EOL: a new ontology for livestock system and rearing conditions

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Precision Livestock Farming challenges: to have

* Animals:
  - efficient in regards to feeding resources
  - robust and adaptable to climate changes / diversity of production systems

* Farming systems:
  efficient management of the production to generate high level of products for consumers and society issues

Exploitation of phenotype databases

Identification of phenotypes

The phenotype is the resultant of the expression of the genotype (G) and the influence of the environment (E) and epigenetic mechanisms (Epi)

\[ P = G + E + E_{pi} \]
A tool for new challenges
Precision Livestock Farming and Phenotyping

* knowledge on biological mechanisms more and more complex
* increasing amount of informations
* diversification of community of users

Need to store and analyse huge mass of information on the basis of a language understood by computer and any users

Necessity to have standardized and shared language

Ontology tool

Informatic storage
Capacity of sequencing

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What is an ontology?

Definition:
formal representation of concepts and of relationships between these concepts within a subject or a specific area.

Characteristics:
• 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
ATOL-EOL: ontologies for farm animal and environment applied to productions targets

www.atol-ontology.com

<table>
<thead>
<tr>
<th>Ontologies</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATOL</td>
<td>ontology of animal trait for livestock</td>
</tr>
<tr>
<td>AquaExcel-ATOL</td>
<td>ontology of fish trait for livestock</td>
</tr>
<tr>
<td>EOL</td>
<td>ontology of environment for livestock</td>
</tr>
</tbody>
</table>

Animal issue

ATOL
Animal Trait Ontology for Livestock

2048 normalized traits 07/2013
phenotypic traits
multispecies

EOL
Environment Ontology of Livestock
environmental conditions of animal productions

630 parameters 07/2013

EAAP 2012

EAAP 2013 Nantes: Session 61
How was the EOL ontology built?

- Check the current ontologies on the environmental features and habitats (especially ENVO: environmental ontology)

- Parameters on environment of fish species identified within the European project AQUAEXCEL (Aquaculture infrastructures for excellence in European fish research)

- Bibliographic analysis (books, papers): new parameters

- Experts group from INRA: first draft of an hierarchy for aquatic and terrestrial animal productions

- Validation of the hierarchy for aquatic productions by experts of AQUAEXCEL project
current progress : ontology completed by new parameters concerning especially the terrestrial productions (ruminant, pig, poultry)
EOL: a reference for the environment parameters

Structure of EOL

Hierarchy with 4 main branches

describe livestock systems, practices, environmental conditions

⇒ EOL: a reference for the environment parameters
Hierarchy of EOL ontology:

more details …

- Diet characteristics
delivery conditions

- Life surrounding

- Physical characteristics of the structure where animals live

- Livestock system where animals are raised

- information used to investigate how the livestock environment and practices impact the phenotypic traits of the animals (ATOL)
What information by parameter?

- Ref of similar parameter in another ontology
- Any measurable or observable characteristic related to the delivery process of feed to livestock
- Other name or synonym used to databases or publications on definition, species specificity, ...
- Standardized procedure
How to use data

ex: how the animal is fed?

Reference parameter

- Chain-feeding system: EOL:0001664
- Feeder filled daily: EOL:0001751
- Group feeding: EOL:0001755
- Ad libitum feed delivery: EOL:0001740
What applications of the ATOL/EOL ontologies databases for users, index for scientific journal, modelling approach

Reference index

ATOL
Animal Trait Ontology for Livestock
Animal trait

EOL
Rearing environment
Livestock systems
Environment of trait

RSOP
Referential of Standard Operating Procedure
How to measure the trait

Experimental research
Phenotype databases
Metaanalysis, modelling approaches

Semantic research
Automatic research in scientific and technical documents

animal trait, environmental parameter, measure method
### Datasets on the 1 year-weight of trouts raised

<table>
<thead>
<tr>
<th>Trial 1 at 10°C</th>
<th>Trial 2 at 12°C</th>
<th>Trial 2 at 15°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>number</td>
<td>Liveweight</td>
<td>number</td>
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<tr>
<td>1</td>
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<td>21</td>
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<td>...</td>
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</tbody>
</table>

#### Metadata

- **EX**: Trials 1 and 2

#### Atol

- **ontologie of animal traits**
  - ATOL:0000351: Body Weight
  - ATOL:0000088: Age (1 year)

#### Eol

- **ontologie of livestock environment**
  - EOL:0000034 : Water temperature
    - (10 °C - 12 °C - 15 °C)

⇒ ATOL/EOL ontologies allow the annotation of phenotyping databases with shared language
in conclusion

to promote standardized and shared language useful for the diversity of users

> to extend the ontology Animal Trait Ontology for Livestock

> impact of environment on the phenotypic trait

 Ferdinando called the online tool **Animal Trait Ontology for Livestock** to extend the ontology Animal Trait Ontology for Livestock. The tool allows to extend the ontology Animal Trait Ontology for Livestock. The tool allows to promote standardized and shared language useful for the diversity of users. The tool allows to promote standardized and shared language useful for the diversity of users.
Welcome to the website: www.atol-ontology.com

Contribute as experts in animal sciences

Contact the coordinator of the project Pierre-Yves.LeBail@rennes.inra.fr

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1) Asking for login and password

› Send an email to Pierre-Yves LeBail including:
› Your first name, your last name and your organism (e.g. INRA).
› The ontology to which you wish to contribute (there may be several).
› Your domains of interest and expertise.
› Species of interest as appropriate.

You will receive an username, a password and an address to connect to the collabora
Thanks for your attention

Welcome to the website

www.atol-ontology.com