A Short History

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I was born on January the 8th, 1942, exactly 300 years after the death of Galileo. However, I estimate that about two hundred thousand other babies were also born that day. I don't know whether any of them was later interested in astronomy. I was born in Oxford, even though my parents were living in London. This was because Oxford was a good place to be born during the war; the Germans had an agreement that they would not bomb Oxford and Cambridge, in return for the British not bombing Heidelberg and Goettingen. It is a pity that this civilized sort of arrangement couldn't have been extended to more cities.

My father came from Yorkshire. His grandfather, my great grandfather, had been a wealthy farmer. He had bought too many farms, and had gone bankrupt in the agricultural depression at the beginning of this century. This left my father's parents badly off, but they managed to send him to Oxford, where he studied medicine. He then went into research in tropical medicine. He went out to East Africa in 1935. When the War began, he made an overland journey across Africa, to get a ship back to England, where he volunteered for military service. He was told, however, that he was more valuable in medical research.

My mother was born in Glascow, Scotland, the second child (out of 7) of a family doctor. The family moved south to Devon when she was 12. Like my father's family, they were not well off. Nevertheless, they managed to send my mother to Oxford. She was there later than my father. After Oxford, she had various jobs, including that of Inspector of Taxes, which she did not like. She gave that up to become a secretary. That was how she met my father in the early years of the War.

We lived in Highgate, north London. Our house was damaged by a V-2 rocket which landed a few doors away. Fortunately, we were not there at the time. In 1950, we moved

the three years I was at Oxford, an average of an hour a day. I'm not proud of this lack of work, I'm just describing my attitude at the time, which I shared with most of my fellow students: an attitude of complete boredom and feeling that nothing was worth making an effort for. One result of my illness has been to change all that: when you are faced with the possibility of an early death, it makes one realize that life is worth living, and that there are lots of things you want to do.

Because of my lack of work, I had planned to get through the final exam by doing problems in theoretical physics, and avoiding any questions that required factual knowledge. However, I didn't sleep the night before the exam, because of nervous tension. So I didn't do very well. I was on the borderline between a first and second class degree, and I had to be interviewed by the examiners to determine which I should get. In the interview, they asked me about my future plans. I replied I wanted to do research. If they gave me a first, I would go to Cambridge. If I only got a second, I would stay in Oxford. They gave me a first.

I felt that there were two possible areas of theoretical physics, that were fundamental, and in which I might do research. One was cosmology, the study of the very large. The other was elementary particles, the study of the very small. However, I thought that elementary particles were less attractive, because, although they were finding lots of new particles, there was no proper theory of elementary particles. All they could do was arrange the particles in families, like in botany. In cosmology, on the other hand, there was a well defined theory, Einstein's General Theory of Relativity.

At that time, there was no one in Oxford working in cosmology. However, at Cambridge there was Fred Hoyle, the most distinguished British astronomer of the time. I therefore applied to do a PhD with Hoyle. My application to do research at Cambridge, was accepted, provided I got a first, but, to my annoyance, my supervisor was not Hoyle, but a man called Denis Sciama, of whom I had not heard. In the end, However, this turned out to be for the best: Hoyle was away abroad a lot, and I probably wouldn't have seen much of him. On the other hand, Sciama was there, and he was always stimulating, even though I often didn't agree with his ideas.

I had not done much mathematics at school or at Oxford, so I found General Relativity very difficult at first, and did not make much progress. Also, during my last year at Oxford, I had noticed that I was getting rather clumsy in my movements. Soon after I went to Cambridge, I was diagnosed as having ALS, amyotrophic lateral sclerosis, or motor

summer school in General Relativity at Cornell University in upstate New York. That was a mistake. It put quite a strain on our marriage, specially as we stayed in a dormitory that was full of couples with noisy small children. However, the summer school was very useful for me because I met many of the leading people in the field.

My research up to 1970, was in cosmology, the study of the universe on a large scale. My most important work in this period was on singularities. Observations of distant galaxies indicate that they are moving away from us: the universe is expanding. This implies that the galaxies must have been closer together in the past. The question then arises: Was there a time in the past when all the galaxies were on top of each other, and the density of the universe was infinite. Or was there a previous contracting phase, in which the galaxies managed to avoid hitting each other. Maybe they flew past each other, and started to move away from each other. To answer this question, required new mathematical techniques. These were developed between 1965 and 1970, mainly by Roger Penrose and myself. Penrose was then at Birkbeck College, London. Now, he is at Oxford. We used these techniques to show that there must have been a state of infinite density in the past, if the General Theory of Relativity was correct.

This state of infinite density is called the Big Bang singularity. It would be the beginning of the universe. All the known laws of science would break down at a singularity. This would mean that science would not be able to predict how the universe would begin, if General Relativity is correct. However, my more recent work indicates that it is possible to predict how the universe would begin if one takes into account the theory of quantum mechanics, the theory of the very small.

General Relativity also predicts that massive stars will collapse in on themselves when they have exhausted their nuclear fuel. The work that Penrose and I had done showed that they would continue to collapse until they reached a singularity of infinite density. This singularity would be an end of time, at least for the star and anything on it. The gravitational field of the singularity would be so strong that light could not escape from a region around it, but would be dragged back by the gravitational field. The region from which it is not possible to escape is called, a black hole, and its boundary is called, the event horizon. Anything, or anyone, who falls into the black hole through the event horizon will come to an end of time at the singularity.

I was thinking about black holes as I got into bed one night in 1970, shortly after the birth of my daughter, Lucy. Suddenly, I realized that many of the techniques that Penrose and I

CURRICULUM VITAE

S W Hawking

Born 8th January 1942 at Oxford, England

1952-1959	Educated at St. Albans School.
1959-1962	Scholar in Natural Science at University College, Oxford.
1962	Final Honour School in Natural Science, Physics, First Class
1962-1965	Research Student in General Relativity under Dr. D W Sciama at Department of Applied Mathematics and Theoretical Physics, Cambridge.
1965-1969	Research Fellow of Gonville and Caius College, Cambridge.
1966	Adams Prize for Essay "Singularities and the Geometry of Spacetime."
1968-1972	Staff member of the Institute of Theoretical Astronomy, Cambridge.
1973	"The Large Scale Structure of Spacetime" (with G F R Ellis), Cambridge University Press.
1973-1974	Research Assistant at the Department of Applied Mathematics and Theoretical Physics, Cambridge.
1974	Elected a Fellow of the Royal Society.
1974-1975	Sherman Fairchild Distinguished Scholar at California Institute of Technology.
1975	Eddington Medal, Royal Astronomical Society.
1975	Pius XI Medal, Pontifical Academy of Science.
1975-1977	Reader in Gravitational Physics, Department of Applied Mathematics and Theoretical Physics, Cambridge.
1976	Dannie Heinemann Prize, American Institute of Physics and American Physical Society.

1984	Foreign Member Elect to the Americal Philosophical Society.
1985	Gold Medal of the Royal Astronomical Society.
1986	"Supersymmetry and its Applications: Superstrings, Anomalies and Supergravity." (with G W Gibbons and P K Townsend), Cambridge University Press.
1986	Elected to Membership of the Pontifical Academy of Sciences, Vatican.
1987	Honorary Doctor of Science, University of Leeds.
1987	Honorary Doctor of Science, University of Newcastle.
1987	Paul Dirac Medal, Institute of Physics.
1988	Wolf Foundation Prize in Physics.
1989	Encyclopaedia Britannica Award.
1989	Honorary Doctor of Science, Tufts University.
1989	Honorary Doctor of Science, Yale University.
1989	Honorary Doctor of Science, University of Cambridge.
1989	Companion of Honour (CH).
1990	Honorary Fellowship, UMIST.
1990	Honorary Doctor of Science, Harvard University.