Practical works

**Modern methods in biotechnology**

(2 credits)

Specialty «6M070100 - Biotechnology», 1 course

Objectives of the discipline:

The course will cover state of the art techniques and methods within plant biotechnology research, including the genetic basis of several important plant properties and the use of molecular genetics and genetically modified organisms (GMO).

Through the course, the student will gain an understanding of the practical use of and theory behind the newest techniques within the field of plant science and will be able to employ that knowledge to solve problems within agricultural plant production through biotechnological approaches.

The course will be relevant for students who wish a practical introduction to the newest techniques and theory within plant science and biotechnology, and who wish to understand the potentials of these techniques in future plant production.

Learning outcomes and competences:

Completing this course, the student is expected to be able to:

* Understand and employ advanced technologies in plant biotechnology such as genetic modification and molecular genetics
* Have gained practical hand-on experience with advanced techniques and equipment within plant science and biotechnology.
* Understand and employ bioinformatics and statistical tools in plant biotechnology.
* Plan and conduct experiments within plant biotechnology.
* Develop strategies and models to solve problems relating to plant biotechnology by using fundamental principles in plant biotechnology and genetics.
* Explain the use of biotechnology in plant breeding.
* Put into perspective and discuss the potentials of plant biotechnology and breeding for achieving a sustainable agriculture, nationally and internationally.

Contents

**1 Practical work.**  Advanced methods and techniques in plant science and biotechnology. Development of new products

The Danish and global plant production is facing major challenges. The rapid population growth, the increased consumption of animal products and the use of crops for energy purposes demand an increased production. In addition, climate change is expected to have pronounced effects on plant production. At the same time there is also a strong wish among the public that future plant production can take place with minimal applications of pesticides and fertilizers. In effect, plant production is developing into a far more dynamic and demanding scenario in the food-, feed-, non-food-, and bioenergy area. Plant biotechnology is expected to play a major role in meeting the demands created by this scenario through knowledge on plant genomes, advanced molecular breeding and development of genetic modified organisms (GMO).

The course intends to provide the students with experience in advanced molecular techniques used in modern plant science and biotechnology through an intensive two week course.

**2 Practical work.**

Differential centrifugation and their using. Methods of identification of subcellular fractions

**3 Practical work.**  Determine protein precipitation methods.

Describe factors affecting protein stability

**4 Practical work.**  Use of modern biotechnological methods in agriculture*.*

**2.** Determine protein precipitation methods

Practical exercises will include:

**5-7 Practical work.**  DNA and RNA isolation from micro dissected tissues Transformation/genetic modification of crop plants, including

direct (particle bombardment) and indirect (Agrobacterium) introduction of DNA,

tissue culture and selection systems,

o   characterization of genetic modified plants using advanced PCR, western blots, enzyme assays and analysis of offspring.

**8 Practical work.**  Microdissection of plant tissues including:

1. cryo sectioning

2. laser-based ablation.

**9 Practical work.**  Advanced gene expression studies including:

1. RNA isolation.

2. cDNA synthesis.

3. qPCR using SYBR Green and TaqMan probes.

4. Data analysis.

**10-15 Practical work.**  Practical use of reporter genes for localization of gene products.

1. Plant protein expression, purification and characterization including:
   * + - 1. theory and practice on transformation of *Pichia pastoris.*
         2. fermentation.
         3. biochemical purification from native and recombinant sources.
         4. biochemical characterization.
         5. UPLC/MS and interpretation of mass spectra and peptide mapping.