# VETERINARY BIOCHEMISTRY

## Course Structure - at a Glance

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<th>CODE</th>
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VBC 601: CHEMISTRY OF ANIMAL CELL  

**Objective:** Teaching of principles of physical chemistry as applicable to veterinary sciences.

**Theory**

**UNIT I**

Pre-biotic world, chemical evolution. cellular architecture, molecular organization and metabolic function.

**UNIT II**

Thermodynamics, chemical equilibrium, standard state, living cell as steady state, open system obeying laws of thermodynamics. Minimum energy conformation, quantum mechanical calculation. AG and ATP.

**UNIT III**

Properties of water, homeostasis, pH, osmosis, viscosity, surface forces adsorption, dialysis, diffusion rate and the sizes of organisms. The blood buffering system. Chemical basis of oral and parental fluid/electrolyte therapies, Bacterial toxigenic diarrhoeas.

**Suggested Readings**


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VBC 602: TECHNIQUES IN BIOCHEMISTRY  

**Objective:** To make students well versed with methodologies used in biochemistry.

**Practical**


**Suggested Readings**


VBC 603: APPLICATIONS OF GENOMICS AND PROTEOMICS IN MOLECULAR BIOLOGY  2+0

Objective: To acquaint students about molecular basis of structure and functional aspects of NA and AA.

Theory

UNIT I

Nucleotides, nucleic acids, high order structures, cohesions and condensins in chromosome structure. SMC proteins, sequencing, mutation, evolution. DNA libraries. Bacterial RNA polymerase, RNA interference. DNA replication, RNA synthesis, control of gene expression. DNA microarrays/chips.

UNIT II


UNIT III


Suggested Readings


VBC 604: BIOCHEMISTRY OF BIOMOLECULES: CARBOHYDRATES LIPIDS AND MEMBRANE'S STRUCTURE 2+0

Objective: Teaching of molecular basis of structure and functional aspects of carbohydrates and lipids.

UNIT I


UNIT II

Lipid classification, metabolism of LCFA, TAG, PL, Sphingolipids, cholesterol, lipoproteins. Regulation of lipid metabolism in fed and fasted states. Regulation of FA oxidation. FAs as regulatory molecules. Glucose production and FAs in type II diabetes. Ketone bodies as fuel.

UNIT III

Lipid bilayers, lipid motility, integral membrane proteins, lipid linked proteins, peripheral membrane proteins, fluid mosaic model, membrane skeleton, lipid asymmetry, vesicle trafficking, secretory pathway, membrane rafts, caveolae fusion, lung surfactant, structure of bacterial rhodopsin. thermodynamics of membrane transport, ionophores, porins, ion channels, aquaporins, transport proteins, P and F types (Na+ - K+ ) ATPases, Ca2+, ion-gradient, Gap Junction, Cl−HCO3−-exchanger, cardiac glycosides, abnormalities in cell membrane fluidity. Haemolytic anaemia.

Suggested Readings


VBC 605: ENZYME CATALYSIS, KINETICS, INHIBITION AND REGULATION 2+0

Objective: To give thorough knowledge of molecular basis of enzyme action in relation to diagnostic importance.

Theory
UNIT I
Mechanisms: Enzyme activation energy and reaction co-ordination, acid-base, covalent, metal ion. Proximity and orientation effects. Preferential transitional state binding.

UNIT II

UNIT III

Suggested Readings

VBC 606: METABOLISM-I: CARBOHYDRATES AND LIPIDS 2+0

Objective: To teach regulatory mechanisms of carbohydrates and lipids metabolism in health and diseases.

Theory
UNIT I
Metabolic control, analysis for enzymes limiting the flux through a pathway. Trophic strategies, universal mapping of metabolic pathways. Thermodynamic relationships. AG, ATP and phosphoryl group transfer, coupled reactions, thioesters, NAD+ and FAD.

UNIT II
Overview of carbohydrate and lipid cycles, control of glycolysis, glycolysis in cancer cells, control of pentose phosphate pathways, deficiency of glucose-6-phosphate dehydrogenase. Control of glycolysis metabolism, control of gluconeogenesis. GSD. Regulation of citric acid cycle, pathways that use citric acid intermediates, Sugar interconversions and nucleotide-linked sugar formation. Disorders associated with impairment of metabolism.

UNIT III
Electron transport and oxidative phosphorylation. Generation of heat by uncoupling in brown adipose tissue.

UNIT IV
Regulation of fatty acid metabolism, inhibitors of fatty acids biosynthesis, sphingolipid degradation and lipid storage disease. Regulation of cholesterol synthesis. PGs in NSAID, leukotrienes, HETEs, hypersensitivity. Influence of glucose metabolism on lipid metabolism.

Suggested Readings
**Objective:** To understand regulatory mechanisms of amino acid and nucleic acid metabolism in health and diseases.

**UNIT I**

Overview of pathways of amino acid and nucleic acid metabolism. Lysosomal degradation, ubiquitin, proteosome, breakdown of amino acids, heme biosynthesis and degradation, biosynthesis of physiologically active amines. Nitric oxide, homocystein as marker of disease. Diseases of amino acid metabolism, porphyrias.

**UNIT II**

Nucleotide synthesis and degradation, inhibition of thymidylate synthesis in cancer therapy. Mutation in coenzyme binding sites and diseases. Forces stabilizing NA structure, restriction endonucleases, small inhibitory RNAs. Chromatin organization. Inhibitors of topoisomerases as antibiotic and anti-cancer agents, interfering with purine and pyrimidine metabolism.

**UNIT III**


**Suggested Readings**


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**Objective:** To give exposure in inter-relationship of cellular metabolism of various macromolecules.

**Theory**

**UNIT I**

Regulation and integration of all metabolic pathways.

**UNIT II**

Organ specialization in fuel metabolism: Brain, muscle, adipose tissue, liver, kidney, inter organ metabolic pathways, hormonal control of fuel metabolism. Tracing metabolic fates, perturbing the system.

**UNIT III**

Signal transduction, gated ion channels, G-proteins, adenylate cyclase, receptor tyrosine kinase, protein phosphatases, cGMP, Ca^{2+}, interaction with phosphoserine/tyrosine, integrations, drugs and toxins, cell cycle and CDKs that affect cell signaling.

**UNIT IV**


**Suggested Readings**


VBC 609: CENTRAL DOGMA AND PROTEIN FUNCTION  
2+0

Objective: Teaching of applied aspects of replication, transcription and translation.

Theory

UNIT I
Overview of transcription and translation in eukaryotes. Collision between DNA polymerase and RNA polymerase, inhibitors of transcription, introns, evolution and expansion of the genetic code.

UNIT II

UNIT III
Actin structure, microfilament dynamics, actin-myosin reacting cycle, tubulin dimmer, microtubules dynamics, kinensins, dyeins.

UNIT IV
Antigen-antibody binding, cytokines, principles of immunochemical methods: agglutination, precipitation, typing of major histocompatibility antigens. Blood group substances in farm animals.

UNIT V

Suggested Readings


VBC 610: CLINICAL BIOCHEMISTRY OF ANIMALS  
2+1

Objective: To make a student well versed with biochemical basis for diagnosis and prognosis of diseases in animals and poultry.

UNIT I
Disturbances of gastrointestinal function, disturbances of rumen function. Lactic acidosis, Pickled pigs and malignant hyperthermia. Diagnosis of neuromuscular disorders.

UNIT II
Myocardial infarction, respiratory distress syndrome. Primary renal dysfunctions and test, doping. Problems in game horses.

UNIT III

UNIT IV

Practical
Estimation of constituents (enzymes, metabolites and electrolytes) of body fluids during normal and pathological conditions. Estimation of hormones. Liver and kidney function tests. Total volatile fatty acids and the fractions in ruminants.

Suggested Readings
Objective: To give a detailed overview of role of biomolecules in health and diseases in animals and poultry.

Theory

UNIT I
Diabetes mellitus, hyperinsulism, galactosemia, hypoglycaemia of baby pigs, Glycogen Storage Disease. Carbohydrate balance in ruminants. Biochemical alterations in body fluids of ruminants in hypoglycaemia, Ruminant ketosis.

UNIT II

UNIT III

UNIT IV

Suggested Readings

Objective: To give a conceptual discussion on role of biomolecules in health and diseases in animals and poultry.

Theory

UNIT I
Mechanism of hormone action, Receptor binding, biosynthetic and metabolic aspects in physio-pathology of hormones, factors, and minerals.

UNIT II
Metabolic functions of the hormones of the hypothalamus, pituitary, thyroid, parathyroid, pancreas, adrenal, pineal, ovaries and testes. Biochemistry of prostaglandins and related agents. Clinical endocrine aspects in production and reproduction status in domestic animals and poultry.

Suggested Readings
VBC 613: BIOCHEMICAL BASIS OF ANIMAL PRODUCTION

Objective: To teach about biochemistry of draft capacity, meat production and dairy chemistry.

Theory

UNIT I

UNIT II
The biochemistry controlling postmortem energy metabolism mechanisms. Application of genomic technologies to the improvement of meat quality of farm animals. Identification of meat quality parameters by proteomics. Application of proteomics to understand the molecular mechanisms behind meat quality. Oxidative stability of post mortem muscles from sheep of various ages.

UNIT III
Metabolic demands of draft animals, and biochemical aspects of work and kinesiology.

Practical
Biochemical tests for proteins of meat, milk and egg and analysis of wool structure.

Suggested Readings

VBC 701: ADVANCES IN BIOCHEMISTRY OF RUMINANT DISORDERS

Objective: To give exposure about biochemical changes in diseases of ruminants.

Theory

UNIT I
Comparative ruminant metabolism, metabolism of various nutrients by microflora. Postruminal digestion of dietary and microbial biomolecules.

UNIT II
Metabolic disorders of rumen and recent development in disorders of ruminants associated with protein, carbohydrate and fat metabolism.

UNIT III
Recent development in disorders of ruminants associated with mineral and electrolyte metabolism.

Suggested Readings
Selected articles from journals.
VBC 702: ADVANCES IN ENZYMEOLOGY  2+0

**Objective:** To teach current developments in actions of enzymes.

**Theory**

**UNIT I**
Current concept on how enzymes work.

**UNIT II**
Recent innovations in enzymes kinetics to understand mechanism.

**UNIT III**
Current topics on regulatory enzymes.

**UNIT IV**
Lysozymes, serine proteases, drug design.

**Suggested Readings**
Selected articles from journals.

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VBC 703: ADVANCES IN CLINICAL BIOCHEMISTRY  0+2

**Objective:** To educate students about current developments in clinical biochemistry.

**Theory**

**UNIT I**
Scope of clinical biochemistry and its application in disease diagnosis.

**UNIT II**
Molecular basis of cell injury and diseases.

**UNIT III**
Molecular basis of autoimmunity, immunodeficiency, oncogenesis.

**UNIT IV**
Functional tests: DNA finger printing, micro and mini satellites, PCR-RFLP in clinical biochemistry, DNA microarrays. Biomolecular prospecting and molecular designing.

**Practical**
Nucleic acid extraction, protein arrays, RT-PCR, hybridization, electrophoretogram ad chromatogram of macromolecules.

**Suggested Readings**
Selected articles from journals.
**VBC 704: MEMBRANE DYNAMICS AND SIGNAL TRANSDUCTION IN ANIMAL CELL** 2+0

**Objective:** Discussions on recent developments in membrane function.

**Theory**

**UNIT I**

Developments in physical & chemical features of biological transport.

**UNIT II**

Developments in membrane dynamics.

**UNIT III**

Developments in solute transport across membrane.

**UNIT IV**

Developments in molecular mechanisms of signal transduction, regulation by steroid hormone, protein kinases.

**UNIT V**

Developments in signaling in microorganisms, special senses.

**Suggested Readings**

Selected articles from journals.

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**VBC 705: METHODS IN PROTEIN ANALYSIS** 2+1

**Objective:** Discussions on contemporary information on techniques in protein research.

**Theory**

**UNIT I**

Separation, purification and characterization of proteins in ECF and membrane.

**UNIT II**

Subcellular organization of proteins fused with green fluorescent protein. High throughput methodologies for determining protein structure.


**UNIT III**

Use of FRET (fluorescence resonance energy transfer) to measure transient changes in second messenger or protein kinase activity in living cell. Proteomics.

**Practical**

Proteomics, protein quantification.

**Suggested Readings**

Selected articles from journals.
VBC 706: NUTRITIONAL BIOCHEMISTRY  2+0

Objective: To give exposure about biochemical principle as applicable to nutrition in animals and poultry.

Theory

UNIT I
Evolution of diet and nutritional status of animals, digestion, absorption in ruminants, equine and poultry.

UNIT II
Calorimetry, BMR, SDA, PER, nutritional need for growth, work, production and disease. Parental nutrition.

UNIT III
Obesity, food additives and naturally occurring toxic substances in food, dietary factors in carcinogenesis, free radical, antioxidant and pro-oxidant.

Suggested Readings
Selected articles from journals.

VBC 707: ADVANCES IN INTERMEDIARY METABOLISM  2+0

Objective: To teach methods and approaches in research on metabolism.

Theory

UNIT I
Energy transformation in living cell, enzymes system, high energy compounds.

UNIT II
Overview of cycles, role of TCA in producing biological precursor in evolution. Control of fatty acid metabolism, lipoprotein metabolism, pathways of amino acids, integration of cycles, metabolism of purines, pyrimidines. CoA, NAD⁺, FAD and ATP.

UNIT III
Analytical approaches in studies on intermediary metabolism.

Suggested Readings
Selected articles from journals.

VBC 708: ENDOCRINE CONTROL OF FUEL METABOLISM  2+0

Objective: To study hormonal regulation and integration of mammalian metabolism.

UNIT I
Hormone: Diverse structure for diverse functions.

UNIT II
Tissue specific metabolism.

UNIT III
Hormonal regulation of fuel metabolism.

UNIT IV
Regulation of body mass, production of beef, egg, poultry and fish.

Suggested Readings
Selected articles from journals.
VBC 709: DIAGNOSTIC ENZYMOLGY – I

Objective: To expose students about use of enzymes in diagnostics.

Theory
UNIT I
History, development, validation of clinical enzyme assay.

UNIT II
Assay of enzymes in clinical cases. Enzyme urea. Enzymes in pathogenesis.

UNIT III
Enzyme histochemistry and cytochemistry, immobilized enzymes. Enzyme immuno diagnostics, molecular genetics.

Suggested Readings
Selected articles from journals.

VBC 710: DIAGNOSTIC ENZYMOLGY – II

Objective: To provide in-depth knowledge about enzymes in diagnosis of diseases of animals and poultry.

Theory
UNIT I
Phosphatases, creatine kinase in diagnosis of diseases of animals and poultry.

UNIT II
Amino transferases, trypsin in diagnosis of diseases of animals and poultry.

UNIT III
Dehydrogenases in diagnosis of diseases of animals and poultry.

UNIT IV
Cholinesterase, lipase, amylase, GGT, GTPx, arginase, AST, ALT & SDH in diagnosis of diseases of animals in poultry. Enzymes in pathogenesis.

Suggested Readings
Selected articles from journals.

VBC 711 BIOCHEMISTRY OF DEVELOPMENT AND DIFFERENTIATION

Objective: To develop understanding of biochemical basis of embryo development in mammals and aves.

UNIT I
Molecular basis of reproductive events including gametogenesis, fertilization, embryo development and differentiation, gene knock out

UNIT II
Homeotic gene maintenance and repair of body tissue.

UNIT III
Biochemical basis of chick and fetal development

Suggested Readings
Selected articles from journals.
VBC 712: ADVANCES IN TECHNIQUES IN BIOCHEMISTRY 0+2

Objective: To expose students about current developments in techniques used in animal biochemistry.

Practical
Tracer methodologies as applied to problems in biochemistry. Electrophoresis, HPLC, GLC & TLC, spectrometry as applied to problems in biochemistry. X-Ray-Crystallography, NMR Spectrometry. Atomic absorption spectrophotometry as applied to problems in biochemistry. Ultracentrifugation as applied to problems in biochemistry.

Suggested Readings
Selected articles from journals.

VBC 713: ADVANCES IN MINERAL AND VITAMIN METABOLISM AND RELATED DISEASES 2+0

Objective: To expose students to latest class material to be given on recent trends in research on cofactor and mineral metabolism disorders in animals.

Theory
UNIT I
Biochemical basis of conditions related to nutrient deficiency & excess

UNIT II
Metabolism of Ca, P, Mg, Na, K and the related diseases in animals and poultry.

UNIT III
Minerals and B Vitamins as cofactors and their metabolism in livestock and poultry.

UNIT IV
Biochemical mechanisms of fat soluble and water soluble vitamins and their metabolism in livestock and poultry.

Suggested Readings
Selected articles from journals.

VBC 790: SPECIAL PROBLEM 0+2

Objective: To provide expertise in handling practical research problem(s).

Practical
Short research problem(s) involving contemporary issues and research techniques.