

SCIENCE & SOCIETY

Looking ahead

A cosmologist advocates thoughtful deployment of science and technology to address the challenges facing humanity

By **Andrew Robinson**

In 2004, the year before he became president of Britain's Royal Society, Martin Rees memorably remarked that "we are no wiser than Aristotle was more than 2000 years ago." The reason that humankind has made such extraordinary scientific progress since Aristotle's time, Rees argued, is primarily because of technological advances, such as telescopes and space probes in the case of astronomy—his own field of expertise.

Rees's latest book, *On the Future: Prospects for Humanity*, written "as a scientist, as a citizen, and as a worried member of the human species," is really a meditation on this earlier thought, short in extent but wide in range: from redesigning genes, through the likelihood of human-induced climate change, to the possibility of encounters with alien intelligence in the Universe. Its overall theme is that Earth's growing population will flourish only if science and technology are deployed with "wisdom."

Inevitably, much of the interest in this topic derives from the author's predictions about the coming decades, although Rees is mindful of the fact that scientists are "rotten forecasters—almost as bad as economists." As he notes, one of his predecessors as astronomer royal famously announced in 1956 that newspaper predictions of imminent manned space travel were "utter bilge."

On the whole, he is cautionary, sometimes pessimistic, whether speaking of our home planet or deep space. About driverless cars, for example, he notes that in 1930 there were a million vehicles on the roads of Britain and more than 7000 fatalities, whereas in 2017, the number of vehicles had increased 30 times and the number of fatalities had fallen to 1700. In the intervening period, roads had improved, yet the main reason for the fall in deaths was increased safety in cars, brought

about by technological improvements, including electronic satellite navigation.

Most likely, this trend will continue, with better lane discipline on motorways, platooning of goods vehicles, and so on. But can we assume that ever-faster computing will enable a wirelessly connected car to distinguish the nature of an obstacle on the road ahead and respond safely to it with greater reliability than an average human driver? Perhaps—yet only by using an amount of electric power comparable with the power needed to propel the car, according to some experts, notes Rees. And will the car's passengers accept no human driver? Not on the basis of civil aviation, the bulk of which is now done



The electric power required to respond to obstacles with greater reliability than a human driver may mitigate the value of driverless cars, notes Rees.

on autopilot but has yet to reach the point of dispensing with a human pilot.

Regarding climate change, Rees anticipates, realistically, that carbon dioxide concentrations in the atmosphere from burning of fossil fuels will continue to rise steadily for the next 20 years. By then, however, it should be possible to predict future "climate sensitivity"—the effect on the ground of increased water vapor and clouds—from a longer time base of data and better modeling.

If sensitivity is high, and existing climates are at risk, then climate may need to be rapidly controlled through geoengineering, by using solar-reflecting aerosols in the upper atmosphere and even sunshades in space. Because the political problems of geoengineer-

On the Future Prospects for Humanity

Martin Rees
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ing would be "an utter political nightmare," Rees argues that it would be "prudent" now to explore geoengineering techniques, so as to clarify which of them make sense and also to dampen down any unjustified optimism about a "quick fix" for climate change.

As for space exploration by humans, Rees favors privately sponsored expeditions, despite his admiration for the 1960–1970s NASA Apollo program. But he strongly disagrees with the view, proposed by Elon Musk of Space-X and also Rees's late Cambridge University colleague Stephen Hawking (not to mention some science-fiction writers), that there can be mass emigration from Earth.

"Coping with climate change may seem daunting, but it's a doddle compared to terraforming Mars. Nowhere in our Solar system offers an environment even as clement as the Antarctic or the top of Everest." Better, thinks Rees, to depute exploration and settlement of other planets to robots and artificial intelligence, enabled by Earth-based humans.

Underlying the development and exploitation of technology must be values that science itself cannot provide, Rees concludes, after some interesting discussion of science and society, including religion. "I would describe myself as a practicing but unbelieving Christian," he comments somewhat enigmatically.

"It's salutary and depressing to realize how much of the economy

is dedicated to activities and products that would be superfluous if we felt we could trust each other," such as military forces and unhackable computer systems, writes Rees. Ancient thinkers, including Aristotle, expressed a comparable regret about their societies. What has changed over the millennia, of course, is that the impact of our lack of wisdom—amplified by the internet—is now global and requires global, not local, solutions. ■

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