

An Advanced Clinical Ontology

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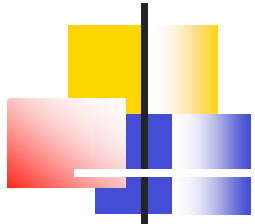
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Three-year project: April 2007- March 2010

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



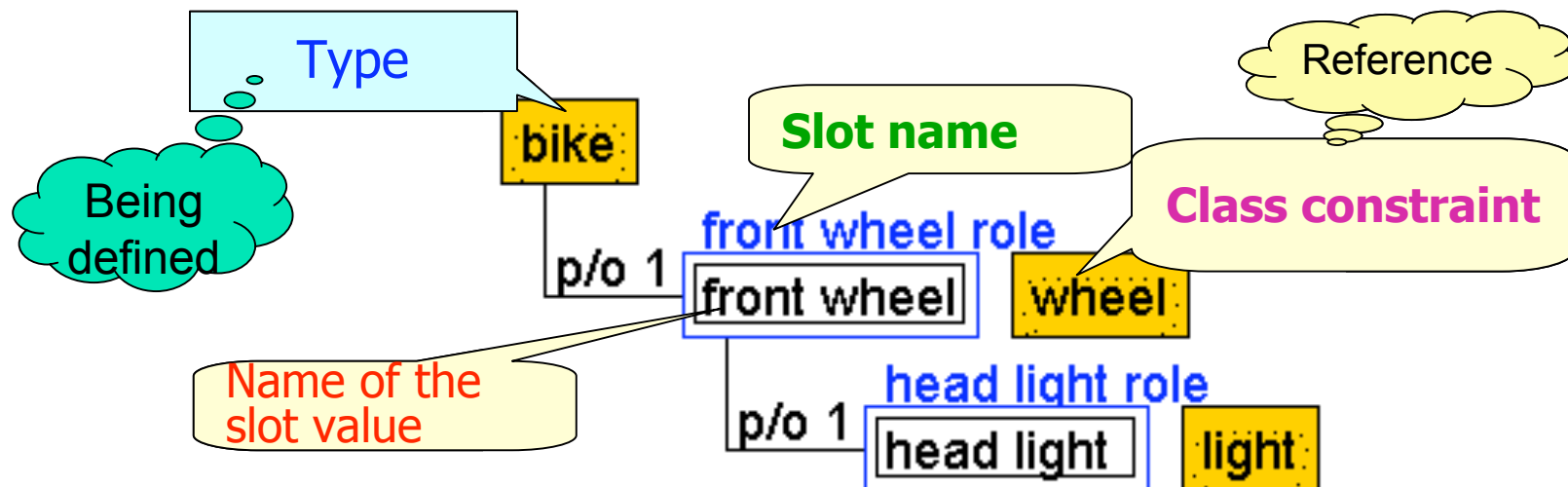
Issues discussed in our ontology

- 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)



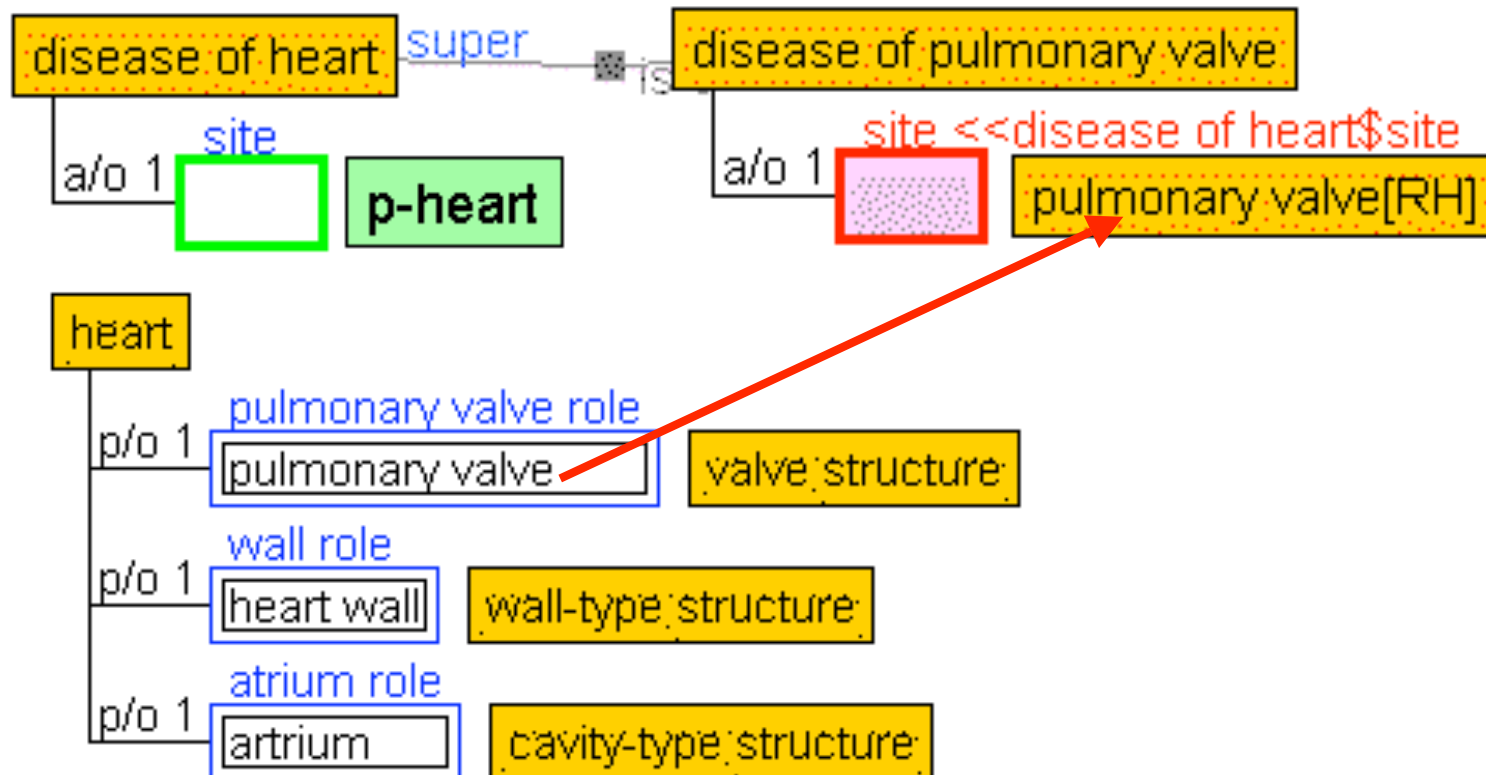
Type definition in Hozo

- 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

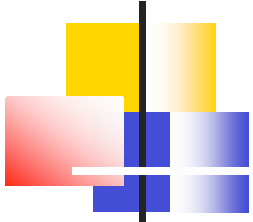


Is-a & part-of issue

Inheritance: a special case

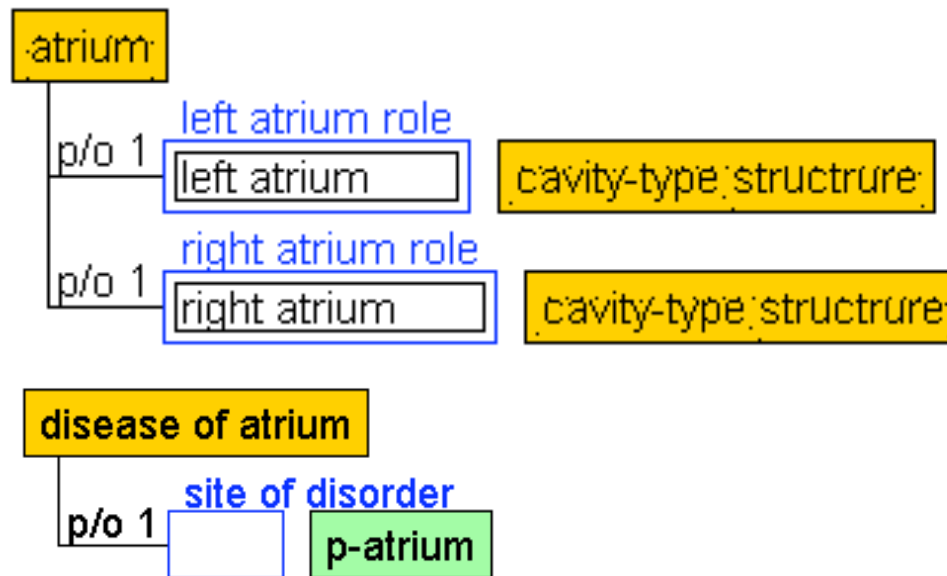


What is “p-” operator?



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

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



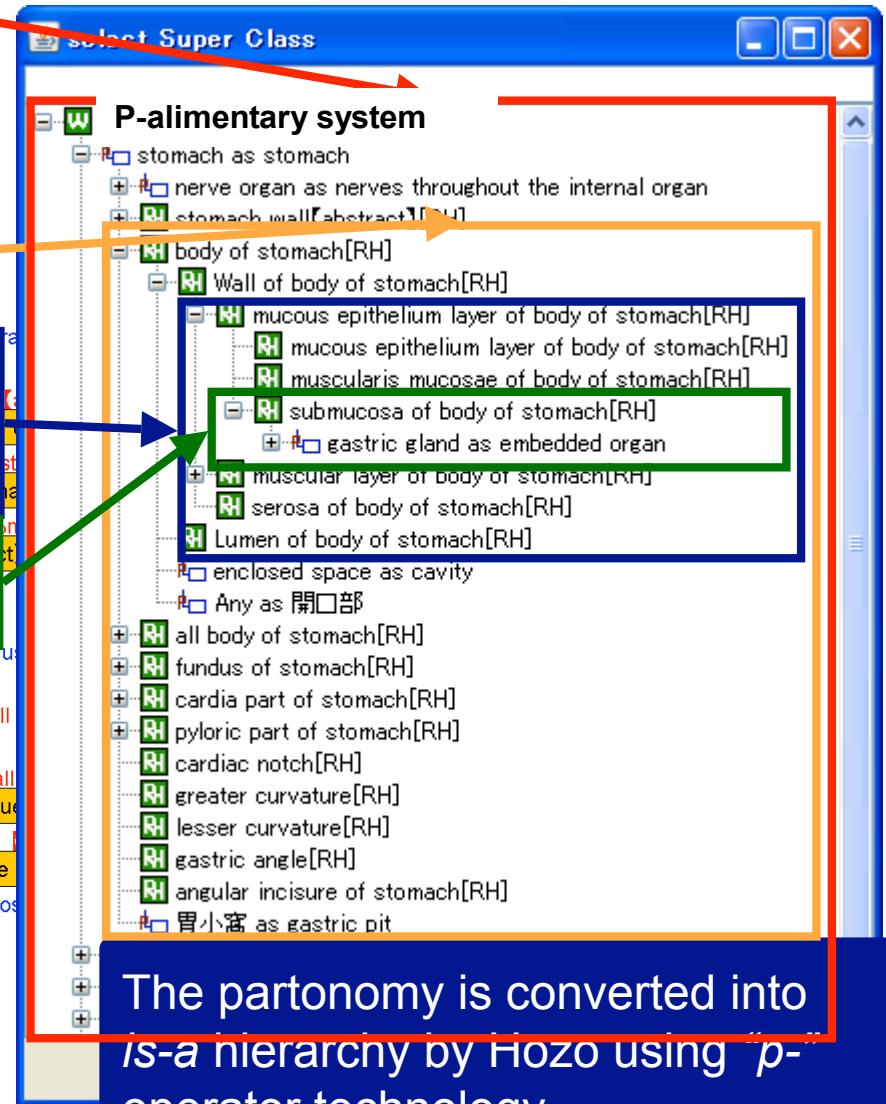
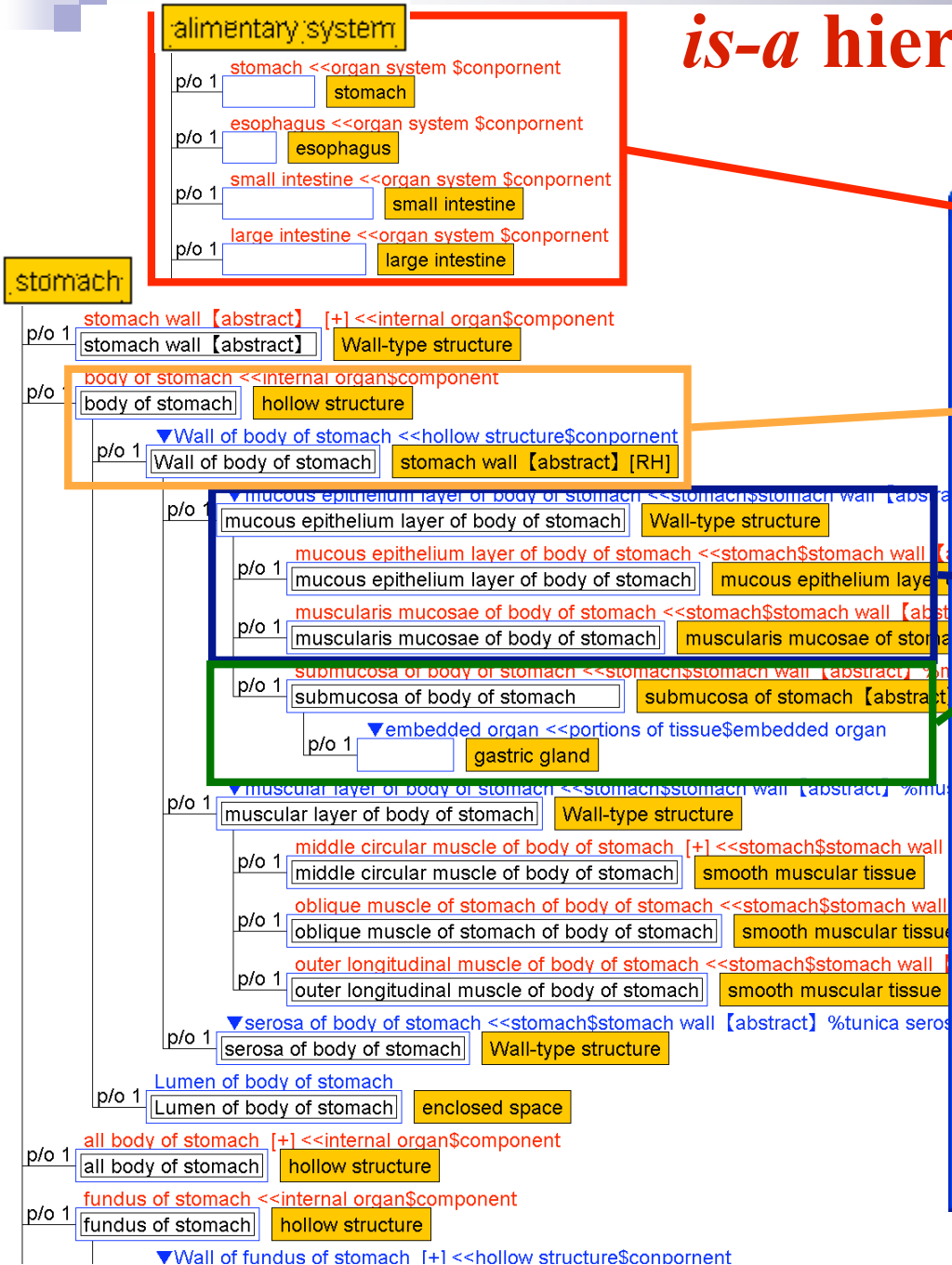
atrium = an entity composed of right and left atriums

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

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

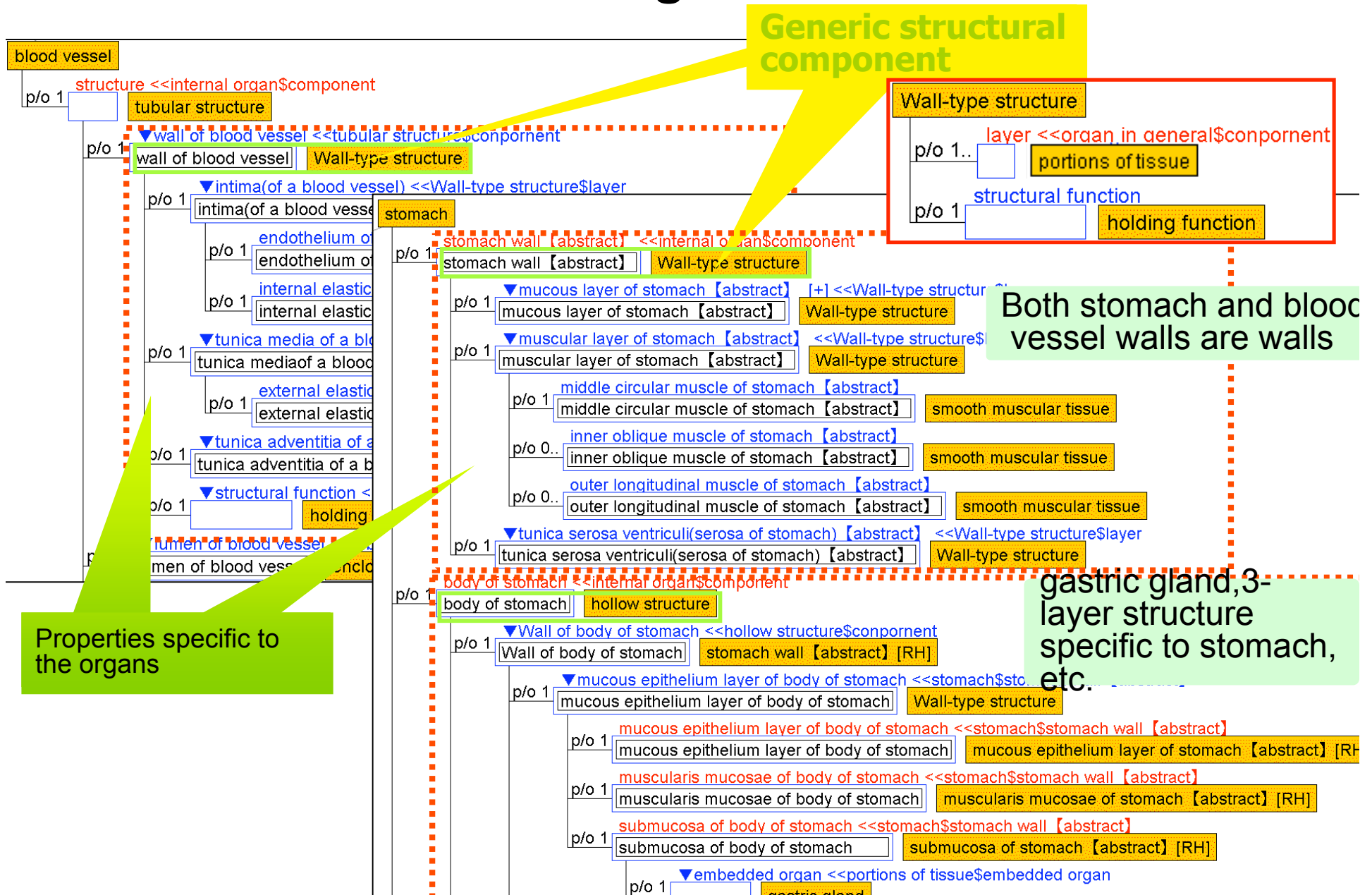
Right atrium *is-a* p-atrium; Right atrium *part-of* atrium

is-a hierarchy generation from part-of information



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

Introduction of generic structural



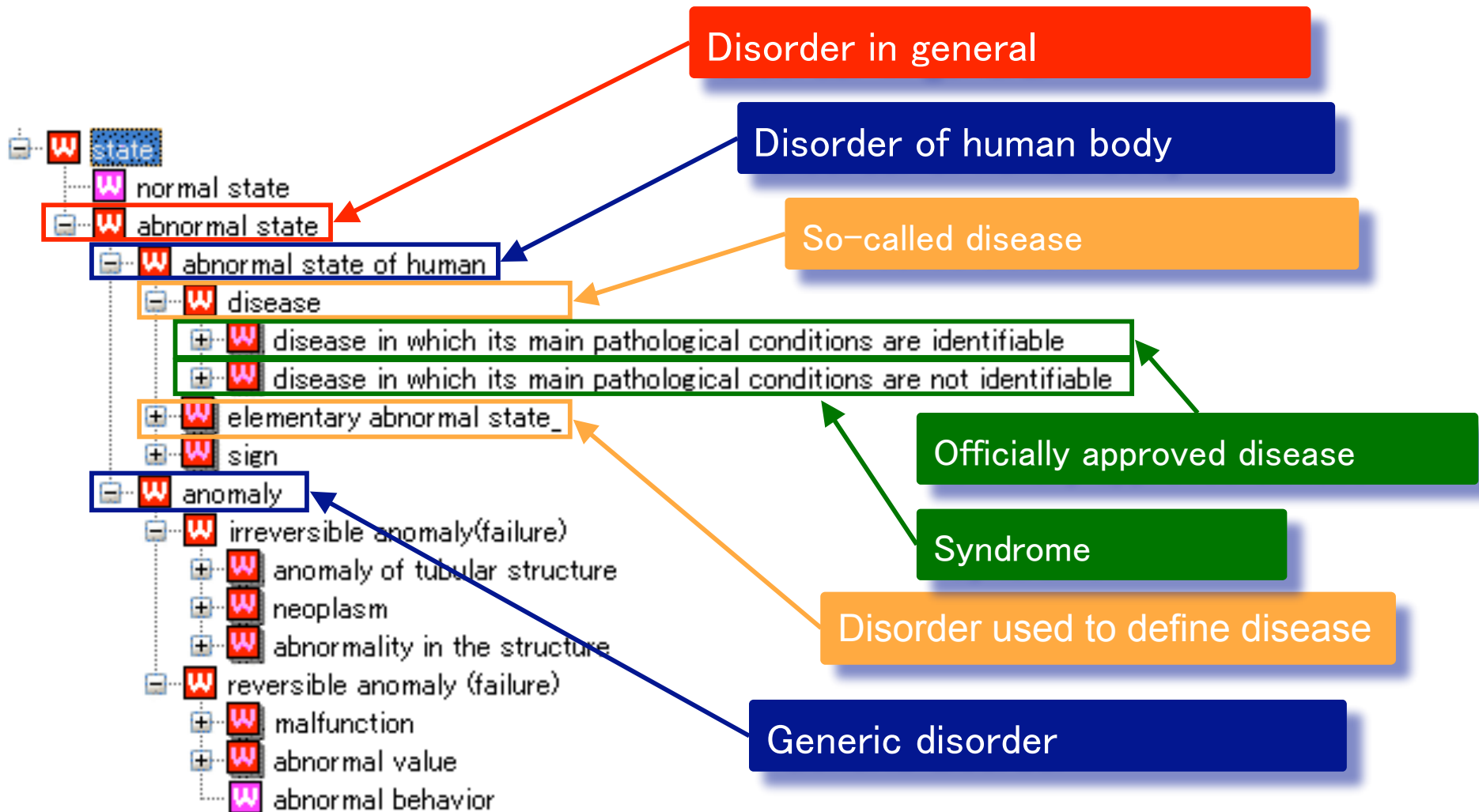


Disease modeling

- Issues and decisions -

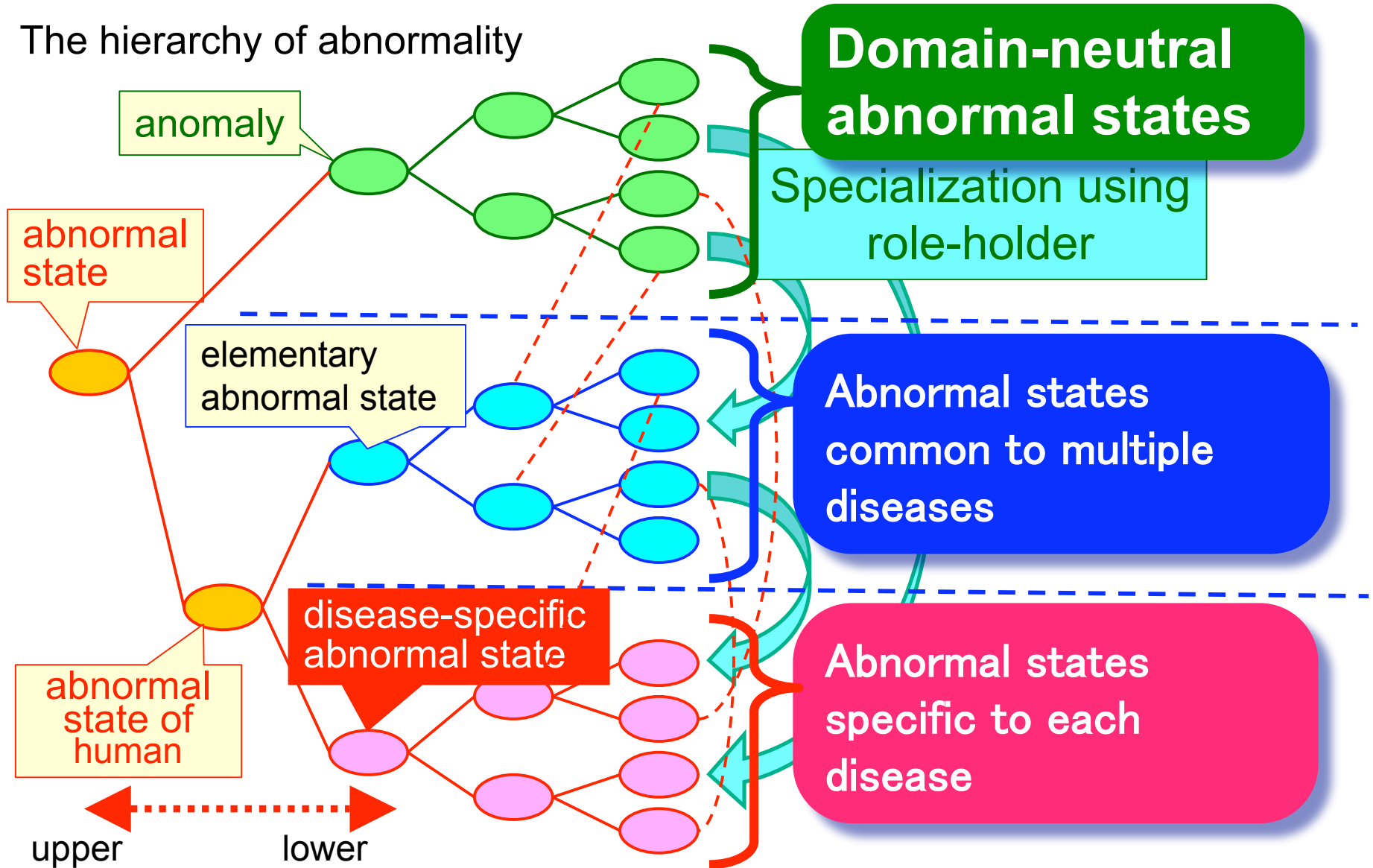
- Various states: pathological state, disease, disorder, dysfunction, failure
 - All are kinds of disorder of human body
 - Introduction of **generic disorder** to use for defining organ- and disease-specific disorder
 - The generic disorder is composed of reversible and irreversible states
- Various 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

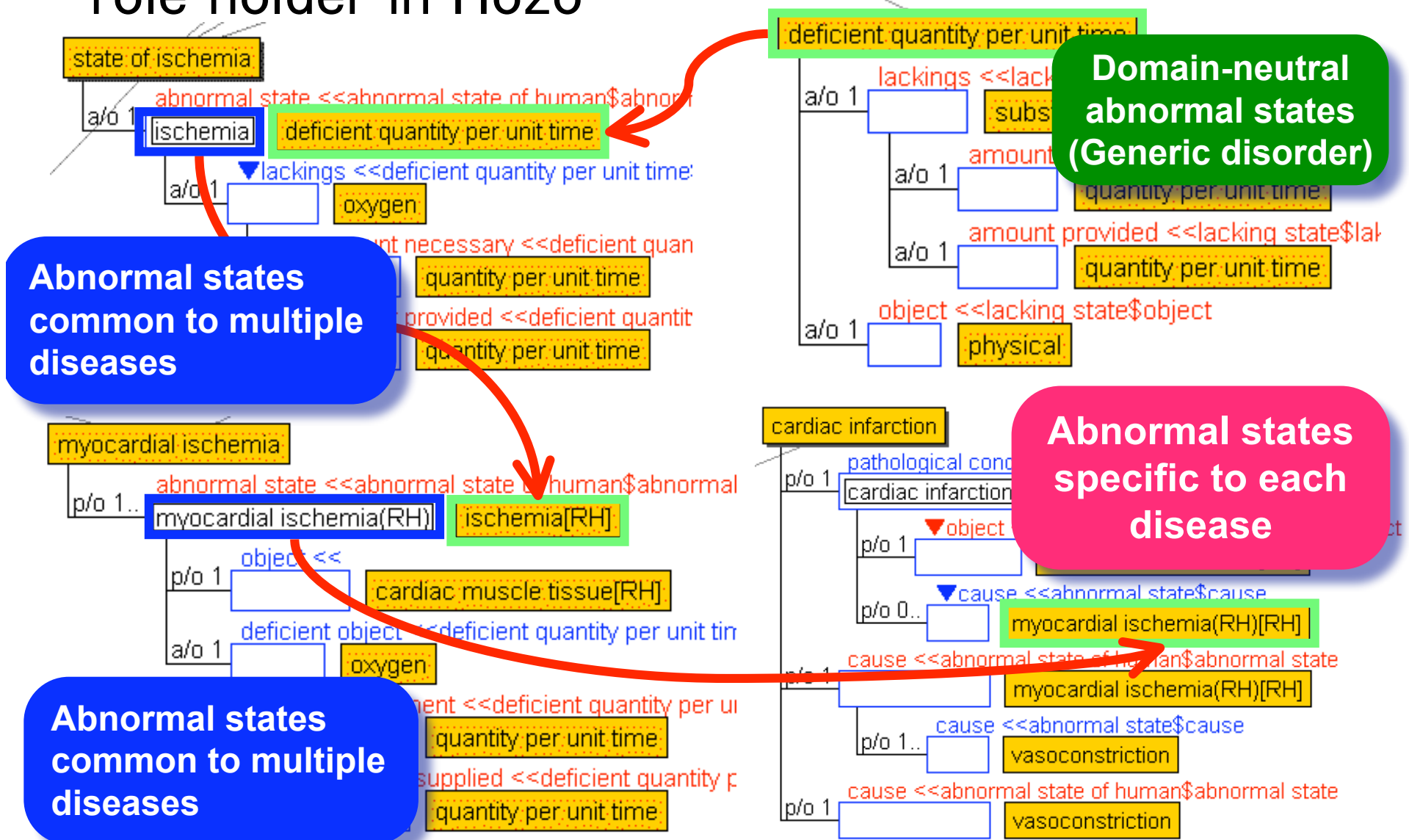


Three-layer description of abnormal states

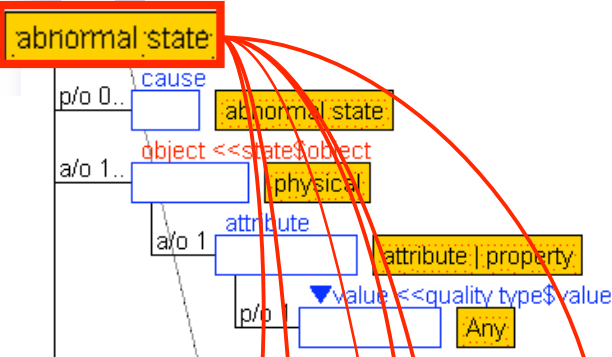
The hierarchy of abnormality



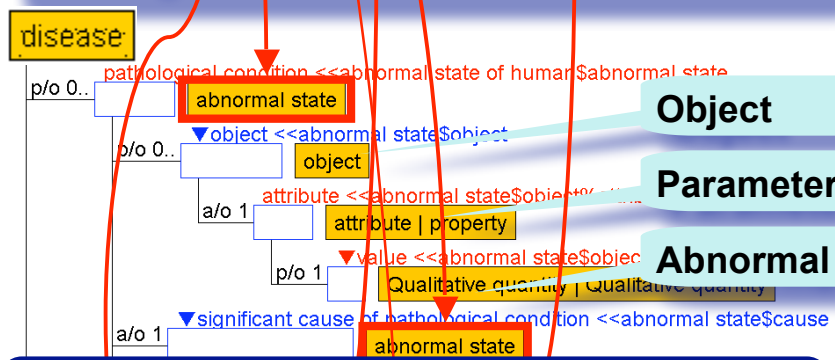
An example of specialization using the idea of role holder in Hozo



Disease model



A disorder is composed of several finer-grained disorders



Object

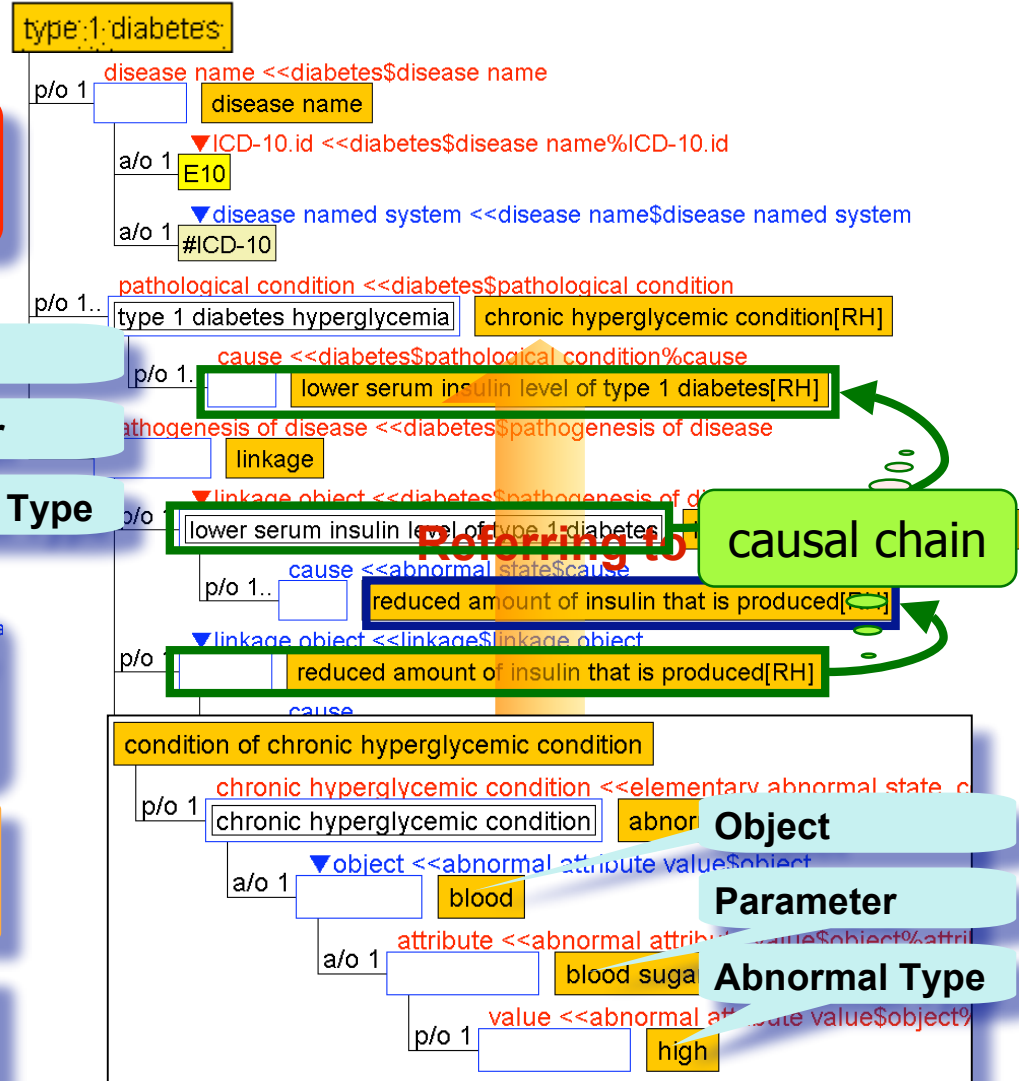
Parameter

Abnormal Type

All kinds of disorders are captured by <E, A, V> formalism

Disorders referred to by many are defined as basic types

Causal chains are modeled as a sequence of disorder states

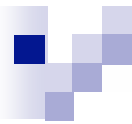


Referring to causal chain

Object

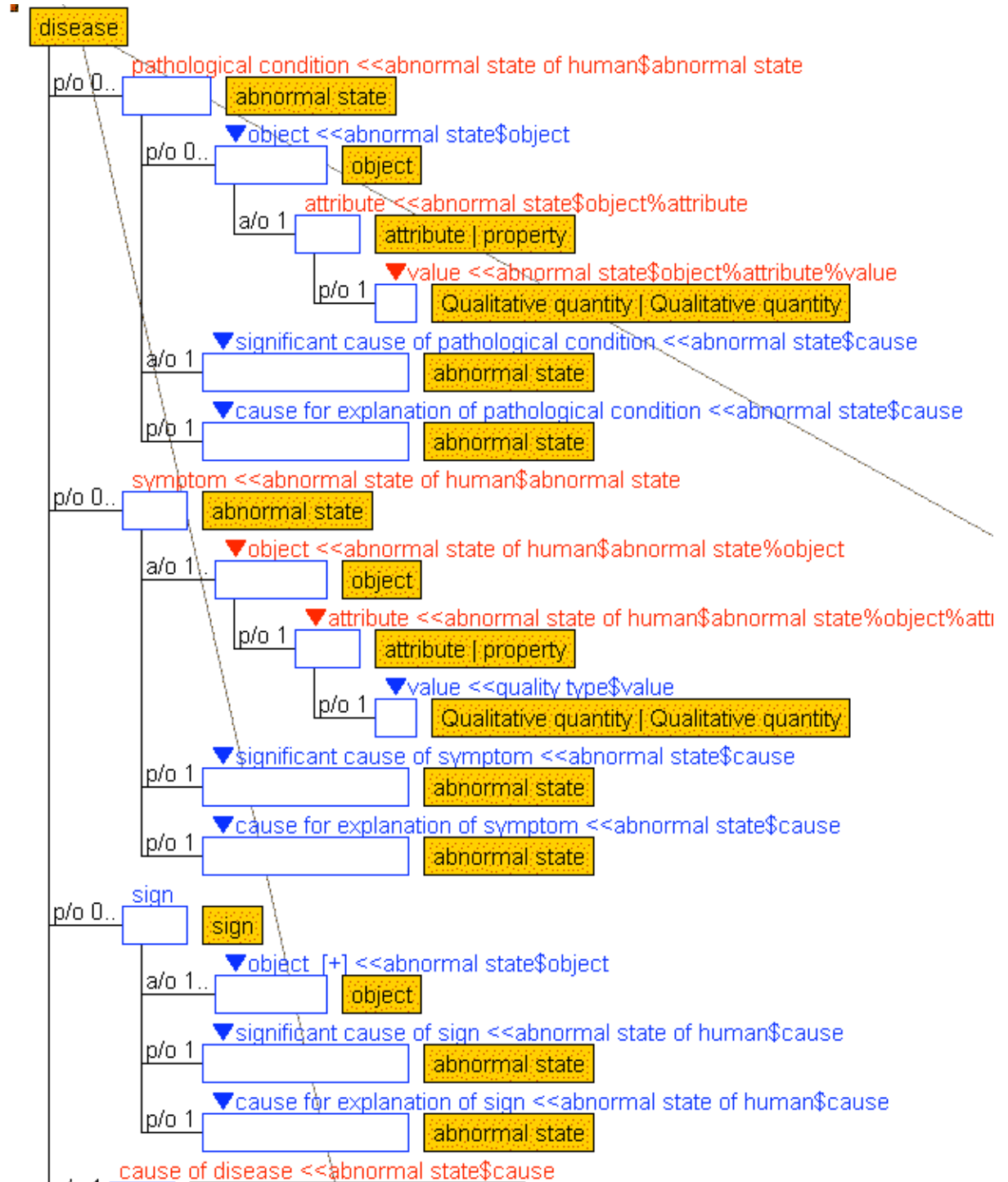
Parameter

Abnormal Type



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

We have flat organization of diseases

Medical knowledge Navigator based on Medical Ontology
Version 1.0 Developed by Medical Ontology Team

WELCOME 医学知識ナビゲータ

分野選択(フォーカシング機能)

全知識 疾患 人体

疾病に関する
異常状態

検索ナビゲータの切り換え

通常医療知識ナビゲータ

- Wikipedia
- Yahoo
- Google

目次・インデックスの切り換え(動的機能)

身体 肢体別 主病態

身体 肢体別 症状

身体 臓器別 主病態

身体 臓器別 症状

身体 サブシステム別 主病態

身体 サブシステム別 症状

disease

- disease
- disease in which its main pathological conditions are identifiable
- diabetes
- angina pectoris 2
- genetic lipid storage disease
- acute pharyngitis
- acute upper respiratory tract inflammation
- salmonella septicemia
- benign prostatic hypertrophy
- glaucoma
- hypoproteinemia (disease)
- colon ulceration
- pneumonia
- alcohol addiction
- 痔瘻
- cystinuria
- bastard measles
- mitral prolapse
- mitral incompetence
- mitral stenosis
- tricuspid valve disease
- interatrial septal defect
- tricuspid insufficiency
- glucose storage disease
- hyperlipidemia
- gout
- cardiac infarction
- intestinal tuberculosis
- Behcet's Syndrome (Behcet's disease)
- noncommunicating hydrocephalus
- Crohn's disease

Subsystem-wise taxonomy

human body(organ system)

- diseases which has pathological condition in alimentary system【消化器システム】
- diseases which has pathological condition in circulatory system【循環器システム】

Main pathological state taxonomy

- disease which has abnormality in metabolism as pathological condition
 - metabolic disorder
- disease which has disturbances of carbohydrate metabolism as pathologic

Symptom-wise taxonomy

- disease which has abnormal state as symptom
 - disease
 - disease which has abnormal state of human as symptom
 - disease which has anomaly as symptom

ICD10-compliant taxonomy

- Certain infectious and parasitic diseases
 - Intestinal infectious diseases
 - Cholera
 - A00.0: cholera due to *Vibrio cholerae*
 - A00.1: cholera due to *Vibrio cholerae* el tor
 - Typhoid and paratyphoid fevers
 - Other salmonella infections
 - A02.0: *salmonella enteritis*
 - Shigellosis
 - Other bacterial intestinal infections
 - Other bacterial foodborne intoxications, not elsewhere classified
 - Amoebiasis
 - Other protozoal intestinal diseases
 - Viral and other specified intestinal infections
 - Tuberculosis
 - Certain zoonotic bacterial diseases
 - Other bacterial diseases
 - Infections with a predominantly sexual mode of transmission
 - Other spirochaetal diseases
 - Other diseases caused by chlamydiae
 - streptococcal meningitis

If or the



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