DIPARTIMENTO DI SCIENZE

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| COURSE: **Insect biotechnological applications in medicine, industry and bio-control (6 CFU)** | | | |
| ACADEMIC YEAR: **2019-2020** | | | |
| TYPE OF EDUCATIONAL ACTIVITY: (Free choice) | | | |
| TEACHER: **Prof. Patrizia Falabella** | | | |
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| Language: **ITALIAN** | | | |
| ECTS: **6**<br>(4 of lectures and 2 of tutorials/practice) | n. of hours: **56**<br>(32 of lectures and 24 of tutorials/practice) | Campus: **Potenza**<br>Dept./School: **Dipartimento di Scienze**<br>Program: **Biotechnology** (L2) | Semester: II<br>From 02/03/2020 to 31/05/2020-<br>20/06/2020 |

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course is the first one analyzing the possible applications of Insect biotechnology in medicine, industry and in bio-control. It will allow the gain of deep knowledge on Insects as new biological systems, alternative to mammals, with their possible application in pharmaceutical and biomedical experimentation, as innovative source for the identification of new molecules and processes of natural origin, in order to improve human activities.

Lectures content will be based on the results of the most innovative scientific research, including reading, understanding and critical evaluation of the most recent scientific works.

• **Knowledge and understanding**: knowledge and ability to understand the basic elements of morphology and functional anatomy of insects, study of biomedical applications based on the use of insects as a model of biomedical research, study of industrial applications of entomological biotechnologies such as the use of insect cell lines for the production of recombinant heterologous proteins and the development of biosensors based on olfactory perception mechanisms in insects. The development of insect-inspired technologies (biomimetics) will be analyzed; study of entomological biomedical applications for plant protection by identification of insect-derived antimicrobial peptides as a new weapon against plant pathogens and study of plant protection strategies against harmful insects by using RNA Interference. Study of Host-Parasitic Interactions as a source of new genes and molecules with potential insecticidal action.

• **Applying knowledge and understanding**: applying knowledge gained through analysis and manipulation of nucleic acids and insect proteins; in particular, the acquired knowledge will enable: to extract and analyze nucleic acids and insect proteins, to produce recombinant proteins from insect genes in bacterial cells and insect cell lines, in vivo (insect injection) and in vitro (on Insect cell lines) bioassays for the functional analysis of bioactive genes and molecules of interest.

• **Making judgements**: ability to choose and judge what is the fruit of the didactic setting of teaching, in which theoretical training is accompanied by examples, applications, exercises, both practical and theoretical, individual and group , aimed to accustom students to make decisions and to judge and predict the effect of their choices. Within this teaching, the student will acquire the ability to work in the laboratory, conduct experiments, build and process databases, consult specific usage protocols (datasheets) and instrumentation manuals, compare and understand the use of different techniques and methods, learning to evaluate the most appropriate ones.

• **Communication skills**: ability to communicate, organizing in a logical and exhaustive manner acquired, knowledge and skills, using a correct language.

• **Learning skills**: ability to collect and organize information received during the lesson hours and seminars held by external experts or sought after on the recommended texts and on available scientific literature.

PRE-REQUIREMENTS

It is important to have basic knowledges on:

- General and inorganic chemistry;
- Organic chemistry;
- Biochemistry;
- Cellular Biology

SYLLABUS

Lectures: 32h

**1) An overall picture on insect morphology and functional anatomy (8h):**

- Tegument
- Muscular, nervous, digestive, circulatory, respiratory Systems
- Immunity

**2) Insect Biotechnology in Medicine (8h):**

- The greater waxmoth *Galleria mellonella* as an alternative model host for human pathogens;
- Fruit Flies as models in biomedical research;
- Therapeutic potential of anti-microbial peptides from insects;
- From traditional maggot therapy to modern biosurgery;
- Insect-associated microorganisms as a source of novel secondary metabolites with therapeutic potential;
- Potential pharmaceuticals from insects and their co-occurring microorganisms.

**3) Insect Biotechnology in Plant Protection (8h):**

- Insect antimicrobial peptides as new weapons against plant pathogens;
- Protection of crops against insect pests using RNA interference;
- Insect transgenesis and the technique of the sterile insect;
- Host parasitoid interactions as source of new genes and molecules with potential insecticidal activity.

4) **Industrial Applications of Insect Biotechnology (8h):**

- Insect cells for heterologous production of recombinant proteins;
- Biotechnologies based on silk;
- Biosensors based on insect olfaction;
- Insect-inspired technologies: insects as a source for biomimetics.

Tutorials/practice 24h

**5) Analysis and manipulation of insect nucleic acids:**

- DNA and RNA extraction from insect;
- Amplification of Insect DNA by PCR;
- Reverse transcription of Insect RNA;
- Evaluation of the expression levels of insect genes by classical methods (Northern blot) and innovative ones (Quantitative Real time PCR);
- Molecular hybridization with specific probes by dot-blot and Southern blot;
- Preparation of cDNA library from insects tissues and screening methods;
- RNA interference

6) **Production of recombinant proteins from insect genes in bacterial vectors and in insect cell lines (8 h):**

- Electrophoresis of proteins and Western blot;
- Preparation and analysis of the transcriptome of insect tissues (RNA seq and the use of the main bioinformatics tools);

*In vivo* bioassays (injection in Insects) and *in vitro* (in insect cell lines ) for the functional analysis of genes and molecules of interest.

TEACHING METHODS

Lectures (32 h), Laboratory tutorials (24h), Project works, Reading and discussion of International scientific papers on the main topic reported during the lectures.

EVALUATION METHODS

Oral examination and Discussion of a project work.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

E. Tremblay – Entomologia applicata. Volume primo: generalità e mezzi di controllo

P.J. Gullan P.S. Cranston Lineamenti di Entomologia Zanichelli

Vilcinskas, A. Insect Biotechnology- Springer

Power Point Lessons

Selected Scientific Articles

INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, the program and the methods of evaluation, the teacher will provide the material (lessons in Power Point, Scientific Articles). Simultaneously, a list of students who intend to enroll the course, together with name, serial number and email, will be drafted.

Office hours: on Tuesday and on Thursday from 15:30 to 16:30 in the teacher office. In addition to the weekly reception, the teacher will be available by e-mail or cell phone.

EXAMINATION SESSIONS (FORECAST)[1]

See on the web site https://unibas.esse3.cineca.it/Home.do

SEMINARS BY EXTERNAL EXPERTS YES x NO

FURTHER INFORMATION

[1]Subject to possible changes: check the web site of the Teacher or the Department/School for updates.