Epigenetics – The Missing Link between Nature and Nurture?

By

Professor Nessa Carey

Professor Carey, who is a molecular biologist and visiting professor at Imperial College, entertained a large audience of the Cirencester Science Society with a vibrant and enthusiastic introduction to the developments in epigenetics research and its relevance to a large of number of applications in the field of medical research.

Having defined epigenetics as relating to those aspects of genetics that are not directly connected to the genetic code the lecturer cited many examples of living organisms that have identical genetic code but dissimilar characteristics. For instance, a queen bee may live 20 times longer and be twice as heavy as the other members of her colony although possessing the same genetic coding. Similarly, the sex of male and female crocodiles with identical genes is determined by the temperature at different periods of life through the gene switching process. However, these examples are descriptions of behaviour patterns rather than a scientific explanation and it is the latter that is important in research into epigenetics.

Nessa Carey then followed with a cleverly illustrated example of the way that genes code the proteins that are essential for life and the way in which this coding is disturbed. Her slides illustrated how DNA “worms” wrapped round 8 histone proteins with “tails”. Chemical groups then attach to the histone tails to switch genes on and off while an excessive number of these latter attract more repressive chemicals which then smother the genes preventing them from switching on again.

Abnormal patterns of epigenetic modifications on our genes lead to cells developing the wrong patterns and combinations of gene expression and this contributes to diseases. Scientists are investigating the role of epigenetics in chronic diseases such as rheumatoid arthritis, chronic obstructive pulmonary disease and schizophrenia as well as in drug addiction and the long-term effects of abusive or neglectful childhoods. Cancer is another major field of human disease where it is known that epigenetics is important. Drugs that target epigenetic changes are being successfully used to treat patients with certain cancers. It is hoped that a deeper understanding of epigenetics will help in the development of drugs for lots of other human illnesses.