# Introduction to Phylogenetic Analysis

## 8–9 September, 2015

### Overview

This workshop will provide an introduction to phylogenetic analysis, including practical exercises based on the software *MEGA* and *BEAST*. It is suitable for graduate students, postdoctoral researchers, and academics at all levels of experience. Prior knowledge of basic phylogenetics is helpful but not essential.

The workshop will be run by Rob Lanfear (Macquarie University) and Simon Ho (University of Sydney), with assistance from Charles Foster and Jun Tong (University of Sydney).

### Programme

The workshop will comprise a series of lectures and practical exercises. The first day will cover interpreting phylogenetic trees, sequence alignment, evolutionary models, and phylogenetic methods. The second day will focus on Bayesian phylogenetic analysis and will include molecular clocks, estimating timescales, coalescent theory, and demographic reconstruction.

The practical exercises will involve basic analyses of a prepared data sets. We will be using free software that can be installed on PC, Mac, and UNIX platforms.

# Workshop Programme

## 8 September: Introduction to phylogenetic analysis (Rob Lanfear)

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|---|---|
| 09.00 – 09.10 | Welcome |
| 09.10 – 10.00 | Lecture 1: Introduction to phylogenetic analysis |
| 10.00 – 10.30 | Lecture 2: Alignment |
| 10.30 – 11.00 | Practical: Automated sequence alignment |
| | *--- Morning tea ---* |
| 11.15 – 12.00 | Practical: Manual refining the alignment |
| 12.00 – 13.00 | Lecture 3: Phylogenetic methods |
| | *--- Lunch break ---* |
| 14.00 – 16.00 | Practical: Phylogenetic analysis |

## 9 September: Bayesian phylogenetic analysis (Simon Ho)

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|---|---|
| 09.30 – 10.15 | Lecture 4: Bayesian phylogenetic analysis |
| 10.15 – 11.00 | Lecture 5: Rates and timescales |
| | *--- Morning tea ---* |
| 11.15 – 13.00 | Practical 2: Molecular-clock analysis |
| | *--- Lunch break ---* |
| 14.00 – 14.30 | Lecture 6: Analysing populations |
| 14.30 – 16.00 | Practical 3: Inferring population history |

# Useful References

**Reference books**

- *Bayesian Phylogenetics: Methods, Algorithms, and Applications*
  Chen, Kuo, & Lewis (2014) Chapman & Hall / CRC.

- *Molecular Evolution: A Statistical Approach*
  Yang (2014) Oxford University Press.

- *The Phylogenetic Handbook*
  Lemey, Salemi, & Vandamme (2009) Cambridge University Press.

- *Reading the Story in DNA*
  Bromham (2008) Oxford University Press.

- *Inferring Phylogenies*
  Felsenstein (2003) Sinauer Associates.

**Molecular clocks and calibrations**

- *Estimating evolutionary timescales using the molecular clock*
  Ho & Duchêne (2014) *Mol Ecol* 23: 5947–5965.

- *The changing face of the molecular evolutionary clock*
  Ho (2014) *Trends Ecol Evol* 29: 496–503.

- *Accounting for calibration uncertainty in phylogenetic estimation of evolutionary divergence times*
  Ho & Phillips (2009) *Syst Biol* 58: 367–380.

**Demographic reconstruction**

- *Skyline-plot methods for estimating demographic history from nucleotide sequences*
  Ho & Shapiro (2011) *Mol Ecol Res* 11: 423–434.

- *Bayesian inference of population size from multiple loci*
  Heled & Drummond (2008) *BMC Evol Biol* 8: 289.

- *Bayesian coalescent inference of past population dynamics from molecular sequences*
  Drummond, Rambaut, Shapiro, & Pybus (2005) *Mol Biol Evol* 22: 1185–1192.

# MACQUARIE University
### SYDNEY · AUSTRALIA

## CAMPUS MAP

**LEGEND**

- PATHWAYS
- ROADS
- BUILDINGS
- FACULTY OF ARTS
- FACULTY OF BUSINESS AND ECONOMICS
- FACULTY OF HUMAN SCIENCE
- FACULTY OF SCIENCE
- OTHER UNIVERSITY BUILDINGS
- MACQUARIE GRADUATE SCHOOL OF MANAGEMENT(MGSM)
- OTHER BUILDINGS (RESEARCH PARK ETC)
- P PARKING ONLY IN CARPARKING
- 1 HOUR PARKING
- STANDARD PARKING
- CASUAL/STANDARD PARKING
- OVERFLOW PARKING
- AUTHORISED VISITOR ONLY
- BIKE HUBS
- SECURITY AND INFORMATION
- BUS STOP
- TRAIN STATION
- DESIGNATED SMOKING AREA
- CAFE/RESTAURANT

## Map labels

MACQUARIE SHOPPING CENTRE

WATERLOO ROAD
HERRING ROAD
EPPING ROAD
BALACLAVA ROAD
CULLODEN ROAD
TALAVERA ROAD
CHRISTIE ROAD
M2 MOTORWAY
UNIVERSITY AVENUE
RESEARCH PARK DRIVE
EASTERN ROAD
SCIENCE ROAD
GYMNASIUM ROAD
LIBRARY ROAD
WESTERN ROAD
CENTRAL AVENUE
MACQUARIE DRIVE
INNOVATION ROAD
COLLEGE ROAD
LINK ROAD
HADENFELD AVENUE
FUTURE UNIVERSITY AVENUE

MACQUARIE University RESEARCH PARK
SIEMENS
EMC
1 INNOVATION ROAD
75 TALAVERA ROAD
HERRING ROAD APARTMENTS

ROBERT MENZIES COLLEGE
DUNMORE LANG COLLEGE

MACQUARIE LAKE
MACQUARIE UNIVERSITY VILLAGE

INSET — SPORTING FACILITIES (CULLODEN ROAD)
W21B, W21A, W19A, W19G, W19M, W19F, W19L

W16A ASTRONOMICAL OBSERVATORY
N3
X13
X8
X3
X4
X2
W4
X5A, X5B
W11A LIGHTHOUSE THEATRE
AMPHITHEATRE
SPORTS CLUB?
W10A SPORTS & AQUATIC CENTRE
N1
N2

CHANCELLERY BUILDING
C10A CAMPUS HUB
CENTRAL COURTYARD
C9A, C8A, C7A, C5A, C5B, C5C, C3A, C3B, C3C LIBRARY
C1, C1A, C2, C3
W2.4A, W3A, W5A, W5B, W5C, W6A, W6B, W6D
WALLY'S WALK
MIA MIA
K6A BANKSIA COTTAGE
BIKE HUB

E1, E3A, E3B, E4A, E4B, E5A, E5B, E6, E6A, E6B, E6C, E6D, E6E, E7A, E7B, E8A, E8B, E8C
BIKE HUB
F3A, F5A, F5B, F7, F7A, F7B, F8A, F9A, F9B, F9C, F10A, F11A
E10, E11A, E12A, E12B, E12C, E14A, E14B, E14C, E14D MGSM
TRAVELODGE
HOTEL PARKING
MGSM PARKING
TECHNOLOGY PLACE

COCHLEAR
PRIVATE PARKING
S1A, S11A, S2.6 AUSTRALIAN HEARING HUB
GUMNUT COTTAGE
Y1A, Y2, Y2A, Y3A, Y4A, Y6A, Y6B, Y11
MARS
POND
CREEK

NORTH

0 25 50 100 150 225