Course Specifications

Valid as from the academic year 2020-2021

Functional Abiotic Interactions (C003331)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)

Credits	Study time	Contact hrs
6.0	180 h	75.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	Gent	lecture	30.0 h
			seminar: coached exercises	5.0 h
			self-reliant study activities	10.0 h
			excursion	15.0 h
			microteaching	15.0 h

Lecturers in academic year 2020-2021

Braeckman, Bart	WE11	lecturer-in-charge
Van Der Straeten, Dominique	WE11	co-lecturer
Willems, Anne	WE10	co-lecturer

Offered in the following programmes in 2020-2021	crdts	offering
Master of Science in Teaching in Science and Technology (main subject Biology)	6	A
Master of Science in Biology	6	A
Exchange Programme in Biology (master's level)	6	A

Teaching languages

English

Keywords

prokaryotes, plants, animals, abiotic interactions, light, temperature, salinity, stress.

Position of the course

The central theme of this course is the interaction of organisms with their abiotic environment. By using the knowledge acquired in the courses of microbiology, plant and animal physiology, the students will gain deeper insight in how an organism copes with fluctuating and extreme environmental factors. A physiological approach will be used, but underlying molecular and evolutionary aspects will receive attention as well. The student will gain insight in the links between physiological adaptation, ecology and biodiversity.

Contents

Prokaryotic interactions with the environment:

- One and two-component systems as common systems to react on external cues.
- Chemotaxis, bacterial mobility
- Bacterial mobility on surfaces (twitching, gliding, swarming) that are essential for life in biofilms
- Response to light, including several bacterial mechanisms of photosynthesis (rhodopsin-based light response and other systems), UV protection.
- Bacterial differentiation as a response to environmental stimuli: sporulation and reversal to a viable, non-culturable stage as survival strategy during starvation or stress.

Interactions of plants with their environment:

- Communication within a plant community: Signaling through volatile organic compounds, neighbour detection
- Stress caused by heavy metals and organic pollutants
- Temperature extremes: cold stress, heat stress

- Drought stress
- Salt stress
- Flooding stress
- Light stress: importance of light intensity and spectral variation; UV stress
- Ozone stress, oxidative stress
- Mechanical stress by wind and wounding

Animal interactions with the environment

- Temperature (temperature effects, thermobiology, thermoregulation)
- Water balance, osmoregulation and excretion
- Extreme marine environments
- Extreme terrestrial environments
- Physiological orientation and navigation systems

Tutorials:
During a few tutorials, students will have a journal club and/or will make a synthesis based on literature provided.
When possible, an excursion is planned.

Initial competences

Succesfull completion of Cell Biology, Biochemistry, Microbiology, plant and animal physiology or having obtained the competences stated in these courses in another way.

Final competences

1 To explain the response of bacteria to various external parameters in the light of the action of two-component systems.
2 To explain the mechanism of action or the current mechanistic hypotheses behind the different forms of bacterial motility.
3 To demonstrate the different ways in which light can be used by microorganisms to support their life style.
4 To illustrate bacterial differentiation using the example of sporulation.
5 To understand the importance and implications of the viable-non-culturable status of bacteria.
6 To interpret the relevance of the natural interactions between the abiotic components temperature and osmolarity in animals.
7 To indentify and qualitatively describe the thermal relations between animals and their environment.
8 To situate the thermal relations of animals and their environment at different spatial and temporal scales (from acute responses to evolutionary adaptations, from biochemical effects to changes with respect to the whole individual).
9 To explain the thermal strategies of ecto- and endotherms.
10 To explain osmotic strategies employed by terrestrial, limnetic and marine species.
11 To describe the phenotypic response of plants to volatile signals and upon plant competition.
12 To illustrate and explain the mechanism of plant communication by means of volatile signals and through neighbor detection.
13 To describe the phenotypic response of plants to abiotic stresses and apply this knowledge to design genetic screenings.
14 To illustrate and explain the mechanism of plant responses to abiotic stresses.
15 To identify strategies to control abiotic stress reactions and evaluate their relevance.
16 To collect, integrate and critically evaluate new information, for example from a review paper in the domain, together with related information from other disciplines.
17 To orally, using a slide presentation, summarize and present new information to other students (possibly in a second language).

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Excursion, lecture, microteaching, self-reliant study activities, seminar: coached exercises

Learning materials and price

- Syllabus with text and slides. Part Zoophysiology is published by Academia Press.
- Total estimated cost: 30 EUR

References

- Willmer, Stone and Johnston (2000) Environmental Physiology of Animals. Blackwell Science, Oxford.

- Hill, Wise and Anderson (2004) Animal Physiology. Sinauer Associates, Sunderland Massachusetts (USA).
- Taiz and Zeiger, Plant Physiology, Sinauer Press, 2010.
  The Molecular Life of Plants, Jones et al., 1st edition, Wiley-Blackwell, 2013
- Brock Biology of Microorganisms, 15th edition 2019, Madigan, Bender, Buckley, Sattley & Stahl. Pearson Education Inc. ISBN 978-1-292-23510-3.

Course content-related study coaching

Questions can be raised at all time during the lectures, the excursion or via the Ufora forum.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination, oral examination

Examination methods in case of periodic evaluation during the second examination period

Written examination, oral examination

Examination methods in case of permanent evaluation

Participation, assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

Periodical evaluation: open questions (oral with written preparation), terminology and multiple choice (written).

Calculation of the examination mark

- Periodical evaluation (80%)
- Non-periodical evaluation (20%).

For the periodic evaluation, the following applies: if a score of less than 10/20 is obtained for one of the components (partim prof. Braeckman, partim prof. Van Der Straeten en partim prof. Willems), a student cannot pass for the whole of the course, even if the mathematical final score would be a number of ten or more on twenty. In such case, the final score will be reduced to the highest fail grade (9/20).
The marks for the non-periodical evaluation are again taken into account in the second examination period.