

---

## Richard Phillips Feynman

### Physicist and Teacher Extraordinary

---

The first three decades of the twentieth century have been among the most momentous in the history of physics. The first saw the appearance of special relativity and the birth of quantum theory; the second the creation of general relativity. And in the third, quantum mechanics proper was discovered. These developments shaped the progress of fundamental physics for the rest of the century and beyond. While the two relativity theories were largely the creation of Albert Einstein, the quantum revolution took much more time and involved about a dozen of the most creative minds of a couple of generations.

Of all those who contributed to the consolidation and extension of the quantum ideas in later decades – now from the USA as much as from Europe and elsewhere – it is generally agreed that Richard Phillips Feynman was the most gifted, brilliant and intuitive genius out of many extremely gifted physicists. Here are descriptions of him by leading physicists of his own, and older as well as younger generations:

*“He is a second Dirac, only this time more human.”* – Eugene Wigner

*“...Feynman was not an ordinary genius but a magician, that is one “who does things that nobody else could ever do and that seem completely unexpected.”* – Hans Bethe

*“... an honest man, the outstanding intuitionist of our age and a prime example of what may lie in store for anyone who dares to follow the beat of a different drum..”* – Julian Schwinger

*“... the most original mind of his generation.”* – Freeman Dyson

Richard Feynman was born on 11 May 1918 in Far Rockaway near New York to Jewish parents Lucille Phillips and Melville Feynman. His physics teacher at High School was Abram Bader, who saw Feynman’s exceptional talents and in a special lecture explained to him the beautiful principle of least action in classical mechanics (see chapter 19, Vol.2, *Feynman Lectures on Physics*). After graduating from MIT Feynman joined Princeton University in 1939 as a graduate student under the guidance of John Archibald Wheeler. They initially worked on extending a 1938 paper of Paul Dirac on the classical theory of radiating electrons in an action-at-a-distance framework. Dirac had always been Feynman’s hero, and for his thesis Feynman turned again to Dirac. It was a conversation with Herbert Jehle in 1941 that led Feynman to a seminal 1933 paper of Dirac in which he had drawn attention to an analogy between the classical action principle, and certain basic expressions in quantum mechanics. In Feynman’s hands this analogy was sharpened to an equality, thus leading to his own new path integral approach to quantum mechanics. This, by the way, is yet to achieve an acceptable mathematical form.



The war years interrupted the efforts of both Feynman and Schwinger to tackle the divergence problems in quantum electrodynamics, another of Dirac's pioneering creations from 1927. In 1965 the Physics Nobel Prize was shared by the two of them and Sin-Ichiro Tomonaga from Japan for their development of renormalization theory. Here is a fine passage from Feynman's prize acceptance speech:

*“Theories of the known, which are described by different physical ideas, may be equivalent in all their predictions and are hence scientifically indistinguishable. However, they are not psychologically identical when trying to move from that base into the unknown.”*

Feynman also did pioneering work in elementary particle physics and in the quantum theory of gravitation. He was a brilliant teacher and lectured extensively to both scientific and general audiences. While he was certainly flamboyant and charismatic, he was not a little above wanting and seeking attention to himself. For the benefit of our younger readers here is a list of many of his books on specialised as well as other topics, several published after his passing:

- a) *Quantum Mechanics and Path Integrals* (with A R Hibbs) – 1965.
- b) *The Character of Physical Law* – 1965.
- c) *Lectures on Physics*, Vols I – III, 1965.
- d) *QED: The Strange Theory of Light and Matter*, 1983 lectures, published 1985.
- e) *Surely You're Joking, Mr. Feynman* – 1988.
- f) *What Do You Care What Other People Think?* – 1988.
- g) *Lectures on Gravitation* 1962–63, published 1995.
- h) *Six Easy Pieces* – 1995.
- i) *Lectures on Computation* 1983–86, published 1996.
- j) *Six Not So Easy Pieces* – 1997.
- k) *The Meaning of It All*, 1963 lectures, published 1998.
- l) *The Pleasure of Finding Things Out* – 1999.

To these should be added his lecture notes on Statistical Mechanics, Photon Hadron Interactions, QED, and Theory of Fundamental Processes. His scientific research papers, it may be noted, number not much more than about fifty! In fact in 1945 at an early stage in his career he said to Schwinger: “I haven't done anything, but you've already got your name on something”.

Feynman was married thrice, and had a son and a daughter. He had a serious interest in art, learning painting and sketching from a professional artist friend. After suffering for many years, he finally succumbed to cancer on 15 February 1988. Two extensive biographies of him have been written: *Genius – Richard Feynman and Modern Physics* by James Gleick (1992) and *The Beat of a Different Drum – The Life and Science of Richard Feynman* by Jagdish Mehra (1994).

*N Mukunda*

*Email: nmukunda@gmail.com*

