UNIVERSITY OF CAMBRIDGE

Institute of Continuing Education

Evolutionary Biology

Start date	21st October 2022	**End date**	23rd October 2022
Venue	Madingley Hall Madingley Cambridge CB23 8AQ		
Tutor	**David Applin**	**Course code**	2223NRX007
Director of ISP and LL	Sarah Ormrod		
For further information contact	inteng@ice.cam.ac.uk		

Tutor biography

David Applin

On graduating in Zoology from the University of Leeds, David moved to Imperial College, London, where he gained his MSc in applied entomology. Research into the reproductive physiology of the sheep blowfly *Lucilia sericata*, begun at Imperial College, became the subject of his PhD thesis at Birkbeck College, London. David has published a number of papers on blowfly reproductive physiology and with Professor John Cloudsley-Thompson published on the molecular and physiological mechanisms of biological clocks.

As Head of Department, David has long experience of teaching biology. He is also the author of many highly successful biology course-books for all levels. Currently he is a freelance author and tutor in Cambridge and a panel tutor for the Institute of Continuing Education in Cambridge University. David continues to pursue his interests in biology and communicating those interests through books and on-line to a wide audience in the UK and overseas. He is an elected Fellow of the Linnean Society and the Royal Entomological Society and an elected Member of the Royal Society of Biology.

Course programme

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

19:00 Dinner

20:30 – 22:00

Begetting Darwin: history and science's social context
We should remember that scientific thinking and progress in science are not isolated from the rest of society. Science takes place within a social context that at the very least should not be in conflict with the pursuit of science. That context includes the freedom to ask questions about, and **t**o investigate the physical and biological world, and all the other questions that have sought answers that were thought to be historically in the providence of divine intervention**.** And for many today are still answered in this way. Scientific enquiry requires a social context unfettered by dogma, be that religious, political or social. We begin the sessions this weekend with a review of evolutionary thinking before Darwin, and the societal changes that perhaps allowed such thinking to emerge. Each session supports the next so, where better than to continue with our beginnings.

22:00 Terrace Bar open for informal discussion

Saturday

07:30 Breakfast (for residents only)

09:00 – 10:30

DNA: evolution's molecule
Evolution is a theory of genealogy tracking characteristics inherited through generations, characteristics encoded in DNA and sorted through natural selection … the big idea attributed to Charles Darwin. *DNA: evolution's molecule* tracks the history of discovering the chemistry and structure of DNA from 1869 to 1953. Chemistry and structure feeds into an understanding of DNA, and in combination enables us to glimpse the 'hows' and 'whats' of the heritage of life on Earth. But … how do we understand DNA?

10:30 Coffee

11:00 – 12:30

Development and Evolution
Beginning in the 19th century, we explore the growth of the idea that embryology and development are important evidences that underpin the evolution of evolutionary theory from Darwinism to the current paradigm of the Integrated Synthesis.

13:00 Lunch

14:00 – 16:00 Free time

16:00 Tea

16:30 – 18:00

Larval Forms
The title *Larval Forms* identifies the topics of the session's content. We explore in detail the idea that types of larvae are in effect precociously hatched embryos. And that ancestrally, larvae were likely nodes of evolution of taxa morphologically very different from the adult stages of the juvenile forms of the life cycles described in the session.

18:00 – 18:30 Free time

18:30 Dinner

20:00 – 21:30

Galapagos Tales
Initially the history of Darwin's finches and their influence on evolutionary theory is discussed in this session. Then we take a detailed look at the long-term ecological studies that are informing current ideas about the processes that lead to speciation in the birds that are icons of evolution in action but were an enigma to Charles Darwin.

21:30 Terrace Bar open for informal discussion

Sunday

07:30 Breakfast (for residents only)

09:00 – 10:30

Conversation (discussions to include what evolution is, variation, natural selection, time and evolution)

10:30 Coffee

11:00 – 12:30

The Man who walked with Henslow
The session covers the developmental origins and molecular genetics of speciation with particular reference to Darwin's finches. The session finishes with concluding remarks referring to simple field work investigating speciation in a meadowland plant community local to Cambridge compared with what has been learnt about speciation in Darwin's finches. Finally, we think of Charles Darwin as an undergraduate at Cambridge walking the meadows with his friend and mentor John Stevens Henslow, seemingly unaware of the evidence for speciation at his feet.

12:45 Lunch

The course will disperse after lunch

Course syllabus

Aims:
The course will allow you to:

1. synthesise ideas on the basis of evidence
2. improve your understanding of science within the context of society
3. appreciate the unity of life on earth

Content:
Evolutionary theory within the context of molecules to ecosystems will be covered with an historical perspective that highlights **Evolution through Natural Selection: the growth of an idea**.

Presentation of the course:
The course will include illustrated lectures, each with linked specific narrative; led Group Discussion; exchanging ideas; case studies, all with the aim of introducing innovative perspectives on Evolutionary Theory.

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

1. Conceptualise evolution within a multidisciplinary framework
2. Contextualise the development of evolutionary theory - pre-Darwin/post-Darwin
3. Think about evolution holistically
4. Forge links between different ideas
5. Evaluate the question - How come biodiversity?
6. Appreciate the range of evidences for evolution
7. Summarise the evolution of evolutionary thinking

Reading and resources list

Watson, J D (2017) - *DNA: the story of the genetic revolution*
Alfred A. Knopf, New York

Grant P R, Grant B R (2014) - *40 years of Evolution: Darwin's Finches on Daphne Major Island*
Princeton University Press, New Jersey

Cary, N (2012) - *The Epigenetics Revolution*
Icon Books, London

Brakefield, P M (2011) - *Evo-devo and accounting for Darwin's endless forms*
Phil. Trans. R Soc B; 2069-2075

Grant P R, Grant B R (2008) - *How and why species multiply: The Radiation of Darwin's Finches*
Princeton University Press, New Jersey

Judson, H F (1996) - *The Eighth Day of Creation: Makers of the Revolution in Biology*
Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York

Hardy, A (1956) - *The Open Sea: Part 1 The World of Plankton*
Collins, London

Garstang, W (1951, reprint 1966) - *Larval forms and other zoological verses*
Basil Blackwell, Oxford

Wallace, A (2021) - *Understanding Evo-Devo*
Cambridge University Press

Hill, C (1970, 2000) - *God's Englishman: Oliver Cromwell and the English Revolution*
Weidenfeld and Nicholson/Classic Penguin

Merton, R (1936) - *Science, Technology and Society in 17th century*
Howard Fertig Pub; Reprint Edition (1st Feb 2002)

Video resources

It would be to the advantage of students to view the following video resources on YouTube before the sessions indicated. Viewing after each session will help to consolidate the content of each session's PowerPoints. Each video can be accessed by searching YouTube using the links and titles as listed.

Session	Video Title	Video link
Larval Forms	What is a veliger? CollinLabPanama	CollinLabPanama
	Bipinnarias	George von Dassow
	Feeding appendicularians	DTU Aqua Broadcast
	Understanding the behaviour of microscopic marine larvae	University of Plymouth
Galapagos Tales	Galapagos Finch Evolution	HHMI BioInteractive
	The Evolution of Darwin's Finches on the Galapagos Islands	Harvard Museum of Natural History