GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2018-2019

Developmental Biology (C003762)

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

Credits	4.0	Study time	109 h	Contact hrs	29.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	Dutch	lecture	25.0 h
		seminar	3.75 h

Lecturers in academic year 2018-2019

Beeckman, Tom	WE09	lecturer-in-charge
Vleminckx, Kris	WE14	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Bachelor of Science in Biochemistry and Biotechnology	4	A
Linking Course Master of Science in Biochemistry and Biotechnology	4	A

Teaching languages

Dutch

Keywords

Organogenesis, morphogenesis, patterning, differentiation, signaling, cell communication, morphogens, growth factors, cell adhesion, cell migration, stem cells, meristems, model systems

Position of the course

This course describes the development of animals and plants with a strong focus on the underlying molecular mechanisms. The field of developmental biology constitutes an ideal frame to integrate several disciplines of the bachelor program (molecular biology, cell biology, physiology, biochemistry and genetics) that are centrally involved in processes as differentiation, morphogenesis and organogenesis. Emphasis lies on the cellular and molecular aspects of development with special focus on the genes and signaling pathways involved.

Contents

A first section describes the principles and basis of developmental biology. A description of the concepts and the molecular and genetic techniques and strategies (gene expression analysis, gain-of-function and loss-of-functionexperiments) is followed by a discussion of the signaling pathways and the different molecular players involved in animal development. Special emphasis will be put on the cellular aspects of morphogenesis and the molecular basis of intercellular communication during embryogenesis. This knowledge is used in a second section discussing the different stages of development in selected vertebrates and invertebrates, focusing on the formation of the body plan, establishment of the axes and the germ layers and on patterning. This is followed by a section discussing late embryonic development and organogenesis, including the formation of the derivatives of the central nervous system, the neural crest, the mesoderm and the endoderm. Finally, formation of the limbs and the gonads is described and embryonic, adult and induced pluripotent stem cells are discussed. Emphasis is put on the molecular aspects of cell-cell communication during embryogenesis and organogenesis.
Next, the characteristics of development in plants are discussed: generation of the rudimentary body plan during embryogenesis and post-embryonic organogenesis via meristems during the entire life cycle. All stages of plant development will be discussed such as embryogenesis, shoot apical meristem activity, leaf, flower and root development, plant architecture, reproduction - the emphasis will be on molecular-genetic control mechanisms. Specific methods will be described (e.g. transgenesis,

mutagenesis, genome sequencing, dye-loading, laser cell ablation). A few gene classes will be studied in more detail related to transcriptional control and chromatin modeling (genetic versus epigenetic control). Genetic models will be presented that explain the balance between determinate and indeterminate growth in apical meristems, that clarify leaf initiation, flower formation and cell specification. The concept of evolutionary developmental biology explaining diversity will be illustrated by means of variation in genetic control of leaf and flower formation. A few applications of the fundamental knowledge in plant breeding will be discussed.

Initial competences

Basic knowledge of genetics, molecular and cell biology, physiology and biochemistry

Final competences

1 Have mechanistic insight in the most important developmental processes.
2 Have knowledge of the most prominent molecular players in developmental processes.
3 Be able to read and interpret the current scientifc literature.
4 Have insight into the experimental methodology and be able to reach relevant conclusions out of these experiments.
5 Be able to interpret potentially complex fenotypes of animals (including congenital diseases in humans) and plants.

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

Lecture, seminar

Learning materials and price

Multimedia presentations and electronic Syllabus with extensive list of figures; available via Minerva

References

Developmental Biology (2016), Scott F. Gilbert and Michael J. F. Barresi, 11th ed., Sinauer Associates.
Mechanisms of plant development (2003), Leyser & Day, Blackwell Science Ltd.

Course content-related study coaching

Interactive support via Minerva (e-mail) or personally: after the lectures or by appointment

Evaluation methods

end-of-term evaluation

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

Written examination with open questions, written examination with multiple choice questions

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

Written examination with open questions, written examination with multiple choice questions

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Written exam (with option for oral defence)

Calculation of the examination mark

2/3 for partim animals (Prof. Vleminckx)
1/3 for partim plants (Prof. Beeckman)