

Introduction

– Programme: 6 November –

- **Introduction of the Joint Experimental Molecular Unit - 15 min**
- **Introduction of the participants – expectations - 15 min**
- **Laboratory facilities in the RBINS and RMCA - 15 min**
- **Break**

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- **Mechanisms and reasons of evolution** - 45 min

Basics of molecular genetics

Definitions and structure of the genetic information

DNA (coding and non-coding regions)

From genes to proteins

Genomes

Variability and inheritance of the genetic information

Mutations

Mitosis and meiosis

Recombination

Polyploidy

Rearrangement of DNA fragments etc.

Genetic markers

Considerations to finding appropriate markers

Markers in the nuclear genomes (coding and non-coding regions)

Markers in the mitochondrial genomes

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The evolution of DNA sequences

Nucleotide substitutions: point mutations/SNPs

Insertions/Deletions

Rearrangement of gene fragments

Molecular clocks – molecular dating

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- **The use of molecular tools in zoology and botany - 75 min**

Brief historical overview

Laboratory methods of molecular evolution and systematics

- Allozyme analyses

- DNA fingerprints (RFLP)

- PCR methods

 - DNA sequencing

 - Fragment analyses

 - Microsatellite analyses

 - AFLP

 - RAPD

 - ISSR-PCR

 - other methods

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Molecular systematic analyses and tree reconstructions

Alignment of DNA sequences

Evolutionary distances and genetic divergence

Methods of tree reconstructions

Parsimony

Maximum likelihood

Bayesian inference of phylogeny

Direct optimization etc.

Break – during the break, visit of the labs are possible

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- **Molecular genetic investigations in natural history collections - 60 min**

From specimens to DNA

- Natural historical collections - “specimen banks”

- Collecting information on voucher specimens - “data banks”

- Building-up and maintaining of tissue collections - “tissue banks”

- Preservation of DNA - “DNA or gene banks”

DNA extraction from museum specimens

- considerations on preservation issues

 - alcohol collections

 - use of ethanol and other alcohols

 - problems with formalin-fixation etc.

 - dry collections

 - whole animal specimens

 - plant collections

 - bone, skull, feather etc. collections

 - skins, exuviae etc.

 - (sub)fossils – archaic DNA

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- **Molecular identification of museum specimens - 45 min**

Definition of the DNA barcoding

Archiving genetic information on specimens

The Consortium for the Barcode of Life

Use and importance of databases

Practical issues on barcoding – molecular genetic investigations

- DNA extraction from type specimens

- Co-operations with taxonomists

- Co-operation with other institutes nation- and worldwide

Other issues on molecular identification - examples

- Identification for CITES

- Molecular identification of trade samples (e.g. caviar)

- Molecular identification of disease vectors (e.g. mosquitos, mice, flies)

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- **Presentation of ongoing projects** – 45 min
 - Erik Verheyen: DNA barcodes for African Muridae
 - Massimiliano Virgilio: Tephritid Barcoding Initiative
 - Céline Poux: Molecules consolidate the placental mammal tree
- **Call for JEMU proposals**
- **Closing discussion**