

# Preface

Italian secondary school children used to have study notes prepared and published for them by a teacher who had been in the past a school master in my own glorious grammar school; this man's name also happened to be 'Bignami', although no relation of mine. If one of his slight grey volumes could condense the whole of Dante's *Divine Comedy*, then I feel confident I shall be able to concentrate on the present booklet of cosmic history from Big Bang to the rise of life and human beings.

In the present case, we are in need, however, of an interdisciplinary volume, because, first of all, we must build this universe with its bricks of matter and energy, and with stars, galaxies, planets and all the rest. We thus have to speak of physics, astronomy, chemistry and biology.

We shall also have to make the bricks of life and try to understand how it started, with us and elsewhere. Here, a very recent discipline comes into the picture, which we shall call *contact astronomy*; but we shall also need more conventional astronomy, both from the ground and from space, in order to look for other "right" worlds around the "right" stars, where there might be life. We shall then speak of system chemistry, of synthetic biology and (very little) of genetics.

We shall ask ourselves if, by any chance, there may be somebody out there. We shall see how, for a long time, we have imagined alien forms of life and in recent times also to look for them, by listening. We shall thus accomplish a bit of history of science (and of science-fiction as well), but we shall also speak of a still nameless discipline,

still to be invented: the way to communicate with somebody we do not know and whom we do not know what to say.

In the end, we shall throw ourselves into some futurology, by imagining what remains to be discovered along the way that binds us to Big Bang.

At the centre of everything, however, there is always the problem of life. Outside Earth we have not found it yet: up to now we have only been imaging it. And about life on Earth too, gaps remain, still missing bits of *fil rouge*, although the latter are growing shorter and shorter.

Working on these student notes, I have discovered there are four ways to try and understand something on the presence—and hence on the origin—of life in the universe:

1. Finding a new far-away Earth, among extra-solar planets, physically unreachable but on which one could “see” unmistakable signs of life.
2. Study the bits of universe that fall on us, meteorites, with all their messages in organic chemistry.
3. Going around exploring, “scratching” the bodies in the Solar system, to see what one can find in it.
4. Trying to understand how life began on Earth, that is to say, the only place where life exists for sure.

The four lines of research are very different from one another as far as objectives and methodology are concerned; they all require quite a lot of mental athletics and open-mindedness. Nobody, I believe, can hope to really master all these topics, as well as the others of which we shall speak, and the present author is surely no exception. If I have tried to push myself beyond my strictly professional competence it is because I believe that at least one attempt at setting the general problem should be performed.

Summing up, with the present notes I would like to contribute to a global vision of the universe, as if it were a forest observed in its entirety. As a physicist and an astronomer, I tend to study single trees (sometimes even twigs, also very far away...), but I am also deeply convinced that science, with its requirements of objectivity and rationality, is the fittest tool to see and understand the forest, vast as it may be.

The main goad for this work has been the contact with the public. In the past two years—the period of incubation for the following pages—I gave above one hundred lectures and seminars in Italy and Europe to a vast and varied audience: secondary school students and teachers; village libraries and Rotary Club lunches; private companies, communicators; and so on.

Also many of the viewers of the series “The Secrets of Space with Bignami”, on National Geographic Channel, wrote to me. I answered almost everybody. The remaining people, with my apologies, will certainly find their answers on these pages.

After these 2 years of full immersion in which I gave public talks on science, I feel like asking myself as well as readers: can the statistics be true that I see quoted by Richard Dawkins? According to this famous evolutionary biologist, 44% of US nationals are convinced not only that God created human beings, but that He created them similar to what they are now and that this happened some 10,000 years ago.

Forty-four percent, almost half the population? It is hard to believe. As it is hard to believe that for one Italian out of four (24%, it would appear, the highest percentage in Europe) the Earth takes one month to revolve around the Sun. These dates seem to me impossible to be accepted, or maybe I was lucky enough to have a learned and passionate public, albeit with some unavoidable simple-mindedness.

In any case, if Dawkins were right in being so pessimistic on the general level of scientific knowledge, well, then some interdisciplinary notes on the universe it seems to me might come in quite handy.

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