

## VARIOUS RESEARCH GROUPS IN THE DEPARTMENT

### **Helminthology**

Prof. Nirupama Agrawal

### **Protozoology/Parasitology**

Prof. A. K. Sharma

Dr. A. M. Saxena

Dr. Amita Kanaujia

### **Endocrinology/Chronobiology**

Prof. Sangeeta Rani

Dr. Shalie Malik

### **Entomology/Pest Management**

Prof. Omkar

Dr. Kalpana Singh

Dr. Geetanjali Mishra

Dr. Ashish Kumar

### **Environmental Toxicology/Fish Biology**

Prof. Madhu Tripathi

Prof. S. P. Trivedi

Prof. Sudhir Kumar

### **Fish & Fin-Fish Bio-Genetic Research**

Dr. Mohd Serajuddin

### **Molecular & Human Genetics/Molecular Endocrinology**

Prof. Sudhir Kumar

Dr. Monisha Banerjee

Dr. Mohd Arshad

Dr. Suchit Swaroop

### **Wild Life Conservation**

Dr. Amita Kanaujia

## Parasitology/Helminthology/Helminth Taxonomy/Protozoology

Helminthology is recognized as one of the thrust areas in UGC-SAP programme. Late Professor G. S. Thaper took the initiatives in this group in 1921. Later on, Late Prof. M.B. Lal, Dr. J. Dayal, Prof. K.S. Singh, Prof. Premwati, Dr. S. C. Baugh, Prof. S. P. Gupta, Prof. R. S. Tandon and several other eminent helminthologists contributed so much to the growth and development of this discipline that in the past this Department was known better for its research in helminthology. The Studies in the past have primarily been confined to the Systematics and life history of the different group of helminthes. Recently, inroads have been made into the newer and contemporary fields such ecological, zoogeographical, phylogenetical, and molecular aspects of helminth parasitology. **Professor N. Agrawal**, has taken the leadership in this regard and is currently engaged in analyzing the phylogenetic relationship of different monogenean worms at the molecular level. Today we have a strong group working in this area (see 8b for details). During the next five years, we plan to pursue the work on the following lines:

1. Helminth fauna of invertebrate and vertebrate hosts shall be studied and we propose to write monographs on:
  - i) Monogenean fauna of India, ii) Indian cercariae and metacercariae
2. Life cycle studies of monogeneans and digeneans worms.
3. Adaptation to the parasitic way of life, host-parasitic interactions, niches of parasites with emphasis on cleaning symbiosis, immunity and tissue reactions, effects on host individuals, host specificity, and microhabitats.
4. Pathological and biochemical studies.
5. Phylogenetical studies of monogeneans worms at molecular level.
6. Statistical analysis of collected data on monogeneans and digenean worms.

**Prof. A.K. Sharma** is working on parasitic protozoans with special reference to pathogenic and non pathogenic small free-living amoebae. Some of the important pathogenic amoebae studied in detail are *Naegleria fowleri*, *Acanthamoebae culbertsoni* and *A. Polyphaga*. His group is working on amphizoic amoebae responsible for infections in central nervous system causing "Amoebic meningitis" and in eyes causing "Amoebic keratitis" in human beings and domestic animals. Various aspects like biological characterization, pathogenicity, Chemotherapy and electron microscopy of these amoebae are studied. Besides variety of other protozoans like flagellates, ciliates etc. are also being studied from different habitats.

**Dr. A. M. Saxena** and his group are conducting quality research on the Morphotaxonomy of Acanthocephala and Trematodes. They have identified several new forms of these parasites. His group has embarked on the use of advanced molecular techniques in order to keep pace with modern research. Besides working on the taxonomy of Acanthocephala and Trematodes. Dr. A. M.

Saxena also carries out extensive research on indigenous blood sugar lowering plants and herbs such as *Momordica charantia*, *Tricosanthes dioica*, *Cucumis melo*, *Cucumis sativus*, *Tricosanthes anguina*, *Benincasa hispida*, *Swertia chirayita*, *Coccinia indica*, *Andrographis paniculata*, *Allium cepa*, *Ocimum sanctum* and *Trigonella foenum graecum*, *Feronia elephantum*, *Cinnamomum tamala*, *Ficus bengalensis*, *Syzygium cumini* etc.

**Dr. Amita Kanaujia** and her group are working in various environmental issues and their focus is on wild life conservation. She is also working with the parasites of various groups of vertebrates.

## **Endocrinology/Chronobiology**

This area is an upcoming and one of the few areas of animal sciences that deals with the systems biology. The group comprises of **Prof. Sangeeta Rani, Dr. Shalie Malik and Dr. Arshad**. The focus of the group is to study: (i) Regulation of biological clocks at the systems (read organism) level, (ii) Neural and endocrine mechanisms by which daily clocks and yearly calendars control temporal organization of circadian and seasonal behaviors and the sequence and duration of the life history stages, (iii) Integration of internal timing mechanisms with external cues: Mechanisms and neural pathways. (iv) Endocrinology of seasonal breeding in birds, (v) Endocrinology of osteoporosis. The model systems are non-migratory and migratory bird and fish species. Dr. Arshad plans also using the rat model system for osteoporosis studies. The techniques used by the group include (i) *In situ* hybridization and Immunohistochemistry, (ii) PCR and Real time quantitative PCR, (iii) Infrared videography for unobtrusive monitoring of nocturnal behavior of birds including sleep, (iv) Continuous monitoring by IR sensors of locomotion and food activity, (v) Anatomical modification in the brain in relation to seasons and physiological status. (vi) Endocrine perturbations and hormone assays, (vi) Studying seasonality in the non-invasive way (molt, body mass, fat score etc.), and (vi) cell culture (in vitro) studies.

The group's research is funded by DST, CSIR and UGC. DST has recognized the group under its IRHPA scheme as Center for Excellence (one of three centers in Animal Science in the country) to work on Biological Rhythm Research in Birds. The current project themes center on:

- I. Temporal organization of pre-migratory and migratory behaviors.
- II. Molecular biology of biological clocks in non-mammalian vertebrates.
- III. Neurobiology of seasonal behaviors. Seasonal changes in the song control system. Developmental changes in the brain (neurogenesis/ synaptogenesis) in response to seasonality and hormone status. Hormonal modulation of brain functions.
- IV. Endocrinology of seasonal behaviors (with reference to changes in melatonin, thyroid hormones and steroid hormones).

V. Physiology of migration. Identification of (novel?) proteins involved in initiation and termination of seasonal behaviors.

VI. Changes in gene expression and protein levels in relation to changes in the migratory status, and to determine whether these changes allow normally diurnal birds to become nocturnally active during migration.

VII. Understanding the proximal mechanisms by which biological clock times reproduction and associated events.

VIII. Endocrinology of seasonal breeding (role of GnIH, GnRH).

IX. Biological rhythm studies and measurement of melatonin in fish.

## **Entomology and Pest management**

The department has done sufficient work on the taxonomy, morphology and physiology of insects of economic importance and has some landmark contribution in the area under the leadership of Late Professors P.D. Gupta, Ram Rakshpal, B.K. Tandan, Prof. Minakshi Shrivastava etc. **Prof. Omkar** is currently active in this field of research. Professor Shrivastava was interested in structural and functional modifications of the insect sensillae, and areas using insects inhabiting diverse habitats. Supported by the ICAR and U.P. State Council of Science and Technology, **Prof. Omkar, Dr. Kalpana Singh, Dr. Geetanjali Mishra** and their lab is working on ladybird beetles, an established and well known predator of aphids, thrips scale insect, mealy bugs, mites and several other insect pests. His research focus is mainly on the use of ladybirds in biocontrol involving laboratory and green house investigations on their life-history and predatory traits, mass multiplication under laboratory conditions, and subsequent well-planned releases based on a detailed study of local abiotic and biotic factors. Plant species, architecture and density in target areas may influence the degree of success of a biocontrol agent.

Furthermore, studies designed to assess local insect populations and their interactions with the introduced predators are of immense consequence to the success of biocontrol. Despite the success of ladybirds against certain prey, history has been a witness to numerous failures because of the lack of attention to the above-mentioned research areas. The aim of this lab is to assess locally abundant ladybird populations for their potential as biocontrol agents by conducting experiments under the following heads: Future plans are as follows: investigations on various life history traits of predaceous ladybirds will be conducted under laboratory conditions in BOD incubators, (ii) prey-predator interactions will be observed and studied in the laboratory as well as in glass house environment, and (iii) predator-predator interactions will be observed and studied in laboratory as well as in glass house environment.

**Dr. Ashish Kumar** has research experience in Entomology and environmental science and wishes to pursue research in these areas.

## Environmental Toxicology/Fish Biology

**Prof. Madhu Tripathi** and her group is working in the field of aquatic toxicology with fish as the experimental model and analyzing the effect of chemical contaminants (specially fluoride) which are polluting the water bodies. A lot of work has been carried out regarding the effect of fluoride on human beings and other mammalian models but there are no reports on fishes despite their great economic and nutritional value. Effect of fluoride in fishes is being observed in the respect of (i) Behavioural observations such as Feeding, Locomotion and Respiration; (ii) Morphometric observations such as Gonado- Somatic Index (GSI), Hepato- Somatic Index (HSI) and Growth Rate; (iii) Histology/Histochemistry of vital organs such as pituitary, liver, kidney, gonads and gills; (iv) Related 'Biochemical Parameters'; (v) Genotoxicity in terms of CAT, MNT and other parameters.

**Prof. Sunil P. Trivedi** has specialization in Ichthyotoxicological and Environmental studies. His expertise lies in the field of water quality monitoring studies involving fishes as models. Presently, he and his group is engaged in working out phytoremedial measures against xenobiotic stress in Indian fresh water food fishes involving cytogenetic end-points viz., CAT, MNT, and DNA damage and repair measurements through SCGE/Comet Assay and RAPD-PCR. **Prof. Sudhir Kumar** is working in the field of genotoxicity.

## Fish and Fin-Fish Bio-Genetic Research

Fishes are one of the most heterogeneous groups and offer a great potential for studying the intraspecific diversity. The Fin-Fish Bio-Genetic Research Lab presently centre on the intraspecific diversity/stock analysis study. The specific areas are:

1. Phenotypic plasticity
2. Genetic polymorphism
3. Life history traits

Phenotypic difference between groups/populations in the wild may reflect genetic differentiation and environmental differences, or a combination of both. The focal point is elucidation of ecotype i.e. phenotypic manifestation of genetic polymorphism. For this study, **Dr. Mohd. Serajuddin** and his group propose to use allozymes and RAPD (Random Amplified Polymorphic DNA) techniques after validation of variations by morphometric, meristic and truss analysis. Efforts are being made to correlate the segregated stocks with their life history traits such as growth, fecundity, spawning and reproduction.

## Molecular & Human Genetics

The 21<sup>st</sup> century has been declared as the century of biological sciences because a vast treasure of molecular information on genomes has emerged as a

result of the Human Genome Project. The Human Genome Project has contributed greatly to the study of inherited diseases and other biological phenomena. This information can be utilized for human health and welfare. Proper interpretation of this enormous genetic information requires understanding of the concepts and widespread education in this area. The Department of Zoology, University of Lucknow has a wide variety of animal models which can be a major asset for genetic studies. Research programmes on molecular systematics of parasites and molecular genetics of human diseases are some of the areas which are already under development.

Molecular and Human Genetics is a new addition in the departmental research profile. As molecular biology and biotechnology are the frontier areas in biological sciences, a modest beginning has been made in this field. **Prof. Sudhir Kumar** and his group are working in the areas of bioinformatics and male infertility.

**Dr. Monisha Banerjee** has recently set up the Molecular & Human Genetics Lab in the department where she and her team are pursuing genetic studies on Type 2 diabetes mellitus and its related complications, cervix cancer and molecular aspects of prenatal diagnostic methods. **Dr. Mohd. Arshad** specializes in Molecular Endocrinology and intends to work on postmenopausal osteoporosis and has established *in vitro* and *in vivo* test systems for evaluation of anti-osteoporotic agents. The cell culture laboratory in the department is in the process of getting established. **Dr. Suchit Swaroop** has interest and experience in parasitology, immunology and biotechnology and wishes to pursue research in these areas.

In the last few years major initiatives have been taken in the department in this frontal area of modern and applied biology both in teaching and research activities.