Course Overview: Marine Genomics

Prerequisites

- DNA structure: double stranded, base pairing, nucleic acids
- DNA to protein: codons, reading frames
- PCR: primers, reverse complementarity
- Species, populations, individuals
- Mendelian inheritance of nuclear DNA (homologous, diploid chromosomes, meiosis, mitosis)
- Uniparental inheritance of mitochondria & chloroplasts
- The central dogma of molecular biology: DNA – transcription – mRNA – translation – protein
- Interpretation of p values of statistical results

Course Content

Individual Level

- Heritability of physiological & morphological traits
- Phenotypic plasticity
- Quantitative genetics
  - Genome scans
  - QTL analyses
  - RNA-seq

Species Level

- Phylogenetics
  - Databases
  - Sequence alignment
  - Estimating genetic distances
  - Tree building (Maximum Parsimony, Maximum Likelihood, Bayesian)
  - Calibrating phylogenies
  - Evaluating hypotheses
- Species-delimitation
- Phylogeography & intraspecific divergence

Population Level

- Population Genetics
  - Concepts: alleles, heterozygosity
  - Drift (Wright-Fisher Model)
  - Dispersal
  - Population structure
  - Selection & Mutation
  - Models describing maintenance of genetic variation
- Population Genomics
  - Reduced representation libraries
  - NGS-based genome reduction (Radseq, GBS)
  - Outlier detection
- Phylogeography
- Organelle (mtDNA) & co-dominant markers (microsatellites)

Community level

- DNA Metabarcoding
- Amplicon sequencing
- qPCR
- Metagenomics
  - Metatranscriptomoics, metaproteomics, metabolomics

End Competences

1. The graduated student understands the ecological and evolutionary processes acting at the genomic level in populations of marine organisms.
2. The graduated student has a good knowledge of the terminology used in the field of molecular ecology.
3. The graduated students understands the underlying principles of the commonly used molecular techniques, including preservation of tissues and specimens.
4. The graduated student is able to make a considerate choice of molecular techniques to address specific ecologically or evolutionary questions.
5. The graduated student has acquired the knowledge to correctly analyse and interpret molecular datasets from the individual to the community level.

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