Ph.D. course: Biogeochemistry and the rhizosphere

Time and place: November 16 to 20 (2015) at University of Gothenburg, Sweden.
Price: there is no participation fee.
Value: 3 ECTS

Why is the rhizosphere a hot-spot for biogeochemistry ?

This is a Ph.D. course about: Priming, microbial ecology, mycorrhiza, belowground carbon and nitrogen transport and transformation, biomarkers.

Through lectures, exercises and discussions **you will get:** Knowledge of the concepts on microbial regulation of biogeochemical cycles. Understanding of mycorrhiza and other soil microbial community groups (incl. methodologies). Understanding of the mechanism of root exudation and 'priming' in the rhizosphere and the effect on soil physics, soil organic matter decomposition and release of CO_2. Practical 'priming' exercise to get a hands-on experience (^{13}C laser).

You need to: i) make a short presentation of own Ph.D. experiment with possibility to get feed-back from course participants and teachers. ii) Participate in all class-hours and the calculations and group discussions. iii) Read distributed literature before the course. iv) At the last day final assignments are assessed.

Confirmed lecturers: Prof. Yakov Kuzyakov (GA-University Göttingen), Dr. Per Bengtson (Lund University), Dr. Karina Clemmensen (SLU Uppsala), Dr. Jennifer Dungait (Rothamstead Research) and local teachers (University of Gothenburg).

How to apply: contact Louise before 15. October: louise.andresen@bot2.bio.uni-giessen.de

There is more between the plant root and the soil than we thought!

UNIVERSITY OF GOTHENBURG

GÖTEBORGS UNIVERSITET

Biogeochemistry – rhizosphere and soil processes, 3 credits

Course period:	Last day for application:
1 week, November 2015	2015-10-30

Course leader / Address for applications:

Louise C. Andresen / louise.andresen@bot2.bio.uni-giessen.de

Course description:

The course for Ph.D. students ('doktorander') is a one week theoretical course with lectures, discussions and calculation exercises. Preparation by reading the curriculum prior to the course is needed.

The focus on biogeochemistry in the rhizosphere signifies interaction of biological and geochemical processes. In this active zone many interactions between living organisms and the environment takes place with the organic and mineral soil: plant roots, mycorrhiza, bacteria, redox (also abiotic), saprotrophic fungi, soil organic matter and nutrients. Different terrestrial environments will be studied.

Responsible department and other participation departments/organisations:

Department of Earth Sciences

Teachers:

Dr. Louise C. Andresen (Course leader and main contact)
Other teachers to be announced

Examiner: Prof. Leif Klemedtsson

Faculty of Science; Department of Earth Sciences

Biogeochemistry- rhizosphere and soil processes, 3 hp

Third cycle education

1. Confirmation

The syllabus was confirmed by the Head of the Department of Earth Sciences 2015 – 06-22

Disciplinary domain: Science
Department in charge: Department of Earth Sciences

Main field of study: Biogeochemistry

2. Position in the educational system

Elective course; third-cycle education.

3. Entry requirements

Admitted to third cycle education.

4. Course content

The following topics:

A) 'Priming' is the process where plant roots leak soluble organic compounds (e.g. carbohydrates, amino acids and low molecular weight organic acids) into the rhizosphere which catalyse biotic and abiotic decomposition processes of soil organic matter and releases a variety of nutrients from the soil minerals and aggregates.

B) 'Mycorrhiza' are fungi that form fungal-plant symbiotic relationship creating a major interface between many plant roots and the soil matrix. Recent advances of the understanding of mycorrhizal communities and types suggest a general importance of the symbiosis for both soil organic matter decomposition and build-up.

C) 'Cycling of inorganic nutrients and metals'. The redox potential of the soil affects the mineralization and humification of organic material. Which electron acceptors that are used in different biotic and abiotic soil reactions depends on the redox potential. What is chemo-denitrification and how does it affect N cycling, and the soil environment?

D) 'Microbial community and functioning' identifies microbial groups using geochemical biomarkers (e.g. phospholipid fatty acids (PLFAs), ergosterol, amino sugars), or genomic biomarkers (RNA/DNA), and investigates changes in community composition in response to environmental factors (e.g. temperature change, elevated CO_2, fertilisation) that can suggest a shift in substrate utilisation and metabolic processes (i.e. respiration and mineralisation that cause greenhouse gas emission). Controls on bulk litter decomposition are considered to be reasonably well understood, but in reality we have only a small understanding of transformation of organic compounds in litter and SOM during decomposition and the relationship with microbial functioning.

5. Outcomes

After completion of the course the Ph.D. student has:

5.1. Knowledge and understanding

- Knowledge of the concepts on microbial regulation of biogeochemical cycles.

- Understanding of functioning and methodology for mycorrhiza and other soil microbial community groups.

- Basic understanding of the mechanism of root exudation and 'priming' in the rhizosphere and the effect on soil physics, soil organic matter decomposition and release of CO_2.

5.2. Skills and abilities

- A practical exercise to get a hands-on experience is planned (^{13}C laser).

- Calculation methodology to assess priming.

- Ability to identify the major relevant chemo-lithotrophic and anaerobic biotic and abiotic processes for terrestrial N cycling

5.3. Judgement and approach

- Make a short presentation of own Ph.D. experiment with possibility to get feedback from course participants and teachers.

- Show ability to critical discuss (in class room presentation and written assignment, see 7. assessment) old and new concepts within microbial ecology, nutrient acquisition by plants (root:mycorrhizal interactions), greenhouse gas producing processes.

6. Required reading

The reading list and supplementary material (lab. manual and exercises) is supplied separate to the syllabus.

7. Assessment

To pass the course, the students are obliged to participate in all class-hours and the calculations and group discussions. At the last day a short written assignment is handed in and assessed.

8. Grading scale

The grading scale comprises Fail, (U), Pass (G)

9. Course Evaluation

The course evaluation is performed at the last day as an open debate followed by an anonymous questionnaire

10. Language of instruction

The language of instruction is English.