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## The Creative Life of a Genius: Nobel Laureate P. A. M. Dirac: A monosyllabic creative genius

V. Krishna Kumar

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V. Krishna Kumar Ph.D.

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# The Creative Life of a Genius: Nobel Laureate P. A. M. Dirac

A monosyllabic creative genius

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Few people perhaps know what “positron” is in “Positron Emission Tomography” (PET scan). PET works by using radioactive atoms which emit particles called positrons, the antiparticle of electrons (Lipkin, 1987, p. 234). Paul Adrien Maurice Dirac (August 8, 1902- October 20, 1984) predicted the existence of positrons purely from mathematical calculations while attempting to reconcile quantum theory with Einstein’s relativity theory four years before Carl D. Anderson discovered it in 1932. Dirac won the Nobel Prize at age 31; his work stimulated many others who became Nobel laureates.

A quantum physics founder, he held the prestigious Lucasian Professor of Mathematics title at the University of Cambridge (1932-69), once held by

Newton. After a brief stint at the University of Miami (1968-72), he became Professor of Physics in 1972 at Florida State University, Tallahassee, where he remained professionally productive until he died.

### Early Home Environment and [Education](#)

Paul Dirac, the middle of three children, was born to Charles Dirac and Florence Hannah Dirac, née Holten. According to Kragh (1990), his father, a highly regarded teacher, wanted his children to have the best education. However, he was also known for being a strict disciplinarian and his “meticulous system of [punishment](#)” (p. 3). Farmelo (2009) notes Paul Dirac saying “I never knew love or affection when I was child” (p. 5). He felt little [grief](#) when his father died and was noted to have said: “I feel much freer now” (Kragh, 1990, p. 2). Apparently, he did most of his schoolwork in his bedroom to escape the difficult home environment (Farmelo, 2009).

According to Kragh (1990), while in school Dirac excelled in mathematics, reading advanced books for his age, he had no interest in Greek mythology, Latin, or classical poetry. He was glad not to have to study Greek or Latin and showed little interest in sports or [social life](#).

Dirac graduated with a B.Sc. from Bristol University in electrical engineering, doing well in theoretical, but not in experimental and technological subjects. As a young man, he had no particular ambition; “he did what he was told” and studies were a means to a job (Kragh, 1990, p. 4). Although graduating with honors, he could not acquire a job because of recession but gladly accepted free tuition to study mathematics at Bristol University. He earned a Ph.D. from the University of Cambridge in 1926 (Krisch, 1987).

### Unique [Personality](#)

Characterized as strange, mystical, monosyllabic, unsocial, and possibly [autistic](#) (Farmelo, 2009), Dirac attributed his [introversion](#) and taciturnity to his disciplinarian father who demanded he speak “perfect” French at mealtime with him (Hawkins, 1998, p. xv), while his siblings ate separately with their mother in the kitchen for reasons unknown (Farmelo, 2009). However, Hawkins (1998) suggests that he might have turned out the same regardless of his demanding father.

Krisch (1990) noted that although Dirac's taciturnity was sometimes mistaken as being haughty or impolite, he seemed to have prioritized thinking over talking; he spoke only to make a point. Despite numerous anecdotes about his strangeness, many remember him warmly. Harish-Chandra (1987) spoke of him as "gentle and kind and yet rather aloof and distant" (p. 35). Pais (1998) observed his 40 years of memories about him were all "fond ones" and that he shared "Niels Bohr's opinion of him: 'Of all physicists, Dirac has the purest soul'" (p. 38). He has been described as being without enmities or dislikes for any person (Kursunoglu, 1987, p. x).

Kragh (1990) noted Neville Mott likened him to Gandhi "little flesh and much mind" (p. 251). He cared little about personal comforts while at home or traveling. He lived a modest, ascetic life, never smoked or drank [alcohol](#), but drank large quantities of water (Farmelo, 2009; Kragh, 1990).

His interests have been described as narrow compared to his contemporaries, perhaps because his father and school had [stressed](#) science, practical education, and languages. According to Kragh (1990), "He had no appreciation for literary scholarship and felt that reading might even have an adverse effect on original thinking." When Robert Oppenheimer offered him two books to read on his way to Japan, he refused saying "reading books interfered with thought" (p. 258).

### Approach to Scientific Work

Dirac's primary interest was in fundamental research, not teaching. He did not want his students to depend on him for advice. Harish-Chandra (1987) remembers dropping out of his lectures when he found that they were the same as his book. When asked to clarify something during a lecture, he repeated it exactly since it was already expressed the best way. In conversations, "he responded most positively to concise questions" (Krisch, 1987, p. 46).

Kemmer (1987, see also Kragh, 1990) observed that his work deviated from the fashionable trends or mainstream physics, but it was highly influential. Dirac was a true intrinsically motivated ivory-tower scientist whose prime rewards were to come up with new ideas and to advance physics by creating *beautiful* mathematical theories. He disliked recognition and publicity. "He escaped to the London Zoo to avoid the many congratulations" on the day he was appointed Lucasian Professor (Kragh, 1990, p. 252). He

almost declined the Nobel Prize, but Ernest Rutherford told him that not accepting it would invite even greater publicity. A London newspaper featured the headline “The genius who fears all women’ and described him as ‘[shy](#) as a gazelle and modest as a Victorian maid” (Kragh, 1990, p, 115).

Farmelo (2009) described him as a top-down thinker “beginning with mathematically precise formulations of fundamental principles and only afterwards using the theory to make predictions” (p. 94). His early work involved taking well-known results and accounting for them by a different theory. He tried one thing and then another when results were not satisfactory. Kragh (1990) observed that Dirac believed that (a) theories progressed incrementally and cites Heisenberg’s observation that his “starting points were particular problems and not wider relationships . . . All that matters is to get over the next three yards” (p. 281); (b) theories must be first *mathematically beautiful* and then simple, but, he cared little about exact proofs and mathematical rigor; (c) a person who originates a theory is not the best to develop it because one cannot view one’s own theory in a detached way and also worry that the theory may fall apart on closer examination; and, (d) if the theory suggested the existence of something, it must exist, referred to as the principle of plenitude.

Farmelo (2009) noted Dirac liked to work undisturbed. At Tallahassee, he worked for three hours in his office occasionally taking a break to go to the library. He did not welcome visitors and would lift the phone receiver and drop it before listening to the caller’s voice. At noon, he joined colleagues for a brown bag lunch, but spoke only occasionally. After lunch, he napped on his office sofa or attended a seminar then returned home for late afternoon tea with his wife. He relaxed after Dinner, went to a “classical concert or read a novel—Edgar Allen Poe mysteries, Le Carre spy thrillers and Hoyles science-fiction stories were among his favorites” (pp. 393-394). He enjoyed watching TV, especially Cher, *Nova science documentaries*, and *The Forsyte Saga*. On the night of *Upstairs, Downstairs*, the Diracs accepted dinner invitations, “only if their hosts agreed in advance to watch it with them in silence” (p. 394). He also preferred to eat undisturbed.

Dirac loved to walk. As a student at Cambridge, he spent almost everyday at the libraries except Sundays when he relaxed, and took long solitary walks in the country mainly to rest and relax from “the intense studies of the week, and perhaps to try and get a new outlook with which to approach the problem the following Monday . . . I had just the problems maybe floating about in the back of my mind without consciously bringing them up” (as quoted in Kragh, 1990,

p, 10-11). He preferred to work in the mornings, believing that “one’s brain power is at its maximum and towards the end of the day I was more or less dull, especially after dinner” (as quoted in Kragh, p.13).

Although, he rarely collaborated, his deep interest in physics led him to attend tea parties and colloquia regularly as a student in Cambridge. He listened more than he talked with other distinguished scientists and acknowledged their role in his thinking. He traveled worldwide, shared his work and learned from others about their work. When he traveled, he enjoyed sightseeing, hiking, and mountaineering. With his friends, he climbed to the top of Uncompraghre peak (4360 meters) and Mount Elbrauz (5,640 meters), Europe’s highest mountain. To practice, he climbed trees in the hills outside Cambridge and on these occasions “he wore his formal black suit that he always wore” (Kragh, 1990, p. 259).

There is much more to Dirac’s life than this brief essay presents and there is much to learn from Dirac’s life, particularly about his dedication, diligence, love of beautiful theories, and his need to avoid recognition and publicity. He loved working, walking, and traveling to advance his work and enjoy nature’s gifts. He did not speak much, but many who knew him well admired him for his scientific insights and remembered him fondly as “gentle and kind” and a “purest soul” along with many amusing anecdotes about his idiosyncratic nature.

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