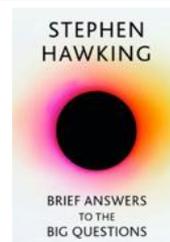




Hawking's Final Answers

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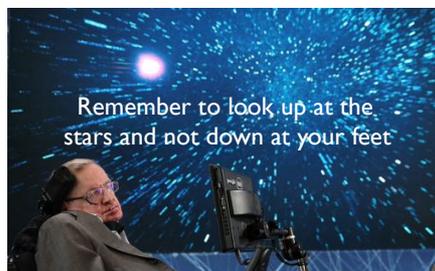


STEPHEN Hawking, died last March, aged 76. *Brief Answers to the Big Questions* (John Murray) draws from his personal archive and was in development at the time of his death. It was completed in collaboration with his academic colleagues, his family and his estate. The book also includes: a foreword by Eddie Redmayne, who played him in *The Theory of Everything*; an introduction by Nobel Prize-winning physicist and friend Kip Thorne; and a moving afterword by Hawking's daughter, Lucy.

Brief Answers addresses 10 big questions on the existence of god, the beginning of the universe, other intelligent life, predicting the future, black holes, time travel, the survival of the earth, colonising space, artificial intelligence, and how we shape the future. His approach is both rational and generally sceptical but infused with optimism.

On the question of the existence of a God, Hawking answers in the negative: "I think the universe was spontaneously created out of nothing, according to the laws of science". Space and energy were invented in an event we now call the Big Bang. But do we not need a God to set it up so that the Big Bang could bang? No, nothing caused the Big Bang because time began at that instant. There is no possibility of a creator because there is no time for a creator to have existed in.

The second question expands on the first. How did it all begin? He begins by quoting Hamlet: "I could be bounded in a nutshell and count myself a king of infinite space". Hawking interprets this as particularly fitting for himself because Hamlet is saying that, although we humans are very limited physically, our minds are free to explore the whole universe. This is not too far wrong because Hamlet means that he could live in his mind and conjure up infinite imaginative possibilities,



"were it not that I have bad dreams". In other words, the horror of the real world keeps intruding into his thoughts, not least the murder of his father. Perhaps, owing to his condition, the real world intruded less on Hawking and he was free mentally to explore the whole universe.

The 'nutshell' metaphor is also used to explain the beginning of the universe, which was initially small and dense. It was actually a hot fireball, which burst into being 13.8bn years ago and expanded and cooled down.

However, this chapter digresses a lot from the question. I would have liked more detail on the moment of the Big Bang and the subsequent expansion. He says that there may be other universes, indeed a great many which, like our own, were created out of nothing. He delivered a paper just before his death where he committed to the idea of a multiverse, but there is no mention of it here.

The question whether there is other intelligent life in the universe is difficult, and Hawking offers a number of possible answers. Maybe earth is the only planet in the galaxy – or the observable universe – where life happened. He prefers to think that there are other forms of intelligent life out there but we have been overlooked. Yet he offers a warning: meeting a more advanced civilisation might be a bit like the original inhabitants of America meeting Columbus. On the question of whether we will survive on this planet, Hawking makes it clear that it is "almost inevitable that either a nuclear confrontation or environmental catastro-

phe will cripple the Earth at some point in the next 1,000 years". But by then he believes that we will have found a way to slip our surly bonds. "The same of course may not be possible for the millions of other species that inhabit the Earth, and that will be on our conscience as a race".

Where do we go? In the next hundred years we will be able to travel anywhere in the solar system, except maybe the outer planets. He suggests that in 500 years we will have visited some of the nearby stars. There are about a thousand of them within thirty light years of earth. If 1 per cent of these have earth-sized planets in the Goldilocks zone, we have ten candidate New Worlds.

But who will go? When an artificial intelligence (AI) becomes better than human beings at AI design and can improve itself without human help, we may face an intelligence explosion that ultimately results in machines whose intelligence exceeds ours. AI might then take off on its own and redesign itself so that humans couldn't compete and would be superseded. Our future is therefore a race between the growing power of our technology and the wisdom with which we use it.

Hawking believes that we have two options for the future: the exploration of space for alternative planets on which to live, and the positive use of artificial intelligence to improve our world. But it is surely wrong to think that only science will save us – indeed he implies that it can be used for good or bad purposes. So science alone is not enough. We also need an ethic and a philosophy that insure science is used wisely.

There is also too much repetition between the chapters, suggesting that it was rushed out without proper editing. That said, *Brief Answers* is an easy and pleasurable read. Hawking's wit and enthusiasm is evident in every page. □