

NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS OF M.Sc. (SEM. III & IV) From June 1993.

SEMISTER III (ZOOLOGY)

1) Any one Special Subject.

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|--------------------------------------|---------------------------------------|
| * Zoo. 301 - Helminthology I | * Zoo. 302 - Experimental-Embryology- |
| Zoo. 303 - Ornithology I | Zoo. 304 - Environmental toxicology- |
| Zoo. 305 - Reproductive Physiology I | Zoo. 306 - Developmental Biology I |
| Zoo. 307 - Entomology I | Zoo. 308 - Physiology I |
| Zoo. 309 - Molecular Biology I | * Zoo. 310 - Environmental Biology I |
| * Zoo. 311 - Genetics - I | |

- 2) Zoo. 321 (a) Enzymology OR Fresh water zoology
Zoo. 321 (b) Biophysics OR Parasitology

3) Any two

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|--------------------------------|---|
| Zoo. 326 - Radiation Biology | Zoo. 327 - Bacterial and phage Genetics |
| Zoo. 328 - Drosophila Genetics | Zoo. 329 - Bioelectronics |
| Zoo. 330 - Endocrinology | * Zoo. 331 - Interdisciplinary |
| Zoo. 332 - Applied entomology | Zoo. 333 - Insect taxonomy |
| Zoo. 334 - Avian taxonomy. | |

- 4) Zoo. 346 - 14 practicals corresponding to Zoo.301 to 311
7 Practical's corresponding to Zoo.321 (a)
4 Practical's for research project.

- 5) Zoo. 347 - 14 practicals corresponding to Zoo.326 to Zoo.334
(any two)
7 practicals corresponding to Zoo.327 (b)
4 practicals for research project.

SEMISTER IV

1) Any one special subject :-

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|---------------------------------------|---------------------------------------|
| * Zoo. 401 - Helminthology II | * Zoo. 402-Experimental Embryology II |
| Zoo. 403 - Ornithology II | Zoo. 404-Environmental toxicology II |
| Zoo. 405 - Reproductive physiology II | Zoo. 406-Developmental Biology II |
| Zoo. 407 - Entomology II | Zoo. 408-Physiology II |
| Zoo. 409 - Molecular Biology II | * Zoo. 410-Environmental Biology II |
| * Zoo. 411 - Genetics II | |

- 2) Zoo. 421 - (a) Physiology of Reproduction OR Terrestrial Ecology
Zoo. 421 - (b) Genetic toxicology OR Pest control.

cont...2

3) Any two

- Zoo. 426 Genetic Engineering & Recombinant DNA techniques.
 - Zoo. 427 Animal Virology.
 - Zoo. 428 Insect Physiology.
 - Zoo. 429 Insect endocrinology
 - Zoo. 430 Neurophysiology
 - Zoo. 431 Insect toxicology
 - Zoo. 432 Tissue Culture
 - Zoo. 433 Poultry Science
 - Zoo. 434 Ichthyology
 - * Zoo. 435 Insect Behaviour
 - * Zoo. 436 Protozoology
 - Zoo. 437 Histochemistry
 - Zoo. 438 Epizootology
 - Zoo. 439 Basic Biotechnology
 - * Zoo. 440 Teratology
 - Zoo. 441 Avian migration
 - * Zoo. 442 Pollution Biology
 - * Zoo. 443 Human Genetics
 - * Zoo. 444 Methodology of Teaching and Assessment in Zoology
 - * Zoo. 445 History of Biology
 - * Zoo. 446 Marine Ecology
 - * Zoo. 447 Resource Management
 - * Zoo. 448 Ecological Genetics
 - * Zoo. 449 Exobiology
 - * Zoo. 450 Origin and Evolution of Species
- 4) Zoo. 461-14 practicals corresponding to Zoo 401 to Zoo 411
7 practicals corresponding to Zoo 421 (a).
4 practicals for research project.
- 5) Zoo. 462-14 practicals corresponding to Zoo 426 to ^{Zoo}450 (any two)
7 practicals corresponding to Zoo 421 (b)
4 practicals for research project.

Note :- For EXAMINATION

- 1) SEMESTER III Courses Zoo 346 & ^{Zoo}347
 - a) In each course zoo 346 and ^{Zoo}347, 15 marks are allotted to project work.
 - b) In course zoo 346 - 45 works are allotted to a course from Zoo 301 to ^{Zoo}311 and 20 marks to zoo 321 (a).
- c) In course zoo 347-45 marks are allotted to courses from zoo 326 to zoo 334 and 20 marks to zoo 321 (b).

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2) SEMESTER IV : Courses zoo51 & zoo52

- a) In each course ⁴⁶¹ zoo/ and ^{Zoo} /462 15 marks are allotted to project work
- b) In course Zoo461 - 45 marks are allotted to a course from Zoo 401 to 411 and 20 marks to 421 (a)
- c) In course ^{Zoo} /462 - 45 marks are allotted to a course from Zoo426 to Zoo450 and 20 marks to ^{Zoo} /421 (b)
- 3) All the courses of M.Sc. Sem I & II are university courses.
- 4) Zoo321 (a) & (b), courses from Zoo326 to Zoo334, Zoo421 (a)&(b) and courses from Zoo426 to Zoo450 are Departmental courses. Rest of M.Sc. Sem. III and IV are university courses.
- 5) Project work of Sem, III and IV is to be evaluated at the end of year with examination of Sem, IV.
- 6) Project work is compulsory, If it is not submitted by a candidate his result should be withheld.
- 7) The detailed syllabus of the courses marked with * is not ready

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Details of ZO0346, ZO0347, ZO0461 and ZO0462

ZO 346 :- i) 14 PRACTICALS Corresponding to ZO 301 to 311

- * ZO 301 : Helminthology I * ZO 302 : Expt. Embryo. I
- ZO 303 : Ornithology I ZO 304 : Environ. Toxicology I
- ZO 305 : Reprodu. Physio. I * ZO 306 : DEVE Bio. I
- ZO 307 : Entomology I ZO 308 : Physiology I
- * ZO 309 : Mol. Biology I * ZO 310 : Environ. Bio. I
- * ZO 311 : Genetics I

ii) 7 Practicals corresponding to ZO 321 (a)

ZO 321 (a) Enzymology OR Fresh water Biology

iii) 4 Practicals for Research Project.

TOTAL PRACTICALS : 25 PRACTICALS - PER SEMESTER

ZO 347 :- 7 Practicals corresponding to each of ZO 926 to ZO 934

(Any two : Total Pract. 14)

- * ZO 326 : Radiation Biology ZO 327 : Bacterial & phage genetics.
- * ZO 328 : Drosophila genetics * ZO 329 : Bioelectronics
- * ZO 330 : Endocrinology * ZO 331 : Interdisciplinary
- ZO 332 : Applied entomology ZO 333 : Insect taxonomy
- ZO 334 : Avian taxonomy.

ii) 7 Practicals Corresponding to ZO 321 (b)

ZO 321 (b) * Biophysics or Parasitology

iii) 4 Practicals for Research Project.

Total Pract.: 25 Practs per Semester.

ZO 461 : i) 14 Practicals corresponding to ZO 401 to ZO 411

- * ZO 401 - Helminthology II * ZO 402 - Expt. Eryology -II
- ZO 403 - Ornithology II ZO 404 - Enviro. toxicology
- ZO 405 - Reprodu. Physiology II * ZO 406 - Develop. Biology -II
- ZO 407 - Entomology II ZO 408 - Physiology II
- * ZO 409 - Mol. Biology II * ZO 410 - Environ. Biology II
- * ZO 411 - Genetics II

ii) 7 Practicals corresponding to ZO 421 (a)

ZO 421 (a) Physiology of Reproduction OR Terrestrial Ecology

iii) 4 Practicals for research Project

Total Practs. 25 Practs. Per Semester.

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ZO 462 : i) 7 Practicals corresponding to each of ZO 426 to ZO 450
(Any two - Total practicals - 14)

ZO 426 : Genetic engineering and Recombinant DNA techniques ZO 427-Animal virology

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|--|-------------------------------|
| * ZO 428 : Animal Physiology | ZO 429- Insect endocrinology |
| * ZO 430 : Neurophysiology | ZO 431- Insect toxicology |
| * ZO 432 : Tissue culture | *ZO 433 Poultry science |
| * ZO 434 : Ichthyology | * ZO 435- Insect behavior |
| * ZO 436 : Protozoology | * ZO 437- Histochemistry |
| * ZO 438 : Epizootology Epizootology | ZO 439- Basic Biotechnology |
| * ZO 440 : Teratology | ZO 441- Avian Migration |
| * ZO 442 : Pollution Biology | * ZO 443- Human Genetics |
| * ZO 444 : Methodology of teaching & assessment in zoology | * ZO 445- History of Biology |
| * ZO 446 : Marine ecology | * ZO 447- Resource management |
| * ZO 448 : Ecological genetics | * ZO 449- Exobiology |
| * ZO 450 : Origin & evolution of species. | |

ii) 7 Practical corresponding to ZO 421 (b)

ZO 421 (b) Genetic toxicology or pest control

iii) Practical for research project.

Total practical : 25 practical per semester.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

Appendix "B"

SYLLABUS FOR M.SC. ZOOLOGY - SEMESTER - III & IV

(from June, 1993)

M.Sc. Zoology Sem.-III

20.303

ORNITHOLOGY - I

1. A) Introduction, Definition of ornithology, shape, size, number & colouration of birds.
B) Diet and way of life Plant eaters, seed eaters, Nectar eaters, insect eaters, hunting and scavenging birds.
2. External structural characters : Characters of bill, tail, wings, feet etc. Plumage and plumage colouration, feather tracts, sequence of plumages and moults. Eclipse plumage, moulting in adults, plumage change with moult, abnormal colouration, colour phase etc.
3. Brief outline of the anatomy, histology and physiology of various body systems of a bird (Pigeon)
4. Flight : Control, power for flight, soaring flight, hovering flight, flight maintenance etc.
5. Territory : Definition, establishment and maintenance of territory size of territory, functions of territory Home range etc.
6. Distribution :
 - a) Geographical distribution - continental, insular, marine.
 - b) Seasonal distribution
 - c) Ecological distribution - Major biotic communities, seral communities, primary and secondary communities edge effect, niche etc.
 - d) Altitudinal distribution

20 : 304 : ENVIRONMENTAL TOXICOLOGY - I

1. Introduction to toxicology : Origin & scope..
2. Types of toxic agents, Viz : agricultural, Industrial, Synthetic, Biotoxins, food additives.
3. Physico - Chemical nature and action of environmental toxicants, Bioacids, Organic, heavy metals, radioactive substances & industrial chemicals.
4. Impact of toxicants on ecosystem.

- 5) factors modifying the effects of toxicants temperature, PH , of soil & water, salinity, physiological status of organisms, age, sex, species etc.
- 6) Physico-chemical and Biological indicators of Pollution due to various toxicants.
- 7) Environmental toxicants in air, water & soil, occupational & industrial health hazards.
- 8) Methodology of toxin analysis :
thin layer chromatography, gas liquid chromatography, atomic absorption, statistical analysis of toxicity data.
- 9) Environmental monitoring of contamination, bio-accumulation, biotransformation and bio degradation, biohazards

Reference Books

Zo 304 & Zo 404 : ENVIRONMENTAL TOXICOLOGY I & II

1. Thomas J. Haley and William O : Hand book of Toxicology, Hemisphere publishing Corporation Washington USA - 1987.
2. Guthrie, I.E. and Perry, J.J. : Introduction to Environmental toxicology, Elsevier N.Y. 1980.
3. Purclom P.W. : Environmental Health, Academic Press NY 1980.
4. Casavett and Doulls Toxicology : Macmillan N.Y. 1985.
5. Hayes A.W. : Principles and Methods of Toxicology. Raven Press New York 1982.
6. Homburger F. Hayes J.A. Petikan, E.W.: A guide to General toxicology, Kangar Press Basal 1983.
7. Hayes W.J. : Pesticide studies in Ham Williams & Wilkins Baltimore 1983.
8. Hayes W.J. : Toxicology of Pesticide, Williams & Wilkins III Ed Baltimore 1975.
9. Baselt R.C. : Biological Monitoring Methods for Industrial chemicals, Biomedical Publications Davis CA 1980.
10. Bri A. Biochemical Toxicology of Environment Agent Ekevier North Holland 1976.
11. Rand, G.M. petrocelli S.R. : Fundamental of Aquatic Toxicology Mewispliere Washington 1985.
12. Eaton J.G. Parrish P.R. Hindricks H.L. "Aquatic Toxicology" Philadelphia 1980.
13. Berman E : Toxic Metals and their Analysis, Heydon London 1980.
14. Nriagu J.O. (a) Cadmium in the Environment
(b) Copper in the Environment
(c) Nickel in the Environment
(d) Zinck in the Environment
15. Andrson L.E. Scott R.M. : Fundamentals of Industrial Toxicology 1981.
16. Kendall R.J. Toxic substances in the Environment Iowa USA 1982
17. Adrien-Albert : Selective Toxicity, chapman & Hall 1985
18. Gilman, A.G.; Goodman. L and Gilman, A (eds) (1980) Goodman and Gilman's Pharmacological Basis of Therapeutics, New York, Macmillan.

20 ; 305 ; REPRODUCTIVE PHYSIOLOGY - I

- (I) -General nature & sexual periodicity.
-Patterns & reproductive cycles :-
a) Seasonal breeders (Sheep or Cattles)
b) Continuous breeders - short oestrous cycle (Rat or Mice)
c) Menstrual cycle - (Man or Primates)
Sequence of events, cyclical changes & hormonal control.
vaginal plug.
- (II) -Morphology and Histology of female and male reproductive organs and accessory reproductive structures..
-cyclical changes in the reproductive organs and accessory reproductive structures in the male and female
-Mammary gland : its structure & development, maintenance and control, theories of lactation and physiological integration, importance of breast feeding.
- (III) Physiology of ovary :- Pituitary- ovary axis, development and maturation of oocyte, endocrine control of ovarian function, ovarian hormones and their action. Molecular mechanism of ovulation, and its control. Corpus :- its structure, formation, fate and function. Oviduct- structure of function. Structure & function of placenta. Mechanism of parturition.
- (IV) Physiology of Testis : Structure and cyclical changes, development of the seminiferous tubules & seminiferous epithelium, maturation of testis, testis-pituitary axis, initiation and control of spermatogenesis, Kinetics of the spermatogenic process, duration of the spermatogenesis, sperm movement, viability and survival, capacitation. Physiology and control of the male accessory organs. Structure and functional activity of epididymis.
- (V) Structure of the pituitary gland, cell types and their role in reproduction. Gonadotrophins & their role in reproduction.
-Structure of the adrenal gland, role of adrenal in reproduction chemistry, biosynthesis and action of Steroid hormones. Sex determination, role of hormones in sex differentiation, Barr bodies & their significance.
-Pheromones - their occurrence, structure & physiology. Prostaglandins, their structure, physiological action & occurrence. and ZOO 405

Reference for 20:305/Reproductive physiology I & III

Books Recommended for M.Sc. part II Zoology

- 1) Parkes, A.S. : Marshall's physiology of Reproduction, Vols I to III.

- 2) Parkes, A.S. : Patterns of sexuality and Reproduction
- 3) Nalbandov : Reproductive physiology.
- 4) Austin, C.R. & Short, R.V. : Reproduction in mammals (Vols 1 to 8)
- 5) Van Tienhoven : Reproductive physiology of vertebrates.
- 6) Hanssou : Physiology of Reproduction.
- 7) Asdell : Patterns of Reproduction-
- 8) McLaren : Advances in Reproductive physiology (vol. 1 to 6)
- 9) Hafez, B.S. and Blandau, R.J. : Mammalian Oviduct
- 10) Gayton, A.C. Horrobin, D.C. Greep, R.O. : Reproductive physiology, M.T.P. International Review of science, vols. 5 to 8
- 11) Rowlands, I.W. : Comparative Biology of Reproduction in mammals (Z.S.I. Symposium)
- 12) Young and Corner : Sex and Internal secretion
- 13) Mckerns, K.W. : The Gonads.
- 14) Zuckerman's, S : Ovary (vol 1 and 2)
- 15) Asdell, Biology of gestation (vol. I & II)
- 16) Finn and Piter : The uterus
- 17) Labhart Alexis : Clinical Endocrinology
- 18) Swyer : Reproduction & sex
- 19) Code, H.H. : Gonadotrophins.
- 20) Schuler, Busstein & (Cooke : Molecular Endocrinology of the steroid hormones.
- 21) Malkinson A.M. : Hormone Action.
- 22) Astwood : Recent progress in Hormone research
- 23) Burrows : Biological action of sex hormones
- 24) Turner and Bagnara : General Endocrinology.
- 25) Pincus and Thimann : The Hormones (vol. I & II)
- 26) Martini & Ganong : Neuroendocrinology (vol. I & II)
- 27) Lipyd, C.W. : Endocrinology of Reproduction.
- 28) Gay, C.W. : Scientific American (vol I, II, IV, V & X)
- 29) Nalbandov : Advances in Neuroendocrinology.
- 30) Holmes, R.L. & Bull, J.N : The Pituitary Gland, A comp. Account
- 31) Howe, A (1973) Pars intermedia its structure & Function Review, Journal of Endocrinology, 59, 385-409.
- 32) Well, P.W. : The Prostaglandins (vol I & II)
- 33) Gringhton et al : control of ovulation
- 34) Villee, C.A. : control of ovulation
- 35) Cowie, A.T. et al : Hormonal control of lactation
- 36) Blandau, R.J. : The Biology of Blastocyst.
- 37) Johanson, A.D. and Gomes, W.R. : The testis (vol 1 to 4)
- 38) Patten : Development of big
- 39) Corner : Hormone in Human Reproduction
- 40) Greep, Koblinsky & Jaffe : Reproduction & Human welfare (Review : Reproductive sciences & contraceptive Development)
- 41) I.C.M.R. (New Delhi) : Technical Handbook on Intranterine contraceptive
- 42) C.S.I.R. : Science Report : Article by Nandi : Plants for population control.
- 43) Lendnicher Daniel : Contraception, "The chemical control of Fertility."

- 44) Hal, Anderson, Smart & Besser : Endocrinology.
- 45) Austin, C.R. & short R.V. : Reproduction in mammals vol.5 -
(Artificial control of Reproduction)
- 46) Zarrow et al : Experimental Endocrinology
- 47) Daniel J.C. : Methods in mammalian Embryology.
- 48) Wischi : Development of vertebrates
- 49) Brachet : Chemical Embryology.
- 50) Ravan : Outlines of Developmental physiology.
- 51) Windle : Physiology of Foetus
- 52) Corner : Hormones in human reproduction

20 : 306 DEVELOPMENTAL BIOLOGY I

1. Cellular and molecular aspects of gametogenesis.
 - Spermatogenesis ; ultrastructure, biochemistry.
 - Ovogenesis and egg organization.
 - Gene amplification and undermethylated DNA
 - Synthesis and storage of maternal mRNAs, rRNAs and RNPs.
 - Protein synthesis.
2. Molecular Biology of early development.
 - Fertilization.
 - Maternal mRNA utilization.
 - Maternal rRNA utilization.
 - Expression of maternal and paternal genes ; genetic evidence.
3. Cell Biology of early development.
 - Role of cell cycle and changes in DNA replication-initiation sites
 - Regulative and mosaic eggs, cleavage and blastulation; determination.
 - Role of cell surface and microtubules.
 - Presumptive fate maps, morphogenetic movements and gastrulation in invertebrates and vertebrate;
 - Nuclear transplanation experiments.
 - Embryonic induction - competence, evocation and inducers.
4. Morphogenesis and organogenesis.
 - Development of the neural crest and its derivatives.
 - Development of the vertebrate kidney.
 - Development of the musculature.
 - Heart morphogenesis and the role of cell death.
 - Development of the tooth.
5. Larval development and metamorphosis.
 - Development of Insect larvae, role of juvenile hormone, formation of DNA and RNA-puffs in the salivary gland, chromosomes and heat-shock experiments. Metamorphosis.
 - Metamorphosis in amphibia. Role of hormones, tail regression, restructurization of rogan system, Neoteny.

Reference Books

1. Balinsk, B.I. (1976) - Introduction to Embryology, Saunders, Philadelphia.
2. Berril, N.J. and Karp, G. (1976) - Developmental Biology, McGraw-Hill, New York.
3. Abercrombie, M., Brachet, J. and King, L. (1961) - Advances in Morphogenesis, Vol. 1-10, Academic Press, New York.
4. Coward, S.J. (1973) - Developmental Regulation Aspects of Cell Differentiation, Academic Press, New York.
5. Balls, M. and Billet, F.S. (1973) - The Cell Cycle in Development and Differentiation, Cambridge University Press.
6. Cameron, I.A.; Padilla, G.M. and Zimmermann, A. (1971) - Developmental Aspects of the Cell Cycle, Academic Press.
7. Locke, M. (1966 onwards) - Current Topics in Developmental Biology, Academic Press, New York.
8. Korts, B. (1976) - Physiology of the Amphibia, Vol. 1, Academic Press, New York.
9. Roberts, J.D. and Okada, T.S. (1978) - Mechanisms of Cell Change.
10. Ede, D.A. Hinchliffe, J.R. and Harris, M. (1977) - Vertebrate Limb and Somite Morphogenesis, Cambridge University Press.
11. Johnson, L.M.H. (1978) - Development in Mammals, Vol. 1-3, North Holland Publ. Co.
12. Fulton, C. and Klein, A.O. (1976) - Exploration in Developmental Biology, Harvard University Press.
13. Lash, J. and Whittaker, J.P. (1974) - Concepts in Development, Sinauer Assoc. Inc. Publ.
14. Raven, Ch.P. (1959) - An Outline of Developmental Physiology, Pergamon Press.
15. Romanoff, A. (1950) - The Avian Embryo, Macmillan Press.
16. LeBue, J. and Gordon, A.S. (1973) - Humoral Control of Growth and Differentiation, Academic Press, New York.
17. Symposia of the Society for Developmental Biology, All volumes.
18. Davidson, E.H. (1976) - Gene Activity during Early Development, Academic Press, New York.
19. Watson, J.D. (1978) - Molecular Biology of the Gene, 3rd Edn, W.A. Benjamin Publ.
20. Current Topics in Developmental Biology, (1972 onwards)
21. Weber, R. (1968-75) - Biochemistry of Animal Development, Vol. 1-11, Academic Press, New York.
22. Wigglesworth, V.B. (1970) - Insect Hormones, Oliver & Boyd, Edinburgh.
23. Developmental Biology (1963 onwards)
24. Journal of Embryology and Experimental Morphology (1955 onwards)

20 : 307 : ENTOMOLOGY - I

Integument and its derivatives. comparative study of Head and its appendages. Thorax and its appendages. Abdomen and its appendages. Light and sound producing organs. comparative anatomical and histological study of Alimentary, circulatory, ventilatory, Excretory, Muscular, Nervous and Reproductive systems; fat body, sense organs and exocrine glands.

Reference Books

1. Inms' Text Book of Entomology-By O.W.Richards and R.G.Davies, (Methuen & Co.; Lond on, 1977). Vols. I and II
2. Principles of Insect Morphology-By R.E.Snodgrass, (Tata, McGraw-Hill, Bombay, 1973).
3. Introduction to Comparative Entomology-By R.M.Fox and J.W. Fox, (Reinhold, New York, 1964).
4. The Insects : Structure and Function-By R.E.Chapman (E.L.B.S.- & E.U.P. London 1972).
5. General and Applied Entomology-By K.K.Nayar, T.N. Ananthakrishan and B.V. David (Tata, McGraw-hill, New Delhi, 1976).

20 : 328 : PHYSIOLOGY - I

1. Pre-biological chemical evolution and origin of life; Evolution of metabolic Pathways and nutritive types; Evolution of specific proteins cytochrome C and haemoglobins.
2. Camparative animal nutrition : Calorimetry anol energy orpects of the diel; essential fatty alids; nitrogen ba nce; sterol requirements; chemistry and metabolic functions of water-solu- and fat - solu utamins ; mineral nutrition; distri- bution and specifility of digestine enzymes in the animal kingdom; Correlation between diet and digestive enzymes.
3. Metabolism : Comparative aspects of the metabolism of fats, alids, porphy , purine, Pyrimidines and sterots., excretory nitrogen metabolism, synthesis and funtion of polyamines; Prostaglandins : chemistry and role; metabolic specializations of animals to anoxia, flight of Palsasitism.
4. Deloxification mechanisms and the role of micro somal mixed function oxidase
5. Physiological and biochemical aspects of
6. Immune responses in animals.
7. Physiollogical compensation to environmental variation ;tolere- nce and resistnace; acclimation and acclimatization, confor- mity and regulating patterns of acclimation.
8. Osmotic relations of animal : volime regulation; osmoconform- rs and intracellular isomatic regulation; extracellular and isomatic regulation in hyperosmotic and hyposomatic media; regulation of water and soil balance in lerrestrial environ- ment, extrarenal salt exoretion, ionic regulation.
9. Blood prigments : Chemistry and role in gas transport; restviratory adaptations.
10. Thermobiology : Effect of tempreture on biological pro Arrheniua equation and activation energy; adapto- tions of animals to tempreture extremes; physiological and biochemical aspects of thermal acclimation in poikilotherms; mechanisms of thermo regulations in homeotherms; hibernation.
- 11 Pressure as an environmental f... and adoptations of animals to high altitudes and occcanic depths.

12. Biological rhythm : Rhythmic activity in biological systems, exogenous and endogenous clock hypothesis, cellular aspects.

REFERENCE BOOKS

1. Pligh, J.J.L. (Loudsiev, Thompson A.G. Mac Donald) : Environmental Physiology of animal, Black wey Scientific Publication.
2. J.A. Nerstain (1972) : Biochemical responses to Environmental stress, Acad. Press.
3. Dunn, A. And Arditti, J. (1968) : Experimental animal physiology Experiments in cellular and general physiology Holt Reinhant and Winston, Inc. N.Y.
4. Guyton, A.G. (1986) : Text book of medical physiology, 7th edition, Saunders Publications
5. Hill, R.W. (1976) : Eruparative physiology of animal and Environmental approach.

Harper and Row Publi., New York.

6. Leyedah, B.H. and Barber, A.A. (1963) : Zoethouts laboratory Experiments in Physioölogy, 6th edition. The C.V. Mosley Toplan Co. Ltd., Tokyo, Japan.
7. Leavell, L.C., F.M. and Miller, M.A. (1964) : 4th edition. workn book and laboratory Manual in anatomy and Physiology. the Mac. Millan Co., New York.
8. Bernard, L. Oser (1979) : Hawk's Physiology chemistry, TMN Published Company Ltd, New Delhi.
9. Practical Course in invertebrate Physiology.

20 : 309 : Molecular Biology - I

1. Structure of sugars, amino acids, bases, nucleosides and nucleotides.
2. Chemical bonds, energy-rich linkages, weak interactions, coupled interactions and group transfer.
3. Primary, secondary and tertiary structure of DNA
4. Methods for determining the primary sequence of nucleic acids.
5. Primary and secondary structure of tRNA.
6. Structure of MS 2 Phage RNA.
7. Primary, Secondary and tertiary structure of proteins.
8. The concept of template surfaces.
9. Mendelian vision of living state.
10. Chromosomal gene organization.
11. Structure, organization and function of genes, structure of lac operon and regulation in phage lambda, structure of plasmid genome.
12. Genetic code.
13. Structure of chromatin.
14. Nucleic acid polymerases.
15. DNA replication.
16. RNA transcription.

Reference Books

- 1) The Molecular Biology of Gene, J.D.Watson, 1978, 2nd Edition, W.A. Benjamin and Co.
- 2-4) Gene Expression, by S.Lewin Vols. 1,2 and 3. Wiley-Interscience Publ. 1974-78.
- 5) Gene Activity During Early Development by E.H.Davidson. Acad. Press New York. 1976.
- 6) DNA Synthesis, A. Corberg, 1974, W.H. Freeman and Co. 1977, San Francisco.
- 7) Molecular Biology of Mammalian Genetic Apparatus by P.O.P.Ts'o 1977. North-Holland Publ. Co.
- 8) Biochemistry of Nucleic Acids. I.N.Davidson, eighth edition, 1977 Chapman and Hall Publ.
- 9) Handbook of Biochemistry and Molecular Biology, H.Sober, 3rd Edition, Chemical Rubber Co. Publ., 1978-79.

ZO : 321 (a) Engymology.

- 1) Nature isolation, characterization, classification, specificity and mechanism of action.
- 2) Factors affecting enzyme activity.
- 3) Single substrate reactions, steady-state theory
- 4) Bisubstrate reactions - Types of Cleland notation
- 5) Inhibition competitive & non competitive inhibition. Allosteric activation & inhibition - Sequential & concerted symmetry models using Aspartate transcarbamylase as an example. Enzyme Turnover.
- 6) Multienzyme complex, regulation & metabolism Enzyme Biosynthesis &
- 7) Control of Biosynthesis of enzymes
- 8) Mechanisms of enzyme reactions
- 9) Immobilized enzymes & their applications
- 10) Structure and function of isozymes.
- 11) Zymogen activation
- 12) Diagnostic, clinical & analytical application of enzymes.
- 13) Coenzymes.

References

- 1) Dixon, M & E.C. Webb. Enzymes Third edition 1979. Academic Press New York.
- 2) Principles in Biochemistry Lehninger. AL. CBS Publ. New Delhi.
- 3) Fundamentals of Enzymology second edition. By Nicholas C Price and Lewins Stevens.
- 4) Basic Biological Chemistry. Malhar & Cordes., Harper International Edition, New York.
- 5) Biochemical Calculations, 2nd edition Irvin, H-Segel, John Wiley & Sons, New York.

Z0 : 321(a) - Fresh Water Zoology

1. Historical perspective present problems of Limnology with special reference to India.
2. Physics and chemistry of fresh water.
3. Classification of habitats and ecological zones.
4. Biotic associations and complexes,
5. Anatomical and physiological adaptations to life in fresh water osmoregulation, To, food/feeding methods, protective adaptations, locomotion.
6. Biology and general organisation of fresh water organisms:
 - (a) Protozoa, Porifera, Coelenterata
 - (b) Platyhelminthes, Nemertea, Rotifera and Gastrotricha
 - (c) Nematoda, Nematomorpha, Endoprocta, Ectoprocta
 - (d) Annelida
 - (e) Arthropoda
 - (f) Mollusca
 - (g) Fishes and Fisheries
 - (h) Amphibia, Reptilia, Aves, Mammals.
7. Freshwater productivity.
8. Biogeography of freshwater animals in India.

Reference Books

- 1) Ecology of Inland Waters and Estuaries-Reid (1962).
- 2) A Guide to the study of freshwater biology-Needham and Needham
- 3) Freshwater Biology - Ward and Whipple.
- 4) Limnology - Welch (1952).
- 5) Limnological Methods - Welch (1948).
- 6) Some aspects of life in fresh water - Popham (1960).
- 7) Fundamentals of Limnology-Ruttner (1963).
- 8) Animal life in Fresh water - Mellanby.
- 9) Freshwater Animals of India-Tonapi (1980).
- 10) Freshwater Ecology-Macan (1963).
- 11) Life in lakes and rivers-Macan and Worthington.

Z0 : 321 (b) Biophysics

1. Simple Math.- What is a derivative, what is an integral, what is a differential equation, what is a vector and a scalar, vector calculus.
2. Structure of an atom and spectrum. Quantum mechanical solution for hydrogen atom, isotopes and radionuclides.
3. Atomic and molecular spectra and spectra of biomolecules.
4. Weak and strong interactions : ionic bonds, covalent linkages, hydrogen bond and dipole interaction.
5. Laws of thermodynamics and concept of free energy.
6. Bioenergetics-electron transfer chain.
7. Bioluminescence.
8. Reaction kinetics, Michaelis-Menton kinetics.

- 13) Levine, N.D. (1961) - "Protozoan Parasites of Domestic Animals and Man" Burgess Publ. Co, Minneapolis, Minn.
- 14) Noble, E.A. and G.A. Noble (1971) - "Parasitology : the biology of animal parasites". 3rd Edn. Lea and Febiger, Philadelphia.
- 15) Read, G.P. (1972) - "Animal Parasitism". Prentice-Hall, Inc., Englewood Cliffs, N.J.
- 16) Smyth, J.D. (1962) - "Introduction to Animal Parasitology". English Univ. Press London.

30 : 326 : Radiation Biology.

- 1) Radiation and interaction with matter.
- 2) Interaction with biological molecules, o2 effect and Target theory.
- 3) Tracer techniques - dosimetry of ionizing radiation, autoradiography, scintillation spectrometry.
- 4) Effect of ionizing radiation on DNA, characterization of DNA damage and repair.
- 5) Effect of ultraviolet radiation of DNA, characterization of DNA damage and excision repair.
- 6) Effect of radiation on Cells-cell survival, transcription, DNA replication, mutation respiration.
- 7) Radiation carcinogenesis.
- 8) Radiosensitivity and radioresistance.
- 9) Radioprotection, physical and biological scavengers and radio-mimicking agents.
- 10) Radiotherapy-principles and application.
- 11) Nuclear imaging -X-ray and nuclear scanning computerized diaxial tomography.

30 : 327 : Bacterial and Phage Genetics.

Classification of bacteria and the cell organization of a Prokaryotic cell

Classification of bacteriophages and structure

Transformation

Conjugation

Bacterial DNA replication.

Recombination between DNA duplexes

Bacterial operons/Lactose operon/his, gal-arg-, complex gene clusters/induction/repression

Phage lambda, infective pathways, development

Genetic system of T-even phages

Genetic system of T-odd phages

Single strand DNA phages

RNA phages

Transposable elements/mu bacteriophage system

20 : 328 : Drosophila Genetics

1. General remarks and advantages in use of Drosophila
2. Linkage groups and mapping of genes.
3. Lethal, semilethal and subvital genes, dosage compensation, sex determination and sex linkage, dominant lethal system.
4. Polytene chromosomes, puffing pattern.
5. Genetics and biochemistry of enzymes and special proteins.
6. Karyotype evolution in genus Drosophila.
7. Mutagenesis, types of mutations, phenocopies.
8. Systems for detection of mutations.
9. Developmental genetics.

Reference Books.

- 1) The Genetics and Biology of Drosophila Eds. M. Ashburner and T.R. F. Wright Volumes 1, 2a, 2b and 2c, 1978, Academic Press N. York.
- 2) Studies in the Genetics of Drosophila- Ed. M.R. Wheeler, University of Texas Publication, Austin.

20 : 329 : Bioelectronics :

1. Definitions of charge, e.m.f., voltage, current, units of measure
2. Simple electrical circuits- Ohm's law, power, wattage etc., parallel and series combinations, potentiometer principle. Kirchoff's laws, effects of electrical current, heat magnetism etc. Principle of grounding.
3. Electrical circuits containing resistance, inductance and capacitance. A.C. circuits (frequency, wavelength etc.); Time dependent wave forms-square, pulsed, triangular, ramp etc.
4. Vacuum tubes-thermionic emission, diodes, photoelectric cells.
5. Cathode ray tubes and applications-oscilloscope, etc.
6. Semiconductors, P.N. junctions, rectification, PNP and NPN transistors, amplifiers and oscillators.
7. Characteristics of biopotentials and biosignals-typical amplifiers and discriminators used for detection of biological signals.
8. Analogue and digital storage of biological signals. Concept of digital electronics and applications.

20 : 330 : Endocrinology :

1. Phylogenetic aspects of endocrine systems.
2. Histology of endocrine glands.
3. Hormones, hormone receptors and mechanisms of hormone action.
4. Neuroendocrine relationships, neurosecretion in vertebrates and invertebrates.
5. Chemistry of invertebrate hormones and their role and mode of action in the control of metabolism, tanning, salt and water balance, reproduction, moulting, metamorphosis and chromatophores.
6. Hypothalamic control of endocrine functions in vertebrates.
7. Chemistry, function and mode of action of pituitary, thyroid, parathyroid pancreatic, adrenal, gonadal and pineal hormones in vertebrates.

9. Diffusion-passive, active and facilitated, Donnan equilibrium.
10. Electrophoresis, electroendosmosis, isoelectric focusing.
11. Nerve potential (bioelectric potential). nerve conduction phenomenon and Hodgkin-Huxley equation.
12. X-ray diffraction-crystallography.
13. Ionizing radiation-dosimetry, interaction with biological molecules O₂ effect and target theory.
14. Theory of centrifugation-sedimentation velocity-sedimentation to equilibrium - diffusion equation.

Reference Books.

- 1) Molecular Biophysics, R.B. Setlow and E.C. Pollard, 1962, Addison-Wesley.
- 2) Biophysics - H.A. Epstein, 1974.

20 : 321 (b) . Parasitology.

- 1) Parasitism : Concept, origin, evolution , advantages and disadvantages in the parasitic life.
- 2) Classification of parasites according to habitat, microenvironment, degree, host specificity, association with host, behaviour, evolution, taxonomy etc.
- 3) Kinds of hosts : definitive, intermediate, primary, secondary, specific, paratenic, carrier, susceptible, resistant, accidental, reservoir, vector.
- 4) Models of parasitic invasion : passive, mechanical, active, contact, transovarial; pathways of entry, sites of habitation.
- 5) Host specificity : definition, origin, types, structural, physiological, ethological, response, tissue, ecological, phylogenetic.
- 6) Habitats and environments of parasites : vertebrate digestive system environmental conditions in different part of the system; blood, reticulo-endothelial system; tissues and other microhabitats; invertebrate; intra-and interspecific competition in the microenvironment.
- 7) Structural, physiological and biological adaptations of parasites for infectiousness, establishment and transmission; shape, size, attachment and protective devices feeding aids, locomotion, respiration, metabolism, reproduction, life cycles, regressive changes, resistant and quiescent free-living stages; parasitism: specialisation or degeneracy?
- 8) Host-parasite system: effects of parasites on hosts-mechanical, nutritional, destructive, toxic, biological etc.

Host's reactions to parasites : resistance, compatibility, immunity; cellular and tissue reactions e.g. phagocytosis, inflammation, repair, abnormal growth, humoral reactions (physiological resistance, immune response) : premunition; avoidance of parasites by hosts; influence of host on parasite life cycle.

- 9) Hyperinfestation : infection, disease, crowding effect, self-cure. Hyperparasitism; multi-stage complex, hyperparasitic transmission, multiparasitism, parasite-mix.
- 10) Disease cycles : concept of diffusion (dissemination); principles of control; protection of host, control in and outside the host
- 11) Measures of control of parasites; chemical, biological, cultural, therapeutic.
- 12) Economic importance : direct effects on human and animal life, economic losses in agriculture, poultry, farm animals fisheries etc.
13. Population biology : parasite-host, predator-prey interactions; pyramid of numbers; seasonal variation of parasite populations; influence of host age on parasite population; effect of host migrations on parasite populations.
- 14) Parasites and zoonosis: Viral, rickettsial, bacterial, protozoan, helminthic, and arthropod diseases.
- 15) Study of the following parasites with respect to geographical distribution, habitat, structure, life cycle, pathogenicity, treatment and prophylaxis. *Leishmania donovani*, *Schistosoma* spp. *Echinococcus granulosus*, *Clonorchis sinensis*, *Trichinella spiralis*, *Enterobius vermicularis*, *Ascaris lumbricoides*, *Ancylostome duodenale*, *Dracunculus medinensis*, *Sarcoptes scabiei*.

Reference Books

- 1) Burnet, M. and D.O. White (1972) - "Natural History of Infectious Diseases". Cambridge Univ. Press, Cambridge, London, New York.
- 2) Boycott, J.A. (1971) - "Natural History of Infectious Disease". Edward Arnold, London.
- 3) Canning, E.U. and C.A. Wright (Eds.) - "Behavioural Aspects of Parasite Transmission". Academic Press, London.
- 4) Chandler, A.C. and C.P. Read (1970) - "Introduction to Parasitology". 10th edn - Wiley Eastern, Delhi.
- 5) Chatterjee, K.D. (1976) - "Parasitology (Protozoology and Helminthology) in relation to clinical medicine". 11th Edn., Chatterjee Medical Publ. Calcutta.
- 6) Cheng, T.C. (1964) - "The Biology of Animal Parasites", Saunders, Philadelphia, London and Toppan, Tokyo.
- 7) Cheng, T.C. (1970) - "Symbiosis", Pegasus, New York.
- 8) Croll, N.A. (1966) - "Ecology of Parasites". Heinemann, London.
- 9) Croll, N.A. (1973) - "Parasitism and Other Associations". Pitman Medical, London.
- 10) Dogiel, V.A. (1964) - "General Parasitology". Oliver and Boyd, Edinburgh and London.
- 11) Jones, A.W. (1967) - "Introduction to Parasitology". Addison-Wesley, Reading Mass.
- 12) Lapage, G. (1951) - "Parasitic Animals". Cambridge Univ. Press, Cambridge, London.

8. Hormonal control of digestion and renal function.
9. Hormonal control of amphibian metamorphosis.
10. Pheromones.

REFERENCE BOOKS

1. C.D. Turner and J.T. Bagnara (1976) - General Endocrinology, W.B.Saunders.
2. D.Schulster, S. Burstein and B.A. Cooke (1976) - Molecular Endocrinology of Steroid Hormones, John Wiley.
3. P.J. Bentley (1976) - Comparative Vertebrate Endocrinology. Cambridge University Press.
4. W.J. Burdette, Ed. (1974) - Invertebrate Endocrinology and Hormonal Heterophyly, Springer - Verlag.

ZO : 332 : Applied Entomology

Fundamentals of Agricultural, Forest, Medical and Veterinary Entomology.

General biology of important pests of crops cultivated in Maharashtra in particular and India in general egg. cereal pests, fibre pests, vegetable pests, fruit pests.

Important pests of forest trees and remedial steps to check their infestation. e.g. Termites, forest defoliators, barers, sap suckers, Brief outline of medical and veterinary entomology with reference to important measures to control the vectors.

House-hold and stored grain pests and their control. Principles and methods of insect control in brief : Mechanical, Biological, Radiological techniques. Use of sex attractants, chemosterilants and hormones in insect control in brief.

Useful insects of economic importance.

BOOKS RECOMMENDED.

1. " Fundamentals of Applied Entomology" By R.E. pfadt (Macmillan, New York, 2nd Ed. 1971).
2. "Introduction to Applied Entomoloty" By J.R.I. Shoot (Longmans Green London, 1963).
3. " Entomology" By D.N. Roy and A.W.A. Brown (The Bangalore printing and Publ. Co.Ltd., 1970).
4. "Insects and other Arthropods of Medical Importance" by K.G.V. Smith. (Trustees of Brit. Mus. Lond. 1973).
5. Crop pests and how to fight them" (Govt. of Maharashtra Pub., Bom.)
6. "Insect pests of Crop by S. Pradhan (NBY, New Delhi, 1969).

20 : 333 : Insect Taxonomy.

Origin, evolution and inter-relationships of insects, principles and history of insect classification; classification of following insect orders up to families.

- 1) Thysanara, (2) Collembola (3) Ephimeroptera (4) Odonata (5) Orthoptera (6) Dictyoptera (7) Phasmida (8) Dermaptera
- (9) Isoptera (10) Mallophaga (11) Anoplura (12) Thysanoptera
- (13) Hemiptera - Pentatomidae, pyrrhocoridae, cimicidae, Belostomatidae, fulgoridae, cicadidae, aphidae, Aleurodae, Jassidae.
- (14) Coleoptera - sub - order - Adephaga. Carabidae, cicindelidae, dytiscidae, sub. order - Polyphaga. staphylinidae, Hydrophilidae, cantharidae, coccinellidae, Dermestidae, Buprestidae, Meloidae, Tenebrionidae, curculionidae, Scarabidae.
- (15) Lepidoptera :- Nymphalidae, papilionidae, Lymantridae, Saturniidae, Geometridae, Noctuidae, Pysalidae, Sphingidae
- (16) Hymenoptera :- Tenthredinidae, apidae, Ichneumonidae, Braconidae.
- (17) Diptera :- Chironomidae, culicidae, Bombycidae, Hippoboscidae, Agromyzidae, Tachinidae, Muscidae.

References.

- 1) Ross & Ross - An Introduction to Entomology.
- 2) V.C. Kapoor - Insect Taxonomy.
- 3) M.S. Mani - A Text book of Entomology.

20 : 334 : Avian Taxonomy.

- 1) Definition of avian taxonomy. Original birds, brief outline of bird evolution.
- 2) Ancestral birds - Archaeornithes.
- 3) External structural organisation of birds from taxonomic View point.
- 4) Study of brief comparative account of bones from taxonomic point of view.
- 5) Classification of Ratitae.
- 6) Classification of Carinatae.
- 7) Nomenclature.

20 : 346 : 14 Practicals corresponding to 20:303 Ornithology I

1. Study of different types of beaks related to feeding habits.
2. Study of different types of feet related to habitats.
3. Study of different types of wings related to flight
4. Study of different types of bird feathers.
5. Study of general external characters & nomenclature of Pigeon (Columba livia).
6. Dissection of digestive, excretory and circulatory systems of Pigeon.
7. Dissection of urinogenital system & brain of Pigeon.

8. Mountings of pecten, filoplume, down feathers etc.
9. Mapping of bird body (Topography)
10. Study of distribution of birds i) Continuous distribution :
and ii) discontinuous distribution.
11. Visit to a field to study five bush birds.
12. Visit to a field to study ten warders
13. Visit to a field to study five garden birds.
14. Visit to a field to study five raptorial birds.

ZO : 346 : ~~.....~~

14 Practiclas - Corresponding to ZO 304, Environmental Toxicology-
I.

Sampling and analysis of air for toxicant

Sampling and analysis of water for toxicant

Sampling and analysis of soil for toxicant

Thin layer chromatography for chlorinated hydrocarbons analysis

Thin layer chromatography for Organophosphoms analysis

Thin layer chromatography techniques for insecticide of plant and
origin.

Bioarray studies in aquatic animals (Fish)

Bioarray studies in insects (mosquito, cotton bng. rhizopartha)

Bioarray studies in Avian animals (Bird)

Bioarray studies in mammals (Rat)

Case study involving environmental impact assesment of toxic
substances in following

- i) Pesticide industry
- ii) Smelter
- iii) Dye and paint-industry
- iv) Tye and Dye industry
- v) Agricultural off
- vi) Cement industry
- vii) Thermal power station
- viii) Paper industry
- xi) Sugar industry

The report is to be submitte in the form of a project report
also statistical analysis of Toxicological data.

Induction of liver toxility in rat by CCl 4.

Nephrotoxility by heavy metal in Rat.

Cardiotoxic studies in isolated h^{heart} preparation (Rabbit/frog)

Nermotoxility studies on phranic nerve diaphragm preparation.

Establishment of haemolytic agents/membram Toxinity

Screening of carsinogenesis / intagenetic by Ame's test.

Effect of insecticide / pesticide on cholinestara enzyme

Effect of insecticide / pesticide, Na -K-ATpare enzyme activity

Hypersensivity of allargent model (Skin)

ZO 346- 14 Practicals Corresponding to ZO 305: Reproductive Physiology I.

Dissection of female reproductive system of Rat/mice and its description.

Surgical operation in Rat/mice I= Ovarietomy.

Surgical operation in Rat/mice II= Tubectomy.

Surgical operation in Rat/mice III= Unilateral adrenalectomy

Vaginal Smear - Vaginal cytology in relation to oestrous cycle.

Histological study of endocrine glands part I :- for identification only.

Pituitary gland :- Anatomy, cell types & localization of trophic hormones.

Histological study of endocrine glands part II :-

Thyroid gland = Histology of Active & inactive gland.

Adrenal gland = Normal histology.

Histological changes in female reproductive organs during different

Phases of reproductive cycle in continuous breeders = rat/mice

Histochemical studies of Carbohydrates, proteins & fats of the

reproductive tract & accessory structures at different of sex cycles.

- PAS- reaction

- Millon Method

- Nile blue sulphate Method.

ZO 346 - 14 Practicals corresponding to ZO 307: Entomology I

Comparative study of Head-Grass Hopper, Honey bee, Wasp (adult, larva), beetle, Red cotton bug.

study of types of mouth parts and Antenna

Types of legs, wings and its venation; and abdominal appendages.

Histology of different organs of alimentary canal, Trachea, heart, muscle, Blood, And five insects to be dissected.

Dissections - Grass Lopper.

Digestive system, - Reproductive, stomodeal nervous system.

Mounting - Tympanum, spiracles, genitalia.

Plant bug.

Digestive, male, female, nervous, heart, alary muscles.

Mounting - Blood- mouthparts

Beetle

Digestive, Reproductive, nervous.

Butterfly

Digestive, reproductive, nervous.

Mouth parts

Housefly

Digestive, Reproductive, nervous, ovipositor of housefly, Halteres

Honey bee -

Digestive, air sacs,

Mounting of mouth parts & sting

ZO : 346 : 14 Practicals corresponding to ZO 308 : Physiology I

(Any 14 to be performed)

- 1) To estimate the Quantity of digestive enzymes in hepatopancreas of crab, liver of frog/Rat
- 2) Determination of iodine number from a given sample of fat.
- 3) To Determine the blood sugar level of human being and crab
- 4) To study the phenomenon of equilibrium by dialysis
- 5) To estimate the oxygen^{CO} consumption in crab in relation to salinity using winkler's method.
- 6) To estimate the oxygen consumption, in crab in relation to temperature by Winkler's method.
- 7) Effect of different Concentrations of Sea water on the body weight of earthworm.
- 8) Effect of calcium deficient in Seawater on the body weight of earthworm.
- 9) Effect of salinity on blood chloride of crab
- 10) To estimate the blood chloride in crab acclimate to different concentrations.
- 11) To find out the loss or gain of chloride ions in crab exposed to hetero-osmotic media.
- 12) To determine the glomerular filtration rate by creatinine clearance test (G.F.R.)
- 13) To study the activity of enzyme originase in the liver of ureotelic and uricotelic Vertebrates.
- 14) Determination of lactic acid in blood of human being before and after exercise.
- 15) Determination of alkaline phosphatase activity in the haemolymph of crab.
- 16) Determination of acid phosphatase activity in the haemolymph of crab
- 17) Estimation of ascorbic acid contents in the extracts of adrenal cortex of a given animal.
- 18) Oxygen consumption after administration of thyroxine or anti-thyroid substance using any suitable animal.
- 19) To study the effect of humidity on the rate of water loss in cockroach, frog and calotes.

ZO : 346 : Practicals corresponding to : zo-321 (a) Enzymology.

Isolation & purification enzyme, proteinases amylase, lipase or chymotrypsin from biological source. (any one) purification fold. Enzyme activity determination specific activity, Effect of P H on velocity of enzyme reaction. Effect of temperature on enzyme reaction. effect of substrate concentration on enzyme reaction. Effect of enzyme concentration on velocity of reaction. Effect of activator / inhibitor on enzyme reaction. Determination of Km. Enzyme activity (Staining) isozyme characterisation by

Electrophoreses (demonstration). Enzyme tests. lipase, amylase, cellulase, pabrain phosphatases.

ZO : 347 - 7 Practicals corresponding to ZO : 332 Applied Entomology.

Study of insect pests of agricultur el importance. pests of Jawar, maize, paddy, sugareane. Study of insect pests of agricultural importance. Pests of vegetables, fibre, crops, and fruit plants. (As available). Study of insect vectors of man, Mosquito, House-fly, Bed-bug, flea, Head louse, Body louse, sand fly, eye fly. study of insect pests of cattle and domestic animals. (As available). study of stored grain pests and ghouse hold pests. study of forest pests i.e. Termites, Borers, defoliators etc. Study of useful insects of economic importance. Field trip.

ZO : 347 - 7 Practicals corresponding to. ZO : 333 Insect Taxanomy.

Collection and preservation of insects, classification of insects up to orders. Collection, Preservation and identification of at least 50 insect species belonging to different families.

ZO : 347 - 7 Practicals corresponding to ZO 327 :
Bacterial and Phage gentics.

1. Growing bacteria - culture media preparation/sterilization/ storage/buffers/safety/precautions/strain nomenclature/ writing protocols.
2. Growing bacteria - suspension culture, plating, plating efficiency, special dilutions, colony counting.
3. Growing mutants, auxotrophs, growth curves, transformation.
4. Bacterial mutagenesis and isolation of sensitive and resistant mutants, replica plating technique.
5. Bacterial transformation with bacterial and plasmid DNAs.
6. Transfection of lambda DNA, Lysogeny, lytic infection/plaque identification.
7. Isolation of phage/plasmid DNA.
8. Genetic mapping experiments.

REFERENCE BOOKS

1. Gene Expression by B. Lewin Vol. I and III.
2. Genetics of Bacteria and their Viruses by W. Hays.
3. Molecular Biology of the Gene by J.D. Watson.
4. Cold Spring Harbor symp on Quant. Biol. 1975 onwards.

ZO : 347 : 7 Practicals corresponding to ZO 334 : Avian taxonomy

1. Study of Archaeopteryx with suitable photographs models etc
2. Study of extinct birds by using charts/models etc.
3. Study of Ratitae by using charts/models etc.
- 4 to 7 Systematics of orders with their examples.
 - a) Sphenisciformes b) ciconiformes c) Anseriformes
 - d) Falconiformes e) Galliformes f) Gruiformes
 - g) charactriformes h) Columbiformes i) Psitta-ciformes
 - j) Cuculiformes k) Strigiformes l) Apodiformes
 - m) Coraciiformes n) Piciformes o) Passeriformes.

ZO : 347 - 7 Practicals corresponding to ZO : 321 (b) PARASITOLOGY

1. Study of structure & life cycle stages of Protozoon Parasites.
2. Study of structure & life cycle states of Platyhelminthes parasites.
3. Ascalhewinthes parasites
4. Auuelid parasites
5. Arturepods parasites
6. Study of vectors.
7. Indentifition of Rectal parasites from cochroch/frog/any suitable animal.

-X-X-X-X-X-X-X-X-X-

SEMESTER - II

ZO : 403 : ORNITHOLOGY - II

1. Behaviour :- Inherited and learned behaviour, Individual behaviour - maintenance behaviour like preening, head scratching, bathing, oiling, sunning, dusting, anting etc. Comfort movements like feather settling, stretching, yawning, resting, sleeping etc. Playing behaviour, pecking behaviour.
2. Social Behaviour :- Agonistic behaviour, Defence behaviour, flocking behaviour. Mating behaviour, mating displays etc. Monogamy, polygamy, polyandry in birds.
3. Visual communication, calls, sexual selection, vocal communication - songs sub songs etc, feeding together, balancing the diet, Drinking etc.

- 4) Nest and Nest building - Development of nests, classification of nests, identification of nest, nest building, protection of the nest.
- 5) Eggs, egg laying and incubation :- Size, shape and coloration of eggs, identification of eggs, number of eggs, number of eggs in a clutch, Number of clutches per breeding season, Egg laying, incubation, brood parasitism, co-operative breeding etc.
- 6) Young, their development and Parental care :- Hatching, development of Altricial young and Precocial young. Age of maturity for breeding, Removal of egg-shells, brooding, feeding, nest sanitation, defense duration of family bond

ZO : 404 : ENVIRONMENTAL TOXICOLOGY - II

- 1) Bioaccumulation and biomagnification in biotic communities.
- 2) Different routes of exposure in organisms.
- 3) Metabolism of toxicants in organisms.
- 4) Effects of toxicants on various body systems, viz : gastrointestinal tract, nervous system, reproductive system, renal system, endocrine organs, respiratory organs, blood and haemopoietic tissues, liver.
- 5) Industrial toxicology
- 6) Forensic toxicology
- 7) Wildlife toxicology
- 8) Genetic toxicology
- 9) Behavioral aspects of toxicity.
- 10) Teratological and carcinogenic effects of toxicants.
- 11) Selectivity of toxicants
- 12) Effects of antioxidants and chelating agents on toxicants; glutathione, penicillamine, vitamin B12, methionine, cysteine.
- 13) Antagonistic effects, synergistic effects, Half life essential and non-essential chemicals.

ZO : 405 : REPRODUCTIVE PHYSIOLOGY - II

A) Mammalian Embryology :-

- (i) Fertilization - its molecular mechanism, early development of embryo. - Pre-implantation changes, decidual reaction, pseudo pregnancy.
- (ii) Implantation :- Morphological and physiological relationship between blastocyst and uterus during implantation, and delayed pregnancy and its hormonal control, uterine changes during pregnancy.
- (iii) Foetal membranes :- Types development, structure and modification in various mammalian orders (Marsupialia, insectivora, chiroptera, carnivora, Hystricomorph rodents, Artiodactyla).
- (iv) Placenta :- Development and various kinds of placentae and their histological structures, physiology, hormones & their

role. Uteroplacental circulation, accessory placental structures, Placental haematoma, hydropomeres.

B) Fertility Regulation :-

- (v) Purpose and importance of birth control, Population Policy and family planning Programme in India, physiological basis, premature birth problems.
- (vi) Female Contraception :- Types of contraceptives, traditional and modern methods, their efficacy, advantages & disadvantages, Biology and Chemistry of contraceptives, mechanism of action permanent methods, Recent advances in fertility regulation.
- (vii) Male Contraception :- Available methods & recently developed methods, advantages and disadvantages, mode of action, Recent advances in the field, Biology & chemistry of male antifertility drugs.
- (ix) Plants for contraception.
- (x) Male and female sterility problems.
- (xi) Artificial insemination in farm animals.

ZO : 406 : DEVELOPMENTAL BIOLOGY -II

- 1). Developmental and Differentiation - Limb development and pattern formation - Development of the pancreas and differentiation of secretory cells - Development and differentiation of silk glands in *Bombyx mori* and control of Fibrin synthesis.
- 2) Establishment of tissue-specific cell lines and terminal differentiation- Stem cell concept, lymphopoiesis and erythropoiesis-Erythropoiesis in Friend Leukemia-Quantal mitosis, myogenesis and chondrogenesis-Clonal growth, cell population turn over and differentiation in keratocytes and intestinal epithelium-Biochemistry of lens cell differentiation-Neuronal differentiation and the role of cAMP-Control of ovalbumin synthesis.
- 3) Regeneration, metaplasia and neoplasia-Regeneration (Transdifferentiation) in Hydra-Limb regeneration and positional effect-Wolffian and lens regeneration and metaplasia- Teratomas and teratocarcinomas-Transdetermination-Neoplasia and growth control-Expression of carcino-embryonic (onco-fetal) antigens-Mammary gland differentiation and carcinogenesis.
- 4) Development and genetic manipulations-Allophenic mice and chimaeras-Somatic cell hybridization-Teratogenesis.
- 5) Integrated approach to differentiation-Developmental recombination in Immunoglobulin genes-Stability of the differentiated state; relation between the cell proliferative-& DNA repair-potentials-Weissman's theory-Holiday's Commitment theory-Davidson and Britten hypothesis-Cascade regulation hypothesis of Scherrer.

Reference Books.

- 1) Balnisky, B.I. (1976)-Introduction to Embryology, Saunders.

- 2) Berrill, N.J. and Karp, G. (1976) - Developmental Biology, McGraw-Hill Publ. Co.
- 3) Saunders, J.W. (1970) - Patterns and Principles of Animal Development. Macmillan, London.
- 4) Abercrombie, M., Brachet, J. and King, T. (1961 onwards) Advances in Morphogenesis, Academic Press, New York.
- 5) Ede, D. (1978) - Developmental Biology. Blackie, Glasgow-London.
- 6) Ede, D., Hinchliffe, J.R. and Balls, M. (1977) - Vertebrate Limb and Somite Morphogenesis, Cambridge University Press.
- 7) Locke, M. (1966) - Major Problems in Developmental Biology, Academic Press, New York.
- 8) Eber, J.A. and Okada, T.S. (1978) - Mechanisms of Cell Change.
- 9) Lofts, B. (1976) - Physiology of the Amphibia, Vol. III, Academic Press New York.
- 10) Davidson, E.H. (1976) - Gene Activity in Early Development. Academic Press, New York.
- 11) Society of Developmental Biology Symposia (1966 onwards) -
- 12) Current Topics in Developmental Biology (1970 onwards). Academic Press New York.
- 13) Kuhn, A. (1971) - Lectures in Developmental Physiology, Springer-Verlag. Heidelberg-Berlin.
- 14) Lash, J. and Whittackar, J.P. (1974) - Concepts in Development, Sinauer Assoc. Inc. Publ.
- 15) LeBue, J. and Gordon, A.S. (1973) - Humoral Control of Growth and Differentiation, Academic Press, New York.
- 16) Schjeide, O.A. and de Vellis, J. (1970) - Cell Differentiation. Van Nostrand-Reinhold, New York.
- 17) Johnson, M.H. (1978) - Development in Mammals, Vol. i-iii. North Holland, Publ.
- 18) Gurdon, J.B. (1974) - The Control of Gene Expression in Animal Development. Clarendon Press, Oxford.
- 19) Burnett, A.L. (ed). (1978) - Biology of Hydra. Academic Press.
- 20) Fulton, C. and Klein, A.O. (1976) - Explorations in Developmental Biology, Harvard University Press.
- 21) Goss, R.J. (1972) - Regulation of Organ and Tissue Growth. Academic Press, New York.
- 22) Coward, S.J. (1973) - Developmental Regulation : Aspects of cell differentiation. Academic Press, New York.
- 23) Stockwell, R.A. (1979) - Biology of Cartilage Cells.
- 24) Beermann, W. et al (1972 onwards) - Recent results and problems in cell differentiation. Springer Verlag. Heidelberg-Berlin.
- 25) Yamada, T. (1977) - Wolffian lens regeneration. Monographs in Developmental Biology, Karger Publ. Basle.
- 26) Weber, R. (1986-75) - Biochemistry of Animal Development, Vols. I-III. Academic Press, New York.
- 27) Scherrer, K. (1973) - In : Protein synthesis in reproductive tissue (ed. Diczfalussy, E.) Karolinska Symp. Stockholm.

- 28) Monroy, A. (1965 onwards) - Current Topics in Developmental Biology. Academic Press, New York.
- 29) Developmental Biology (1963 onwards) - Academic Press, N.Y.
- 30) Journal of Embryology and Experimental Morphology (1965 onwards)
- 31) Nature London.
- 32) Proc. Nat. Acad. Sci. U.S.A.
- 33) Journal of Cell Biology.
- 34) Wilson, J.G. and Warkany, J. (1965)- Teratology, Principles & Techniques. University of Chicago Press.
- 35) Wallam, D.H. - Advances in Teratology.
- 36) Finch, C. and Hayflick, L. (1977) - Handbook of the Biology of Agingvan Nostrand- Reinhold Co.
- 37) Sherman, M.I. and Solter, D. (1975)- Teratomas and Differentiation. Academic Press, New York.
- 38) Fishman, W.H. and Sell, S. (1976)- Onco-developmental gene expression. Academic Press, New York.
- 39) Taylor J.H. (1977-79)- Molecular Genetics, Vols. I-III. Academic Press, New York.
- 40) Romanoff, A. (1960)- The Avian Embryo, Macmillan Press
- 41) Differentiation, (1972 onwards) - Springer Verlag. Heidelberg.
- 42) The Journal of Molecular Biology (1965 onwards)- Academic Press. London.

ZO : 407 : ENTOMOLOGY II

Spermatogenesis and Oogenesis, Seminal transger; Fertilization ;Sex determination; Pre-eclosion morphogenesis; Blastoderm formation; Germ cells; Gastrulation; Blastokinesis; Differentiation of germ layers; Segmentation; Appendage formation; Organogenesis in brief; Fate of germinal layers; Oviposition; Hatching; Post-embryonic development; Hadorn's experiments with imaginal discs; Metamorphosis; Growth, Regeneration, Aging. Totipotency of energids (cleavage nuclei).

Insect relationships with non-living and living environment; Weather; Temperature; Moisture; Light; Food; Plants; Animals; Man; Insect habitats and ecological niches; Inter-specific relations, Insect populations; Natality; Mortality; Biotic potential; Photoperiodism; Diapause; induction, duration, termination, control and significance; social insects.

Reference Books

- 1) 'The Insects-Structure and Function' by R-F-Chapman (ELBS, London 1972).
- 2) 'A Text Book of Entomology' by H.H. Ross (John Wiley and Sons, Inc. New York, 3rd Edn. 1965).
- 3) 'Imm's Text Book of Entomology' by O.W. Richards and R.G.Davies (Methuen London.1977). Vols. I and II.

- 4) 'Embryology of Insects and Mariapods' by O.A.Johanson and F.R. Butt, (McGraw Hill New York, 1953.)
- 5) 'The ecology of insect populations in theory and practice' L.R. Clarks P.W. Geier, R.D. Hughes, R.F. Morris (Methuen London 1968)
- 6) 'Developmental Systems in Insects', Vol. I, by S.J. Counce and C.H. Waddington (Academic Press, London, 1972)
- 7) 'Developmental Systems in Insects Vol.II', by S.J.Counce and C. H. Waddington (Academic Press, London, 1973).

ZO : 408 : PHYSIOLOGY II

- 1) Structural elements of the nervous system; brief account of the organization and evolution of Nervous system in animals .
- 2) Excitable properties of nerve cells : testing potential, ionic basis of action potential, Properties of the nerve impulse, condition velocity; measurement of nerve potentials.
- 3) Synaptic transmission : ultrastructure of the synapse; electrical and chemical synapses, neurotransmitters and their metabolism; neurotransmitter receptors, involvement of cyclic AMP; axonal transport, excitatory and inhibitory synapses.
- 4) Integrative properties of the Nervous system, integration at synapses; reflexes, and nervous integration,
- 5) Sensory integration: Primary and Secondary receptors; receptor and generator Potentials, adequate stimulus and classification of receptors.
- 6) Mechano-reception : Pacinian corpuscles, proprioceptors and Kinaesthetic Sense. Lateral line organs; statocysts; chordotonal organs in insects.
- 7) Chemo-reception : Olfaction and gustation in insects and Vertebrates; Cellular aspects of chemosimulation.
- 8) Photo-reception : Visual pigments, Photopic and Scotopic responses; Colour vision; retinal potentials, visual cortex, functioning of the compound eye in arthropods
- 9) Physiological aspects of brain energy metabolism.
- 10) Learning and memory : Short-term and Long-term memories; molecular basis of memory; sleep.
- 11) Muscle contraction : ultrastructure of Smooth and Skeletal muscles; contractile Proteins; theories of contraction, energetics of muscle contraction : Muscle phosphagens and phosphogen Kinases, mechanical aspects of contraction; heat production, fast and slow muscles, their innervation and metabolic specializations, muscular fatigue and dystrophy.
- 12) Circulation : structure of cardiac muscle; Cardiac cycle; haemodynamics, pacemakers, nervous and humoral control of heart, effects of inorganic ions; types of blood cells and haemopoiesis; clotting.

- 13) Control of Ventilation : Respiratory centres of the brain and ventilation, nervous control and role of chemo receptors; control of respiration in diving animals.
- 14) Electric organs : Structure and function
- 15) Bioluminescence : Structure of Luminescent organs, chemistry and function of Luminescence.
- 16) Chemistry and action of various and toxins.

Reference books

- 1) Baldwin E. and Bell, J.D. : Colen practical physiological chemistry, 10th edition 1955. Cambridge W. Heffer and sons Ltd. Cambridge U.K.

ZC : 409 : MOLECULAR BIOLOGY II

- 1) Structure of transcription unit T7 bacteriophage.
- 2) Organization and structure of eukaryotic genome, Law of DNA constancy and redundancy.
- 3) One band and one gene hypothesis in Drosophila.
- 4) Structure of eukaryotic transcriptional unit.
- 5) Synthesis and processing of pre-mRNA and mRNA and structure.
- 6) Nuclear and cytoplasmic ribonucleoproteins.
- 7) Role of RNA in protein synthesis-structure and operation of the translational complex.
- 8) Post-translational processing and modifications of proteins.
- 9) Cellular storage of proteins and secretion.
- 10) Synthesis, storage and role of maternal RNAs during sea urchin and amphibian development.
- 11) Amplification of ribosomal genes during oogenesis.
- 12) Localization and reiteration of 5s RNA genes.
- 13) Independent control of DNA replication in polytene chromosomes.
- 14) Mechanisms of DNA damage and repair, and their role in the conservation of genome integrity.
- 15) Organization, structure and regulation of genes for haemoglobin, immuno-globulin, histones and vitellogenin.
- 16) Role of cyclic AMP as second messenger.
- 17) Structure and organization of cell surface receptors and their role.
- 18) Control of cellular proliferation.

Reference Books

- 1) Gene Expression, by B.Lewin, Vols. 1 (1973), 2 (1974) and 3 (1978), Wiley-Interscience Publ.
- 2) Gene Activity During Early Development, by E.H.Davidson, Academic Press, N.Y., 1976.
- 3) DNA synthesis, A. Kornberg, 1974, W.H. Freeman and Co. 1977, San Francisco.

- 4) Cold Spring Harbor Sump. in Quant., Biol., 1966 onwards.
- 5) Biochemistry of Nucleic Acids. J.N. Davidson, eighth edition, 1977, Chapman and Hall Publ.
- 6) Cell Nucleus, Vols. I,II,III, by H.Busch, Academic Press N.Y., 1974.
- 7) Mol. Biology of Mammalian Genetic Apparatus by P.O.P.Ts'o Vol, 1, North Holland Publ. Co., 1977.
- 8) Molecular Genetics, Vol. I-III, by J.H. Taylor (ed.), Academic Press, Inc. 1977.

20. 221 (a) PHYSIOLOGY OF REPRODUCTION

Physiological and biochemical aspects ;
 Review on hormones and prostaglandins.
 Ovarian cycles : Control by hormones and environmental factors.
 Puberty and menopause.
 Blastocyst and its implanatation.
 Placentation : nutritive and endocrine functions.
 Foetal antigens and immunological tolerance.
 Hormonal factors in pregnancy and parturition.
 Hormonal and biochemical aspects of lactation.
 Applied aspects :
 Control of fertility (Contraception, sterility, induced breeding, artificial insemination in vitro fertilization, Immunological approuche of fertility synchronization of cycles in populations etc)
 Genetic aspects :
 Counselling, cloning etc.

Recommended Books

- 1) P.J.Hogarth (1978)- Biology of Reproduction, Wiley, New York.
- 2) J.S.Perry (1971)- The Ovarian Cycle of Mammals. Oliver and Boyd.
- 3) C.R. Austin and R.V. Short (1972)-Reproduction in Mammals, Vols. 1 to 8, Cambridge University Press.
- 4) M.C. Shelesnyak and G.j.Marcus, eds. (1969)-Ovum Implanatation, Gordon and Breach, New York.
- 5) G.E. Lamming and E.C. Amoroso, eds. (1967)- Reproduction in the Female Mammal, Butterworths, London.
- 6) H.Gibian and E.J. Plotz, eds. (1970)-Mammalian Reproduction, Springer Verlag.
- 7) P.G.Crosingani and D.R.Mishell, Eds. (1976)-Ovulation in the Human, Academic Press.
- 8) J.C. Daniel, Ed. (1978)-Methods in Mammalian Reproduction, Academic Press.
- 9) M.H. Johnson, Ed. (1977)-Development in Mammals, NorthHolland.
- 10) S.Patton and R.G. Jenson (1976) - Biomedical Aspects of Lactation, Pergamon Press.
- 11) W.D.Odell and D.L.Moyer (1971)-Physiology of Reproduction, C.V. Mosby Company.

- 12) Cohen (1977)-Reproduction, Butterworths.
- 13) A. McLearn, ed. (1966 onwards)- Advances in Reproductive Physiology, Academic Press.
- 14) A. Van Tienhoven (1968)-Reproductive Physiology of Vertebrates.

OR.ZO : 421 (a) TERRESTRIAL ECOLOGY :

1. Introduction.
2. Ecosystems.
3. Biosynthesis, Food Chains, Food webs and Trophic levels, Ecological pyramid.
- 4) Limiting factors.
- 5) Organization of terrestrial community and population.
- 6) The species and the individual in the ecosystem.
- 7) Development and evolution of the ecosystem.
- 8) Terrestrial environment.
- 9) Terrestrial Biota.
- 10) Structure of terrestrial community.
- 11) Soil subsystem.
- 12) Terrestrial permiants.
- 13) Distribution of Biomass.
- 14) Vegetation subsystem.
- 15) Adaptations-structural.
- 16) Adaptations-functional.
- 17) Ecology of animal parasites and diapause.
- 18) Zoonosis.
- 19) Conservation of natural balance.
- 20) Diffusion.
- 21) Impact of agriculture on terrestrial ecology-impact of industrialization on terrestrial ecology-deforestation.
- 22) Chemical pollution.
- 23) Radiation pollution.
- 24) Forest management.
- 25) Wildlife management.

Reference Books

- 1) Odum, E.P.(1971)-Fundamentals of Ecology, 3rd edition, W.B. Saunders Co., PP.574.
- 2) Wollwork, J.A. (1970)-Ecology of Soil Animals, McGraw-Hill, pp. 283.
- 3) Benton, H.A. and Werner, W.E. (1958)- Principles of Field Biology and Ecology, McGraw-Hill, Book Co., Inc. pp.341

ZO : 421 (b) : GENETIC TOXICOLOGY

Introduction to general toxicology, Scope and definition of genetic toxicology, Introduction of cytogenetics, mutagenesis, mechanism of mutagenesis, DNA repair in relation to genetic toxicology; Expression of mutagenesis, changes in ploidy; Sister chromatid exchange analysis, molecular aspects of chromosome, aberration, unscheduled DNA synthesis, Nature of genotoxins-Physical, chemical,

environmental, man-made; Methods and models to study genetic toxicology-transforming principles, Bacterial tester strains, paramoecium, Drosophila, mammalian cell cultures, mammalian in vivo studies, Host mediated assays. Mutagenesis and carcinogenesis, Risk assessment in genetic toxicology.

Reference Books

- 1) Chemical Mutagens-Principles and methods for their detection Ed. Hollander, A.-Vol. a-5, Plenum Press.
- 2) Chemical Mutagenesis in Mammals and Man-Eds. Vogel, F. and G. Rohrborn, 1970, Springer Verlag.
- 3) Mutagenic Effects of Environmental Contaminants-Ed. Sutton, H.E. and Harris, M.I. 1972, Academic Press.
- 4) Mutation Research-(Section on Genetic Toxicology testing).
- 5) Journal of Environmental Pathology and Toxicology-Patnotox Publishers Inc.

ZO : 421 (b) : PEST CONTROL

Pests and their importance, damage caused by pests; chemical pesticides and their use, Insecticides, Acaricides, Fungicides, Nematocides, Molluscicides, Herbicides, Pesticides for vertebrate pests, Drawbacks of chemical control, Biological control, Autocidal methods of control, Sterile Male technique, Genetic control, Pheromones in Pest Control; Attractant; Repellents and Antifeedants, Resistant Varieties, Integrated control.

Reference Books

- 1) "Pest Control-A Survey" By A. Woods. (McGraw-Hill, London, 1974).
- 2) "Pest control"-By W.W. Kilgore and R.L. Doutt (Academic Press, New York, 1967).

ZO 426: Genetic Engineering and Recombinant DNA Techniques.

Bacteria/phages/plasmids/cosmids/Charon phages/chimaeric plasmids
Bacterial transformation with plasmids (R-factors)

Chimaeric plasmids

Restriction endonucleases

DNA structure, sequence complexity

DNA polymerases, Polynucleotide ligases, Nick translation

Terminal deoxynucleotidyl transferase : end-addition

DNA extraction procedures

DNA purification by buoyant density centrifugation

DNA electrophoresis in agarose native and alkaline gels DNA

electrophoresis in glyoxal, methylmercury and formamide

Two dimensional DNA electrophoresis, DNA elution

Shotgun procedure for cloning

DNA restriction fragment analysis

Isolation of mRNA and synthesis of cDNA and cloning

DNA : DNA and DNA : RNA hybridization

Choice of the vector/vehicle and host strains
NIH guidelines for recombinant^N DNA techniques
DNA sequencing procedures/Maxam and Gilbert; Sanger et al.
Production of gene libraries and screening of cloned DNA
Fragments for specific gene functions and locations on genetic
maps, In situ hybridization procedure

ZO : 427 : Animal Virology

1. What are viruses? Origin and definition, classification and nomenclature.
2. Structure of viral nucleic acids.
3. Protein biosynthesis.
4. Tissue culture and its application in virology.
5. Biochemical and biophysical methods in virology.
6. Replication of RNA viruses-Positive strand viruses (Polio, FMDV, Toga). Negative strand viruses (Flu, Rhabdo, Bunya).
7. Replication of DNA viruses-Adeno/SV40, Polyoma, Herpes, Pox viruses.
8. Molecular mechanisms of virus mutagenesis.
9. Conjugation (transduction).
- 10) Recombination/gene reassortment.
11. Complementation.
12. Replication of phages.
13. Plasmids.
14. Slow viruses and persistent infection.
15. Mechanism of action of interferon.
16. Humoral and cell mediated immunity in viral infection.
17. Viral vaccines.
18. Viruses in animal and human diseases.
19. Diagnostic virology.
20. Operon concept.
21. Gene splicing.
22. Cell-free protein synthesis and product analysis.

Reference Books

- 1) General Virology, 3rd edition, by S.E.Luria, J.E.Darnell, Darnell, D.Baltimore and A. Campbell, Wiley, 1978.
- 2) Chemistry & Biology of Viruses, by H. Fraenkerl-Conrat, Academic Press. 1969.
- 3) Gene Expression, Vol, 3 : Plasmids and phages, by B.Lewin, Wiley 1978.

ZO:428 : Insect Physiology

Integument as a barrier to the penetration of substances; Digestion and Nutrition. Circulation of blood, Haemolymph, Haemopoietic organs, Excretion. Water and Temperature relations; Respiratory mechanism, Physiological properties of insect muscle, Locomotion terrestrial, aerial and aquatic, Neural integration sense organs; Behaviour; Pheromones; Hormonal control of reproduction and metamorphosis.

Reference Books

- 1) 'The Principles of Insect Physiology' by V.B. Wigglesworth (Chapman and Hall Ltd., London, 7th Ed. 1972).
- 2) 'An introduction to Insect Physiology' by E. Bursell (Academic Press Inc. New York, 1978).
- 3) 'The Physiology of Insects' by M. Rockstein, Vol. I-VI (Academic Press London, 1973-76).

ZO : 429 : Insect Endocrinology

Histological structure of the following endocrine organs- Brain, ventral ganglia, corpora cardiaca, corpora allata, ecdysial gland.

Chemical structure of hormones. Hormonal regulation of metamorphosis, reproduction, diapause, intermediary metabolism and osmoregulation.

Physiology of Bur sicon and pheromones, Thanctosis.

REFERENCE BOOKS

1. Insect Hormones-By-Novak V.J.A. (1975). Edn. 4. Chapman and Hall, London.
2. Insect Neurohormones-by- Raabe, M (1982), Plenum Press, New York.
3. Insect Hormones - By Wigglesworth, Oliver and Boya.
4. A Text Book of Insect morphology, physiology and Endocrinology By . Tembhare, D.B. (1990) II Edn. S. Chand and Co. New Delhi.

ZO:430 : Neurophysiology

1. Structural elements of the nervous system; brief account of the organization and evolution of Nervous system in animals.
2. Excitable properties of the nerve cells: resting potential; ionic basis of action potential; properties of the nerve impulse; conduction velocity; measurement of nerve action potentials.
3. Synaptic transmission: Ultrastructure of the synapse; electrical and chemical synapses; comparative account of neurotransmitters, their metabolism; neurotransmitter receptors; involvement of cyclic-AMP in synaptic transmission; axonal transport; excitatory and inhibitory synapses.
4. Integrative properties of the nervous system: Integration at synapses; reflexes and nervous integration,
5. Sensory integration (Photoreception): Visual pigments; photopic and scotopic responses; colour vision; retinal potentials; visual cortex.
6. Physiological aspects of brain energy metabolism and effect of temperature, drugs etc.
7. Drug action, tolerance and dependence.
8. Learning and memory; short-term and long-term memories; molecular basis of memory; sleep.
9. Aging of nervous system.

REFERENCE BOOKS

- 1) P.N.Usherwood-Nervous System, Arnold, 1973.
- 2) H.S.Bachelard-Brain Biochemistry, Chapman and Hall, London, 1974.
- 3) A.N.Davison (Ed.)-Biochemical correlates of brain structure and function, Academic Press, London, 1977.
- 4) G.A. Cottrell and P.N.R.Usherwood (Ddn.)-Synapses, Blackie and Sons, Glasgow, 1977.
- 5) Prosser, C.L. (Ed.)- Comparative Animal Physiology, W.B.Saunders Co., Philadelphia, 1973 (Chapters 11,14,15).
- 6) Kandel, E.R. and J.H. Schwartz (Eds.)-Principles of Neural Science. Elsevier North-Holland, New York, (1981).
- 7) Shepherd, G.M.-Neurobiology, Oxford Univ. Press, New York, 1983.

ZO : 431 : INSECT TOXICOLOGY

1. History, Principles & Scope
2. Evaluation of Toxicity of Insecticide
Toxicity tests against insects; bioassay; LD50; (Toxicity tests against higher animals, acute toxicity)
3. Classification & chemistry of Insecticides :-
a) Classification based on mode of entry, action, & chemical nature
b) Reactions of organophosphorus insecticides;
c) Structure of insecticide in relation to toxicity, synergism & antagonism.
d) Reaction between organophosphorus, carbamate & enzyme.
4. Physico-chemical factors in relation to toxicity surface; physical state.
5. Entry & mode of action of Insecticide -
a) Penetration through cell, cuticle & skin
b) Background of neurobiology & transmission of impulses.
c) Mode of action of chlorinated hydrocarbon, organophosphorus & carbamates
6. Metabolism of Insecticides.
a) Phase I & phase II reaction.
b) Metabolism of chlorinated, organophosphorus Carbamate & botanical insecticide
7. Selectivity & Resistance
Ecological, physiological, Origin & development of resistance; mechanism of resistance cross and multiple, monogenic & polygenic.

REFERENCE BOOKS - for INSECT TOXICOLOGY

1. Text Book of Insect - Toxicology; R.P. Shrivastava & R.C. Saxena, Himanshu Publications - Udaipur.
2. The Chemistry & action of Insecticides; H.H. Shepard, MacGraw Hill, New York.
3. Defoxification Mechanism; R.T. Williams, Wiley, New York.
4. Text Book of Toxicology - K.P. DuBois & E.M.K. Geiling, Oxford University Press, Oxford.
5. Biochemical Toxicology of Insecticide; R.D.O'Brien & I Yamamoto, Academic Press, New York.
6. Toxicology of Insecticides - F.M. Mastumurg, Plenum, New York.

20 : 432 : TISSUE CULTURE

1. Introduction to tissue culture.
2. Basic requirements : Cell and its environment.
3. Aseptic and sterilization techniques (glassware, plastic ware, gadgets, physical, chemical, storage, packing).
4. Methods of tissue culture and their advantages and disadvantages;
 - a) Hanging drop.
 - b) Perfusion chamber.
 - c) Roller tube.
 - d) Keighton tube.
 - e) Suspension culture
 - f) Monolayer
 - g) Mass culture technology; Short term; Long term; Established cell line culture; Primary cell culture.
 - h) Cell lines.
 - i) Cloning.
 - j) Organ culture : Clot, grid, chorioallantoic, ocular.
5. Problem of cell types : Histological, Physicochemical, characterization and behavioural patterns of basic cell types, enzyme

pattern, drug sensitivity, virus susceptibility, plating efficiency, tumorigenicity.

6. Parameters of growth for in vitro cultures and evaluation of culture dynamics.
7. Natural media and designing of synthetic media.
8. Methods for storage of cell lines.
9. Contributions of cell and tissue culture studies to
 - i) Cell biology : Cell division, cell cycle, Cell fusion, Cell locomotion.
 - ii) Cyto-genetics: Cytogenetics of man. DNA synthesis, Heterochromatin and heteropyknosis, Sex chromatin, Sex chromosomes.
 - iii) Embryology : Embryoculture, Culturing of mammalian ova.
 - iv) Virology.
 - v) Cancer Research : Malignant transformation of cells in culture using oncogenic chemicals.
10. Designing of Tissue Culture laboratory.

REFERENCE BOOKS

Cell and Tissue Culture, J.Paul. Oxford Univ. Press, 1976.

ZO : 433 : POULTRY SCIENCE

1. Retrospect, Prospects and future of Poultry industry in India.
2. Poultry economics : why poultry industry should be augmented in India.
3. Poultry management : An overview.
4. Different types in poultry management : deep litre and tyre system.
5. Purposes of poultry keeping : Table use, Broiler, Layers and their management.
6. Poultry feeding, housing, watering.
7. Poultry sanitation.
8. Poultry diseases- routine medication.
9. Poultry vaccines.
10. Marketing of poultry and poultry products.
11. Starting a poultry farm in rural area and in urban area.
12. Biology of poultry.
13. Poultry products and human nutrition.

REFERENCE BOOKS

1. Poultry Keeping in India-Naidu, P.M.N. ICAR, New Delhi (1967).
2. Poultry Husbandary-E.N.Moore, J.N.Panda, ICAR, Publication 1976.
3. Diseases of Poultry -H.E.Hotstad, L.H.Schwarte, Iowa State University Press Ames. Iowa, USA. (1977)

ZO : 434 : ICHTHYOLOGY

1. Classification and diagnostic characters, origin and evolution.
2. External morphology, body form, fins and other appendages, skin colouration and scalation.
3. Endoskeleton : Skull, jaw suspension, axial and appendicular skeleton.
4. Musculature, locomotion: swimming and non-swimming.

5. Food and feeding habits, digestive system, nutrition.
6. Structure and function of gills, metabolic rate, adaptations for air breathing, air bladder.
7. Reproduction : sexuality, reproductive systems and cycles; spawnin parental care outline of embryonic and larval develop.
8. Nervous system: general organisation and special features; intelligence, behavioural patterns.
9. Sense organs : eye, internal ear, lateral line system, chemoreceptors.
10. Migration.
11. Fish venoms and toxins, electrogenic and luminescent organs, dangerous fishes.
12. Ecological classification of fishes ; factors governing distribution in marine, estuarine and freshwater habitats; adaptations for benthic life.
13. Zoogeography of Indian fishes.
14. Home aquaria.

REFERENCE BOOKS

- 1) Alexander, R.McN. (1970)-Functional Design in Fishes. B.I. Publications, Bombay.
- 2) Axlerod, H.R. and L.F. Schultz (1955)- Handbook of Tropical Aquarium Fishes, McGraw-Hill, New York.
- 3) Brown, M.E. (Ed.) (1957)- The Physiology of Fishes. Vol. I and II. Academic Press, New York.
- 4) Chandy, M. (1970)-Fishes, In : 'India-The Land and People'. National Book Trust, New Delhi.
- 5) Day, F. (1958)- The Fishes of India. Vol. I and II. Willian Dawson and Sons Ltd. London.
- 6) Harden Jones, F.R. (1968): Fish Migration, Edward Arnold, London.
- 7) Hardisty, M.W. and I.C. Potter (1971-72)- The Biology of Lampreys Vol. I and II. Academic Press, London and New York.
- 8) Lagler, K.F., J.E. Bardach, R.R. Miller and D.R.M. Passino (1977)- Ichthyology, 2nd edn., John Wiley and Sons, New York.
- 9) Love, M.S. and G.M. Cailliet (Eds.) (1979)-Reading in Ichthyology. Indian edn., Prentice-Hall of India, New Delhi.
- 10) Nikolsky, G.V. (1963)- The Ecology of Fishes. Academic Press, London and New York.
- 11) Poznanin, L.P. (Ed.) (1977)-Ichthyology, Amerind, New Delhi, Bombay
- 12) Sterba, G. (1962)-Freshwater Fishes of the World. Vista Books, London.
- 13) Hoar, W.S. and D.J. Randall (1969)-Fish Physiology Vols. I onwards. Academic Press, New York.

ZO : 437 : HISTOCHEMISTRY

1. Introduction to histochemistry-history.
2. Use of optical instruments and electron microscope in histochemistry.
3. Principles and practice of section cutting (microtomy).
4. Fixatives and fixation: Principles, chemistry and effect on cell organelles.
5. Carbohydrates : old and new classification, methods for detection of neutral and acid mucosubstances-chemistry of the reaction.
6. Proteins-histochemical classification, methods for detection of various endgroups, blocking reactions.
7. Detection of nucleic acids and nucleoproteins.
8. Lipids-chemistry, physical and chemical methods of detection.
9. Hydrolytic and oxidative enzymes : Kinetics of enzymes, problems, methods; activators and inhibitors.
10. Principles of radioautography-detection, quantification.
11. Use of exogenous enzymes in detection of macromolecules.
12. Detection and localization of metal ions
13. Electron microscopy and electron-microscope histochemistry.
14. Techniques in immunochemistry.
15. Quantification of colour reactions in situ.

REFERENCE BOOKS

- 1) Pearse, A.G.E.- Histochemistry-Theoretical and Applied, Vols. I and II. 1976.
- 2) Lillie, R.L.-Histopathologic Technic and Practical Histochemistry Ed. II, 1952.
- 3) Gomori, G.-Microscopic Histochemistry, 1952.
- 4) Barks, T. and Anderson, P.J.-Histochemistry, Theory, Practice and Bibliography, 1963.
- 5) McManus and Mowry, R.W.-Staining methods, histologic and histochemical, 1964.
- 6) Chayen, J., Bitensky, L., Butcher, R. and Poulter, L.A. Guide to Practical Histochemistry, 1969.
- 7) Ham, R.W.-Textbook of Histology.
- 8) Bourne, G.H. -An Introduction of Functional Histology, 1961.

ZO : 438 : EPIZOOTOLOGY

1. Approach.
2. Relationship between species and pyramid of numbers.
3. Diseases involving two primary living factors: Host, parasite; three factors: host, parasite, vector; Anthroponoses and Zoonoses.
4. Reservoir concept.
5. Auxiliary Factors : Physical, biological and social.
6. The parasites : (a) Kinds-viruses, rickettsiae, bacteria, protozoa, helminths, arthropods. (b) Specificity-parasitism versus clinical manifestations, Host range, Infective dosages, Virulence,

- Longevity, Effects on vectors. Adaptations for reaching hosts.
7. The vectors : (a) Taxonomic groups, (b) Methods of transmission, Mechanical/biological propagative, Biological cycle development, Biological-Cycle progative, Biological-transovarial and Trans-stadial transmission, (c) Mechanism of transmission, (d) Stages which act as vectors. (e) Characteristics of the Arthropods in the transmission cycle, (f) Effects of environment on vectors and transmission, (g) Importance of knowledge of the natural history of the Arthropod Vector.
 8. The Host : types, incubation period, host-parasite association, Immunology, Effects of parasite interactions on host, effects of habits of human host on disease, Epidemiological, classification of diseases in man.
 9. The Reservoir kinds.
 10. Nidality of Vector-borne diseases.
 11. Disease Cycles.
 12. Principle of Control :
 - (a) Measures directed against the parasite-prophylactic and therapeutic, Drug resistance.
 - (b) Measures directed against the vectors.
 - (c) Measures directed against reservoirs.
 - (d) Measures directed at the human host.

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- 1) Sinnecker, H. (1976)-General Epidemiology, Wiley-Interscience London, pp.228.
- 2) I.G. Riche, W.H. and Milner, J. (1971)-Epidemiology of Medical Ecology, Churchil-Livingstone, Edinburg and London, pp. 460.
- 3) Burnet, M. and White, I.C. (1972)-Natural History of Infectious of Diseases Cambridge University Press.

ZO : 439 : BASIC BIOTECHNOLOGY

1. Genetic Engineering & its Application

Introduction gene structure & function, tranfer of genetic information, restriction & modification, construction of recombinant DNA molecules in vitro. Molecular clonning, vector, plasmid & clonning vehicles. Antisense RNA technology, DNA hybridisation, genetic Diseases, PCR, site directed mutagenesis. DNA finger printing.

2. Mocovlonal Antibody & Hydridoma cells. Antigen antibody reaction, Hydridomas & preparation of monoclonal antibody, Lymphokines, Application and utilization of monoclonal antibodies, Viral caccines, malaria caccine, Biosensors - immunosensors, Gene therapy.

3. Cell culture and Biothechnology of Animals.

Introduction, serum, role of plasma mem., cell cultures as sources of valuable products, mammalian genome, Genetic recombina- mammalian cells and embryos, ferrying genes into mammalian

cells, transformation, Biotechnology of Domestic animals.

4. Processes and products dependent on cultural animal cells.
 - i) Viral vaccines :- mumps, measles, Rubella, Polio & mouth.
 - ii) Cellular chemicals : & interferon, B-interferon interleukin-2, plasminogen activator (Wrokinase)
 - iii) Immunobiologicals : monoclonal antibodies, Passive vaccines or therapeutic agents.
 - iv) Hormones : growth hormone, prolactin, ACTH,
 - v) Viral Predators : insecticides, methodology for product generation, Monolayer cell growth system, downstream processing, Genetically engineered animal cells & Bacteria, Humulin production.
5. Enzyme Biotechnology -
 - i) Enzyme as bulk products : introduction, organism sources, strain development, fermentation, Processing and purification examples of enzyme production X-amylase, enzyme application glucose isomerase
 - ii) Production and Purification of five enzymes.

Introduction, fermentation, sources for enzyme extraction of intracellular enzymes purification, storage, tests, assays & specification.
 - iii) Enzyme application - introduction, immobilisation cells or enzymes, stabilisation, Biocatalysts reactors, the application of biocatalysts.
6. Biotechnology and Biodegradation :- Biomass production, Bioenergy, Biogas, use of microorganism in pollution, control, waste treatment, waste management, bio hazards.

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1. Bullock, J.D.; Kristiansen, B. Basic Biotechnology 1987, Academic Press New York.
2. Prave, P., Faust, V., Sitting, W & Sukatsch, D.A.; fundamentals of Biotechnology, VCH Publisher, New York (1987)
3. Prave, P., Faust, V.; Sitting, W & Sukatsch, D.A. Basic Biotechnology, VCH Publication, New York 1987.
4. Spier, R.E. & Griffiths, J.B. : Animal cell Biotechnology Vol I & II Academic Press, Orlando (1985)
5. Schook, L.B. : Monoclonal Antibody Production Techniques & applications ; Marcel, Dekker. New York (1986)
6. Trevan, M.D. : Boffey S ; Goulding K.H. & Stanburg P. : Biotechnology the Biological principles, Tata McGraw Hill Publishing company Ltd. New York 1987.
7. Animal cell culture & Production of Biochemicals edited by sasaki & K. Ikura (Kluwer Academic Publisher, Boston 1991.

ZO 441 :- Avian Migration. ... 40 ...

1. Definition, Historic background, stimulus for migration.
2. Types of migration on the basis of distance travelled.
 - a) local b) short distance c) long distance migration with suitable examples.
3. Migration in new-world and old world with examples.
4. Study of migratory routes of swallow, swifts, Geese, cranes golden plover, Black-poll warbler, Bobolink, Albatross, Skuas etc.
5. Fuel for migration, navigation, piloting, orientation, true navigation, risk of migration, etc.
6. Ornithological methods-bird watching, bird photography, recording bird songs and sounds, capturing birds for banding etc.

ZO : 461 : 14 Practiclas corresponding to ZO 403 - Ornithology II

- 1) Temporary and permanent mounting of chick embryo with suitable methods.
- 2) Identification of different whole mount stages of chick embryo.
- 3) Study of sections of 72 hours incubation stage, passing through heart brain.
- 4) Study of mating behaviours & displays with suitable charts, model, photograph etc.
- 5) Study of threat displays and distraction technique with suitable charts, models. Handling of a field Binocular.
- 6) Study of preening behaviour in field.
- 7) Study of resting and sleeping behaviour of some birds in field.
- 8) Study of different nest types in laboratory or field.
- 9) Collection of eggs of different shapes and size. (atleast five)
- 10) Study of altricial and precocial young in nature
- 11) Study of food capturing in different birds in fields (at least 5 birds)
- 12) Recording of sound calls & songs of suitable birds in field
- 13) Preparation of nest boxes for garden birds.
- 14) Measurement of bird population-census by direct counting & by sampling.

ZO : 461 : 14 Practicals corresponding to ZO 404 Environmental Toxicology II

Evaluation of ED 50; LC 50; of toxicants using invitable test animal. by Litchfield Willcoxon method.

Spectral analysis of cytochrome P4 50 after intoxication.

Biochemical estimations of various parameters-following intoxication in.

- a) Carbohydrate
- b) Protein
- c) Lipid
- d) Nucleic acid

Studies of key enzyme after intoxication in Rat - like. phosphatases, Extarases, transaminases. Clinical Haematology : TLL, DLC, ESR, morphology of RBC; MHCV; Indises.

Study of histopathological response of pesticides / heavy metals in fish / mammalson

- i) Skin
- ii) Alimentary canal
- iii) Liver
- iv) Pancreas
- v) Testis
- vi) Ovary
- vii) Kidney
- viii) Brain
- ix) Spinal cord
- x) Blood
- xi) Bones
- xii) Muscles
- xiii) Endocrine glands.
- xiv) Lung

Effecacy test of

- i) fungicide
- ii) Harbinides
- iii) Weedicides
- iv) Bactericides
- v) Antiviral agent

Studies on injury of membranes by biologically active agents

ZO : 405

ZO : 461 : 14 Practicals Correspoding/Physiology II

Dissection of male reproductive system of rat/mice & its description

Surgical operation in rat/mice part I - Orchidectomy / castration

Surgical operation in rat/mice part II- Vasectomy.

Study of spermatogeneres & identification of cell types in semiki-ferous tabutes.

Study of various stages of development of the mammalism egg, cleavage, blastula & gastrulation.

Total count of spermatozoa from rat/mice

Motility count of spermatozoa from Rat/ Mice.

Indentification of study of different foetal membrabces and different types of placeutae.

Permanent histological preparations of Reproductive tract orgaus of Rat/Mice.

Submission of at least any five stides of reproductive tract organs of rat/mice.

ZO : 461 : 14 Practicals Corresponding to ZO : 407. Entomology-II

Study of insect Eggs -

Eggs of aquatic insects (Mosquito, Ranatra)

Eggs of terrestrial insects

(Silk moth, musca, Drosophila, Suprestid beetle, Wasp, Honey bee, Grasshopper). Nothecae - Mantis, cockroach.

Histological study of Reproductive system. Male Reproductive system- Testis, Vas. def., Esaculatory duct, Accessary gland, Female Reproductive system (Histological study) Ovary, oviduct, common oviduct, pedicel, Ovariole, types of ovarioles, spermatheca.

Early embryology of Insects. Egg, cleavage, Blastula, Germ band, Embryonic envelopes.

Study of insect nymphs, larvae, pupae : Aquatic nymphs, Terrestrial nymphs. Types of Larvae, Types of Pupae.

Study of social insects. Isoptera, Hymenoptera - Verpidae and formicidae.

Some experiments on insects .

- a) Dorsal light effect.
- b) Temperature preference in maggots/ larvae of mosquitoes.
- c) Role of surface tension in Gerris/Notonecta.
- d) Rearing of insect in captivity (any one) Housefly, Mosquito and any other suitable insect.

ZO : 461 : 14 Practicals Corresponding to ZO : 408 - Physiology II

- 1) Instrumentation
- 2) To measure the nerve conduction velocity
- 3) To record human Cardiogram (Demonstration)
- 4) Preparation of motor end plates
- 5) To study the effect of ATP, Mg²⁺ and K⁺ on muscle contraction of frog.
- 6) Effect of adrenalime on muscle glyugea of Rat
- 7) To Estimate the amount of lactic acid in normal and fatigue muscle of frog
- 8) Demonstration of different types of reblex action in frog
- 9) To study the heart beat of frog under certain experimental condition
Effect of unigranic ions on heart rate of frog by Kymograph.
- 10) To determine the flask constant with Warbuing's manometer
- 11) Determination of o₂ consumption of different tissues by warbuing's manometer (apparatus)
- 12) Effect of adrenalime on liver slywgen of Rat
- 13) Effect of starvation on liver slywgen of Rat
- 14) Quantitative estimation of Succinic dehydrogenase (SDH) in muscle of Tāt.
- 15) Effect of eyestack removal on oxygen consultatdon in urab.

ZO 462 : 7 Practical Corresponding to ZO : 426 : Genetic
Engineering & Recombinant DNA techniques :

1. Gram-positive and Gram negative bacteria, identification, classification and methods for culture.
2. Bacterial culture in suspension, on solid media, identification, classification of auxotrophs growth of HB 101 or c600 mutant strains on solid of agar, serial dilutions, colony counts.
3. Isolation of plasmid DNA and purification on CsCl-ethidium bromide density gradients.
4. Transformation of HB 101 (ten/amp) by plasmid PBR 322 (amp⁺ /let⁺) transformation frequency calculations replica plating technique.
5. DNA agarose gel electrophoresis technique for plasmid DNA and DNA restriction fragments.
6. DNA estimation by microdiphenylamine procedure. UV absorption spectra, ethidium bromide staining. Hydroxyapatite chromatography of DNA, Thermal melting behaviour.
7. Radioactive labeling of DNA in bacteria and radioactivity counting technique. Preparation of salivary gland chromosomes.
8. Insertion of DNA restriction fragments into plasmid DNA and cloning ; procedure.

REFERENCE BOOKS

1. Method in Enzymology Vol.65 1981.
2. Gene Expression B.Lewin, Vol 1-3.
3. Recombinant DNA Ed. Denniston and Enquist Vol.15 1981 Dowde Hutchinson and Ross Stroudsberg, Pennsylvania, U.S.A.
4. Proc. of National Academy of Sciences 1975 onwards.
5. J.Molecular Biology.
6. Cell.
7. Europ J. Biochemistry.
8. Nature.

ZO 462 - 7 Practicals Corresponding to ZO 431 - Insect Toxicology

Static Bioassay Test -
Calculation of LC 50 & LD 50.
Toxicity Testing,

a) Acute, b) sub Acute c) Chronic
Effect of insecticide on Cholinesterase enzyme.

Residual Analysis of Toxins by :

- a) i) Chemical assay
ii) Spectrophotometry
iii) Chromatography

Analysis insectivore Bioassay method.

Isolation of Insecticide from plant material/Botanicals.

Effect of Biological & Physical factors on Insecticide Residues-

Biological; Physical; unstring; brushing and snapping,
sunlight, temperature; moisture, soil type; cover crops.

Insecticidal pollution -

pathways of environmental contamination ; level of insecticidal contamination; Bioaccumulation susceptibility of Biological material to insecticides.

Insecticidal poisoning, symptoms & Treatment At manufacture, operation & consumer level, symptoms of poisoning and treatment, DDT, BHC, organophosphates, Carbamates, & Pyrethroids.

ZO : 462 : 7 Practicals corresponding to ZO : 441

Avian Migration

1. Handling of a field binocular, study and repair of different parts.
- 2 to 5 Visit to suitable localities to observe migratory birds (Aquatic birds), Migratory waders (ponds, streams, lakes etc. migratory warblers (bush and tree), etc.
6. Study of banding procedure on a suitable bird.
7. Visit to a bird sanctuary of India.

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ZO : 462 - 7 Practicals Corresponding to ZO : 429:

Insect Endocrinology

Dissection of endocrine organs of cockroach - Brain, Corpora cardiaca, corpora allata.

Effect of extracts of corpora allata and or corpora cardiaca on heart beats of cockroach. mounting of ecdysial gland of cockroach. whole mount of Brain showing Neurosecretary cells. Section of Brain to study different types of neurosecretary cells.

ZO : 462: 7 Practicals Corresponding to ZO:439 :Basic Biotechnology

Transformation Experiment

Immobilisation of enzyme

ELISA - demonstration

Antigen - Antibody reaction, simple & radial diffusion.

Immunoelectrophoresis - Antigen, Antibody reaction. Antibody titre.

Enzyme activity

Enzyme Tests - isolation of amylase, trypsin and chymotrypsin from pancreas.

Production of alcohol / citric acid / penicillin by fermentation

Characterisation of restricted fragments of DNA on agarose gel electrophoresis.

ZO : 462 - 7 Practicals corresponding to ZO:421 (b) Pest Control

1. (a) To study the effect of contact insecticides on the behaviour of insects.
(b) To find out percentage mortality of the insects treated.
2. (a) To study the effect of fumigants on the behaviour of insects.
(b) To find out percentage mortality of insects treated.
3. To study the effects of orally administered Zn phosphate on the liver, kidney and intestine of mouse.
4. To screen certain plant extracts as prospective attractants.
5. To screen certain plant extracts as prospective repellents / antifeedants.
6. To screen certain chemicals as prospective molluscicides.
7. Field trip.

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