

Project Details

Field: Biology

Titel of Project:

Biomimicry of the adhesive organs of stick insects

Faculty: 1

Abstract:

Adhesive organs enable insects to cling to various substrates even during rapid locomotion. In this process a very fast but reliable change of adhesion and detachment is realised. To reveal the detailed underlying mechanisms of this impressive performance we analyse at our institute the fibrous ultrastructure, the physical properties, the adhesion force and the detachment process of the adhesive organs of the stick insect *Carausius morosus*. Based on these data we attempt to fabricate a fibre reinforced artificial adhesion organ, which develops high adhesion forces to substrates of different roughness and which can easily be detached if desired.

In the UROP RWTH project we will continue the analysis of the morphology and the adhesion of the adhesion organs of stick insects and perhaps we will start to copy the adhesion organ technically. For the morphological analysis we will use SEM (scanning electron microscopy) to get detailed insights into the branching of the fibres in the arolium. For the analyses of the adhesion force, measurements on stick insects will be carried out. These analyses will be carried out with a vertical and a horizontal centrifugation assay using polishing papers of different roughness as substrates. In order to find appropriate adhesion materials for the construction of an artificial adhesion organ we will measure the adhesive force of very flexible hydrocolloids (gels made out of special polysaccharides and water) on epoxy resin replicas of different roughness. To produce suitable fibres for the fibre-reinforced material we momentarily elaborate an electrospinning set-up at our institute. Electrospinning is a method for the generation of ultra thin ($< 1 \mu\text{m}$) fibres. With this set-up we plan to spin three dimensional networks of parallel oriented fibres. The interspaces between these fibres shall be filled with the adhesion material. If you are specially interested in a Finite Element Modulation of the fibrous inner structure of the adhesion organ of stick insects contact us, too.

Task:

- Measurement of the adhesion force of stick insects
- Measurement of the adhesion force of artificial adhesion materials
- Cutting of semi thin cross sections for SEM analysis

Requirements:

- Handling of insects is essential
- Experience in SEM and handling of a microtome is desirable but not essential

Language Skills: - English, (German)

Computer Skills: - Experience in Excel is desirable

Others:

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Faculty: 1

Institute: Institute for Biology II

Project Details

Field: Biotechnology / Molecular Biotechnology

Titel of Project:

Evaluation of bacterial community changes in soil by molecular analysis of nitrogen-fixing bacteria

Faculty: 1

Abstract:

A current research project in our group is dealing with alfalfa plants inoculated with different bacteria and the hereby caused effects on plants as well as on microbial communities in the soil. The applied bacteria are a nitrogen-fixing *Rhizobium*, *S. meliloti*, and a plant-growth-promoting bacterium, *A. brasilense*.

Preliminary results showed no significant difference in soil communities of the differently inoculated plants. The conclusions were based on results of 16S-rDNA amplification which shows the whole bacterial community of the soil without previous cultivation. It could well be that the total bacterial community does not change by the inoculations; however, a more detailed analysis of specific bacterial groups might reveal differences. Such a group could be nitrogen-fixing bacteria. The additional analysis of this group can add valuable information to the whole output of the project.

Task:

The intern will perform analysis of nitrogen-fixing bacteria as part of the mentioned research project. The initial phase will involve testing and establishing of suitable primers for usage in PCR of soil DNA and cDNA, e.g. for the *nif* genes. Then, experiments will be performed with DNA extracted from soil of the ongoing inoculation experiments. The analysis of the obtained PCR products will be done by DGGE (denaturing gradient gel electrophoresis). The trainee will be involved in all the steps, starting with the first phase of planning the experiments, establishing the best method, coordinating the experiments with other project co-workers and finally evaluating the results. The principal methods (PCR, DGGE) are established at the institute, and intense support will be given to the intern to learn all the required experimental skills. However, previous experiences with working in a laboratory as well as a sound knowledge of the theoretical background of PCR are necessary.

Requirements:

Previous lab experience, interest in molecular biology, theoretical background in genetics, ability to work self-dependently and organized

Language Skills: German and/or English

Computer Skills: MS Office

Others:

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Faculty: 1

Institute: Biologie I, Ökologie des Bodens