



Study Plan

School: School of Sciences and Technology

Degree: Bachelor

Course: Applied Animal Science (cód. 146)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO01145	Introduction to Agriculture and Animal Production Systems	Animal Science	6	Semester	156
MAT00931	Mathematics	Mathematics	7	Semester	181
QUI01095	General Organic Chemistry	Chemistry	5	Semester	130
Group of Free Options					
BIO10917L	Cell Biology	Biological Sciences	6	Semester	156

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT00915	Statistics	Mathematics	6	Semester	162
BIO00408L	Microbiology	Biological Sciences	6	Semester	156
ERU00533	Principles of Engineering Applied to Animal Science	Engineering	6	Semester	156
QUI01041L	General Biochemistry	Chemistry	6	Semester	156
Group of Free Options					

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO01144	Animal Genetics and Breeding Techniques	Animal Science	6	Semester	156
ZOO01136	Animal Anatomy and Physiology I	Animal Science	6	Semester	156
ZOO01147	Agricultural and Animal Production Organization	Animal Science	6	Semester	156
MVT01028L	Notions of Animal Health	Veterinary Medicine	6	Semester	156
Group of Options					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU00534	Information and Automation Systems in Animal Science	Engineering	6	Semester	156
FIT00733	Fundamentals of General Agriculture	Plant Science	6	Semester	156

2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MVT01029	Animal Reproduction: Physiology and Control	Veterinary Medicine	6	Semester	156
ZOO01146	Animal Nutrition	Animal Science	6	Semester	156



2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO01143	Animal Behaviour and Welfare	Animal Science	6	Semester	156
ZOO01135	Food and Food Technologies for Animals	Animal Science	6	Semester	156
ZOO01137	Animal Anatomy and Physiology II	Animal Science	6	Semester	156

3rd Year - 5th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO01148	Technological Processes and Food Quality	Animal Science	6	Semester	156
ZOO01153	Non-Ruminant Production Systems and Techniques	Animal Science	6	Semester	156
ZOO01155	Ruminant Production Systems and Techniques	Animal Science	6	Semester	156

Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO01154	Alternative Animal Production Systems and Techniques	Animal Science	6	Semester	156
ZOO01138	Equine and Companion Animal Studies	Animal Science	6	Semester	156
ERU00531	Farm Buildings and equipments	Engineering	6	Semester	156

3rd Year - 6th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO01411	Project	Animal Science	8	Semester	208
ZOO10918	Project (CTAN)	Animal Science	8	Semester	208
ZOO01160	Internship in Professional Context	Animal Science	10	Semester	260

Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO01140	Science and Technology of Meat and by-products	Animal Science	6	Semester	156
ZOO01141	Science and Technology of Other Products of Animal Origin	Animal Science	6	Semester	156
ZOO01142	Science and Technology of Milk and Dairy Products	Animal Science	6	Semester	156
ZOO01149	Animal Production in Tropical and Subtropical Regions	Animal Science	6	Semester	156



Conditions for obtaining the Degree:

*** TRANSLATE ME: Ciência e Tecnologia Animal

Para obtenção do grau de licenciado em Ciência e Tecnologia Animal é necessário obter aprovação a 138 ECTS em unidades curriculares obrigatórias e 42 ECTS em unidades curriculares optativas, distribuídas da seguinte forma:

1^o Ano

1^o Semestre:

4 UC Obrigatórias num total de 24 ECTS

1 UC Optativa de formação geral restrita às áreas científicas de Informática, Economia, Sociologia ou Linguística num total de 6 ECTS

2^o Semestre

4 UC Obrigatórias num total de 24 ECTS

1 UC Optativa Livre num total de 6 ECTS

2^o Ano

3^o Semestre

4 UC Obrigatórias num total de 24 ECTS

1 UC Optativa num total de 6 ECTS

4^o Semestre

5 UC Obrigatórias num total de 30 ECTS

3^o Ano

5^o Semestre

3 UC Obrigatórias num total de 18 ECTS

2 UC Optativas num total de 12 ECTS

6^o Semestre

2 UC Obrigatórias num total de 18 ECTS

2 UC Optativas num total de 12 ECTS

Program Contents

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Introduction to Agriculture and Animal Production Systems (ZOO01145)

The functions accomplished by animals and by the animal science in the human lives (introduction to the animal science and to the livestock production, the animal values for mankind, factors affecting the structure of agriculture worldwide, diversity of the agriculture production systems). The biological sciences underlying the animal science and livestock production (an introduction the different courses from the animal nutrition to the animal welfare, through the new biotechnology tools and genetic engineering). The animal industries (vertical integration of the different animal productions, from swine and poultry to the apiculture, from the aquaculture to the raise and care of companion, sport and leisure animals, through animal productions for meat, milk and eggs). Animals and society (professional careers in animal science, food safety, animal rights and welfare, animals in sustainable agriculture).

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Mathematics (MAT00931)



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General Organic Chemistry (QUI01095)

Resume

Scope of organic chemistry and importance in the field of animal science technology. Fundamentals of structure, bonding and properties of organic compounds. Families of organic compounds, nomenclature and structural representation. Basic concepts of stereochemistry. General physical and chemical properties of organic compounds. Examples of organic reactions. Synthesis techniques, separation and analysis of organic compounds. Organic compounds in animal life.

Detailed

Theoretical

1. Introduction

The scope of Organic Chemistry and influences on actual chemistry panorama and general society, in particular in the field of animal science technology. Development of organic chemistry as a science. Families of organic compounds. Functional groups.

2. Structure and Chemical Bonding

Atomic structure. Development of the theory of chemical bonding. Valence Bond Theory. Hybridization of atomic orbitals. Molecular Orbital Theory. Representation of molecular structures. Polar covalent bonds. Formal charges. Resonance.

3. Nomenclature of organic compounds

Systematic nomenclature of representative families of organic compounds: alkanes and cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amides, esters and amines.

4. Physical properties of organic compounds

Molecular geometry. Polarity of molecules. Intermolecular forces. Physical properties: phase changes, density and solubility.

5. Alkanes, Cycloalkanes and Conformational Analysis

Structure and properties of alkanes and cycloalkanes. Source of alkanes and cycloalkanes. Reactivity. Conformational analysis.

6. Enantiomers

Types of isomerism. Enantiomers and tetrahedral carbon. Chirality. Optical activity. Absolute configuration. Diastereomers. Racemic mixture. Properties of enantiomers.

7. Introduction to organic reactions

Types of organic reactions. Reaction mechanisms. Radical and polar reactions. Equilibrium, rate and energy changes. Bond dissociation energies. Energy diagrams and transition states. Acids and bases: concepts, relative strength and predicting acid-base reactions. Structure-acidity relationships. Organic acids and bases. Oxidation and reduction in organic chemistry.

8. Alkenes and alkynes

Structure of alkenes. Unsaturation degree. Stereochemistry and E, Z notation. Stability, physical properties and typical reactions of alkenes. Structure and stability of alkynes. Physical properties and reactivity of alkynes.

9. Halogenated organic compounds

Structure and physical properties. Typical reactions.

10. Aromatic compounds

Structure and stability of benzene. Aromaticity and Hückel rule. Aromatic ions and heterocycles. Polycyclic aromatic compounds. Physical properties and typical reactions of benzene derivatives.

11. Alcohols and phenols

Structure and physical properties. Typical reactions.

12. Ethers

Structure and physical properties. Typical reactions.

13. Overview of carbonyl compounds

Types of carbonyl compounds. Nature of carbonyl group. Typical reactions of carbonyl compounds.

14. Aldehydes and ketones

Structure and physical properties. Typical reactions.

15. Carboxylic acids and its derivatives

Structure and physical properties of carboxylic acids. Acidity of carboxylic acids. Physical properties and typical reactions of carboxylic acids. Structure, physical properties and typical reactions of carboxylic acids derivatives: acyl halides, anhydrides, esters and amides.

16. Amines

Structure and physical properties. Basicity and acidity of amines. Typical reactions.

Theoretical-practical

Analysis and resolution of problems for deepening of knowledge acquired in lectures.

Introduction to Organic Laboratory. Preparation, use of laboratory time, neatness, scientific notebook, sources of information and report preparation. Emergency procedures and safe laboratory practices. Material, glassware, equipment and basic laboratory techniques in organic chemistry. Realization of laboratory experiments related to the syllabus of the course and preparation of their reports.

Tutorial



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Cell Biology (BIO10917L)

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Statistics (MAT00915)

1. Introduction: Main concepts. Population and sample. Variables and data. Types of variables. Relation between statistics and probability.
 2. Descriptive statistics: Describing data with graphs and tables. Measures of central and non central tendency, dispersion, skewness and kurtosis. Correlations coefficients.
 3. Basic probability: Sample space and events. Calculation probabilities using simple events. Independence, conditional probability and multiplication rule. Bayes' rule.
 4. Discrete and continuous random variables: Density and probability functions. Expected value and variance and their properties. Independent random variables. Joint probability function and marginal probability function. Covariation and correlation and their properties.
 5. Some useful distributions: Discrete distributions: Binomial and Poisson. Continuous: Normal and Exponential. Properties of Normal distribution. Normal approximation of the Binomial distribution.
 6. Sampling distributions: Sampling. Central limit theorem. Sampling distributions of: sample mean, sample proportion, sample variance, mean sample difference, difference between sample proportions and ratio of sample variances.
 7. Point and interval estimates: Parameters and statistics. Estimator and estimative. Desired properties for the estimators. Notion of confidence interval. Confidence intervals for one and two means, one and two means proportions, one and two variances.
 8. Hypothesis testing: Null and alternative hypothesis. Significance level and p value. Types of errors and test power. Unilateral and bilateral tests. Duality between confidence intervals and hypothesis tests. Kolmogorov-Smirnov and Shapiro Wilks tests. Hypothesis test for one and two means, one and two means proportions, one and two variances.
 9. Analysis of variance: One-Way ANOVA. ANOVA table. Assumptions. Multiple comparisons of sample means.
 10. Non-parametric tests: adjustment and independence Chi-square tests.
 11. Simple linear regression: simple linear regression model. Least squares estimators of the regression parameters. ANOVA table. The coefficient of determination. Statistical inference about regression parameters: confidence intervals and hypothesis tests. Prediction.
- Using the SPSS software.



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Microbiology (BIO00408L)

Theoretical:

1. Historical context and Ubiquity
2. Diversity of the Microbial World
3. Microbial Growth and Death
4. Metabolism
5. Basics of Molecular Microbiology: Microbial genetics, Virology, Immunology
6. Microbes and disease; Normal flora, Pathology, infection and disease, Mechanisms of pathogenicity, Principles of epidemiology
7. Food microbiology: Hygiene and concept of indicator. Processing and storage of food. Foodborne diseases
8. Ecology and environmental microbiology: Soil and water, Biogeochemical cycles, Agricultural applications, Wastewater treatment, Biotechnology applications

Lab Practice:

Aseptic practice

Observation of bacteria, fungi and protists.

Demonstration of Ubiquity

Preparation and sterilization of culture media.

Isolation of pure culture.

Colonial and cellular morphology. Staining methods

Microbial counts

Environmental conditions for growth (pH, temp., O₂)

Anaerobic Culture

Antibiograms

Microbial spreading simulation

Water and milk analyses

Plant symbiosis.

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Principles of Engineering Applied to Animal Science (ERU00533)

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General Biochemistry (QUI01041L)

Introduction to Biochemistry and its interconnection with the other sciences. The importance of water and inorganic ions in Biosystems. Biological buffer systems. Methods and techniques used in biochemistry. Nomenclature, structure and properties of Biomolecules: carbohydrates, lipids, amino acids, peptides, proteins and nucleic acids. Lipoproteins. Biomembranes. Enzymes and enzyme kinetics. Bioenergetics and bioelectrochemistry. The importance of ATP in metabolism. Anabolism and catabolism. The main metabolic pathways. Introduction to the metabolism of carbohydrate, fat and protein. Integration and metabolic regulation.

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Animal Genetics and Breeding Techniques (ZOO01144)



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Animal Anathomy and Physiology I (ZOO01136)

Part I: General Organization of the Animal Body

Introduction to Animal Anatomy and Physiology

General organization of the animal organism

Anatomical terminology

Part II: Protection, Support and Movement

Skeletal System: Axial Skeletal and Appendicular Skeletal: structure and function

Joints

Anatomo-Functional Classification of Joints

Muscular system: types and mechanisms of muscle contraction

Part III: Control, Communication and Coordination

Neurons: Functional and anatomical structure and neural circuits

General Organization of the Nervous System: Peripheral and Central Nervous System

Endocrine System

Endocrine Glands: Secretion, Control and Mechanisms of Hormone Action

Hormones

Part IV: Introduction to Transport and Maintenance

The Cardiovascular System

Anatomical structure of the heart and blood vessels

Physiology of the heart

Blood composition and blood cells

Systemic circulation and pulmonary circulation

Basic concepts of immunity

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Agricultural and Animal Production Organization (ZOO01147)

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Notions of Animal Health (MVT01028L)

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Information and Automation Systems in Animal Science (ERU00534)

Computer Science - Advanced use of Spread Sheets - Programming (a language of choice) - Systems (computer components, I/O systems) - Introduction to electronics (basic concepts of electricity and electronics) - Sensors and data-loggers - Functions and types - Installation and programming - Acquisition, storage and processing of data - PLCs and automates - Automation and applications in animal housing - Monitoring animal well-being - Integration and control of systems

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Fundamentals of General Agriculture (FIT00733)

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Animal Reproduction: Physiology and Control (MVT01029)



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Animal Nutrition (ZOO01146)

1. Feeds (concept of feed and nutrient analysis of feed).
2. Nutrients (the main nutrient groups, their properties and functions in animals).
3. Digestibility and digestive kinetics (bioavailability of nutrients and the importance of determination, factors affecting digestibility).
4. Energy and energy systems energy content of feeds (gross, digestible, metabolizable and net energy) and energy evaluation systems for ruminants, monogastric and pets.
5. Protein and protein systems (protein quality of food and protein evaluation systems for both monogastric and ruminant) systems. Interactions between energy and protein.
6. Voluntary food intake.
7. Nutritional requirements of animals (needs for maintenance, growth and fattening, breeding, egg production and lactation).
8. Feed formulation.

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Animal Behaviour and Welfare (ZOO01143)

1. The study of animal behaviour and its applications. 1.1 Learning to see: animal observation
2. Behaviour and physiology 2.1. Sleep 2.2. Feeding behavior 2.3. Central regulation
3. The organisation of behavior. 3.1. Motivation 3.2. Emotions
4. Developing, learning and cognition. 4.1. Clicker training
5. Living in group 5.1. Reproductive behavior 5.2. Maternal behavior 5.3. Common social behavior: grooming and agonistic behaviour
7. Abnormal behaviour, stress and welfare.
8. Human-animal relations. 8.1. Facilities 8.2. Legislation 8.3. Handling

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Food and Food Technologies for Animals (ZOO01135)

Interaction between production and use of pastures. Nutritional requirements of grazing animals. Factors affecting the efficiency of grazing (pasture availability, quality pasture, grazing systems, behavior of grazing animals). Principles of supplementation of grazing animals. Principles of forage conservation. Nutritive value of silages and factors of variation. Nutritive value of hay and factors of variation. Energy concentrates (cereal grains and by-products, fats, roots, tubers and by-products). Protein concentrates (protein sources of plant and animal origin). Dietary sources of minerals and vitamins. Feed additives. Technology of manufacturing compound feed.

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Animal Anatomy and Physiology II (ZOO01137)

Digestive System: anatomy of the digestive tract, regulation of gastrointestinal function, digestive secretions, mechanisms of digestion and absorption, digestion in ruminants, monogastric animals and birds.

Growth and development: body composition and carcass characteristics, growth curves and allometry, growth effect on body composition, factors that affect body composition, growth endocrinology.

Reproductive system in the male, reproductive tract of female, oestrus. Fertilization, pregnancy and parturition.

Lactation: structure, growth and development of the mammary gland, lactogenesis, galactopoiesis.

Regulation of body temperature: body temperature, physiological responses to heat and cold, hypothermia and hyperthermia.



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Technological Processes and Food Quality (ZOO01148)

1. Quality: The quality models. The Food Quality. Implementation of a TQM. EEC regulation of food industry (animal products)
The sensory requirements of food quality. {\}
2. Microbial growth {\}
3. HACCP -Definition, Objectives. Principles of HACCP. Stages of the implementation of HACCP. Analysis of the implementation of a HACCP system in a food business.
Applicable regulation {\}
4. Hygiene in food industry - Food Hygiene. All-purpose and specific hygiene
Applicable regulation (legal controls)
5. Cleaning and disinfection. General Settings. Cleaning and Disinfection (essentials and selection and characteristics of the cleaning and disinfection agent).
6. Classification of Unit Operations-unit operations according to the objective and the transfer phenomena.
7. Application of the food-cold refrigeration and freezing food.
8. Brief approach to technological processes and quality control along the production chain: fish, eggs, fresh meat and processed products, milk and milk products



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Non-Ruminant Production Systems and Techniques (ZOO01153)

SWINE PRODUCTION

Introduction to pig production: Origin and domestication of pigs. Types and swine breeds. Evolution of swine production. Swine production in the world.

Pig Reproduction: Boars reproductive performance. Artificial Insemination. Reproductive cycle of the sow: Puberty, pregnancy, parturition, lactation.

Productivity: expression and calculation. Factors affecting productivity.

Piglets management: Care and management of piglets at farrowing time. Characteristics of the newborn piglet. Physiological particularities of piglet. Weaning and post-weaning: Management practices.

Growing pigs management: Factors affecting growth and development of pig. Carcass and meat quality. Management practices.

Nutrition and feeding of pig: Feeds. Nutrient requirements. Feeding programs in intensive systems: boars, gilts, pregnancy and lactation sows, piglets, growing and finishing pigs.

Pig production and environment: Linkages between pig production and the environment. Technologies and management practices to reduce the environmental impacts. Waste management.

Alternative pig production systems: Historical background. General characteristics of alternative systems of pig production.

Alentejano and Bísaro pig breeds production. Out-door pig production. Iberian pig production. Free range pig production.

Organic pig production.

Technical-economic analysis: Technical and economic indicators. Use of computer programs in technical-economic analysis of intensive and extensive pig farms.

POULTRY PRODUCTION

Introduction to poultry production: Origin and domestication of poultry. Types, breeds and strains of poultry. Poultry production in the world.

General aspects of poultry production: Organization of poultry industry. Breeding and selection in egg and meat poultry. Poultry products.

Nutrition and feeding of poultry. Feeds. Nutrient requirements. Feeding programs for broilers and layers.

Management of layers: Breeds and strains. Production systems. Pullet growing and layers. Animal housing, environmental comfort, lighting programs. Technologies and management practices. Egg quality.

Management of broilers: Breeds and strains. Characterization of production systems. Animal housing, environmental comfort, lighting programs. Technologies and management practices.

Alternative poultry production systems.

RABBIT PRODUCTION

Introduction to rabbit production: Breeds of rabbits. Classification of rabbits. Uses of rabbits. Rabbits production in the world, in E.U. and in Portugal.

Reproduction of rabbits: Physiology of reproduction. Reproductive cycle of the doe. Reproductive management practices.

Nutrition and feeding of rabbits: Feeds. Nutrient requirements. Feeding programs.

Production systems of rabbit meat.

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Ruminant Production Systems and Techniques (ZOO01155)



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Alternative Animal Production Systems and Techniques (ZOO01154)

The animal productions mentioned in 'Objectives' will be approached respecting, at least, the following common approach: origin, evolution and current state; species' anatomic and physiologic bases; biogeography of the (sub)species; species' regulation strategies (at individual and colony level); strategies and behaviours to react to environmental changes; basics of facilities/equipments, behaviour and well-being, feeding, reproduction; animal health and pathology; management practices, production types and derived products; production ecology and ethics; notions of production economy and markets; major regulatory frameworks; possible integration in another bio-production systems; major sector-specific difficulties faced nowadays and expected developments.

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Equine and Companion Animal Studies (ZOO01138)

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Farm Buildings and equipments (ERU00531)

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Project (ZOO01411)

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Project (CTAN) (ZOO10918)

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Internship in Professional Context (ZOO01160)

Course contents will be student-specific, as a function of his/her vocational interests and type of hosting entity.

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Science and Technology of Meat and by-products (ZOO01140)

Meat technology

Introduction to the study of the meat, poultry meat.

Slaughtering operations of cattle, pig, lamb and poultry. Legislation. Carcass quality and grading by subjective and objective methods. Meat cuts according Portuguese legislation. Preservation of carcasses and meat by cooling. Chilling and freezing of meat. Chemical composition and structure of muscle.

Post-mortem changes in muscle and its conversion into meat. PSE and DFD meats. Meat quality. Measuring the composition and physical characteristics of meat: protein, lipids and collagen, colour, water holding capacity and texture.

Conditioning of meat. Factors affecting meat quality: Production and technological. Meat packet technology.

Processing principles of meat manufacturing. Mechanisms of meat preservation: dry-cured, cooked, smoked and fermented.

Modifications during processing (proteolysis and oxidation). Additives used in meat products and its technological effects.

Technological processes of dry-cured products, cooked hams, sausages and emulsion sausages. Meat microbiology.



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Science and Technology of Other Products of Animal Origin (ZOO01141)

Fish and fish products: Fish as food and raw matter. Quality and quality changes in fresh fish. Intrinsic and extrinsic quality. Post-mortem changes in fish. Preservation of fish quality by chilling and freezing. Processing of fish. Dry-cured, smoked and canned fish.

Eggs and egg products: Chemical and physical characterization of the egg and its structure. Quality criteria and functional properties. Factors affecting the quality and functional proprieties. Norms for commercialization. Liquid egg products: whole egg, egg yolk, and egg white. Pasteurization conditions and processing.

Skin, leathers, and wools: skinning, preservation, and transportation of skins. Grading and classification of skins. Definition of leather and proprieties. Shear, inspection, and storage conditions. Grading and classification.

Beekeeping: Pollination types of cultivated plants that can benefit from it, efficiency improvement and ways of determining pollination efficiency, pollination in 'open sky' and in glass houses, contracts and risks associated to pollination services, national and international markets and main bee products (honey, pollen, wax, propolis, royal jelly, venom, mated queens and nuclei) origin, processing, final characteristics and uses by colonies/beekeepers; strategies, techniques and limits associated to intensified production systems; harvesting, processing and product presentations; rules, market standards and safety and quality control; markets and strategies for increased added-value.

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Science and Technology of Milk and Dairy Products (ZOO01142)

Introduction to dairy science and technology: milk and dairy products production, consumption, data and trends. National and international regulations for milk processing and products;

Milk production and biosynthesis. Dairy chemistry and physics. Factors of variation of dairy products and composition. Dairy microbiology. Dairy processing. Utilities: steam, refrigeration and waste handling systems.

Dairy products. Processing. Lab work

Packaging and distribution. Traceability and normalization. Quality control of milk and dairy products

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Animal Production in Tropical and Subtropical Regions (ZOO01149)