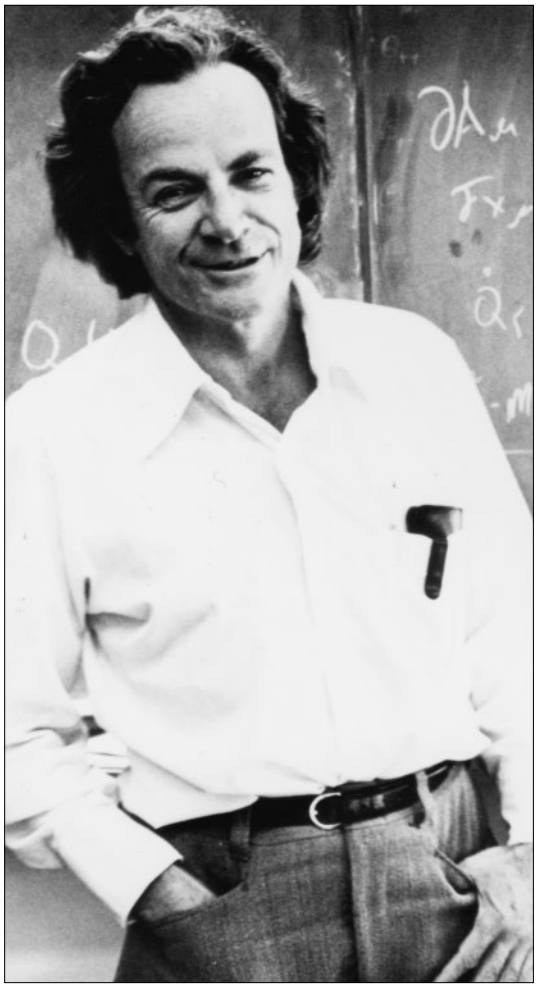
TEACHING ANECDOTES

Anecdotes to enliven teaching by providing personal stories to flesh out the hinterland of a topic.

Richard Phillips Feynman



Richard Feynman on fine form: more than just a physicist. Courtesy Emilio Segrè Visual Archives.

Born: 11 May 1918 in Far Rockaway, New York.

Occupation: Physicist, bongo player, safe cracker, author, explorer and self-mythologist.

Distinctions: Feynman won the Nobel Prize for Physics in 1965, but his real distinction is his unique view of things – this is what has made him the physicist's physicist.

Loved by: His family, generations of his students and the physics community.

Hated by: Authority, with whom he often clashed.

Not to be confused with: Julian Schwinger.

Early life: Feynman's parents, Melville and Lucille, were eastern European immigrants – Melville from Byelorussia and Lucille from Poland. Melville was a uniform maker, which, he claimed, made him immune to rank and title. He'd seen generals, cardinals and other so-called VIPs in their underwear being measured for their clothes. Family legend has it that on hearing of his wife's pregnancy, he said: 'If it's a boy it will be a scientist.' (Richard's younger sister Joan also became a professional physicist.)

Each night Melville read to Richard from the *Encyclopaedia Britannica*, adding helpful examples to translate ideas into reality. For example, explaining that *Tyrannosaurus rex* was 25 feet high, he said: 'If he stood in our yard, he would be high enough to put his head through the window.' He also displayed an intuitive idea about physics, explaining concepts like inertia using his son's toy truck.

Feynman began to teach himself about elementary calculus with books borrowed from the library to supplement what he learned from Public School 39. He applied to college with his perfect grades in maths and science. However, his poor grades in other subjects and his Jewish background caused problems. His application to Columbia was turned down but he was accepted at MIT. At 17 Richard went to Massachusetts. He spent four years there before going on in 1939 to Princeton for his graduate work with John Wheeler. The original problem he was set was boring and he worked on his ideas about electromagnetic radiation and quantum theory – ideas that had been inspired in him by Paul Dirac's work. His first talk on his work had quite a distinguished audience, featuring both Wolfgang Pauli and Albert Einstein. He completed his thesis in 1942, but by now he was involved with two things that

would change his life: a girl called Arlene, whom he was to marry, and a secret programme called the Manhattan Project.

Feynman was assigned to Hans Bethe's theoretical team doing calculations for various parts of the bomb. He quickly gained a reputation as a very bright young man and a practical joker. He broke into safes and played tricks on the military men guarding the scientists. Unfortunately, Arlene developed tuberculosis. Project director Robert Oppenheiner arranged for her to be moved to a local hospital.

Richard and Arlene married, but she died in 1945. Ironically, he borrowed Klaus Fuchs' car to drive to the hospital – the vehicle that the British spy used to smuggle details of the project to the Soviets via Donald MacLean and others. Feynman had mixed feelings in later life about his work on the atomic bomb. He remembered clearly going to New York in 1945 and imagining how much would have been destroyed by the weapon that they had worked on. He also contrasted the jubilant scenes in Los Alamos with what was going on in Japan at the same time.

After the war Feynman was reunited with Bethe, at Cornell University, where he continued to work on the quantum mechanical electromagnetic theory.

Defining moments: During the late 1940s Richard developed a unique methodology to solve the quantum electrodynamics problem that he had worked on for so long – he used diagrams and a graphical method. Bethe described it as 'genius'. Feynman shared the 1965 Nobel Prize with Julian Schwinger (from the same New York background) and Shin'ichiro Tomonaga, who had solved the problem using more traditional methods.

Later life: In 1950 Feynman became professor of theoretical physics at the California Institute of Technology. He had already planned a sabbatical before receiving the offer, so he spent the first 10 months of his new appointment in Brazil.

He remained at Caltech for the rest of his career. He became interested in other projects and effectively invented nanotechnology in a lecture that he gave in 1959. He developed a reputation as a bongo drummer. He also became interested in art, attending life-drawing classes, and he claimed that he liked to go to topless bars to help him with his physics. He also drove a microbus with Feynman diagrams on the side and the number plate 'QANTUM'.

In 1986 he was appointed to the Presidential Commission on the Challenger shuttle disaster and he famously identified, live on TV, that the frozen O-rings were at the heart of the problem.

In 1979 he was diagnosed with cancer and underwent major surgery, from which he recovered. However, the cancer returned in the mid-1980s.

He became an unlikely bestselling author when the anecdotes and stories that his friend and drumming companion Ralph Leighton had recorded were published as *Surely You're Joking Mr Feynman* in 1985. A second volume appeared soon afterwards. He married twice more and had two children.

Feynman died on 15 February 1988. The Caltech students hung a huge banner from the main building. It said, simply: 'We love you Dick.'

Legacy: A cottage industry has developed around Feynman's output. You can now buy CDs of his lectures, reissued and repackaged books, and memorabilia. Every day physicists use his eponymous and ubiquitous diagrams.

Steven Chapman

STARTING OUT

A forum for newcomers to physics teaching to share tips, ideas, survival strategies and experiences.

What Katie did next: part 8

Driving to school after the autumn half-term holiday, I remembered that I had promised to ditch the alphabetical seating plans that I had imposed on my classes since September. The switch has worked surprisingly well – many of the kids work to good effect with their friends, and a cluster of chatty boys has moved to the front of the lab where I can keep my beady eye on them.

The transition to newly qualified teacher (NQT) has been strange. As a PGCE student you get used

to the frequent lesson observations, and there was often another teacher in the room. I had a little jolt of nerves the first time I was left alone in charge of my new classes. You soon get used to it, though, so it was scary all over again to begin the round of induction-year observations. I guess they expect me to know what I'm doing by now.

Teaching is easier and more fun now that I know my classes better, and the strengths and weaknesses of the children become evident. I think the cliché 'don't smile before Christmas' is terrible advice if you want to build good relationships with your students. Perhaps the person who said it just meant that you might not have the time to smile.

Teaching is never mundane, thanks to the kids. My year-7 group instantly formed a chain gang to ferry buckets of water back and forth when a tap jammed on over a blocked sink. A year-11 boy arrived at Olbers' paradox himself: why is the night sky dark when the universe contains so many stars? And a year-13 girl independently made the mental leap to realize that simple harmonic motion could describe vibrating particles in solids as well as swings and pendulums.

When I have a spare nanosecond, I remember to be thankful for my light NQT timetable, but I still don't have the time to prepare as many exciting lessons as I did during my teaching practices. The scheme of work rules, and established teachers may groan when a new one is introduced, but remember – all of the schemes of work are new to NQTs. The pressure of ploughing through them is relentless.

Module tests and mocks loom for my year-10 and year-11 groups. The children are getting nervous, but I know these are the first real tests of my teaching, too. I might let you know how we get on.

Katie Pennicott, *NQT, Backwell School, Bristol*

The experimental physicist at work.

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