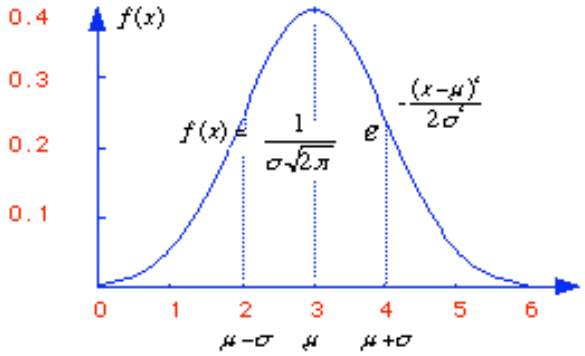
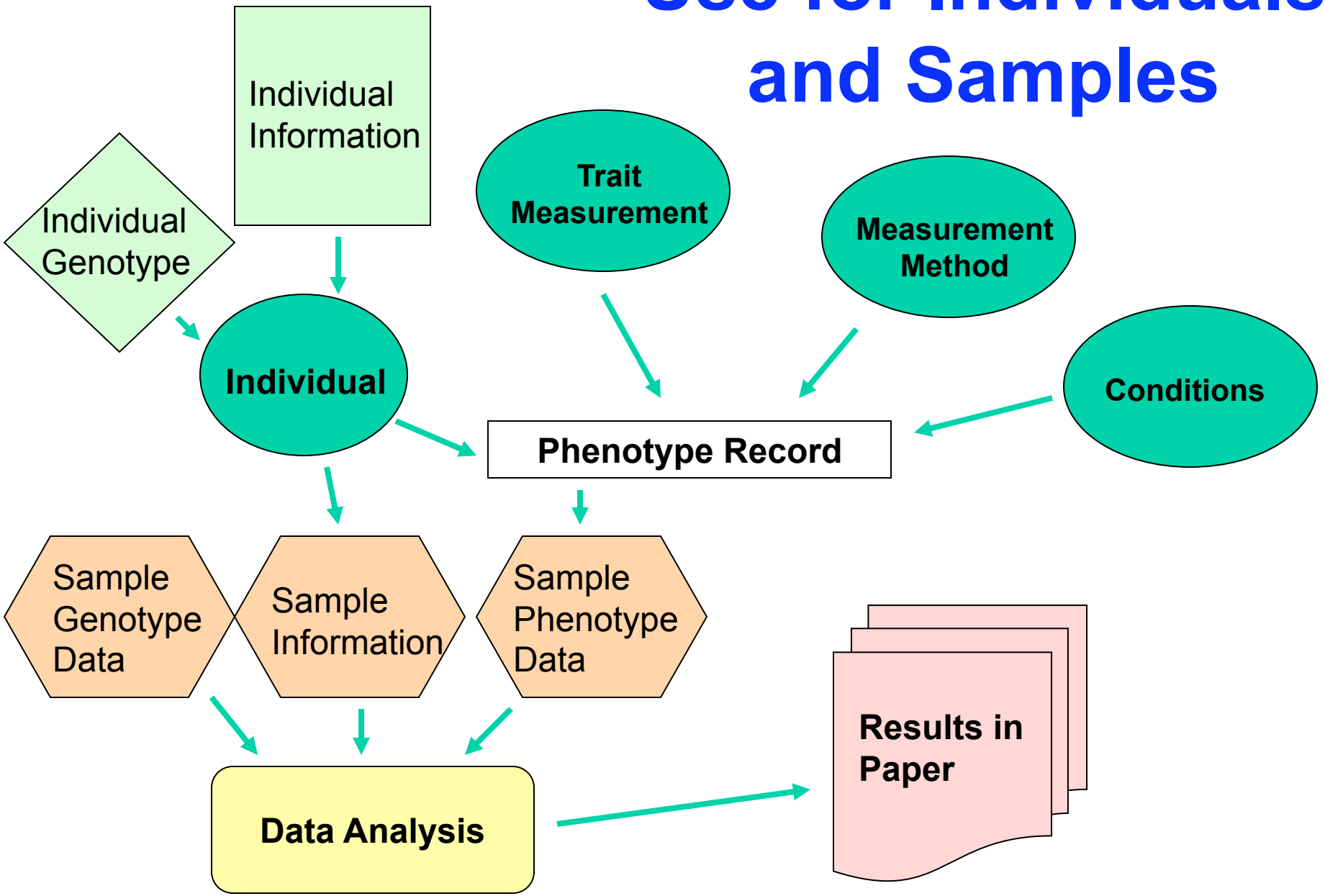


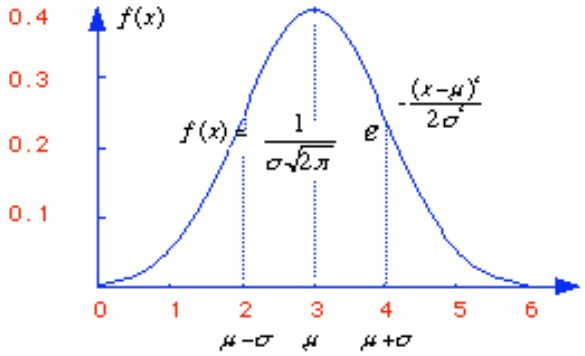
Global Perspectives on Animal Trait Ontology

J.M. Reecy, C. Park, Z.-L. Hu, I. Hulsegge,

H. Van Der Steen, J.-F. Hocquette

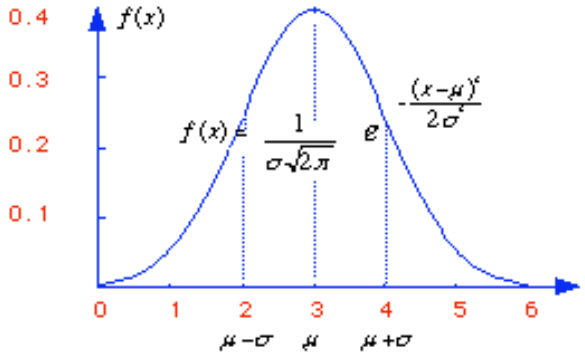
Use for Individuals and Samples



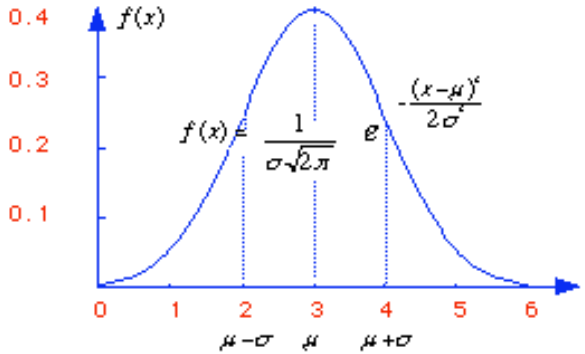


"What's in a name? That which we call a rose By any other name would smell as sweet."

Romeo and Juliet (II, ii, 1-2)

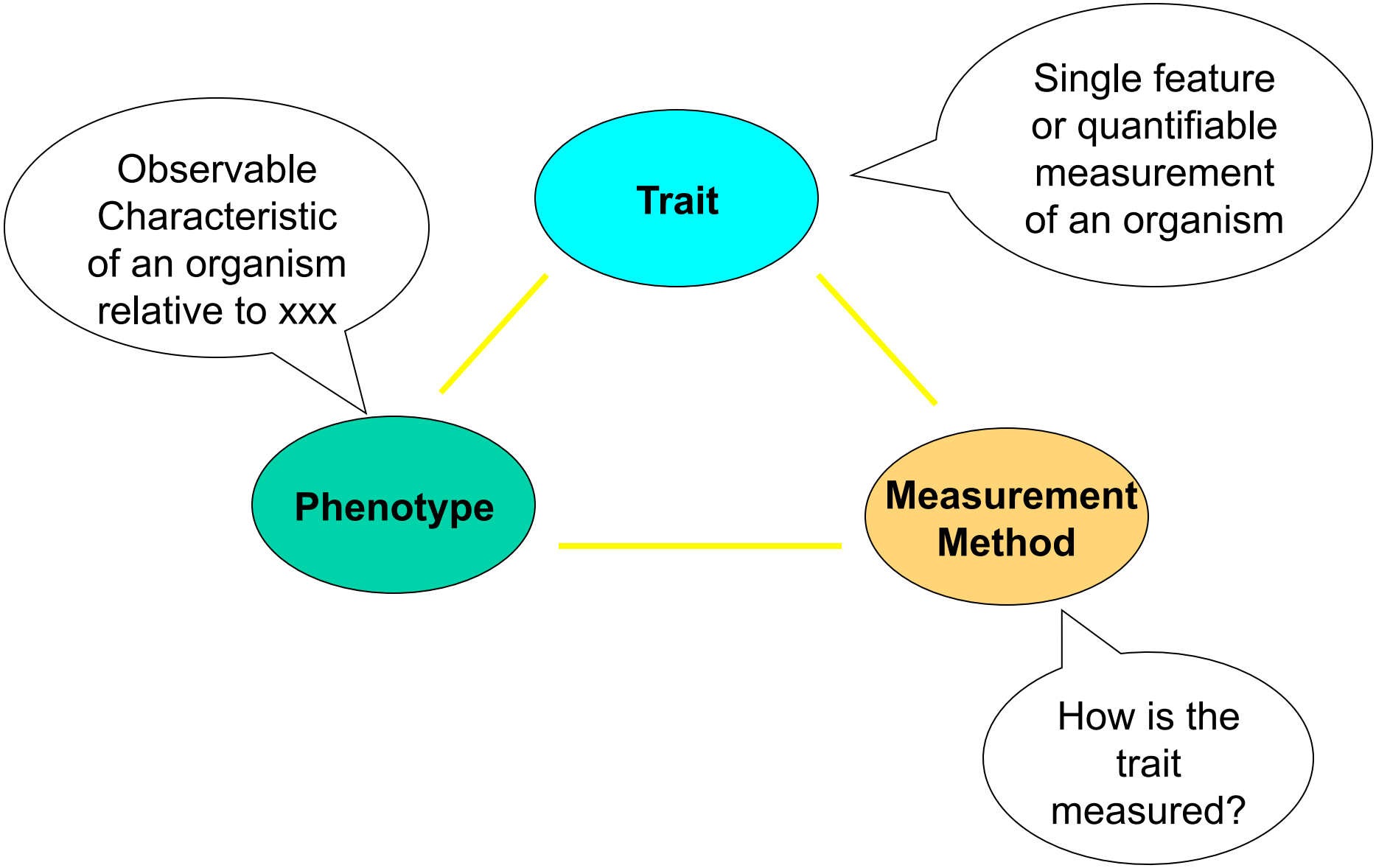


Have you ever struggled with trait nomenclature when comparing publications?

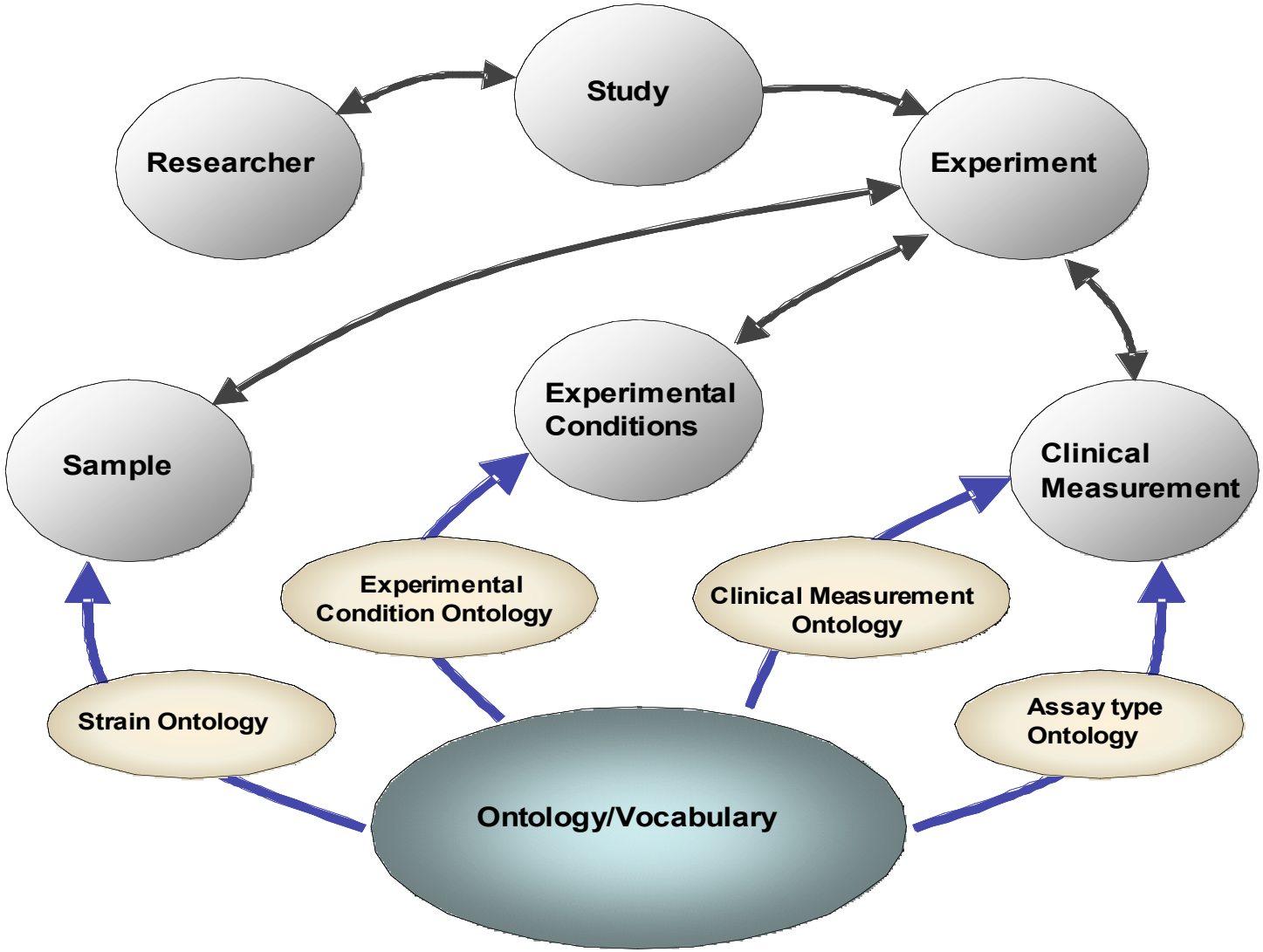


- **Why do we need an ATO**
  - To facilitate organization/comparison of data
  - Standardize nomenclature/facilitate knowledge transfer within and across species
  - Facilitate data retrieval
  - Facilitate data analysis
  - Enhance education

What is a phenotype/Trait?



Complex Experimental Measurement Data



The Open Biomedical Ontologies

NRSP-8
rmatics

Ontologies | Resources | Participate | About

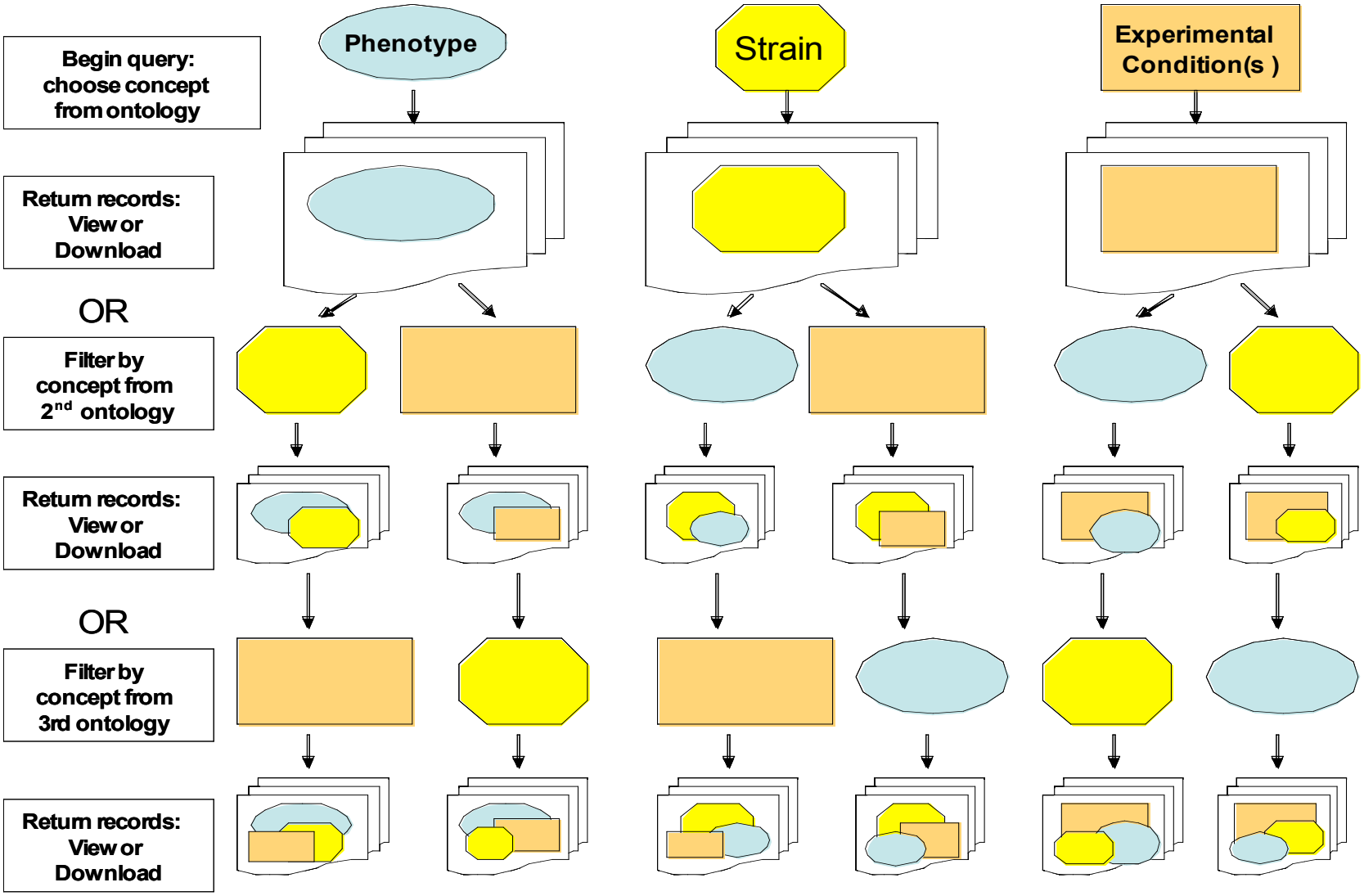
The OBO Foundry is a collaborative experiment involving developers of science-based ontologies who are establishing a set of principles for ontology development with the goal of creating a suite of orthogonal interoperable reference ontologies in the biomedical domain. The groups developing ontologies who have expressed an interest in this goal are listed below, followed by other relevant efforts in this domain.

In addition to a listing of OBO ontologies, this site also provides a statement of the OBO Foundry principles, discussion fora, technical infrastructure, and other services to facilitate ontology development. We welcome feedback and encourage participation.

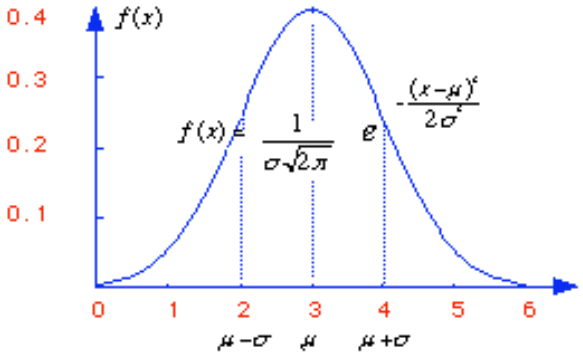
Click any column header to sort the table by that column. The s link to the term request trackers for the listed ontologies.

OBO Foundry candidate ontologies

Title	Domain	Prefix	File	Last changed
Amphibian gross anatomy	anatomy	AAO	amphibian_anatomy.obo	2008/06/19
Amphibian taxonomy	anatomy	ATO	amphibian_taxonomy.obo	
Ascomycete phenotype ontology	phenotype	APO	ascomycete_phenotype.obo	2009/07/10
Biological process	biological process	GO	gene_ontology_edit.obo	2009/08/24
C. elegans development	anatomy	WBls	worm_development.obo	2008/01/31
C. elegans gross anatomy	anatomy	WBbt	WBbt.obo	2009/08/19
C. elegans phenotype	phenotype	WBPhenotype	worm_phenotype.obo	2009/08/19
Cell type	anatomy	CL	cell.obo	2008/12/09
Cellular component	anatomy	GO	gene_ontology_edit.obo	2009/08/24
Cereal plant trait	phenotype	TO	plant_trait.obo	2009/08/18
Chemical entities of biological interest	biochemistry	CHEBI	chebi.obo	2009/07/29
Common Anatomy Reference Ontology	anatomy	CARO	caro.obo	2007/06/17
Dictyostelium discoideum anatomy	anatomy	DDANAT	dictyostelium_anatomy.obo	2008/05/29
Drosophila development	anatomy	FBdv	fly_development.obo	2008/12/11
Drosophila gross anatomy	anatomy	FBbt	fly_anatomy.obo	2009/03/17
Environment Ontology	environment	ENVO	envo.obo	2009/05/20
Evidence codes	experiments	ECO	evidence_code.obo	2009/03/20
Fly taxonomy	taxonomy	FBsp	fly_taxonomy.obo	2007/04/10
Foundational Model of Anatomy (subset)	anatomy	FMA	fma2_obo.obo	
Fungal gross anatomy	anatomy	FAO	fungal_anatomy.obo	2009/07/10


Begin query: choose concept from ontology
Phenotype
Strain
Experimental Condition(s)
Return records: View or Download
OR
Filter by concept from 2nd ontology
Return records: View or Download
OR
Filter by concept from 3rd ontology
Return records: View or Download

Development of Vertebrate Trait Ontology



Ontology

IS_A

PART_OF

Vertebrate Trait Ontology

Mouse

Rat

Human

Livestock

?

Cattle

Swine

Chicken

ATO

Search ATO:

Exact Match

Submit

Advanced Query

Ontology Filter:

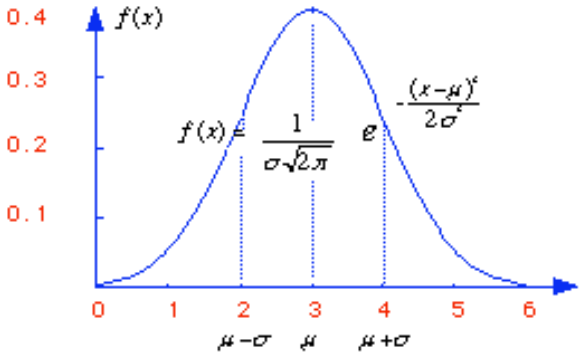
All
feed consumption
First rib backfat

Set Filters

Display options:

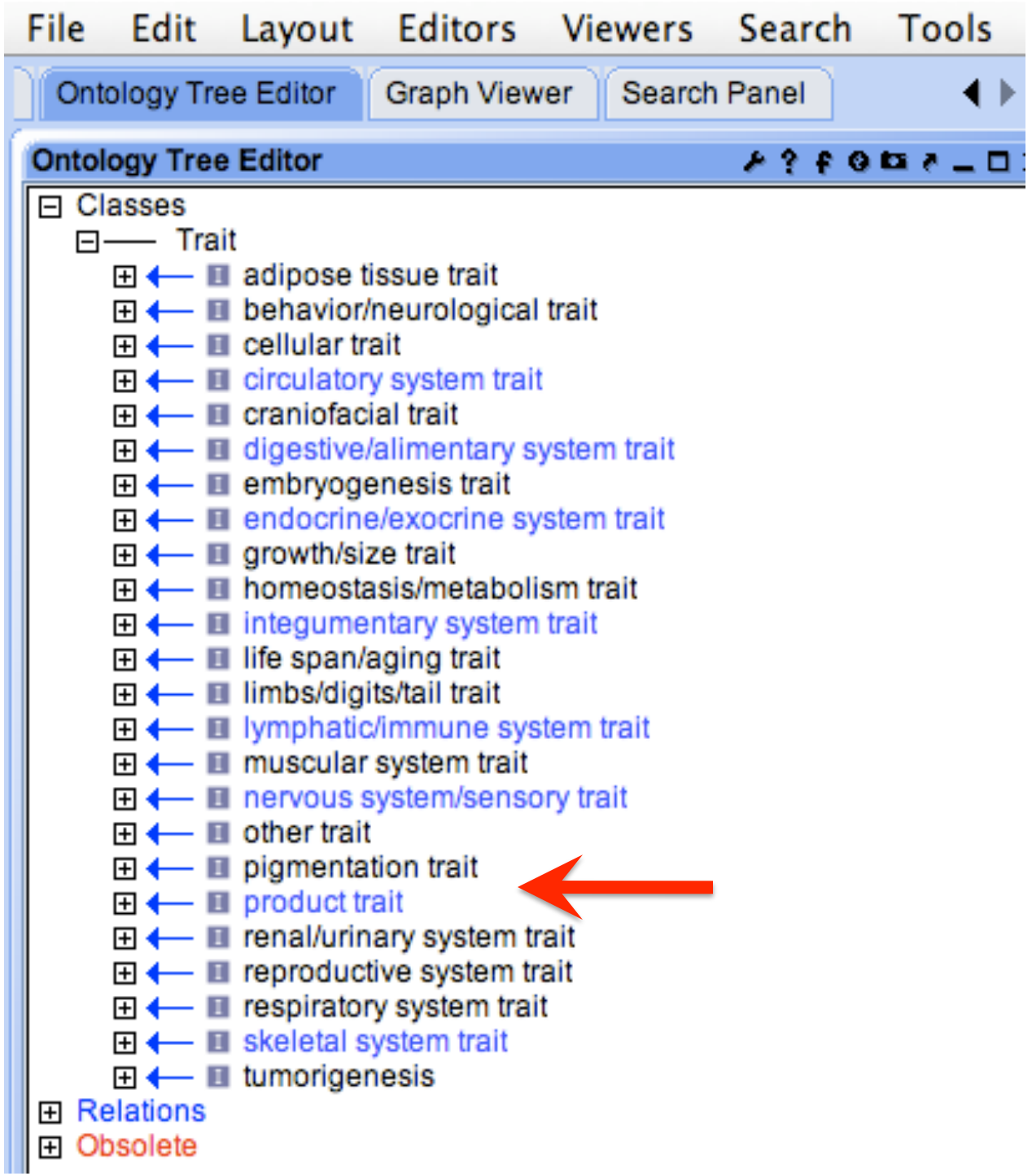
- XML
- Flat File

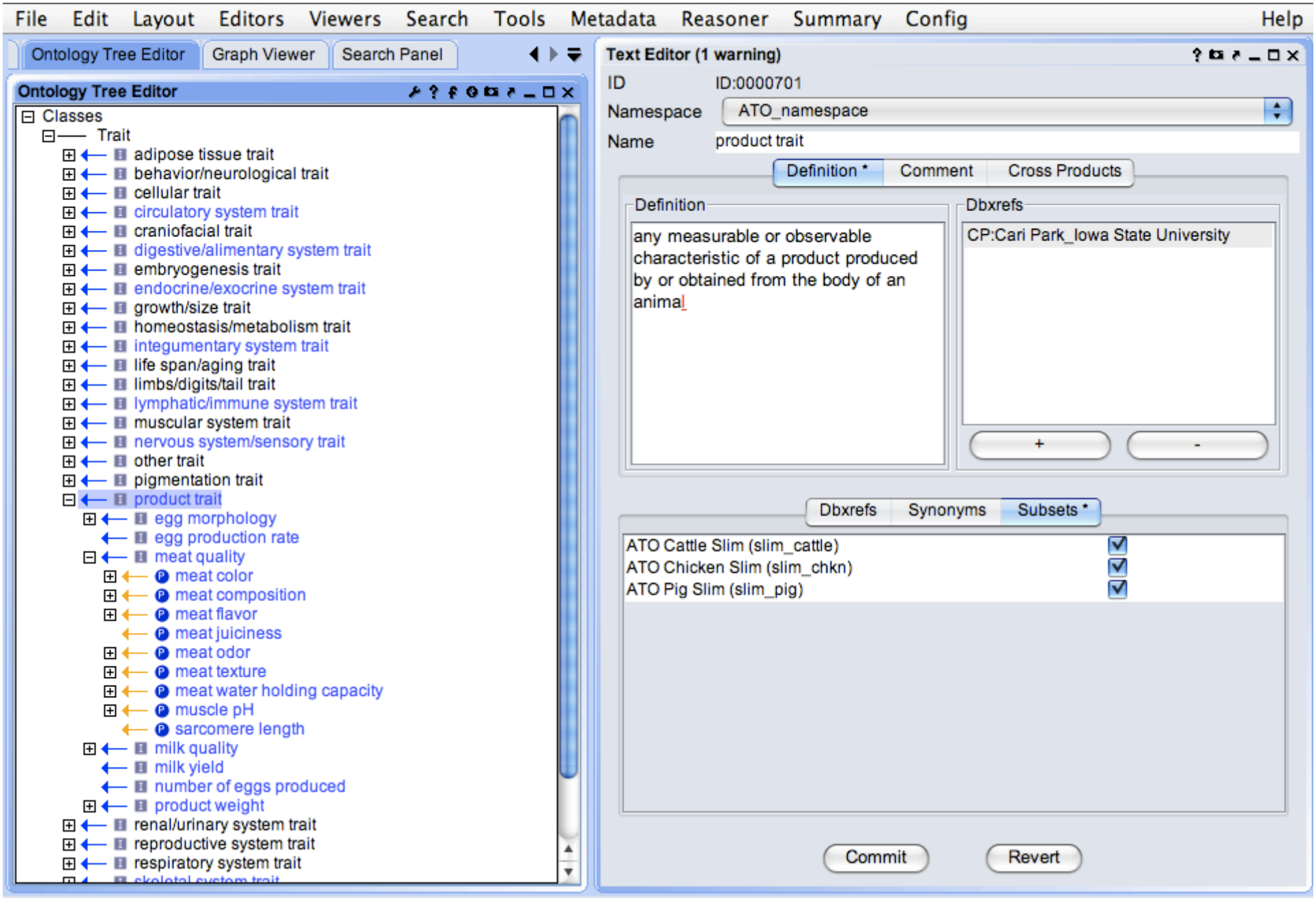
PERMALLINK
ATO HOME

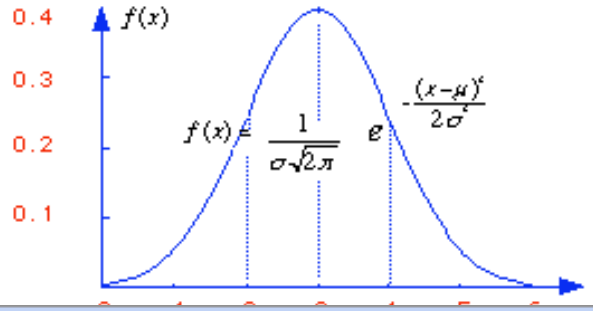


- **all : all**
  - ATO:0000346 : ATO
  - ATO:0000348 : Bos taurus
  - ATO:0000482 : Gallus gallus
  - ATO:0000347 : Sus scrofa

How to organize traits?




File Edit Layout Editors Viewers Search Tools Metadata Reasoner Summary Config Help
Ontology Tree Editor
Graph Viewer
Search Panel
Ontology Tree Editor
Classes
Trait
adipose tissue trait
behavior/neurological trait
cellular trait
circulatory system trait
craniofacial trait
digestive/alimentary system trait
embryogenesis trait
endocrine/exocrine system trait
growth/size trait
homeostasis/metabolism trait
integumentary system trait
life span/aging trait
limbs/digits/tail trait
lymphatic/immune system trait
muscular system trait
nervous system/sensory trait
other trait
pigmentation trait
product trait
egg morphology
egg production rate
meat quality
meat color
meat composition
meat flavor
meat juiciness
meat odor
meat texture
meat water holding capacity
muscle pH
sarcomere length
milk quality
milk yield
number of eggs produced
product weight
renal/urinary system trait
reproductive system trait
respiratory system trait
Text Editor (1 warning)
ID
ID:0000701
Namespace
ATO_namespace
Name
product trait
Definition *
Comment
Cross Products
Definition
any measurable or observable characteristic of a product produced by or obtained from the body of an animal
Dbxrefs
CP:Cari Park_Iowa State University
+
-
Dbxrefs
Synonyms
Subsets *
ATO Cattle Slim (slim_cattle)
ATO Chicken Slim (slim_chkn)
ATO Pig Slim (slim_pig)
Commit
Revert



Ontology Tree Editor | Graph Viewer | Search Panel

Ontology Tree Editor

- Trait
  - adipose tissue trait
  - behavior/neurological trait
  - cellular trait
  - circulatory system trait
  - craniofacial trait
  - digestive/alimentary system trait
  - embryogenesis trait
  - endocrine/exocrine system trait
  - growth/size trait
  - homeostasis/metabolism trait
  - integumentary system trait
  - life span/aging trait
  - limbs/digits/tail trait
  - lymphatic/immune system trait
  - muscular system trait
    - muscle morphology
      - eye muscle morphology
      - heart muscle morphology
      - muscle development
      - muscle fiber morphology
      - muscle size
      - skeletal muscle mechanoreceptor morphology
      - skeletal muscle morphology
      - smooth muscle morphology
      - tendon morphology
    - muscle physiology
      - ability to move the eye muscles
      - adenosine deamination
      - muscle androstenone level

Text Editor (1 warning)

ID MT:0005369

Namespace Trait.ontology

Name muscular system trait

Definition * | Comment | Cross Products

Definition

any measurable or observable characteristic of the contractile tissue that produces movement

Dbxrefs

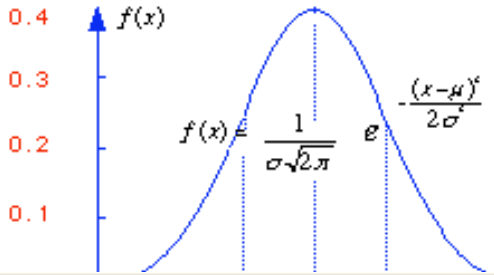
CP:Cari Park_Iowa State Unive

+ -

Dbxrefs | Synonyms | Subsets *

- ATO Cattle Slim (slim_cattle) ☑
- ATO Chicken Slim (slim_chkn) ☑
- ATO Pig Slim (slim_pig) ☑

Reproduction Ontology



File Edit Ontologies Reasoner Tools Refactor Tabs View Window Help

Ontology1191324893.owl (http://www.owl-ontologies.com/Ontology1191324893.owl)

Active Ontology | Entities | Classes | Object Properties | Data Properties | Individuals | OWLViz | DL Query

Asserted class hierarchy | Inferred class hierarchy

Asserted class hierarchy: ReproductivePerformance

- ReproductiveBehaviour
- ReproductiveFailure
- ReproductivePerformance
  - AgeAtFirstConception
  - AgeAtFirstParturition
  - AgeAtFirstService
  - AgeAtPuberty
  - CalfCrop
  - CalvingIndex
  - EaseOfParturition
  - OestrousCycle
  - ParturitionInterval
  - ParturitionPercentage
  - Rate
  - ReproductiveIndex
  - ServicesPerConception
  - VoluntaryWatingPeriod

Object property hierarchy | Data property hierarchy | Individuals

Object properties:

Class Annotations | Class Usage

Annotations: ReproductivePerformance

Annotations

hasDefinition
"The final outcome of all processes involved in 1) quality and quantity of gametes of both sexes 2) pregnancy rates 3) survival rates of embryo, foetus and newborn [source: REPO]"

hasIdentifier
"REPO:0000002"

hasSynonym
"breeding performance"

hasSynonym
"reproductive ability"

hasSynonym
"reproductive capacity"

hasSynonym
"reproductive efficiency"

Description: ReproductivePerformance

Equivalent classes

Superclasses

Thing

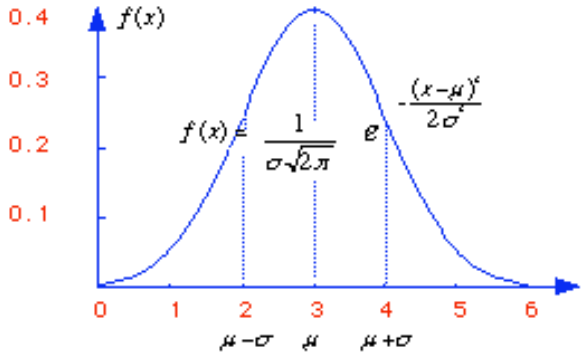
Inherited anonymous classes

Members

Disjoint classes

http://www.sabre-eu.eu/SABREResults/REProductionOntologyREPOWP3WP6/tabid/388/Default.aspx

Ina Hulsegge



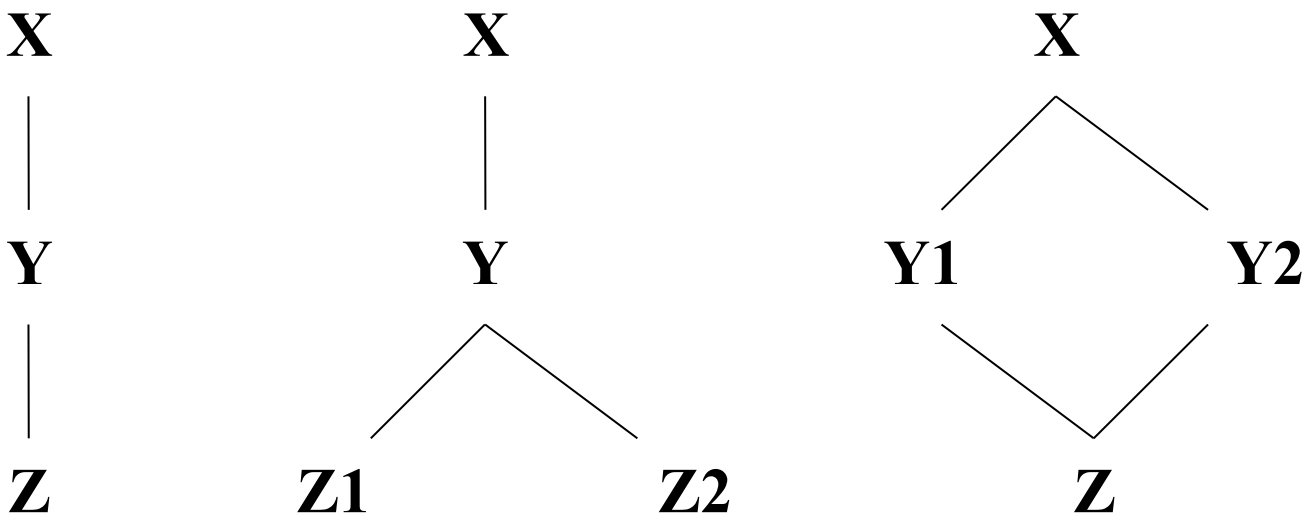
Future Cross mapping of Ontologies

Case: A **Case: B** **Case: C**

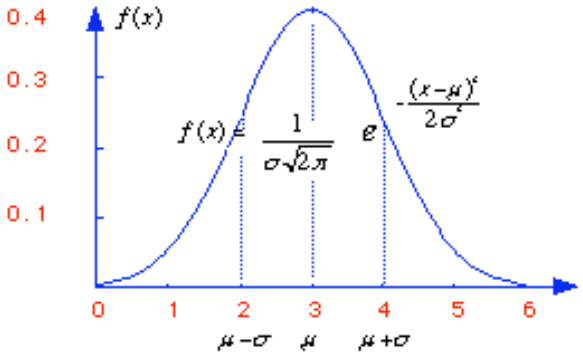
Disease

Phenotype

Trait

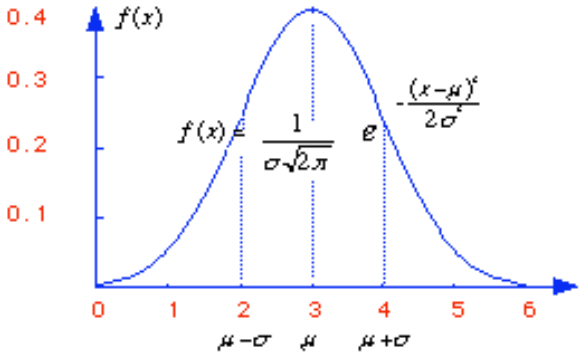


ATO Example



Disease	Phenotype(s)	Trait
1. Obesity	Increased adipose weight Increased lipid weight	Adipose weight Lipid weight
2. Dwarfism	Decreased bone length Abnormal bone morphology	Bone length Bone morphology
3. Mastitis	Increased somatic cell count	Somatic cell count

Summary



- Assembled a consortium
  - ISU, RGD, MGI, EADGENE, INRA
  - Experts welcome
- Trait Ontology development is on-going
  - Core curation rules have been develop
  - Higher-order terms have been identified
- Data analysis resource

Acknowledgements

Iowa State University

- Sue Lamont
- Max Rothschild
- Chris Tuggle
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- Eric Fritz
- Laron Hughes
- Jie Bao
- Neeraj Kaul
- Vasant Honavar

Collaborators

- Mary Shimoyama
- Anne Kwitek
- Mindy Dwindell
- Diane Munzenmaier
- EADGENE
  - Hein Van der Steen
  - Ina Hulsegge
- INRA
  - Pierre-Yves Le Bail
  - Jean-Francios Hocquette