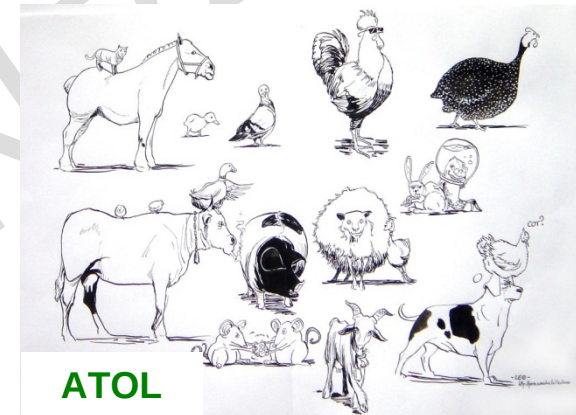




ATOL : a new ontology for livestock



C. Hurtaud, M.C. Meunier-Salaün,

J. Bugeon, A. Fatet, M. Reichstadt, A. Valancogne, J. Vernet, I. Hue, P.Y. Le Bail

O. Dameron,

J. Reecy, C. Park

INRA PHASE department

INSERM Rennes

Iowa State University

ATOL: why?

Because of an increasing complexity



- A more and more complicated knowledge
- Increasing amount of information
- Diversification of community of users
- A need of a more efficient management of the evolution of our production systems $\Rightarrow$

PREDICTION OF PHENOTYPE

Change of paradigm

From an analytic approach to an integrated and systemic approach

Necessary to have a shared language

a language usable by software and in the same time offering possibility of data basis management, semantic analysis or modeling approach using concept and relationships between measurements

ATOL : an ontology



Ontology ?

1) **Ontology** = formal representation of concepts and of relationships between these concepts within a subject or a specific area.



2) Characteristics :

- It describes a field of interest with concepts and relationships
- The concepts and the relationships are **clearly defined**
- The meaning of an item is used in **an unequivocal way.**
- The concepts are organized in **a structural way** (often an hierarchy)
- The items have to **be easily used by computer** (for bibliographic request research).



The Open Biomedical Ontologies

Ontologies **Resources** **Publications** **About**

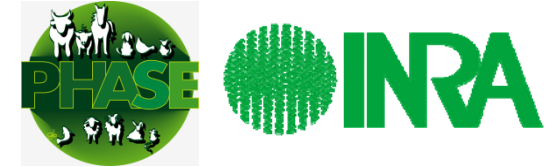
The OBO Foundry is a collaborative experiment involving developers of science-based ontologies who are establishing a set of principles for ontology development with the goal of creating a suite of high-quality, interoperable, reusable ontologies for the biomedical domain. The groups developing ontologies 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 lists, technical infrastructure, and other services to facilitate ontology development, the secure backup and encourage participation.

Click any column header to sort the table by that column. The [OBO Foundry](#) link in the bottom right corner leads to the latest ontologies.

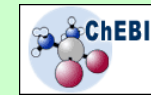
OBO Foundry candidate ontologies					
Ontology	URI	Version	Public	File	Last updated
Biological process ontology	obo:bioprocess	1.0.0	Yes	bioprocess.obo	2009/01/18
Biological structure ontology	obo:biostucture	1.0.0	Yes	biostucture.obo	2009/01/18
Biological molecule ontology	obo:biomol	1.0.0	Yes	biomol.obo	2009/01/18
Biological cell ontology	obo:biocell	1.0.0	Yes	biocell.obo	2009/01/18
Biological tissue ontology	obo:biotissue	1.0.0	Yes	biotissue.obo	2009/01/18
Biological organ ontology	obo:bioorgan	1.0.0	Yes	bioorgan.obo	2009/01/18
Biological system ontology	obo:biosystem	1.0.0	Yes	biosystem.obo	2009/01/18
Biological process ontology	obo:bioprocess	1.0.0	Yes	bioprocess.obo	2009/01/18
Biological structure ontology	obo:biostucture	1.0.0	Yes	biostucture.obo	2009/01/18
Biological molecule ontology	obo:biomol	1.0.0	Yes	biomol.obo	2009/01/18
Biological cell ontology	obo:biocell	1.0.0	Yes	biocell.obo	2009/01/18
Biological tissue ontology	obo:biotissue	1.0.0	Yes	biotissue.obo	2009/01/18
Biological organ ontology	obo:bioorgan	1.0.0	Yes	bioorgan.obo	2009/01/18
Biological system ontology	obo:biosystem	1.0.0	Yes	biosystem.obo	2009/01/18
Biological process ontology	obo:bioprocess	1.0.0	Yes	bioprocess.obo	2009/01/18
Biological structure ontology	obo:biostucture	1.0.0	Yes	biostucture.obo	2009/01/18
Biological molecule ontology	obo:biomol	1.0.0	Yes	biomol.obo	2009/01/18
Biological cell ontology	obo:biocell	1.0.0	Yes	biocell.obo	2009/01/18
Biological tissue ontology	obo:biotissue	1.0.0	Yes	biotissue.obo	2009/01/18
Biological organ ontology	obo:bioorgan	1.0.0	Yes	bioorgan.obo	2009/01/18
Biological system ontology	obo:biosystem	1.0.0	Yes	biosystem.obo	2009/01/18

ATOL: the context



Context of the establishment of ATOL

1) Numerous ontologies in biology (such as PATO-Phenotypic Quality Ontology, ChEBI, Digital Morphology, Zebrafish Anatomical Ontology, Disease Ontology, Infectious Disease Ontology, Mouse Pathology, Gene Ontology, Mouse Genome Informatics...)



2) Those focused on phenotype (Human Trait Ontology, Mammalian Phenotype Ontology...) mainly concern the human or animal models used to study human diseases.



⇒ Building of an ontology of normalized traits for farm animals « **ATOL** » (**Animal Trait Ontology for Livestock**), by INRA (department PHASE) and Iowa State University.

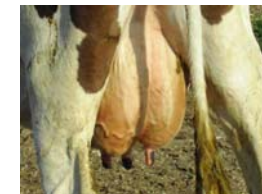


ATOL: the objectives

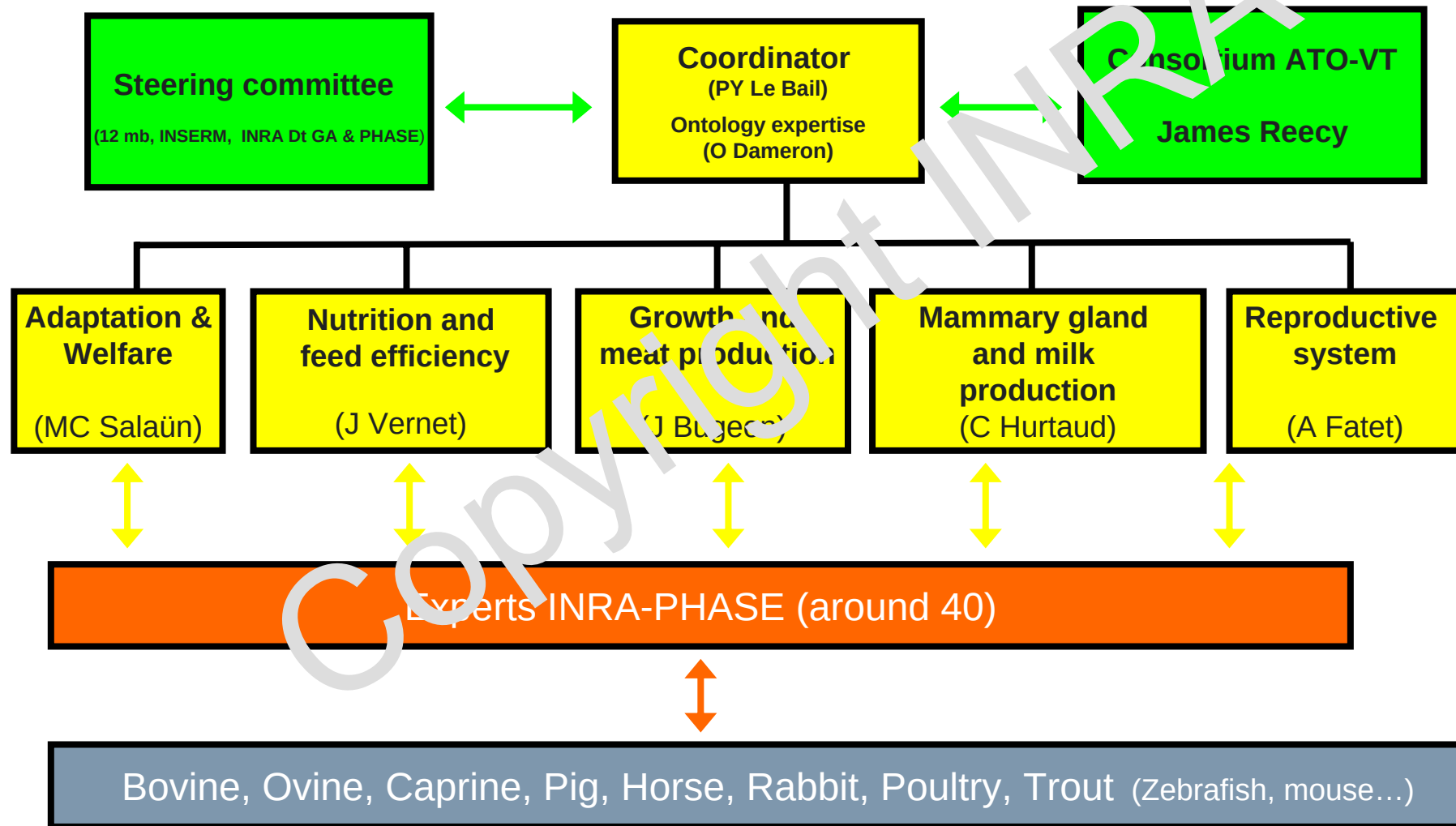
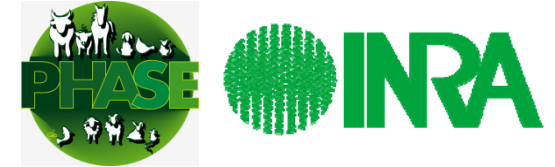


The objectives of ATOL

1. To have **a reference ontology** for phenotyping of farm animals shared by international scientific and teaching community.
2. To have a **language usable by software** (data basis management, semantic analysis, modeling...)
3. To have the traits as **generic** as possible
4. To have the ontology as **efficient** as possible and close to technical measurements
5. To have a structure applied to **production** targets



ATOL : Structure and network



Structure of the French ATOL network

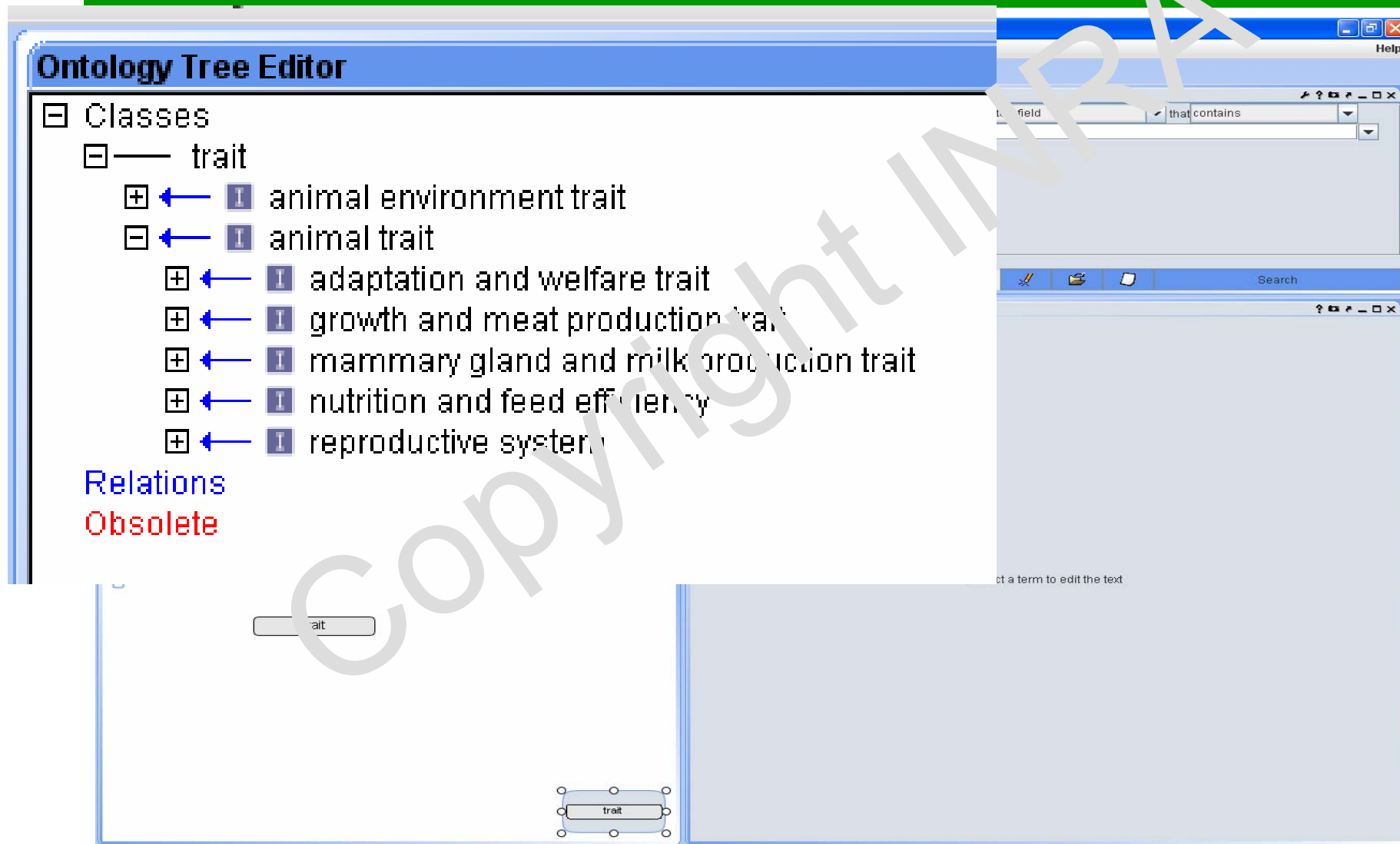


	Cattle	Sheep	Goat	Pig	Horse	Rabbit	Poultry	Rainbow trout	Mouse	Zebrafish
Adaptation and welfare trait (MC Salaün)	×	×	×	×	×	×	×	×	×	
Reproductive system (A. Fatet)	×	×	×	×	×	×	×	×	×	×
Nutrition and feed efficiency (J. Vernet)	×	×	×	×	×	×	×	×	×	×
Mammary gland and milk production (C. Hurtaud)	×	×	×	×		×			×	
Growth and meat production (J. Bugeon)	×	×		×		×	×	×	×	×

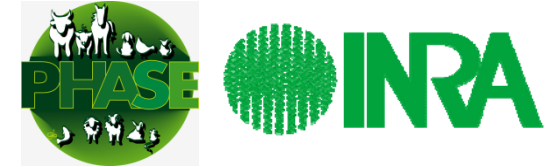
ATOL : Structure



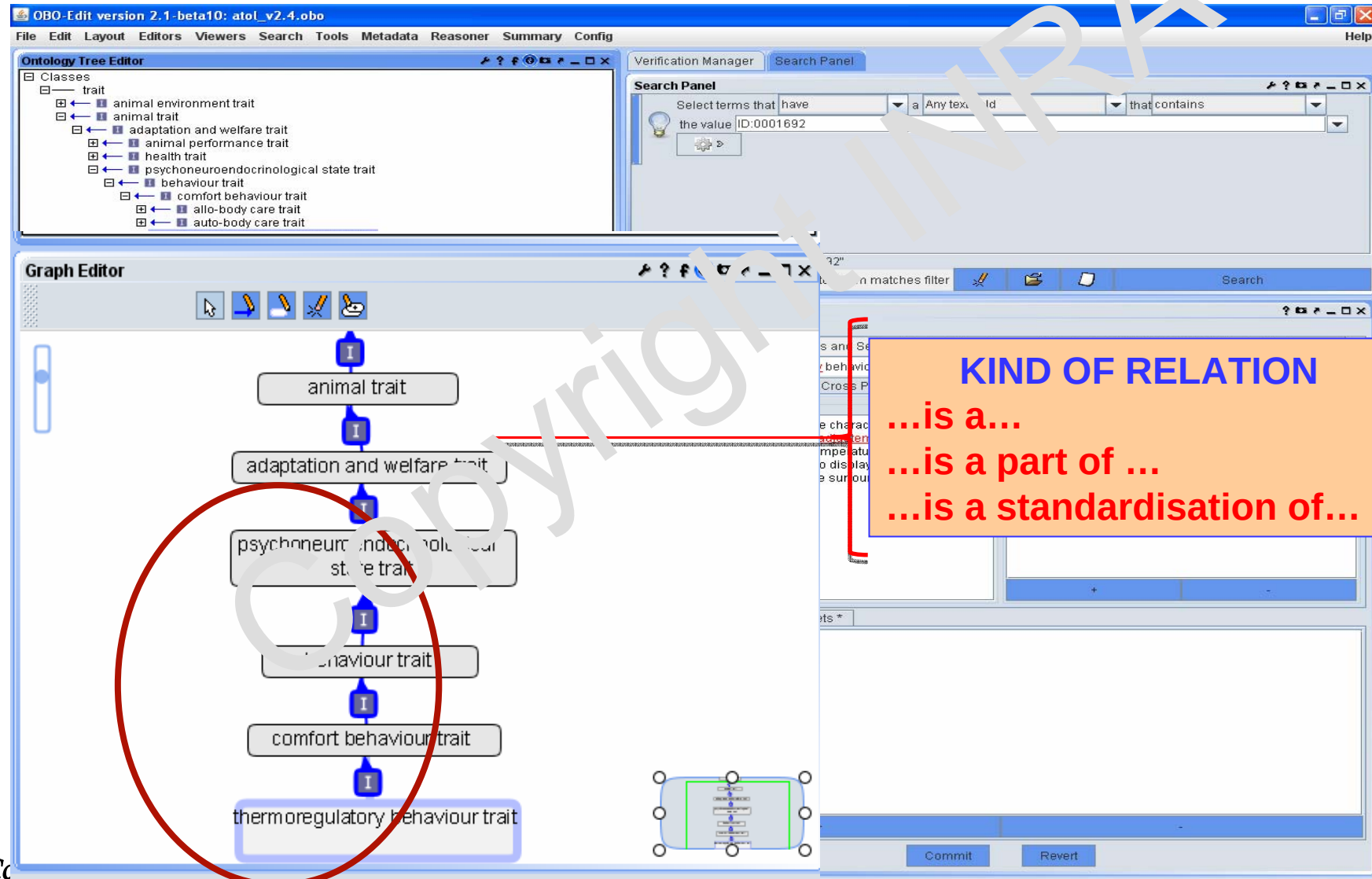
1) Hierarchy



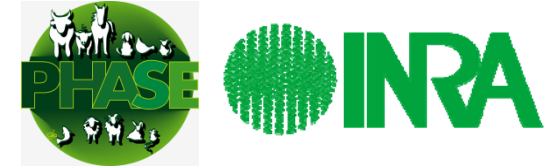
ATOL : Structure



1) Hierarchy



ATOL : Structure



2) Definition and identification

Text Editor (3 warnings)

ID: PH:0000829

Namespace: file:C:/Documents and Settings/hurtau.../Me.../Me.../Me...

Name: thermoregulatory behaviour trait

Definition *
any measurable or observable characteristic related to physiological and behavioral adjustments to maintain a stable and constant central temperature whatever the surrounding temperature, or to display a variation of temperature dependent on the surrounding

Dhvre: INRA:PHASE, INRA PHASE

Phenotypes
Genes
Epigenetic regulation
mRNA
Proteins
QTL

Graph Editor

animal
adaptation
psychoneuroendocrinological state trait
behaviour trait
comfort behaviour trait
thermoregulatory behaviour trait

Poultry (Poultry)	☒
Rabbit (Rabbit)	☒
Rainbow_trout (Rainbow_trout)	☒
Sheep (Sheep)	☒
Turkey (Turkey)	☒
Zebrafish (Zebrafish)	☐

Commit Revert

ATOL : Structure



3) Species

OBO-Edit version 2.1-beta10: atol_v2.4.obo

File Edit Layout Editors Viewers Search Tools Metadata Reasoner Summary Config Help

Ontology Tree Editor

- Classes
 - trait
 - animal environment trait
 - animal trait
 - adaptation and welfare trait
 - animal performance trait
 - health trait
 - psychoneuroendocrinological state trait
 - behaviour trait
 - comfort behaviour trait
 - allo-body care trait

Search Panel

Select terms that have a Any text field that contains the value ID:0001692

Xrefs Synonyms Subsets *

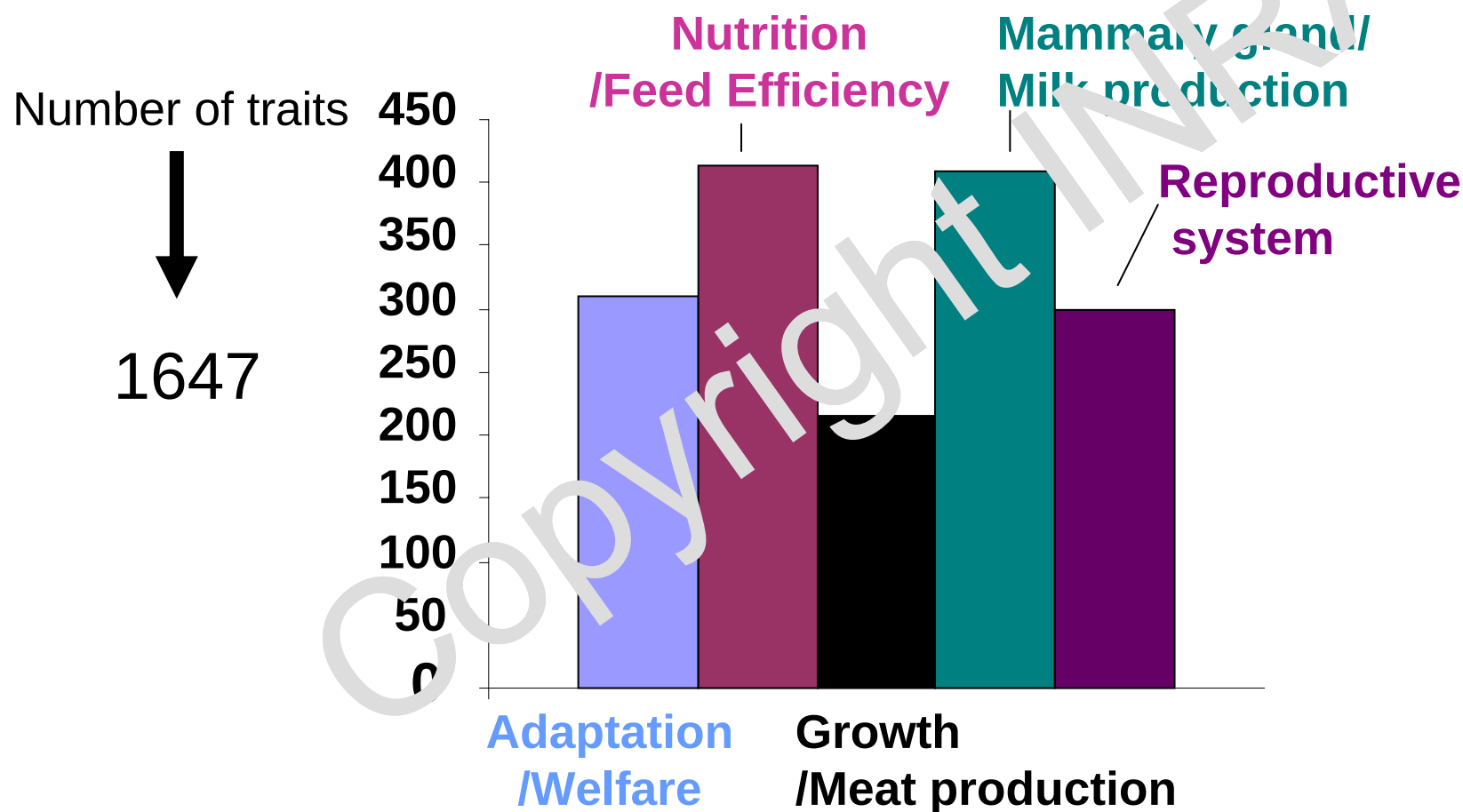
Cattle (Cattle)	☒
Chicken (Chicken)	☐
Goat (Goat)	☒
Horse (Horse)	☒
Mouse (Mouse)	☒
Pig (Pig)	☒
Poultry (Poultry)	☒
Rabbit (Rabbit)	☒
Rainbow_trout (Rainbow_trout)	☐
Sheep (Sheep)	☒
Turkey (Turkey)	☐
Zebrafish (Zebrafish)	☐

Commit Revert

Ontology : ATOL



not still finished, need always to be improved



improvement : new traits, definition, validation by species, relationships

A collection of ten line drawings of various farm animals, arranged in a grid-like fashion. The animals include a horse, a rooster, a turkey, a cow, a pig, a sheep, a goat, and a dog. The drawings are simple and stylized, with some animals having small, handwritten labels next to them.

Ontology on the
environnement of animals
(Experimental conditions,
farming systems)

**Reference index
required
by scientific journals**

[illegible]

Copyright is forbidden without author's permission

ICAR June 22-23 Bourg-en-Bresse, France

Ontology on the environnement of animals

On going on fish in European project Aquaexcel

[illegible]

Referential of SOP: Standard Operating Procedure (phenotypic measure or reference article)

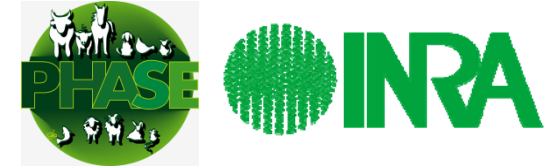
[illegible]

Database on methods : first draft



Recensements des données par la Cellule Qualité du département PHASE									
Base de Données des Modes Opératoires techniques									
Quelques exemples de mots clefs par colonne									
Méthodes : observation, dosage, gestes techniques, prélèvements, traitements									
Matrice : muscle, foie, urine, sang, plasma ...									
Métabolite : acides aminés, CO2, glucose ...									
Unit	Species	Method	Biologic	substrate	Procedure	Contact person	Publication		
16	lapin, souris	prélèvement	glande mammaire		prélèvement de lait	C. Hue-Beauvais (vangneng@jouy.inra.fr)	NON		
17	GPL	observation	glande mammaire		Whole Mount - Montage in toto	M. Charlier (madia.charlier@jouy.inra.fr), C. Hue-Beauvais	NON		
18	NUAGE	Poisson	dosage	aliment - matière première	glucose	Détermination de l'amidon	breque@st-pee.inra.fr	oui	
19	NUAGE	Poisson	dosage	féces	Cr2O3	Détermination de l'oxyde de chrome	breque@st-pee.inra.fr	oui	
20	NUAGE	Poisson	dosage	aliment-matière première-poisson-féces	matière sèche	Détermination de la mat. sèche - Gravimétrie par étuve	Marie-Josée Borthaire@st-pee.inra.fr	oui	
21	NUAGE	Poisson	dosage	muscle	amine	Détermination de la teneur en amines biogènes - Chromatographie « phases inverses »	breque@st-pee.inra.fr	oui	
22	NUAGE	Poisson	dosage	plasma	acide aminé	Détermination de la teneur en acides aminés - Extraction des acides aminés libres dans le plasma	breque@st-pee.inra.fr	oui	
23	NUAGE	Poisson	dosage	aliment-matière première	acide aminé	Détermination de la teneur en acides aminés - Hydrolyse en phase liquide	breque@st-pee.inra.fr	oui	
24	NUAGE	Poisson	dosage	aliment-matière première-tissus	acide aminé	Détermination de la teneur en acides aminés - Séparation par chromatographie en phase inversée (HPLC)	breque@st-pee.inra.fr	oui	
25	NUAGE	Poisson	dosage	plasma	acide aminé	Détermination de la teneur en acides aminés libres totaux - Spectrophotométrie par absorption	breque@st-pee.inra.fr	oui	
26	NUAGE	Poisson	dosage	aliment-matière première-poisson-féces	energi	Détermination de l'énergie brute	Marie-Josée Borthaire@st-pee.inra.fr	oui	
27	NUAGE	Poisson	dosage	aliment-matière première-tissus-féces		Détermination de l'indice de peroxyde - Méthode au thiocyanate de fer	stephanie.fontagne@st-pee.inra.fr	oui	
28	NUAGE	Poisson	dosage	aliment-matière première-poisson-féces		Détermination des cendres brutes	Marie-Josée Borthaire@st-pee.inra.fr	oui	
29	NUAGE	Poisson	dosage	aliment-matière première		Détermination des lipides (Soxtherm)	larroquet@st-pee.inra.fr	oui	
30	NUAGE	Poisson	dosage	muscle	lipide	Détermination des Lipides selon la méthode de Folch	larroquet@st-pee.inra.fr	oui	
31	NUAGE	Poisson	dosage	aliment-matière première-poisson-féces	azote	Détermination des protéines (azote total)	Marie-Josée Borthaire@st-pee.inra.fr	oui	
32	NUAGE	Poisson	dosage	plasma		Détermination des protéines par la méthode de Bradford	Christiane.Vachot@st-pee.inra.fr	oui	
33	NUAGE	Poisson	dosage	aliment-matière première-poisson-féces	phosphore	Détermination du phosphore total	breque@st-pee.inra.fr	oui	
34	NUAGE	Poisson	dosage	œufs-larves	az	Dosage de l'azote ammoniacal et de l'azote uréique dans les œufs et	Christiane.Vachot@st-pee.inra.fr	oui	
35	NUAGE	Poisson	extraction	foie	ARN	Extraction d'ARN totaux du foie de poissons	Elisabeth.Plagnes-Juan@st-pee.inra.fr	oui	
36	NUAGE	Poisson	traitement échanti	muscle-féces		Lyophilisation	Marie-Josée Borthaire@st-pee.inra.fr	oui	
37	NUAGE	Poisson	dosage	foie		Mesure de l'activité de l'uricase dans le foie (1.7.3.3)	Christiane.Vachot@st-pee.inra.fr	oui	
38	NUAGE	Poisson	dosage	foie	NAD	Mesure de l'activité de la Glucose-6 Phosphatase (3.1.3.9)	Christiane.Vachot@st-pee.inra.fr	oui	
39	NUAGE	Poisson	dosage	foie	NADH	Mesure de l'activité de la glutamate deshydrogénase (GDH 1.4.1.2)	Christiane.Vachot@st-pee.inra.fr	oui	
40	NUAGE	Poisson	dosage	foie	NAD	Mesure de l'activité de la Phosphoenol Pyruvate Carboxykinase dans le	Christiane.Vachot@st-pee.inra.fr	oui	
41	NUAGE	Poisson	dosage	foie	NAD	Mesure de l'activité de la pyruvate kinase dans le foie (PK 1.2.4.1)	Christiane.Vachot@st-pee.inra.fr	oui	
42	NUAGE	Poisson	dosage	foie	NADPH	Mesure de l'activité de l'hexokinase (2.7.1.1) et de la glucokinase (2.7.1.2)	Christiane.Vachot@st-pee.inra.fr	oui	
43	NUAGE	Poisson	dosage	aliment-matière première-muscle	acide gras	Séparation des acides gras par chromatographie en phase gazeuse (CPG)	larroquet@st-pee.inra.fr	oui	
44	NUAGE	Poisson	dosage	muscle	lipide	Séparation des lipides neutres et polaires sur mini colonne de silice	larroquet@st-pee.inra.fr	oui	
45	PAIB	toutes espèces	technique	tous	peptides	Dessalage des protéines et peptides par Zip Tip® C4 ou C18	Y. Labas	non	
46	PAIB	toutes espèces	technique	tous	peptides	Digestion des protéines en gel	Y. Labas	non	
47	PAIB	toutes espèces	technique	tous	peptides	Digestion des protéines standard en solution	Y. Labas	non	
48	PAIB	toutes espèces	technique	tous	peptides	Enrichissement des phosphopeptides	Y. Labas	non	

ATOL : perspectives

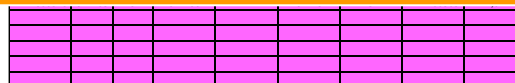


1) Links with other tools or ontologies



Standardized Procedure
Quality policy

Reference index
required
by scientific journals



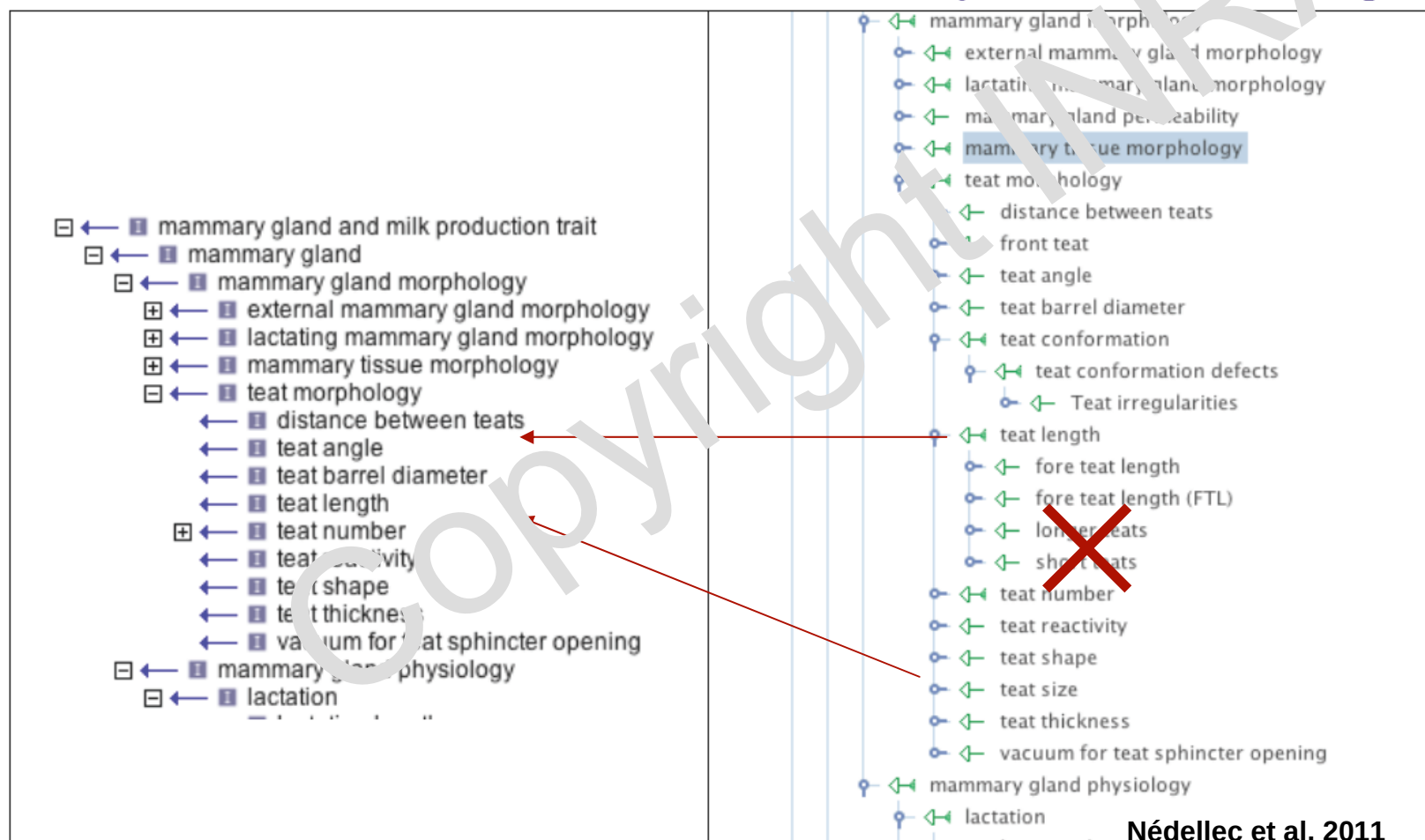
Work between experts from ATOL and experts of semantic research

Addition of new traits



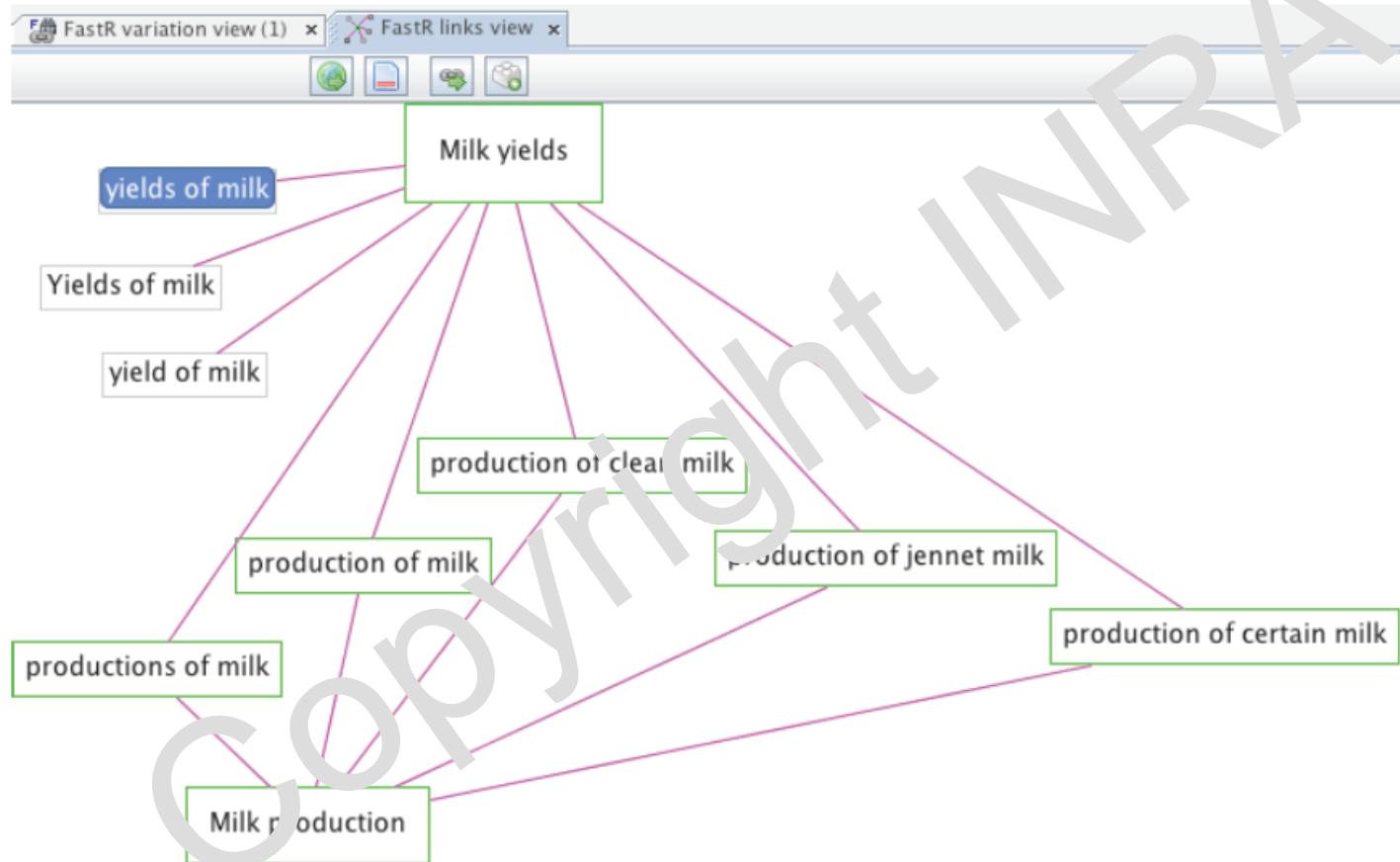
ATOL 2.3

ATOL enriched by term extraction from corpus of the journal Animal



Work between experts from ATOL and experts of semantic research

Addition of synonyms



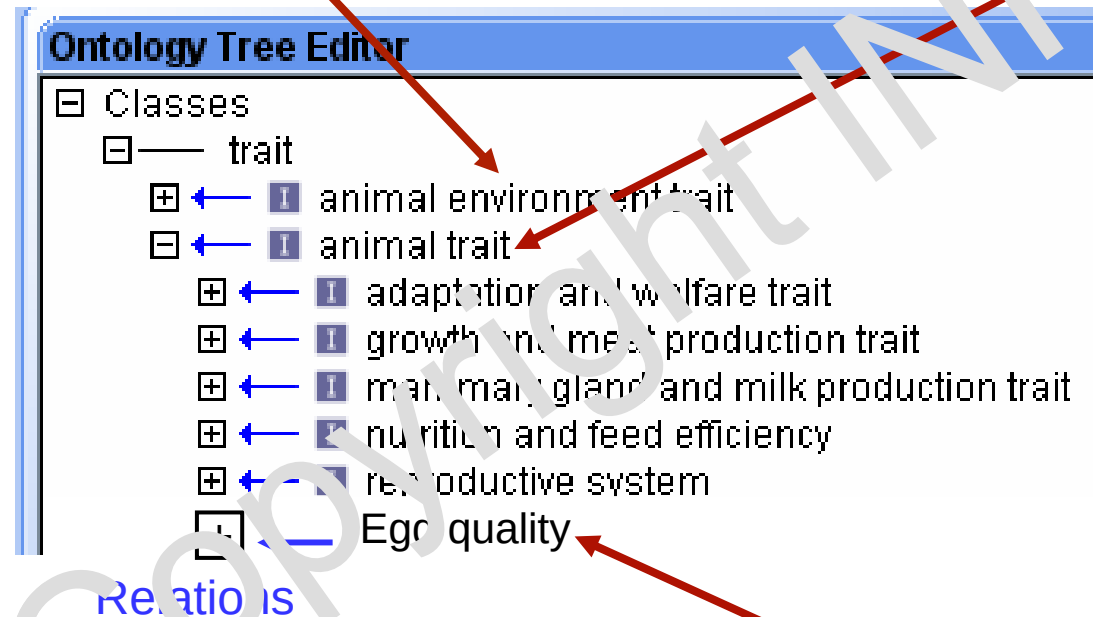
Nédellec et al, 2011

Conclusion



All species

New traits



Improvement

Egg quality

ATOL : Thanks for your attention



ATOL

