

# PONDICHERRY UNIVERSITY PUDUCHERRY



## **M.Sc. Public Health Entomology**

### **Regulations and Syllabus**

**2023 – 2024 Onwards**

# **M.Sc. Public Health Entomology**

## **Regulations**

## **M.Sc. Public Health Entomology**

### **Scope of the Course**

There is a growing need for entomologists in the field of Public Health in view of emerging and re-emerging vector-borne diseases in India and other tropical countries. Apart from the State Health Departments, National Centre for Vector-Borne Diseases Control (NCVBDC), National Centre for Disease Control (NCDC), National Health Mission (NHM), and Indian Council of Medical Research (ICMR) require personnel with knowledge and expertise on entomology, epidemiology and prevention/control of vector-borne diseases for their programmes pertaining to vector-borne diseases. In view of this felt need, a two-year M.Sc. Public Health Entomology (PHE) course has been started at ICMR-Vector Control Research Centre (ICMR-VCRC), Puducherry in 2011. The ICMR initiated a National Public Health Entomology Programme in 2022, and M.Sc. PHE is expanded to four more Institutes viz., (i) ICMR-Regional Medical Research Centre, North East (ICMR-RMRCNE), Dibrugarh, Assam, (ii) ICMR-Regional Medical Research Centre (ICMR-RMRC), Gorakhpur, Uttar Pradesh, (iii) ICMR-National Institute for Research in Tribal Health (ICMR-NIRTH), Jabalpur, Madhya Pradesh and (iv) ICMR- Rajendra Memorial Research Institute of Medical Sciences (ICMR-RMRIMS), Patna, Bihar.

### **Course Description**

This is a unique course in India catering to national as well as global needs. The course provides an opportunity for students to gain in-depth knowledge of Public Health Entomology and intense training on the modern approaches for epidemiology, prevention and control of vectors and vector-borne diseases.

Arthropods affect the health and well-being of human beings in a wide variety of ways, by transmitting several of the most devastating infectious diseases. This course provides an overview of the ways in which arthropods impact public health, laying greater emphasis on insect vectors and vector-borne diseases prevention and control. The course focuses on vectors of local as well as global importance. An epidemiological perspective is integrated throughout the course. Biology, ecology, environment, surveillance and application of modern tools in the management of vectors and vector-borne diseases are dealt with in detail. Enormous attention is paid to develop skill-set of the students required for operational programmes.

### **Eligibility for Admission**

#### **Category I**

Candidates who have obtained a recognized undergraduate degree related to Biological/Medical/Paramedical/Agriculture/Veterinary/Biotechnological disciplines accepted as equivalent by the academic council of the Pondicherry University will be eligible. A minimum of 50% mark is essential for General/Unreserved/OBC and 40% for SC/ST candidates in their Under Graduate Degree examination, the qualifying examination for admission to the course. The requirement for differently-abled candidates will depend on the category they belong to. Candidates who are appearing for the qualifying exam in the year 2023 and are awaiting their results are also eligible to apply. However, they should submit the relevant certificates at the time of admission.

## **Category II: In-service (Self-supporting / Sponsored)**

### **A. Indian Nationals**

Government employed In-service candidates with age 48 or below either in Centre or State Health Department and candidates sponsored by the Public Health Sectors should have passed the Degree examination in any of the disciplines indicated under Category I from a recognized University accepted by the Academic Council of Pondicherry University, Puducherry. The candidates should send their application with a "No Objection Certificate"/ "Certificate of Sponsorship" from their Employer.

### **B. Foreign Nationals**

The applicants under this category possessing qualification as mentioned under the Category I or the qualification for which Equivalent Certificate obtained from Association of Indian Universities, New Delhi are eligible to apply. They will be required to produce Eligibility Certificate from Pondicherry University, Puducherry, subsequently for recognition of their qualification. Applications should be routed through the employer or sponsoring/nominating authority/organization. Applicants with valid visa for the entire duration of the study, only, will be considered.

### **Duration of the Course**

The duration of the course is TWO academic years (4 Semesters, Full time)

### **Medium of Instruction**

English shall be the medium of instruction for all subjects of study and examinations of the Course.

### **Learning Objectives**

Students shall be able to:

- (i) define the basics of arthropods of public health importance
- (ii) recognize vector - host - pathogen relationships in arthropod-borne diseases
- (iii) conduct epidemic / outbreak investigation of vector-borne diseases
- (iv) apply modern tools for surveillance and diagnosis of vector-borne diseases
- (v) design appropriate prevention and control measures including rationalization of the use of insecticides in Public Health Programmes
- (vi) promote Integrated Vector Management

### **Course Structure**

The M.Sc. Programme is divided into two parts. Each part consists of two Semesters as given below.

<b>Part</b>	<b>Year</b>	<b>Semester-Odd</b>	<b>Semester-Even</b>
I	First	Semester -1	Semester -2
II	Second	Semester -3	Semester -4

## CREDIT HOURS ALLOTTED TO DIFFERENT PAPERS INCLUDING DISSERTATION

Semester	Subject Code	Subject	Hours		
			Theory	Practical	Credit hours
I	MPHET 101	Biology & Ecology of Arthropods of Public Health Importance	65		4
	MPHET 102	Morphology, Taxonomy and Bio-diversity of Vectors	65		4
	MPHET 103	Physiology and Bio-chemistry of Insects of Public Health Importance	65		4
	MPHET 104	Environment and Public Health	65		4
	MPHEP 105	Practical – 1: Biology & Ecology of Arthropods of Public Health Importance		30	1
	MPHEP 106	Practical – 2: Morphology, Taxonomy and Bio-diversity of Vectors		30	1
	MPHEP 107	Practical – 3: Physiology and Bio-chemistry of Insects of Public Health Importance		30	1
	MPHEP 108	Practical – 4: Environment and Public Health		30	1
II	MPHET 201	Vector-Borne Parasites and Pathogens of Public Health Importance	65		4
	MPHET 202	Application of Molecular Biology, Immunology and Bioinformatics in Public Health Entomology	65		4
	MPHET 203	Epidemiology of Vector-borne Diseases	65		4
	MPHET 204	Biostatistics	65		4
	MPHEP 205	Practical – 1: Vector-Borne Parasites and Pathogens of Public Health Importance		30	1
	MPHEP 206	Practical – 2: Application of Molecular Biology, Immunology and Bioinformatics in Public Health Entomology		30	1
	MPHEP 207	Practical – 3: Epidemiology of Vector-borne Diseases		30	1
	MPHEP 208	Practical – 4: Biostatistics		30	1
	MPHEFT 209	Field Training			
III	MPHET 301	Pesticides used in Public Health	65		4
	MPHET 302	Control of Vectors of Public Health Importance	65		4
	MPHET 303	Integrated Vector Management	65		4
	MPHET 304	Vector Borne Diseases Control Programmes	65		4
	MPHEP 305	Practical – 1: Pesticides used in Public Health		30	1
	MPHEP 306	Practical – 2: Control of Vectors of Public Health Importance		30	1
	MPHEP 307	Practical – 3: Integrated Vector Management		30	1
	MPHEP 308	Practical – 4: Vector Borne Diseases Control Programmes		30	1
IV	MPHERM 401	Research Methodology	65		4
	MPHED 402	Dissertation and Viva-voce		200	20
<b>Total</b>			<b>845</b>	<b>560</b>	<b>84</b>

**Field Training**

At the end of Semester II, students will be visiting various ICMR Institutes, Field Stations, National Centre for the Vector-Borne Diseases Control and other National laboratories for observational training in the R& D activities and hands on training in the operational aspects of vector borne disease control.

At the completion of field visits, the students are required to submit a report and make a presentation of their field training.

**Dissertation**

All the students must undertake dissertation work at the final semester (IV semester). Each student is individually placed under a faculty at their respective Institutes to work on the dissertation.

This process includes:

- (a) the conceptualization of the independent research that will comprise the dissertation
- (b) the preparation of and satisfactory defense of the dissertation proposal
- (c) the collection, analysis and interpretation of data
- (d) presentation of findings in the dissertation format and oral defense of the dissertation

**Attendance required for appearing for examination**

No student who has less than 70% attendance in any course shall be permitted to attend the end-semester examination and he/she shall be given FA grade— failure due to lack of attendance. He/she shall be required to repeat that course.

## SCHEME OF EXAMINATION

Semester	Subject Code	Subject	Theory				Total Max.
			IA Min	IA Max	UE Min	UE Max	
I	MPHET 101	Biology & Ecology of Arthropods of Public Health Importance	25	50	50	100	150
	MPHET 102	Morphology, Taxonomy and Bio-diversity of Vectors	25	50	50	100	150
	MPHET 103	Physiology and Bio-chemistry of Insects of Public Health Importance	25	50	50	100	150
	MPHET 104	Environment and Public Health	25	50	50	100	150
	MPHEP 105	Practical – 1: Biology & Ecology of Arthropods of Public Health Importance			25	50	50
	MPHEP 106	Practical – 2: Morphology, Taxonomy and Bio-diversity of Vectors			25	50	50
	MPHEP 107	Practical – 3: Physiology and Bio-chemistry of Insects of Public Health Importance			25	50	50
	MPHEP 108	Practical – 4: Environment and Public Health			25	50	50
II	MPHET 201	Vector-Borne Parasites and Pathogens of Public Health Importance	25	50	50	100	150
	MPHET 202	Application of Molecular Biology, Immunology and Bioinformatics in Public Health Entomology	25	50	50	100	150
	MPHET 203	Epidemiology of Vector-borne Diseases	25	50	50	100	150
	MPHET 204	Biostatistics	25	50	50	100	150
	MPHEP 205	Practical – 1: Vector-Borne Parasites and Pathogens of Public Health Importance			25	50	50
	MPHEP 206	Practical – 2: Application of Molecular Biology, Immunology and Bioinformatics in Public Health Entomology			25	50	50
	MPHEP 207	Practical – 3: Epidemiology of Vector-borne Diseases			25	50	50
	MPHEP 208	Practical – 4: Biostatistics			25	50	50
	MPHEFT 209	Field Training				30	30
III	MPHET 301	Pesticides used in Public Health	25	50	50	100	150
	MPHET 302	Control of Vectors of Public Health Importance	25	50	50	100	150
	MPHET 303	Integrated Vector Management	25	50	50	100	150
	MPHET 304	Vector Borne Diseases Control Programmes	25	50	50	100	150
	MPHEP 305	Practical – 1: Pesticides used in Public Health			25	50	50
	MPHEP 306	Practical – 2: Control of Vectors of Public Health Importance			25	50	50
	MPHEP 307	Practical – 3: Integrated Vector Management			25	50	50
	MPHEP 308	Practical – 4: Vector Borne Diseases Control Programmes			25	50	50
IV	MPHERM 401	Research Methodology			50	100	100
	MPHED 402	Dissertation and Viva-voce	Dissertation		Viva-voce		170
			150		20		
<b>Total</b>							<b>2700</b>

**UE** – University Examination; **IA** – Internal Assessment

Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the Pondicherry University.

The system of evaluation for (i) Internal Assessment, (ii) Practical Examination, and (iii) Field Training shall be as follows:

	<b>Marks</b>
<b>(i) Internal Assessment</b>	<b>50</b>
(a) Assignment*	10
(b) Seminar*	10
(c) Theory Internal Examination	30

\* Any two Units of each theory paper to be chosen, one for Assignments and other for Seminar

<b>(ii) Practical paper</b>	<b>50</b>
Practical (40), Record (5) & Viva-voce (5)	
<b>(iii) Field Training</b>	<b>30</b>
Report (20), Presentation (10)	

### **Pattern of question paper for End semester examination**

There will be three sections in the question paper.

Section A: 10 Marks (10 x 1) - 10 one-mark questions and all questions must be answered.

Section B: 30 Marks (5 x 6) – Five of Six questions to be answered and each carry 6 marks.

Section C: 60 Marks (4 x 15) – Four of Five questions to be answered and each carry 15 marks.

### **Pass Percentage**

Minimum marks for pass in the examination shall be 50% for all courses.

### **Award of the degree**

Degree will be awarded based on the overall marks secured by the student as given below,

- A candidate who secures an overall average of not less than 75% shall be declared to have passed the examination in First class with Distinction, provided he/she has passed the examination in every subject in the very first appearance.
- A candidate who secures an overall average of not less than 60% shall be declared to have passed the examination in First class provided he/she has passed all the subjects at the first appearance/before the completion of the final semester.
- All other successful candidates shall be declared to have passed in second class.

### **Span Period**

Students who fail in the end semester examination shall be permitted to reappear in the following End Semester examination. The maximum period to complete the programme shall be FOUR years.



**Outcome of the Course:**

By the end of the course, students shall be empowered with

- I. Basic skills in public health entomology, including vector biology, ecology, environment, epidemiology and control of vectors and vector-borne diseases.
- II. Undertaking epidemic / outbreak investigation of vector-borne diseases
- III. Use of modern tools for surveillance and diagnosis of vector-borne diseases
- IV. Decision-making skill in planning and implementation of appropriate prevention and control measures, including monitoring and evaluation, under the ambit of Integrated Vector Management.

\*\*\*\*\*

# **M.Sc. Public Health Entomology**

## **Syllabus**

# MPHET 101: Biology & Ecology of Arthropods of Public Health Importance

## THEORY

65 Hrs

**Objective:** To provide basic knowledge on arthropods of public health importance

### Unit I Introduction to Arthropods of public health importance

Salient features and distribution of arthropod vectors of human diseases – zoonotic diseases – public health nuisance

### Unit II Behavioural and Developmental life history of arthropods of public health importance

Structural and functional morphology of mouth parts and genitalia – Fundamentals of sensory mechanism and behaviour such as mating, host seeking, feeding, resting, oviposition. Development and life history – life history pattern, diapauses, hibernation, aestivation, dermal death point – influence of environmental extremes

### Unit III Biology of blood feeding arthropods of public health importance

Life history of importance vector mosquitoes *Anopheles* (*An. stephensi*, *An. culicifacies*, *An. fluviatilis*), *Aedes* (*Ae. aegypti*, *Ae. albopictus*), *Culex* (*Cx. quinquefasciatus*, *Cx. tritaeniorhynchus*), *Mansonia* (*Ma. annulifera*, *Ma. uniformis*) – Sandflies (*Phlebotomus argentipes*) – black flies (*Simulium damnosum*)

### Unit IV Biology of blood feeding and filth breeding arthropods of public health importance

Life history of horse flies, tsetse flies, house flies, myiasis causing flies, fleas (species of *Xenopsylla* and *Ctenocephalides*), Triatomine bug, bed bug, head and body louse.

### Unit V Biology of blood feeding acarina of public health importance

Life history of Ixodids (*Haemaphysalis*, *Ixodes*, *Dermacentor*, *Rhipicephalus*, *Amblyomma*), Argasid (*Argas*, *Ornithodoros*) and Mites (*Sarcoptes*, *Leptotrombidium*, *Dermatophagoides*).

### Unit VI Ecology of arthropods of public health importance

Introduction to vector ecology – ecosystem and ecosystem concept – energy flow. Population – structure, dynamics – r & k selection, carrying capacity – growth rate – Population interaction with abiotic and biotic factors – Natality, mortality, survivorship, age distribution – Life table analysis.

### Suggested Readings:

1. Armed Forces Pest Management Board (2019). Bed Bugs – Importance, Biology, and Control Strategies. Armed Forces Pest Management Board Technical Guide No. 44.
2. Changlu Wang, Chow-Yang Lee and Michael Rust (2021) Biology and management of German Cockroach, ISBN 978-1789248104, CABI Publishing.
3. Chapman RF (2013). The Insects: Structure and Function, Cambridge University Press, London, 5<sup>th</sup> Edition, ISBN-13 : 978-1107624801.
4. Clements AN (1992) Biology of Mosquitoes, Volume 1: Development, Nutrition and Reproduction (CABI Publishing). Hardcover ISBN- 978-0851993744.

5. Clements AN (1999) *Biology of Mosquitoes, Volume 2: Sensory Reception and Behaviour* (CABI Publishing) Hardcover. ISBN-978-0851993133.
6. Clements AN (2011) *Biology of Mosquitoes, Volume 3: Transmission of Viruses and Interactions with Bacteria* (CABI Publishing). ISBN- 978-1845932428.
7. Eldridge BF and Edman JD (2003) *Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods*. Springer; 2nd revised ed. 2004 edition ISBN-13 : 978-1402017940.
8. Gail Miriam Moraru and Jerome Goddard II (2022) *The Goddard Guide to Arthropods of Medical Importance*, Paperback, Taylor & Francis Ltd; 7th edition, ISBN : 978-1032338521.
9. Gupta SK (2010) *Medical Veterinary and Public health important Mites and Ticks: A Handbook*, Publisher - Nature books India, Hardcover, ISBN-13-? 978-8190655163.
10. Kirby C. Stafford III (2008) *Fly Management Handbook: A Guide to Biology, Dispersal, and Management of the House Fly and Related Flies for Farmers, Municipalities, and Public Health Officials*, The Connecticut Agricultural Experiment Station, New Haven, CT 06504 - Bulletin 1013.
11. Lehane MJ (2005) *The Biology of Blood-Sucking in Insects* (Paperback), Cambridge University Press; 2nd edition, ISBN-978-0521543958.
12. Maurice B. Mitzmain (2019) *General observations on the Bionomics of the Rodent and Human Fleas*. Publisher. Forgotten Books , ISBN : 978-1334413018.
13. Mullen GR and Durden LA (2018) *Medical and Veterinary Entomology (Illustrated)*, Publisher : Academic Press; 3rd edition (2 October 2018). ISBN. 978-0128140437.
14. Nicholas Burgess and Cowan GO (2012). *A Colour Atlas of Medical Entomology* (CRC Monographs on Statistics & Applied Probability Book 10) (Hardcover) 1st Edition, Kindle Edition, ASIN - B00FB67BHS.
15. Norbert Becker, Dusan Petric, Marija Zgomba, Clive Boase, Minoo Madon, Christine Dahl and Achim Kaiser (2010) *Mosquitoes and their Control*, ISBN-978-3-540-92873-7, Springer Berlin, Heidelberg.
16. Oliver B Williams (2019). *The Sand Fly* (Paperback). Zeitgeist Publishers..Pp 1- 412 ISBN-978-0578590646
17. Richard C. Wilkerson, Yvonne–marie Linton and Daniel Strickman (2021) *Mosquitoes of the World, Volumes 1 and 2*. Hardcover. Johns Hopkins University Press, ISBN-978-1421438146.
18. Sarita Kumar (2022) *Advances in Diptera: Insight, Challenges and Management Tools*. Hardcover (2022), ISBN-978-1803563534.
19. Service MW (2012) *Medical Entomology for Students*. Publisher - Cambridge University Press; 5th edition (10 May 2012), ISBN- 978-1107668188.Paperback.
20. Walter Scott Patton (2018) *A Textbook of Medical Entomology*. Publisher -Forgotten books. ISBN : 978-0259972044.

**Outcome:** Understanding of biology and ecology of arthropods of public health importance

# MPHET 102 Morphology, Taxonomy and Bio-diversity of Vectors

## THEORY

65 Hrs

**Objective:** To familiarize the students with the morphology, taxonomy and biodiversity of vectors

### Unit I Morphology of medically important insects and other arthropods

Head: antenna – mouth parts, Thorax: wings – wing venation – legs – general structure, Abdomen: Appendages – cerci – external genitalia.

### Unit II Taxonomic concepts and Classification of Arthropoda

Type concept – Population concept – History and Levels of Taxonomy: alpha – beta – gamma taxonomy. Taxonomic hierarchy: Species – Genus – Family – Order – Class – Phylum. Species concept: species – infraspecific categories – Sibling species – subspecies – variants within populations.

Characteristics of different Classes of Arthropoda. Classification of Insecta. Characteristics of Orders: Diptera – Siphonaptera – Anoplura – Hemiptera – Dictyoptera.

### Unit III Classification of Diptera, Siphonaptera and Anoplura, Acarina

Characteristics of Families Culicidae – Phlebotomidae – Muscidae – Tabanidae – Calliphoridae. Characteristics of mosquitoes – *Anopheles* – *Culex* – *Aedes* – *Mansonia*. Characteristics of sand flies: *Phlebotomus* – *Sergentomyia*. Characteristics of flies: *Musca* – *Calliphora*.

Characteristics of Family Pulicidae. Characteristics of fleas: *Xenopsylla* – *Pulex* – *Ctenocephalides*. Characteristics of *Pediculus* – *Pthirus*.

Characteristics of families Ixodidae – Argasidae – Trombiculidae – Sarcoptidae, Characteristics of Ticks: *Boophilus* – *Rhipicephalus* – *Haemaphysalis* – *Ornithodoros*, Characteristics of mites: *Leptotrombidium* – *Sarcoptes*.

### Unit IV Collection and preservation techniques

Mosquitoes– sand flies – fleas – lice – ticks – flies: adult collection methods - traps - larval collection methods – wet preservation – dry preservation. Mosquito taxonomic inventory

### Unit V Biodiversity

Concepts and characteristics of biodiversity – Biodiversity hotspots – Biosphere – Species documentation – Diversity indices – Invasive species. Relationship between anthropogenic stressors – vector biodiversity.

## Suggested Readings:

1. Annual Review of Eco, Evo & Systematics (2011). Annual Reviews Inc.
2. Annual Review of Entomology (2011). Annual Reviews Inc.
3. Barraud P.J. (1934). The fauna of British India, including Ceylon and Burma. Diptera, Family Culicidae, Tribes Megarhini and Culicine. Taylor and Francis, London Publisher. Published under the authority of the Secretary of State for India in Council. Pp371.
4. Burgess, N.R.H and Cowan, G.O. (1993). A colour atlas of medical entomology: Chapman and Hall, London.
5. Christophers S.R. (1933). The fauna of British India, including Ceylon and Burma. Diptera, Family Culicidae, Tribe Anophelini. Taylor and Francis, London Publisher. Published under the authority of the Secretary of State for India in Council.
6. Furman, D. P., & Catts P. (1982). Manual of Medical Entomology. 4<sup>th</sup> edition. Cambridge University Press.
7. Gullan, P.J. and Cranston, P.S. (2014). The Insects - An Outline of Entomology. 5<sup>th</sup> Edition. John Wiley & Sons, Ltd.
8. Huber, J. (2017) Biodiversity of Hymenoptera, Chapter 12. In: Footitt, R.G. & Adler, P.H. (eds) Insect Biodiversity: Science and Society. John Wiley and Sons Ltd, Hoboken, USA.
9. Kenneth G. V. Smith. (1973). Insects and other Arthropods of Medical Importance. The Trustees of the British Museum, London.
10. Kevin J. Gaston and John I. Spicer. (2004). Biodiversity an introduction. 2<sup>nd</sup> Edition. Blackwell Publishing Company.
11. Mc Gavin, G. (2001). Essential Entomology: An order- by-order introduction. Oxford University Press.
12. O. M. B. B. (1953). Methods and Principles of Systematic Zoology. By Ernst Mayr, E. G. Linsley, and R. L. Usinger. pp. ix 328, with 45 figs. McGraw-Hill Book Company, 1953. Price 51s. Geological Magazine, 90(5), 374-374.
13. Oldroyd H. (1970). Collecting, preserving, and studying insects. 2<sup>nd</sup> Edition. London: Hutchinson.
14. Ride, W. D. L (1985). Code international de nomenclature Zoologique : adopté par la XXe Assemblée générale de l' Union internationale des sciences biologiques. 3rd edition. International Trust for Zoological Nomenclature in association with British Museum (Natural History). University of California Press, Berkeley and Los Angeles.
15. Romoser W.S. and Stoffolano J.G. (1973). The Science of Entomology. 4<sup>th</sup> Edition. Macmillan New York.
16. Service, M.W. (1980). A Guide to Medical Entomology. McGraw-Hill Book Company, London.
17. Smart, J., Jordan, K., & Whittick, R.J. (2011). A hand book for the identification of insects of medical importance. 2<sup>nd</sup> Edition. Biotech Books.
18. Smith, R. F., Mittler, T. E., Smith, C. N., & America. (1973). History of entomology. Palo Alto, Calif.
19. Tembhare D. B. (2016). Modern Entomology. 2<sup>nd</sup> Edition. Himalaya Publishing House Pvt. Ltd.

**Outcome:** Students can easily identify, classify insects of public health importance and familiarize with the collection and preservation methods. They also understand on the concepts and importance of biodiversity.

# MPHET 103: Physiology and Biochemistry of Insects of Public Health Importance

## THEORY

65 Hrs

**Objective:** To provide knowledge on physiology and biochemistry of Insects of Public Health Importance

### **Unit I Integumentary system**

Formation of insect cuticle – Biochemical composition of various layers – Physiology of moulting – Secretion and composition of moulting fluid – Moulting associated enzymes and hormones.

### **Unit II Nutrition and Digestion**

General nutritional requirements – carbohydrate – protein – lipid – metabolic pathways in insects – structural functions of insect digestive system – blood digestion in haematophagous insects – mouth parts of mosquitoes – feeding mechanisms in mosquito larvae and adult.

### **Unit III Respiratory and Circulatory system**

Structural regions, adaptations, and functional properties with special reference to aquatic forms of mosquitoes – Cyclic or discontinuous respiration – Respiratory metabolism and cytochrome oxidase system.

Circulatory system structure – Mechanism and neuronal/hormonal control of circulation – Haemolymph constituents and functions – Haemocytes, haemopoietic organelles and immune molecules – Phenoloxidase system, melanization and encapsulation.

### **Unit IV Excretion and osmoregulation**

Structural design of organs of excretion with special reference to aquatic stages of mosquitoes – Excretion in hematophagous insects – Osmoregulation in terrestrial and aquatic insects – Physiology of osmoregulation in aquatic stages of mosquitoes.

### **Unit V Nervous system and sense organs**

Regions of nervous system – Physiology and co-ordination of nervous system components, sense organs – Circadian rhythm in mosquitoes – Sensory physiology of host – seeking behaviour in mosquitoes – Pheromones/kairomones and control of behavior of vector insects.

### **Unit VI Reproduction and development**

Egg development and abdominal conditions in mosquitoes and sandflies – reproductive strategies in mosquitoes and sandflies - Autogeny, gonotrophic cycle and physiological age determination in mosquitoes – Reproductive organs of mosquitoes (male & female) – Types of ovarioles – Vitellogenesis and spermatogenesis – Fertilization, zygote formation and embryogenesis – Metamorphosis – Endocrine control of development and maturation. Biosynthetic pathways and inhibitors of mosquito juvenile hormone.

## Suggested Readings:

1. Beckage N and Beckage E (2008). Insect Immunology. Publisher: Academic Press 2008-01-25
2. Bender, D. A., Jacob, M., Rodwell, V. W., Harper, H. A., Murray, R. K., Gross, P. L., Weil, P. A., Kennelly, P. J., Varghese, J., Botham, K. M., Rand, M. L., Rodwell, V. W., Mayes, P. A. (2018). Harper's Illustrated Biochemistry 31e. United Kingdom: McGraw-Hill Education.
3. Chapman, R. F. (2013). The Insects: Structure and Function. India: Cambridge University Press..
4. Dorn, A., J. H. Willis, D. Hoffmann, G. Hoyle, G. R. Wyatt, W. J. Bell, G. D. Prestwich, P. N. R. Usherwood, and G. T. Brooks. (1985) "Comprehensive Insect Physiology, Biochemistry and Pharmacology." International Journal of Tropical Insect Science 6, no. 2 (April 1, 1985): i–xiv..
5. Gilbert L.I (2009). Insect Development: Morphogenesis, Molting and Metamorphosis. Academic Press; 1st edition.
6. Gilbert L.I (2011). Insect Molecular Biology and Biochemistry. (2011). Netherlands: Elsevier Science. Academic Press; Illustrated edition
7. Gupta (1991) Immunology of Insects and Other Arthropods." Routledge & CRC Press.
8. Marc Klowden, Subba Palli. (2022). Physiological Systems in Insects 4th Edition. Academic Press.
9. Nation, J. L. (2016). Insect Physiology and Biochemistry, Third Edition. United Kingdom: Taylor & Francis.
10. Pattabiraman, T.N. (2008). Laboratory Manual and Practical Biochemistry. All India Publishers and Distributors.
11. Rodwell, V. W., Harper, H. A., Botham, K. M., Murray, R. K., Bender, D. A., Jacob, M., Rodwell, V. W., Mayes, P. A., Rand, M. L., Gross, P. L., Kennelly, P. J., Weil, P. A., Varghese, J. (2018). Harper's Illustrated Biochemistry 31e. United Kingdom: McGraw-Hill Education.
12. Rosales Ca (2017). Cellular and Molecular Mechanisms of Insect Immunity. In Insect Physiology and Ecology, edited by Vonnie D. C. Shields. Rijeka: IntechOpen, 2017. <https://doi.org/10.5772/67107>.
13. Snodgrass R.E (2012). The Morphology of Insect Sense Organs and the Sensory Nervous Systems. Literary Licensing.
14. Tembhare, B.D. (2012). Modern Entomology. Published by Himalaya Publishing House Pvt. Ltd.
15. Zalucki, Myron P. (2023). Annual Review of Entomology 68, no. 1 (2023): v–vii.
16. Zgomba, M., Becker, N., Kaiser, A., Madon, M. B., Boase, C., Petrić, D., Dahl, C. (2020). Mosquitoes: Identification, Ecology and Control. Germany: Springer International Publishing.

**Outcome:** Helping the students understand the functioning of different organs, metabolism and the biochemical processes in insects.



# MPHET 104: Environment and Public Health

## THEORY

65 Hrs

**Objective:** To provide knowledge on the role of environment and its impact on public health

### **Unit I Environment, Health and Sanitation**

An introduction to Environment and Health – Eco health – Sanitation – Hygiene and Personal protection – Components of environment - Issues and challenges in environmental sanitation - Environmental monitoring and measurement techniques

### **Unit II Environmental pollution and health hazards**

Types of pollution and their impact on human health – Regulation and monitoring – Pollution control practices – Pollution control devices – water pollution – impact on vector proliferation - Solid waste and Waste water management - Biomedical waste management – guidelines

### **Unit III Environmental Risk Factors**

Environmental risk factors and risk assessment: urbanization and industrialization – impact on Health – Climate change – global warming – Mitigation and adaptation - – Governmental and Intergovernmental action - National Program on Climate Change & Human Health (NPCCHH) - Environmental determinants of emerging and re-emerging vector borne diseases

### **Unit IV Environmental Health in Emergencies and Disasters**

Nature of emergencies and disasters – Emergency Response – Recovery and Sustainable Development – Risk of outbreaks of water borne – Fly borne and vector borne diseases – Bioterrorism and Biological warfare - National Disaster management – institutional setup - National disaster management policy and plan

### **Unit V Public Health Promotion**

Agenda for development Program - Role of environmental management in preventing epidemics of VBDs - Preserving Biological diversity - Role of environmental engineering - Environmental Health Promotion

### **Unit VI Managing Health, Environmental Linkages & Healthy Public Policy**

Environmental and health impact assessment: Health Impact Assessment (HIA) and Environmental Impact Assessment (EIA) – Sustainable development goals related to environment and health – Healthy public policy in practice.

## Suggested Readings:

1. Andrew Kibble, Greg Hodgson, Henrietta Harrison, Naima Bradley, Robie Kamanyire, Virginia Murray. (2014). Essentials of Environmental Public Health Science: A Handbook for Field Professionals. OUP Oxford. ISBN:9780199682881, 0199682887.
2. Central Pollution Control Board. (2022). Guidelines for management and Disposal of waste and Management. Ministry of Environment, Forest and climate change, Government of India. <https://cpcb.nic.in/waste-management-technologies/>
3. David J. Briggs, Richard M. Stern, Tim L. Tinker. (1999). Environmental Health for All: Risk Assessment and Risk Communication for National Environmental Health Action Plans. Springer Netherlands. ISBN:9780792354536, 0792354532.
4. Ellen K. Cromley, Sara L. McLafferty (2012). GIS and Public Health. Guilford Publications, ISBN:9781609187507, 1609187504.
5. Health Villages: A guide for communities and community health workers (2002), WHO, Geneva.
6. National Centre for Vector Borne Disease Control (NCVBDC), (2022). Guidelines and Annual reports. <https://ncvbdc.mohfw.gov.in/index1.php?lang=1&level=1&sublinkid=5899&lid=3686>
7. Prapa Sorosjinda-Nunthawarasilp, Ronald Markwardt. (2021) Innovations in the Entomological Surveillance of Vector-borne Diseases. Cambridge Scholars Publisher. ISBN:9781527572164, 1527572161.
8. Silpa Kaza, Lisa Yao, Perinaz Bhada-Tata, Frank Van Woerden. (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. World Bank Publications. ISBN:9781464813474, 1464813477
9. Sustainable Development and Health for all: Building the capacity of National Health authorities, WHO – SEARO, 1999, No.30.
10. World Health Organization (1991). Insect and rodent control through environmental management: A community action programme WHO.
11. World Health Organization (2008). Public Health significance of urban pests (WHO - Europe 2008) ISBN 978 -92-890-7188-8.
12. World Health Organization (2016). Environmental health. Regional Committee for the Western Pacific, 067. (2016). Environmental health.
13. World Health Organization (2018). Health, environment and climate change. Executive Board, 142. (2018). Health, environment and climate change. World Health Organization.

**Outcome:** Gaining knowledge on environment, health and sanitation, understanding the Impact of climate change on VBDs and performing health impact assessment.

## MPHEP 105: Biology & Ecology of Arthropods of Public Health Importance

### PRACTICALS

30 Hrs

1. Rearing techniques of vector species (*Anopheles stephensi*)
2. Life table construction and analysis (*Culex quinquefasciatus*)
3. Demonstration of life cycle stages of mosquitoes.
4. Dissection and mounting of mouth parts: Sandfly, mosquito.
5. Dissection and mounting of male genitalia and pharyngeal armature of Sandfly and mosquito
6. Dissection and mounting of spermatheca of mosquito
7. Dissection and mounting of spiracular plate, cephalopharyngeal skeleton of house fly
8. Analysis of abiotic factors affecting adult survival

## MPHEP 106: Morphology, Taxonomy and Bio-diversity of Vectors

### PRACTICALS

30 Hrs

1. Demonstration of mouth parts and wings of medically important insects.
2. Identification of *Culex quinquefasciatus*, *Cx. tritaeniorhynchus*, *Anopheles stephensi*, *Aedes aegypti*, *Ae. albopictus*, *Mansonia annulifera*, *Ma. uniformis*.
3. Identification of *Phlebotomus papatasi*, *Ph. argentipes*, *Chrysomya bezziana*.
4. Identification of *Xenopsylla astia*, *Xe. brasiliensis*, *Xe. cheopis*, *Pthirus pubis*, *Pediculus capitis*.
5. Identification of *Boophilus*, *Rhipicephalus*, *Haemaphysalis*, *Ornithodoros*.

## **MPHEP 107: Physiology and Biochemistry of Insects of Public Health Importance**

### **PRACTICALS**

30 Hrs

1. Qualitative analysis of protein, lipid and chitin in insect integument.
2. Qualitative analysis of digestive enzymes in the gut of insect
3. Total protein estimation in the ovary of mosquitoes.
4. Haemolymph collection, staining and identification of haemocytes of mosquitoes.
5. Protein profiling of mosquito haemolymph through SDS-PAGE and HPLC.
6. Gel elution of protein through Electro elution method.
7. Membrane feeding of mosquitoes and determination of Sella's abdominal conditions.
8. Physiological age determination of mosquitoes by examination of the ovarian features.
9. Demonstration of ametabolous, hemimetabolous, and holometabolous conditions.
10. Demonstration of oviposition attractancy in mosquitoes by exposing gravid females to oviposition attractants.
11. Demonstration of juvenile hormone activity on mosquito immatures by exposing to JH analogues.

## **MPHEP 108: Environment and Public Health**

### **PRACTICALS**

30 Hrs

1. Visit to Pollution control Board and familiarize with its functioning
2. Water quality analysis of mosquito vector breeding habitats
3. Visit to Biomedical waste treatment plant
4. Operational aspects on solid waste management.
5. Operational aspects on waste water management
6. Environmental and entomological risk assessment of dengue transmission in an endemic area.
7. Visit to Department of Revenue and Disaster management

# MPHET 201: Vector-Borne Parasites and Pathogens of Public Health Importance

## THEORY

65 Hrs

**Objective:** To provide in-depth knowledge on Vector-Borne Parasites and Pathogens of Public Health Importance

### **Unit I Malarial Parasites**

History and geographic distribution of human malaria (Global and India) – Taxonomic position of different malaria parasites – Distinguishing characters of different species of human malarial parasites – zoonotic malarial parasites. Life cycle and host-parasite interactions – pathogenesis and clinical manifestations - diagnosis and control.

### **Unit II Lymphatic Filarial Parasites**

History and geographic distribution of lymphatic filariasis (Global and India) – Taxonomic position of different human filarial parasites – Distinguishing characters of different parasite species/strains – zoonotic filarial parasite and animal model. Life cycle and host-parasite interactions – Endosymbionts and their significance – pathogenesis and clinical manifestations - diagnosis and control.

### **Unit III Onchocercid, Schistosome, Loa Loa, Mansonella and Dracunculid Parasites**

Geographic distribution – Taxonomic position of different human parasite species – Vectors of different parasites – Distinguishing characters of different species – Life cycle and transmission – Intermediate hosts - pathogenesis and clinical manifestations – diagnosis and control.

### **Unit IV Arboviral pathogens**

Classification of Arboviruses – Dengue, Chikungunya, Japanese encephalitis, Kyasanur Forest Disease (KFD), West Nile, Yellow fever and Zika - pathogenesis and clinical manifestations - diagnosis and control. Geographic distribution – Viral structure and replication – Transmission and maintenance cycle.

### **Unit V Leishmaniasis, Trypanosomiasis and Babesiosis**

Geographical distribution – Different species and differentiating features – pathogenesis and - clinical manifestations – diagnosis and control. life cycle and transmission.

### **Unit VI Bacterial and rickettsial pathogens**

Bacterial pathogens – leptospirosis. Plague – Lyme disease - Rickettsial pathogens – scrub typhus – endemic typhus – epidemic typhus – pathogenesis - clinical manifestations – diagnosis and control.

## **Suggested Readings:**

1. Advances in Parasitology Vol. 1-4 (2011). Annual Reviews Inc.
2. Ananthanarayan, R., Jayaram Paniker, C.K. (2022). Textbook of Microbiology. Ed. Reba Kanungo, Sonal Saxena. 12th Edition. Universities Press (India) Pvt. Ltd.
3. Brenner, R.R. and Shoka, A.M. (1987). Chagas' disease vectors. Volume I and II by CRC press, Florida.

4. Bruce F. Eldrige, John D. Edman (2012) Medical Entomology. Springer Dordrecht. <https://doi.org/10.1007/978-94-011-6472-6>
5. Bruce-Chwatt, L.J. (1985). Essential Malariology, The Alden Press, Oxford.
6. Burton J. Bogistch, Clint E. Carter, Thomas N. Oeltmann. (2005). Human Parasitology. Third Edition, Elsevier Academic press.
7. Chaterjee, K.D. (1981). Parasitology: Protozoology and Helminthology: Introduction to Clinical Medicine. Ed 12. Chaterjee Medical Publishers.
8. Chiodini, P. L., Goering, R., Dockrell, H. M., & Zuckerman, M. (2018). Mims' medical microbiology and immunology. 6th Ed. Elsevier Health Sciences.
9. David M. Knip, Peter M. Howley. (2013). Fields Virology. Ed. 6. Vol. 1, Wolters Kluwer Health/Lippincott Williams and Wilkins
10. Davis A. Warrell and Herbert M. Gilles. (2002). Essential Malariology, Fourth Edition. Arnold pub. Oxford.
11. Gubler, D.J. E. E. Ooi, S. Vasudevan, J. Farra, Duane J. Gubler, Eng Eong Ooi, Subhash Vasudevan, Jeremy Farrar. (Aug. 2014). Dengue and Dengue Hemorrhagic Fever. Ed. 2. CABI
12. Kalra, N. L. and Bang Y. H. (1988). Manual on Entomology in Visceral Leishmaniasis, SEA/VBC/35.WHO.
13. Kochchar, S.K. (2009). A Text Book of Parasitology. Wisdom Press.
14. Manabu Sasa, (1976). Human filariasis- A global survey of epidemiology and control. University of Tokyo press.
15. Jeremy F, Peter JH, Thomas J, Gagandeep K, David L, Nicholas JW. Manson's Tropical Diseases, 24/e, Elsevier Health 2024
16. Mukherjee, K.L & Ghosh, S. (2022). Medical Laboratory Technology Vol.I, II & III: Procedure Manual for routine diagnostic Test Fourth edition
17. Nikos Vasilakis, Duane J. Gubler. (May 2016). Arboviruses: Molecular Biology, Evolution and Control. Ed. 1. Caister Academic Press
18. Nutman. (2002). Lymphatic filariasis. Imperial College.
19. Peters N. and Killick-Kendrick. (1987). Leishmaniasis in Biology and medicine. Vol. 1 - 3 Academic Press.
20. Richman, D. D., Whitley, R. J., & Hayden, F. G. (Eds.). (2020). Clinical virology. John Wiley & Sons.
21. Stephen H. Gillespie and Peter M. Hawkey. (2006). Principles and practice of clinical Bacteriology. John Wiley and Sons Ltd.
22. Tyagi. B.K. (Jan 2022) Medical Entomology. Ed 2. Scientific Publishers, India
23. Warnsdorfer W.H. and Sri. Mc Gregor, I. (1998). Malaria: Principles and Practice of Malariology. Vol. I and II, Churchill Livingstone, New York.
24. WHO, (1985). Bench Aids for the diagnosis of malaria.
25. William Albert Ripley, Oskar Augustus Johannsen (Nov 2011). Handbook of Medical Entomology. Ed 1, Nabu Press.

**Outcome:** Gaining a thorough knowledge on life cycle and transmission, pathogenesis and clinical manifestations, diagnosis and control of vector-borne parasites and pathogens



# MPHET 202: Application of Molecular biology, Immunology and Bioinformatics in Public Health Entomology

## THEORY

65 Hrs

**Objective:** To provide practical knowledge on the application of Molecular biology, Immunology and Bioinformatics in Public Health Entomology

### Unit I Molecular basis of Insect-pathogen interactions

Structure of nucleic acids; DNA replication methods, Transcription, Translation. Genome organization of Vectors and Vector-borne pathogens - Regulation of gene expression in vectors and parasites - vector-pathogens interactions- mosquito gut microbiota and their importance.

### Unit II Molecular techniques and tools for diagnosis

PCR - Types- multiplex, qPCR, LAMP PCR. DNA barcoding - population genetics and molecular phylogeny of mosquito vectors and vector-borne parasites using molecular markers – RAPD, AFLP, RFLP, SNPs, Microsatellites, lineage markers. Molecular Taxonomic markers - 18srRNA, ITS-2, Multilocus sequence typing (MLST) – Microsatellite markers – DNA barcoding – COI.

### Unit III Application of Gene cloning and characterization in VBDs

Molecular cloning – Restriction endonucleases types and digestion – ligation – transformation – restriction mapping of DNA fragments – construction of genomic and cDNA libraries, screening - site directed mutagenesis. Real-time PCR and differential expression of genes by RT-PCR. DNA sequencing- Next generation sequencing methods-Transgenic mosquitoes- Genome editing- CRISPR-Cas9

### Unit V Bioinformatics applied to vector insects

Introduction to Bioinformatics – Biological databases – search and retrieval – sequence alignment and annotation – Molecular Phylogeny -Types of phylogenetic trees, phylogenetic tree construction- tree evaluation-Bootstrapping. Molecular taxonomy - Introduction to Molecular Taxonomy - Taxonomic Markers - Protein structure prediction and applications in vector borne disease. Introduction to Omics – Genomics, comparative genomics, Transcriptomics and proteomics

### Unit VI Immunology

Innate and adaptive immune responses- Cellular and humoral immunity – Immune evasion- production of monoclonal and polyclonal antibody techniques – immune-diagnostics for Vector Borne Diseases- Insect cell culture and its applications.

### **Suggested Readings:**

1. Albert L. Lehninger, David Lee Nelson, Michael M. Cox. (2021). Principles of biochemistry. 8th edition. W. H. Freeman. McGraw HILL.
2. Andreas D. Baxevanis and B.F. Francis Ouellette (2020). Bioinformatics: A practical guide to the analysis of genes and proteins 4th edition. John Wiley.
3. Annual Review of Immunology (2023). Volume 41, Annual Reviews Inc.
4. Arthur M. Lesk (2019). An Introduction to Bioinformatics 5th edition.
5. Benjamin Lewin (2017). Gene XII. Jones and Bartlett Publishers.
6. Bioinformatics and functional genomics 3rd edition (2015), John Wiley.
7. Brown, T.A. (2023). Genomes 5th edition. CRC Press.
8. David Freifelder, George Malacinski. (2015). Essentials of Molecular Biology - 4th edition.
9. Kubly, Immunology 9th edition (2018). Thomas J. Kindt
10. Marjorie A. Hoy (2018). Insect Molecular Genetics; An Introduction to Principles and Applications. Fourth edition
11. Mukherjee, K.L & Ghosh, S. (2022). Medical Laboratory Technology Vol.I, II & III: Procedure Manual for routine diagnostic Test Fourth edition
12. Nicholl, D.S.T (2023). Introduction to Genetic Engineering. Ed 4. Cambridge University Press.
13. Old, R.W. and S. B Primrose. (2006). Principles of Gene Manipulation: An Introduction to Genetic Engineering. 7th edition. Blackwell publishing.
14. Roitt's Essential Immunology 13th edition (2016). P.J. Delves. Wiley Blackwell.

**Outcome:** Enabling the students to understand concepts and application of molecular techniques and use of bioinformatics and immunological techniques in the areas of public health entomology.

# MPHET 203: Epidemiology of Vector Borne Diseases

THEORY

65 Hrs

**Objective:** To learn the concepts and principles of epidemiology with reference to vector borne diseases

## Unit I Introduction to Epidemiology

Epidemiology - definition - scope and applications - endemic, epidemic, pandemic - epidemic curve - types of epidemic - concept of disease - concept of causation - epidemiologic triad - pathogen/parasite factors - vector factors - environmental factors - cyclic and secular trend of diseases - emerging and re-emerging vector borne diseases - concept of disease control - elimination/eradication - concept of disease prevention.

## Unit II Modes of disease transmission

Source & reservoir of infection - source and sink sites – biological and mechanical transmission - Intermediate and definite hosts - inter-seasonal maintenance.

## Unit III Epidemiological studies

Descriptive studies - case reports/case series - Analytical studies - ecological/cross sectional study/case control/cohort - concept of bias - Experimental study- clinical/community trials - Association and causation- criteria for judging causality – introduction to qualitative research

## Unit IV Vector and disease surveillance

Surveillance concepts - Monitoring vs surveillance – vector survey methods - special surveys (extensive and intensive) - Epidemic/outbreak investigations - Surveillance tools - Notifiable diseases and their surveillance - Public health emergencies of international concern (PHEIC). Basics of mathematical modelling in VBDS - Use of Geographical Information System (GIS) and Remote Sensing (RS) – Geo-Environmental based Transmission Risk Model for Prediction and Forecasting of vector abundance and VBDS.

## Unit V Epidemiological measures

Epidemiological measures - incidence - prevalence - case fatality rate - risk difference - relative risk - Odds ratio - attributable risk - population attributable risk - protective efficacy - standardization of rates (direct/indirect) - screening for diseases (types and uses, criteria for screening, sensitivity, specificity, positive and negative predictive values) - screening vs diagnostic testing.

## Unit VI Vector Borne Diseases - Indices

Malaria: Basic reproduction rate – vectorial capacity – vector competence – inoculation rate – stability index – Human Blood Index (HBI) – Parasite Indices.

Filariasis: Human parasite indices – vector infection indices – endemicity – MDA surveys – measures of coverage & compliance.

Arboviral Diseases: Vector indices (dusk index, house Index, container Index, Breteau Index, pupal Index) – Minimum Infection Rate (MIR).

## Suggested Readings:

1. Bonita R., Beaglehole, R. and Kjellstrom, T. (2006). Basic Epidemiology (Second edition). WHO, Geneva.
2. Gordis, L. (2018). Epidemiology (Sixth edition.). Philadelphia: Elsevier Saunders
3. Harwood R.F. and James M.T. (1979). Entomology in Human and animal health. Macmillan Publishing Co.Inc, London. 7 Ed.
4. John W Creswell (2007). Qualitative inquiry & research design, New Delhi: Sage publications
5. National ethical guidelines for biomedical and health research involving human participants. New Delhi: Indian Council of Medical Research; 2017.
6. Park K. Park's textbook of Preventive and Social Medicine. 27<sup>th</sup> ed. Jabalpur: M/s Banarsidas Bhanot Publishers;2023.
7. Raju K. H, Sabesan S, Subramanian S, and Jambulingam P. Validating the Association of Japanese Encephalitis Vector Abundance with Paddy Growth, Using MODIS Data. Vector-Borne and Zoonotic Diseases. 2018; 18(10).
8. Raju KH, Sabesan S, Rajavel AR, Subramanian S, Natarajan R, Thenmozhi V, Tyagi BK, Jambulingam P. A preliminary study to forecast Japanese Encephalitis vector abundance in paddy growing area, with the aid of radar satellite images. Vector-Borne and Zoonotic Diseases. 2016; 16(2): 117-23.
9. Reiner Jr RC, Perkins TA, Barker CM, et al.,. 2013. A systematic review of mathematical models of mosquito-borne pathogen transmission: 1970–2010. J R Soc Interface 10: 20120921. <http://dx.doi.org/10.1098/rsif.2012.0921>
10. Rothman K, Greenland S, and Lash TL. Modern epidemiology, 4<sup>th</sup> Edition. Philadelphia, PA: Lippincott Williams & Wilkins.
11. Roy D.N. and Brown A.W.A. (1970). Entomology (Medical and Veterinary) including insecticides & insects & Rat control; The Bangalore Printing & Publishing Co. Ltd., Bangalore.
12. Sabesan S, Raju KH, Subramanian S, Srivastava PK, Jambulingam P. Lymphatic filariasis transmission risk map of India, based on a geo-environmental risk model. Vector-Borne and Zoonotic Diseases. 2013; 13(9): 657-65.
13. Sabesan S, Vanamail P, Raju KHK, Jambulingam P. Lymphatic filariasis in India: Epidemiology and control measures. J PG Medicine. 2010; 56(3): 232-38.
14. Sabesan, S and Hari Kishan Raju, K. and Vanamail, P. Spatial Delimitation, Forecasting and Control of Japanese Encephalitis: India a case study. The Open Parasitology Journal. 2008, 2: 59-63
15. WHO (2005). International Health Regulations. Available from: [WHO.int/ ihr/ publications/ 9789241580496/en](http://www.who.int/ihr/publications/9789241580496/en)
16. WHO (2016). Handbook: Vector surveillance and control at ports, airports and ground crossings. International Health Regulations. Available from: [WHO.int/ihr/publications/9789241549592/en/](http://www.who.int/ihr/publications/9789241549592/en/)

**Outcome:** Understanding the basic concepts in Epidemiology and its practical application and the various epidemiological study designs (quantitative and qualitative), epidemiological measures and its application to VBDs

# MPHET 204: Biostatistics

## THEORY

65 Hrs

**Objective:** To understand the important concepts, principles and application of statistics in biology

### Unit I Descriptive statistics

Types of data: Qualitative and Quantitative, Discrete and Continuous data - Methods of data collection. Presentation of Data: Frequency and cumulative frequency distribution, graphical and diagrammatic representation of Data - Measures of Central tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean – Measures of Dispersion: range, inter-quartile range – Mean deviation – variance – standard deviation – standard error – coefficient of variation.

### Unit II Sampling methods

Population - sample – parameter - statistic - sampling frame – sampling unit - Methods of sampling: probability sampling – simple random sampling with and without replacement – systematic – stratified – cluster; non-probability sampling – quota, convenience, snowball and purposive/judgment, Advantages & disadvantages; Determination of sample sizes for one and two sample problems (proportion and mean).

### Unit III Correlation and regression

Scatter diagram – Pearson's and Spearman's rank correlation coefficients – Linear regression analysis – Probit regression analysis - calculation of LC50 /LC90 values - relative potency, Logistic regression analysis - Odds ratio.

### Unit IV Basics of probability distributions

Random Experiment / Trial - Concepts of probability: Sample space – events – mutually exclusive and independent events, addition and multiplication laws of probability - Binomial – Poisson – negative binomial and normal distributions, Basic Problems.

### Unit V Tests of Significance

Null and alternative hypotheses - level of significance - type I / type II errors - Parametric tests (Small Sample Tests: Test for means and Variances based on t, F; Large Sample Tests: Single mean - Single proportion – Two means – Two proportions – Fisher's Z transformation, One and Two way ANOVA) - Non-parametric tests (Chi square test of independence, Kolmogorov- Smirnov one sample test, Sign test, Mann- Whitney U-test; Kruskal – Wallis test (One way ANOVA)).

## Suggested Readings

1. Altman, D. G. (1991). Practical Statistics for Medical Research. Chapman and Hall. London
2. Bourke, G. J., Daly L. E. and McGilvray, J. (1985). Interpretation and uses of Medical Statistics. Blackwell Scientific publications.
3. Cochran, W. G. (1997). Sampling Techniques. John Wiley & Sons 3rd edition.
4. Daly, L. and Bourke, G. J. (2008). Interpretation and uses of medical statistics. John Wiley & Sons.
5. Daniel, W.W. (2006). Biostatistics: A foundation for analysis in the Health Sciences. John Wiley & sons. 7th edition.
6. Freund, R. J. and Wilson, W. J. (2003). Statistical methods. Elsevier.
7. Gerstman, B. B. (2014). Basic biostatistics. Jones & Bartlett Learning. LLC.
8. Gupta, R.K. (2012). Courses in mathematics. Tata McGraw-Hills.
9. Hogg, R. V. and Craig, A. T. (2013). Introduction to Mathematical Statistics. Prentice Hall. 7th edition
10. Indrayan, A. and Malhotra, R. K. (2017). Medical Biostatistics. CRC Press.
11. Lwanga, S. K., Lemeshow, S. and World Health Organization. (1991). Sample size determination in health studies: a practical manual. World Health Organization.
12. Murthy, M.N. (1967). Sampling Theory and Methods. Statistical Publishing society Calcutta.
13. Raj, D. (1968). Sampling Theory. Tata McGraw Hill.
14. Rao, P.S.S. and Richard J. (2012). An Introduction to Biostatistics and research methods. Hall of India Pvt. Ltd. New Delhi.
15. Rosner, B. (2015). Fundamentals of biostatistics. Cengage learning.
16. Ryan, T. P. (2013). Sample size determination and power. John Wiley & Sons.
17. Snecdecor, G. W. and Cochran, W.G. (1991). Statistical Methods. IOWA State University Press.

**Outcome:** Gain practical knowledge on distribution, sampling, correlation, regression, probability and the test of significance.

## MPHEP 205: Vector-Borne Parasites and Pathogens of Public Health Importance

### PRACTICALS

30 Hrs

1. Preparation of stains - JSB I and II, Leishman and Giemsa.
2. Preparation of blood smears (thick and thin) and staining with JSB. Leishman and Giemsa  
For detection of malarial parasites.
3. Identification of human malaria parasite species through examination of blood smears:  
(I) *Plasmodium vivax* (II) *P. falciparum* (III) *P. malariae* (IV) *P. ovale*
4. Dissection of salivary glands and midgut for demonstration of parasite infection.
5. Staining and examination of blood smears for detection of microfilariae.
6. Membrane filtration technique for detection of microfilariae.
7. Dissection and examination of mosquitoes for filarial parasite (*Wuchereria bancrofti* and *Brugia malayi*)
8. Demonstration of various stages of filarial parasites and differentiation of species.
9. Weil-felix test for scrub typhus
10. Demonstration of Dracunculid worm – Leptospira bacterium – Leishmania parasite – Trypanosome parasites – Babesiosis parasites.
11. Demonstration of arbo-viral particles – IFA test

## **MPHEP 206: Application of Molecular biology, Immunology and Bioinformatics in Public Health Entomology**

### **PRACTICALS**

30 Hrs

1. Isolation and quantification of nucleic acids from parasite and mosquito vector
2. Isolation of plasmid DNA and Restriction endonuclease digestion (demo)
3. Primers designing for amplification of DNA fragments.
4. Amplification of DNA by PCR
5. Agarose gel electrophoresis of nucleic acids
6. Demonstration of RFLP, RAPD and SNPs for mosquito identification.
7. Demonstration of DNA bar coding.
8. Demonstrating real time PCR (gene expression/quantification).
9. Antigen – Antibody reactions, RDT (Malaria, Filariasis, Dengue), SDS-PAGE
10. Bioinformatics databases- Nucleic acids, protein and structure and databases and data retrieval.
11. Homology search by BLAST
12. DNA/Protein sequence analysis, multiple sequence analysis using BioEdit, ClustalW, ClustalX,
13. Phylogenetic analysis using Mega.



## MPHEP 207: Epidemiology of Vector Borne Diseases

### PRACTICALS\_

30 Hrs

1. Demonstration of survey methods - *Aedes*, *Anopheles*, *Culex* (Adult and immature).
2. Determination of Entomological Indices - Vectorial capacity (Malaria).
3. Estimation of *Stegomyia* Indices: House, Container, Breteau and Pupal Index.
4. Determination of Epidemiological Indices: Prevalence, Incidence for Malaria, Filariasis and Dengue (PHC Data/ Field surveys).
5. Disease epidemic/ outbreaks – Case studies – Investigation and Report writing.
6. Visit to sea port/airport health office to study formalized surveillance and reporting system.
7. Demonstration on GIS technology and Mapping.

## MPHEP 208: Biostatistics

### PRACTICALS

30 Hrs

1. Descriptive statistical measures (e.g. mosquito larval, parasite counts, etc.)
2. Charts and graphs (e.g. meteorological data, species composition by space and time)
3. Determinations of sample size for cross-sectional, prospective and case-control studies.
4. Ordinary least-square linear regression (e.g. vector infection vs. human infection).
5. Student's t-tests for paired and unpaired samples.
6. Chi-square test ( $2 \times 2$ ;  $2 \times n$ ) comparing proportions (e.g., susceptibility status by species)
7. One-way/two-way ANOVA (e.g. bioassay data by species /larval density by type of habitats and collection methods).
8. Probit model to biological assay data and lethal concentrations.
9. Logistic regression analysis and interpretation of odds ratios (e.g. disease presence-absence data, risk factors associated with disease)
10. Non-parametric tests: Sign test, Mann-Whitney U test, Kruskal-Wallis (one way ANOVA)  
Kolmogorov-smirnov one sample test – paired sample test – Wilcoxon signed rank test – paired sample rank test

# MPHET 301: Pesticides used in Public Health

## THEORY

65 Hrs

**Objective:** To learn about the pesticides and their usage in public health management.

### Unit I Introduction to pesticides

Pesticides in public health – Isolation and development of pesticides of plant and animal origin - Use of pesticides – History of pesticides/Insecticides– Definition of various terms — Classification of pesticides: According to hazardous category, chemical type, physical state, main use etc. – Chemical Pesticides – Bio-larvicides – Insect growth regulators – Mode of action – Advantages of chemical control and its utility in vector control – Pesticide formulations: Types of formulations – conventional and newer formulations (nano based) - Selection of formulations – Adjuvant – Combining insecticides: Physical and Chemical incompatibility – Combination and mixture insecticide formulations.

### Unit II Pesticide Application Equipment

Equipment: Types – Application – Types of nozzle – Control flow valve (CFV): Types and advantages – Determination of discharge rate – Determination of droplet size – classification of different sprays – Application procedures: Application rates – conversion factors – preparation of spray solution/suspension – conversion tables for dosages – Area measurement and dosage determination.

### Unit III Pesticide Regulation

Pesticide regulation policies – International policies: The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) – Registration – Approval criteria for registration – Pesticide issues and related legislation – Regional Policies: Pesticide problems in Asia – Policy and monitoring guidelines – National Policies: Insecticide Act in India – CIB & RC – Registration – Licensing – Product labelling – Notification of poisoning and cancellation of registration – Offences and Punishment.

### Unit IV Management of Public Health Pesticides

Elements of management of public health pesticides: Product registration – Procurement – Label – Storage and transport – Distribution – Application – Disposal – surveillance of pesticide poisoning – Quality control; Safe use of pesticides: general principles of safety measures – medical surveillance; Operative procedures: Preparation of spray materials – House treatment with residual spraying – Indoor and outdoor space spraying – Larvicidal – Rodenticidal – Herbicidal – Miticidal – Ixodidical treatments – Diagnosis and treatment of poisoning.

### Unit V Evaluation of Newer Insecticides/ Insecticides Formulations

WHO evaluation scheme – Evaluation of chemical adulticides/ larvicides/IGRs/bio-larvicides/ LLINs: Phase I: Laboratory evaluation – Phase II: Small-scale field evaluation (larvicides in natural or simulated habitats, adulticides & LLINs in experimental huts): Non-inferiority and Superiority trials – Phase III: Large scale (village level) field evaluation – Effect on non-target organisms – Ease of application – Operational feasibility and community acceptability – Evaluation: Repellents – Adulticides (IRS & Space

spraying) – Insecticide treated Nets and Fabrics – Evaluation indicators: Process indicators – Impact indicators – outcome indicators.

## **Unit VI Insecticide Resistance and Management**

Current status of insecticide resistance – Types of resistance – Impact of insecticide resistance on the control of vectors – Socio economic impact of resistance: Administrative, operational, Financial, Social and Agricultural implications – Detection and monitoring of vector resistance (Filter paper and Bottle assays): Determination of resistance frequency and intensity – Insecticide targets and mechanisms of resistance – Resistance management –Underlining concepts of resistance management strategies.

### **Suggested readings:**

1. Bert L. Bolimont. (2000). The standard pesticides user's guide. 5th edition, Prentice Hall Inc. New Jersey.
2. Clarke P. M., Tandy M. J., White B. Guidelines for the design of chromatographic analytical methods intended for CIPAC collaborative study: The determination of active ingredient in formulated materials by high performance liquid chromatography. CIPAC/4105/R.
3. Cremlyn R. (1979). Pesticides preparation and mode of action. John Wiley and Sons, Ltd., New York.
4. Haskell P. T. (1985). Pesticides application: Principles and practices. Clarendon Press. Oxford.
5. Indian Council of Medical Research (2012). Perspectives of Indian Medicinal plants in the management of lymphatic filariasis, ICMR.
6. Indian Council of Medical Research (2012). Phytochemical Reference standard of selected medicinal plants, ICMR.
7. Indian Council of Medical Research (2012). Quality Standards Indian Medicinal Plants, ICMR.
8. Jorgen Stenersen (2004). Chemical pesticides, mode of action and toxicology by CRC, Press, London.
9. Kenneth A. Hassall (1982). The chemistry of pesticides. The Macmiller Press Ltd., Hong Kong.
10. Rozendaal, A.J. (1997). Vector Control. Methods for use by individuals and communities. World Health Organization, Geneva.
11. Service MW (2008) Medical Entomology for Students by, Edition: illustrated, reprint, revised, Publisher: Cambridge University Press, ISBN:0521709288, 9780521709286, 289 pages
12. WHO (1985). Specification for pesticides used in public health. Insecticides- Molluscicides- Repellents-Methods. 6<sup>th</sup> edition, WHO. Geneva.
13. WHO (2016). Test procedures for insecticide resistance monitoring in malaria vector mosquitoes – 2nd ed. World Health Organization, Geneva, Switzerland. pp. 48.
14. WHO (2019). Data requirements and protocol for determining non-inferiority of insecticide treated net and indoor residual spraying products within an established WHO intervention class. WHO/CDS/GMP/2018.22. Rev.1.
15. WHO (2020). The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2019 Edition.
16. WHO (2022). Manual for monitoring insecticide resistance in mosquito vectors and selecting appropriate interventions. World Health Organization, Geneva, Switzerland 2022. Licence: CC BY-NC-SA 3.0 IGO
17. World Health Organization (1990). Pesticide application equipment for vector control. Twelfth Report of the WHO experts Committee on Vector Biology and Control. Technical Report Series 791. Geneva.

18. World Health Organization (1997). Chemical methods for the control of vectors and pests of public health importance, Geneva. WHO/CTD/WHOPES/97.2.
19. World Health Organization (2005). Guidelines for laboratory and field testing of mosquito larvicides WHO/CDS/WHOPES/GCDPP/2005.13.
20. World Health Organization (2005). Guidelines for laboratory and field testing of long-lasting insecticidal mosquito nets. WHO/CDS/WHOPES/GCDPP/2005-11.
21. World Health Organization (2006). Guidelines for testing mosquito adulticides for indoor residual spraying and treatment of mosquito nets. WHO/CDS/NTD/WHOPES/GCDPP/ 2006.3.
22. World Health Organization (2009). Guidelines for efficacy testing of insecticides for indoor and outdoor ground-applied space spray application. WHO/HTM/NTD/WHOPES/2009.2.
23. World Health Organization (2009). Guidelines for efficacy testing of house hold insecticide products. WHO/HTM/NTD/WHOPES/2009.3.
24. World Health Organization (2009). Guidelines for efficacy testing of mosquito repellents for human skin. WHO/HTM/NTD/WHOPES/2009.4.

**Outcome:** Empowering students for handling various spray equipment, pesticide application, rational use of pesticide and insecticide resistance management.

# MPHET 302: Control of Vectors of Public Health Importance

## THEORY

65 Hrs

**Objective:** To provide knowledge on the principles of vector control using appropriate intervention.

### **Unit I Introduction to Control of Vectors and Ectoparasites of Public Health Importance**

Vector control: Principle – Aims – objectives – goals – Importance and advantages – History and background – Alternatives to the use of insecticides – Ectoparasites of Public Health Importance and their control.

### **Unit II Principles of Vector Control**

Vector control at individual or at community or at both levels – Selection of appropriate control measures – Personal protection measures – Types of vector control- Selective, comprehensive and integrated methods - Recent trends in control of vectors of public health importance – use of *Wolbachia* and transgenic mosquitoes

### **Unit III Control of mosquitoes and flies (Black flies, Sand flies, Biting midges, Tabanids, Stable flies)**

Selection of suitable site-specific control measures- Personal protection measures – zooprophylaxis – Insecticide treated fabrics – Long lasting insecticide treated mosquito nets (LLINs) – Insecticide spraying (larviciding – indoor residual spraying – space spraying) – Alternatives – biological control – environmental management including source reduction.

### **Unit IV Control of Tsetse flies and Triatomine bugs**

Tsetse fly: Prevention and control – Traps and insecticide impregnated screens – Insecticide spraying (ground and aerial). Triatomine bugs: Introduction to control measures – Application of insecticides – insecticides and formulations – House modification/ improvement – improvement of Peri-domestic environment – insecticide treated bed nets – fumigant canisters.

### **Unit V Control of bedbugs, fleas, lice, ticks, mites and others**

Bedbugs: Detection – repellents – household measures – insecticide treated bed nets – smoke generators – smoke density – residual insecticide spraying; prevention and control of rodents (physical, trapping, application of baits) – control of rodent ectoparasites - control of fleas in human, rat, cat, dog control of lice (head, crab or pubic and body lice) – control of ticks: hard and soft ticks, - control of mites: trombiculid, scabies, dust and domestic mites – control of cyclops – fresh water snails – venomous arthropods.

### **Unit VI Control of cockroaches and house flies**

Cockroaches: Environmental management: cleanliness and hygiene, reduction of accessibility chemical and biological control – baits and traps – repellents – modern methods.

House flies: Inspection – Exclusion: Environmental sanitation and hygiene – habitat destruction – prevention of fly pathogen contact – food protection – prevention of man – fly contact – Mechanical – Biological and Chemical control.

## Suggested Readings:

1. Azad, A.F (1986). Mites of public health importance and their control. World Health Organization. Division of Vector Biology and Control (1986).
2. Barbara Ogg, Clyde Ogg and Dennis Ferraro (2006). Cockroach control Manual, Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln.
3. Benelli G, Jeffries CL, Walker T (2016). Biological Control of Mosquito Vectors: Past, Present, and Future. *Insects*. Oct 3; 7(4):52. doi: 10.3390/insects7040052. PMID: 27706105; PMCID: PMC5198200.
4. Changlu Wang, Chow-Yang Lee and Michael Rust (2021). Biology and management of German Cockroach, ISBN 978-1789248104, CABI Publishing.
5. Charles Gordon (2021). The House-fly, *Musca Domestica* Linn [microform]: Its Structure, Habits, Development, Relation to Disease and Control, Legare Street Press, Pp 1-424
6. Charles William Pitts (2021). Investigations on Insecticides as Feed Additives for the Control of the House Fly, *Musca Domestica*.
7. Dennis French, Tom Craig, Jerome Hogsette, Jr, Angela Pelzel-McCluskey, Linda Mittel, Kenton Morgan, David Pugh and Wendy Vaala (2016). External Parasite and Vector Control Guidelines, The American Association of Equine Practitioners.
8. Friederike Krämer, Norbert Mencke (2012). Flea Biology and Control: The Biology of the Cat Flea Control and Prevention with Imidacloprid in Small Animals.
9. Guidelines for integrated vector management for control of *Aedes* mosquito, Govt of India National Vector Borne Disease Control Programme, Directorate General of Health Services, Ministry of Health & Family Welfare
10. <https://ncvdbc.mohfw.gov.in/Doc/Guidelines-Mosquito-and-other-vector-control-response-2020.pdf>
11. <https://ncvdbc.mohfw.gov.in/WriteRead/Data/l892s/Compendium-Entomological-Surveillance & Vector-Control-India.pdf>
12. <https://ncvdbc.mohfw.gov.in/WriteReadData/l892s/Guidelines for use of larvivorous fish.pdf>
13. <https://ncvdbc.mohfw.gov.in/WriteReadData/l892s/Guidelines-for-ITNS-LLINS.pdf>
14. <https://www.who.int/news/item/16-11-2016-five-year-who-investigation-shows-that-llins-remain-a-highly-effective-tool-in-the-malaria-fight>
15. <https://www.who.int/teams/control-of-neglected-tropical-diseases/leishmaniasis/vector-control>
16. Ian F. Burgess (2004). Human Lice and their Control, *Annu. Rev. Entomol.* 49:457–81 doi: 10.1146/annurev.ento.49.061802.123253
17. WHO (2015). Indoor Residual Spraying. An operational manual for indoor residual spraying (IRS) for malaria transmission control and elimination,
18. Janet Wallace and Clive Boase (2018). Fly Management Guidance - Version 3.
19. Karl Maramorosch (2017). Biotechnology for Biological Control of Pests and Vectors, ISBN – 978-1315891200, CRC press, Pp
20. Lena Lorenz and Mary Cameron (2013). Biological and Environmental control of Disease vectors. CABI Publishing
21. Madeleine C. Thomson (1995). Disease Prevention through Vector Control Guidelines for relief organizations, Oxfam (UK and Ireland),
22. Gary R. Mullen, Lance A. Durden (2019). Medical and Veterinary Entomology. 3rd Edition, Academic Press, London.

23. Michigan Department of Community Health and the Michigan Bed Bug Working Group (2010). Michigan manual for the Prevention and Control of Bed bugs,
24. Ndiath, M.O. (2019). Insecticides and Insecticide Resistance. In: Arie, F., Gay, F., Ménard, R. (eds) Malaria Control and Elimination. Methods in Molecular Biology, Vol 2013. Humana, New York, NY. [https://doi.org/10.1007/978-1-4939-9550-9\\_18](https://doi.org/10.1007/978-1-4939-9550-9_18)
25. Norbert Becker, Dusan Petric, Marija Zgomba, Clive Boase, Minoo Madon, Christine Dahl and Achim Kaiser (2010). Mosquitoes and their Control. Springer Berlin, Heidelberg.
26. NVBDCP (2015). Manual on Integrated Vector Management (IVM Manual), Directorate of National Vector Borne Disease Control Programme, Govt. of India
27. Pat O'connor-marer (2006). Residential, Industrial, And Institutional Pest Control. Agriculture & Natural Resources; 2nd Ed,
28. Ramón Eduardo Rebolledo Ranz (2022). Insecticides - Impact and Benefits of Its Use for Humanity.
29. Robert Harris Hutchison (2018). A Maggot Trap in Practical Use: An Experiment in House-Fly Control, Forgotten books.
30. Seal SC. (1987). Plague: Conquest and eradication in India (Plague-prevention and control-India). Indian Council of Medical Research, New Delhi.
31. Stephen L. Doggett (2005). Bed bug ecology and control, Pests of Disease and Unease, Australia
32. van Emden HF and Service MW (2004). Pest and Vector Control, Online- DOI:<https://doi.org/10.1017/CBO9780511616334>, Pp 1-349.
33. World Health Organization (2022). Determining discriminating concentrations of insecticides for monitoring resistance in sand flies: Report of a multi-centre laboratory study and WHO expert consultations.
34. World Health Organization. (2020). Evaluation of genetically modified mosquitoes for the control of vector-borne diseases: position statement, October 2020. World Health Organization. <https://apps.who.int/iris/handle/10665/336031>. License: CC BY-NC-SA 3.0 IGO
35. World Health Organization. (2020). Multi sectoral approach to the prevention and control of vector-borne diseases: a conceptual framework. World Health Organization. <https://apps.who.int/iris/handle/10665/331861>. License: CC BY-NC-SA 3.0 IGO

**Outcome:** In-depth knowledge on selection and use of different intervention methods for control of arthropods of public health importance.



# MPHET 303: Integrated Vector Management

## THEORY

65 Hrs

**Objective:** To provide an in-depth knowledge on principles, concepts and developing IVM strategies.

### **Unit I Principles and key elements of Integrated Vector Management (IVM)**

introduction — Basic concepts and definition of Integrated Vector Management – IVM Framework - feasibility, merits and limitations – success stories –vector management- role of vector control in controlling/preventing vector borne diseases- planning IVM- situation analysis and needs assessment- implementation plan- monitoring and evaluation.

Global Vector Control response (GVCR): GVCR framework advocacy and resource mobilization-capacity strengthening- Support for basic and applied research- Regulatory and policy support-progress by WHO regions. Vector Control Needs assessment (VCNA): Background-objective-framework-methods-assessment- procedures – Four Pillars of Action.

### **Unit II Ecosystem and vector borne diseases**

Local Determinants of the Disease - Responses to vector borne disease in an ecosystem framework – food chain and food web – prey and predator interactions – water management – eco-epidemiological approach to address multiple vector borne diseases

### **Unit III Evidence based integration of vector control options**

Principles of vector control – personal protection measures – Selection of Vector control Tools - evidence based decision making process for integration of vector control options – Vector Assessment.

### **Unit IV Inter-Sectoral Convergence (ISC)**

Inter-sectoral Collaboration- Concept, Need, Scope & Various Stakeholders/Agencies - Process & Methods of inter-sectoral collaboration- Benefits & Constraints of ISC - sustainability of partnership- Experience of ISC at national and international level, Importance of public health acts in IVM strategy – Legislative Measures and International Health Regulation.

### **Unit V Community and Social Mobilisation**

Definition, Requirements, Principles and Process- Health Behaviour Models: Theories of Behavioural Change – Advocacy Workshops - Health Awareness and Assessing Health Behaviour Change: KAP Assessment. Communication for Health Promotion: Information, Education and Communication (IEC), Behavioural Change Communication (BCC), Social and Behaviour Change Communication (SBCC), Communication for Behavioural Impact (COMBI). Social Mobilisation for IVM Case Studies: Experiences in the control of vector borne diseases.

### **Unit VI Public Health and Agriculture practices**

Public Health and agriculture practices – Integration of Integrated Pest Management (IPM) and IVM Farmer's Field Schools – Safe Handling and Disposal of Insecticides and Pesticides.

## Suggested Readings:

1. Andrade C, Menon V, Ameen S, Kumar Praharaj S. (2020). Designing and Conducting Knowledge, Attitude, and Practice Surveys in Psychiatry: Practical Guidance. *Indian Journal of Psychological Medicine*.;42(5):478-481. doi:10.1177/0253717620946111
2. Asale, A., Kussa, D., Girma, M., Mbogo, C., & Mutero, C. M. (2019). Community based integrated vector management for malaria control: lessons from three years' experience (2016–2018) in Botor-Tolay district, southwestern Ethiopia. *BMC Public Health*, 19, 1-14.
3. Core structure for training curricula on integrated vector management ISBN 978 92 4 150278 8
4. Dobe. M (2022). Health Promotion and Education Foundations for Changing Health Behaviour. 1<sup>st</sup> edition Academic Publishers.
5. Glanz, K., Rimer, B. K., & Viswanath, K. (2015). *Health Behavior: Theory, Research and Practice*. San Francisco:4<sup>th</sup> edition Jossey-Bass.
6. Global vector control response 2017–2030 ISBN 978-92-4-151297-8
7. Guidance on policy-making for integrated vector management ISBN 978 92 4 150279 5
8. Handbook for integrated vector management. ISBN 978 92 4 150280
9. Herdiana, H., Kartika Sari, J. F., & Whittaker, M. (2018). Intersectoral collaboration for the prevention and control of vector borne diseases to support the implementation of a global strategy: A systematic review. *PLOS ONE*, 13(10), e0204659.
10. Jacobsen, K. H. (2020). *Introduction to health research methods: A practical guide*.3<sup>rd</sup> edition Jones & Bartlett Publishers.
11. Ministry of Health and Family Welfare (2013). Social and Behavior Change Communication. [https://pdf.usaid.gov/pdf\\_docs/PA00K6VP.pdf](https://pdf.usaid.gov/pdf_docs/PA00K6VP.pdf)
12. Monitoring and evaluation indicators for integrated vector management. ISBN 978 92 4 150402 7
13. Mutero, C. M., Mbogo, C., Mwangangi, J., Imbahale, S., Kibe, L., Orindi, B., ... & Mukabana, W. R. (2015). An assessment of participatory integrated vector management for malaria control in Kenya. *Environmental health perspectives*, 123(11), 1145-1151.
14. Ng'ang'a, P. N., Aduogo, P., & Mutero, C. M. (2021). Strengthening community and stakeholder participation in the implementation of integrated vector management for malaria control in western Kenya: a case study. *Malaria Journal*, 20, 1-14.
15. Okia, M., Okui, P., Lugemwa, M., Govere, J. M., Katamba, V., Rwakimari, J. B., ... & Chanda, E. (2016). Consolidating tactical planning and implementation frameworks for integrated vector management in Uganda. *Malaria Journal*, 15, 1-11.
16. Pennington, P. M., Rivera, E. P., De Urioste-Stone, S. M., Aguilar, T., & Juárez, J. G. (2021). A successful community-based pilot Programme to control insect vectors of Chagas disease in rural Guatemala. In *Area-Wide Integrated Pest Management* 1<sup>st</sup> edition (pp. 709-727). CRC Press.
17. Petkovic, J., Riddle, A., Akl, E. A., Khabisa, J., Lytvyn, L., Atwere, P., ... & Tugwell, P. (2020). Protocol for the development of guidance for stakeholder engagement in health and healthcare guideline development and implementation. *Systematic reviews*, 9(1), 1-11.
18. Salunke, S., & Lal, D. K. (2017). Multisectoral approach for promoting public health. *Indian Journal of Public Health*, 61(3), 163-168.
19. Sanders, K. C., Rundi, C., Jelip, J., Rashman, Y., Smith Gueye, C., & Gosling, R. D. (2014). Eliminating malaria in Malaysia: the role of partnerships between the public and commercial sectors in Sabah. *Malaria Journal*, 13(1), 1-12.

20. WHO. (2012). Communication for behavioural impact (COMBI): A toolkit for behavioural and social communication in outbreak response. <https://apps.who.int/iris/handle/10665/75170>
21. World Health Organization. (2020). Global vector control response 2017–2030. Geneva. 2017.
22. World Health Organization. (2012) . Handbook for integrated vector management. World Health Organization. <https://apps.who.int/iris/handle/10665/44768>

**Outcome:** Enabling the students to understand key elements of IVM, plan evidence-based decisions and implementation of appropriate intervention measures involving all the stakeholders in a cost-effective manner.

# MPHET 304: Vector-Borne Disease Control Programmes

## THEORY

65 Hrs

**Objective:** To provide an overview of health system and vector-borne disease control programmes at national level.

### Unit I Health System in India

National Health Policy 2017- Universal Health Coverage(UHC)- National Health mission(NHM)-National Rural Health Mission (NRHM)- National Urban Health Mission (NUHM)- District Health Plan - Strengthening of Vector Borne Disease Control Programme through Accredited Social Health Activist (ASHA)- Health Sub Centers (HSCs) - Primary Health Centers (PHCs) - Community Health Centers (CHCs)- Health planning and management- community engagement- Ayushman Bharat scheme- health protection scheme-health and wellness centres- One health approach for disease control and prevention

### Unit II Introduction to vector borne diseases control and prevention

Sustainable developmental goals- NCVBDC - disease control strategies: disease management- diagnosis and treatment, vaccination, chemoprophylaxis and chemotherapy-based control and prevention; Integrated Disease Surveillance Project (IDSP) -Health Management Information System (HMIS)- International health regulations (IHR) Role of media in vector borne disease control

### Unit III National Malaria Elimination Program

Problem statement: Global and India- - Early Case Detection and Prompt Treatment (EDPT) - Drug Distribution Centers (DDCs) and Fever Treatment Depots (FTDs) - Modified Plan of Operation (MPO) - Urban Malaria Scheme (UMS) - *P. falciparum* Containment Programme (PfCP) – Roll back malaria (RBM) - Management of drug resistance–National Framework for Malaria Elimination (NFME)(2016-2030) - National Strategic Plan for Malaria Elimination 2017-2022- Malaria elimination strategies- SWOT analysis, Malaria vaccines – National Drug Policy

### Unit IV National Program for Elimination of Filariasis

Problem statement: Global and India-History – Organization - current burden - Elimination of lymphatic filariasis (ELF) – Global Programme for ELF (GPELF) –Mass drug Administration-Morbidity management and Disability Prevention, Filaria survey-Antigenemia-Microfilaraemia-Monitoring and Evaluation-Transmission assessment survey- Recent advances – triple drug therapy, molecular xenomonitoring.

### Unit V National Kala-Azar Elimination Programme

Problem statement: Global and India- Endemic areas in India– Diagnostic & Treatment guidelines – Visceral Leishmaniasis, Post-Kala Azar Dermal Leishmaniasis, Cutaneous Leishmaniasis, Intervention strategies – elimination programme- early detection & treatment

### Unit VI Control of arbo-viral and other vector borne diseases

Trends in the outbreaks of dengue/chikungunya – clinical presentation and classification-diagnosis and case management, prevention and control strategies, dengue vaccine, Wolbachia based control strategies. Japanese encephalitis – Endemic and Epidemic situations – Acute Encephalitis Syndrome (AES) - Diagnosis and case management, JE vaccines, Immunization program.

Rickettsial diseases- Scrub typhus: Problem statement – clinical presentation-diagnosis-treatment-control strategies. Kyasanur Forest Disease (KFD) - Problem statement-clinical presentation-diagnosis-treatment-vaccines-prevention strategies.

Other diseases – Zika, Crimean Congo hemorrhagic fever, Plague

**Suggested Readings:**

1. Eldridge BF, Edman JD. (2012). Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods, Springer.
2. Jeremy F, Peter JH, Thomas J, Gagandeep K, David L, Nicholas JW. Manson's Tropical Diseases, 24/e, Elsevier Health 2024
3. Jugal Kishore. (2022). National Health Program Of India National Policies And Legislations Related To Health, 14/e, New Delhi, Century Publications 2022.
4. NCVBDC- <https://ncvbdc.mohfw.gov.in/>
5. Paniker CK, Ghosh S. (2021). Paniker's Textbook of Medical Parasitology, 9/e, Jaypee Brothers Medical Publishers.
6. Park. K. (2023). Park's textbook of preventive and social medicine, 27/e, Bhanot publishers.

**Outcome:** A thorough understanding on the health system in the country and national level control and elimination programmes envisaged for different VBDs.

## MPHEP 305: Pesticides used in Public Health

### PRACTICALS

30 Hrs

1. Handling of different pesticide application equipment-Pneumatic/compression sprayer for indoor residual spraying, Knapsack sprayer for larviciding, cold/thermal fogger for space spraying.
2. Determination of discharge rate of sprayers
3. Droplet size determination.
4. Determination of larval susceptibility to different insecticides: Preparation of stock solutions and serial concentrations; Methods of testing.
5. Determination of adult susceptibility to different insecticides: Preparation of insecticide impregnated papers; methods of testing: WHO Tube/Filter paper assay and Bottle assay.
6. Determination of adult susceptibility of house flies by topical application.
7. Laboratory evaluation of insecticides against different surfaces.
8. Evaluation of vaporizers/ aerosols/fumigants (vapour-borne toxicity).
9. Evaluation of larvicides/ bio-larvicides/insect growth regulators under field conditions.
10. Maintenance of spray equipment.
11. Residue analysis (Colorimetric methods; HPLC Technique).

## **MPHEP 306: Control of Vectors of Public Health Importance**

### **PRACTICALS**

30 Hrs

1. Characterization of mosquito breeding habitats.
2. Demonstration of environmental control measures.
3. Demonstration of application of bio-control agents.
4. Demonstration of personal protection materials / measures.
5. Demonstration of Insecticide treatment of mosquito nets/curtains + Cone bioassays
6. Demonstration of indoor residual spraying.
7. Demonstration of space spraying.
8. Demonstration of collection and control methods of mites.
9. Use of bait formulations for housefly and cockroach control.
10. Demonstration of housefly control using chemical and biological methods.
11. Rodent Ecto parasite Survey.
12. Demonstration of rodent control methods.

## **MPHEP 307: Integrated Vector Management**

30 Hrs.

### **PRACTICALS**

1. Situation analysis and vector control needs assessment (VCNA) for planning IVM in a given locality.
2. Survey on health awareness and behavior in a given community.
3. Conduct of Advocacy Workshop.
4. Construction of food chain-food web and energy flow in a pond/rice field ecosystem
5. Visit to IVM partners / stakeholders.
6. Visit to Farmers' Field School – identification and calculation of ratio between beneficial and harmful insects/predators.
7. Demonstration of community mobilization techniques.



## **MPHEP 308: Vector-Borne Disease Control Programmes**

### **PRACTICALS**

30 Hrs

1. Case detection and treatment of malaria.
2. Case detection and treatment of filariasis.
3. Filariasis morbidity management methods.
4. Demonstration of Dengue and JE - clinical features.
5. Case reporting procedures.
6. Visits to District Health Office/ Primary Health Centre: National Programme - Organization – Functioning.

# MPHERM 401: Research Methodology

## THEORY

65 Hrs

**Objective:** To provide basic knowledge on conducting research study

### **Unit I Good Laboratory Practice (GLP) and Research**

Good Laboratory Practice (GLP): Introduction - Fundamentals of GLP – definition - Types of research - application perspectives - Objectives - Paradigms of research

### **Unit II Reviewing the literature and developing frame work**

The place of literature review in research - clarity and focus to research problem - improving research methodology - broadening knowledge base in research area - enabling to contextualize research findings - review the literature searching for the existing literature and selected literature - developing a theoretical and conceptual framework

### **Unit III Formulating a research problem**

Importance of formulating a research problem - sources of research problems - considerations in selecting a research problem - steps in formulating a research problem - formulation of research objectives - the study population - establishing operational definitions - formulating a research problem in qualitative research

### **Unit IV Identifying variables and Constructing hypotheses**

Difference between a concept and a variable - Converting Concepts into variables – Types of variables - Definition of hypothesis - functions - testing - Types of hypotheses - Errors in testing a hypothesis - Hypotheses in qualitative research

### **Unit V Research Design and Constructing Instrument for Data Collection**

Quantitative and qualitative study designs - data collection - primary and secondary sources - The questionnaire constructing a research instrument in quantitative research - Pre-testing a research instrument - Prerequisites for data collection in qualitative research - developing evaluation methodology.

### **Unit VI The Research process**

Problem identification - planning research study - conceptualizing research design - sampling & selecting samples - constructing instrument for data collection – writing a research proposal - conducting a research study - collecting data - processing and displaying data - writing a Research Report – Glossary – Bibliography – Publication of Research findings – citation analysis – impact factor

## Unit VII Support Tools

**Ethics:** Concept - issues – vulnerable population - seeking consent - sensitive information –maintaining confidentiality – conflict of interest.

**Plagiarism:** Definition - types – consequences – research misconduct.

**Intellectual Property Rights (IPRs):** Introduction – Kinds of IPR – Patent, Copy Right, Trade Mark, Design, Geographical Indication – India’s National IP Policy.

### Suggested Readings:

1. Beall, J (2012) Predatory publishers are competing open access. *Nature*, 489(7415), 179-179
2. Chaddah P (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized
3. CR Kothari & Gaurav Garg (2019) *Research Methodology: Methods and techniques*
4. CSIR (2020) *Guidelines for Ethics in Research and in Governance*
5. ICMR (2017) *Handbook on Intellectual Property Rights and Technology Transfer*
6. ICMR (2019) *Policy on Research Integrity and Publication Ethics*
7. Indian National Science Academy (INSA), *Ethics in Science Education, Research and Governance (2019)*, ISBN:978-81-939482-1-7.
8. *Introducing Research Methodology (2017): A Beginner’s Guide to Doing a Research Project* by Uwe Flick
9. John W. Creswell and J. David Creswell (2018) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*
10. Kambadur Muralidhar, Amit Ghosh, Ashok Kumar Singhvi – INSA (2019) *Ethics in Science Education, Research and Governance*
11. MacIntyre, Alasdair (1967) *A Short History of Ethics*. London.
12. National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009) *On being a Scientist’ A Guide to Responsible Conduct in Research*; 3<sup>rd</sup> Edition, National Academies Press.
13. Ranjit Kumar (2019) *Research Methodology: A Step-by-Step Guide for Beginners*
14. Resnik D.B. (2011) *What is ethics in research & why is it important*. National Institute of Environmental Health Sciences 1-10.
15. Wayne C. Booth, Gregory G. Colombo, and Joseph M. Williams (2016) *The Craft of Research*

**Outcome:** Enabling students to propose projects and design research methods, interpretation and writing reports and thesis.