

Skeleton keys: unlocking the past using bones, biomarkers and bioinformatics

Start date 1 November 2019 **End date** 3 November 2019

Venue Madingley Hall
Madingley
Cambridge
CB23 8AQ

Tutor Dr Lingyan Chen
Dr Jenna Dittmar
Dr Barbora Hroch

Course code 1920NRX010

Director of ISP and LL

Sarah Ormrod

**For further information on this
course, please contact the Lifelong
Learning team**

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To book

See: www.ice.cam.ac.uk or telephone 01223 746262

Tutor biography

Dr Barbora Hroch has a Master's degree in Laboratory methods and PhD in Bioanalytical chemistry. She currently works as Research Associate at the MRC Epidemiology Unit, Nutritional Biomarker Laboratory, University of Cambridge. Barbora's main expertise is in development of novel bioanalytical and diagnostics methods for nutritional and cancer biomarkers. She is passionate about teaching and has an extensive teaching record of various laboratory related subjects (sample pre-treatment, chromatography and mass spectrometry) in higher education.

Dr Lingyan Chen has a PhD degree in Immunogenetics (King's College London) and a Master's degree in Clinical Pharmacology. She works as a Statistical Geneticist at the Cardiovascular Epidemiology Unit, Department of Public Health and Primary Care, University of Cambridge. Lingyan's expertise is in large-scale human genetic research to understand the pathophysiology of complex diseases and evaluate risk factors to inform drug discovery programmes. She is interested in applying artificial intelligence in genetic research.

Dr Jenna Dittmar is a Research Associate in the McDonald Institute for Archaeological Research at the University of Cambridge and is Junior Research Fellow at Darwin College. She holds a PhD in Biological Anthropology (University of Cambridge) and a MSc in Human Osteology and Paleopathology (University of Bradford). As a specialist in paleopathology, Jenna analyses human skeletal remains from archaeological sites to identify and understand diseases in past populations. Her current research focuses on the health of the inhabitants of Medieval Cambridge surrounding the time of the Black Death.

Friday

Please plan to arrive between 16:30 and 18:30. You can meet other course members in the bar which opens at 18:15. Tea and coffee making facilities are available in the study bedrooms.

19:00 Dinner

20:30 **Session 1: What we can learn from the dead**

22:00 Terrace bar open for informal discussion

Saturday

07:30 Breakfast

09:00 **Session 2a: Discovering the past with archaeology, history and AI**

The basic theory of artificial intelligence (AI) and its application in archaeology will be introduced and explored through examples of how AI can decode archaeological characters.

Session 2b: What bones can reveal

This session introduces what osteologists can find out by studying the bones of people who have been dead for hundreds of years including; age at death, biological sex, and the diseases that they would have experienced.

10:30 Coffee

11:00 **Session 3: Osteology Practical Session**

Working in groups, participants will use scientific methods to examine and record personal information from archaeological human skeletal remains.

13:00 Lunch

14:00 **Session 4: Exploring the past with biomarkers**

Biomarker terminology and their use in archaeological research will be explained. Biomolecular techniques will be described. Participants will also receive lab results for the skeletons observed in session 3 to enable preparation of a report later in the course.

16:00 Tea

16:30 Free

18:30 Dinner

20:00 **Session 5: Reconstructing past lives (optional)**

This time can be used for groups to meet and begin to integrate their data and prepare their reports. Staff members will be present and textual resources will be available for guidance

21:30 Terrace bar open for informal discussion

Sunday

07:30 Breakfast

09:00 **Session 6: Integrating data: Reconstructing past lives (in groups)**

Participants will begin to integrate their data sets to reconstruct the osteobiography of their assigned individual. Each group will prepare a report which will be presented to the other participants in Session 7

10:30 Coffee

11:00 **Session 7: Report of findings: Who's who in Medieval Cambridge**
Discussion and feedback

12:45 Lunch

Course syllabus

Aims:

1. To promote knowledge of the use of archaeological, bioanalytical and data-based methods used in the identification and analysis of historic remains.
2. Introduce the methods used to identify and diagnose diseases on human skeletal remains from archaeological sites.
3. To develop an appreciation of the possibilities and limitations of modern scientific technologies in exploring the past.

Content:

The exploration of human history has traditionally been led by historians and archaeologists who have relied on traditional methods such as the analysis of historical manuscripts and archaeological artefacts to understand the human journey. This course will introduce how new technologies in the area of archaeology can be combined with traditional methods to advance our understanding of the past.

The course will begin by introducing how archaeological methods, specifically the study of human skeletal remains can be used to reconstruct an individuals' life including their biological sex, how long they lived, health status, diet, and how mobile they were throughout their lives. On Saturday, session 2a will explore how archaeological sites are found and how artificial intelligence (AI) can be used to unlock the past. The basic theory of AI and its application in archaeology will be introduced and explored through examples. Session 2b introduces what kind of information osteologists can find out about people who have been dead for hundreds of years including; age at death, biological sex, and the diseases that they would have experienced. During session 3, participants will divide into groups and will work as a team to apply the methods described in session 2 to analyse archaeological human skeletal remains. The fourth session will introduce biomolecular archaeology and the techniques used for the identification and determination of biomarkers in ancient samples will be explained and demonstrated. During this session, each team will be provided with lab results pertaining to their specific skeleton. For session 5 (optional) and session 6, participants will work in their groups to use the information they collected to reconstruct the life of their individual skeleton. In Session 7, each group will give a short presentation on what they were able to learn about their individual skeleton.

Presentation of the course:

This course will be presented through tutor-led lectures and through group work which incorporates a practical handling session with human skeletal remains. This course is aimed for Level 4 – first year undergraduate students.

As a result of the course, within the constraints of the time available, students should be able to:

1. Identify the methods used in archaeology, bioanalysis and data science disciplines to discover the past.
2. Demonstrate an understanding of how human skeletal remains can be analysed to inform researchers about the lives of past people.
3. Evaluate and reflect upon the potential of modern scientific technologies to explore aspects of the past.

Reading and resources list

Listed below are texts that might be of interest should you wish to supplement your learning on the course. Any essential reading is marked with an asterisk

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Author	Title	Publisher and date
Charlotte Roberts Keith Manchester	The Archaeology of Disease	2010, The History Press
Tim White Pieter Folkens	The Human Bone Manual	2005, Academic Press

Relevant Papers

Cessford, C. (2015). The St. John's Hospital Cemetery and Environs, Cambridge: Contextualizing the Medieval Urban Dead, *Archaeological Journal*, 172(1), 52-120, DOI: 10.1080/00665983.2014.984960

*Robb, J., Inskip, S. A., Cessford, C., Dittmar, J., Kivisild, T., Mitchell, P. D., ... & Scheib, C. (2019). Osteobiography: The History of the Body as Real Bottom-Line History. *Bioarchaeology International*, 3(1), 16-31.

Spyrou, M. A., Keller, M., Tukhbatova, R. I., Scheib, C. L., Nelson, E. A., Valtueña, A. A., ... & Cessford, C. (2019). Phylogeography of the second plague pandemic revealed through analysis of historical *Yersinia pestis* genomes. *Nature Communications*, 10(1), 1-13.

Website addresses

1. Guidance for Good Practice - Organic Residue Analysis and Archaeology
<https://historicensland.org.uk/images-books/publications/organic-residue-analysis-and-archaeology/heag058a-organic-residue-analysis-and-archaeology-guidance/>
2. The Archaeological Biomarker Revolution (R.P. Evershed)
<https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1475-4754.2008.00446.x>
3. Computer Science, Artificial Intelligence and Archaeology
<https://pdfs.semanticscholar.org/40d6/918b00a576174092b29dbc8b8919bebcdca5.pdf>
4. Archaeology and Artificial Intelligence in the Future of Web-based Learning
https://www.academia.edu/1656494/Archaeology_and_Artificial_Intelligence_in_the_Future_of_Web-based_Learning?auto=download
5. Excavations 2.0: how aincient uses artificial intelligence to unlock the past
<http://www.aincient.org/blog/excavations-2-0-aincient-uses-artificial-intelligence-unlock-past/>
6. Digitised Diseases
<http://www.digitiseddiseases.org/alpha/>

Additional information

Venue

Please see our website for directions to Madingley Hall : www.ice.cam.ac.uk/about-us/how-find-us

Refreshments

Tea and coffee, lunch and dinner will be provided as on the timetable above. If you have any specific dietary requirements or allergies and have not already advised us, please inform our Admissions Team on ice.admissions@ice.cam.ac.uk or +44 (0)1223 746262.

Note Students of the Institute of Continuing Education are entitled to 20% discount on books published by Cambridge University Press (CUP) which are purchased at the Press bookshop, 1 Trinity Street, Cambridge (Mon-Sat 9am – 5:30pm, Sun 11am – 5pm). A letter or email confirming acceptance on to a current Institute course should be taken as evidence of enrolment.

Information correct as of: 25 October 2019