

On the centenary of the birth of Francis H. C. Crick – from physics to genetics and neuroscience

O centenário de nascimento de Francis H.C. Crick – da física para a genética e a neurociência

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ABSTRACT

The year 2016 marks the centenary of the birth of Francis Crick (1916–2004), who made outstanding contributions to genetics and neuroscience. In 1953, in a collaborative study, Francis Crick and James Watson discovered the DNA double helix, and in 1962 they and Maurice Wilkins were awarded the Nobel Prize in Physiology or Medicine. Crick subsequently became very interested in neuroscience, particularly consciousness and its relationship to the claustrum, a small gray matter structure between the insula and putamen.

Keywords: crick; double helix; Nobel prize; consciousness; claustrum.

RESUMO

O ano de 2016 é o centenário de nascimento de Francis Crick (1916–2004), físico, biólogo e neurocientista, cujas contribuições para a genética e a neurociência foram magníficas. Crick, em um estudo colaborativo com Watson, descobriu a estrutura molecular do DNA (dupla hélice) em 1953, e em 1962 ambos receberam o prêmio Nobel de Fisiologia ou Medicina, junto com Wilkins. Após Crick tornou-se muito interessado na área de neurociência, particularmente no estudo da consciência, e a sua relação com o claustrum, uma pequena estrutura de substância cinzenta localizada entre a ínsula e o putame.

Palavras-chave: crick; dupla hélice; prêmio Nobel; consciência; claustrum.

Neurosciences, particularly neurology, have made great strides in recent years, most notably in the fields of genetics and molecular biology, where a significant number of discoveries have been made, including new genes, proteins and neuronal signaling mechanisms. This genuine revolution in neurology started in the 1950s and was given impetus by the discovery of the structure of DNA, with the publication of the study by Watson and Crick in 1953 and the awarding of the Nobel prize to the authors and Maurice Wilkins in 1962^{1,2}. The aim of this article is to review the career of the physicist, biologist and neuroscientist Francis H. C. Crick and the brilliant contributions he made to science.

A SHORT BIOGRAPHY

Francis Harry Compton Crick (Figure 1) was born on June 8th, 1916, to Harry Crick and Annie Elizabeth Crick (née Wilkins), both from middle-class families, in Weston Favell, a village near Northampton in the United Kingdom. In the biography written

by Olby, Crick observed that there were no scientists in his family and recalls that his father once said, “at least none of them was hanged!”¹. After attending Northampton Grammar School and Mill Hill School, Crick graduated in physics from University College London in 1939. Between 1940 and 1947 he was hired as a Civilian Scientist in the Royal Navy, and in 1947 he started research in biology at the Strangeways Research Laboratory in Cambridge and, in 1949, at the Medical Research Council (MRC) unit, in the Cavendish Laboratory, Cambridge¹. The following year, he became a PhD student at Gonville and Caius College, Cambridge¹. In 1951, he published his first scientific papers, initially on the structure of proteins, and then began his studies of deoxyribonucleic acid (DNA). In 1953, the classic paper “Molecular structure of nucleic acids; a structure for deoxyribose nucleic acid” by Watson and Crick was published in the journal *Nature* (April 25th)². Together with his coworkers James Watson and Maurice Wilkins, he was awarded the Nobel Prize for Physiology or Medicine in 1962 for discovering the structure of DNA. Famous all around the world, Crick became involved in many different research activities in

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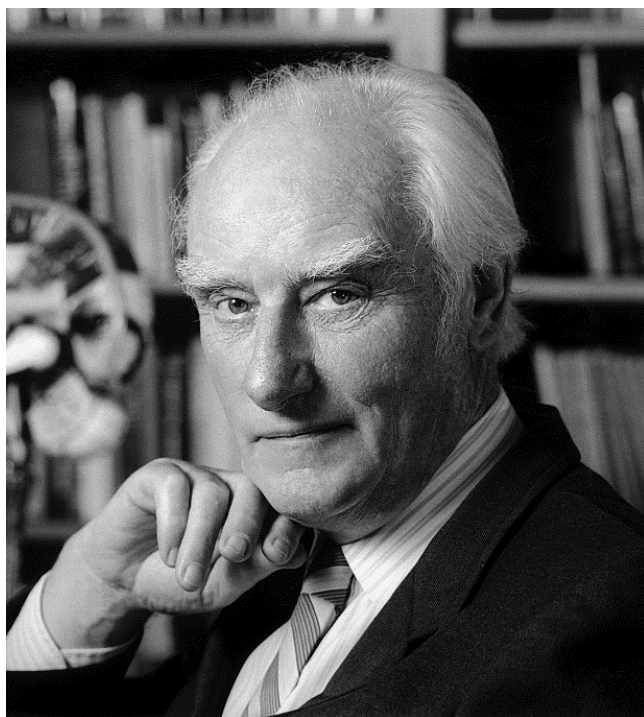
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different universities in the USA (Harvard, The Salk Institute), Europe (Denmark, Sweden and Germany) and Russia. In 1977 he started work at the Salk Institute, California, where he remained until his death on July 28th, 2004¹.

DNA – THE DOUBLE HELIX AND THE NOBEL PRIZE

The article by Watson and Crick published in the April 1953 edition of *Nature* showing clearly and accurately the molecular structure of deoxyribose nucleic acid (DNA), the molecule of life, was the crowning achievement of research Crick started in 1951 with a much younger American biologist by the name of James D. Watson¹. The first attempts to determine the structure of DNA proved unsuccessful. However, two years later, the two researchers were joined in their efforts by other important scientists, including Maurice F. Wilkins, a contemporary of Crick, and Rosalind Franklin, a British biophysicist, whose X-ray diffraction studies made a vital, yet little-recognized, contribution¹. The period 1951 to 1953 was one of great scientific competition as various groups, including those led by Erwin Chargaff and especially Linus Pauling in the USA, sought tirelessly to discover the structure of DNA¹. The second attempt by Crick and Watson to do so was a success, and their famous article, which was some 600 words long, was published in *Nature* in 1953 (Figure 2)^{1,2}. As a result of this study and various others related to the discovery of the DNA double helix published by Crick and collaborators, the Nobel Prize for Physiology or Medicine was awarded jointly to Crick, Watson and Wilkins in 1962¹.



Extracted from en.wikipedia.org, December 27th, 2015.

Figure 1. Francis Crick (1916–2004).

CRICK AND THE CLAUSTRUM

After Crick moved to the USA to work at the Salk Institute, in San Diego, California, he became very interested in neuroscience, particularly the neurobiological theory of consciousness¹. Working with a young scientist of German descent, Christof Koch, Crick began to study the role of the claustrum as the key structure in producing consciousness. The claustrum (meaning “hidden away”), whose function has yet to be fully elucidated, is a long, thin, subcortical, band-like gray-matter structure in the telencephalon of the brain of all mammals. It is a mysterious, thin, irregular sheet of neurons between the external and extreme capsulae and the insular cortex and striatum (putamen)^{1,3}. It is reciprocally connected with all cortical areas, including the motor, somatosensory, visual, auditory and limbic areas, and receives modulatory input from subcortical structures. Several researchers believe the claustrum performs sensory integration or modulation of cortical functional networks, and Crick and Koch proposed the analogy of a conductor coordinating the players in an orchestra^{1,3,4,5,6}. In 1994, Crick published a book with the title “The Astonishing Hypothesis” and the subtitle “The Scientific Search for the Soul”¹. Subsequently, in 2004, he wrote the foreword to the book “Quest for Consciousness”



Extracted from blog.red-lane.bolton.sch.uk, December 27th, 2015.

Figure 2. DNA – the double helix².

by Koch¹. In both books the authors focus on the search for a neural basis for consciousness and suggest that the claustrum plays a key role in this¹. Later studies reinforced this idea^{7,8}. In 2004, at the age of 88 and much weakened because of treatment for cancer of the colon, Crick still had time to correct the last version of a paper he wrote with Koch that was published posthumously in 2005 under the title “What is the function of the claustrum?” (Figure 3)⁹.

CONCLUSION

The scientist Francis Crick, who would have been 100 in 2016, was awarded the Nobel prize in 1962. He was a gifted researcher who made various contributions to science, initially in the fields of physics and biology and then in genetics, with the fantastic discovery of the DNA double helix, and

Review

What is the function of the claustrum?

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The claustrum is a thin, irregular, sheet-like neuronal structure hidden beneath the inner surface of the neocortex in the general region of the insula. Its function is enigmatic. Its anatomy is quite remarkable in that it receives input from almost all regions of cortex and projects back to almost all regions of cortex. We here briefly summarize what is known about the claustrum, speculate on its possible relationship to the processes that give rise to integrated conscious percepts, propose mechanisms that enable information to travel widely within the claustrum and discuss experiments to address these questions.

Keywords: neuroanatomy; connectivity; primate; electrophysiology; gap junctions; cortex

Figure 3. Crick and Koch and the claustrum.

finally in neuroscience, with his study of the claustrum and its relationship to consciousness¹⁰.

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