

## Mendel University in Brno, Czech Republic

invites applications for

### 10 Postdoctoral positions

**Scholarship provider** - European social fund

#### Eligibility

Candidates should be:

- graduates of a PhD program in appropriate subjects, graduated after 28<sup>th</sup> March 2008;
- native speakers of Czech, Slovak or English language or having very good written and oral communication skills in English proven by certificate (CAE level or similar);
- authors or co/authors of at least 2 papers in scientific journals with IF.

#### Application

We invite motivated candidates to send their application, including:

- structured CV including certificates of academic degrees
- max. one page summary of scientific achievements
- publication track record including at least two papers with IF
- recommendation letters (max. 3)
- research plan based on the description of the individual topics of research set out below (max. 5 pages, including – current state of knowledge, objectives of the project, methods, significance).

Applications should be sent to the e-mails of the project coordinator Dr. Vilem Reinöhl – [vilem.reinoehl@mendelu.cz](mailto:vilem.reinoehl@mendelu.cz) and the mentor of the chosen research program.

**Application deadline** - 6<sup>th</sup> January 2012

#### Selection procedure

During the first stage of selection the sent applications will be evaluated and chosen candidates will be invited for an interview.

#### Duration of the project and benefits

The project will start on the 1<sup>st</sup> March 2012 and is scheduled for 34 months. Salary will be 50.000 CZK per month (approx. 2000 EUR). Place of work is Brno, Czech Republic (except one project located in Lednice na Moravě).

#### Duties of the Postdoc

- independent research and cooperation within the department in its recent research program are mandatory
- research results should be published in international peer reviewed journals
- application for 3rd party funding
- supervision of PhD and undergraduate students
- organization of seminars for PhD and undergraduate students.

### **„Whole tree eco-physiology“**

Postdoctoral position at the Department of Forest Botany, Dendrology and Geobiocoenology, Faculty of Forestry and Wood Technology, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant science, forestry, eco-physiology or related subjects. Experience in the field of plant eco-physiology, sap flow measurements, etc. is a plus.

#### **Research program description**

The project is focused on plant eco-physiology especially with respect to water relations and aboveground plus belowground structure of trees and forest ecosystems. There are three distinctive aims on which the candidate will be focused. First, tree and stand water relations as an important part of energy balance of the ecosystem. We have applied two thermodynamic methods for measurement the sap flow rate (Trunk Heat Balance and Heat Field Deformation), which give quantitative data and can serve in long-term for field studies of the water consumption and related processes. Furthermore, the data can be interpreted in terms of aboveground and belowground effective tree and stand structures (such as root water supply from different soil depths and leaf transpiration in different canopy layers). Such results are always compared with geometrical distribution of leaves and roots determined by other special instrumental methods. Secondly, tree water relations as an indicator of tree health status. Seasonal and diurnal dynamics of sap flow provide information on proper or wrong functional status of trees and stands. Level of drought or hypoxia stresses can be easily distinguished and location of the main problems can be spatially specified too. Estimated magnitude of threat serves as the background for management purposes. Lastly, understanding of the principles of thermal-based and electric-based measurements. Fieldwork giving results applicable for practical forestry, horticulture, hydrology and similar scientific fields needs permanent further improvements and development of new methods suitable for whole tree studies based on different principles. Cooperation with groups of other scientific branches in biologically or technically oriented Universities or Institutions is therefore unavoidable part of eco-physiological studies.

**Mentor:** *Prof. Jan Čermák*

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**„ Pests and pathogens in relation to the intensity of stress affecting the tree“**

Postdoctoral position at the Department of Forest Protection and Wildlife Management, Faculty of Forestry and Wood Technology, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in forestry, applied ecology, plant science, or related subjects. Experience in the field of forest pathology, mycology, entomology, zoology and applied ecology is a plus.

**Research program description**

A number of forest dieback and decline episodes was recorded in many areas all over the world, including central Europe. Since 1997, more than 10 million hectares of forests have been damaged. The disequilibrated tree-water relations, as a result of draught, are most frequently the trigger of such processes. Subsequently, the trees are attacked by phloem-feeding insects, pathogenic fungi, nematodes, etc. However, our knowledge of these processes to date is strongly limited. Thus, the study within the postdoctoral position is aimed on causal relations within insects-nematodes-fungi-tree pathosystem. The research will be conducted on Norway spruce/Scots pine/silver fir, and will be focused on the relation between the intensity of stress affecting the tree and the process of the tree colonization by phloem-feeding insects, pathogenic fungi, and nematodes. Intensity of stress will be able to quantify due to cooperation with ecophysicologists, when equilibrium of water-tree relations and its energy balance will be monitored. Furthermore, interactions among phloem-feeding insects, nematodes, and pathogenic fungi should be investigated in detail. Also, semiochemicals should be sampled and analyzed to reveal associations within aforementioned pathosystem, using electroantennographic detection or behavioral experiments.

**Mentor:** *Assoc. prof. Libor Jankovsky*

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### **„Silviculture and Carbon Forestry”**

Postdoctoral position at the Department of Silviculture, Faculty of Forestry and Wood Technology, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant science, silviculture, forestry or related subjects. Experience in the field of plant physiology and morphology, ecology, genetics, global change, remote sensing, etc. is an advantage.

#### **Research program description**

Nowadays, a global climate change (GCC) due to increasing atmospheric CO<sub>2</sub> concentration just starting and it is predicted to continue for next several centuries. The trees are long-lived organisms which are not able to escape from rapidly changing site conditions. Therefore, currently planting and/or young growing trees will suffer by these conditions as their adaptive mechanisms do not reach the same rate. Under GCC, forests play two dominant roles: i] they consume CO<sub>2</sub> from the atmosphere, and ii] they are able to sequester and store the carbon into biomass and soil for a long time. Foresters had powerful instruments in silvicultural treatment system as they can enhance and modify carbon storage capacity by forest ecosystems using optimization of tree species composition, age structure, spatial organization and functional links among all organisms within a forest ecosystem. Silviculture based only on a system approach through knowledge from genetics, eco-physiology, environmental sciences and remote sensing can give us a reliable answer: How do we need to manage forest stands in sustainable way? Therefore, this study will be focused on application of eco-physiological research approaches into silviculture and forest management practice. Spatial and temporal distribution of potential and real production activity will be identified on the base of monitoring of radiation regime and other microclimatic parameters, leaf area distribution and dynamics of development, chemical, morphological and physiological activity of leaves or needles within the stand. Different silviculture treatments will be taken into consideration to evaluate these effects on carbon sequestration etc.

**Mentor:** *Dr. Radek Pokorný*

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**„Bioenergetics of coniferous zygotic and somatic embryogenesis - molecular and proteomics approaches”**

Postdoctoral position at the Department of Forest Protection and Wildlife Management, Faculty of Forestry and Wood Technology, in cooperation with the Department of Plant Biology and CEITEC MENDELU (Central European Institute of Technology, European Center of Excellence), Faculty of Agronomy, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant science, plant molecular biology, biotechnology or related subjects. Experience in the field of plant physiology, plant molecular biology, etc. is a plus.

**Research program description**

The project is aiming at studying zygotic embryogenesis in conifers to develop protocols for mass-scale production of selected conifers, for either conventional tree breeding purposes or for cultivation in specific areas. The general outcomes of the project will be increased knowledge of the zygotic embryogenesis in conifers and efficient protocols for somatic embryogenesis. The aims will be reached by the comparison of zygotic and somatic embryogenesis on morphological, biochemical, molecular, and proteomics levels followed by comprehensive statistical analyses and modeling to recognize the specific properties and features needed for effective somatic embryogenesis. A special emphasis will be dedicated to the determination and characterization of the energetic status of developing zygotic embryos, their megagametophytes and expression of genes related to bioenergetical metabolism (e.g. alternative oxidase, ATP synthetase) and selected proteins.

**Mentor:** *Assoc. Prof. Jana Krajňáková*

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***„Interaction of plant hormones in Arabidopsis development under low light intensity“***

Postdoctoral position at the Department of Plant Molecular Biology and Radiobiology and CEITEC MENDELU (Central European Institute of Technology, European Center of Excellence), Faculty of Agronomy, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant physiology, molecular biology, biochemistry, genetics or related subjects. Experience in the field of photobiology, proteomics, transcriptomics and/or bioinformatics is a plus.

**Research program description**

Plants perceive and integrate a range of ever changing environmental cues to regulate morphology according to their habitat and the time of the year. Of these, light has the most profound effects on development. Plants are exquisitely sensitive to light parameters such as the spectral quality, intensity, direction and duration of the light signal and modulate development in response to all of these factors. Light and cytokinin signaling are intertwined at several levels, and the nature of their interactions is a matter of vigorous research. Low photosynthetic photon flux density (PPFD) is reportedly a signal for the shade avoidance response of which hypocotyl elongation is an integral part. Recently, we have found novel evidence for the involvement of cytokinin in the hypocotyl response to low PPFD (Reková et al., in preparation). Roles of several other plant hormones in regulating hypocotyl growth under low PPFD have been well established, and we have found preliminary evidence for the interaction of cytokinin with them. In this project, the interactions of cytokinin with other plant hormones in the regulation of hypocotyl elongation under low PPFD will be analyzed in detail using a combination of genetic, pharmacological and proteomic tools. We thus expect to uncover novel information on the involvement of cytokinin in the multilevel network that regulates the shade avoidance response, a process where the activities of auxin and gibberellins are already well-known.

**Mentor:** *prof. Břetislav Brzobohatý*

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***“Global proteome analysis of temperature perception in Arabidopsis and its cross-talk with cytokinin signaling on proteome and growth response levels “***

Postdoctoral position at the Department of Plant Molecular Biology and Radiobiology and CEITEC MENDELU (Central European Institute of Technology, European Center of Excellence), Faculty of Agronomy, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant physiology, molecular biology, biochemistry, genetics or related subjects. Experience in the field of proteomics, transcriptomics, bioinformatics and/or plant stress physiology is a plus.

**Research program description**

Plants must adapt to ever changing environmental conditions, including often dramatic alterations in temperature during diurnal cycles. Degree of tolerance to heat and cold-shock has a direct impact on plant fitness, and, consequently, plant productivity. Still, temperature perception remains poorly understood. Global transcriptome analysis revealed transcripts differentially regulated in response to temperature stress including those involved in plant hormone cytokinin signaling. To get a deeper insight into functional relevance of the previous transcriptomic data, the fraction of plant proteome and phosphoproteome that undergoes differential regulation under heat- and cold-stress will be identified in Arabidopsis. Cytokinins have been implicated in increased tolerance to heat-shock, and cross-talk between temperature and cytokinin signaling has been proposed (Černý et al., 2011, Journal of Experimental Botany, 62(3): 921-937). In this project, mutual modification of temperature and cytokinin signaling will be analyzed. We thus expect to uncover novel information on cross-talk between these two signals on proteomic level and its projection to growth regulation.

**Mentor:** *prof. Břetislav Brzobohatý*

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## **„Role of phenols in metal uptake“**

Postdoctoral position at the Department of Chemistry and Biochemistry and CEITEC MENDELU (Central European Institute of Technology, European Center of Excellence), Faculty of Agronomy, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant physiology, plant molecular biology or related subjects. Experience in the field of plant physiology, plant molecular biology, etc. is a plus.

### **Research program description**

Phenolic metabolites represent considerable part of the plant organic matter (up to 30%), indicating their significance for overall growth and stress protection. They are induced by a variety of stresses including excess of metals, but little is known about their role in the metal uptake. Few previous papers (Kováčik et al.) revealed the correlation between metal uptake and accumulation of phenols but exact individual metabolites are not known. It is therefore the main aim of the suggested experiments to highlight the significance of phenolic metabolism and individual metabolites in tolerance to metal excess. For complexity, experiments will include not only exogenous application of the selected phenolic metabolites (benzoic and cinnamic acid derivatives and flavonoids) but also the inhibition of direct pivotal phenolic enzyme (phenylalanine ammonia-lyase) and related antioxidative pathway (glutathione biosynthesis). Nitrogen deficiency, which stimulates accumulation of phenols, will be used as an indirect and nutritional stress to study the role of phenols in metal excess. Chamomile (*Matricaria chamomilla*, Asteraceae) will be used as the main object because it is a widely-used medicinal plant accumulating considerable amount of metals such as cadmium. Selected hyperaccumulator plants (*Arabidopsis haleri* and *Thlaspi caerulescens*, Brassicaceae) will be used for comparison in some experiments.

**Mentor:** *prof. Bořivoj Klejdus*

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### ***“Molecular and hormonal regulation of plant architecture“***

Postdoctoral position at CEITEC MENDELU (Central European Institute of Technology, European Center of Excellence) and the Department of Plant Biology, Faculty of Agronomy, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant physiology, plant molecular biology or related subjects. Experience in the field of plant physiology, plant molecular biology, confocal microscopy and/or bioinformatics, etc. is a plus.

#### **Research program description**

The project focuses on the hormonal and molecular events connected with the dormancy to growth or growth to dormancy transitions in axillary buds. The present knowledge of gene expression changes during breaking of apical dominance are mainly 24 hours after decapitation and few data are available in a shorter intervals (e.g. Balla, et al, Plant J., 2011). Therefore expression patterns of cell cycle related genes, auxin biosynthesis and transport genes and other early events during dormancy to growth and vice versa transition in detailed timescale will be evaluated in model plants *Arabidopsis* and/or pea. Treatments leading to the changes of the growth status like decapitation, hormonal treatments, blocking of biosynthesis, signaling or transport of hormones will be used to elucidate the hormonal and molecular regulation of the processes. Further forward and reverse genetic approaches to elucidate the role of the dormancy marker genes will be used.

**Mentor:** *Dr. Vilém Reinöhl*

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*Differentiation and dedifferentiation in plant cells“*

Postdoctoral position at the Department of Plant Biology, Faculty of Agronomy, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant physiology, plant genetics, plant biotechnology, plant molecular biology or related subjects. Experience in the field of plant anatomy and morphology, cytology, etc. is a plus.

**Research program description**

The ontogenic development of plants is linked to cell division and cell differentiation. The plant cell division, its structural and regulatory processes, have been under the focus for a long time and a lot of valuable information was obtained. The process of cell differentiation has been studied for a long time but many features of this process remain to be elucidated. In the plant development the cell dedifferentiation is also constituent part of ontogenic development or response to the environmental stimuli. The knowledge of this phenomenon is weak. The suitable experimental system is necessary for capturing of new details of both processes. The cell cultures, as a model for single cell, and cultures of early and late somatic embryos as a model for organised developing structure will be used in the postdoc studies. The structural changes of organelles, transport of nutritional and regulatory compounds including energy donors will be studied. The investigation will be focused on the role of programmed cell death, its molecular and biochemical regulation and positional effects in differentiation will be also in the focus.

**Mentor:** *Prof. Ladislav Havel*

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**„ Marker assisted breeding to increase adaptability of apricots “**

Postdoctoral position at the Department of Fruit Growing, Faculty of Horticulture in Lednice na Moravě, Mendel University in Brno, Czech Republic.

Candidates should be graduates of a Ph.D. program in plant physiology, plant molecular biology or related subjects. Experience in the field of plant physiology, plant molecular biology, plant breeding, etc. is a plus.

**Research program description**

Apricot production in Central Europe has many risks, mainly during the post-dormancy period. To improve the yield stability and profitability of apricot production it is first necessary to develop new varieties. Additional problems are diseases like viruses (e.g., Plum pox Virus – PPV) and phytoplasma. Many breeding programs and also that of Faculty of Horticulture in Lednice are focusing on selection for Sharka (PPV) resistance. There are many apricot progenies featured by different levels of PPV resistance. Many ancestors also come from different eco-geographical groups, which could enable to prove that PPV resistance was introduced with Chinese germplasm.

On the basis of apricot hybrid phenotyping donors of Sharka resistance (PPV) from various eco-geographic groups will be determined. Within apricot progenies the most promising hybrids for practical growing and breeding will be selected. The hypothesis about Chinese genotypes as the donors of PPV resistance will be solved by markers associated with the PPV resistance locus.

**Mentor:** *Prof. Boris Krška*

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