

PhD course: Wood Biology and Biotechnology

Oct 30-Nov 3, 2017

3 ECTS

Course description

Development of novel wood-based products requires an understanding of the biological processes that lead to wood cell differentiation including cell division, expansion, secondary cell wall formation and programmed cell death.

One week intensive PhD course provides a brief overview of wood organization, chemistry and structure in conifers and hardwoods, from the molecular level to the tissue organization level, followed by an update on molecular, genetic and physiological aspects of wood cell differentiation and cell wall formation. Current tools for studying wood structure and chemical composition, as well as the bioinformatics tools available for wood biology are introduced with practical demonstrations. Lectures and seminars are given by experts in the field. Many opportunities for social interactions and networking.

Organizers:

Prof. Ewa Mellerowicz, SLU, Sweden

Dr. Anna Kärkönen, Natural Resources Institute Finland, Luke, Finland

Prof. Teemu Teeri, University of Helsinki, Finland

Course literature:

Jörg Fromm – Cellular aspects of Wood Formation. Springer-Verlag Berlin Heidelberg 2013.
ISBN 978-3-642-36490-7

Approx. 20 research papers suggested by the lecturers.

Lecturers

1. Prof. Ewa Mellerowicz, UPSC, SLU
2. Dr. Urs Fischer, UPSC, SLU
3. Dr. Totte Niittyta, UPSC, SLU
4. Dr. Junko Takahashi-Schmidt, UPSC, SLU
5. Prof. Thomas Moritz, UPSC, SLU
6. Prof. Rishikesh Bhalerao, UPSC, SLU
7. Dr. Hannele Tuominen, UPSC, UU
8. Dr. Andras Gorzsas, UU
9. Dr. Nathaniel Street, UPSC, UU
10. Dr. Mattias Hedenström, UPSC, UU
11. Dr. Judith Felten, UPSC, SLU
12. Dr. Anna Kärkönen, Natural Resources Institute Finland, Luke (www.luke.fi)
13. Dr. Kaisa Nieminen, Univ Helsinki, Natural Resources Institute Finland, Luke
14. Dr. Marcus Rüggeberg, ETHZ, Switzerland
15. Prof. Geoffrey Daniels, SLU, Uppsala, Sweden
16. Prof. Björn Sundberg, Stora Enso, Sweden
17. Dr. Edouard Pesquet, SU, Sweden
18. Sven-Olof Lundqvist, INNVENTIA, Sweden

Labs/demo – Xylogenic cell cultures – Dr. Sacha Escamez, UmU

Bioinformatic resources – Dr. Nicolas Delhomme, UmU

Oct 30, 2017, Mon *Wood cellular organization*

- 09:00-09:15 Course Introduction [EM]
09:15-11:00 Lecture: Wood structure and ultrastructure, wood studies by microscopy [GD]
11:00-12:00 Lecture: Wood cellular development [EM]
13:00-16:00 Wood anatomy lab [GD + EM]
16:00-20:00 Mingle with refreshments and non-UPSC PhD students' poster session

Oct 31, 2017, Tue *Control of wood development*

- 9.00-9:30 Lecture: Model systems for studying wood formation (Xylogenic cultures, Arabidopsis, poplar, spruce) – [HT]
9.30 – 10.00 demo: Arabidopsis xylogenic system [SE]
10.15-12:00 Lecture: Molecular and hormonal control of cambial meristem identity, activity, and secondary wall formation [UF]
13.00-14.00 Lecture: Cambial seasonal activity and its regulation, seasonal effects on wood differentiation [RB]
14.00-15.00 Lecture: Reaction wood and growth stresses in trees [JF]
15:00-17:00 Seminars on hormonal control and cambial growth:
 Ethylene-[JF]
 Gibberellins – [TM]
 Cytokinins – [KN] " Cytokinin regulation of wood formation"

Nov 1, 2017, Wed *Wood cell wall biosynthesis*

- 09:00-10:30 Lecture: Carbon flux to wood and biosynthesis of cellulose – [TN]
10.30-12.00 Lecture: Biosynthesis and modification of hemicelluloses and pectins [EM]
13.00-14.00 Lecture: Role of cytoskeleton for secondary wall sculpturing [EP]
14:00-15:30 Lecture: Lignin biosynthesis and polymerization, lignin formation in spruce cell suspension systems - [AK].
15.30-16.30 Lecture: PCD in tracheary elements and fibers - importance for wood properties [HT]
16:30-19:00 Poster session by UPSC students with refreshments – manipulation of carbon flux, cellulose, hemicellulose, pectin, lignin, and PCD in trees

Nov 2, 2017, Thu *Wood cell and cell wall analysis*

- 09:00-10:00 Lecture: Wet chemistry methods and pyrolysis [JT]
10:00-11:00 Lecture: FT-IR & Raman (micro)spectroscopy and multivariate analysis [AG]
11:00-12:00 Lecture: NMR [MH]
13:00-15:00 Lab demonstrations: pyrolysis, NMR, FT-IR [JT, AG, MH]
15:00-16:00 Lecture: Analysis of cell walls by antibodies [UF]
16.00-17.00 Lecture: X-ray analysis of wood [MR]

Nov 3, 2017, Fri

- 09:00-10:00 Analysis of wood by Sylviscan - [SOL]

Bioinformatic resources

- 10:00-11:00 Bioinformatics resources for studying wood biology [NS]
11:00-12:00 Practicum on using bioinformatics resources [ND]
13.00-14.00 Practicum, cont

Biotechnology of wood formation

- 14.00-16.00 Towards improved wood production – Stora Enso biotech – [BS]
16.00-16:30 Course evaluation [EM, AK]
16.30-19.00 Pizza and beer with teachers