An Advanced Clinical Ontology

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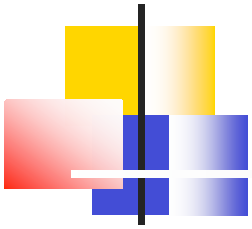
A couple of thousands of diseases with
necessary/sufficient types to characterize them

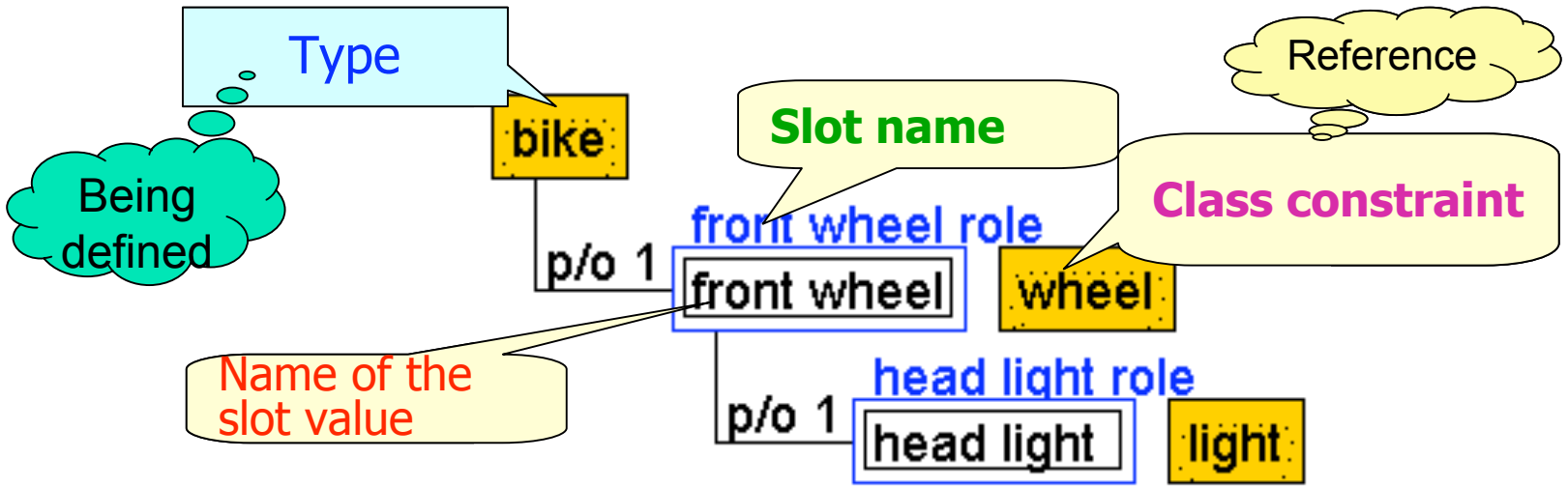
Issues discussed in our ontology



- is-a/part-of issue
  - <finger ***part-of*** hand>
  - <Injury of a finger ***is-a*** injury of a hand>
  - Introduction of *"p-"* operator
- Commonality vs. specificity
  - Introduction of generic structural/disorder components
- Three-layer quality description
  - Exploitation of Hozo's role representation
- **Multiple perspectives for classification**
  - **On-demand *is-a* hierarchy generation**
- Multiple perspectives for an entity
  - Introduction of viewpoint-specific definition function (to be implemented soon)

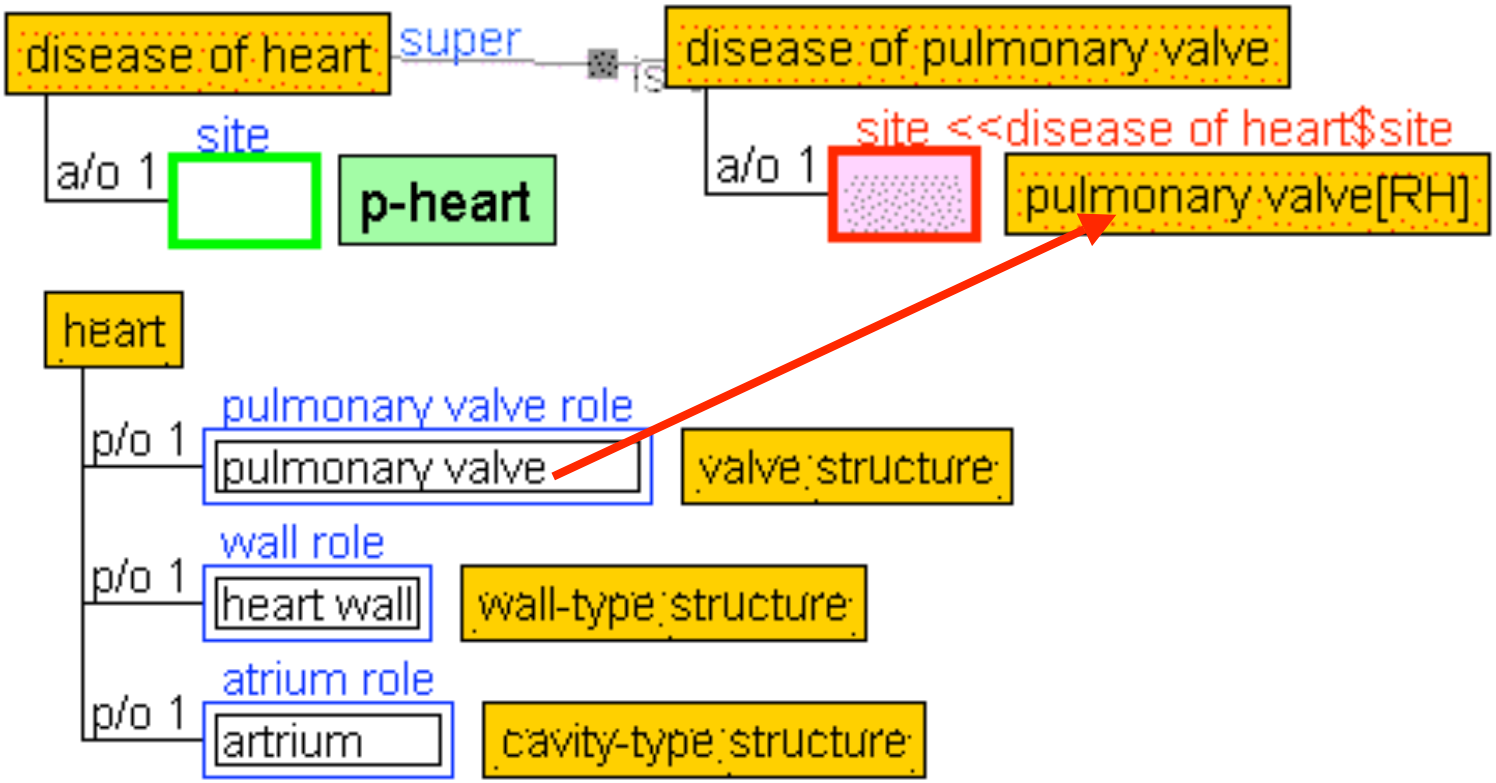
Type definition in Hozo

- Mutual dependency between the whole and its parts
- Any part has a **role** in the context of the whole
- Any part must be defined in the context of the whole
- Tight relationship between theories of roles and parts



Is-a & part-of issue

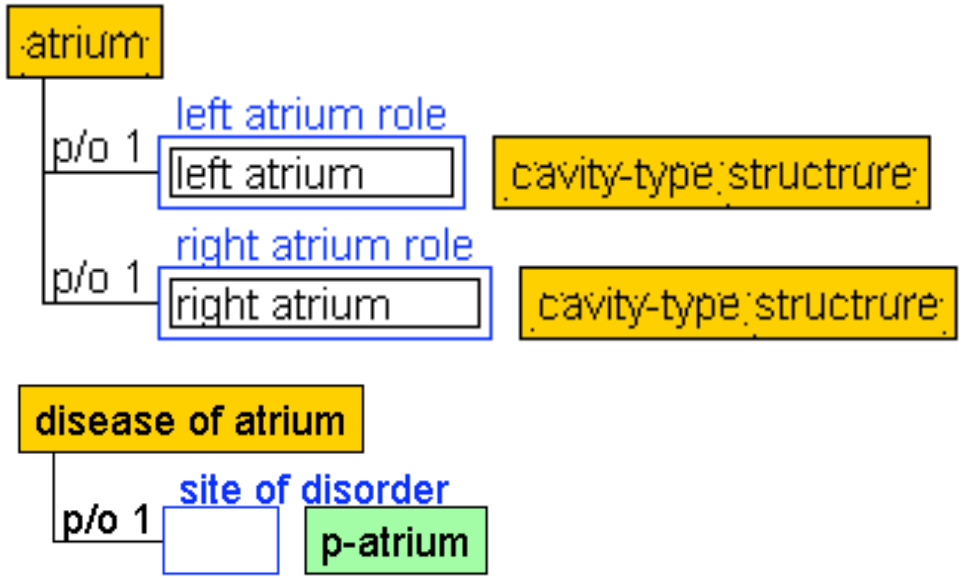
Inheritance: a special case



What is "*p-*" operator?

Any part of X *is-a p-X*

p-X **= a generic concept representing all parts of X**



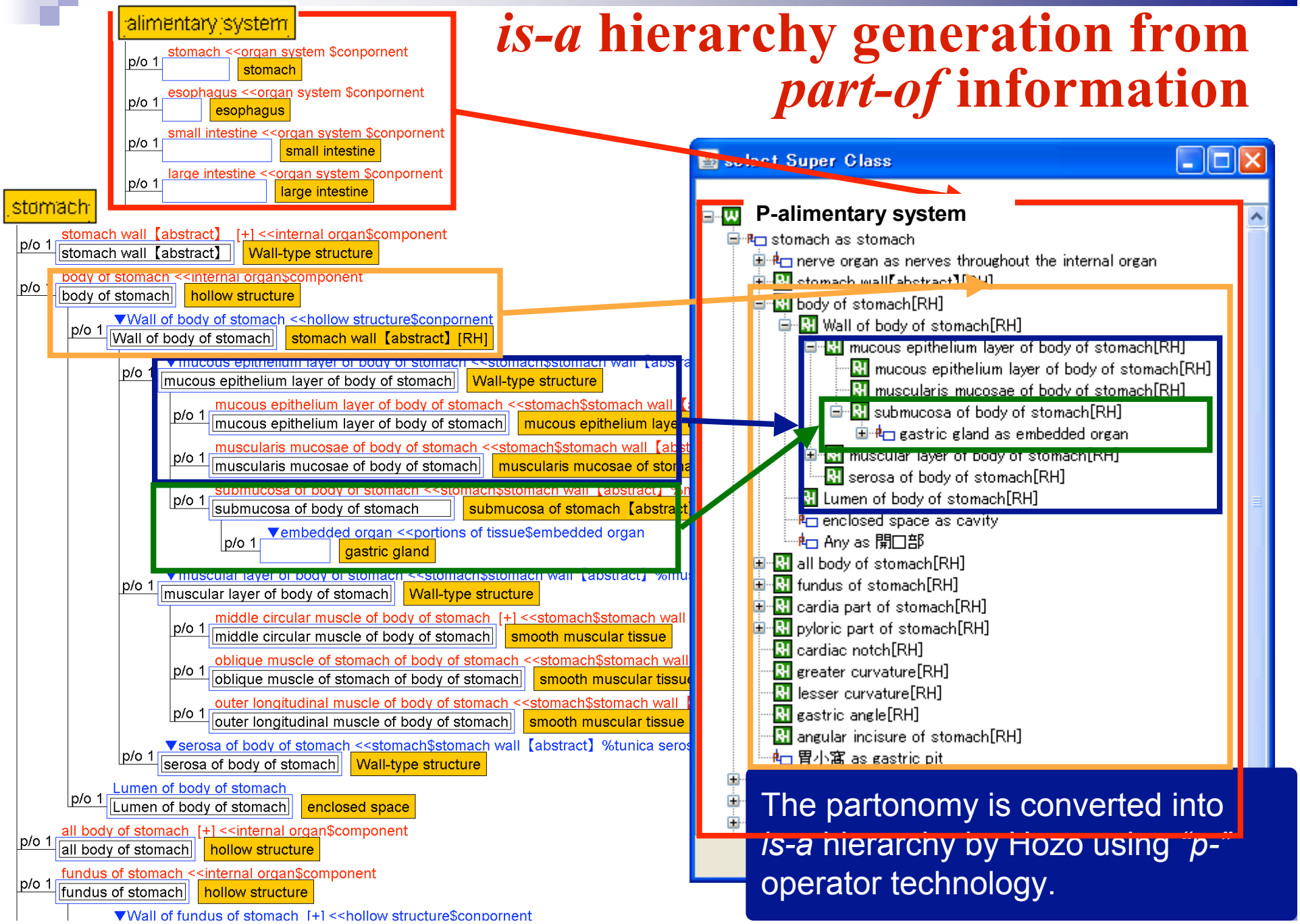
atrium = an entity composed of right and left atriums

p-atrium = a generic concept representing all parts of atrium

Left atrium *is-a p-atrium*; Left atrium *part-of* atrium

Right atrium *is-a p-atrium*; Right atrium *part-of* atrium

is-a hierarchy generation from *part-of* information

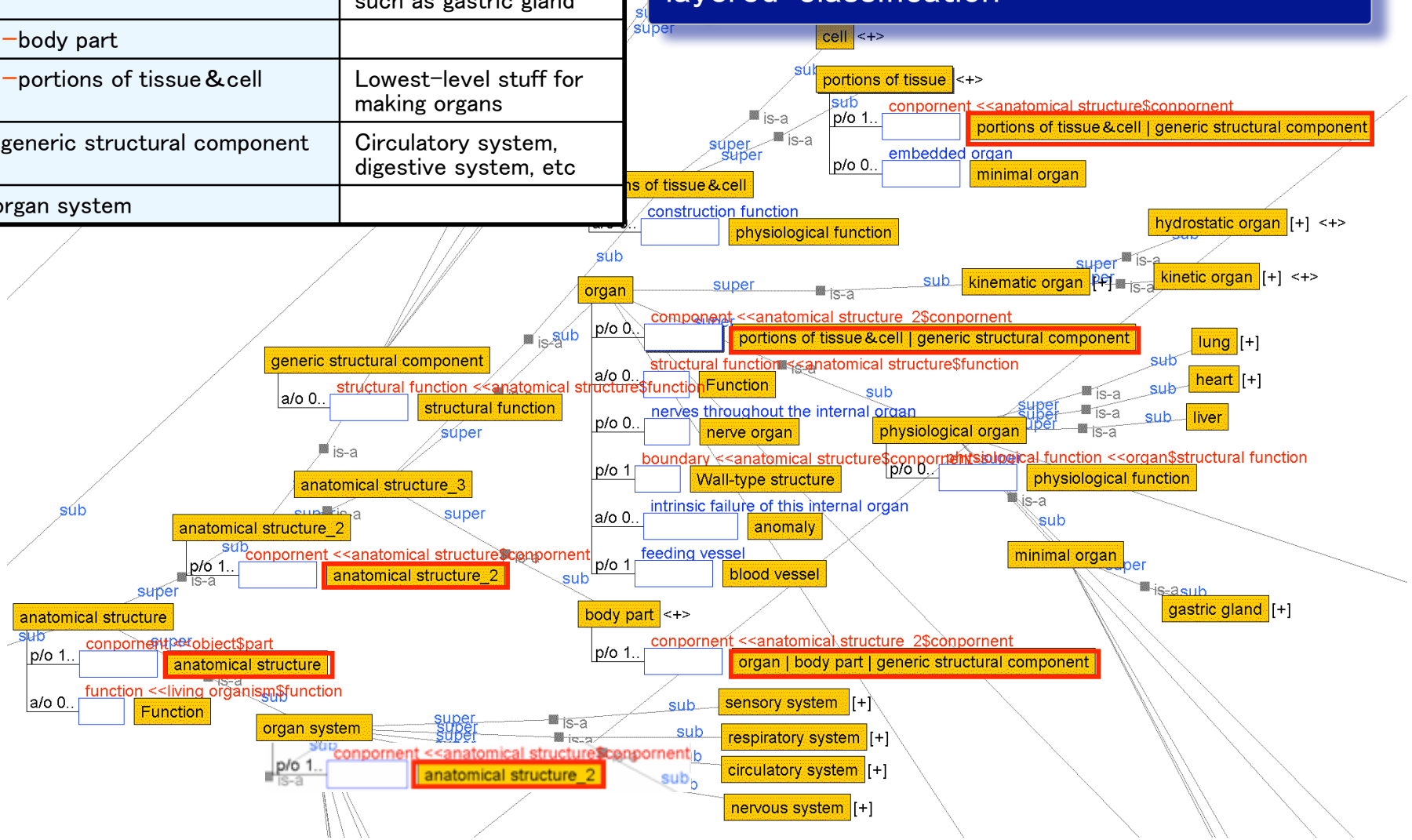


The partonomy is converted into *is-a* hierarchy by Hozo using "*p-*" operator technology.

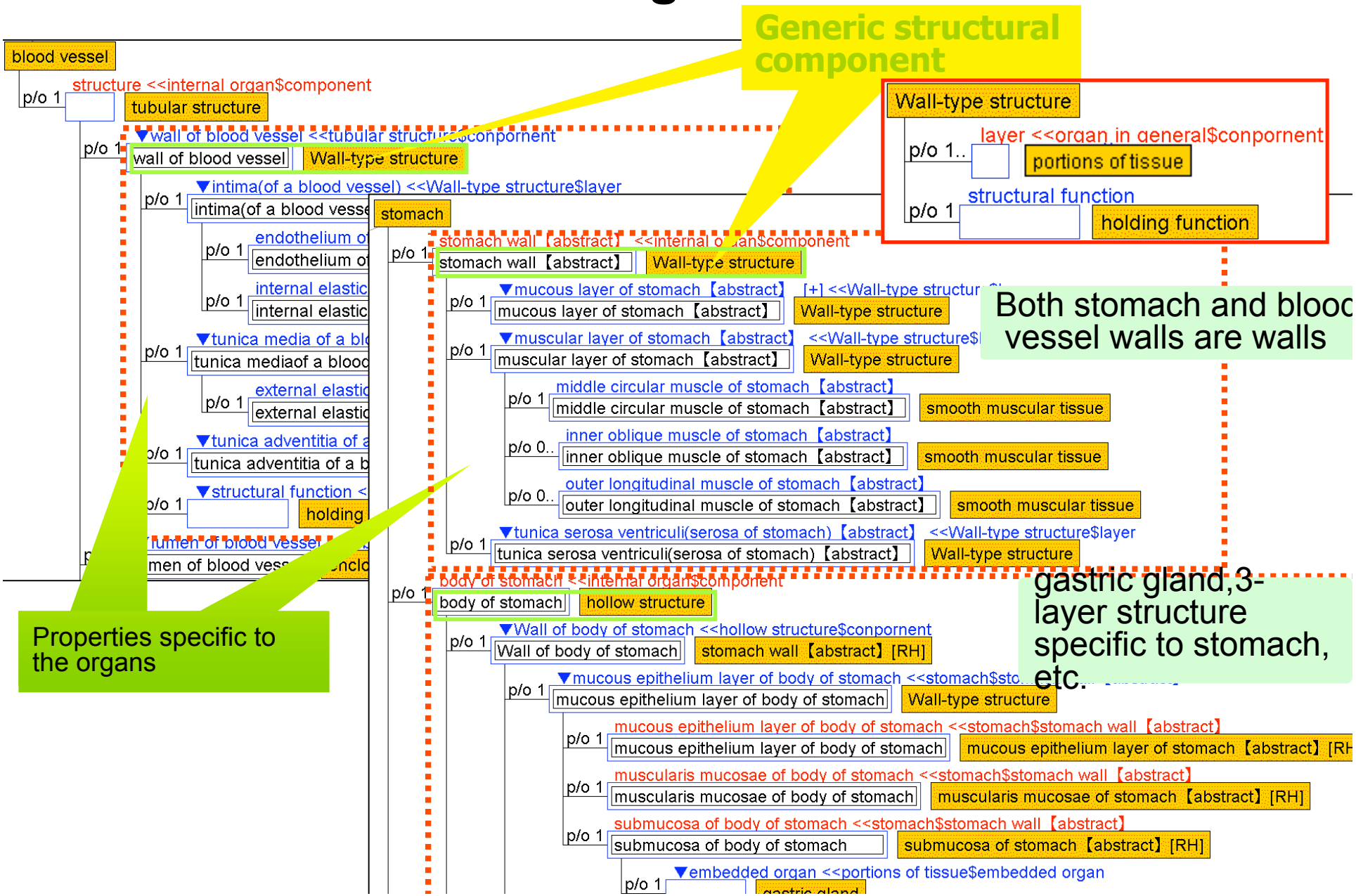
Overview of body structure

anatomical structure	All parts of human body
−anatomical structure_2	Generic parts of human body
−anatomical structure_3	
−organ	Typical organ such as heart
−minimal organ	Lowest−level organ such as gastric gland
−body part	
−portions of tissue＆cell	Lowest−level stuff for making organs
−generic structural component	Circulatory system, digestive system, etc
− organ system	

Recursive definition rather than simple layered−classification

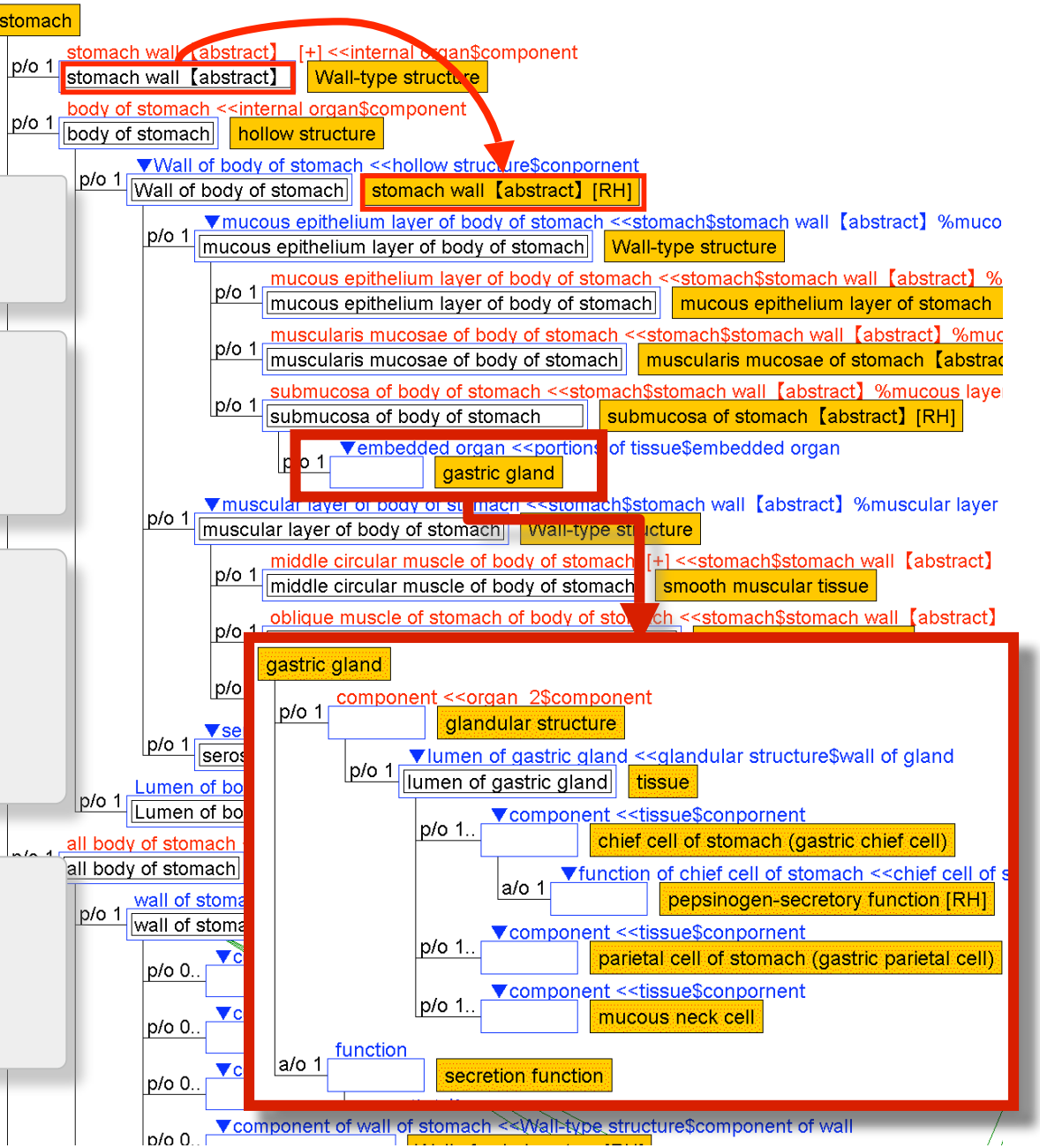


Introduction of generic structural



Concrete example

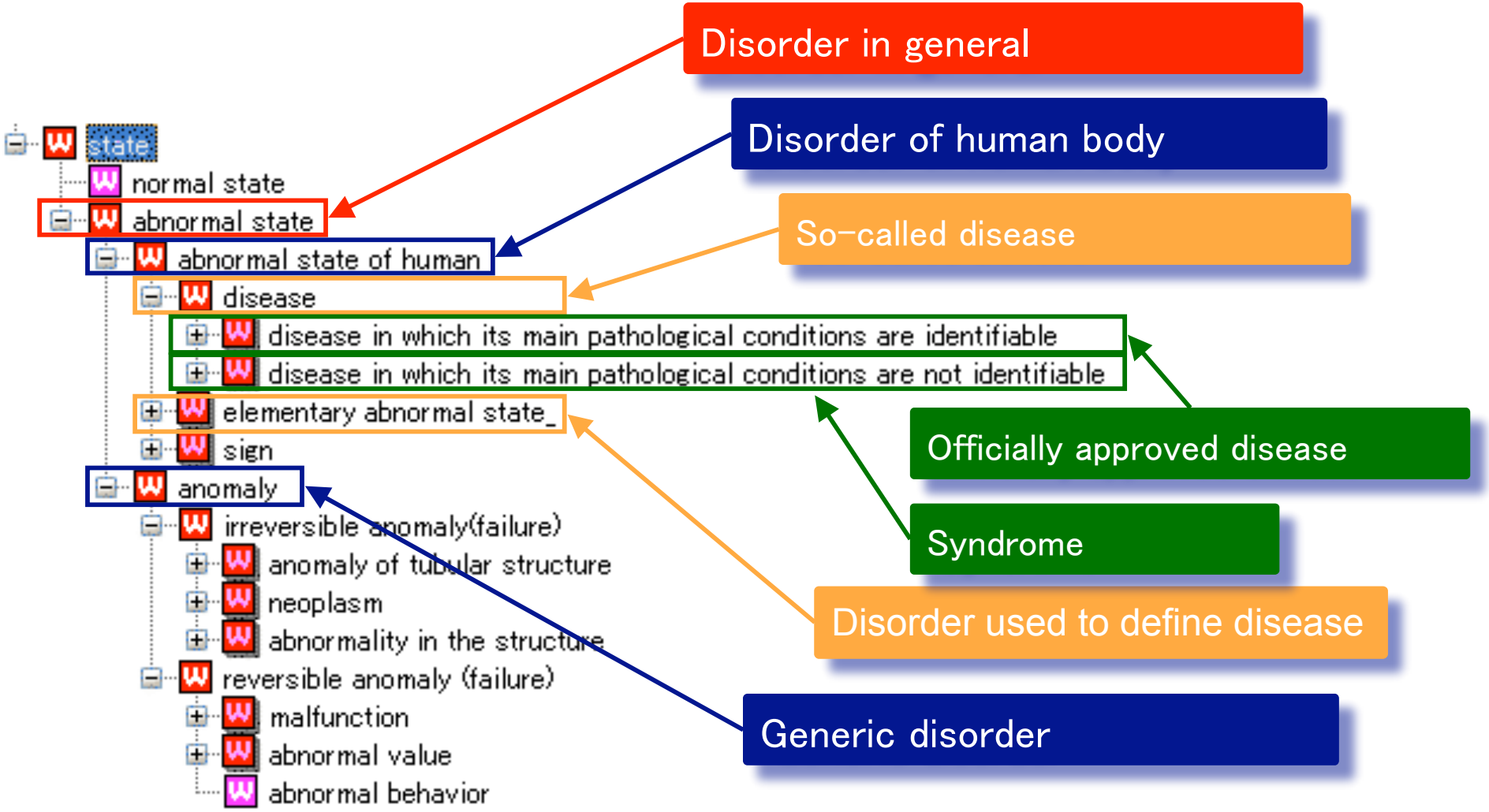
- Stomach is composed of body of stomach, cardia, etc.
- Defined using hollow structure
- It has cavity and wall
- The wall is composed of mucous, muscular and serosa layers. It has functions to secrete pepsinogen, etc.
- Gastric wall is further specialized to submucosa and cells which has gastric gland.



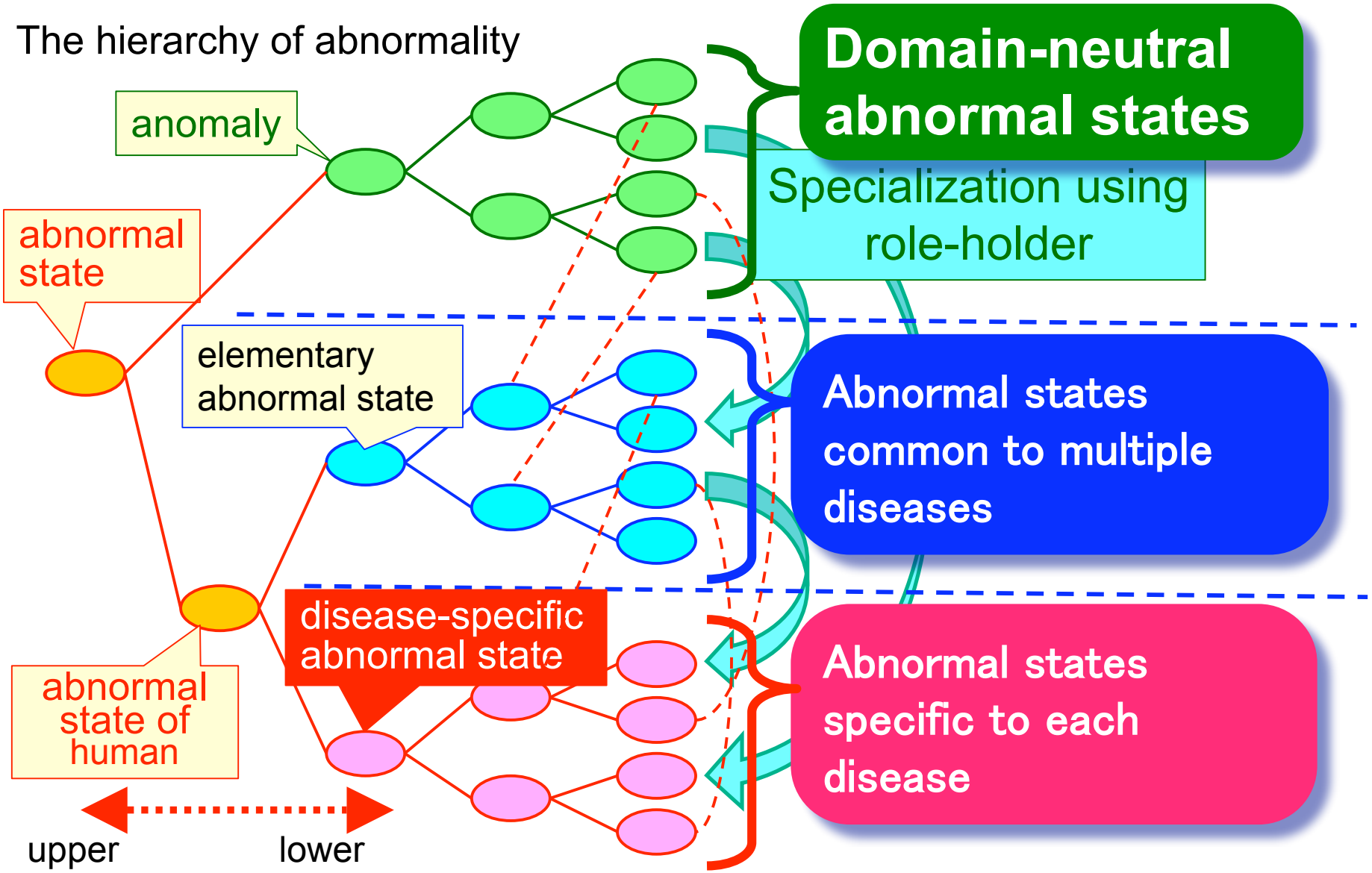
Disease modeling
- Issues and decisions -

- Various states: pathological state, disease, disorder, dysfunction, failure
  - All are kinds of disorder of human body
  - Introduction of **generic disorder** to use for defining organ- and disease-specific disorder
  - The generic disorder is composed of reversible and irreversible states
- Various viewpoints of diseases
  - Necessity of common and fundamental viewpoint
  - A fundamental classification as an infra, and **on-demand** generation of other classifications according to the viewpoint specified
- Three-layer quality description
  - Exploitation of Hozo's role representation
- History of transition of disease names
  - Names associated with time slot
- Exclusion of transition of disease state (future work)

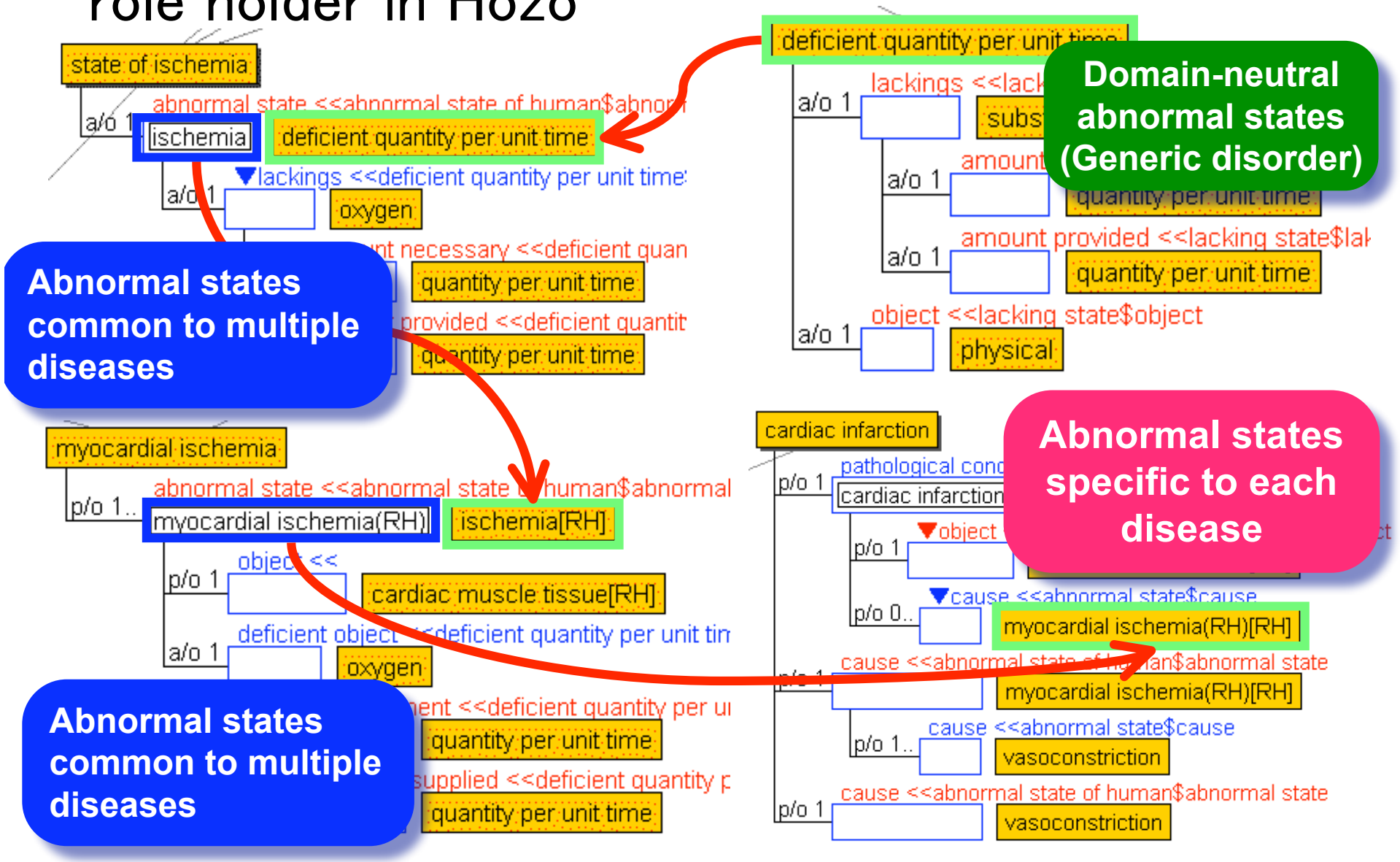
Upper types related to abnormal states



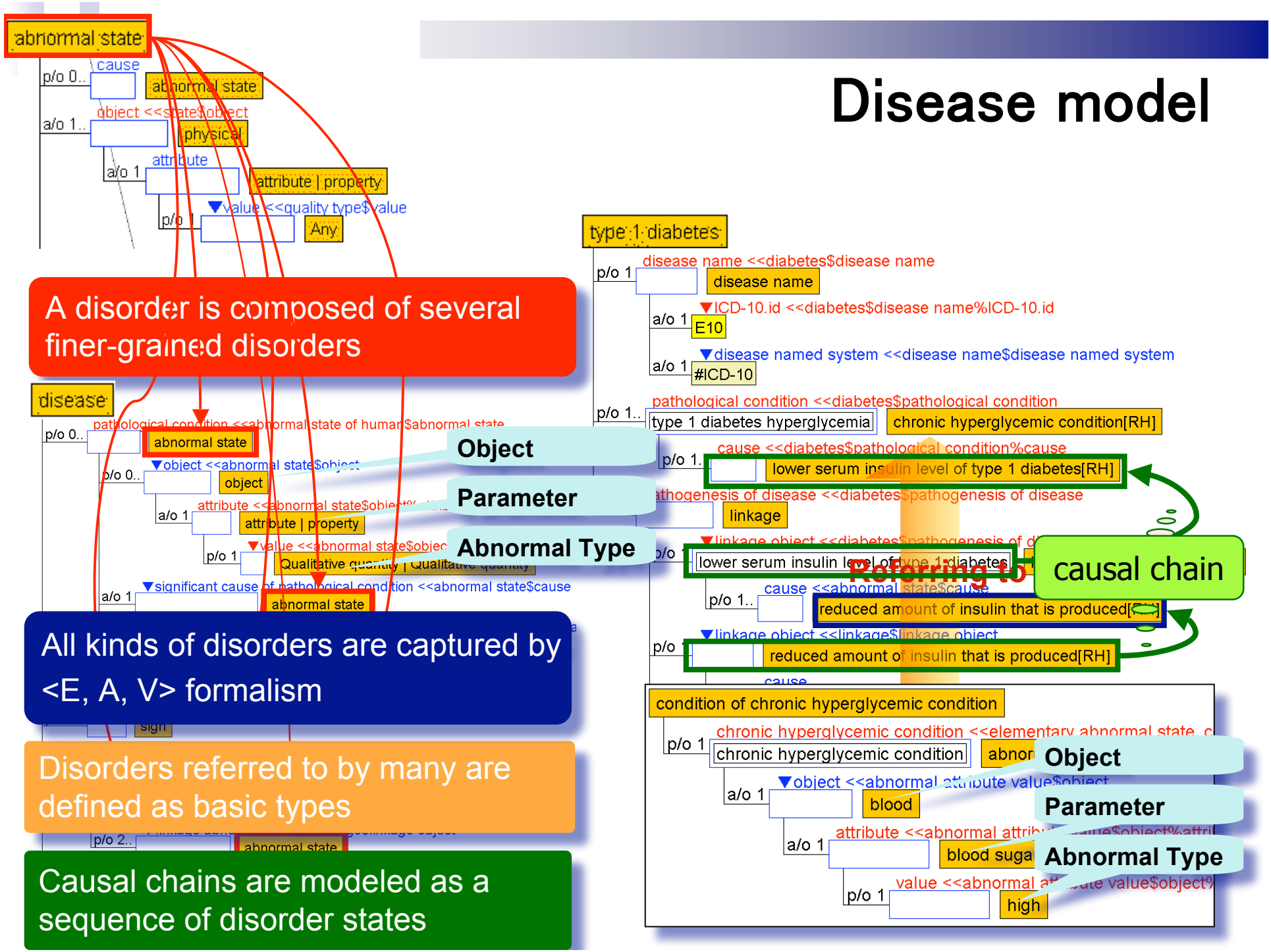
Three-layer description of abnormal states



An example of specialization using the idea of role holder in Hozo

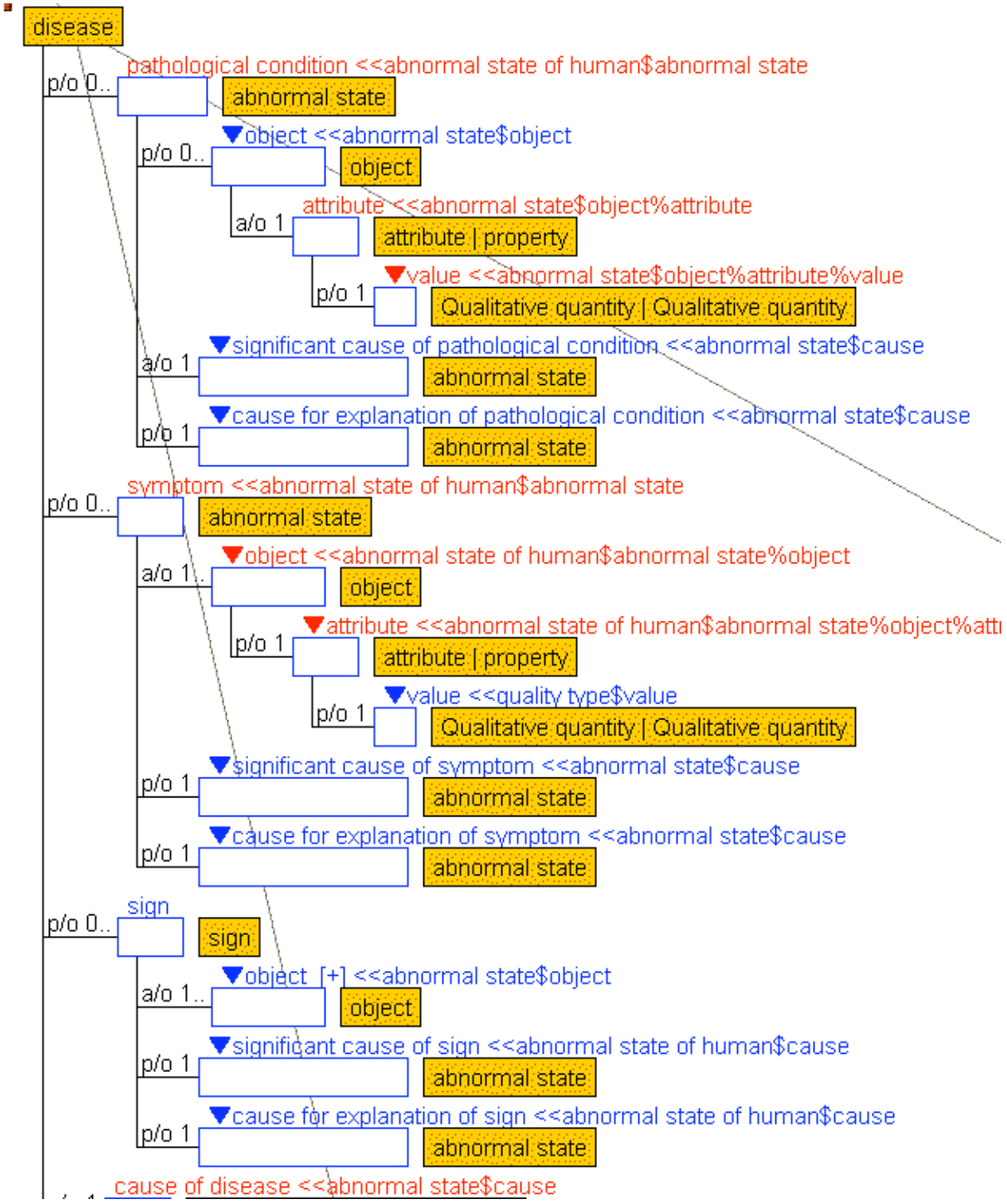


Disease model

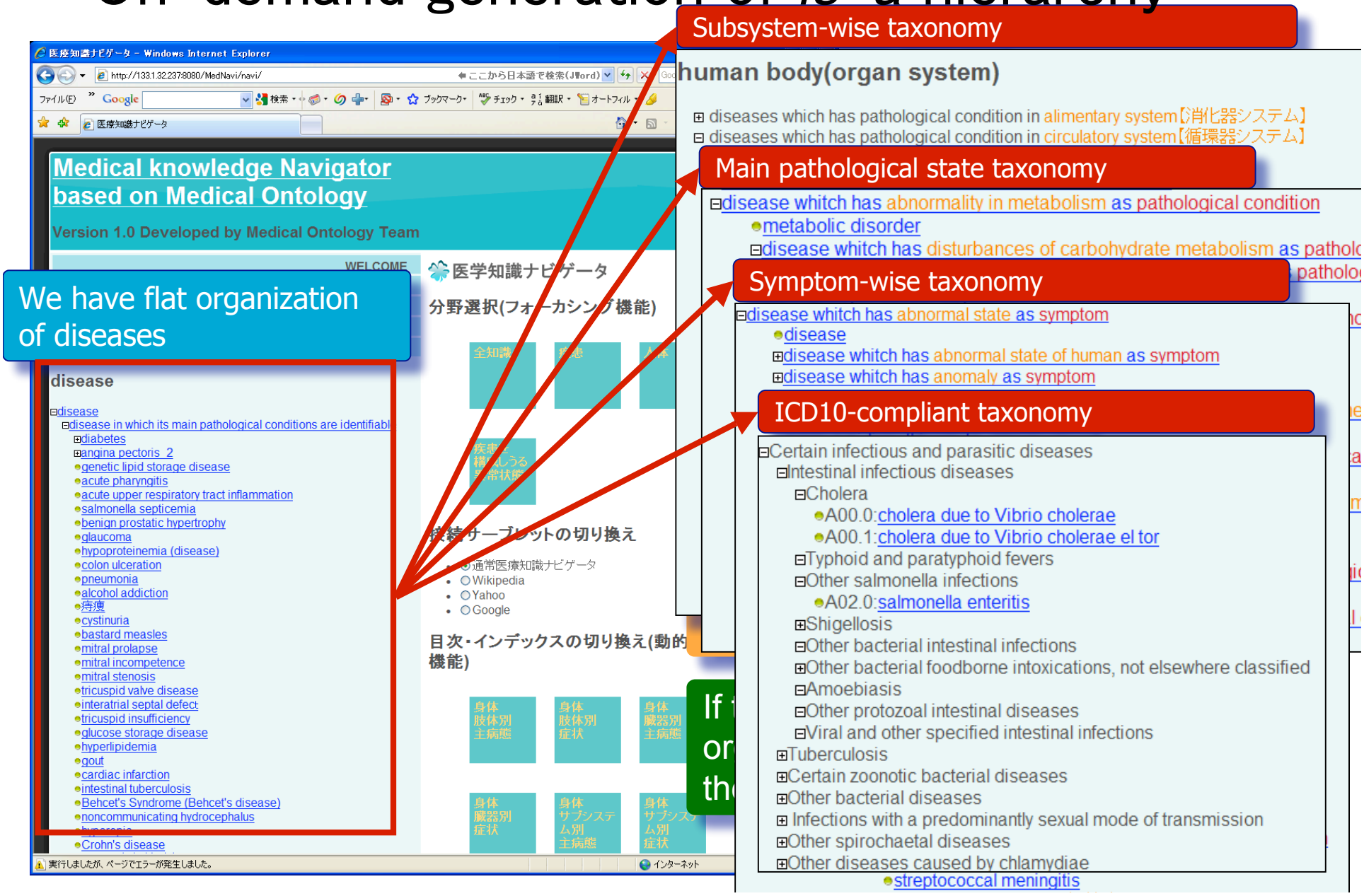


How to dynamically generate *is–a* hierarchy

- Diseases are organized based on states in rather flat structure
- By choosing the slot the user is interested in, then diseases are organized according to the *is–a* hierarchy of its class constraint.



On-demand generation of *is-a* hierarchy



Concluding remarks

- Achievements
  - *P-Operator* for is-a/part-of issues
  - Commonality vs. specificity
    - Introduction of generic structural/disorder components
  - Three-layer quality description
    - Exploitation of Hozo's role representation
  - **Multiple perspectives for classification**
    - **On-demand *is-a* hierarchy generation**
- Future work
  - Increasing the number of diseases
  - Alignment with the existing ontologies