

Non-print Items

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Abstract

[AU2]

Cyril Dean Darlington (1903–81) was one of the influential figures in biology in the twentieth century, in particular making significant discoveries about the chromosome theory of heredity; unifying biology through the fundamental principles of evolution, cytology, genetics, and biochemistry; and making contributions to genetics and society. Building on diverse work from animals and plants, he was the first to describe clearly the nature of the partitioning and segregation of chromosomes at mitosis and the recombination events between chromatids that occur at meiosis.

a0005 **Darlington, Cyril Dean**

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d0005 **Glossary**

Cytogenetics The study of the structure and function of the chromosomes and their relationship to genetics and inheritance.

Cytology The study of the structure and function of cells, particularly by observation with microscopy and molecular approaches.

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p0015 Cyril Dean Darlington (19 December 1903–26 March 1981) made major discoveries about the chromosome theory of heredity, unifying biology through the fundamental principles of evolution, cytology, genetics, and biochemistry. He was one of the influential figures of British biology of the twentieth century, along with William Bateson, J. B. S. Haldane, and Julian Huxley, making contributions to fundamental biological discoveries, and more controversially to genetics and society. Building on diverse work from animals and plants, he was the first to describe clearly the nature of the partitioning and segregation of chromosomes at mitosis and the recombination events between chromatids that occur at meiosis. Indeed, his writings have been considered to establish the chromosome as the central unit of genetics, making the scientific field of cytogenetics. His early book *Recent Advances in Cytology* (1932) enabled chromosome genetics to be taught for the first time. He advanced the dictum that looking at chromosomes was another way of looking at genes, a view that has profoundly influenced fundamental biological thought. His work combined experimental and technical excellence with intellectual insight into the behavior of his experimental materials, building hypotheses about the meaning of the structures he visualized by microscopy.

p0020 Darlington was born in Lancashire in the north of England, but brought up in London. He went on to graduate in 1923 with a BSc in agriculture from the college that became Wye College, University of London, although he later attributed his success to lack of academic training. Having been inspired by the book *The Physical Basis of Heredity* by Morgan, Sturtevant, and Bridges (Darlington and LaCour, 1942), Darlington moved to the John Innes Horticultural Institution as a volunteer to work under William Bateson. At the John Innes Institution, his plan to become a farmer in Australia was abandoned, and he progressed to a position as a member of staff, eventually becoming Director in 1939, before moving to the Sherardian Chair of Botany in Oxford, a post he held from 1953 to retirement to an Emeritus Professorship in 1971.

p0025 From the start, the work of Darlington was strongly theory, hypothesis, and model-driven, integrating a wide variety of facts and observations to make a unified science of cytogenetics. Working with Len LaCour, Kenneth Mather, W. C. F. Newton, and others at the John Innes Institution, he was responsible for many technological advances in cytology (e.g., Darlington, 1939), developing the methods of chromosome spreading for investigations of meiosis and mitosis. These cytological techniques replaced earlier laborious embedding and sectioning methods where the chromosome structures were

poorly defined so their behavior could not be followed. In the late 1920s, there was considerable controversy about the nature of events of meiosis, but Darlington built on his own observations in polyploids to show that all chiasmata result from crossing-over between chromatids of partner chromosomes. He also concluded that the chromosome consists of a single strand of duplex DNA, reasoning that the double structures visible at mitosis arose from replication, while those at meiosis arose by pairing of parental chromosomes. This clear, although originally controversial, model was supported by genetical experiments as well as by observation, and fitted well to his view that “Hypothesis based on comparative inference has often proved more reliable than the ‘facts’ of direct observation.” His structural observations of chromosomes at mitosis and meiosis placed in the broader context of the cell cycle allowed him to discover the now-accepted role of the centromere, adopted from Waldeyer, in chromosome segregation.

His book, *Recent Advances in Cytology* (Darlington, 1932), p0030 was a remarkable synthesis of large amounts of data about chromosomes in mitosis and interphase, from plants and animals, organizing disparate observational data about the nucleus, although the interpretive statements in it were widely criticized. For the first time, he presented the concept of the centrality of genetic and gene control of breeding systems and genetic mechanism, and established that chromosomes recombine and are inherited with the genes they carry. Soon after publication of *Recent Advances*, he traveled to the United States and the Far East, where he discussed many of his then-controversial ideas with leading geneticists. Parts of this book were expanded into *The Evolution of Genetic Systems* (Darlington, 1939 and later editions). The theories propounded in this volume are central to the integration of cytology and genetics into population and evolutionary biology, treating chromosomes as the underpinning of genetic systems. The synthesis in this book was widely praised and highly influential. He was elected to Fellowship of the Royal Society in 1941.

Around the time of his move to Oxford in 1953, Darlington p0035 was becoming interested in broader issues related to genetics and the human condition, including work in sociobiology on genes and human society. Darlington was outspoken in leading the exposure of the fraudulent genetics of the Soviet geneticist Trofim Lysenko, the suppression of scientific genetics, and the purge of geneticists under Stalin. Darlington made what were, at the time, important contributions to debates on science and politics, with uninhibited statements of strongly held views.

However, his views on sociopolitical issues, the genetic determinism of human qualities, and writings about behavioral genetics led to many disputes at the time, and he was characterized as a supporter of eugenics.

p0040 Despite what some saw as his abrasive personality, Darlington was a shrewd leader, teacher, and mentor. During the 14 years of his Directorship of the John Innes, there were an average of about 17 staff, producing more than 40 papers a year. Of his many colleagues and students, 11 became Fellows of the Royal Society, with many becoming professors or institution directors. In the days when a career could be spent working toward a monograph, Darlington held strong views on publication, saying "work not published is not done." He published prolifically himself, with journal papers, books, and even letters to newspapers, covering not only cytogenetics but also pedagogy and more philosophical discussions. After difficulty in publishing some papers (recording rejections from the *Journal of Experimental Biology* as not being experimental enough, and the *Journal of Genetics* as not being genetical enough), in 1947 he founded and edited, with R. A. Fisher, the journal *Heredity*. Late in his life, he generously transferred the journal to the Genetics Society, where it remains a well-respected publication. Darlington was also a significant (and outspoken) contributor and organizer of many conferences right to the end of his life.

p0045 While being generous to his friends and collaborators, Darlington seemed to go out of his way to enrage his enemies being quoted by Lewis (1983) as saying, "next to friends, enemies, if well chosen are the best stimulus to research." Lewis added that he has no friends who knew his subject. He had an overriding mistrust of authority and hate for committees. He held strong and controversial views on the teaching of biology, including the need to build on the unifying characteristics of the study of genetics, which now underpin most university biology courses outside medicine. His writings and teachings always emphasized the synthesis of ideas, and their support from experiments, writing that "All of us like to be supported by earlier observations, but few of us like to be

anticipated by earlier ideas." Darlington's outspoken defence of fundamental scientific research, scientific freedom, and the place of science in decision making, as well as the linkage of research and teaching, have many parallels in the early twenty-first century.

See also: Chromosomes; Cytogenetics (00373); Morgan, Thomas Hunt (00974); Bateson, William (01681).

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Further Reading

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Relevant Websites

- <http://www.jic.ac.uk> – The John Innes Centre. Cyril Dean Darlington (1903–1981): Cytologist and geneticist. FRS 1941. [bib0055](#)
- <http://www.jic.ac.uk> – The John Innes Centre. See under 1923 C D Darlington joins JIH. [bib0060](#)
- <http://www.jic.ac.uk> – The John Innes Centre. It includes interview with Darlington 1979. [bib0065](#)

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Biographical Sketch

AU8 J. S. (Pat) Heslop-Harrison is Professor of Molecular Cytogenetics and Cell Biology at the University of Leicester, UK, and President of the Society for Experimental Biology. His work is largely with crop plants, their wild relatives, and model species, in a comparative context. The research involves study of chromosomes and the genomes, at the DNA and functional levels, including development of models and systems approaches. Particular projects examine the nature, origin, and consequences of polyploidy; the evolution of repetitive DNA sequences over evolutionary and plant-breeding timescales; and the assessment and exploitation of biodiversity in crops. He teaches courses in cell biology and genetics, and has projects with both tropical and temperate crops.

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