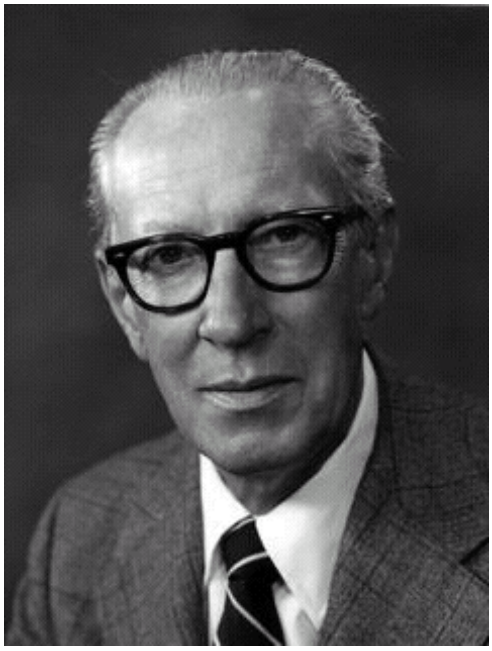


Courtesy of E.I. du Pont de Nemours, Wilmington, Delaware

Theodore L. Cairns

July 20, 1914 — September 26, 1994

By Blaine C. McKusick

THEODORE L. CAIRNS, COMMONLY known as "Ted," was a DuPont Company research scientist who made important contributions to the science of chemistry, applications of chemistry, and U. S. scientific policy. He spent thirty-eight years in DuPont's Central Research Department, the last eight as its director.

Cairns was born in Canada in the city of Edmonton, Alberta. He attended Edmonton public schools and then entered the University of Alberta in 1932 as a chemistry major. He graduated with a B.S. in 1936. He showed an aptitude for research even as an undergraduate, co-publishing a paper on aminobiphenyls based on research done under the direction of Professor Reuben B. Sandin.

About a year before graduation, he met Margaret Jean McDonald, a fellow University of Alberta student majoring in home economics. The scene of their initial meeting--a smelly chemistry laboratory--was not especially romantic. His ownership of a rumble-seated car, which he had purchased for twenty-five dollars, perhaps impressed Margaret. They often dated during their senior year at the university.

Cairns had decided that opportunities for chemists were greater in the United States than in Canada and sought Sandin's help in gaining admittance to an American graduate school. Sandin recognized Cairns's potential as a chemist and recommended him to the renowned Professor Roger Adams of the University of Illinois Chemistry Department. Cairns was admitted to that department in the fall of 1936, and he promptly started to work with Professor Adams on the stereochemistry of substituted biphenyls. The research went well, and Cairns received his doctorate in 1939 after only three years, instead of the normal four.

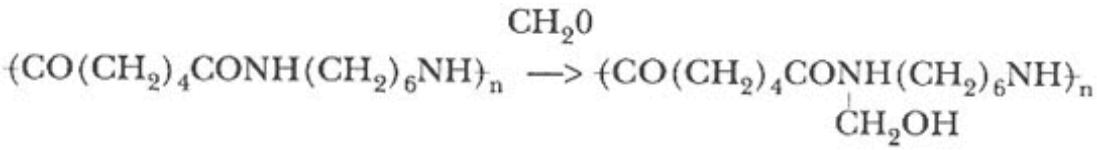
Academia beckoned, and in the fall of 1939, after working that summer in the laboratories of the Eastman Kodak Co., Cairns joined the faculty of the Chemistry Department at the University of Rochester as an instructor.

Cairns and Margaret McDonald had not been able to see much of each other after their graduation from the University of Alberta (she was working in a Baltimore hospital). However, they corresponded regularly, and they married in Toronto in 1940. Their first child John was born in 1941; by that time Cairns had become a U. S. citizen, and Margaret followed suit a year later.

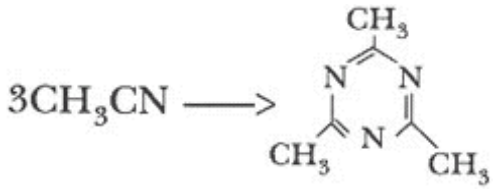
Life as a professor seemed less attractive close up than from a distance, and Ted's former professor, Roger Adams, long a valued consultant to the DuPont Company, painted a bright picture of research opportunities there. Indeed, opportunities were very good, for Wallace Carothers and DuPont colleagues had recently discovered the first practical synthetic fiber (nylon) and the first practical synthetic rubber (neoprene). Cairns visited the laboratories of the DuPont Experimental Station in Wilmington, Delaware, was favorably impressed by the chemists he met and the facilities he saw, and left the University of Rochester to join DuPont in 1941, a few months before the United States entered World War II.

At the time Cairns came to DuPont, the importance of nylon was well recognized there. It seemed that its chemical modification might open up new uses for it, and Cairns studied its modification by formaldehyde and other reactants. Some of the work was instigated by wartime needs for nylon with special properties. Interesting, patentable results were obtained.

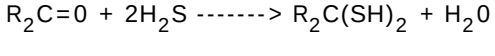
With the coming of peace, expansion of research became possible, and the DuPont Experimental Station grew rapidly. With the expansion came a need for strong, capable research leaders, and Cairns soon found himself the leader of a group of eight or so Ph.D. chemists seeking useful applications of chemistry. His group looked for a new chemistry of cheap, reactive raw materials such as acetylene, ethylene, carbon monoxide, hydrogen sulfide, and hydrogen cyanide. Thus they turned up N-methylol polyamides by the reaction of formaldehyde with polyamides.



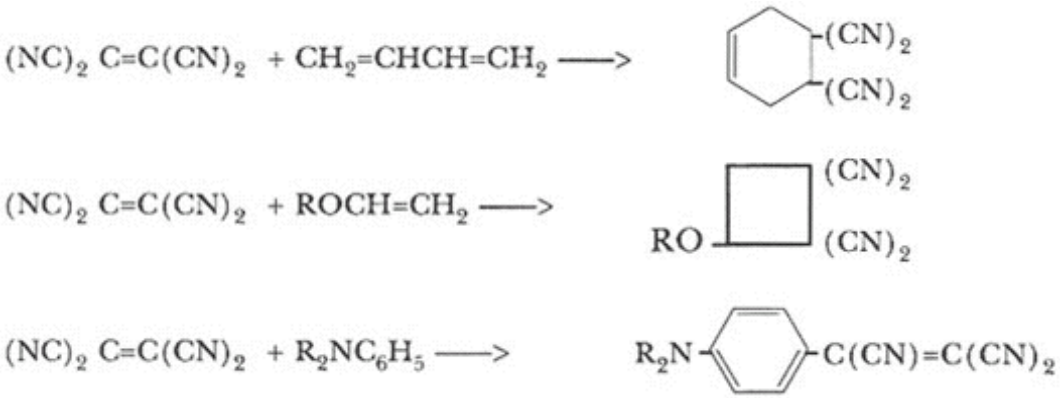
In examining the effect of very high pressure on chemicals, they found that a pressure of 8000 atmospheres converted nitriles to s-triazines.



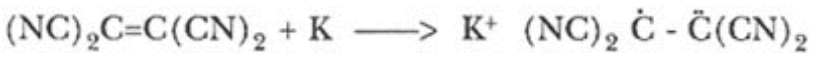
Such pressures on mixtures of ketones and hydrogen sulfide provided gem-dithols, previously unknown.



Impressed by the properties of poly(tetrafluoroethylene), or Teflon, discovered elsewhere in DuPont, Cairns proposed the synthesis and polymerization of the as yet unknown tetracyanoethylene. Its initial synthesis was not easy, but once that hurdle was passed, it proved a very reactive, versatile chemical. Although it failed as a source of polymers, it formed six-membered ring adducts with 1,3-dienes, four-membered ring adducts with vinyl ethers, brilliantly colored tricyanovinyl dyes with aromatic amines, and many other classes of products.



Tetracyanoethylene readily forms an anion radical, for example, by reaction with potassium:



This anion radical had unanticipated stability, permitting isolation of various of its salts with interesting electronic, optical, and magnetic properties. These salts have been the subject of widespread studies for the past thirty years. The decamethylferrocenium salt was the first molecule-based ferromagnetic material ever characterized. Its critical temperature was only 4.8šK, but a salt prepared from dibenzene-vanadium is ferromagnetic above room temperature. An extraordinary variety of magnetic properties is available from the radical anions of TCNE and other cyanocarbons. This subject was reviewed in *Chemical and Engineering News* fairly recently.[1]

Cairns was gradually given greater responsibility in DuPont, becoming the laboratory director of the Central Research Department in 1952, its research director in 1966, and director of the entire department in 1971. When the Central Research Department merged with DuPont's Development Department in 1977, Cairns became director of the resultant Research and Development Department, an organization of hundreds of chemists and engineers devoted to discovering new chemistry and developing practical applications for it.

Cairns retired in 1979, with a multitude of his co-workers of the preceding thirty-eight years jamming the DuPont Country Club ballroom to demonstrate their friendship and admiration for him. He had been an inspiring leader who, as his long-time colleague Robert M. Joyce has pointed out, "was an inspiring leader with a sharp eye for spotting chemical talent and a great sense of putting the right person in the right job."

Cairns participated in many professional activities, especially in the field of chemical publication. He was on the Editorial Board of *Organic Syntheses* (1949-56) and then served on its Board of Directors for several years. He subsequently worked similarly for its sister publication *Organic Reactions*, serving on its Editorial Board from 1960 to 1969. He played a truly vital role for *Organic Reactions* from 1967 to 1969. Its editor-in-chief Arthur Cope suddenly died in 1967. With great uncertainty as to the publishing plans and commitments that Cope had made, none of the other editors was willing to take Cope's place. Cairns, unwilling to see this useful publication die, became its unofficial editor-in-chief until William Dauben of the University of California, Berkeley, with urging from Roger Adams and Cairns, accepted the job in 1969. His acceptance was just in time to see that volume 17 was issued and that this important chemical publication got back on its feet. Cairns remained on the Advisory Board of *Organic Reactions* for several years, during which time he co-authored an important chapter on "Cyclopropanes from Unsaturated Compounds, Methylene Iodide, and Zinc-Copper Couple."[2]

Cairns was on the Board of Editors of the *Journal of Organic Chemistry* from 1965 to 1970. He was active in the American Chemical Society both locally and nationally. He was on the Executive Committee of its Organic Division in 1955-56, its chairman in 1964-65, and represented it on the American Chemical Society Council during most of the period 1955-65.

He was elected to the National Academy of Sciences in 1966 after having served on one of its most important committees, the Committee for the Survey of Chemistry, in 1964-65. This committee produced a definitive and influential assessment of basic research in chemistry in the United States.

His broad experience and knowledge in science and technology was put to use through membership on several important government committees:

The Delaware Governor's Council on Science and Technology, 1969-72

President Nixon's Science Policy Task Force, 1969

The President's Science Advisory Committee, 1970-73

The President's Committee on the National Medal of Science, 1974-75

The Polytechnic Institute of New York Advisory Council for Chemistry, 1976-78

For several years Cairns chaired the Division of Chemistry and Chemical Technology of the National Research Council. His accomplishments were recognized by several awards:

The City of Wilmington's Outstanding Citizen Award, 1963

The American Chemical Society Award for Creative Work in Synthetic Organic Chemistry, 1968

SOCMA (Society of Chemical Manufacturers Association) Medal for Creative Research in Synthetic Organic Chemistry, 1968

Honorary Doctor of Laws degree, University of Alberta, 1970

Perkin Medal, American section of the Society of Chemical Industry, 1973

Cresson Medal, The Franklin Institute, 1974

Cairns would use the occasion of an award to express views on the progress of technology and the future of research, thereby influencing both. For example, on receiving the Perkin Medal of the Society of Chemical Industry in New York in 1973, the topic of his address was "The Environment for Industrial Research." He noted the importance of investigation to improve product lines and processes and to find alternative raw materials to improve quality or lower mill costs. However, he stressed the value of searching for new products and new ventures to be at the heart of business ten to fifteen years in the future. He concluded by saying that "the world offers no end of difficult problems to be solved and will be glad to try whatever solutions we can provide at a reasonable price."

Ted and Margaret Cairns had four children: John A., a Minneapolis lawyer; Margaret Etter, a professor of organic chemistry, crystallography, and solid state interactions at the University of Minnesota, who died in 1992; Elizabeth Reveal, a Washington, D.C., financial adviser to local governments; and James R., a manager of trust accounts for a Philadelphia bank. The family was always close knit. As the children were growing up, the family did many things together, such as tennis, skating, gardening, and

travel.

After retirement Cairns continued to follow the course of chemistry and other sciences with interest, but he seldom played an active role. He occasionally attended scientific meetings, such as dinner meetings of the editors of *Organic Syntheses* or *Organic Reactions*, when the meetings happened to be nearby. He at last had time to pursue his hobby of gardening, especially the raising of unusual varieties of dahlias. However, age gradually caught up with him, and on September 26, 1994, he died in Wilmington at age eighty. Besides his wife and three children, Cairns was survived by a sister, Eleanor Cairns Everington of Stony Plain, Alberta; eight grandchildren; and three great-grandchildren.

Robert M. Joyce was a close friend and colleague of Cairns for four decades, beginning in graduate school days at the University of Illinois and extending through extensive collaboration in the DuPont Company. He well described Cairns as "an inspiring leader with a sharp eye for spotting chemical talent and a great sense for putting the right person in the right job."[3]

NOTES

[1] J. S. Miller and A. J. Epstein, "Designer Magnets," *Chem. Eng. News* 73 (No. 40) (Oct. 2, 1995): 30-41.

[2] Cyclopropanes from unsaturated compounds, methylene iodide, and zinc-copper couple. *Org. React.* 20(1973):1-131.

[3] R. M. Joyce. "Theodore L. Cairns," *Org. React.* 47(1995):vii-viii.

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