

**REVISED CURRICULUM
OF
VETERINARY PARASITOLOGY**

**CURRICULUM DEVELOPMENT PROJECT
SPONSORED BY
MINISTRY OF SCIENCE AND TECHNOLOGY
ISLAMABAD**



**UNIVERSITY GRANTS COMMISSION
H-9, ISLAMABAD
2001**

CURRICULUM DIVISION, UGC

Prof. Dr. Altaf Ali G. Shaikh
Mr. Muhammad Javed Khan
Malik Ghulam Abbas
Mr. Zaheer Ahmad Awan
Miss Ghayyur Fatima

Director General (C&T)
Director Curriculum
Deputy Director
Education Officer
Research Associate

Composed by Ghaffoor Ahmad, UGC, Regional Centre, Lahore

CONTENTS

1.	INTRODUCTION	7
2.	OBJECTIVES	10
3.	SCHEME OF STUDIES (For D.V.M.)	10
4.	DETAIL OF COURSES (-do)	11
5.	SCHEME OF STUDIES (Postgraduate Courses)	19
6.	DETAIL OF COURSES (-do)	20
7.	RECOMMENDATIONS	40

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 44th 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 Curriculum Revision Committee on Veterinary Parasitology in May, 2001 at the U.G.C., Regional Centre, Lahore 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)
DIRECTOR GENERAL (C&T)

May, 2001

INTRODUCTION

A meeting of the National Curriculum Revision Committee to finalize the draft curriculum of Veterinary Parasitology prepared in preliminary meeting was held on May, 8-10, 2001 at UGC, Regional Centre, Lahore. The following attended:

1. Prof. Dr. Sikandar Hayat
Dean Faculty of Vet. Sciences,
University of Agriculture, Faisalabad. Convener
2. Prof. Dr. Muhammad Sharif Phulan,
Chairman,
Department of Parasitology,
Sindh Agriculture University, Tandojam Member
3. Dr. Najeem ur Rehman
Department of Parasitology
Institute of Animal Husbandry and Veterinary Sciences,
Faculty of Agriculture,
Gomal University, D.I. Khan Member
4. Dr. M. Akhtar Qureshi
Assistant Professor,
University College of Agriculture,
Rawalakot, AJK. Member
5. Dr. M. Qasim Khan
S.S.O. Animal Sciences Institute,
NARC, Islamabad. Member
6. Dr. Z. K. Afridi,
Senior Research Officer,
Directorate of Veterinary Research Institute,
Peshawar. Member
7. Prof. Dr. Birjees Hayat
Nominee
Pakistan Vet. & Medical Council, Islamabad. Member

Grants Commission for reposing confidence in him and for providing vet. Parasitologists this forum. He assured the commission of his own and on behalf of the members of the committee of full cooperation and intellectual contribution in revamping the curriculum. He stressed the members to avail this unique opportunity for developing lasting bonds of friendship and for close interaction amongst them. The committee, after discussing the existing curricula of Vet. Parasitology and Protozoology at graduate and postgraduate levels and benefiting from the presence of experts from Pakistan Agricultural Research Council as well as vet. Research institute agreed to the uniform draft curricula as detailed below:

OBJECTIVES

1. To equip the graduate of Veterinary Sciences with the latest knowledge in the field of Veterinary Parasitology.
2. to prepare the experts in the field of Parasitology, who could be able to diagnose, treat and control parasitic diseases of poultry and livestock.

SCHEME OF STUDIES FOR VETERINARY PARASITOLOGY FOR D.V.M. (DOCTOR OF VETERINARY MEDICINE) DEGREE

<u>Title of Course</u>	<u>Credit Hours</u>
General Parasitology & Protozoology	3(2-2)
Helminthology	4(2-4)
Veterinary Entomology	4(2-4)
Meat Hygiene and Inspection	2(1-2)
Parasitology Clinic	<u>1(0-2)</u>
	14(7-14)

Note: The DVM degree course comprise minimum 194 credited hours.

DETAIL OF COURSES

GENERAL PARASITOLOGY & PROTOZOLOGY

3(2-2)

Theory

General Parasitology

Introduction to Parasitology, Basic Terminology, Effects of Parasites on their host and their economic significance, Types of Parasitism. Host and organ specificity, Parasitic life cycle; Nomenclature and classification of parasites, Immunity and resistance, Parasitic zoonoses.

Protozoology

History of Protozoology, Anatomy of Protozoa, Nutrition, Locomotion, Reproduction and excretion in Protozoa, Classification of Protozoa, Morphology, life cycle, diagnosis, pathogenesis and control of the species of following genera of Protozoa; *Trypanosoma*, *Leishmania*, *Trichomonas*, *Histomonas*, *Giardia*, *Entamoeba*, *Eimeria*, *Isospora*, *Cryptosporidium*, *Toxoplasma*, *Sarcocystis*, *Plasmodium*, *Haemoproteus*, *Leucocytozoan*, *Hepatozoan*, *Babesia*, *Theileria*, *Balantidium*, *Anaplasma*, *Ehrlichia*, *Eperythrozoon*, *Haemobartonella*, Protozoan zoonoses.

Practical

1. Preparation of solutions used for parasitological examinations.
2. Methods of collection, preservation and transportation of parasitic material.
- 3-4. Qualitative and Quantitative faecal examination for protozoa.
- 5-6. Blood examination for protozoa.
7. Examination of genital discharges for *Trichomonas*.
8. Microscopic measurement of protozoa.
- 9-18. Identification of Important members of protozoa.

Books Recommended

1. Roberts, L. S. and J.J. Janovy. 2000. Foundations of Parasitology. 5th Edition, W.C.B. Company, U.K.
2. Urquhart G. M., J. Armour, J. L. Duncan, A.M. Dunn, F. W. Jennings. 2000. Veterinary Parasitology, Longman Scientific Technical, U.K.
3. Hayat, C. S. and M. Akhtar. 1999. Parasitic Diagnosis, UGC, Govt. of Pakistan.
4. Ash, L. A. and T. C. Orihel. 1991. Parasites; a guide to laboratory procedures and identification. (ASCP) Press. American Society of Clinical Pathologists.
5. Levine, N. D. 1990. Veterinary Protozoology. Iowa State University Press, Ames, Iowa, USA.
6. Soulsby, E. J. L. 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. The English Language Book Society Bailliere Tindall, London.
7. Ruprah, N. S. 1985. A Textbook of Clinical Protozoology. Oxonian Press, Pvt. Ltd.

HELMINTHOLOGY

4(2-4)

Theory

Introduction: Classification, Anatomy and Physiology of Helminths. Morphology, life cycle, diagnosis and control/biocontrol of the species of the following:

Trematodes

Dicrocoelium, Opisthorchis, Fasciola, Fasciolopsis, Fascioloides, Echinostoma, Metagonimus, Paragonimus, Eurytrema, Prosthogonimus, Nanophyetus, Paramphistomum, Cotylophoron, Gastrothylax, Gastrodiscus, Schistosoma, Ornithobilharzia.

Cestodes

Anoplocephala, Paranoplocephala, Moniezia, Avitellina, Stilesia, Thysanosoma, Davainea, Raillietina, Amoebotaenia, Choanotaenia, Dipylidium, Hymenolepis, Taenia, Multiceps, Echinococcus, Mesocestoides, Diphylobothrium, Spirometra.

Nematodes

Ascaris, Parascaris, Toxascaris, Toxocara, Oxyuris, Enterobius, Heterakis, Ascaridia Subulura, Strongyloides, Rhabditis, Strongylus and small strongyles, Chabertia, Oesophagostomum; Stephanurus, Ancylostoma, Necator, Uncinaria, Bunostomum, Trichostrongylus, Ostertagia, Cooperia, Haemonchus, Dictyocaulus, Metastrongylus, Protostrongylus, Angiostrongylus, Habronema, Thelazia, Spirocerca, Gongylonema, Tetrameres, Gnathostoma, Dirofilaria, Wuchereria, Loa, Parafilaria, Setaria, Dipetalonema, Onchocerca, Dracunculus, Trichinella, Trichuris, Capillaria, Dioctophyma, Acanthocephala, Macrocanthorhynchus, Annelida, Hirudo, Helminth zoonoses; (trematode, cestode and nematode zoonoses), Miscellaneous.

Practical

- 1-3. Methods for collection, transportation, fixation and preservation of flukes, tapeworms and round worms.
- 4-8. Methods for collection and examination of faeces, urine and sputum for the presence of eggs/larvae of various helminths.
- 9-10. Methods for examination and staining of blood film for helminths.
- 11-30 Identification of important members of class Trematoda, Cestoda, Nematoda and Acanthocephala.
- 31-32 Practical demonstration of helminths at slaughter houses.

Books Recommended

1. Halton, D. W., M. Behinke and I. Marshal. 2001. Practical Exercises in Parasitology. Cambridge University Press, BSP.
2. Urquhart, G. M., J. L. Duncan, A. M. Qunn, F. W. Jenniry. 2000. Veterinary Parasitology, Longman Scientific and Technology, U.K.

3. Kassai. T. 1999. Veterinary Helminthology. Butterworth Heinemann, Oxford.
4. Georgi, J. R., M. E. Georgi and V. J. Theodorides. 1999. Parasitology for Veterinarians. 7th Ed. W.B. Saunder Company London.
5. Hayat C. S. and M. Akhtar. 1999. Parasitic Diagnosis, UGC, Govt. of Pakistan.
6. Chowdhry, N., I. Tada. 1994. Helminthology. Narosa Publication House, New Delhi.
7. Miyazaki, U. I. 1991. An illustrated Book of Helminthic Zoonosis. International Medical Foundation of Japan. Tokyo, Japan.
8. Soulsby, E. J. L. 1986. Helminthes, Arthropods and Protozoa of Domesticated Animals. The English Language Book Society Bailliere Tindall, London.
9. Ministry of Agriculture, Fisheries and Food. 1986. Manual of Veterinary Laboratory, Parasitological Techniques, Reference Book 418, Her Majesty's stationery Office, London.

VETERINARY ENTOMOLOGY

4(2-4)

Theory

Introduction to Entomology: Arthropods & their economic significance; Classification of Arthropoda; Respiratory, digestive, nervous and reproductive systems of arthropods, Morphology, life cycle, vector role and control of the species of the following families:

- a. Phthiraptera: Haematopinidae, Linognathidae, Pediculidae and others.
- b. Hemiptera: Cimicidae, Reduvidae.
- c. Siphonaptera; Pulicidae, and others.
- d. Diptera; Culicidae, Ceretopogonidae, Simulidae, Psychodidae, Tabanidae, Gastrophilidae, Glossinidae, Muscidae, Calliphoridae, Oesteridae, Hypodermatidae, Cuterebridae, Hippoboscidae

- e. Acarina: Ixodidae, Argasidae, Demodicidae, Sarcoptidae, Psoroptidae, Dermanyssidae, Cheylotidae.
- f. Pathogens transmitted by insects and archnids.
- g. Biological control of arthropods.

Practical

- 1-2 Methods for collection, fixation and preservation of arthropods.
- 3-4 Methods for preparation of permanent mounts and pinning of insects and arachnids.
- 5-6 Examination of skin scrapings for mange.
- 7-8 Identification of diptera larvae by stigmal plates.
- 9-10 Practical demonstration of wing venation of insects.
- 11-12 Field visit at livestock and poultry farms for collection and identification of ectoparasites.
- 13-32 Identification of important members of the order Phthiraptera, Hemiptera, Siphonaptera, Diptera, and Acarina.

Books Recommended

- 1. Georgi, J. R., M. E. Georgi and V. J. Theodorides. 1999. Parasitology for Veterinarians. 7th Ed. W.B. Saunder Company London.
- 2. Hayat C.S. and M. Akhtar. 1999. Parasitic diagnosis, UGC, Govt. of Pakistan.
- 3. Wall, R. and D. Shearer. 1997. Veterinary Entomology. 1st Ed., Chapman & Hall.
- 4. Kettle, D.S. 1995. Medical and Veterinary Entomology. 2nd Ed. C.A.B. International, Walingford Oxon UK.
- 5. Soulsby, E. J. L. 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. The English Language Book Society Bailliere Tindall, London.
- 6. William, S.R. 1981. The Science of Entomology, 2nd Edition. The McMillan Pub. Co., Inc., N.Y.
- 7. Lancaster, J. L. and M. V. Meisch. 1986. Arthropods in Livestock and Poultry Production. Ellis Hardwood Ltd.

Theory

Objectives of meat inspection; Slaughter houses/abattoirs, its requirements, construction and hygiene; Food animals and their breeds, Transport of food animals and its effect on carcass quality; Antemortem inspection and its objectives, Different methods of slaughtering, Dressing of carcass; Systematic postmortem inspection of the carcass and different organs; Location and importance of lymph nodes in meat inspection, Rigor mortis; Differentiation of meat of different animals, Characteristics of good meat; Condemned meat and its disposal, Conditions rendering the meat unwholesome for human consumption; Judgement of meat; Putrefaction and other postmortem changes. Food poisoning, Meat preservation; Hygienic control of meat in markets; Animal by-products, Hide and skin industry; Inspection of poultry meat. Laws governing slaughter in Pakistan.

Practical

- 1-5 Demonstration at local slaughter houses.
 - a. General layout of a slaughter house.
 - b. Antemortem examination of sheep, goats, cattle and buffaloes.
 - c. Postmortem examination of carcass.
 - d. Dressing and systematic inspection.
 - e. Identification of pathological lesions on carcass.
6. Differentiation of meat of different animals.
 1. Chemical test for putrefaction.
- 8-9 Glycogen test to check substitution of meat.
- 10-11 Trichnoscropy
12. Recognition of various pathological conditions of meat and edible organs in the laboratory.
- 13-16 Visit of modern abattoir to see:
 - a. Construction and facilities.
 - b. Antemortem, Postmortem inspection and carcass dressing.
 - c. Proper disposal of condemned meat
 - d. Processing of by-products.

Books Recommended

1. Gracey, J. F. 1999. Meat Hygiene. 10th Edition. The English Language Book Society, Bailliere Tindal, London U.K.
2. Wilson W. G. 1998. Wilson's Practical Meat Inspection. Blackswell Science Production Company.
3. Alan B. and M. Johnston. 1996. Poultry Meat Hygiene and Inspection. W.B. Saunders Company, Ltd.
4. Herenda, D. C. and D. A. Franco. 1991. Food Animal Pathology and Meat Hygiene. Mosby year Book. London.

PARASITOLOGY CLINICS

1(0-2)

Theory

Economic significance of parasitic diseases of livestock and poultry; Examination of animals and birds for ectoparasites. Examination of faeces/droppings, blood, etc. for endoparasite: Systematic postmortem examination of animals and birds: Culture of parasitic ova for differential diagnosis of parasites: Parasite control/treatment strategies: Chemoprophylactic and immunoprophylactic measures, use of anthelmintics, antiprotozoals, insecticides and acaricides, livestock and poultry farm disinfection, vector control programme; Modes of administration/application of drugs for the control of ecto and endoparasites, Handling of parasitic problems at local livestock and poultry farms; Preparation of climatographs for the prevalence of different parasitic diseases; Poultry farm designing with special perspective to the control of parasitic diseases.

Books Recommended

1. Hendrix, C. M. 1998. Diagnostic Veterinary Parasitology. 2nd Eds. Mosby.
2. Taylor, A. E. R. and J. R. Baker. 1987. *In vitro* Methods for Parasite Cultivation. Academic Press, New York, USA.

3. Soulsby, E. J. L. 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. 7th Edition. The English Language Book Society, Baillare Tindall, London.
4. Margaret, W. Sloss and R. K. Russel. 1982. Veterinary Clinical Parasitology. 5th. Ed. Iowa State University Press, Ames, Iowa, USA.
5. Ministry of Agriculture Food and Fisheries. 1979. Manual of Veterinary Parasitological Laboratory Techniques. Reference Book No.418. Her Majesty's Stationary Office, London.

**SCHEME OF STUDIES
FOR
PROPOSED POSTGRADUATE COURSES
IN PARASITOLOGY**

<u>S.No.</u>	<u>Title of Course</u>	<u>Credit Hours</u>
1.	Advanced Parasitology General	4(3-2)
2.	Medical Entomology	4(3-2)
3.	Techniques in Parasitology	4(2-4)
4.	Wild Life Parasitology	3(1-4)
5.	Chemotherapy of Parasitic Diseases	4(3-2)
6.	Physiology of Endoparasites	4(3-2)
7.	Immunology of Parasitic Infections	4(3-2)
8.	Ecology of Animal Parasites	3(3-0)
9.	Medical Protozoology and Helminthology	4(3-2)
10.	Applied Helminthology	4(2-4)
11.	Diagnostic Parasitology	4(2-4)
12.	Epidemiology of Parasitic Diseases	4(2-4)
13.	In vitro cultivation of parasites	4(2-4)
14.	Biotechnology for Parasite Control	4(2-4)
15.	Techniques in Molecular Parasitology	4(2-4)
16.	Advanced Protozoology	4(3-2)

DETAIL OF COURSES

ADVANCED PARASITOLOGY GENERAL

4(3-2)

Theory

Embryology: oogenesis, embryonic development, cell consistency, post embryonic development of parasite; Parthenogenesis; Karyogamy; Hermaphroditism; Protandry; Intersex; Role of chromosome and cytology in taxonomy of parasites; Cellular organization of the Protozoa, Helminths and Arthropods; Motility and penetration of Protozoa; Surface coat, tegument and peritrophic membranes of parasites; Muscular, digestive, reproductive and nervous systems of parasites; Genetics of parasites; Intraspecific variation; Nutrition and metabolism; Parasites and hormones; Cryopreservation of parasites.

Practical

- 1-3 Observations on the development of different stages of parasites.
- 4-8 Examination of different systems of parasites
- 9-10. Dissection of grasshopper, cockroach and ascarids, the system analysis.
- 11-14 Collection of literature and review of research
15. Preparing research proposal.
16. Presentation of research papers.

Books Recommended

1. Urquhart, G. M., J. Armour, J. L. Duncan, A. M. Dun and F. W. Jennings. 2000. Veterinary Parasitology. Longman Scientific and Technical, U. K.
2. Georgi. J. R., M. C. Georgi and V. J. Theodorides. 1999. Parasitology for Veterinarians. 7th Ed. W.B. Saunders Co. Ltd.
3. Smyth, J. D. 1994. Animal Parasitology, 3rd Ed. Cambridge University Press, London.
4. Mehlorn, H. 1988. Parasitology in Focus, Facts and Trends. Springer-Verlag, Berlin.
5. Cheng, E.G. 1972. The Biology of Animal Parasites. W.B. Saunders Company. Philadelphia USA.

Theory

Introduction to Medical Entomology. Arthropods as a cause and carrier of diseases. Development and Classification of insects and arachnids. Mouth parts and their importance in the transmission of diseases. Insecticidal and acaricidal practices. Morphology; life cycle, medical importance and control of the following insects and arachnids.

Cockroaches and beetles; Bed bugs, conenose and other bugs; Sucking and biting lice; Simulid Gnats, Phlebotomus flies and Mosquitoes; Horse flies, Deer flies, Snipe flies Syrphid flies, Muscoid flies, Louse fly; House fly and its relatives. Tsetse flies, Stomoxys flies, Horn flies, Myiasis causing flies, Fleas and Ticks. Mites and Pentasomids, Venomous and Urticarial Arthropods.

Practical

- 1-3 Collection, preservation and pinning of adult insects and arachnids of medical importance.
- 4-5 Mouth parts of insects and arachnids, Wing venation of insects,
- 6-7 Mounting of stigmal plates and their identification.
- 8-9 Demonstration of life cycle stages of typical insect and arachnids.
- 10-12 Methods of preparation and examination of skin scrapings for mites.
13. Methods for dissecting arthropod vectors to determine infection rates.
- 14-16 Identification of various species of cockroaches, beetles, bugs, lice, flies, fleas ticks and mites.

Books Recommended

1. Wall, R. and D. Shearer. 2001. Veterinary Ectoparasites: Biology, Pathology and Control. 2nd Ed. Blackwell Science Publication.
2. Georgi, J. R., M. C. Georgi and V. J. Theodorides. 1999. Parasitology for Veterinarian. 7th Ed. W.B. Saunders Co. London.
3. Wall, R. and D. Shearer. 1997. Veterinary Entomology. Chapman and Hall.

4. Herms, W. B. and M. T. James. 1996. Medical Entomology. The McMillan Co New York, USA
5. Kettle, D. S. 1995. Medical and Veterinary Entomology. CAB International, Wallingford, Oxon, UK.
6. Service, M. W. 1980. A guide to Medical Entomology. The McMillan Press Ltd. London.

TECHNIQUES IN PARASITOLOGY

4(2-4)

Theory

Introduction; Operation and maintenance of commonly used equipment; Procedures of collection, preservation and transportation of parasitic material; Faecal examination; direct, sedimentation and floatation techniques; Faecal culture, recovery and storage techniques; Coccidial sporulation, Recovery of larval parasites from soil, tissue and pastures. Examination of vectors for larval forms; Egg/larval counts in samples; Micrometry; Preservation and staining of parasites; Preparation of whole mounts; Direct and indirect blood examination; Methods of examination of urine, sputum, aspirates, biopsies for parasitic infections; Examination of skin scrapings for ectoparasites; Preparatory techniques for electron microscopy. Immunodiagnostic techniques.

Practical

- 1-3 Operation of important laboratory equipment.
- 4-7 Direct, sedimentation and floatation techniques for faecal examination.
- 8-9 Faecal culture techniques.
10. Baermann's techniques.
- 11-13 Recovery of parasitic larvae from soil, tissue and pasture.
- 14-20 Examination of vectors for larval forms.
- 21 Egg counts by McMaster and Stoll's techniques.
- 22 Microscopic measurement of objects.
- 23-25 Preservation, staining and preparation of parasite mounts.
26. Histological examination of tissues for parasites.
- 27-28 Elisa techniques for parasitic diagnosis.
- 28-29 Blood examination using direct and indirect methods.
- 30 Examination of skin scrapings.

31-32 Examination of other body materials for parasites.

Books Recommended

1. Halton, J. D. W., M. Behinke and I. Marshal. 2001. Practical Exercises in Parasitology, Blackwell Science Publication.
2. Hayat, C. S. and M. Akhtar. 1999. Parasitic diagnosis, UGC, Govt. of Pakistan.
3. Hendrix, C. M. 1998. Diagnostic Veterinary Parasitology. 2nd Edition. Msoby.
4. Garcia, L. S. and D. A. Bruckner. 1988. Diagnostic Medical Parasitology. Elsevier Science Publishing Co. Inc., New York, 10010, USA.
5. Ministry of Agriculture, Food and Fisheries. 1986. Manual of Veterinary Parasitological Laboratory Techniques. Reference Book No.418, Her Majesty's Stationary Office, London, U.K.
6. Walls, K. W. and P. M. Schantz. 1986. Immunodiagnosis of Parasitic Diseases. Vol-I. Helminthic Diseases. Iowa State University Press, Ames, Iowa.
7. Thienpont, D., F.Rochette and O. F. J. Vanparijs. 1979. Diagnosing Helminthiasis Through Coprological Examination. Janssen Research Foundation, Belgium
8. MacInnis, A. J. and M. Voge. 1970. Experiments and Techniques in Parasitology. W. H. Freeman and Company, San Francisco, USA.

WILDLIFE PARASITOLOGY

3(1-4)

Theory

An overview of Wildlife in Pakistan; Parasites of wild animals and birds; Role of wild animals and birds in dissemination of parasitic diseases to domestic animals and man; Pathogenesis, diagnosis and control of ecto and endo-parasites of wild animals and birds.

Practical

- 1-7. Collection of literature on parasites of wild animals and birds.
- 8-17. Collection of parasites, faeces/droppings from wild animals and birds.
- 18-20. Processing of parasitic material for examination.
- 21-26. Preparation of permanent mounts
- 27-32 Identification of parasites

Books Recommended

- 1. Fowler, M. E. 1999. Zoo and Wild Animal Medicine: Current Therapy-4, W. B. Saunders Company, Philadelphia, USA.
- 2. Levine, N. D. 1990. Veterinary Protozoology. The Iowa State University Press, Ames, Iowa, USA.
- 3. Soulsby, E. J. L. 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. 7th Ed. Bailliere and Tindall, London.
- 4. Davis, J. W. and R. C. Anderson. 1971. Parasitic diseases of wild Mammals, The Iowa State university Press, Ames, Iowa, USA.

CHEMOTHERAPY OF PARASITIC DISEASES

4(3-2)

Theory

Introduction; Different groups of antiparasitic compounds and their mode of action; Various modes and precautions in administration of antiparasitic compounds i.e. parenteral, drench, spray, dip etc.; Antiprotozoals, anthelmintics, insecticides and acaricides of common use; Deworming/chemotherapeutic schedules; Drug resistance, toxicity and side effects; Economics of using antiparasitic compounds; Recent developments in the chemotherapeutic agents against parasites; Antiparasitic activity of indigenous plants; Commonly available antiparasitic compounds in Pakistan.

Practical

- 1-5 Selection of criteria for evaluation of different antiparasitic compounds

- 6-9 Demonstration of various modes of administration/application of antiparasitic compounds
- 10-13 Tests for detection of drug resistance in parasites
- 14-16 Literature collection and review of research.

Books Recommended

1. Georgi, J. R. and M. E. Georgi, V. J. Theodorides. 1999. Parasitology for Veterinarians. 7th ed., W.B. Saunder's Company, London.
2. Radostits, O. M. and D. C. Blood. 1994. Veterinary Medicine, 8th Ed. W.B. Saunder Company London.
3. Gillman, A. G., T. W. Rall, A. S. Nies and P. Taylor. 1991. The Pharmacological Basis of Therapeutics, 8th Ed. pp.954-1016. Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, New York.
4. Booth, N. H. and L. E. Medonald. 1988. Veterinary Pharmacology and Therapeutics. Iowa State University Press.

PHYSIOLOGY OF ENDOPARASITES

4(3-2)

Theory

Introduction, Historical perspective and importance of Parasitology; Morphology and anatomy of different classes of parasites; Feeding and nutritional physiology of cestodes, trematodes, nematodes and protozoa; Alimentary, surface and transtegumentary absorption of nutrients and their enzymes involved in digestion; Carbohydrate metabolism and energy production in parasites; Lipids and nucleic acids of parasites; Excretory and reproductive system in different classes of parasites; Parasite transmission; Mechanism of locating and penetrating the host; Circadian rhythms and transmission; Establishment and growth of parasites; Mechanisms of hatching, establishment migration and growth inhibiting factors. Nervous systems, sense organs and behavioural coordination in parasites, Host-Parasite interactions.

Practical

- 1-2 Preparation of solutions to be used in Practical.
- 3-4 Collection, preservation and mounting of helminths and protozoa
- 5-6. Identification of various organelles of parasites
- 7-8. Dissection of *Ascaris* and Earthworm for the purpose of demonstration of various systems
- 9-11. Observation on the different developmental stages of parasites
- 12-14. Determination of carbohydrate, fat and protein contents of common parasites
- 15-16 Literature collection and review of research.

Books Recommended

1. Smyth, J. D. and D. P. McManus. 1989. The Physiology and Biochemistry of Cestodes. Cambridge University Press, New York.
2. Long, P. L. 1982. The Biology of the Coccidia. Edward Arnold Ltd. London.
3. Chappel, L. H. 1979. Physiology of Parasites, Blackie & Sons Limited Bishop Briggs, Glasgow G64 2NZ, U.K.
4. Lee, D. L. and H. J. Atkinson, 1977. Physiology of Nematodes. Columbia University Press, New York, USA.

IMMUNOLOGY OF PARASITIC INFECTIONS

4(3-2)

Theory

Natural and acquired immunity; Host specificity; Natural parasitocidal substances; Effector mechanisms in the immunity against parasites; T-Cells, macrophages, granulocytes, mast cells, platelets, antibodies, non-specific effector mechanisms; Factors affecting cellular and humoral

immune responses; Immune responses and mucosal inflammation in parasitic infections; Escape mechanisms; Intrinsic resistance, Avoidance of recognition, Suppression of host's immune response; Immunopathological consequences of parasitic infections; Mechanisms involved in premunition, Hypobiosis, self cure and spring rise phenomena in parasites; Immunity against external and internal parasites; Strategies in designing parasite vaccines; Limitations in the preparation of vaccines against parasites. Immunodiagnosis.

Practical

- 1-3 Preparation of crude antigens of different parasites.
- 4-6 Development of hyperimmune sera against different parasite antigens.
- 7-11. Demonstration of various techniques to assay antigen antibody interactions.
- 12-16. Indirect Fluorescent Antibody test for *Babesia* species. Elisa technique for serodiagnosis of warble flies, Echinococcosis and Babesiosis.

Books Recommended

1. Tizard, I. R. 1996. Veterinary Immunology. An Introduction. 5th Ed. W.B. Saunders, Co. London.
2. Wakelin, D. 1996. Immunity to parasites. 2nd Ed. Cambridge University Press, London.
3. Olsen, G. K. 1995. Immunology and Immuno pathology of domestic animals. 2nd Edition, Mosby.
4. Hudson, L. and C. H. Hay. 1991. Practical Immunology. 3rd edition. Blackwell Scientific Publications, London.
5. Ploeg, L. T., C. R. Canter and H.J. Vogel. 1990. Immune recognition and evasion: Molecular aspects of host parasite interaction. Academic Press Inc., London.

6. Roit, I., J. Bostoff and D. K. Male. 1990. Immunology. 2nd Edition. Gower Medical Publishing, London.
7. Walls, K. W. and P. M. Schantz, 1986. Immunodiagnosis of Parasitic Diseases. Vol-I. Helminthic Diseases. Academic Press, Inc. Harcourt Brace.
8. Marchalonis, J.J. 1984. Immunobiology of parasites and parasitic infections. Vol. 12, Plenum Press, New York.

ECOLOGY OF ANIMAL PARASITES

3(3-0)

Theory

Introduction; Terms and evolution of concepts; Parasites as selective agents; Physiological or behavioural defence; Defence or manipulation; Vector feeding; Prey selection by definitive hosts; Optimal foraging; Risk avoidance; Social behaviour; Reproductive tactics; Evolution of parasite life cycles; Selection pressure and life cycle filters; The life cycle fluidity; Co-evolution of macroparasites and their hosts; Genetic variation in host susceptibility to macroparasites; Population dynamic of host parasite associations; Population genetics and dynamics.

Books Recommended

1. Bush, A. O., J. C. Fernandez, G.W.Esch and R. Seed. 2001. "Parasitism" The Discovery and Ecology of Animal Parasites. Cambridge University Press, BSP.
2. Poulin, R. 1998. Evolutionary Ecology of Parasites from Individuals of Communities. Chapman Hall.
3. Martin, S. W., A. H. Meek and P. Willeberg. 1993. Veterinary Epidemiology: Principles and Methods. International Book Distributing Co.
4. Toft, C. A., A. Aeschlimann and L. Bolis. 1991. Parasite-Host Associations, Oxford University press, New York, USA.
5. Rollinson, D. and R. M. Anderson. 1985. Ecology and Genetics of Host-Parasite Interactions. Academic Press Inc.,

6. Kennedy, C. R. 1975. Ecological Animal Parasitology. Blackwell Scientific Publications.

MEDICAL PROTOZOOLOGY AND HELMINTHOLOGY 4(3-2)

Theory

Introduction: General characteristics of protozoa; Adult structure and life cycle patterns of helminths; Intestinal protozoa; Amoebae, flagellates, coccidia; Protozoa from other body sites and tissues; Intestinal and tissue nematodes; Filarial nematodes; Intestinal and tissue cestodes; Intestinal trematodes; Liver and lung trematodes; Blood trematodes; Protozoa and helminthes of zoonotic importance; Unusual parasitic infections; Parasitic infections in the compromised host; Laboratory acquired parasitic infections.

Practical

- 1-2 Differentiation between parasitic and non parasitic Amoebae.
- 3-9 Differential identification of important parasites
- 10-11 Examination of stool for protozoa
- 12-13 Examination of stool for helminths
- 14-15 Examination of blood for protozoa and helminths
- 16 Review of literature.

Books Recommended

1. Kassai, T. 1999. Veterinary Helminthology. Butterworth Heinemann, Oxford.
2. Ichhpujani, R. L., R. Bhatia. 1998. Medical Parasitology. Jaypee Brothers.
3. Chowdhury, N. and I. Toda. 1994. Helminthology. Narosa Publishing House New Delhi, India.

4. Bogitsh, B. J. and T. C. Cheng. 1990. Human Parasitology. Saunders College Publishing. Philadelphia, U.S.A.
5. Garcia, L. S. and D. A. Bruckner. 1988. Diagnostic Medical Parasitology. Elsevier Science Publishing Co. Inc., New York, 10010 U.S.A.
6. Peters, W. and H. M. Gilles. 1988. A Colour Atlas of Tropical Medicine and Hygiene. The English Language Book Society, London, U.K.
7. Anonymous. 1979. Parasitic Zoonoses. Technical Report Series No.637, World Health Organization, Geneva.

APPLIED HELMINTHOLOGY

4(2-4)

Theory

Classification of helminths; Morphology and taxonomic characteristics of different species of helminths; An introduction to helminth culture; Modes of development of resistance in helminths against anthelmintics. Methods of evaluation of anthelmintics.

Practical

- 1-5 Collection of literature on helminths.
- 6-15 Collection of helminths from slaughter houses.
- 16-18 Preparation of solutions for mounting and culturing the helminths.
- 19-23 Preparation of permanent mounts of helminths.
- 24-27 Culture of helminthic ova for development of larvae for taxonomic studies; detection of drug resistance.
- 28-32 Identification of helminths.

Books Recommended

1. Kassai, T. 1999. Veterinary Helminthology. Butterworth Heinemann, Oxford.
2. Foreyt, W. J. 1999. Veterinary Parasitology Reference Manual. 4th Ed. Blackwell Science Publications.
3. Chowdhury, N and I. Tada. 1994. Helminthology. Narosa Publishing House. New Delhi.
4. Garcia, L. S. and D. A. Bruckner. 1988. Diagnostic Medical Parasitology. Elsevier Science Publishing Co., Inc., New York 10010, U.S.A.
5. Soulsby, E. J. L. 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. The English Language Book Society, Bailliere Tindall, London.
6. Ministry of Agriculture, Food and Fisheries. 1986. Manual of Veterinary Parasitological Laboratory Techniques. Reference Book No.418, Her Majesty's Stationery Office, London, U.K.

DIAGNOSTIC PARASITOLOGY

4(2-4)

Theory

Philosophy and approach to diagnostic Parasitology; Artifacts that can be confused with parasite organisms; Quality control procedures for diagnostic parasitology laboratory; Diagnosis of important protozoal, helminth and arthropod diseases; Conventional, serodiagnostic and specific procedures; Parasitic infections and clinical correlations; Histological identification of parasites; Significance of haematology and biochemistry as a diagnostic aid in parasitic infections; Xenodiagnosis and animal inoculation tests; Differential diagnosis of larval cestode infections and haemoprotozoan parasites; Taxonomical differentiation of nematode larvae; Parasitic and non-parasitic larvae; Keys for the identification of helminths, insects and arachnids; significance of stigmal plates in the identification of larval fly infestations.

Practical

- 1-5 Diagnosis of important protozoal infections
- 6-10 Diagnosis of important helminth diseases
- 11-15 Diagnosis of diseases caused by insects and arachnids.
- 16-18 Observations on various haematological parameters in parasitized and healthy individuals.
- 19-21 Observations on various biochemical parameters in parasitized and healthy individuals.
- 22-23 Animal inoculation tests for detection of parasites
- 24-25 Demonstration of variations among different larval cestode forms
- 26-27 Demonstration of variations among different haemoprotozoan parasites
- 28-29 Demonstration of variations among different nematode larvae
- 30-31 Identification of larval fly infestations
- 32 Review of literature.

Books Recommended

1. Hayat, C. S. and M. Akhtar. 1999. Parasitic Diagnosis, UGC, Govt. of Pakistan.
2. Garcia, L. S. and D. A. Bruckner, 1998. Diagnostic Medical Parasitology. Elsevier Science Publishing Co., Inc., New York 10010, USA.
3. Hendrix, C.M. . 1998. Diagnostic Veterinary Parasitology. 2nd Edition, Mosby.

4. Gutierrez, Y. 1990. Diagnostic Pathology of Parasitic infections with clinical correlation. Lee & Febiger, Philadelphia, USA.
5. Sun, T. 1988. Colour Atlas and Textbook of Diagnostic Parasitology. Igaku-Shoin, Tokyo, Japan.
6. Ministry of Agriculture, Food and Fisheries. 1986. Manual of Veterinary Laboratory, Parasitological Techniques, Reference Book 418, Her Majesty's stationery Office, London.
7. Pictorial Keys: Arthropods, Reptiles, Birds and Mammals of Public Health Significance. 1967. U.S. Department of Health Education and Welfare, National Communicable Disease Centre, Atlanta Georgia 30333, USA.

EPIDEMIOLOGY OF PARASITIC DISEASES

4(2-4)

Theory

Introduction to epidemiology and its significance; Basic terminology, general concepts, selection of epidemiological parameters; Surveillance studies; Host-parasite associations; Population biology and genetics, genetic variability and parasite transmissions; Age-intensity and age-prevalence profile of parasite infections; Ecological and evolutionary dynamics of parasites; parasite prevalence and seasons; Epidemiological approaches for the control of parasites; Application of molecular techniques in epidemiology of parasitic infections.

Practical

- 1-6 Identification of areas of parasitic problems
- 7-10 Selection of population for sampling.
- 11-19 Surveillance studies for parasitic infections by gross examination or serological investigations.
- 20-26 Storage, analysis and interpretation of data
- 27-29 Formation of climatographs for various areas to forecast parasitic diseases.

30-31 Designing strategies for parasite control and eradication

32 Review of Literature.

Books Recommended

1. Urquhart, G. M. J. Armour, J. L. Duncan and F. W. Jennings. 2000. Veterinary Parasitology. 3rd Ed. The English Language Book Society/Longman Scientific and Technical, UK.
2. Thrusfield, M. 1997. Veterinary Epidemiology. 2nd Ed. Blackwell Science Publication.
3. Matrin. S. W., A. H. MEEK and P. Willeberg. 1993. Veterinary Epidemiology. Principles and Methods, International Book Distributing Company.
4. Toft, C. A., A. Aeschlimann and L. Bolis. 1991. Parasite Host Association. Oxford University Press, New York, USA.
5. Wayne, S. and H. Allan. 1987. Veterinary Epidemiology, Principles and Practices. Meek & Preben Willeberg, Iowa State University Press, Ames, Iowa, USA.
6. Rollinson, D. and R. M. Anderson. 1984. Ecology and Genetics of Host-Parasite Interactions. Linnean Society Symposium Series No.11, Academic Press, New York, USA.

IN VITRO CULTIVATION OF PARASITES

4(2-4)

Theory

History of cell culture; Development of invertebrate cell culture; Types of cell culture media; Advances in culture media; Growth requirements and characteristics; Physiology and biochemistry of cultured cells: Nutritional requirements of insect cells in vitro, serum free culture of insect cells; Endocrinology in invertebrate cell/tissue culture; Physical and chemical factors affecting invertebrate cells; Methods of in vitro cultivation; Application of invertebrate cell culture in Immunology, Biotechnology and Molecular biology; Application of cell cultures to the pathology of insects

and higher animals; Development of cell lines for parasite cultivations; Recent developments in the culture of protozoa, trematodes, cestodes and nematodes.

Practical

- 1-2 Introduction to invertebrate cell culture.
- 3-5 Preparation of culture media
- 6-10 Preparation of invertebrate cell culture systems
 - i. Primary cell culture system
 - ii. Secondary cell culture system
 - iii. Established cell lines system
 - iv. Micro carrier invertebrate cell culture system
- 11-30 *In vitro* cultivation of different species of parasites
- 31-32 Collection and review of literature

Books Recommended

1. Mitsubishi, J. 1989. Invertebrate cell system applications. Vol. I. CRC Press, Inc, Boca Raton, Florida.
2. Mitsubishi, J. 1989. Invertebrate cell system applications. Vol.II CRC Press, Inc. Boca Raton Florida.
3. Taylor, A. E. R. and J. R. Baker. 1987. *In vitro* methods for parasite cultivation. Academic Press, New York USA.
4. Maramorosch, K. and J. Mitsubishi. 1982. Invertebrate cell culture application. Academic Press, New York, USA.

BIOTECHNOLOGY FOR PARASITE CONTROL

4(2-4)

Theory

Introduction to biotechnology; Scope of veterinary parasite vaccines; Prospects for rapid vaccine development; Application of biotechnology in

parasite control strategies; Molecular concepts, principles and approaches; Application of recombinant DNA technology to genetic analysis of sporozoan parasites; Vectors for recombinant vaccine delivery; Advances in adjuvant technology and application; The genetic of host response and its influence on control strategies; Genetic markers for the selection of parasite resistance in livestock; Control of gastrointestinal and tissue nematodes, trematodes and cestodes; Control of intraerythrocytic and other intracellular parasites; Biotechnology and control of mosquitoes and myiasis causing flies; Vaccination against ticks.

Practical

- 1-3 Techniques of nucleic acid purification.
- 4-7 Gel electrophoresis and restriction of DNA and RNA.
- 9-10 Preparation and labeling DNA and RNA probes
- 13-16 Southern and Northern blotting
- 17-19 Hybridization assays
- 20-22 Expression of libraries
- 23-26 Techniques of cloning, parasite genes in bacteria
- 27-32 Recombinant DNA: Rapid preparation of recombinant vector and insect DNA, polymerase chain reaction (PCR), DNA sequencing, construction and screening of genomic DNA libraries.

Books Recommended

1. Mowat, N. and M. Rweyemance, 1999. Vaccine Manual, The Production and Quality Control of Veterinary Vaccines For Use in Developing Countries . Daya Publishing House Delhi 110035. (Republished by arrangements with FAO).
2. Gupta. P. K. 1998. Elements of Biotechnology. Rastogi Publications, India.

3. Peters, A. R. 1993. Vaccines for Veterinary Applications, Butterworth-Heinemann Ltd., Jordon Hill, Oxford OX2 8DP, UK.
4. Warren, K. S. 1993. Immunology and molecular biology of parasitic infections, Blackwell Scientific Publications Oxford.
5. Young W. K. 1992. Animal Parasite Control Utilizing Biotechnology, CRC Press, Inc., Boca Raton, Florida, 33431.
6. August, T. M. 1984. Molecular Parasitology. Academic Press, Inc., New York.
7. Hyde, J. E. 1990. Molecular Parasitology. Van nostrang Reinhold, New York.

TECHNIQUES IN MOLECULAR PARASITOLOGY

4(2-4)

Theory

Introduction to molecular Parasitology; Preparation of antigens from parasites: Sodium-Dodecyl Sulphate electrophoresis; gel staining and radiographic procedures; Methods of developing monoclonal and polyclonal antibodies; Immunoblotting and specific antigen-antibody interactions; Immunoflourescent techniques; Enzyme-Linked Immunosorbant assays (ELISA); Purification of antigens/antibodies.

Practical

- 1-8.1 Parasites and Antigens:
 - i. Preparation of Somatic antigens
 - ii. Secretory and excretory antigens
 - iii. Metabolic labeling of parasites in vitro
 - iv. Labeling of surface Antigens

- 9-15 Purification of Parasite Antigens and Antibodies:
 - i. Gel filtration
 - ii. Antibody purification
 - iii. Purification of antigen by affinity chromatography
 - iv. Fast protein liquid chromatography.

- 16-24 Parasite Proteins and Carbohydrates:
 - i. Protein and carbohydrate detection and solublization

- ii. Characterization of parasite proteins by SDS polyacrylamide gel electrophoresis (PAGE).
- iii. Staining gels for proteins and carbohydrates

25-32 Parasite Antibodies and Immunoassays:

- i. Polyclonal and monoclonal antibody production
- ii. Immunoblotting and immunoprecipitation
- iii. Enzyme-Linked immunosorbant Assay, (ELISA) Radioimmunoassay,(RIA) Immunofluorescent and immunoelectron microscopic techniques

Books Recommended

1. Greshwin, K. O. 1995. Immunology and Immunopathology of domestic Animals. Mosby.
2. Warren, K. S. 1993 Immunology and molecular biology of parasitic infections, Blackwell Scientific Publications, Oxford.
3. Maizels, R. M, M. L. Blaxter, B. D. Robertson and M. E. Selkirk. 1991. Parasite antigens, parasite genes. A laboratory manual for molecular Parasitology. Cambridge University Press, New York.
4. Hyde, J. E. 1990. Molecular Parasitology. Van nostrang Reinhold New York.
5. August, T. M. 1984. Molecular Parasitology. Academic Press, Inc., New York.

ADVANCED PROTOZOOLOGY

4(3-2)

Theory

Introduction to the protozoa; Anatomy/Structure, locomotion, nutrition, reproduction and lifecycle of protozoa; History and classification of phylum protozoa; Evaluation of symbiotic protozoa; Haemoflagellates and other Zoomastigophora; *Histomonas*, *Parhistomonas* & related forms; *Trichomonads* and other flagellates; Amoeba and *Giardia*; *Apicomplexa*, Coccidia proper and *Hepatozoans*; *Cryptosporidium*, *Plasmodium*, *Haemoproteus* and *Leucocytozoans*; *Sarcocystis*, *Toxoplasma* and related protozoa; Piroplasms; Ciliata and Gregarina.

Practical

- 1-4 Laboratory diagnosis of protozoan infections; Microscopic examination of thick and thin blood smears for haemoprotozoa.
- 4-8 Culture methods for Amoeba, Paramecium and Trypanosomes
- 9-11 Demonstration of various spp. from human stools.
- 12-14 Sporulation of coccidian oocysts; Estimation of total oocyst production in 24 hours; Preparation of pure cultures of coccidia and isolation of coccidian oocysts;
- 15-16 Microscopic examination of blood for *Plasmodium*, *Anaplasma* and *Leucocytozoans*.

Books Recommended

1. Uguhart, G. M. J. Armour, J. L. Duncon, A. M. Dunn and F. W. Jennings. 2000. Blackwell Science Publications.
2. Collier, L. 1998. Topley & Wilsons Microbiology & Microbial infections Vol-5. "Parasitology". Arnold London.
3. Ash, L. A. & T. C. Orihel. 1991. Parasites: A guide to Laboratory Procedures and Identification. ASCP Press, American Society of Clinical Pathologists, USA.
4. Levine, N. D. 1990. Veterinary Protozoology, Iowa State University Press, Ames Iowa, USA.
5. Kreier, J. P. and J. R. Baker, 1987. Parasitic Protozoa. Allen & Unwin Publishers, London.
6. Soulsby, E. J. L. 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. The English Language Book Society, Bailliere Tindall, London.
7. Ruprah, N. S. 1985. A Textbook of Clinical Protozoology. Oxonian Press, Pvt.Ltd..

RECOMMENDATIONS

The Curriculum Revision Committee for the subject of Veterinary Parasitology in its meeting held on May 8-10, 2001 submitted the following recommendations:-

1. Revised undergraduate and post-graduate courses alongwith credit hours discussed and finalized in the meeting, should be uniformly implemented in all the Parasitology Departments.
2. One composite degree comprising Animal Husbandry and Veterinary Science courses should be uniformly implemented. The students should have choice during their post graduation for the specialization in Animal Husbandry or Veterinary Science subjects.
3. The suffix "Veterinary" be deleted from the postgraduate degree.
4. External examination system should be revived and the external examiners should preferably be appointed from academic and research institutions in the related fields.
5. Sabbatical leave system for the teachers should be initiated.
6. The teachers of the Department should be provided financial support for their participation in the National and International conference/symposia/seminars.
7. Short term visits should be arranged in between the University teachers and researchers for the Interaction and exchange of views. This will help in the preparation of integrated and coordinated research proposals.
8. Training/refresher courses should be arranged for teachers of the universities
9. Publication of research articles in international/national journals should be financed by the UGC.
10. Libraries of Universities/research organizations should be equipped with latest books, journals and CD ROMs bearing research articles.

11. Uniform teacher/students ratio be maintained and the vacancies of teachers in all universities be filled.
12. The teaching posts be created according to the pyramid proposed by the UGC, in each Department.
13. Facilities should be financed by the UGC for import of research and teaching materials.
14. For furtherance of research in Parasitology, a Parasite Bank should be established at the Department of Parasitology University of Agricultural, Faisalabad/Lahore Campus and full facilities should be extended for the purpose.
15. Adequate laboratory animal facilities for postgraduate research should be provided preferably in each Parasitology Department or atleast at the faculty level.
16. Lecture rooms and laboratories should be equipped with audio-visual facilities.
17. Parasitology laboratories should be strengthened with the adequate provision of chemical, glass ware and equipments.

(Prof. Dr. Sikandar Hayat)
Convener

(Dr. Haji Ahmad Hashmi)
Secretary

LIST OF BOOKS (Available at Mirza Book Agency, Lahore)

Bush, Albert O., Jacquelin C. Fernandez, Gerald W. Esch and J. Rechard Seed, 2001. Parasitism – The Discovery and Ecology of Animal Parasites. Camperidge University Press Black well Science Publication.

Jerzey, David W. Halton, M. Behinke and I. Marshal, 2001. Practical Exercises in Parasitology, Cambridge University Press, Blackwell Science Publication.

Springer, H. Mehlhorn, 2001. Enyclopedic Reference of Parasitology, Blackwell Science Publication.

Mowat, N. and Mark Rweyemame, 1999. Vaccine Mannual – The Production and Quality Control of Veterinary Vaccines for use in Developing Countries. Daya Publishing House, Delhi. 110035. (Reported by arranging with the FAO of UN.

Wall, R. and D. Shearer. 1997. Veterinary Entomology, 1st Edition Chapman & Hall.

Kassai, T., 1999. Veterinary Helminthology. Butterworth Heinemann, Oxford.

Sloss, M., R. Kemp and A. Zajac, 1999. Veterinary Clinical Parasitology, Iowa State University Press, Iowa. Blackwell Science Publication.

Thrusfield, M. 1997. Veterinary Epidemiology, 2nd Edition, Blackwell Science Publication.

Foreyt, W.J., 1999. Veterinary Parasitology Reference Manual. 4th Edition Blackwell Science Publication.

Wall R. and D. Shearer. 2001. Veterinary Ectoparasits: Biology, pathology and Control. 2nd Edition, Blackwell Science Publication.

LIST OF BOOKS FOR PARASITOLOGY

1. Alan B. and M. Johnston. 1996. Poultry Meat Hygiene and Inspection. W.B. Saunders Company, Ltd.
2. Ministry of Agriculture Fisheries and Food. 1986. Manual of Veterinary Parasitological Laboratory Techniques. Reference Book No.418. Her Majesty's Stationary Office, London.
3. Ash, L.A. & T.C. Orihel, 1991. Parasites: A guide to Laboratory Procedures and Identification. ASCP Press, American Society of Clinical Pathologists, USA.
4. August, T.M. 1984. Molecular Parasitology. Academic Press, Inc., New York.
5. Bogitsh, B.J. and T.C. Cheng, 1990. Human Parasitology. Saunders College Publishing. Philadelphia, U.S.A.
6. Booth, N. H. and L. E. Medonald. 1988. Veterinary Pharmacology and Therapeutics. Iowa State University Press.
7. Bush, A.O., J. C. Fernandez, G.W.Esch and R. Seed, 2001. "Parasitism" The Discovery and Ecology of Animal Parasites. Cambridge University Press, BSP.
8. Chappel, L.H. 1979. Physiology of Parasites, Blackie & Sons Limited Bishop Briggs, Glasgow G64 2NZ, U.K.
9. Cheng, E.G. 1972. The Biology of Animal Parasites. W.B. Saunders Company. Philadelphia USA.
10. Chowdhury, N. and I. Toda. 1994. Helminthology Narosa Publishing House New Delhi, India.
11. Collier, L. 1998 Topley & Wilsons Microbiology & Microbial infections Vol-5 Parasitology. Arnold London.
12. Davis, J.W. and R.C. Anderson, 1971. Parasitic diseases of wild Mammals, The Iowa State university Press, Ames, Iowa, USA.
13. Foreyt, W. J. 1999. Veterinary Parasitology Reference Manual. 4th Ed. Blackwell Science Publications.
14. Fowler, M.E. 1999. Zoo and Wild Animal Medicine: Current Therapy-4, W. B. Saunders Company, Philadelphia, USA.
15. Garcia, L.S. and D.A. Bruckner, 1988. Diagnostic Medical Parasitology. Elsevier Science Publishing Co. Inc., New York, 10010, USA.
16. George. J. R., M.C. George and V. J. Theodorides. 1999. Parasitology for Veterinarians. 7th Ed. W.B. Saunders Co. Ltd.

17. Gillman, A.G. , T.W. Rall, A.S. Nies and P. Taylor, 1991. The Pharmacological Basis of Therapeutics, 8th Ed. pp.954-1016. Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, New York.
18. Gracey, J.F. 1999. Meat Hygiene. 10th Edition. The English Language Book Society, Bailliere Tindal, London U.K.
19. Greshwin, K.O. 1995. Immunology and Immunopathology of domestic Animals. Mosby.
20. Gupta. P.K. 1998. Elements of Biotechnology. Rastogi Publications, India.
21. Gutierrez, Y., 1990. Diagnostic Pathology of Parasitic infections with clinical correlation. Lee & Febiger, Philadelphia, USA.
22. Halton, J. D. W., M. Behinke and I. Marshal. 2001. Practical Exercises in Parasitology, Blackwell Science Publication.
23. Hayat, C.S. and M.Akhtar 1999. Parasitic Diagnosis, UGC, Govt. of Pakistan.
24. Hendrix, C.M. . 1998. Diagnostic Veterinary Parasitology. 2nd Edition, Mosby.
25. Herenda, D.C. and D.A. Franco. 1991. Food Animal Pathology and Meat Hygiene. Mosby year Book. London.
26. Herms, W.B. and M.T. James, 1996. Medical Entomology. The McMillan Co New York, USA
27. Hudson, L. and C.H. Hay, 1991. Practical Immunology. 3rd edition. Blackwell Scientific Publications, London.
28. Hyde, J.E. 1990. Molecular Parasitology. Van nostrang Reinhold New York.
29. Ichhpujani, R. L., R. Bhatia. 1998. Medical Parasitology. Jaypee Brothers.
30. Kassai, T. 1999. Veterinary Helminthology. Butterworth Heinemann, Oxford.
31. Kennedy, C.R. 1975. Ecological Animal Parasitology. Blackwell Scientific Publications.
32. Kettle, D.S. 1995. Medical and Veterinary Entomology. 2nd Ed. C.A.B. International, Walingford Oxon UK.
33. Kreier, J.P. and J.R. Baker, 1987. Parasitic Protozoa. Allen & Unwin Publishers, London.
34. Lancaster, J. L. and M. V. Meisch. 1986. Arthropods in Livestock and Poultry Production. Ellis Hardwood Ltd.
35. Lee, D.L. and H.J. Atkinson, 1977. Physiology of Nematodes. Columbia University Press, New York, USA.

36. Levine, N.D., 1990. Veterinary Protozoology. Iowa State University Press, Ames, Iowa, USA.
37. Long, P.L. 1982. The Biology of the Coccidia. Edward Arnold Ltd. London.
38. MacInnis, A.J, and M. Voge, 1970. Experiments and Techniques in Parasitology. W. H. Freeman and Company, San Francisco, USA.
39. Maizels, R.M, M.L. Blaxter, B.D. Robertson and M.E.Selkirk, 1991. Parasite antigens, parasite genes. A laboratory manual for molecular Parasitology. Cambridge University Press, New York.
40. Manual of Veterinary Parasitological Laboratory Techniques. 1986. Reference Book No.418, Ministry of Agriculture, Fisheries and Food, Her Majesty's Stationery Office, London, U.K.
41. Maramorosch, K. and J. Mitsubishi, 1982. Invertebrate cell culture application. Academic Press, New York, USA.
42. Marchalonis, J.J. 1984. Immunobiology of parasites and parasitic infections. Vol. 12, Plenum Press, New York.
43. Margaret, W. Sloss and R.K. Russel. 1982. Veterinary Clinical Parasitology. 5th. Ed. Iowa State University Press, Ames, Iowa, USA.
44. Martin. S.W.,A.H. MEEK and P.Willeberg. 1993, Veterinary Epidemiology. Principles and Methods (PB), International Book Distributing Company.
45. Mehlorn, H. 1988. Parasitology in Focus, Facts and Trends. Springer-Verlag, Berlin.
46. Ministry of Agriculture, Fisheries and Food, 1986. Manual of Veterinary Laboratory, Parasitological Techniques, Reference Book 418, Her Majesty's stationery Office, London.
47. Mitsubishi, J., 1989. Invertebrate cell system applications. Vol. I. CRC Press, Inc, Boca Raton, Florida.
48. Miyazaki, U.I., 1991. An illustrated Book of Helminthic Zoonosis. International Medical Foundation of Japan. Tokyo, Japan.
49. Mowat, N. and M. Rweyamance, 1999. Vaccine Manual, The Production and Quality Control of Veterinary Vaccines For Use in Developing Countries . Daya Publishing House Delhi 110035. (Republished by arrangements with FAO).
50. Olsen, G.K. 1995 Immunology and Immuno pathology of domestic animals. 2nd Edition, Mosby.
51. Parasitic Zoonoses. 1979. Technical Report Series No.637, World Health Organization, Geneva.
52. Parsad. 1996. Veterinary Clinical Diagnostic Technology.

53. Peters, A.R. 1993. Vaccines for Veterinary Applications, Butterworth-Heinemann Ltd., Jordon Hill, Oxford OX2 8DP, UK.
54. Peters, W. and H. M. Gilles, 1988. A Colour Atlas of Tropical Medicine and Hygiene. The English Language Book Society, London, U.K.
55. Pictorial Keys: Arthropods, Reptiles, Birds and Mammals of Public Health Significance. 1967. U.S. Department of Health Education and Welfare, National Communicable Disease Centre, Atlanta Georgia 30333, USA.
56. Ploeg, L.T., C.R. Canter and H.J. Vogel, 1990. Immune recognition and evasion: Molecular aspects of host parasite interaction. Academic Press Inc., London.
57. Poulin, R. 1998. Evolutionary Ecology of Parasites from Individuals of Communities. Chapman Hall.
58. Radostits, O.M. and D.C. Blood. 1994. Veterinary Medicine, 8th Ed. W.B. Saunder Company London.
59. Roberts, L. S. and J.J. Janovy. 2000. Foundations of Parasitology. 5th Edition, W.C.B. Company, U.K.
60. Roit, I., J. Bostoff, and D. K. Male. 1990. Immunology. 2nd Edition. Gower Medical Publishing, London.
61. Rollinson, D. and R.M. Anderson, 1985. Ecology and Genetics of Host-Parasite Interactions. Linnean Society Symposium Series No.11, Academic Press, New York, USA.
62. Ruprah, N. S. 1985. A Textbook of Clinical Protozoology. Oxonian Press, Pvt. Ltd.
63. Service, M.W. 1980. A guide to Medical Entomology. The McMillan Press Ltd. London.
64. Smyth, J. D. 1994. Animal Parasitology, 3rd Ed. Cambridge University Press, London.
65. Smyth, J.D. and D.P. McManus. 1989. The Physiology and Biochemistry of Cestodes. Cambridge University Press New York.
66. Smyth. 1994. Animal Parasitology (PB). UK.
67. Soulsby, E.J.L., 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. 7th Edition. The English Language Book Society, Baillare Tindall, London.
68. Sun, T., 1988. Colour Atlas and Textbook of Diagnostic Parasitology. Igaku-Shoin, Tokyo, Japan.
69. Taylor, A.E.R. and J.R. Baker, 1987. *In vitro* Methods for Parasite Cultivation. Academic Press, New York, USA.

70. Thienpont, D.; F.Rochette and O.F.J. Vanparijs. 1979. Diagnosing Helminthiasis Through Coprological Examination. Janssen Research Foundation, Belgium
71. Thrusfield, M. 1997. Veterinary Epidemiology. 2nd Ed. Blackwell Science Publication.
72. Tizard, I. R. . 1996. Veterinary Immunology. An Introduction 5th Ed. W.B. Saunders, Co. London.
73. Toft, C.A. A. Aeschlimann and L. Bolis, 1991. Parasite-Host Associations, Oxford University press, New York, USA.
74. Urquhart, G.M., J.Armour, J.L. Duncan, A.M. Dun and F.W. Jennings. 2000. Veterinary Parasitology. Longman Scientific and Technical, U. K.
75. Wakelin, D., 1996. Immunity to parasites. 2nd Ed. Cambridge University Press, London.
76. Wall, R. and D. Shearer. 1997. Veterinary Entomology. Chapman and Hall.
77. Wall, R. and D. Shearer. 2001. Veterinary Ectoparasites: Biology, Pathology and Control. 2nd Ed. Blackwell Science Publication.
78. Walls, K. W. and P.M. Schantz, 1986. Immunodiagnosis of Parasitic Diseases. Vol-I. Helminthic Diseases. Iowa State University Press, Ames, Iowa.
79. Warren, K.S., 1993 Immunology and molecular biology of parasitic infections, Blackwell Scientific Publications, Oxford.
80. Wayne, S. and H. Allan, 1987. Veterinary Epidemiology, Principles and Practices. Meek & Preben Willeberg, Iowa State University Press, Ames, Iowa, USA.
81. William, S.R., 1981. The Science of Entomology, 2nd Edition. The McMillan Pub. Co., Inc., N.Y.
82. Wilson W.G. 1998. Wilson's Practical Meat Inspection.
83. Young W.K. 1992. Animal Parasite Control Utilizing Biotechnology, CRC Press, Inc., Boca Raton, Florida, 33431.