Molecular Genetics for Aquatic and Marine Biodiversity Conservation

Course Code: 176040H01 .....

Overview

In a wider standpoint, conservation genetics uses a combination of ecology, molecular biology, population genetics, evolutionary taxonomy and mathematical modelling. It is mutually a basic and an applied science. First, scientists must understand the genetic relationships among the organisms they're interested to study. Moreover, wildlife experts use techniques to preserve biological diversity in these species. The organisms that conservation geneticists study usually belong to endangered or threatened populations. To develop ways to help these populations, scientists ask two questions: What has brought these populations to the brink of extinction, and what steps can we taken to reverse this trend? Information about the genetic diversity of the organisms under study helps scientists and managers establish strategies where past conservation efforts have addressed populations from a mathematical, evolutionary, or taxonomic point of view. Modern efforts include genetic studies, giving conservation scientists and ecological managers much more information about the diversity among the individuals in a population. Without genetics, we may conserve the wrong population or waste valuable resources on a population that isn't endangered.

Considering the importance of molecular genetic analysis, course would consist of lecture and practical sessions to familiarize students and faculties with the basic theory and practice of molecular genetics that involve genetic principles, marker selection, sample size, sequence assembleance and data analysis using various softwares and programmes. More emphasis will be given for inference making out of the results analysed from the genetic data for conservation.

Modules	**A: Molecular genetics for aquatic and marine biodiversity conservation :** **March 12 - 21, 2019** **Number of participants for the course will be limited to fifty.**
You Should Attend If…	▪ Engaged in ecological research with a biology background ▪ You are zoologist, botanist, microbiologist, biotechnologist or veterinary professionals. ▪ You are a student or faculty from academic institution interested in learning how to do research on molecular genetist or molecular biologist or want to work with molecular data for bioinformatics analysis.
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $200** **Industry/ Research Organizations: INR 5000.00** **Academician : INR 3000.00; Research Students : INR 1500.00** The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.
Registration	Link for GIAN portal: http://www.gian.iitkgp.ac.in/GREGN/index

The Faculty

Professor David Haymer is a professor of molecular biology at university of Hawaii at Manoa, USA. He is investigating the use of genetic markers to study the population dynamics of insect pest species. He is also using a similar approach to document evolutionary relationships of species forming a complex. Cloning and characterization of genes involved in sex determination is another area of his expertise. Using a differential hybridization approach to identify genes involved in the sex determination process in several insect pest species, he have identified a number of candidate genes that appear to be expressed in only one sex. These are being analyzed to determine the extent to which they may be involved in the sex determination process.

Professor Gulab Khedkar is Director of the Paul Hebert Centre for DNA Barcoding and Biodiversity Studies which oversees DNA barcoding involvements in India. He is a Professor of Molecular Biology in the Department of Zoology and Director of its Centre for Coastal and Marine Biodiversity. India is home to at least 0.6 million species (about 7% of global diversity), but only 17% are known. To speed their discovery, Dr. Khedkar has promoted DNA barcoding through workshops, training courses, and collaborations. His laboratory works in the general area of evolutionary biology with a focus on aquatic organisms that combines lab and fieldwork. From a methodological perspective, he exploits diverse techniques for the molecular characterization of population (e.g. microsatellites, DNA sequencing, genome sequencing) and modelling. He is exploring genome size variation among species, and its impact on life history traits. Aside from metabarcoding studies on microbes from different ecosystems, he is probing mitochondrial evolution by assembling complete genomes for 500 taxa. He is also developing molecular protocols to aid food authentication.

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Course Co-ordinator

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Schedule of the Course on molecular genetics for aquatic and marine biodiversity conservation

Date	Topic	Time	Professor Name	Lecture/Practical
12/03/2019	Inauguration	**11.30-12.00**	**VC, DH, GD, RD**	
12/03/2019	Basic Principles of Heredity, Sex Determination and Sex-Linked Characteristics	**12.30-13.30**	**DH**	**Lecture**
	Ploidy in natural populations and its consequences	**14.30-15.30**	**GDK**	**Lecture**
	Molecular genetic analysis and biotechnology	**16.00-18.00**	**DH**	**Practical**
13/03/2019	Theory and practice of molecular genetic analysis: basic principles, historical developments, need and future	**10.30-12.00**	**DH**	**Lecture**
	Role of genetics in ecology and conservation: ecological sciences and conservation recent trends	**12.30-13.30**	**DH**	**Lecture**
	Components considered for ecological modelling, concept of speciation and community, marine ecology as a base of life	**14.30-15.30**	**GDK**	**Lecture**
	Problems related to genetic traits and mechanism to resolve them using various approaches	**16.00-18.00**	**DH**	**Practical**
14/03/2019	Species as an ecological unit: Molecular concept of taxonomy, classical examples of challenges associated with morphological taxonomy, recent development in the field of DNA barcoding.	**10.30-11.30**	**GDK**	**Lecture**
	Molecular markers and their applications: historical review of development of molecular markers	**11.30-12.30**	**DH**	**Lecture**
	Practice of DNA Barcoding data analysis, sequence alignment, and problem resolving session.	**14.30-16.30**	**GDK**	**Practical**
15/03/2019	Molecular markers and their applications: comparative account of various marker, Nuclear markers vs. Mitochondrial markers.	**10.30-11.30**	**DH**	**Lecture**
	River ecology, case studies on large river basin modelling and use of markers.	**11.30-12.30**	**GDK**	**Lecture**
	Case study on drosophila population genetics, data analysis and development of predictive models for population vulnerability.	**14.30-16.30**	**DH**	**Practical**
16/03/2019	Principle of populations genetics : concept of a population, alfa, beta and gamma diversity and molecular analysis of heritability, and genetic diversity relations, etc.	**10.30-11.30**	**DH**	**Lecture**
	Modes of inheritance: Nuclear versus organelle, Haploid chromosomes, and Uniparental markers: a cautionary note.	**11.30-12.30**	**DH**	**Lecture**
	Genetic analysis of single populations: quantifying genetic diversity, quantifying genetic diversity, Useful websites and software.	**14.30-16.30**	**DH**	**Practical**
17/03/2019	Molecular marker development strategy, marker optimization, result interpretations and its inference.	**10.30-11.30**	**DH**	**Lecture**
	What is phylogeography? Application in phylogenetic analysis in population analysis.	**11.30-12.30**	**GDK**	**Lecture**
	Building phylogenetic tree, application of molecular clocks, Bifurcating trees, The coalescent and its applications.	**14.30-16.30**	**GDK**	**Practical**
18/03/2019	Molecular approaches to behavioural ecology, Mating systems, Manipulation of sex ratio, Sex-biased dispersal.	**10.30-11.30**	**DH**	**Lecture**
	Applications of molecular ecology: Wildlife forensics, Agriculture, Fisheries	**11.30-12.30**	**GDK**	**Lecture**
	Development of laboratory protocols for forensic investigations	**14.30-16.30**	**DH**	**Practical**
19/03/2019	Evolutionary genetics: acquainting mutation,	**10.30-11.30**	**DH**	**Lecture**
	DNA variation mapping, restriction site mapping, and various modes to map evolutionary changes in DNA motif	**11.30-12.30**	**DH**	**Lecture**
	Various technologies and their application is molecular genetics	**14.30-16.30**	**GDK**	**Practical**
20/03/2019	Next generation sequencing technology and its application in micro community analysis for aquatic ecology	**10.30-11.30**	**DH**	**Lecture**
	Barcode of life data systems and its practice	**11.30-12.30**	**GDK**	**Lecture**
	Conceiving manuscript and report writing, use of endnote and online tools	**14.30-16.30**	**DH**	**Practical**
21/03/2019	Conceiving manuscript and report writing, use of endnote and online tools.	**10.30-11.30**	**DH**	**Lecture**
	NCBI/BOLD data submission, retrieval and analysis.	**11.30-12.30**	**GDK**	**Practical**
	Use of online tools for data analysis, referencing and data visualization	**14.30-16.30**	**DH**	**Practical**

Paul Hebert Centre for DNA Barcoding and Biodiversity Studies

About Us

Our core purpose is to create knowledge and develop applications to sustain natural systems on which all life depends.

Biodiversity measures the variation of life shaped through ecology and evolution from genes to species and ecosystems. The Paul Hebert Centre for DNA Barcoding and Biodiversity Studies, Dr. Babasaheb Ambedkar Marathwada University (BAMU) is the nodal centre of DNA barcoding and it's Paul Hebert Centre for DNA Barcoding and Biodiversity Studies (PHCDBS) is dedicated to the study of biodiversity at the species level and the advancement of this field of research.

PHCDBS is also the focal point for all biodiversity-related research at BAMU to benefit over 50 Indian scientists across all Colleges and most departments. This **Interdisciplinary Biodiversity Initiative at PHCDBS** brings together all the BAMU biodiversity-related research community, and strengthens the individual potential to accelerate outcomes through collaborative action. A critical mass of expertise covering all aspects of biodiversity science makes it possible to tackle problems with innovative approaches in ways that cannot be achieved by any one partner alone. Members of PHCDBS research all facets of biodiversity-related problems from soil microbiome to human gut microbiome and social, ethical and legal issues associated with emerging science.

Our research outcomes are applied to design solutions to major needs of industry and society ranging from breeding better plants, improving and protecting animal and human health, stepping-up conservation and environmental assessments, detecting marketplace fraud, to enabling to more effective control of invasive pest species and disease vectors.

Our Vision

To map the biodiversity for future generations using DNA as a base of life, and to demonstrate how this capability advances scientific and societal goals.

Our Mission

Leadership

To remain a national leader in the development of DNA-based approaches for specimen identification and species discovery with a focus on multicellular life.

Collect and Index

To complete the inventory of all species by automating the analysis of biodiversity through the coupling of advanced DNA sequencing technologies with high performance computing.

Educate to Protect

To provide the information needed to better manage biodiversity with the goal of minimizing the loss of populations and species.

Support Global Science

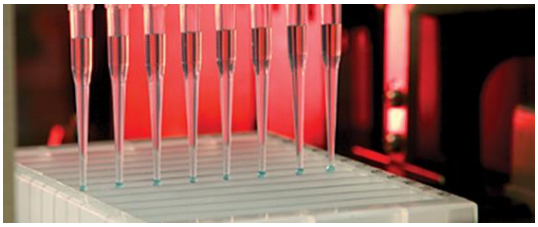
To develop the international collaborations that will allow biodiversity science to establish and operate a Global Research Infrastructure.

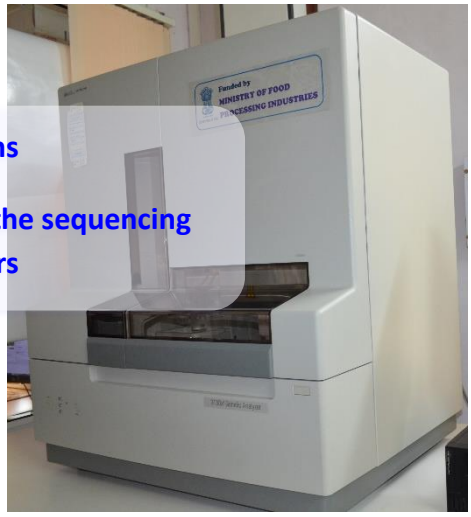
Our Values

- The PHCDBS is committed to the transformation of biodiversity science and will achieve this by working closely with other researchers and research organizations in India.
- The PHCDBS is committed to advancing understanding of new approaches in biodiversity science through its involvement in educational and national development programs.
- The PHCDBS is committed to the professional advancement of its staff and to the strong integration of its Units.
- The PHCDBS is committed to advancing the scientific reputation of its home institution, its states, and its nation.

Facilities

First established as a core genomics facility to enable research programs of the PHCDBS's scientific team, is now the India's largest analytical hub for DNA barcoding with the primary goal of delivering the most reliable and comprehensive species genetic identification service.





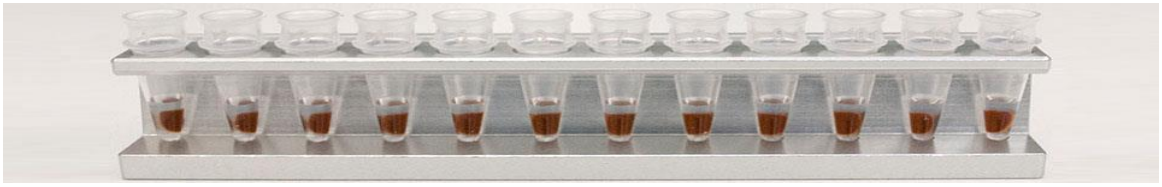
Sanger Sequencing Platforms

PHCDBS developed own protocol to cut the sequencing costs, affordable to our users

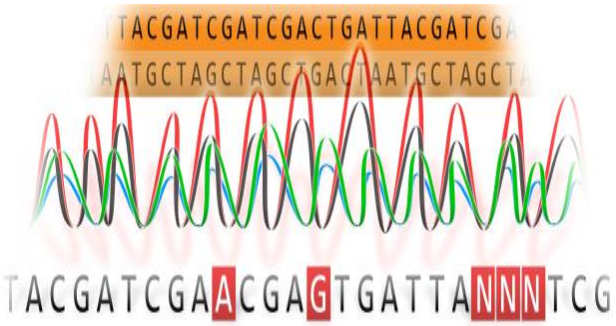
Next Generation Sequencing Platforms for second line massive sequencing of genomes and metagenome projects

Services

The Paul Hebert Centre for DNA Barcoding and Biodiversity Studies provides analytical support to its academic partners, government researchers, and private sector clients. Building on its expertise in field operations, molecular biology, and bioinformatics and strengthened by more than a decade of leadership in the DNA barcoding community, the PHCDBS offers a wide range of services.



Sequencing Services



Our end-to-end DNA barcoding and other genomic solutions begin with user consultation and finish with a sample-to-answer workflow. All stages are completed in our core analytical facility.

The PHCDBS has the research infrastructure and expertise to support both discovery science and applied research. Whether your project involves assembling a barcode reference library or environmental assessment, our staff can complete every step from sampling and databasing to data generation and interpretation.

For every project – from a single sample to thousands of specimens, from high to low DNA concentrations, from single source to mixed samples, from biological traces to eDNA detection – we use conventional protocols and break-through patented techniques powered by liquid handling platforms and sequencing technologies from Sanger and third generation DNA sequencers.

Applications

How can we help you

At PHCDBS, we apply our technologies and develop solutions designed to solve biodiversity problems, no matter what their size or area of activity. From R&D collaboration to services to training, we offer the highest quality level of science and share the risks associated with innovation.

We wish to address industry and public concerns where effective biomonitoring assessment and accurate species identification are critical:

- Environmental surveillance/monitoring – tracking the impact of human activities on the environment; gauging the success of restoration efforts; monitoring water quality and aquatic ecosystems
- Endangered species – enhancing taxonomic and ecological knowledge about endangered species and creating a diagnostic framework for monitoring and curbing illegal harvest and trade
- Invasive species – identifying and monitoring invasive organisms and their ecological impact, improving diagnostic measures to prevent cross-border transfer of alien species
- Agriculture and forestry – identifying and monitoring agriculture and forestry pests and biological control agents
- Human health – identifying and monitoring human disease vectors and reservoirs; reconstructing ecological relationships between the components of natural-borne disease foci
- Market surveillance – detecting product substitution in foods and herbal products, revealing contaminated food sources