UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Natural Compounds and Bioactivity

2627-1-F0602Q132

Aims

The teaching of Biochemistry of natural substances aims to provide knowledge about the secondary metabolism of plants, with particular insights into the applications of secondary metabolites in the pharmacological, nutraceutical and food fields.

1. Knowledge and understanding - the course provides in-depth knowledge regarding the mechanisms of the biosynthesis of secondary metabolites in plant systems.
2. Ability to apply knowledge and understanding - at the end of the course the students will have acquired scientific knowledge regarding the metabolic pathways of plants and their role in human health and will be able to understand the link between secondary metabolites and applications in the pharmacological and nutritional.
3. Making judgments - the knowledge acquired will give students the skills to evaluate the different categories of secondary metabolites such as bioactive molecules to be used as drugs, nutraceuticals and foods.
4. Communication skills - at the end of the course the students will have acquired the ability to present the topics covered orally with language properties.
5. Learning skills - at the end of the course, the students will have acquired the ability to critically read and discuss the scientific literature relevant to the topics covered and related subjects.

Contents

Distribution and characterization of natural substances in plants. Sites of synthesis and accumulation. Secondary metabolism: the biosynthetic bricks, the mechanisms of synthesis. Role of secondary metabolites in plant defense mechanisms. The acetate, shikimate, mevalonate and methyl erythritol phosphate pathways. Biosynthesis of terpenoids, from monoterpenes to polyterpenes. Alkaloids. Applications of secondary metabolites in the pharmacological and nutritional fields.

Detailed program

The teaching of Biochemistry of natural substances has as its main objective the acquisition of the processes that regulate the biosynthesis of the main secondary metabolites of plant origin of pharmacological and nutraceutical interest, also considering their role in plant defense mechanisms. Introductory part: review of the reactions involved in the main metabolic pathways and of the main classes of primary metabolites. General scheme of the main synthesis pathways of secondary metabolites in plant systems. The acetate pathway: fatty acids and polyketides. The shikimate pathway: aromatic amino acids and phenylpropanoids. Aromatic polyketides: curcumin and its biosynthetic pathway. Flavonoids and stilbenes. Combretastatins: vegetable stilbenes of particular pharmacological interest. The antioxidant power of dietary flavonoids including resveratrol, quercetin, kaempferol and catechins. Mevalonate and methylerythritol phosphate pathways: terpenoids and their biological role. The biosynthetic pathway of artemisinin: a sesquiterpene with antimalarial activity. Taxol: its discovery, its synthesis and its use as an anticancer drug with antimitotic action. Ginsenosides, phytosterols and cardioactive glycosides. Alkaloids: biosynthetic pathway, structural elements, classification and biological properties. During the course, ample space will be given to the discussion of scientific publications that identify some of the metabolites described as bioactive molecules to be used as drugs, nutraceuticals and foods. Compatibly with access availability, some lessons may be held at the Vivaio Bicocca. The topics of this teaching are closely connected with the issue of ecological transition and with the "One health laboratory: from the environment to health" of the second semester of the Biology degree course in which the bioactive compounds, extracted from plant matrices, will be tested on specific cellular systems.

Prerequisites

The student who attend the course must have a good knowledge on the main classes of natural organic substances treated in the basic courses of organic chemistry and biochemistry.

Teaching form

Lessons will take place in person.
-19 lessons (each lasting two hours) will be conducted as follows:
the first part of each lesson (at least 1 h) will be delivered in an erogative format, aimed at presenting the main concepts through in-class lectures supported by PowerPoint presentations on the covered topics.
the second part (at least 30 minutes) will follow an interactive format, allowing for discussion with students and further exploration of the topics introduced, based on experiments drawn from scientific literature.
-2 lessons (each lasting two hours) will be conducted:
in a fully interactive format: journal club sessions involving an in-depth discussion of a scientific article by students working in groups.
The teaching will be in Italian.

Textbook and teaching resource

Recommended texts:
Paul M. Dewick “Chemistry, biosynthesis and activity of natural substances” Piccin
Lectures with powerpoint presentations and discussion of scientific articles on topics covered and on some insights.

Semester

First semester.

Assessment method

Student performance will be assessed through an oral examination. During the exam, 3 to 4 questions will be posed to evaluate the knowledge acquired on the topics covered in class, the clarity and coherence of the exposition, and the ability to establish connections among the various subjects discussed. No midterm assessments are scheduled."

Office hours

By appointment writing to the teacher: paola.coccetti@unimib.it.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION