

## Stephen Hawking: A Personal Tribute

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3.14 is famous once again!  $\pi$  is 3.14 approximately,  [\$\pi\$ -day](#) is on 3-14 (March 14th), Albert Einstein's birthday is on 3-14 and now Stephen Hawking's demise. A famous cosmologist, an icon of the scientific community and an inspiration for generations to come, Stephen Hawking is regarded as one of the most brilliant theoretical physicists since Einstein. All throughout his life, he remained a living example of courage, determination and brilliance. Diagnosed with motor neuron disease just as he stepped into his 20s, **Stephen William Hawking** had probably resolved to fight his illness by making a breakthrough in understanding the universe we live in. He once remarked, "*My goal is simple. It is a complete understanding of the universe, why it is as it is and why it exists at all.*". Definitely, he lived up to his resolution till the end of his life even after being confined to a wheel chair for more than half a century. He successfully overcame his physical constraints and went on to become one of the most celebrated physicists in the world.

Stephen Hawking was born on 8th January 1942 in Oxford, England to Frank Hawking and Isobel Hawking. Coincidentally, the day of his birth was also the 300th death anniversary of one of the greatest scientists of all time, Galileo Galilei. Well, Hawking modestly remarked "*around two hundred thousand other babies were born that day, so maybe it is after all not such an amazing coincidence!*" Hawking's parents attended the Oxford University where his father studied medicine and his mother studied philosophy, politics and economics. Stephen's father had the desire to admit him to Westminster School, one of England's best schools but Stephen fell ill on the day of the scholarship exam and so he couldn't appear for the exam. It would not have been possible for his father to cover the fees of Westminster School without a scholarship and hence Stephen was sent to St. Alban's School which was also well-known and academically excellent. Stephen, in his book "[My brief history](#)", describes his days at St. Alban's as

I was never more than about halfway up the class. It was a very bright class. My classwork was very untidy, and my handwriting was the despair of my teachers. But my classmates gave me the nickname Einstein, so presumably they saw signs of something better. When I was twelve, one of my friends bet another friend a bag of sweets that I would never amount to anything. I don't know if this bet was ever settled, and if so, which way it was decided.

Hawking had always been interested in how things operated and, in his teens, used to take them apart to see how they worked but he remarked in his book, "*I was not so good at putting them back together again. My practical abilities never matched up to my theoretical inquiries.*" Stephen's father encouraged his interest in science and guided him in mathematics. This naturally molded his passion for scientific research. Even then, the father and the son had lots of differences in opinion regarding the choice of course which Stephen was to pursue at Oxford University. Stephen insisted on studying mathematics and physics, whereas his father wanted him to study biology to pursue a career in medicine. At the end, Stephen won the argument. He performed exceptionally well in the entrance exam at Oxford, scoring

95% marks in the two physics papers and outstanding marks in the two mathematics papers. Thus, he was admitted to Oxford University as a scholar. During his first year at Oxford, he attended only mathematics lectures and tutorials and completed college exams solely in mathematics. During his three years at Oxford, Stephen amused his classmates and tutors with his excellent problem solving abilities. Hawking used to make very few notes and possessed only a handful of textbooks. He was so far ahead in his field that he had become distrustful of many standard textbooks. Three years into the university's course as the final exams approached, Stephen realized that he could have prepared better. He noted in his autobiography,

Because of my lack of preparation, I had planned to get through the final exam by doing problems in theoretical physics and avoiding questions that required factual knowledge. I didn't sleep the night before the exam because of nervous tension, however, so I didn't do very well. I was on the borderline between first and second class degrees, 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 that I wanted to do research. If they gave me a first, I told them, I would go to Cambridge. If I only got a second, I would stay in Oxford. They gave me a first.

Hawking arrived in Cambridge in October 1962 as a graduate student. He had applied to work with [Fred Hoyle](#), the most famous British astronomer of the time, and the principal defender of the steady-state theory. The inspiration for this came from Stephen's involvement on a summer course with Hoyle's student Jayant Narlikar (click [here](#) for an interview with Narlikar published in Gonit Sora), the famous Indian astrophysicist. As Hoyle was preoccupied with enough students, so Stephen was assigned to Dr. Dennis Sciama, much against his liking but he soon discovered that Dr. Sciama was a fine scientist and a very helpful mentor, always available for him to talk to. Dr. Sciama suggested him to pursue astrophysics. However, he was determined to work on cosmology and started reading textbooks on general theory of relativity, but as he had not studied sufficiently higher standard mathematics as an undergraduate, he was soon struggling with the complex computations involved in the general theory of relativity. Together with this, he was having a tough time in finding a suitable research problem to study for his PhD. In the midst of all these, Stephen was not doing well with his health and after a series of investigatory tests he was diagnosed with amyotrophic lateral sclerosis (ALS) or motor neuron disease. White and Gribbin, in their [biography of Hawking](#), wrote "*ALS affects the nerves of the spinal cord and the parts of the brain that produce voluntary motor functions. The cells gradually degenerate over a period of time and cause paralysis as muscles atrophy throughout the body. Apart from this the brain is unaffected, and the higher functions such as thought and memory are left untouched.*". Hawking was of course stronger than his disease. He wrote in his autobiography,

The realization that I had an incurable disease that was likely to kill me in a few years was a bit of a shock. How could something like this happen to me? However, while I was in the hospital, I had seen a boy I vaguely knew die of leukemia in the bed opposite me, and it had not been a pretty sight. Clearly there were people who were worse off than me - at least my condition didn't make me feel sick. Whenever I feel inclined to be sorry for myself, I remember that boy.

His illness made him more determined to achieve his dream of understanding the universe better than many others. He wrote,

My dreams at that time, however, were rather disturbed. Before my condition was diagnosed, I had been very bored with life. There had not seemed to be anything worth doing. But shortly after I came out of the hospital, I dreamed that I was going to be executed. I suddenly realized that there were a lot of worthwhile things I could do if I was reprieved. Another dream I had several times was that I would sacrifice my life to save others. After all, if I was going to die anyway, I might as well do some good. But I didn't die. In fact, although there was a cloud hanging over my future, I found to my surprise that I was enjoying life. What really made the difference was that I got engaged to a girl called Jane Wilde, whom I had met about the time I was diagnosed with ALS. This gave me something to live for.

Stephen continued his endeavour of knowing the unknown, balancing his physical constraints, family life and academic life all together. Fortunately, for him, he was a theoretical physicist and so all that he needed for his work were his brain, mind, memory and thoughts which were unaffected by the disease. During his Ph.D years, he became quite interested in the works of Jayant Narlikar who was then pursuing Ph.D under Fred Hoyle. He began to develop his own theories and probably Hoyle was unaware of the extent of Stephen's excellence. In one of Hoyle's lectures meant for making a public announcement of his findings, Hawking pointed out a serious mistake showing that the latest component of his theory was wrong. Asked how he was so sure of his remark, Stephen answered "*Because I worked it out*". Later, Hawking wrote a paper based on his mathematical findings that had led him to question Hoyle's work. It was indeed well received by his peers and established him as a talented young researcher. While still into the formative years of his own Ph.D. under Sciama, Hawking was already making a name for himself in cosmological research. He was opposed to the steady-state theory of the beginning of the universe, which was the basis of Hoyle's and Narlikar's work, and so he was in search of better ideas and explanations. Over the course of time, a young applied mathematician [Roger Penrose](#) had introduced Hawking and his peers at Cambridge to the idea of a space-time singularity at the center of a black hole, which left them tremendously excited. Hawking successfully applied the singularity theory to his work and came out with a masterpiece in the final chapter of his thesis. He was then awarded Ph.D for his exceptional work. He was just 23.

In the early 70s, Hawking and Penrose started working on developing the theory of black holes by applying the concept of singularities. Gradually, Hawking felt the necessity of using thermodynamics, a seemingly irrelevant field, as an analogy in understanding black holes. Meanwhile, another researcher Jacob Bekenstein at Princeton University was actually applying thermodynamical concepts to obtain interesting results. Hawking couldn't somehow agree with Berkenstein. In an attempt to come up with something better, Hawking felt that a good option was to combine general relativity, the theory of the very large, with quantum theory, the theory of the very small. Meanwhile, Hawking was finding it difficult to deal with the mathematics of his work. His illness had reached a stage where he could use neither paper and pen nor a typewriter. So, he was forced to develop techniques for manipulating all the complex mathematical equations in his mind without having to write them down. Of course, working on the equations in his head was very difficult enough and even but after months of intense work, Hawking kept coming up with results which didn't make sense as per the then existing scientific beliefs, including his own. According to the equations, black holes appeared to be emitting radiation. This was believed to be impossible during those times but he was still convinced that he was really on to something big and decided not to disclose it to anyone. Within a few months, however, Hawking's discovery was revealed to others by Sciama and Roger who were very excited with it. Going against all the then current beliefs

about black holes, Hawking, based on mathematical reasoning, had been forced to the unarguable conclusion that not only did tiny black holes emit radiation, but under certain conditions they could actually explode. Eventually, he published his work in Nature. Physicists all over the world lauded his work and many of them considered his findings to be the most significant development in theoretical physics. The radiation that he had discovered could be emitted by certain black holes came to be known as Hawking Radiation. As the ideas of objects like black holes spread among the general public, Stephen Hawking was gradually becoming a celebrated name.

This article, of course, couldn't get even a bird's eye view of Stephen Hawking's work. The technical details of his research work require far more rigorous understanding of physics and mathematics. Through [his books](#), Hawking had tried his best to convey his understanding of the universe to the general readers who are far away from the world of complicated mathematical equations. He will certainly be remembered for popularizing science among the public and in media all over the world. Hawking was also involved in a number of charities dealing with physical disability and in particular with motor neuron disease. He firmly believed that the technology available to him through the money he had earned as an author should be made available to other seriously disabled people. He lead several campaigns generate funds for the people who have been paralyzed either through accidents or diseases such as ALS. Stephen Hawking's life illustrates that no restrictions can limit the extent of human thinking. The motor neuron disease had confined his body to a wheelchair but it could not confine his thoughts and ideas. His life and works will continue to inspire people for years to come.

References :

[Stephen Hawking: My brief history; Nantam Books, New York.](#)

[Michael White and John Gribbin; Stephen Hawking : A life in science; The John Henry Press, Washington DC; 2002.](#)

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