

Epigenetics: more than just our genes

Start date Sunday 8 December 2019 **End date** Sunday 8 December 2019

Venue Madingley Hall
Madingley
Cambridge

Tutor Dr Srinjan Basu **Course code** 1920NDX301

Dr Laetitia Chauve

Dr Clara Novo

Dr Shamith Samarajiwa

Director of Academic Centres Dr. Corinne Boz

For further information on this course, please contact The Arts and Sciences Team on artscience@ice.cam.ac.uk or 01223 761322

Tutor biography

Dr Basu holds a PhD in Molecular, Cellular and Chemical Biology from Harvard University. He is currently working at the University of Cambridge developing imaging and computational approaches to understand epigenetic proteins in embryonic stem cells. You can often find him spreading his love of biology as a science communicator at the Cambridge Science festival.

Dr Chauve studied at Ecole Normale Supérieure and University Pierre and Marie Curie in Paris, where she obtained a PhD in Molecular and Cellular Biology. She uses the nematode *C. elegans* as a model organism to explore cellular stress responses and their role during ageing. At the moment, her research focuses on gene expression variability between genetically identical individual worms at the Babraham Institute in Cambridge.

Dr. Novo holds a PhD in Genetics from the University of Leicester. Her expertise lies in the molecular mechanisms responsible for genome stability and nuclear organization. Currently, she studies how epigenetics contributes to the three-dimensional genome organisation in embryonic stem cells at the Babraham Institute, Cambridge.

Dr Samarajiwa trained in both computing and biomedicine and holds a PhD in Molecular Immunology and Computational Genomics from Monash University, Australia. His research group at

the MRC Cancer Unit, University of Cambridge applies computational biology, data science and artificial intelligence approaches to multi-omic biomedical big data to understand gene and epigenome regulation and immune interactions in cancer.

Course programme

09:30	Terrace bar open for pre-course tea/coffee
10:00 – 11:15	Session 1: What is Epigenetics, and why does it matter?
11:15	Coffee
11:45 – 13:00	Session 2: The big data revolution
13:00	Lunch
14:00 – 15:15	Session 3: Epigenetics and disease: when things go wrong
15:15	Tea
15:30 – 16:45	Session 4: Can my lifestyle choices affect the future?
16:45	Day-school ends

Course syllabus

Aims:

The course aims to:

- Introduce the concept of epigenetics, and how it regulates genetic information to allow for different cellular functions.
- Highlight how DNA sequencing and computational analysis have advanced our understanding of epigenetics.
- Explore the impact of epigenetics on disease (e.g., cancer, ageing).
- Evaluate the scientific evidence for transmission of environmental information to the next generation(s) via epigenetic effects.

Target Audience:

- Students of any age interested in learning more about epigenetics. There is no prior scientific background required.
- Secondary school teachers interested in enhancing their knowledge about epigenetics (recently included in the A-level biology syllabus as part of regulation of transcription and translation)
- Clinical professionals with no background in molecular biology, and interested in learning about epigenetics.

Content:

Do your genes define who you are? Does your lifestyle influence your future? Can we reverse ageing and diseases? The sequencing of the whole human genome has been a major breakthrough, promising an understanding of how diseases and ageing are defined by our genes. However, the reality is far more complex. We now know that it is not only the DNA sequence that matters but also how it is controlled. This is called Epigenetics and in this course, we will uncover why it has revolutionized modern medicine.

Session 1: What is Epigenetics, and why does it matter?

We will introduce the concept of epigenetics, explore the epigenetic code and how epigenetics is regulated. We will explain the differences between the genome and the epigenome with interactive problem-solving tasks.

Session 2: The big data revolution

We will cover the different layers of epigenetic regulation of the genetic information and how recent advances in whole genome sequencing and computational analysis have advanced this knowledge.

Session 3: Epigenetics and disease: when things go wrong

Epigenetics regulates genetic information and thus, its misregulation can contribute to disease. In this session we will explore epigenetic contribution to different diseases, including ageing and cancer.

Session 4: Can my lifestyle choices affect the future?

The dynamic nature of epigenetics implies that lifestyles may affect it. We will critically analyse the latest scientific evidence for lifestyle effects in epigenetics (e.g. twin studies) and for epigenetic memory (e.g. epigenetic trans-generational effect), and the media sensationalism surrounding this topic.

Presentation of the course:

The course will be a mixture of tutor-led lectures combined with problem solving activities and discussions to foment critical thinking in the field. There will be an opportunity to see epigenetic changes in live microscopic worms.

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

- Explain the differences between epigenetics and genetics.
- Identify techniques used to interrogate the epigenome and how big data has revolutionized the epigenetic field.
- Explain the role of epigenetics from a clinical perspective and its potential for modern medicine.
- Identify life experiences that can affect your epigenome and understand their reversibility.

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 *

Author	Title	Publisher and date
Francis, Richard C.,	Epigenetics: How Environment Shapes Our Genes,	W. W. Norton & Company (2012)
Nessa Carey,	The Epigenetics Revolution: How Modern Biology is Rewriting Our Understanding of Genetics, Disease and Inheritance,	(2012)

Website addresses

<http://learn.genetics.utah.edu/content/epigenetics/>

<https://bitesizebio.com/8807/a-crash-course-in-epigenetics-part-1-an-intro-to-epigenetics/>

Epigenetic News items that will be discussed in session 4:

Constandi, M. (9 september 2011). Pregnant 9/11 survivors transmitted trauma to their children. The Guardian.
<https://www.theguardian.com/science/neurophilosophy/2011/sep/09/pregnant-911-survivors-transmitted-trauma>

Johns Hopkins Medicine. (5 April 2018). To track environmental impact on genome, don't forget the 'epi' in genetics research. ScienceDaily.
<https://www.sciencedaily.com/releases/2018/04/180405093209.htm>

Dr Mercola (september 14 2017). Falling for this myth could give you cancer. Dr Mercola natural health newsletter
<https://articles.mercola.com/sites/articles/archive/2017/09/14/tips-to-boost-your-happiness.aspx>

David Gorski (2013). Epigenetics: it does not mean what quacks think it means
<https://sciencebasedmedicine.org/epigenetics-it-doesnt-mean-what-quacks-think-it-means/>

Rose, M. (December 6 2017) Quantum living: Epigenetics and exercise: how genes take shape to change your DNA one workout at a time. Huffpost
https://www.huffingtonpost.com/marina-rose-qdna/quantum-living-epigenetic_b_10919162.html

Aguirre, C. (may 5 2016). Nutrigenomics: the diet that can change your DNA. Huffpost
https://www.huffingtonpost.com/dr-claudia-aguirre/how-diet-changes-your-dna_b_7129758.html

Morad, R. (april 24 2017). How diet can change your DNA. Scientific american
<https://www.scientificamerican.com/page/sponsored/nestle/how-diet-can-change-your-dna/>

Dr Mercola (april 11 2010). Falling for this myth could give you cancer. Dr Mercola natural health newsletter
<https://articles.mercola.com/sites/articles/archive/2012/04/11/epigenetic-vs-determinism.aspx>

Oregon State university (29 april 2010) "Epigenetic" concept offer new approach to degenerative diseases –ScienceDaily
<https://www.sciencedaily.com/releases/2010/04/100428081836.htm>

Additional information

Venue

Details of how to find Madingley Hall can be found on our website:
<http://www.ice.cam.ac.uk/who-we-are/how-to-find-the-institute>

Refreshments

Tea and coffee and lunch will be provided. 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: 18 April 2019 25 November 2019 25 November 2019