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FRED HOYLE

The scientific life of Fred Hoyle (1915–2001) was truly unparalleled. During his career he wrote ground-breaking scientific papers, and caused bitter disputes in the scientific community with his revolutionary theories. Hoyle is best known for showing that we are all, literally, made of stardust, in his paper explaining how carbon, and then all the heavier elements, were created by nuclear reactions inside stars. However, he constantly courted controversy, and 2 years later he followed this with his ‘steady state’ theory of the universe. This challenged another model of the universe, which Hoyle called the ‘big bang’ theory.

Fred Hoyle was also famous amongst the general public. He popularised his research through radio and television broadcasts, and wrote best-selling novels. Written from personal accounts and interviews with Hoyle’s contemporaries, this book gives valuable personal insights into Fred Hoyle and his unforgettable life.

Simon Mitton is a Fellow of St Edmund’s College, Cambridge, and was the astronomy publisher at Cambridge University Press for 20 years. He is the author or editor of several books on astronomy and the history of science, including *Cambridge Scientific Minds* (Cambridge University Press, 2000). The International Astronomical Union designated an asteroid as Mitton 4027 in recognition of the achievements of Simon and his wife Dr Jacqueline Mitton in popularising astronomy through book writing.

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FOREWORD BY PROFESSOR PAUL DAVIES

I AM OFTEN ASKED if I had a mentor who propelled me towards a life in science. There was no personal mentor as such, but Fred Hoyle, more than anybody, was my role model, and he strongly influenced my career in several ways. I was one of many youngsters deeply influenced by *Frontiers of Astronomy*, which I read whilst in the Sixth Form at Woodhouse Grammar School in North Finchley. About the same time I was presented at Speech Day with *Norton's Star Atlas* by our local Member of Parliament, one Margaret Thatcher. These events set me squarely on the path of theoretical astronomy and cosmology.

Fred's science fiction also influenced me. I have vivid memories of the television series *A for Andromeda*, featuring the ravishing Julie Christie. His masterful book *The Black Cloud* continues to colour my thinking about the nature of life and consciousness. I was thrilled to discover that a professional scientist could combine fundamental research with fiction writing, bringing to both challenging new concepts and ideas.

The first Hoyle lecture I attended was delivered at the Royal Society in 1967, when I was a beginning PhD student at University College London. Fred spoke about the arrow of time, and the Wheeler-Feynman theory of electrodynamics. I can definitely trace my lifelong interest in the nature of time to this lecture. Indeed, I soon thereafter abandoned my research into atomic astrophysics and took up the problem of providing a quantum description of the Wheeler-Feynman theory for the remainder of my PhD thesis.

It was a calculated move. My supervisor picked Fred to be the external examiner of the thesis. I vividly recall the viva examination, which took place in the Physics Department at UCL in the late spring of 1970. Fred was late, and his wife Barbara was on the phone worried that he had gone to the wrong part of the University. It was my first experience of the touching way in which Barbara took care of her often absent-minded husband. Fred's response to this wifely concern was a gruff, 'Where else was there to go?'

The viva went amazingly well in spite of my nervous state at being cross-examined by a national icon (a fellow student of mine had been failed at

this stage just the week before). However, I found that if I asked Fred questions, rather than the other way around as is intended, he couldn't resist lapsing into his famous didactic mode, embarking on extended expositions. This tactic helped fill up the time, giving me opportunities to conceal the gaps in my understanding.

With my PhD out of the way, the next part of my career strategy was to apply for a job at Fred's Institute of Theoretical Astronomy in Cambridge. I reasoned that with my thesis fresh in his mind, and his research with Jayant Narlikar on the Wheeler-Feynman theory still in progress, Fred might take a chance on me, and indeed he did. Armed with a coveted research fellowship, I moved to Cambridge in September 1970 to join the select group in Fred's empire.

At the time, I took it all for granted – the spacious offices, the sliding glass doors opening onto the well-tended gardens, the croquet lawn, the tea and coffee breaks in the library. But looking back, I now see how splendid it all was. In those days Martin Rees was just a young postdoc and Stephen Hawking a little-known mathematician in a wheelchair. Today, the list of names reads like a roll call of the finest minds in cosmology and astronomy. But they were all just young researchers then, newcomers who had been given a wonderful break by working in such an environment. Fred's thoughtfulness in designing the building with its various user-friendly features greatly contributed to the extraordinary productivity of the staff.

I have many fond memories of the two years I spent at the Institute. One of them was of Willy Fowler's sixtieth birthday. We clubbed together to buy him a model train, and went for a drink to a local pub afterwards. Fred disappeared, a habit at which he was most adept. Willy was a bit diffident about being described as a great astronomer. 'I don't even know the constellations,' he remarked gloomily. 'Nor do we,' came a chorus in response. 'But Fred does!' complained Willy. 'That's because he writes popular books,' was the reply. And I have to confess at being in awe of Fred's vast breadth of knowledge and eclectic interests. I recall him lecturing on topics as diverse as quantum electrodynamics, Mach's principle, ice ages and Stonehenge, whilst knocking off science-fiction novels in as little as three weeks (as he once told me).

Most of my professional interaction with Fred was conducted via Narlikar, who would phone Fred at home – he preferred to work away from the hubbub – and explain the latest problem with this or that piece of mathematics. Fred would consider the matter and set Jayant to work on

it. Then we would have another round of discussion, with Fred in absentia. He did show up a lot during the summer months, though, when the ‘Texas mafia’ descended. Don Clayton and a group of young postdocs from Rice University would breeze in, creating a lively and chaotic atmosphere for a few weeks. I can recall many an ardent discussion about astrophysics spilling out into the grounds, the conversation punctuated by a game of croquet or tea on the lawn. These were exhilarating times, with lots of seminars and informal chit-chat. Little did I know that I was witness to much history in the making.

My own work consisted of casting around for something worthwhile to do, and in that respect I have a lot to thank Fred for. It was his research that got me interested in anything that combined the large and the small – cosmology and microphysics. As a result, I discovered the papers of Leonard Parker on the creation of quantum particles by the expanding universe. This set the scene for my work on quantum field theory in curved space-time, a sort of half-way house to a quantum theory of gravity, which occupied much of my career. I also got stuck into my first book, *The Physics of Time Asymmetry*, which was a direct consequence of Fred’s Royal Society lecture. Although I came to disagree with some of Fred’s ideas on the arrow of time, his imaginative thinking provided a valuable stimulus to my own work.

I was vaguely aware of the undercurrents of animosity within the university towards Fred and his well-appointed Institute. The Hoyle-Ryle controversy was public knowledge, and I had heard Martin Ryle deliver a pointedly anti-Hoyle lecture at the Royal Astronomical Society some years earlier. But my only direct experience with the precarious state of the Institute came when I first arrived, and was refused membership of the University Library. The Librarian recognized neither my BSc nor my PhD from London University; only Oxford and Cambridge degrees were considered ‘real’! My Fellowship at the Institute of Theoretical Astronomy was shrugged aside as counting for nothing, since the Institute was not a college. Only members of colleges with ‘MA status’ were officially permitted through the hallowed portals. When I retorted that this seemed a rather stupid policy, I was told that when the university library was established in the fourteenth century ‘there were no institutes’. Eventually I gained library membership by virtue of taking on some low-grade undergraduate supervising for Peterhouse.

I left the Institute in mid-1972, just as Fred’s reign came to an end.

There were very few histrionics; indeed, the transition to the new regime was orderly and well-mannered. I remember Fred taking great care to find his young research fellows alternative employment. He supported my successful application for a lectureship at King's College London, remarking to me that he just needed to secure a position for Chandra Wickramasinghe and his responsibilities would be discharged. It says a lot about his generosity of spirit that he would show such conscientious concern for his young protégés at a time of enormous personal turmoil.

I did maintain contact with the Hoyles after they left Cambridge. When I moved to the University of Newcastle upon Tyne in 1980 I visited Fred at his cottage in Cockley Moor, and the Hoyles once came over for lunch at my house in Newcastle. I heard Fred lecture a few times in those post-Cambridge days, both about quasar redshifts and panspermia. I was also on his mailing list for a vast output of polemical preprints, some of which never made it to publication, but all of which were wonderful to read, and written in a style that I have often tried to emulate. Fred had a knack of making the most outrageous ideas or tenuous arguments seem obvious and reasonable, purely by his elegant and economical prose. He would have made a wonderful politician.

Fred Hoyle was undoubtedly one of the most colourful scientists of the twentieth century. I loved his maverick personality and contempt for orthodoxy, combined with a diffident personal style and straightforward manner that made a welcome contrast to the egotistical flamboyance of so many science popularizers. 'I don't care what they think,' he once remarked when discussing the many detractors of his claims about discrepant redshifts. My favourite Hoyleism is 'it is better to be interesting and wrong than boring and right'. Fred was, however, both interesting and right on many occasions. He will probably go down in history for his pioneering work on nucleosynthesis, but he was best known for fearlessly championing the steady-state theory in the face of mounting observational evidence against it. This theory was undeniably an incorrect model of the universe, but it did contain some elements of truth, and it provided an alternative ideology against which the prevailing cosmological ideas could be pitted. Just because the model turned out to be wrong does not mean it was valueless.

Fred's most speculative work was in astrobiology, begun after he left Cambridge, and carried out in collaboration with Wickramasinghe, who by then had moved to Cardiff. Fred was convinced that comets could be abodes for microbial life, and that if they approached the sun, the dormant

yet viable cargo would be liberated amidst the material evaporated off by the solar heat. In this manner, life might be delivered to planets; indeed, Fred argued that Earth may not merely have been seeded in this manner, but episodically re-infected. He unsuccessfully tried to convince the authorities that infectious pandemics might originate this way. Three decades on, and the life-in-comets theory doesn't look so daft. Space missions are in progress that should test the idea.

In typical Hoyle style, however, Fred was not content to leave it at that. His 1950s epiphany, in which he discovered that the existence of carbon – the life-giving element – hinged sensitively on certain precise details of nuclear physics, gave him a deep sense that the universe was, in his words, 'a put-up job'. For Hoyle, the hand of intelligence had left clear fingerprints all over physics and cosmology. It was an unconventional quasi-religious philosophy that rested uneasily with his earlier and vehement anti-God stance. In his final years, Fred sought to incorporate his speculative notions about life in the universe into a sort of total Hoyle-world-view. Ingeniously packaged and eloquently argued, this thesis combined neo-steady-state thinking with panspermia, quantum mechanics, time-reversed causation and intelligent design. It was a heady mix.

It is my deep regret that Fred's failing health obliged him to cancel at the last minute his offer to chair a lecture I gave at the Royal Society in October 2000. The occasion was a special Millennium conference on time, and my topic was 'the arrow of time'. This would have been history going full circle, for it was in that very building that I had heard Fred lecture on the same topic over thirty years before.

A few months later Fred died, and with his death a chapter closed on the history of British science. I am now older than Fred was when he quit Cambridge, and there have been a few times in my life when I have felt the same as he did about university bureaucracy. Like Fred, I too began pondering the big questions of life and the universe in my later career. I confess that some of my work is also getting pretty speculative these days, but when I start to lose my nerve I hear a small voice from the grave beseeching, 'Don't worry what they think!'

Paul Davies, Macquarie University, Sydney
January 2005