



## Practical Course on Phylogenetics Faculdade de Ciências da Universidade de Lisboa

### Organizers:

Computational Biology & Population Genomics Group (<http://cobig2.fc.ul.pt>)  
Centre for Ecology, Evolution and Environmental Changes

**Teacher:** Octávio Paulo (DBA professor, cE3c researcher)

**Calendar:** January 30<sup>th</sup>-February 3<sup>rd</sup> 2017

**Duration:** 36 hours

**Schedule:** 13h-20h, Monday-Thursday; 13h-21h Friday

### Objectives:

Phylogenetics is one of the scientific areas of Biology that has grown fast and evolved in methodological terms in the last years. Its applications go from the studies of the evolution of species and populations to the least expected, as the study of the origin of the AIDS virus or seasonal cycles of the flu. The course is aimed at students and professionals that intend to get started in phylogenetic analysis as well as researchers already with some experience wanting to deepen or update their knowledge in the field. The course consists of theoretical classes as well as hands-on practical sessions using software. Participants are encouraged to bring their own sequence data for analysis.

### Objectivos:

A Filogenética é uma das áreas científicas das Ciências da Vida que mais tem crescido e evoluído metodologicamente nos últimos anos. As suas aplicações vão hoje desde o estudo da evolução das espécies e populações animais até às mais inesperadas, como o averiguar da origem do vírus da Sida ou dos ciclos sazonais de Gripe.

O presente curso é destinado a estudantes ou profissionais que pretendam iniciar-se na análise filogenética e também a investigadores já com alguma experiência mas que queiram aprofundar e actualizar os seus conhecimentos. O curso consistirá em aulas teóricas alternadas com aulas práticas de utilização de software. Encorajam-se os participantes que tenham dados de sequências a trazê-los para análise.

### Resume

Brief historic perspective about phylogenetics and molecular evolution. Review of the basic concepts regarding genome organization, structure and function of genes, genetic codes and mutation types.

Basic principles of phylogenetic analysis: character evolution, homologies and homoplasies, evolutionary tree types, types of data sets for analysis etc.

Methods of phylogenetic inference: parsimony, distances, maximum likelihood and Bayesians. Models of molecular evolution. Substitution rates and patterns. Methods of model selection. Search algorithms and optimization solutions. Exhaustive and heuristic searches. Analysis of the robustness of phylogenetic trees and their components. Hypothesis testing on evolutionary trees.

**This course can have a recognition of 6 ECTs for FCUL PhD students enrolling in it as part of their first doctoral year. For FCUL PhD students only requiring 5 ECTs recognized in their specific PhD programmes the last 6 hours of the course are not mandatory and the certificate will be on 'Topics in Phylogenetics'.**

### **Programa**

Dia 1 – Segunda-feira

13h00 – 16h00 - Introdução à filogenética; princípios básicos; alinhamentos

16h30 – 20h00 - Utilização de Sequencher e BioEdit para tratamento das sequências e construção de matrizes

Dia 2 – Terça-feira

13h00 – 16h00 - Inferência por máxima parcimónia e distâncias

16h30 – 20h00 - Obtenção de sequências no Genbank; alinhamento com o Clustal, Concatenator e Mega5

Dia 3 – Quarta-feira

13h00 – 16h00 - Modelos de evolução e Máxima verosimelhança

16h30 – 20h00 - Utilização do PAUP para análise de máxima parcimónia e de distância e máxima verosimelhança.

Dia 4 – Quinta-feira

13h00 – 16h00 - Inferência bayesiana

16h30 – 20h00 - Utilização de MrBayes para inferência bayesiana. Alternativas ao PAUP para máxima verosimelhança.

Dia 5 – Sexta-feira

13h00 – 16h00 - Bootstrap, testes e search

16h30 – 21h00 - Aplicações dos conceitos; Análise de casos de estudo propostos pelos estudantes

**Location:** Departamento de Biologia Animal, FCUL

**Nº (min, max) students:** 15-20 students

**Minimum formation:** students of 'Licenciatura' (bachelor) in Biology

**Fee:** free for 1<sup>st</sup> year PhD students in the Doctoral programme in Biology (UL), Biodiversity, Genetics and Evolution (UL; UP) and Biology and Ecology of Global Changes (UL; UA) when the course counts credits for their formation, in which case the delivery of a final report done after the course is mandatory; 300 euros for Professionals and postdocs, 250 euros for BTI, BI and PhD students and 180 euros for master and bachelor students in FCUL as well as unemployed

When the maximum number of students is reached 10 vacancies will be available for non-paying 1st year PhD students mentioned above, being, by order of preference: 1) cE3c students; 2) BIODIV students (not from cE3c); 3) FCUL students (not from cE3c); 4) BEAG students (not from FCUL).

**Deadline for applications:** January 8th 2017

To apply send an e-mail to [octavio.paulo@fc.ul.pt](mailto:octavio.paulo@fc.ul.pt) with the following information:

Name:

E-mail:

Phone:

Professional activity: Professional/Postdoc

BTI, BI, PhD student (with/ without scholarship) Lic./Master student

Academic formation:

Institution:

Student of the 1st year of Doctoral programme Biodiv (FCUL/FCUP), Biologia (FCUL) or BEAG (FCUL or UA)?:

