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STRICT EMBARGO
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STATEMENT BY PROFESSOR MARTIN J. REES

At The Templeton Prize News Conference, April 6, 2011

'Big questions' are central to the Templeton Foundation's agenda. None are bigger than those posed by cosmology: How large is physical reality? What is the role of life in the cosmos? How did our complex cosmos emerge, giving rise to conscious beings able to ponder the wonder and mystery of their existence? I'm privileged to have spent much of my life engaging with these issues, mainly based in Cambridge where I've benefited from collaboration and discussion with many mentors, colleagues and students. Moreover, this has been a time when (owing to technical advances) our knowledge and understanding has enlarged at an unprecedented rate.

These topics fascinate a wide public. Indeed the night sky is the part of our environment that's been common to all cultures throughout human history. All have gazed up at the 'vault of heaven', and interpreted it in their own way.

To our ancestors, the Earth seemed vast, with open frontiers. Today, no new continents remain to be discovered, and our planet seems constricted, and overcrowded – a fragile 'pale blue dot' in a vast cosmos.

Our Sun is one of a hundred billion stars in our Galaxy; billions of those stars are orbited by planets (many perhaps with biospheres). Our Galaxy is itself just one of many billion galaxies in range of our telescopes. And there is compelling evidence that this entire panorama emerged from a hot, dense 'beginning' nearly 14 billion years ago.

But, as always in science, each advance brings into focus new questions that couldn't previously have even been posed and which enlarge our horizons still further. The vast domain that astronomers can observe could be an infinitesimal part of the totality. Our big bang may not be the only one: we may be living in a 'multiverse' – an archipelago of cosmoses, perhaps governed by an array of different physical laws.

The bedrock nature of space and time, and the unification of cosmos and quantum are surely among science's great 'open frontiers'. These are parts of the intellectual map where we're still groping for the truth – where, in the fashion of ancient cartographers, we must still inscribe 'here be dragons'. But to call this a quest for the 'theory of everything' is hubristic and misleading. Biologists and environmental scientists (and even most physical scientists) aren't held up at all by the lack of such a theory – they are tackling a third frontier: the very complex. Our everyday world presents intellectual challenges just as daunting as those of the cosmos and the quantum and that's where 99 percent of scientists deploy their efforts. It may seem incongruous that scientists can make confident statements about galaxies billions of light years away, while being baffled about issues close at hand that we all care about – diet and common diseases, for instance. But this is because

living things with intricate levels of structure (even the smallest insects) are far more complex than atoms and stars.

Everything, however complicated – breaking waves, migrating birds, and tropical forests – is made of atoms and obeys the equations of quantum physics. But even if those equations could be solved, they wouldn't offer the enlightenment that scientists seek. Each science has its own autonomous concepts and laws. Reductionism is true in a sense. But it's seldom true in a useful sense. Problems in biology, and in environmental and human sciences, remain unsolved because it's hard to elucidate their complexities – not because we don't understand subatomic physics well enough.

Along with the origin of the physical universe, the beginnings of life surely pose another 'big question'. This enigma fascinates even the most firmly 'Earth-bound' biologists. But it has special resonance for astronomers who have learnt (but only since the 1990s) that other stars have planets circling around them, just as the Earth, Mars and Jupiter circle around our own star, the Sun. Could some of these 'extra-Solar' planets harbour some form of life? Could they even be inhabited by beings that we could recognise as intelligent? Our cosmos would then seem far more interesting: we would look at a distant star with renewed interest if we knew it was another Sun, shining on a world as intricate and complex as our own.

We may learn this century whether biological evolution is unique to the 'pale blue dot' in the cosmos that is our home, or whether Darwin's writ runs through a wider universe that teems with life – even with intelligence.

Are there special perspectives that cosmologists can offer to philosophy? I think there are. First, their findings disclose the interconnectedness of cosmic processes. Not only do humans share a common origin with the entire web of life on Earth, but all living things depend on the stars: life is energised by heat and light from the Sun; we are made of atoms that were forged from pristine hydrogen, in faraway stars long ago. To understand ourselves we must understand the atoms we're made of – and the intricate complexity with which they combine into DNA, proteins and cells. But we must also understand the stars in which those atoms were made.

But cosmologists offer another distinctive insight: an awareness not only of the immensity of space but of the 'deep time' that lies ahead. The stupendous timespans of the evolutionary past are now part of common culture. But most people still somehow think we humans are the culmination of the evolutionary tree – and that hardly seems credible to an astronomer. Our Sun formed 4.5 billion years ago, but it's got 6 billion more before the fuel runs out. According to the best current ultra-long-range forecast, the expanding universe will continue – perhaps until infinity – becoming ever colder, ever emptier. So, even if life were now unique to Earth, there would be abundant scope for posthuman evolution on the Earth or far beyond. It won't be humans who witness the Sun's demise: it will be entities as different from us as we are from a bug – either organic or silicon-based.

Some people might surmise that intellectual immersion in vast expanses of space and time would render cosmologists serene and uncaring about what happens next year, next week, or tomorrow. But, for me, the opposite is the case. My concerns are deepened by the realisation that, even in a perspective extending billions of years into the future, as well as into the past, this century may be a defining moment. Our planet has existed for 45 million centuries, but this is the first in its history where one species – ours – has Earth's future in its hands, and could jeopardise not only itself, but life's immense potential.

That's why I see no incongruity in having, in the last decade, become more engaged with issues of science policy and ethics, and global problems generally. Over most of history, threats to humanity, and to the environment, have come from nature – disease, earthquakes, floods, and so forth. But now, the worst threats come from humans – collectively and individually. We've entered an era that's sometimes called the anthropocene.

Despite the prevailing economic gloom and the running sore of intractable international tensions – despite endemic poverty and sickness – there are grounds for hope. Indeed for most people in most nations, there's never been a better time to be alive. Moreover, the innovations that will drive economic advance – information technology, biotech and nanotech – can boost the developing as well as the developed world. Creativity in science and the arts is open to hugely more than in the past. We're becoming embedded in a cyberspace that can link anyone, anywhere, to all the world's information and culture – and to every other person on the planet. And broader application of modern farming techniques (not excluding GM) should allow sufficient 'sustainable intensification' of agriculture to feed a world population that is likely to reach 9 billion by mid-century. That's all good news.

But the intractable politics and sociology – the gap between potentialities and what actually happens – engenders pessimism. Will richer countries recognise that it's in their self-interest for the developing world to prosper, sharing fully in the benefits of globalisation? Can nations sustain effective but non-repressive governance in the face of threats from small groups with high-tech expertise? And can the focus of our sympathies become more broadly international? And – above all – can our institutions prioritise projects that are long-term in political perspectives, even if a mere instant in the history of our planet?

All too often the focus is short term and parochial – the urgent and the local loom higher on political agendas than even the gravest long-term challenges. We downplay what's happening even now in impoverished far-away countries. And we give too little thought to what kind of world we'll leave for our grandchildren.

As regards my own 'philosophy', I continue to be inspired by the music, liturgy and architectural tradition of the Anglican Church in which I was brought up. No-one can fail to be uplifted by great cathedrals – such as that at Ely, near my home in Cambridge. Ely Cathedral overwhelms us today. But think of its impact 900 years ago – think of the vast enterprise its construction entailed. Most of its builders had never travelled more than 50 miles; the Fens were their world. Even the most educated knew of essentially nothing beyond Europe. They thought the world was a few thousand years old – and that it might not last another thousand.

But despite these constricted horizons, in both time and space – despite the deprivation and harshness of their lives – despite their primitive technology and meagre resources – they built this huge and glorious building – pushing the boundaries of what was possible. Those who conceived it knew they wouldn't live to see it finished. Their legacy still elevates our spirits, nearly a millennium later.

What a contrast to so much of our discourse today! Unlike our forebears, we know a great deal about our world – and indeed about what lies beyond. Technologies that our ancestors couldn't have conceived enrich our lives and our understanding. Many phenomena still make us fearful, but the advance of science spares us from irrational dread. We know that we are stewards of a precious 'pale blue dot' in a vast cosmos – a planet with a future measured in billions of years – whose fate depends on humanity's collective actions this century.

In today's runaway world, we can't aspire to leave a monument lasting a thousand years, but it would surely be shameful if we persisted in policies that denied future generations a fair inheritance. Wise choices will require the effective efforts of natural scientists, environmentalists, social scientists and humanists. All must be guided by the knowledge that 21st century science can offer, but inspired by an idealism, vision and commitment that science alone can't provide.

Finally, it remains for me only to express my deepest appreciation to the Templeton Foundation for this award. It was, needless to say, entirely unexpected. I am diffident about my credentials, but it is a great privilege to join the distinguished and diverse roll-call of previous awardees.

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