

| PsGeneral information | |
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| Academic subject | PHYSIOLOGY OF ANIMAL NUTRITION |
| Degree course | Course chosen by the student from: - Interclass in Natural and Environmental Sciences - Interclass of Biology - Interclass of Biotechnology - Nutrition Sciences for Human Health LM61 |
| Academic Year | Preferably 2 nd or 3 th |
| European Credit Transfer and Accumulation System (ECTS) | 4 |
| Language | Italian |
| Academic calendar (starting and ending date) | Second semester march 1, 2022 – june 10, 2022 |
| Attendance | Mandatory attendance |

| Professor/ Lecturer | |
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| Name and Surname | Lucantonio Debellis |
| E-mail | lucantonio.debellis@uniba.it |
| Telephone | 080-5443331 |
| Department and address | Department of Biosciences, Biotechnologies and Biopharmaceutics Campus in Via E. Orabona, 4 - Biological dept. building; floor -1 St. 26 |
| Virtual headquarters | |
| Tutoring (time and day) | From Monday to Friday by previous e-mail appointment |

| Syllabus | |
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| Learning Objectives | The course aims to provide knowledge of the mechanisms and nutrition strategies that allow animals to take food from the external environment, of the trophic relationships with the environment and between the different classes of animals, of the characteristics of the nutrients necessary for nutrition, of the physiological and functional aspects of the digestive system and of the processes that make it possible to modify and use the food material through the digestion and absorption of food, of the neuroendocrine mechanisms involved in the control of eating behavior. |
| Course prerequisites | Basic knowledge of Physics, General and Organic Chemistry, Biochemistry, General Physiology and Zoology. |
| Contents | <ul style="list-style-type: none"> • Nutrition and energy <ul style="list-style-type: none"> – Primary biological needs, nutrition, nutrition. Autotrophic and heterotrophic organisms. Main constituents of foods and their roles. The replacement. Biological work. Energy flows in the living organism. The calorimetry. Energy balance. Metabolic rate: meaning, extent and factors that influence it. Flow of nutrients between living organisms: Food chains or webs; Trophic levels; Biomass pyramid; Lindeman's Law; Pyramid of energies; Distribution of biomass. • Nutrients <ul style="list-style-type: none"> – Nutritional requests. Macronutrients and micronutrients; Essential nutrients. – Macronutrients: Water: Characteristics; Water balance of the body. Protides: Characteristics and functions in the body; Food sources; Nitrogen cycle; Essential amino acids and their role; Protein efficiency ratio; Biological and chemical value of proteins. Carbohydrates: Characteristics and functions in the body; Food sources; Lipids. Characteristics and functions in the body; |

- The problem of energy reserves: The energy supply of carbohydrates, lipids and proteins; Calorimeter bomb.
- Micronutrients: Mineral salts, role and characteristics. Water-soluble and fat-soluble vitamins and their role.
- **Research and food intake strategies**
- Food intake mechanisms. Supply modalities in an ecosystem. Classification of animals based on: organic nature of food, type of food, intake mechanisms, size of organic compounds. Osmotrofi. Phagotrophs, microphages and macrophages
- Mechanisms of nutrient absorption: through the body surface, through the digestive system. Endocytosis. Phagocytosis. Filtration (porifera, lamellibranchs, birds, cetaceans). Liquid feed (suckers). Solid feeding (capture of prey in invertebrates and vertebrates) teeth, claws, beaks.
- **Morpho-functional organization of the alimentary channels in the different phyla**
- Food systems in unicellular organisms and multicellular organisms. Discontinuous reactors. Continuous flow reactors with thermal agitation. Continuous flow piston reactors. Unconventional systems of food intake: *Riftia pachyptila* and *Elysia chlorotica*.
- Digestive in INVERTEBRATES: Rotifers, Arthropods, Ciliates, Porifera, Cnidarians, Platelminti, Nemertini, Molluscs (Bivalves, lamellibranches, Gastropods, Cephalopods), Annelids, Arthropods (Crustaceans, Insects, Arachnids), Echinoderms (Echinotids, Echinotids).
- Digestive system in VERTEBRATES: Teleost fish, Selachians, Amphibians, Reptiles, Birds, Mammals (Monogastric stomach. Digastric stomach. Rumination. Fermentation in ruminants. Microbiota of the rumen. Pseudoruminants. Fermentation in non-ruminant animals. Symbiosis with heterotrophic microorganisms. and general functions Pre-gastric fermenters Post-gastric fermenters.
- Digestive in MAMMALS: digestion, absorption, secretion and motility. Functional anatomy of the gastrointestinal system and related glands. Extrinsic nervous and humoral control of the motility of the alimentary canal. Motility of the alimentary canal: muscle motility and ciliary motility. Peristalsis, segmentation, migrating motor complexes, frustration and mass movement. Reverse peristalsis and regurgitation. Intrinsic control of the motility of the alimentary canal. Main characteristics and components of the secretory organs and digestive secretions: salivary glands, stomach and gastric juice, exocrine pancreatic secretion, liver, cholecystis and bile, enteric secretion. Small intestine: histology, cytology and comparative aspects. Digestion and absorption of carbohydrates, proteins and lipids. Entero-hepatic circle. Evolutionary responses of the physiology of nutrition. Lactase and lactose intolerance. Large intestine. Characteristics and role of the microbiota. White adipose tissue and brown adipose tissue. Influence of diet on the dynamics of the intestinal structure. Epigenetic action of nutrition.
- **Neuroendocrine control of eating behavior**
- Mechanisms of hunger and satiety. Responses triggered by food intake: acute responses, chronic responses (acclimatization), timed periodic responses (endogenous biological clocks: central and peripheral clocks, circadian and circannual rhythms; Zeitgeber factors) and responses related to development.

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| | <ul style="list-style-type: none"> • Behavioral, functional and molecular strategies of toxic and poisonous animals <ul style="list-style-type: none"> – Biotoxins and their classification. Lethal dose. Toxicological characteristics of Porifera, Cnidarians, Polychaetes, Gastropods, Molluscs, Cephalopods, Echinoderms, Arthropods chelicerates, Hymenoptera, Amphibians, Reptiles, Teleost fish, Mammals. |
| Books and bibliography | <p>A. Teaching materials distributed during the course</p> <p>B. "ALIMENTAZIONE, NUTRIZIONE E SALUTE" di L. Debellis et al. - Ed. EdiSES.</p> <p>C. "FISIOLOGIA dalle molecole ai sistemi integrati" di E. Carbone et al. – 2nd ed. - Ed. EdiSES</p> <p>D. Articles from scientific journals proposed during the course.</p> |
| Additional materials | |

| Work schedule | | | |
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| Total | Lectures | Hands on (Laboratory, working groups, seminars, field trips) | Out-of-class study hours/ Self-study hours |
| Hours | | | |
| 32 | 32 | 0 | 68 |
| ECTS | | | |
| 4 | 4 | 0 | |
| Teaching strategy | | The teaching modality will be that of "blended learning": mixed frontal and remote teaching at the same time. | |
| Expected learning outcomes | | | |
| Knowledge and understanding on: | | <ul style="list-style-type: none"> • Functional significance of nutrition, the need for specific nutrients for maintaining homeostasis and the health of organisms. • Knowledge of the ecological aspects of food webs and trophic levels in the animal kingdom. • Knowledge of the different strategies, methods and evolution in food intake, physiological, morphological and functional aspects of living beings, of their food systems, of the digestive system in the various animal classes and of the processes that make it possible to modify and use the food material by digesting food and absorbing nutrients. • Knowledge of the elements that contribute to the control of feeding behavior in animals | |
| Applying knowledge and understanding on: | | <ul style="list-style-type: none"> • Characterizing aspects of the different animal food strategies. • Identify the critical aspects of relationships in food webs and trophic pyramids. • Understand the role of different nutrients for maintaining homeostasis and health status. • Understanding the role of morphological, physiological and behavioral adaptations of different species in relation to food strategies. | |
| Soft skills | | <ul style="list-style-type: none"> • <i>Making informed judgments and choices</i> Developed through lectures and in-depth study of scientific texts and articles, it must lead the student to be able to evaluate the need for specific nutrients for maintaining homeostasis and health, the nutritional qualities of foods and the impact on health of eating behaviors. • <i>Communicating knowledge and understanding</i> Developed through comparison during lessons, it must lead the student to be | |

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| | <p>able to describe the knowledge relating to the nutritional needs of the individual, and to the systems of the human body related to nutrition and maintenance of health.</p> <ul style="list-style-type: none"> • <i>Capacities to continue learning</i> Developed through the study and deepening of the bibliography, in order to perfect the learning ability from highly complex technical-scientific texts, monographs, scientific periodicals, regarding the nutrition. |
| Assessment and feedback | |
| Methods of assessment | Ongoing oral assessment - Oral exam |
| Evaluation criteria | <ul style="list-style-type: none"> • <i>Knowledge and understanding</i> Correctly identify the specific problems proposed and capacity to organize knowledge. • <i>Applying knowledge and understanding</i> Knowledge and understanding adequately related to the teaching contents. • <i>Autonomy of judgment</i> Develop a critical and functional reasoning and to argue on specific proposed problems. • <i>Communicating knowledge and understanding</i> Report, in a clear way and using an adequate vocabulary, the contents of the course and other acquired knowledge and to argue on specific problems proposed. • <i>Communication skills</i> Effectiveness in answering questions |
| Criteria for assessment and attribution of the final mark | The final grade is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. |
| Additional information | |
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