



Ontology Mapping of PATO to YATO for the improvement of interoperability of quality description



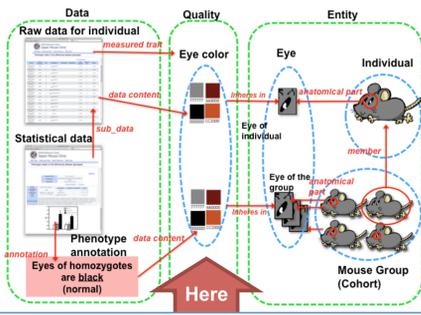
Hiroshi Masuya¹, Nobuhiko Tanaka¹, Kazunori Waki¹, Tatsuya Kushida², Kouji Kozaki³ and Riichiro Mizoguchi³

1 RIKEN BioResource Center, Tsukuba, Japan; 2 NalaPro Technologies, Inc, Tokyo, Japan; 3 Osaka University, Ibaraki, Japan

Introduction:

“Quality description” is an essential for the integration of phenotype information in bioinformatics

Yet Another Top-level Ontology (YATO) : The top-level framework to facilitate broad interoperability between different ontological frameworks



Quality types (traits)	Quality-values (phenotypes)
Color	Nominal scale value (Blue, square, kinked)
Concentration	Ordinal scale value (long, quick, smooth, bright)
Shape	Interval scale value (12°C)
Deviation	Rational scale value (10cm, 2mg/ml, 280K)
Length	
Resistance	

Phenotypic quality ontology (PATO) is a BFO-based ontology for phenotypic quality description for biological domain

- quality
 - physical object quality
 - quality of a single physical entity
 - cellular quality
 - complexity
 - composition
 - functionality
 - maturity
 - morphology
 - necessity (continuant)
 - organismal quality
 - physical quality
 - population quality
 - position
 - relaxation
 - strength
 - sufficiency
 - threshold
 - wetness
 - process quality
 - acute
 - chronic
 - quality of a single process
 - quality of related processes
 - qualitative
 - conspicuousness
 - count in organism
 - deviation(from_normal)
 - intensity
 - magnitude
- process quality
 - acute
 - chronic
 - quality of a single process
 - quality of related processes
- qualitative
 - conspicuousness
 - count in organism
 - deviation(from_normal)
 - intensity
 - magnitude

Mapping to YATO framework

Ontology mapping between PATO to YATO-GXO (PATO term to YATO-GXO framework)

- Quality-Quantity
 - quality type
 - accidental attribute
 - intra-placementPATO:0000140
 - intrinsic attribute
 - LO relational
 - continuous
 - forward
 - backward
 - thresholded
 - gram-stainability
 - resistance toPATO:0001046
 - response toPATO:0000077
 - sensitivity towardPATO:0000085
 - basic attribute
 - quantitative attribute
 - meta attribute
 - countPATO:0000053
 - deviation(from_normal)PATO:0000069
 - presencePATO:0000070
 - concentration ofPATO:0000033
 - non-meta attribute
 - intensityPATO:0000049
 - ratePATO:0000161
 - qualitative attribute
 - genuine qualitative attribute
 - structural attribute
 - shapePATO:0000052
 - qualitative spatial pattern
 - morphologyPATO:0000051
 - patternPATO:0000060
 - composition related attribute
 - directionPATO:0000039
 - biological sexPATO:0000047
 - pseudo-qualitative attribute
 - property
 - extrinsically qualitative
 - wet property
 - distribution property
 - fertility property
 - fertilePATO:0000955
 - male fertilePATO:0000891
 - female fertilePATO:0000888
 - sterilePATO:0000956
 - female sterilePATO:0000892
 - male sterilePATO:0000890
 - efficiency property
 - temperature property
 - functionality property
 - response property
 - resistance property
 - concentration property
 - vividness property
 - intrinsically qualitative
 - color property
 - red property
 - reddish
 - deep red
 - quality value
 - nominal scale value
 - nominal color value
 - composition related value
 - placement value
 - shape value
 - phenotypic sex value
 - non-categorical
 - unit:UO:0000000 ← Unit ontology is integrated.
 - quantity
 - continuous quantity
 - interval scale quantity
 - rational scale quantity
 - ordinal scale quantity
 - ordinal scale value
 - attribute independent
 - meta attribute value
 - presence value
 - count value
 - concentration value
 - deviation value
 - non-meta value
 - amount value
 - color brightness value
 - chroma value
 - relative color value
 - size quality value
 - experiment specific binary size quality value
 - Two ordinal value system
 - attribute dependent system 2_v
 - size system 2_v
 - length system 2_v
 - Wavelength system 2_v
 - depth system 2_v
 - Riken length system
 - distance system 2_v
 - Height system
 - width system
 - thickness system
 - perimeter system
 - 2-D extent system 2_v
 - 3-D extent system 2_v
 - intuitive size system 2_v
 - color brightness system
 - temperature system 2_v
 - color vividness system
 - IQ-relational value system
 - wetness system
 - attribute independent 2_v
 - Three ordinal value system
 - attribute independent 3_v

Attribute: PATO terms of “attribute slim” are mapped according to the fundamental classification of Attribute.

Property: a specified Quality type obtained from the abstract Quality value, enables the systematic representation of a more detailed quality description

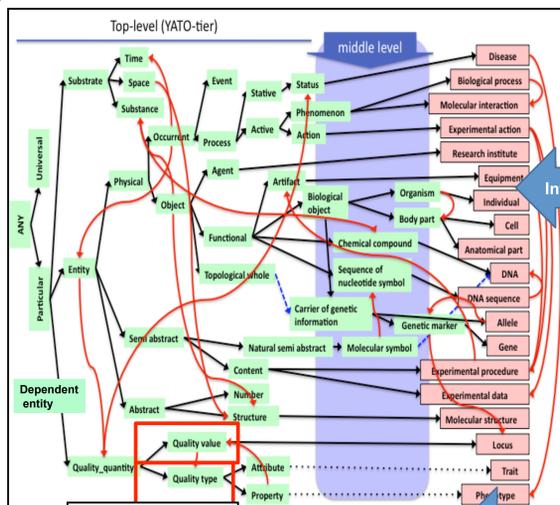
Quality value: the value measured by every scales, namely, nominal (categorical), ordinal, interval and rational scales (e.g. 10 cm).

NEW Ordinal value system: detailed specification of ordinary value depends on the various contexts.

YATO-GXO framework

Top level: Yet Another Top-level Ontology
Bridge between biological domain level: Genetics Ontology

•YATO is the latest top-level “reference” ontology to build interoperability among top-level ontologies.



DOLCE (Descriptive Ontology for Linguistic and Cognitive Engineering)

Two-hierarchy model

<Object, Attribute, Value> (e.g., <John, height, 180cm>) formalism

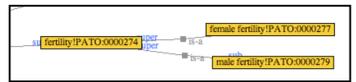
GALEN (Generalized Architecture for Languages, Encyclopaedias and Nomenclatures in medicine)

Two-hierarchy model

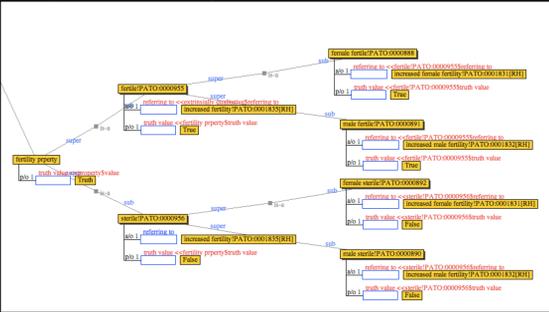
<Object, Property, Value> (e.g., <John, tallness, large>) formalism

Other quantitative descriptions in biology

Attributes for fertility

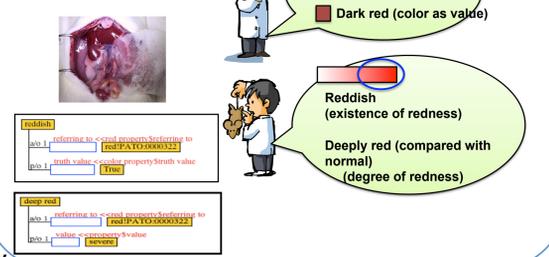


Properties for fertility

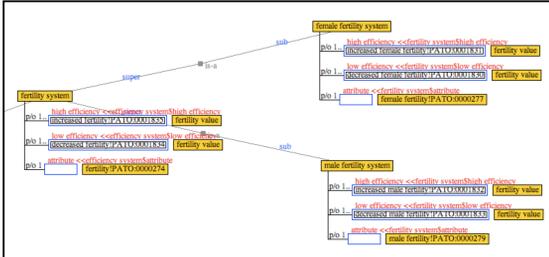


Property is useful to represent advanced description of quality

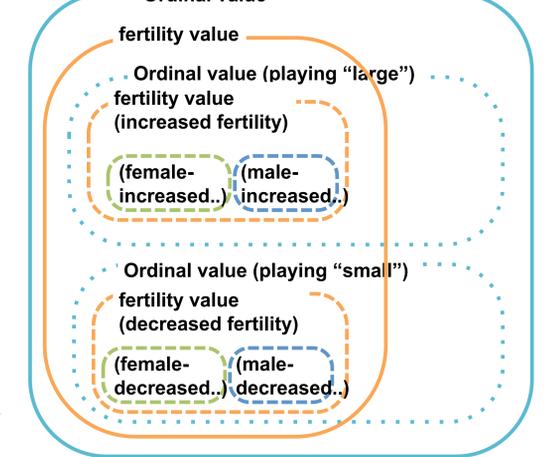
Example: Description of color of liver (pathological description)



Quality value (system) for fertility



Ordinal value



We have worked out a trial of implementation of quality description in RIKEN-SciNeS system (RDF/OWL based database)

<https://database.riken.jp/sw/>
<https://database.riken.jp/sw/view#RIA00110>

