

Robustness, from a woolly concept to operational measures

Presentation of the module

Farm animals are constantly facing perturbations due to changing environmental and farm conditions, which influence their performance and health. Characterization of animal response when faced with these perturbations is of main concern to ensure a sustainable production. Indeed, a better understanding of the adaptation mechanisms used by the animal to cope with these perturbations (through resistance and resilience) is a prerequisite to propose adequate farm management strategies and for the development of precision livestock farming systems. Several experimental studies were conducted to investigate the influence of environment on the performance of farm animals. To get the most out of experimental data, the use of mathematical models is necessary to consider the systemic aspect of animal response. Accordingly, in this course, we will discuss different modelling tools to quantify and characterize the animal's adaptive response and the robustness trait.

Course objectives

- (1) To provide the elements for understanding the concept of animal robustness as a complex, multi-level and dynamic concept. We will also discuss its relevance in management strategies.
- (2) To discuss the multi-components aspect of robustness, and the fact that the trade-off between different functions (e.g. survival, production and reproduction) is necessary to ensure the robustness of an animal.
- (3) To provide mathematical and statistical tools to characterize and quantify this important trait.

It is worthwhile to mention that this course helps the participants to boost their international network.

Pedagogic strategy

The school includes plenary lectures, practical works and seminars. We put a focus on time dedicated to practical works and discussions (at least 50 percent of school time).

Prerequisite/ target audience

The school is addressed to French and International PhD students, all biologists and animal scientists (Post docs, educational staff and professional) interested in the robustness concept and the modelling tools to characterize it.

Basic notions on biology, mainly the concept of robustness is appreciated. You **do not need** to be modeller for participation in this school.

Program

1. Introduction to the robustness, animal adaptation and resilience faced with different types of perturbation (e.g. sanitary and nutritional challenges, heat stress and any types of environmental perturbations).
2. State of the art of current problems in breeding programs for different species of farm animals and the influence on production performance: e.g. acidosis in ruminants, diarrhea at weaning for monogastrics, non-controlled environmental perturbations, etc.
3. New technologies of phenotyping: from high throughput omic data at different levels to high frequency data of precision livestock systems.
4. Statistical and mathematical methods for modelling and analysis of phenotyping data; to extract biological meaningful information, especially to quantify the robustness trait. In this part of the course, we explain that the type of data drives the choice of the adequate analysis strategy.
5. Finally, we discuss the possibility for the farmers and breeding companies to apply these robustness indicators.

Practical information

Registration form

<https://docs.google.com/forms/d/1L4I8jw5j-9aLV5IRulf8IMS74mleh3ePfKMvniMGlpw/prefill>

Please send your CV and the agreement of your supervisor/head of department to

Masoomah.Taghipoor@inra.fr

Cindy.Eyma@agroparistech.fr

Registration deadline: February 2019

Date: 1 – 5 April 2019

Location: AgroParistech, Paris

Course fee

PhD student: The module is free of charge

Young scientists and professional: 400 euros

The course registration includes course materials and coffee breaks.

Lunch, diners and accommodation are in charge of candidates.

Organisers	Invited Speakers
Masoomeh Taghipoor (Inra, MoSAR) Celine Domange (AgroParisTech, MoSAR) Lucile Montagne (AgroCampusOuest, Pegase) Nicolas Friggens (Inra, MoSAR) Rafael Munoz Tamayo (Inra, MoSAR) Christelle Loncke (AgroParisTech MoSAR) Sylvie Giger Reverdin (Inra, MoSAR) Philippe Schmidely (AgroParisTech, MoSAR)	Florence Gondret (Inra, Pegase) Margaret Kelleher (ICBF) Helen Leclerc (Inra, GABI) Alban Thomas (Ifip) Jaap vanMilgen(Inra, Pegase) Andrea Wilson (Royal School of Veterinary Studies)

Day 1 (Monday 01/04/2019)

Introduction to the concept of robustness

Time	Title	
9:30-10	Module presentation	M. Taghipoor
10-10:30	Small quiz on robustness	
10:45-12:30	Cours1.a. Concept of robustness	F. Gondret L. Montagne N. Friggens
13:45-15	Practical work: presentation of case studies	S. Giger Reverdin R. Munoz Tamayo M. Taghipoor
15:30-17	Cours1.b. Concept of robustness	F. Gondret L. Montagne N. Friggens
17-17:30	Discussion on the responses to the quiz	

Day 2. (Tuesday 02/04/2019)

State of the art of current problems and data collecting

Time	Title	
9 - 10:30	Seminar 1. What is behind the selection in breeding companies and the necessity to quantify the robustness	A. Thomas
10:45-12:30	Practical work: discussion a. Robustness at each case b. Quantification of adaptive response depends on the type/frequency of data collected	Organisers
13:45-15:15	Seminar2. What is behind the selection in research institutes and the necessity to quantify the robustness	H. Leclerc
15:30-17:30	Practical work: development of the conceptual model	Organisers

Day 3. (Wednesday 03/04/2019)

Difficulties for collecting data: a history and new technologies + Mathematical tools to treat data

Time	Title	Who/How
9 - 11	Course3. New technologies for phenotyping	C. Loncke J. vanMilgen
11:15-12:30	Work on case studies : link with available data	Organisers
14-15	Cours4. Mathematical methods to characterize robustness	R. Munoz Tamayo M. Taghipoor
15:30-17:30	introduction to softwares for practical work	Organisers

Day 4. (04/04/2019)

Application of robustness for farmers + case studies on software

Time	Title	Who/How
9-10:30	Seminar3. Advantages and constraints for farmers, breeding companies to apply these indicators	Margaret Kelleher (ICBF)
10:45-12:30	Practical work: modelling and simulation	Organisers
13:30-15:30	Presentation of research topics	
16-17:30	Practical work: modelling and simulation	Organisers

Day 5. Conclusion

9-10:30	Presentation of a case study	Andrea Wilson
11:12:30	Work on group to present the results	Organisers
13:30-15	Presentation of the results	Participants
15:15-16:15	Presentation of the results	Participants
16:15-16:30	Take home message	Organisers