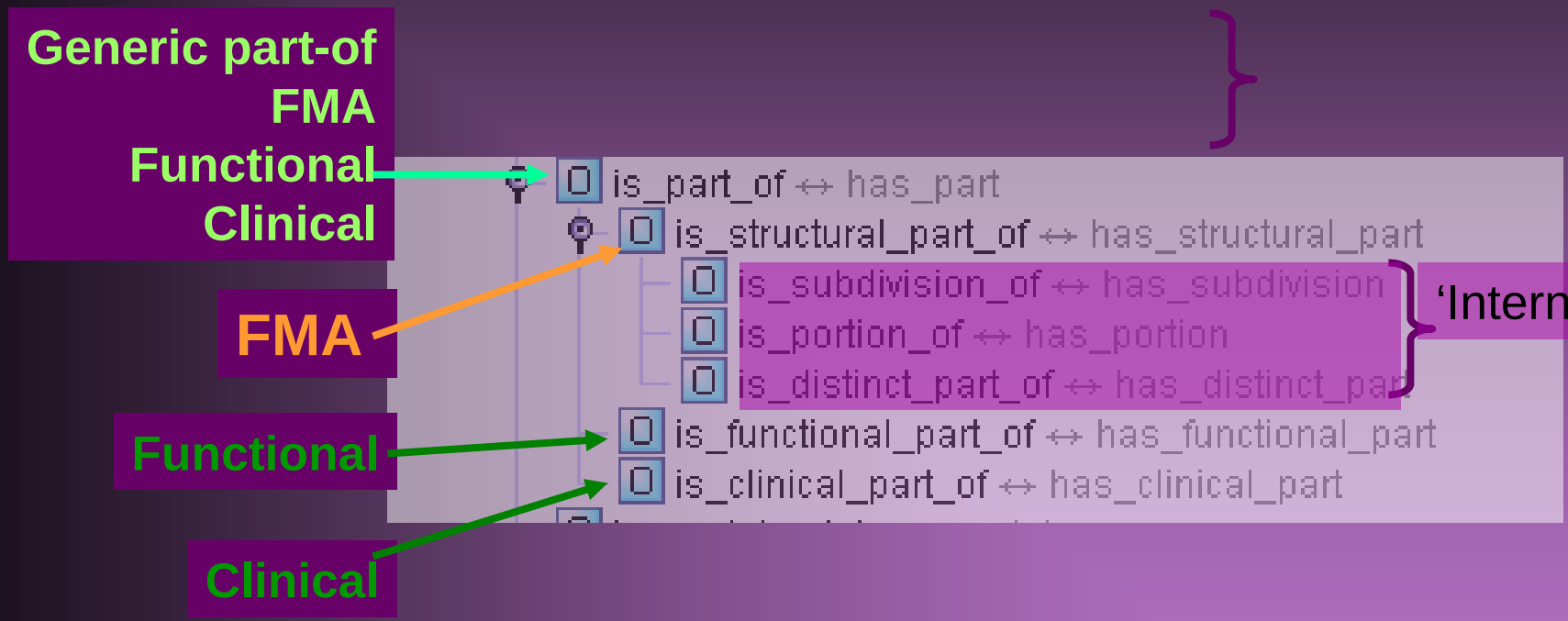
Represent context and views by variant properties



Disease of (Heart or part-of-heart)

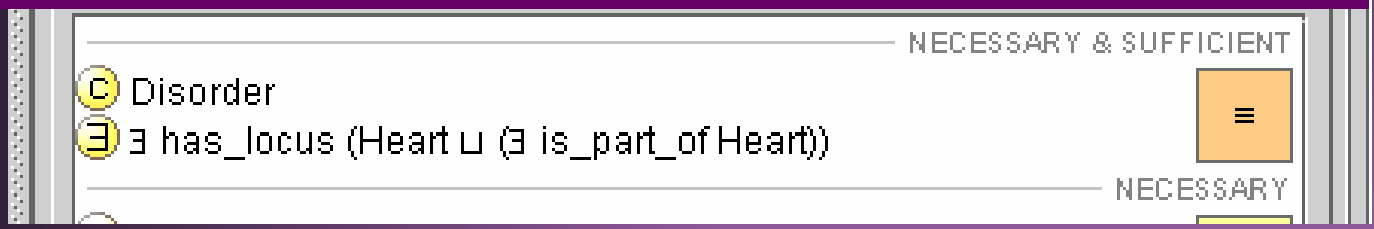
Disease of Pericardium

Integration of Contexts in Protégé-OWL

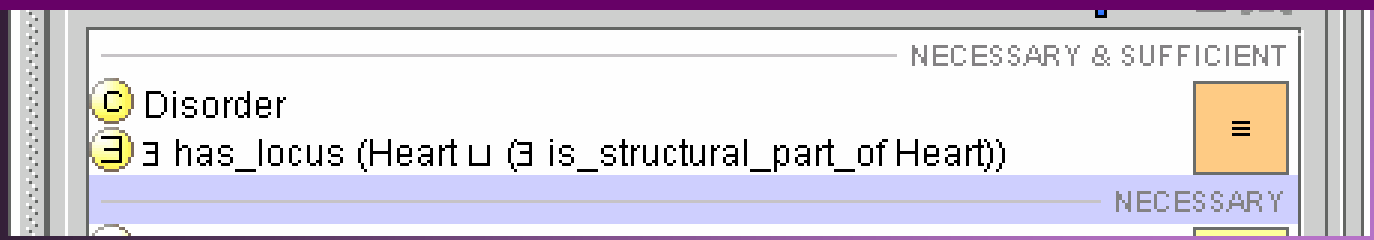


Protégé-OWL alternative views

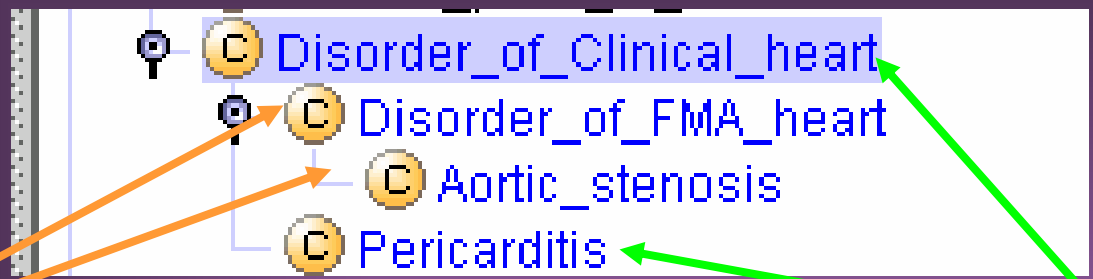
Disorder of "Clinical heart"
"Disorder of heart of any part of the heart"
(including *clinical* and *functional* parts)



Disorder of "FMA heart"
"Disorder of heart or any *structural* part of the heart"



Consequences for classification of diseases



Disorders of the things anatomists recognise as parts of the heart

Doctors consider it a heart disease, even though developmentally/structurally it is not

Summary: Why Classify?

- To *compose* concepts
- To untangle *polyhierarchies* – to *Normalise*
- To avoid *combinatorial explosions*
- To manage *context*
- To check *consistency* and *help users find errors*

Summary: When to Classify?
Applications do not need a classifier to benefit from classification

- **Pre-coordination**
  - **If concepts/terms can be predicted**
  - **When classifier is not available at run time**
  - **When we must fit with legacy applications**
- **Post-coordination**
  - **When a a few concepts are needed from a large potential set**
  - **When a classifier is available**
    - **and time cost is acceptable**
  - **When applications can be built or adapted to take advantage**

Remember:
Think about the Life Cycle

- **The life cycle for pre-coordinated ontologies**
  - **Gather requirements, sketch, experiment**
  - **Establish patterns – design a "language"**
    - **What a subject domain expert can learn in a few days**
  - **Bulk authoring**
  - **Classification**
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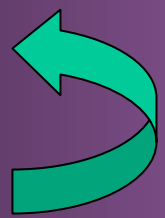

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    - **Taxonomies (Protégé, DAG-Edit, OWL-Lite, RDF(S), Topic Maps, …**
      - **Query and use with you favourite tool**

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