

**REVISED CURRICULUM  
OF  
ANIMAL PHYSIOLOGY AND ANIMAL  
PHARMACOLOGY**

**Curriculum Development Project**

Sponsored by  
**Ministry of Science & Technology  
Islamabad**



**UNIVERSITY GRANTS COMMISSION  
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2001**

## **CURRICULUM DIVISION, UGC**

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*Composed by Nadeem A. Janjua, UGC Head Office, Islamabad*

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## **PREFACE**

Curriculum of a subject is said to be the throbbing pulse of a nation. By looking at the curriculum of a subject, one can judge the state of intellectual development and the state of progress of a nation. The world has turned into a global village, new ideas and information are pouring in a constant stream. It is, therefore, imperative to update our curricula by introducing the recent developments in the relevant fields of knowledge.

In exercise of the powers conferred by Sub-section (1) of section 3 of the Federal Supervision of Curricula Textbooks and Maintenance of Standards of Education Act 1976, the Federal Government vide Notification No.D773/76-JEA (Cur.), dated December 4, 1976, appointed University Grants Commission as the Competent Authority to look after the Curriculum Revision Work beyond Class XII at Bachelor level and onwards to all Degrees, Certificates and Diplomas awarded by Degree Colleges, Universities and other Institutions of higher education.

In pursuance of the above decisions and directives, the Commission is continually performing curriculum revision in collaboration with the Universities. According to the decision of the 44<sup>th</sup> Vice-Chancellors' Committee, curriculum of a subject must be reviewed after every 3 years. For the purpose, various Committees are constituted at the national level comprising senior teachers nominated by the Universities. Teachers from local degree colleges and experts from user organizations, where required, are also included in these Committees.

The National Curriculum Revision Committee on Vet. Physiology and Vet. Pharmacology in May, 2001 at UGC Regional Office, Karachi finalized the draft curriculum after due consideration of the comments and suggestions received from the Universities and Colleges where the subject under consideration is taught.

The Final draft prepared by the Curriculum Revision Committee duly approved by competent authority is being circulated for implementation by the Universities.

**(PROF. DR. ALTAF ALI G. SHAIKH)**  
**ADVISER (C&T)**

June, 2001





## INTRODUCTON

Meeting of National Curriculum Revision Committee on the subject of Vet. Physiology and Vet. Pharmacology was held in the University Grants Commission Regional Office from May 24-26, 2001 to prepare final draft curriculum for graduate and post-graduate degree programs. Following members attended the meeting: -

1. Professor Dr. Saghir Ahmed Jaferi, Convener  
Principal,  
College of Veterinary Sciences  
Lahore.
2. Professor Dr. Bashir Ahmad Sheikh Member  
Sindh Agriculture University  
Tandojam  
Representative of PVMC, Islamabad
3. Professor Dr. Maqbool Ahmed Memon Member  
Chairman,  
Department of Physiology,  
Faculty of Veterinary Science & Animal Husbandry,  
Sindh Agriculture University,  
Tandojam.
4. Dr. Abdul Mateen Khan Member  
Director  
Institute of Animal Husbandry &  
Veterinary Sciences, Gomal University,  
D.I. Khan.
5. Dr.M.Akhtar Qureshi, Member  
Assistant Professor,  
University College of Agriculture,  
Rawalakot, A.J.K.
6. Dr.Tofique Ahmed Qureshi, Member  
Assistant Professor,  
Department of Veterinary Pharmacology,  
Sindh Agriculture University ,  
Tandojam.

- |     |  |                               |
|-----|--|-------------------------------|
| 7.  | Mr.Zakir Ullah<br>Lecturer,<br>Department of Animal Physiology,<br>Gomal University,<br>D.I.Khan.  | Member                        |
| 8.  | Dr. M.Ata Ullah Khan<br>Research Officer,<br>Veterinary Research Institute,<br>Govt. of NWFP,Peshawar,   | Member                        |
| 9.  | Dr.Nemat Ullah<br>P.S.O. Animal Sciences Institute,<br>National Agricultural Research Centre,<br>P.O. NIH, Islamabad.  | Member                        |
| 10. | Dr.Mohammad Mohsin Siddiqui<br>Associate Professor,<br>Department of Livestock Management.<br>and Animal Breeding<br>NWFP, Agricultural University,<br>Peshawar. | Member                        |
| 11. | Lt. Col. Tariq Mehmood Khan<br>ADRV & FHQ Logistic Area,<br>Karachi  | Member                        |
| 12. | Professor Dr. Muhammad Nawaz<br>Department of Veterinary Pharmacology<br>University of Agriculture<br>Faisalabad   | Secretary                     |
| 13. | Dr. Altaf Ali G.Shaikh,<br>Adviser C&T,<br>U.G.C.Islamabad.  | Director General (Curriculum) |
| 14. | Mr.Zaheer Ahmed Awan<br>Education Officer<br>University Grants Commission,<br>Islamabad.   | Coordinator                   |

The meeting started with the recitation from the Holy Quran by the Convener. Dr. Altaf Ali G. Shaikh, Director General (Curriculum) and Adviser (C&T) UGC., Islamabad thanked participants of the meeting and briefed about the constitutional role of the Commission. He elaborated the process of curricular revision to maintain the baseline curricula and the necessity there of. He also assured that the UGC will play its role in getting through the recommendations from the concerned agencies to adopt/implement the draft curriculum in the universities and stressed that efforts be made to have unified curriculum throughout the country with the cooperation of the Universities and Councils.

The members of the Committee thoroughly deliberated on the undergraduate and postgraduate draft curricula in veterinary physiology and pharmacology. These subjects are being taught at three institutions namely;

1. Department of Physiology & Pharmacology,  
Faculty of Veterinary Science,  
University of Agriculture, Faisalabad.
2. Department of Physiology & Bio-chemistry and  
Department of Pharmacology,  
College of Veterinary Sciences, Lahore.
3. Department of Physiology & Biochemistry and  
Department of Pharmacology,  
Faculty of Veterinary Science & Animal Husbandry,  
Sindh Agriculture University, Tandojam.

Dr. Mateen, who attended the meetings at his own request, informed the committee members that these subjects were also being taught to the veterinary students at the Institute of Veterinary Medical Sciences, Gomal University, D.I. Khan.

The committee members suggested certain alterations, modifications, corrections and amendments to the draft curricula in the subjects of veterinary physiology and pharmacology, which were added to the draft curricula after comprehensive considerations. The revised/final versions of the curricula for both the subjects are given in Appendix I.

During these deliberations, recommendations of the last meeting and several points relevant to the curricula and DVM degree program came under discussion and were considered important for appropriate action. These points are included as specific and general recommendations and are given below:

(Professor Dr. Mohammad Nawaz)  
Secretary

(Professor Dr. S.A Jaferi)  
Convener

## APPENDIX I

### PHYSIOLOGY

#### Graduate

<b>V.Ph. 311</b>	<b>Introduction to Veterinary Physiology (for B.Sc (Hons) Animal Husbandry)</b>	<b>3(2-2)</b>
V.Ph 312	Physiological Chemistry	4(3-2)
V.Ph 313	Neuromuscular & Endocrine Physiology	3(2-2)
V.Ph 314	Cardiovascular, Respiratory & Renal Physiology	4(2-4)
V.Ph 415	Comparative Digestive Physiology	3(2-2)
V.Ph 416	Avian Physiology	1(1-0)

#### Postgraduate Courses

V.Ph 701	General Principles of Physiology	4(3-2)
V.Ph 702	Physiology of Respiratory & Cardiovascular System	3(2-2)
V.Ph 703	Physiology of Nerve Muscles	3(2-2)
V.Ph 704	Physiology of Digestion & Metabolism	4(3-2)
V.Ph 705	Endocrinology	3(2-2)
V.Ph 706	Physiology & Biochemistry of Rumen	4(3-2)
V.Ph 707	Physiology of Steroid Hormones	3(2-2)
V.Ph 708	Cell Physiology	4(3-2)
V.Ph 709	Physiological Techniques	3(0-6)
V.Ph 710	Enzymology	3(2-2)
V.Ph 711	Physiology of kidney and sweat glands	4(3-2)

### PHARMACOLOGY

#### Graduate Courses

V.Pm 421	General Pharmacology	3(2-2)
V.Pm 422	Systemic Pharmacology	4(2-4)
V.Pm 423	Chemotherapy and Toxicology	3(2-2)

### Postgraduate courses

V.Pm 701	General Pharmacology	3(2-2)
V.Pm 702	Advanced Pharmacology I	4(3-2)
V.Pm 703	Advanced Pharmacology II	3(2-2)
V.Pm 704	Pharmacokinetics	4(2-4)
V.Pm 705	Pharmaceutics	3(2-2)
V.Pm 706	Pharmacology of Central Nervous System	3(2-2)
V.Pm 707	Pharmacology of Autonomic Nervous System	3(2-2)
V.Pm 708	General Therapy	3(2-2)
V.Pm 709	Pharmacotherapy	4(3-2)
V.Pm 710	Chemotherapy	3(2-2)
V.Pm 711	General Toxicology	4(3-2)
V.Pm 712	Systemic Toxicology	3(3-0)
V.Pm 713	Biochemical Pharmacology	3(2-2)
V.Pm 714	Pharmacology of autacoids	3(2-2)

## **ANNEXURE I**

### **PROPOSED CURRICULLA**

#### **V.Ph. 311. INTRODUCTION TO VETERINARY PHYSIOLOGY 3(2-2) (For B.Sc. (Hons.) Animal Husbandry)**

##### **THEORY**

Introduction: Intracellular organization and Physiology, Body fluids; Blood, lymph, cerebrospinal fluid, synovial fluid, Blood circulation and cardiovascular system; Physiological properties and cellular and chemical constituents of blood, Blood coagulation, Blood groups and their importance in livestock. The conduction system of the Heart, Regulation of cardiac out put, Regulation of the Heart and Blood vessels, Regional circulation and pulmonary circulation. Respiratory system; Mechanism of Respiration, types of breathing, Air volumes and capacities, Exchange of Gases, Control of Respiration, Artificial Respiration. Digestive system: Ingestion of food by various animals. Mastication, Salivation and Deglutition, Functions of saliva. Simple stomach digestion; Gastro-intestinal motility, secretions and functions, liver and pancreatic secretion and functions, Digestion in Ruminants; Rumination, Fermentation, Functions of Omasum and Abomasums, Absorption from stomach and intestines. Water balance and Excretion; Electrolytes, physiology of kidney and physiology of the skin; Endocrine glands and their secretions and functions. Physiology of lactation and Reproduction. Nervous system: spinal cord and brain functions, autonomic nervous system.

##### **PRACTICALS**

Introduction of various laboratory instruments, Collection of blood in different species of animals and use of anticoagulants. Measurements of normal pulse, respiration and rectal temperature. Hematological experiments. Determination of blood groups. Determination of blood pressure. Determination of various lung capacities and volumes. Urine examination for normal constituents. Microscopic examination of urine. Test for saliva, Dissection for location of endocrine glands in rat and chicken. Visit to university farm for observation on prehension, mastication and rumination of domestic animals. Observation on the stomach of buffalo, cattle and camel.

## BOOKS RECOMMENDED

1. Breazile, J.E. (Recent edition). Textbook of Veterinary Physiology. Lea and Febiger, Philadelphia, USA.
2. Frandson, R.D. 1992. Anatomy and Physiology of Farm Animals. Lea and Febiger, Philadelphia.
3. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca's.USA.

**V.Ph.312**

**PHYSIOLOGICAL CHEMISTRY**

**4(3-2)**

### THEORY

Introduction, Physiological aspects; Hydrogen ion concentration, ionic product of water, the relationship between pH and pKa, Buffer solutions, Regulation of acid-base balance; functions of acid-base buffers, The Henderson Hasselbalch equation, The buffer systems of the body fluids, Respiratory acid base balance, renal regulations of hydrogen ion concentration, Bio-membrane; structures and related processes, transport; passive diffusion, facilitated diffusion, Active transport, Carbohydrates; General characteristics, classification, Stereoisomerisms, Optical isomerism and Optical activity, Cyclic forms of sugars, Glycosidic linkage, Chemical properties, Disaccharides, polysaccharides. Proteins and amino acids; Structure, Amino acids occurring in protein molecules, Peptide linkage, Physiological significance, Classification, Amphoteric properties, Isomerism, Structures; Primary, Secondary and tertiary. Enzymes: General characteristics, Activity, Mechanism of Enzyme Reaction, chemical nature. Lipids: Characteristics and Functions. Classification: simple lipids, compound lipids, derived lipids, fatty acids; saturated and unsaturated with physical and chemical properties. Triglycerides: properties, steroids and sterols; cholesterol, 7-dehydrocholesterol, Ergosterol. Carbohydrate metabolism; Glycolytic pathways; Glycolysis, Tricarboxylic acid cycle. Calculation of ATP moles formed in glucose utilization, Oxidative phosphorylation and formation of ATP. Pentose phosphate shunt. Glucuronic acid pathway. Glucogenesis, Glycogenesis and Gluconeogenesis, Metabolism of fructose and galactose, Integration with amino acid metabolism, Protein and amino acid metabolism; Plasma amino acids, synthesis of non essential amino acids, Fate of plasma amino acids, Amino acids in urine, Biochemical reactions. Fate

of ammonia. Urea formation, other pathways of ammonia utilization, Fate of non nitrogenous residues of amino acids, special pathways and physiological functions of individual amino acids, creatine and creatinine metabolism. Lipid metabolism; Transport of lipids in the body fluids; Transport of triglycerides and other lipids by the lymph from the gastrointestinal tract, removal of chylomicron from the blood. Transport of fatty acids in the blood in combination with albumin. The lipoproteins and their special function in transporting cholesterol and phospholipids. Biosynthesis of fatty acids, triglycerides, cholesterol and prostaglandin's. Role of adipose tissue in fat metabolism, Metabolism of free fatty acids, oxidation of fatty acids, Use of triglycerides for energy and formation of ATP, Factors affecting plasma cholesterol concentration, ketogenesis and utilization of ketone bodies, ketosis, metabolism of bile acids and salts. Integration of metabolism of carbohydrates, proteins and fats.

#### **PRACTICALS:**

Preparation of solutions. Demonstration of pH meter and preparation of standard curve. Assignments on osmotic pressure and dialysis. Polarimetry, Measurement and calculation of degree of rotation for various optically active substances in solutions. Spectrophotometry; Blood glucose and proteins determination by spectrophotometry. Electrolyte determination by flame photometry. Chromatography including paper chromatography and Column chromatography. Tests for identification of carbohydrates. Tests for identification of lipids.

#### **BOOKS RECOMMENDED:**

1. Ahmad, Mushtaq, 1996. Essentials of Medical Biochemistry. Vol. 1, Merit Publishers, Faisalabad.
2. Ahmad Mukhtar, 1993. Textbook of Modern Biochemistry. Vol.1. Vanguard Books Ltd., Lahore.
3. Murrari, Robert, K. Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell, 1993. Harper's Biochemistry 23<sup>rd</sup> ed. Prentice-Hall International (UK) Limited, London.
4. Champe, Pamela C., Richard A. Harvey, 1995. Lippincott's Illustrated Reviews: Biochemistry. 2<sup>nd</sup> ed. J.B. Lippincott Company, Philadelphia.
5. Stryer, L. 1995. Biochemistry. W.H Freeman Company, USA.

**V.Ph.313**

**NEUROMUSCULAR AND ENDOCRINE**

**THEORY**

Excitable cells: nerve and muscle cells: Neuron, structure and classification, Action potentials, Electro-chemical events, Conduction of action potential, Synapse, Synaptic transmission, Chemical mediators, Poly-synaptic transmission. Receptors: Chemoreceptors, Mechanoreceptors, Electroreceptors, Thermoreceptors, Proprioceptors; Central nervous system, Peripheral nervous system; Autonomic nervous system, Sympathetic and Parasympathetic divisions of the ANS. Muscle cells, types of neural control, Neuro-muscular junction, Types of the junctions. Concept of Homeostasis in endocrine physiology, Classification of hormones, General mechanism of hormone action, Chemical messenger and regulator, Concept of first and second messenger, Regulation of hormone secretion and secretory mechanisms, Hypothalamus and pituitary, adenohypophysis (anterior pituitary) and neurohypophysis (Posterior pituitary) and their hormones. Metabolic hormones, Hormonal regulation of water and electrolytes; Prostaglandin's, Steroid hormones. Sexual development and reproduction of male and female. Fetal placental unit. Physiology of lactation.

**PRACTICALS**

Nerve muscle preparation of frog. Isolated heart activity of rabbit, Decelerated frog heart activity, Isolated intestinal segment activity. Demonstration on kymograph. Topography of taste and relationship between taste and smell. Demonstration on the location of endocrine glands in rat and birds. Effect of insulin on the glucose metabolism. Effect of thyroidectomy on growth of animal. Effect of adrenaline on the metabolic profile of rats. Effect of growth hormone on rats. Effect of complete and partial adrenalectomy on rats. Effect of castration and replacement therapy on male rats. Isolated rat uterus and effect of oxytocin on it. Dissection for location of endocrine glands in rats and chicken. Physiological and biochemical aspects of lactation. Stress Physiology. Effect of hot and cold environment on animals.

**BOOK RECOMMENDED**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors).



Introduction of various laboratory instruments. Collection of blood in different domestic animals. Use of various experimental animals. Determination of packed cell volume by different methods. Determination of Hemoglobin concentration by different methods. Determination of Coagulation time and bleeding time. Determination of erythrocyte sedimentation rate in the blood of different species of domestic animals. Counting of Red Blood Cells, Counting of White Blood Cells. Differential leukocytic count. Determination of blood groups in man. Estimation of specific gravity and pH of blood. Estimation of icterus index of blood. Determination of blood pressure by direct method (Arterial cannulation) and effects of vagus stimulation. Recording of myocardial activity in isolated heart. Listening of heart sounds (Auscultation). Recording of respiratory movement by Pneumograph and by tracheal cannula. Measurements of various lung capacities and volumes. Auscultation of different respiratory sounds and chest movements during respiration. Different methods of artificial respiration in man and animals. Measurement of urine flow by cannulating the ureters. Effect of vagus stimulation and injection of strong solution of glucose on the flow of urine. Urine examination for normal and abnormal constituents. Microscopic examination of urine.

**BOOKS RECOMMENDED:**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca, USA.
2. Arthur C., M.D. Guyton, J.E. Hall. 2000. Textbook of Medical Physiology. 10<sup>th</sup> Edition. W.B. Saunders Company, Philadelphia.
3. Ruckebusch, Y.L. Phancuf and R. Dunlop, 1991. Physiology of small and large animals. B.C. Decker, Inc. Philadelphia. Hamilton
4. Frandson, R.D. 1992. Anatomy and Physiology of Farm Animals. Lea and Febiger, Philadelphia.
5. Withers, P.C. 1992. Comparative Animal Physiology. Saunders College Publishing, New York, USA.
6. Mushtaq, A. 1999. General physiology. Merit publishers. Lahore.

## **THEORY**

Comparative physiology of carnivorous and herbivorous gastro-intestinal tracts; canine, equine and ruminants. Prehension, chewing and swallowing, Saliva, its secretion, composition and functions. The stomach of Non-Ruminant Animals; Gastric secretion, contractile activity of the stomach, Emesis. The Ruminant stomach; Growth and development of the ruminant digestive system. Factors affecting forestomach development. Rumen ecosystem, microbial characteristics of different organisms, protozoa, fungi and their role in rumen. Factors affecting microbial growth and variation in rumen microbial population. Digestion in the abomasum, small and large intestine. Physiology of liver, bile and pancreas. Factors affecting digestion in carnivores and herbivores. Absorption from the gastro intestinal tract; volatile fatty acids, ammonia, monosaccharides, lipids and amino acids. Appetite, palatability and control of feed intake; roughages intake, energy intake with mixed high concentrate diets, energy intake in relation to digestibility in ruminants. Disorders of gastrointestinal tract; bloat, nitrate and urea toxicity. Metabolic disorders. Deficiencies of energy; protein, mineral and vitamins.

## **PRACTICALS**

Laboratory exercise for measurement of size and volume of various parts of G.I. Tract of sheep, cattle, camel and poultry (slaughter house material). Mussel view of reticulum, rumen, omasum and abomasum. Demonstration of motility and absorption in small intestine of poultry/rabbit/dog. On farm Observations for prehension, mastication, regurgitation, re-swallowing and counting of jaw movements of domestic animals. Collection of saliva and various chemical tests. Microscopic examination of ruminal protozoa and bacterial cells. Measurement of in-vitro and in-vivo digestibility, ammonia, pH and bacteria in fistulated animals.

## **BOOKS RECOMMENDED**

1. Church, D.C. 1993. The Ruminant Animal Digestive Physiology and Nutrition. Waveland Press, USA..
2. Ruckebusch, Y.L. Phaneuf and R.Dunlop. 1991. Physiology of small and large animals. B.C. Decker, Inc. Philadelphia. Hamilton.
3. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca.USA.

## **V.Ph. 416 AVIAN PHYSIOLOGY**

**1(1-0)**

### **THEORY**

Physiology of digestion: Regulation of food intake, motility of alimentary canal, secretion and digestion by the digestive organs. Absorption of the nutrients. Nutrient requirements, imbalances, deficiencies. Avian respiration and air circulation, respiration rates and volumes. Transport of blood gases, regulation of respiration. Regulation of body temperature, heat stress. Physiology of stress. General adaptation syndrome. Physiology of the urinary system. Reproductive physiology: Sexual maturity in the chicken, synchronization with age, weight and light stimulation. Egg formation. Physiology of circulation. Anemia. Reticuloendothelial system and immunity. Behavioral changes and Vices.

### **BOOKS RECOMMENDED**

1. Sturkie, P.D. (Recent Edition). Avian Physiology.
2. Bell, D.J. and B.M. Freeman. (Recent edition). Physiology and Biochemistry of the Domestic Fowl. Academic Press, London.
3. Freeman, B.M. and P.E. Lake. (Recent edition). Egg Formation and Production. British Poultry Science Ltd. Edinburgh.
4. King, A.S. and J. Melellan. (Recent edition). Form and Function in Birds. Academic Press. London.
5. Etches, R.J. 1995. Reproduction in Poultry. CABI Publishing ,CAB International. London.

## **POST-GRADUATE COURSES**

### **PHYSIOLOGY**

**V.Ph 701      GENERAL PRINCIPLES OF PHYSIOLOGY**  
**4(3-2)**

### **THEORY**

Functional organization of the living body. Homeostasis. pH of body fluids and its regulation. Buffer systems, acidosis and alkalosis, role of kidneys and respiratory system in body pH. Role of stress, allergy and shock in pH of body. Body temperature, its regulation and fever. Radiation its uses and hazards in biology. Body defense mechanism, innate and adoptive immune response. Reticulo-endothelial system. Properties of leukocytes.

### **PRACTICALS**

Measurements of body fluid volumes, pH measurements, surface tension, dialysis, diffusion and osmosis, metabolic and pulmonary acidosis and alkalosis. Acid and base excesses.

### **RECOMMENDED BOOKS**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca, USA.
2. Arthur C., M.D. Guyton, J.E. Hall. 2000. Textbook of Medical Physiology. (10<sup>th</sup> Edition) W.B. Saunders Company, Philadelphia.
3. Mc Dowell, J. (Recent edition). Principles of General Physiology.

**THEORY**

Physiology of respiration, mechanism of pulmonary ventilation, pulmonary volumes and capacities, physical principles of gaseous exchanges, transport of oxygen and carbon dioxide in blood. Regulation of respiration, neural control of respiratory cycle, anoxia, effects of breathing on circulation. Heart muscle, its rhythmic excitation and physiology. Regulation of cardiac functions, electrocardiogram, physical characteristics of systemic circulation, local control of blood flow by tissues, nervous and humoral system. Coronary circulation and cardiac failure. Circulatory shock, its physiology and treatment.

**PRACTICALS**

Effect of stress, exercise and hypoxia on blood characteristics, blood pressure determination in normal and dehydrated dogs by direct methods. Electrocardiography, recording of respiratory movements with stethograph. Effect of various conditions on blood coagulation.

**BOOKS RECOMMENDED**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca, USA.
2. Arthur C., M.D. Guyton, J.E. Hall. 2000. Textbook of Medical Physiology. (10<sup>th</sup> Edition) W.B. Saunders Company, Philadelphia.
3. Ganong, W.F. 2001. Review of Medical Physiology. 20<sup>th</sup> Edition. Mc- Graw-Hill Professional Publishing. USA.



**THEORY**

Autonomic nervous system, different impulses from the viscera, resting membrane potential of nerves, nerve action potential and its propagation, metabolism of the nervous system. Spinal Cord, effect of sections of roots or spinal nerves, properties of spinal reflexes. Brain; reticular formation of brain, the thalamus, function of cerebral hemispheres. Physiology of muscular system; molecular mechanism of muscle contraction, mechanisms of skeletal muscle contraction, special features of muscles and abnormalities of skeletal muscle function. Neuromuscular transmission through junction, contraction of smooth muscles and role of tissue factors and/or hormones, mechanical characteristics of smooth muscle contraction.

**PRACTICALS**

The demonstration of the effect of single shock to muscle nerve preparation and to calculate time period of various phases. Effect of temperature on muscle contraction. Muscle activity recording in free and after bathed condition. Effect of increasing strength of stimuli on muscular contraction, effect of several successive stimuli on nerve muscle preparation. Study of fatigue phenomenon in muscle to determine the velocity of nerve impulse in frog's nerve muscle preparation.

**BOOKS RECOMMENDED**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca, USA.
2. Arthur C., M.D. Guyton, J.E. Hall. 2000. Textbook of Medical Physiology. (10<sup>th</sup> Edition) W.B. Saunders Company, Philadelphia.



**V.Ph. 704      PHYSIOLOGY OF DIGESTION AND METABOLISM**  
**4(3-2)**

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**THEORY**

Functional anatomy of the digestive system. Saliva: salivary glands structure, regulation of salivary secretion, composition of saliva and its significance in digestion. Digestion of food in the stomach: structure of gastric glands, secretion and regulation of gastric juice. Enzymic digestion of food. Stomach movements and their control. Structure of intestinal glands: secretion, regulation and composition of intestinal juice. Bile: synthesis, storage, release, its composition and regulation.

Pancreatic juice: storage, release and its regulation by hormones of the gastro-intestinal tract and their significance in digestion. Digestion of food in the small intestine, structure of absorptive surface and villi. Absorption of nutrients from the gastro intestinal tract, mechanisms of absorption. Absorption of ions and nutrients from stomach, small intestine and hindgut. Rate of passage of food through gastro intentional tract. Structure of liver and its functions. Carbohydrate metabolism: blood glucose, glycolysis, citric acid cycle, pentose phosphate shunt, glycogen, glycogenolysis, and glycogenesis. Lipid metabolism; lipid transport and disposition, biosynthesis of fatty acids, inter-conversions, triglycerides synthesis and catabolism, ketolysis, cholesterol biosynthesis, and catabolism. Protein metabolism: deamination, transamination, urea formation, and protein synthesis. Vitamins and minerals absorption and metabolism. Physiology of gastrointestinal disorders: vomiting, constipation, diarrhea, gastritis, peptic ulcers, pancreatitis, enteritis and gall stones.

**PRACTICALS**

Collection and analysis of saliva and pancreatic juice, Pavolov's pouch, thiry villa fistula, fistulation of rumen and collection of ruminal fluid. Motility of G.I. tract.

## **BOOKS RECOMMENDED**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals, 11<sup>th</sup> Edition. M .J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca. USA.
2. Arthur C., M.D. Guyton, J.E. Hall, 2000. Textbook of Medical Physiology. (10<sup>th</sup> Edition) W.B. Saunders Company, Philadelphia.
3. Ganong, W.F. 2001. Review of Medical Physiology. 20<sup>th</sup> Edition. Mc-Graw Hill Professional Publishing USA.

## **V.Ph.705                      ENDOCRINOLOGY                      3(2-2)**

### **THEORY**

Historical background. Mechanism of hormone action. Types of chemical messenger, methods of study. Assay of hormones, neuroendocrine integration. Influence of nervous system on the endocrine glands and pathways involved in the regulation of endocrine activity. The adenohipophysis; morphology and hormones; growth hormone, adrenocorticotrophin (ACTH), gonadotrophin (FSH, LH, LTH), thyroid stimulating hormone (TSH), hypothalamic control of adenohipophyseal functions. Hormones of posterior lobe; oxytocin, vasopressin, The thyroid gland: anatomy, synthesis and biological action of thyroid hormones, parathyroid hormones. The pancreas: anatomy, hormones of pancreas; insulin and glucagons, biological actions of pancreatic hormones. Adrenal gland: anatomy, hormones of adrenal and their actions. Gastrointestinal hormones. Steroid hormones. Organs of uncertain endocrine functions.

### **PRACTICALS**

Anatomical studies of endocrine organs including their histology. Thyro-parathyroidectomy in laboratory animals. Adrenalectomy, water load of adrenalectomized animals, replacement therapy, radio immunoassay, enzyme immuno assay of hormones.

## **BOOKS RECOMMENDED**

1. Turner, C.D. (Latest). General Endocrinology. W.R. Saunders Co., Philadelphia.

2. Zarrow, M.X., J.M.Yochim and J.L. McCarthy. (Recent edition). Experimental Endocrinology: a source book of basic techniques. Academic Press. New York.
3. McDonald and Pineda. 1989. Veterinary Endocrinology and Reproduction. Lea & Febiger. Philadelphia. USA.

## **V.Ph.706 PHYSIOLOGY AND BIOCHEMISTRY OF RUMEN 4(3-2)**

### **THEORY**

Structure of the rumen, development of the ruminant stomach. Salivary glands and their secretions. Composition of saliva and its role in rumen fermentation, regulation of salivary secretion. Significance of esophageal groove. Eructation. Causes, prevention and cure of bloat. Rumen microflora and fauna, microbial symbiosis rate. Quantitative aspects of rumen gases and VFA production. Absorption of VFA, and nitrogenous compounds and lipids. Vitamin and mineral metabolism. Absorption from the omasum and abomasum. Digestion and absorption in the abomasum, small intestine and hindgut. Physiology of gastric secretions, intestinal secretion, pancreatic juice and bile. Quantitative aspects of fermentation in ruminants. Regulation of food intake, rate of passage of food through alimentary tract.

### **PRACTICALS**

Properties of saliva. Isolation and identification of rumen microorganisms. Factors affecting the growth of rumen microorganisms. Measurement of rate of passage of food. Measurement of rate of digestibility (in vitro, in vivo, in sacco). Estimation of rumen ammonia and blood urea under various physiological conditions. Preparation of fistulated animals.

## **BOOKS RECOMMENDED**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M.J. Swenson and W.O Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca, USA.
2. Van Soest. 1980. Ecology of Rumen. Cornell University Press, Ithaca, USA.

## **V.Ph.707      PHYSIOLOGY OF STEROID HORMONES 3(2-2)**

### **THEORY**

Adrenal cortex: corticosteroids, minerals and glucocorticoids synthesis and biological actions of corticoids, regulation of adrenocortical secretion, effects of adrenalectomy. Stress mechanism and general adaptation syndrome, relationship of steroids to metabolic diseases. The testis: anatomy, biochemistry and synthesis of androgens. Biological affects of androgens, regulation of androgens secretion, catabolism of androgens. The ovary: anatomy chemistry and synthesis of estrogens and progesterone. Biological actions, regulation, secretion and catabolism of ovarian hormones. The hormones of pregnancy and lactation. Hormones as growth promoting substances.

### **PRACTICALS**

Ovary and vaginal smears in rats, Bioassay procedures of estrogens, androgens, corticosteroids and other hormones. Removal of testis. Use of RIA and ELISA for progesterone assay.

## **BOOKS RECOMMENDED**

1. Turner, C.D. (Latest edition). General Endocrinology. W.R. Saunders Co., Philadelphia.
2. Zarrow, M.X., J.M.Yochim and J.L. McCarthy. (Latest edition). Experimental Endocrinology: A source book of basic techniques. Academic Press. New York.
3. IAEA. 1994. Laboratory Manual. IAEA, Sieberdorf, Austria.

**THEORY**

Organization of cell membrane, cytoplasm, organelles and nucleus. Comparison of various types of cells; blood cells, muscle cells, nerve cells, bone cells, liver cells, plant cells and specialized cells. Physiology of the cell: functions of lysosomes, reticulum, golgi apparatus, mitochondria and nucleus. Locomotion of cell. Cell cycle: mitotic process and replication of chromosomes and DNA, transfer RNA, ribosomal RNA, process of translation and protein synthesis on ribosome. Introduction to genetic engineering. Transport through cell membrane. Diffusion through lipid bilayer and protein channels, selective permeability, factors affecting transport across the cell membrane. Osmolality, active transport, sodium potassium pump. Membrane potential and the action potential. Endocytosis: phagocytosis and pinocytosis. Control of activities in the cell: genetic regulation and enzymatic regulation of cell activities.

**PRACTICALS**

Study of various body cells and functional tissues. Study of cell organelles and their functions. Biological transport systems across the cell membrane. Osmosis and osmolarity.

**BOOKS RECOMMENDED**

- 1 Giese, A.C. (Recent edition). Cell Physiology, 6<sup>th</sup> Edition, W.B. Saunders Co., London.
- 2 Campbell (1995). Molecular Biology of Cell.
- 3 Adams. (1992). The Cell.

Practical exercises with theoretical introduction in the following areas; anesthesia (local and general) in different animals. Blood and plasma estimation; measurement of blood pressure by direct and indirect methods. Blood grouping. Pulse, pressure and flow rates etc. Electroencephalograph. Use of colorimeters and spectrophotometers: analysis of blood, urine and other body fluids. Chromatographic analysis. Surgical techniques used in physiological research. Ablation and replacement therapy. Electrophoresis and PCR techniques.

### **BOOKS RECOMMENDED**

1. Kolmer, J.A., E.H. Spaulding and H.W. Robinson. (Latest edition). Approved Laboratory Technique. Appleton Century Crofts, INC. New York.
2. Oser, B.L. (Latest edition). Hawk's Physiological Chemistry. McGraw Hill Book Company, New York.
3. Salam. 1996. Physiological Techniques. Nobel Books. Lahore.

### **V.Ph.710 ENZYMOLOGY 3(2-2)**

#### **THEORY**

Enzymes: their structure, functions, classification, nomenclature and specificity. Enzymes and homeostasis. Regulation of reactions catalyzed by enzymes. Co-enzymes and co factor, allosteric enzymes. Isoenzymes, biological oxidation, Enzyme Kinetics, Use of enzymes for correction of metabolic disorder, use of enzymes as markers.

#### **PRACTICALS**

Creatininw phosphokinase (CPK), alkaline phosphates, ALT, AST

### **BOOKS RECOMMENDED**

1. Ganong, W.F. 1999. Review of Medical Physiology. Lange, Medical Publication California, USA.
2. West and Tod. (Latest edition). Enzymology.

## **V.Ph. 711. PHYSIOLOGY OF KIDNEY AND SWEAT GLANDS 4(3-2)**

### **THEORY**

Physiologic anatomy of kidney, basic theory of nephron function. Renal blood flow, glomerular filtration rate, factors affecting glomerular filtration rate. Formation of urine by the kidneys, tubular function and plasma clearance, reabsorption and secretion in the kidney, inulin and creatinine clearance as measure of G.F.R., para-amino-hippuric acid (PAH) as a measure of plasma flow. Constituents of urine, renal mechanism of controlling glomerular filtration, excretion of urea, sodium and potassium, regulation of blood volume and extracellular fluid, composition and thirst mechanism, regulation of acid base balance, micturition. Physiologic anatomy of sweat glands, secretion and its regulation by the autonomic nervous system, mechanism of sweat secretion, acclimatization of the sweating mechanism, factors influencing sweating.

### **PRACTICALS**

Techniques for determination of G.F.R. and conducting renal clearance studies, Urine analysis, Dialysis.

### **BOOKS RECOMMENDED**

1. Dukes, H.H. 1993. Dukes' Physiology of Domestic Animals. 11<sup>th</sup> Edition. M. J. Swenson and W.O. Reece (Editors). Comstock Publishing Associates. A Division of Cornell University Press, Ithaca, USA.
2. Frandson R.D. 1979. Anatomy and Physiology of Farm Animals, 3<sup>rd</sup> Edition, Lea and Febiger Philadelphia.
3. Ganong, W.F. 2001. Review of Medical Physiology. 20<sup>th</sup> Edition. Mc- Graw-Hill Professional Publishing. USA.

## **PHARMACOLOGY**

### **UNDERGRADUATE COURSES**

#### **V.Pm.421 GENERAL PHARMACOLOGY 3(2-2)**

##### **THEORY**

General Pharmacology: Introduction, historical perspective, scope and definitions. Drug development and regulatory clearance. Drug sources including biotechnology. Classification of drugs. Physico-chemical characteristics of drugs and transport mechanism across bio-membranes. Drug formulations and routes of their administration. Bio-disposition of drugs including absorption (bio-availability), protein binding, distribution, metabolism and excretion, Pharmacokinetics principles and applications. Drug action: non-specific and specific, structure-activity relationship, receptor theories. Dose-response relationship. Therapeutic index. Drug resistance, Adverse reactions to drugs. Drug interactions. Drug residues and their veterinary and public health concerns, role of veterinarian in prevention of residues. Mass medication and growth promoting agents. Drug abuse and doping.

##### **PRACTICALS**

Terminology, weights and measures. Prescription writing, statistical and other calculations. Partition coefficient of drugs. Formulations: external and internal dosage forms. Techniques of drug administration in animals. Identification of various drugs. Preparation of ointments, liniments and tinctures. Experiments on drug antagonism and synergism. Drug assays. Tests for screening of residues: Nitrates, Nitrites.

##### **BOOKS RECOMMENDED**

1. Brander G.C., D.M. Pugh, R.J. Bywater and W.L. Jenkins (1991) Veterinary Applied Pharmacology and Therapeutics, 5<sup>th</sup> ed., Ballier Tindall, London.
2. Booth, N.H. and L.E. McDonald (1988) Veterinary Pharmacology and Therapeutics. 6<sup>th</sup> ed. Iowa State University Press, Ames.



Pre-anesthetic medication. Techniques of administration of volatile anesthetics. Demonstration of epidural anesthesia in dogs, buffaloes cows and sheep. Conduction plexus anesthesia in frog. Infiltration, surface and intra-spinal anesthesia in rabbit.

#### **BOOKS RECOMMENDED**

1. Brander G.C. D.M. Pugh, R.J. Bywater and W.L. Jenkins (1991) Veterinary Applied Pharmacology and Therapeutics, 5<sup>th</sup> Ed., Ballier Tindall, London.
2. Booth, N.H. and L.E. McDonald (1994). Veterinary Pharmacology and Therapeutics. 6<sup>th</sup> Ed. Iowa State University Press/Ames.
3. Einstein, R., R. S. Jones, A. Knifton & G.A. Stamer (1994) Principles of Veterinary Therapeutics, Longman Sci. Tech., Essex, England.
4. Barragry, T.B. (1994) Veterinary Drug Therapy, Lea & Febiger, Philadelphia.
5. Debuf, Y.M. (1994) The Veterinary Formulary; Handbook of Veterinary Medicines Used in Veterinary Practice, 2<sup>nd</sup> Ed., the Pharmaceutical press, London.
6. Akhtar, M.S., (1984) Introduction to Veterinary Pharmacology & Therapeutics. 2<sup>nd</sup> Ed. University of Agriculture, Faisalabad.
7. Katzung B. G. (1995). Basic and clinical pharmacology. 6<sup>th</sup> Ed. Apleton and Lange. Norwalk.

#### **V. Pm 423 CHEMOTHERAPY AND TOXICOLOGY 3 (2-2)**

##### **THEORY**

**Chemotherapy:** Concepts, definitions and principles, sensitivity and resistance, resistance mechanisms and control. Antiseptics and disinfectants. Beta lactam antibiotics, aminoglycosides, macrolides, lincosamides, tetracycline's, chloramphenicol and quinolones. Sulfonamides. Antiviral drugs. Drugs used for external and internal parasites, coccidiostats and blood parasites. Anti-tumor agents.

**Toxicology:** Terms and definitions, toxicokinetics and toxicodynamics. Sources of poisoning. Factor affecting toxicology. Symptomology, testing, test reports and diagnosis of poisoning. Principles of non-specific and specific antidotal therapy. Important poisoning of veterinary concern and their treatment.

### **PRACTICALS**

Sensitivity tests of antibiotics, Microbiological assay of antibiotics. Photometrics techniques for determination of sulfa drugs in biological fluids. Acute toxicity studies, strychnine poisoning in dogs/rabbits. Tests for screening of residues, antibiotics, nitrates, nitrites and hydrocyanic acid toxic level in fodder.

### **BOOKS RECOMMENDED**

- 1 Akhtar, M.S., (1996) Introduction to Veterinary Pharmacology & Therapeutics. 2<sup>nd</sup> Ed. University of Agriculture, Faisalabad.
- 2 Katzung B. G. (1995). Basic and clinical pharmacology. 6<sup>th</sup> Ed. Apleton and Lange. Norwalk.
3. Booth, N.H. and L.E. McDonald (1994). Veterinary Pharmacology and Therapeutics. 6<sup>th</sup> Ed. Iowa State University Press. Ames.
4. Lorgue. (1996). Clinical Veterinary Toxicology.

## POST-GRADUATE COURSES

### V.Pm. 701 GENERAL PHARMACOLOGY 3(2-2)

#### THEORY

Introduction and scope of pharmacology, drugs and their sources, purification of drugs from natural sources, modification of chemical structure, synthesis of new drugs, drug development, screening, bioassay and standardization. Drug evaluation, clinical trials, systems of classifying drugs, drug dosage forms and their characteristics, routes of drug administration, characterization of drug effects. Role of pharmaceutical industry in use and abuse of drugs, monitoring of drug use, hazards of drug therapy, drug interaction and its clinical significance, drug safety.

#### PRACTICALS

Purification of drugs from natural sources, screening and bioassay procedures, bioavailability of different dosage forms and following various routes of administration.

#### BOOKS RECOMMENDED

1. Gilman, A.G., L.S. Goodman, T.W. Rall and F. Murad, 1995. The pharmacological Basis of Therapeutics, 5<sup>th</sup> Ed., Macmillan co., London.
2. Laurence, D.R. 1968. Evaluation of Drug Activities, Pharmacometrics Vol I & II, Academic press, London.
3. Goldstein, A., L.Amow and S.M. Kalman. (Latest edition). Principles of Drug Action-The Basis of Pharmacology, John Wiley & Sons, New York.
4. Katzung B. G. (1995). Basic and clinical pharmacology. 6<sup>th</sup> Ed. Apleton and Lange. Norwalk

**THEORY**

Physico-chemical characteristics of drugs. Transmembrane movements of drug molecules, drug absorption through various routes, drug distribution, protein binding of drugs, drug entry into the brain and cerebrospinal fluid, placental transfer of drugs. Pulmonary disposition of drugs. Renal and extra renal excretion of drugs. Drug metabolism: Species variations in drug metabolism, the microsomal enzymes, environmental and genetic factors affecting drug metabolism and response. Mechanisms of enzyme induction, significance of drug levels determination. Application of metabolism and dispositions studies in the development and evaluation of drugs.

**PRACTICALS**

General principles and procedures for the study of protein binding, disposition and metabolism of drugs. Illustration of drug distribution and excretion. Correlation of drug disposition with pharmacological actions.

**BOOKS RECOMMENDED:**

1. LaDu, B.N., H.G. Mandel and E.L. Way (Latest edition).  
Fundamentals of Drug Metabolism and Drug Disposition. The William & Wilkins Company, Baltimore. USA.
2. Clarke, E.G.C. (Latest Edition). Isolation and Identification of Drugs.  
The Pharmaceutical Press. London.
3. Klingele, H.D. (Latest edition). Absorption, Distribution, Transformation and Excretion of Drugs. Charles Thomas, Springfield, Illinois.

**THEORY**

Molecular mechanism of drugs action, receptors, drug receptor interaction and its characterization, consequences of interaction, receptor isolation, analysis of graded dose response relationship. Structure activity relationship. Drug actions not mediated through receptor. Pharmacogenetics and drug idiosyncrasy. Drug toxicity due to impaired drug metabolism. Altered sensitivity to drugs. Abnormal distribution and response to drugs. Drug allergy, immunologic basis. Drug resistance, drug tolerance and physical dependence, and mechanism of development of dependence. Therapeutic index.

**PRACTICALS**

Graded dose response, drug-receptors interaction, log-dose response curve, tests for predicting drug allergies.

**BOOKS RECOMMENDED**

1. Goldstein, A.L. Arrow and S.M. Kalman. (Latest edition). Principles of Drug Action, the Basis of Pharmacology. John Willey & Sons, New York.
2. Ariens, E.J. (Latest edition). Molecular Pharmacology. Academic Press, New York
3. Poster, R. and M.O. Connor. (Latest edition). Molecular Properties of Drug Receptors, Ciba, Foundation Symposium. J. & A. Churchill, London.
4. Katzung B. G. (1995). Basic and clinical pharmacology. 6<sup>th</sup> Ed. Apleton and Lange. Norwalk

**THEORY**

Definition and clinical significance of pharmacokinetics, physico-chemical characteristics of drugs. The body as drug environment, principles of pharmacokinetic analysis, zero-order and first-order Kinetics, Concept of compartments, single compartment model, two-compartment model and multiple compartment model. Kinetics of drug absorption, distribution and elimination. Concept of half-life, volume terms in pharmacokinetics, organ and whole body clearance. Application of pharmacokinetics, single-dose, multiple dosage and constant infusion, dosing interval, regimen adjustment, Factors influencing kinetic parameters. Drug compliance.

**PRACTICALS**

Determination of half-life kinetics of absorption, distribution, elimination and clearance. Determination of kinetic models, non-linear kinetics, goodness of fit, linearity and super-position in kinetics. Determination of dosage regimen and factors influencing kinetic parameters.

**Books Recommended**

- 1 Wagner, J.G. (Latest Edition). Biopharmaceutics and Relevant Pharmacokinetics. Intelligence Publications, Hamilton Press, USA.
2. Levy, G. (Ed). (Latest Edition). Clinical Pharmacokinetics, A Symposium Washington, American Pharmaceutical Association. Academy of Pharmaceutical Sciences. USA.
3. Wagner, J.G. (Latest Edition). Fundamentals of Clinical Pharmacokinetics. Drug Intelligence Publications. Hamilton Press. USA.
5. Katzung B. G. (1995). Basic and Clinical Pharmacology. 6<sup>th</sup> Edition. Apleton and Lange. Norwalk

## **V.Pm 705 PHARMACEUTICS 3 (2-2)**

### **THEORY**

Introduction and definitions, types of pharmaceutical preparations, physical pharmacy, weights and measures, calculations. Containers and closures, labeling, color and flavour, solutions, suspensions, emulsions and creams. Oral dosage forms, ointments, pastes and jellies, suppositories and pessaries. Sterilization practices in pharmaceuticals, sterilization of injections and other pharmaceutical products, classification of injections, sterility testing and aseptic techniques, preservation of pharmaceutical products; pharmacognosy. Medicinal chemistry, incompatibilities. Forensic pharmacy and drugs law.

### **PRACTICALS**

Exercises in the preparation of different solutions, extracts, suspensions, emulsions, ointments etc. for external and internal uses. Study of different types of incompatibilities. Formulation of injections, sterilization, aseptic techniques and sterility testing methods. Visits to pharmaceutical laboratories.

### **BOOKS RECOMMENDED**

1. Carter, S.J. 1987. Dispensing for Pharmaceutical Students, 12<sup>th</sup> Churchill Livingstone, London, Edinburgh.
2. Balcon, N.W. and Martindales. (Latest edition). British and US Pharmacopoeias.
3. Javed A.K. 1996. Quality control of pharmaceutical preparations. Lahore.
4. Remington Pharmacy. Lange Books. UK.
5. GOP. 1976. Drug Act. Ministry of Law, Government of Pakistan. Islamabad.

**V.Pm 706 PHARMACOLOGY OF CENTRAL NERVOUS SYSTEM 3(2-2)**  
**THEORY**

Introduction: anatomical and physiological considerations, neurohumoral transmission in CNS. Classification of CNS drugs, locus and mechanism of drug actions, CNS versus peripheral drug actions. Central Nervous System depressants: Pharmacological properties, absorption, and metabolism. Structure activity relationship of all CNS depressants, General anesthetics: principles of anesthesiology, signs and stages of anesthesia, electroencephalograph changes, pre-anesthetic medications. General anesthetic agents: pharmacological properties, administration, metabolism, and choice of anesthetics. Inhalant and intravenous anesthetics: chemistry, pharmacological actions, metabolism and excretion. Anesthetics poisoning. Hypnotics and sedatives. Local anesthetics. Drugs used in psychiatric disorders, drug for epilepsy. Psychotic drugs. CNS stimulants. Analgesics and Antipyretics. Emetics and antiemetics.

**PRACTICALS**

Methods of evaluation of drug action on CNS. Study of stages of volatile anesthesia. Effects of premedications on the duration and intensity of general anesthesia. Hypnotics and their antidotes in rats and rabbits. Stimulants of CNS and their antidotes in rats and mice. Evaluation of effect of drugs on the voluntary motor activity. Cross circulation experiment in dogs. Local anesthesia-Guinea pig intra-dermal test. Local anesthesia, surface anesthesia (rabbit eyes), plexus anesthesia in frogs. Evaluation of pyrogens and antipyretic agents. Demonstration of emesis& anti emesis.

**BOOKS RECOMMENDED**

1. Gilman, A.G., L.S. Goodman, T.W. Rall and F. Murad, 1991. The Pharmacological Basis of Therapeutics . MacMillan Publishing Company, New York.
2. Booth, N.H. and L.E. McDonald, 1996. Veterinary Pharmacology and Therapeutic. The Iowa State University Press, Ames.
3. Grossland, J. 1991. Lewis's pharmacology, 8<sup>th</sup> Edition Churchill Livingstone, Edinburgh, UK.
4. Wright. 1995. Wright's Veterinary Anesthesia. ELBS. UK.

**V.Pm 707 PHARMACOLOGY OF AUTONOMIC NERVOUS SYSTEM 3(2-2)**

**THEORY**

Neurohumoral transmission, autonomic nervous system; anatomy and general functions of the autonomic nervous system. Acetylcholinesterase: storage and release of acetylcholine, characteristics of cholinergic transmission, adrenergic transmission, synthesis, storage and release of catecholamines, termination of actions, general actions of adrenergic transmitters, pharmacological considerations. Cholinergic agonists: choline esters, properties of muscarinic and nicotinic receptors, pharmacological properties, cholinomimetics natural alkaloids and synthetic analogs, anticholinesterase agents, cholinesterase reactivators. Atropine, scopolamine alkaloids and synthetic analogs. Anticholinesterase agents and cholinesterase reactivators. Atropine, scopolamine and related antimuscarinic drug, atropine, scopolamine and related belladonna alkaloids, synthetic and semi-synthetic substitutes of belladonna alkaloids, therapeutic uses of antimuscarinic drugs. Norepinephrine, epinephrine and other sympathomimetic amines: sites and mechanism of actions, chemistry and structure activity relationship. Pharmacology of iso-proterenol, dopamine, dibutamine and other non-catecholamines including amphetamines, ephedrine, metaraminal, phenylephrine and methoxamine. Selective beta- 2 adrenergic stimulants: terbutaline salbutamol, albuterol, therapeutic uses of sympathomimetic drugs. Drugs that inhibit adrenergic nerves and block adrenergic receptors: alpha-adrenergic blocking agents, phenoxybenzamine and related haloalkylamines, other alpha-adrenergic blocking agents and therapeutic uses. Beta adrenergic blocking agents: propranolol, atenolol, nadolol, thimolol, pindolol cardio selective beta-1 adrenergic blocking agents, Calcium channel blockers. Centrally acting agents that interfere with adrenergic neuron blocking agents. Monoamine oxidase inhibitors (MAOI). Ganglionic stimulating and blocking agents. Neuromuscular blocking agents: pharmacological properties, therapeutic uses, toxicology, diagnostic uses.

**PRACTICALS**

Exercises to learn the use of chymograph. Study of effects of autonomic drugs on small un-anesthetized animals, dogs and rats blood pressure and respiration. Ganglion blocking agents and cat's nictitating

membrane. Frog rectus abdominis muscle and muscle relaxant drugs. Dog's tibialis anterior muscle and neuro-muscular blocking agents. Effects of autonomic drugs on eye in rabbits.

### **BOOKS RECOMMENDED**

1. Gilman, A.C. L.S. Goodman, T.W. Rall and F. Murad, 1991. The Pharmacological Basis of Therapeutics. MacMillan Publishing Company, New York, USA.
2. Goth, A., 1991. Medical Pharmacology. C.V. Mosby Company, St. Louis. Iowa. USA.
3. Booth, N.H. and L.E. McDonald. Veterinary Pharmacology. 1995. The Iowa State University Press, Ames.

**V.Pm 708 GENERAL THERAPY 3(2-2)**

### **THEORY**

Anti-allergic and anti-anaphylactic drugs, drugs acting on the dermatomucosal surface. Drugs acting on the alimentary tract like antacids, laxatives and cathartics. Therapy of ruminal disorders. Drugs acting on the blood and blood forming tissues, anti-anemic drugs, anticoagulants. Hormones and their antagonists, contraceptives. Water soluble and fat soluble vitamins. Heavy metals and their antagonists.

### **PRACTICALS**

Effect of drugs on the gastric acid secretion, surgical techniques for the study of action of drugs on the gastro-intestinal tract. Action of drugs on haemopoetic system and blood.

### **BOOKS RECOMMENDED**

1. Gilman, A.C. L.S. Goodman, T.W. Rall and F. Murad, 1986. The Pharmacological Basis of Therapeutics 7<sup>th</sup>, Ed. The MacMillan Co., London.
2. Booth, N. and L.E., McDonald. 1985. Veterinary Pharmacology 5<sup>th</sup> Ed. IOWA State University Press, Ames, IOWA, USA.
3. Balcow, N.W. and Martindale. 2000. British and US Pharmacopoeias.

**V.Pm 709 PHARMACOTHERAPY 4(3-2)**

**THEORY**

Drugs acting on the respiratory system, cardiovascular drugs: cardiac glycosides, anti arrhythmic drugs, antihypertensives, vasodilators, antiatherosclerotic drugs. Water, salts and ions; agents effecting volume and composition of the body fluids. Cations: calcium, magnesium, barium, lithium, and ammonium. Anions: phosphate, iodide, fluoride and other anions. Drugs affecting renal functions and electrolyte metabolism, diuretics and antidiuretics, antiedematic agents, inhibitors of tubular transport of organic compounds. Drugs acting on the uterus.

**PRACTICALS**

Demonstration of pharmacodynamics of drugs acting on heart, blood pressure, and urinary system and uterus.

**BOOKS RECOMMENDED**

1. Gilman, A.C., L.S. Goodman, t.W. Rall and F. Murad, 1991. The Pharmacological Basis of Therapeutics. The MacMillan Co., London.
2. Booth N. and L.E. McDonald. 1995. Veterinary Pharmacology. The Pharmaceutical Press, London.
3. Satoskar. 1998. Pharmacotherapeutics. CBS Publishers. New Delhi.

**V.Pm. 710 CHEMOTHERAPY 3(2-2)**

**THEORY**

Chemotherapy of microbial diseases: introduction, the sulfonamides, antibiotics, the penicillins, cephalosporins, aminoglycosides, quinolones, macrolides and tetracyclines. Miscellaneous antimicrobials, antifungals, antivirals and natural antibiotics (peptides). Chemotherapeutics used against parasites. Use of insecticides in domestic animals. Rodenticides. Chemotherapy of neoplastic diseases: alkylating agents, antimetabolites, hormones and other anti-proliferatives.

## **PRACTICALS**

Comparison of the effectiveness of chemotherapeutics following topical and parenteral applications. Microbiological assay procedures. Culture sensitivity tests.

## **BOOKS RECOMMENDED**

1. Gilman, A.C. L.S. Goodman, T.W. Rall and F. Murad. 1991. Pharmacological Basis of Therapeutics. The MacMillan Co., London.
2. Booth N. and L.E. McDonald. 1995. Veterinary Pharmacology. Iowa State University Press Ames, Iowa, USA.
3. Katzung B. G. (1995). Basic and Clinical Pharmacology. 6<sup>th</sup> Ed. Apleton and Lange. Norwalk
4. Satoskar. 1998. Pharmacotherapeutics. CBS Publishers. New Delhi.

**V.Pm.711**

**GENERAL TOXICOLOGY**

**4(3-2)**

## **THEORY**

Toxicology, historical development, role of toxicology, toxicological evaluation. Classification of poisons: inorganic, organic and plant poisons. Characteristics of exposure, spectrum of toxic effects, cellular response to the toxic insult, indices of toxicity, biodisposition of toxicants, absorption, distribution, excretion and metabolism, toxicokinetics, factors related to the exposure situation, factors related to the internal and external environments. Diagnosis of poisoning and treatment principles.

## **PRACTICALS**

Toxicological screening, acute, sub-acute and chronic toxicological evaluation.

## **BOOKS RECOMMENDED**

1. Gilman, A.G., L.S. Goodman, T.W. Rall and F. Murad, 1991. The Pharmacological Basis of Therapeutics. MacMillan Publishing Company, New York, USA.
2. Casarett, L.J. and Doull, J. (Latest edition). Toxicology, the Basis Science of Poisons, Ballier Tindoll, London.

3. Booth N.H. and L.E. McDonald. Veterinary Pharmacology and Therapeutics 1995. Iowa State University Press, Ames, USA.
4. Clarke, E.G.C. (Latest Edition). Isolation and Identification of Drugs. The Pharmaceutical Press. London.

**V.Pm 712      SYSTEMIC TOXICOLOGY                      3(3-0)**

**THEORY**

Terms and definitions, toxicodynamics, basic principles of diagnosis and treatment. Poisons causing respiratory insufficiency: hindering oxygen uptake, hindering oxygen transport to tissues, inhibiting oxygen utilization by tissues. Poisons markedly increasing tissue oxygen demand. Poisons having multiple action on respiratory efficiency poisons causing nerve stimulation or depression, poisons directly damaging the brain and spinal cord. Poisons causing colic and liver and kidney damage.

**BOOKS RECOMMENDED**

1. Gilman, A.C., L.S. Goodman, T.W. Rall and F. Murad, 1991. The Pharmacological Basis of Therapeutics. The MacMillan Co., London.
2. Casarett, L.J. and Doull, J. (Latest edition). Toxicology: the basic science and Poisons. Ballier Tindolls, London.
3. Booth N. and L.E. McDonald. 1995. Veterinary Pharmacology. The Pharmaceutical Press. London.
4. Katzung B. G. (1995). Basic and clinical pharmacology. 6<sup>th</sup> Ed. Apleton and Lange. Norwalk

**V.Pm 713      BIOCHEMICAL PHARMACOLOGY                      3(2-2)**

**THEORY**

The concept of biochemical lesions, biochemical and pharmacological aspects of histochemistry. Functions of sub-cellular structures: bacterial cell walls and membranes, mitochondria, drugs and lysosomes, transfer of ions and molecules across cell membrane. Effect of drugs on structure, biosynthesis and catabolism of nucleic acids, proteins, carbohydrates and lipids. Drugs forming reversible complexes

with DNA, inhibition of the synthesis of precursors of nucleic acids (RNA & DNA). Mode of action of antiviral agents. Principles of chromatography.

### **PRACTICALS**

Isolation and purification procedures: Thin layer and paper chromatography. Centrifugation of sub-cellular components. Introduction to enzyme kinetics, methods of studying enzymatic reactions. The Gilson respirometer; effect of drugs on pH, temperature, substrate, enzyme concentration and on enzyme catalyzed reactions.

### **BOOKS RECOMMENDED**

1. Bacq, Z.M. (Latest edition). Fundamentals of Biochemical Pharmacology. Pregmon Press Ltd.
2. Goldstein, A.L. Arrow and S.M. Kalman. (Latest edition). Principles Of Drug Action. The Basis Of Pharmacology. John Wiley & Sons, New York.
3. Javed A.K. 1996. Quality control of pharmaceutical preparations. Lahore.

**V.Pm 714      PHARMACOLOGY OF AUTACOIDS      3(2-2)**

### **THEORY**

Histamine and antihistamines, 5-hydroxytryptamine (serotonin) and their antagonists. Polypeptides: angiotensin, endogenous rennin-angiotensin system, and inhibitors of the rennin-angiotensin system, role of hypertension. Plasma Kinins; Kallidin, Bradykinin, Kallikrein and other Kinins and Vasodilator peptides, prostaglandins, prostacyclin, Thromboxane alpha-2 and leukotriens; possible functions in physiological and pathological processes and therapeutic uses.

### **PRACTICALS**

Assay of histamine on the guinea pig ileum, experiment on histamine, antihistamine antagonism on isolated guinea-pig ileum, Histamine and anaphylaxis, experiment on 5-hydroxytryptamine-lysergic acid diethylamide antagonism on rat hind quarter preparation, experiment on the formation of histamine from histidine.

## **BOOKS RECOMMENDED**

1. Goodman, L.S. and A. Gilman. (1991). The pharmacological basis of therapeutics. MacMillan Publishing Co. UK.
2. Koppanyi, T. and A.G. Karczmar. (Latest edition). Experimental pharmacodynamics. Burgess Publishing Co. USA.

**RECOMMENDATIONS**  
**CURRICULA VETERINARY PHYSIOLOGY AND PHARMACOLOGY**

**I. SPECIFIC**

1. Curricular revision in any subject is a specialized task that can only be accomplished pragmatically by the experts in the respective disciplines. For the revision of the curricula in veterinary physiology and pharmacology, out of 10 members, the Curriculum Committee constituted for these subjects was comprised of only 2-3 subject experts in each discipline. The composition of the Committee exceedingly reduced the possible specialist's input and alluded to the fact that, in future, the expert's committees should be formulated with an extraordinary prudence.
2. Only teachers having qualification and experience in the subjects of veterinary physiology and pharmacology are competent to teach these subjects. However, due to scarcity of teachers in these disciplines there is an immediate requirement for manpower development. For this purpose, the facilities presently available well established institutions may be engaged through UGC to fulfill these requirements on priority basis.
3. Presently, some universities are offering one-year Master degree program while the others are offering two years program. All postgraduate Master's degree awarding Universities/Institutions should follow the realistic duration of minimum two years to cover the essential curricular contents required for the Master's degree in the subjects of veterinary physiology and pharmacology.
4. The M.Sc. Hons. Degree has been equated by UGC to be equivalent to M.Phil it becomes mandatory for other 2 universities i.e. Tandojam and Peshawar to change their curricula to fit into two years phenomenon. The course therefore developed by this group must invariably be offered and implemented in four semesters along with research activity.

5. To acquaint the students with the current international trends and developments in the relevant subjects, an access to the Internet facilities and latest books/journals should be provided to all the Universities through budgeting by the UGC.

## **II. GENERAL**

1. In view of the recommendations of the last meetings “reverting back to a unified degree program” by the University of Agriculture, Faisalabad once again a comprehensive and thorough discussion upheld the recommendation of the last meetings. These recommendations are:
  - i. The University of Agriculture, Faisalabad, like past, should revert back to the previous system of a one basic degree program.
  - ii. The Faculty of Animal Husbandry at University of Agriculture, Faisalabad, as in the past may offer postgraduate program for specialization in animal husbandry disciplines.
2. The members observed and emphasized that the UGC has a major role to play in accomplishing this task. However, to accomplish this uphill task, a close collaboration and synergy amongst the UGC and the Pakistan Veterinary Medical Council can help resolve issue of the graduate, proficient to fulfill the future challenges. It was also noted with an air of satisfaction that there was some coordination between UGC and PVMC in connection with the development of both graduate and postgraduate programs. Therefore, the Committee members proposed that:
  - i. The UGC, in collaboration with the PVMC, PVMA, and expertise in the public and private sector may organize a congregation to resolve “once for all” the issue of the graduate required by the livestock sector.

- iii. The UGC should organize a meeting preferably at Islamabad, to deliberate on the need for 5 years degree course as prevalent internationally and also recommended by the PVMC while considering the training requirements of the veterinary graduates.
    - iv. On resolution of the outstanding issues of the national importance, the UGC may ensure implementation of the recommendations emerging during these meetings.
    - v. The UGC and PVMC jointly should monitor the progress of the implementation of the recommendations emerging during this and further meetings.
3. The Committee members expressed the need to improve the quality of education, therefore the number of students in DVM degree program should be admitted according to the available facilities in terms of faculty, labs, farms and funds.
4. To improve the quality of education and research, the UGC may implement its programs intended for inter-campuses and inter-institutional coordination, also between the universities and research organizations.
5. The UGC may organize advanced training and refresher courses for teaching and research staff of universities for effective implementation of the revised curricula.
6. To achieve the objectives of academic freedom and interactive hybridization of knowledge, it is imperative that the unnecessary restrictions be alleviated. While carrying forward the recommendations of the previous meetings, the Committee members expressed that:
  - i. The specialization in the basic and preclinical disciplines of veterinary sciences should be made open at the postgraduate level not only to the graduates of Animal Husbandry and

Veterinary Sciences but also other disciplines like Pharmacy, MBBS, and Biochemistry etc.

- ii. To achieve this objective, the UGC may immediately take up this matter with the University of Agriculture, Faisalabad so as to exclude the prefix “veterinary “ with post-graduate degree and departments of the basic and preclinical subjects. This will alleviate the hegemony of the prefix “veterinary” such as M.Sc. in Veterinary Physiology from the Department of Veterinary Physiology, Faculty of Veterinary Science.
  - iii. The improved/modernized version should read as M.Sc. from the Department of Microbiology, Faculty of Veterinary Science.
7. UGC may also recommend to the Federal and Provincial governments that for specialized jobs, the preference should be given to the specialists of that very discipline only.
  8. This group was also of unanimous opinion that despite best efforts of cooperation and consideration shown by the UGC in equating M.Sc (Hons) with that of M.Phil the faculty members at various places faced problems of compensations on account of changed nomenclature. It is therefore, recommended that the very nomenclature of the postgraduate degree be renamed as M.Phil rather than M.Sc. (Hons) in a particular discipline.
  9. Carrying forward the recommendation of the previous meetings, once again it was experienced that the UGC Regional Centre, Karachi needs immediate up gradation of the computer facilities for an efficient discharge of its functions.