Abstract: Advances in biotech, cyber-technology, robotics, and space exploration could, if applied wisely, allow a bright future “even for 10 billion people” by the end of this century.

But there are dystopian risks we ignore at our peril.

These risks are of two kinds: those stemming from our ever-greater collective “footprint” on the Earth, and those enabled by technologies so powerful that even small groups can, whether by error or design, cause global catastrophe.

Martin Rees, the UK Astronomer Royal, will explore this unprecedented moment in human history during his Perimeter Institute public lecture on October 2, 2019. A former president of the Royal Society and master of Trinity College, Cambridge, Rees is a cosmologist whose work also explores the interfaces between science, ethics, and politics.

In his October 2 talk “which kicks off the 2019/20 season of the Perimeter Institute Public Lecture Series “Rees will discuss the outlook for humans (or their robotic envoys) venturing to other planets. Humans, Rees argues, will be ill-adapted to new habitats beyond Earth, and will use genetic and cyborg technology to transform into a “post-human” species.

Rees’ talk at Perimeter will cover themes from his 2018 book, On the Future: Prospects for Humanity. Rees is an acclaimed thinker, author, and speaker who belongs to numerous scientific academies around the world. His past books include Before the Beginning, Our Final Century?, Just Six Numbers, Our Cosmic Habitat, and Gravity’s Fatal Attraction.
ON THE FUTURE
PROSPECTS FOR HUMANITY
MARTIN REES
PRINCETON UNIVERSITY PRESS
PRINCETON & OXFORD
THIS CENTURY IS SPECIAL

It’s the first in the 45 million centuries of Earth’s history where the main threats come not from nature, but from one species (ours), which has the long-term future in its hands.
Challenge: Global Population Predictions

Total population by major area

Historical progression of Global Population

<table>
<thead>
<tr>
<th>Total Population</th>
<th>Year</th>
<th>Interval</th>
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</thead>
<tbody>
<tr>
<td>3 billion</td>
<td>1959</td>
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<tr>
<td>4 billion</td>
<td>1974</td>
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<td>5 billion</td>
<td>1987</td>
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*Denotes predicted year

Source: UN DESA – Population Division, 2011
Challenge: Global Population Predictions

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Source: UN DESA – Population Division, 2011
Model mean global mean temperature change for high emission scenario RCP8.5

Model mean global mean temperature change for low emission scenario RCP2.6
‘Cleaner’ energy sources

Wind/wave/tides
(storage methods needed)
Nuclear (fission and fusion)
Solar
‘Plan B’: geoengineering

- Reduce amount of sunlight reaching ground (aerosols in upper atmosphere, mirrors in space, etc)

- Or extract carbon dioxide from atmosphere (i.e undo the geoengineering we’ve unwittingly done by burning fossil fuels)
Technologies in 2050 and beyond

Biotech
Technologies in 2050 and beyond

Biotech
Robotics and AI
How ‘humanlike’ will they be?

Sensors, movement, self-awareness?
Darwinian evolution will be superceded by (much faster) technological evolution.

Genetic ‘redesign’ or AI?
Is life out there already?
Transit Detection of Exoplanets

Photometric Light Curve
NASA Kepler Mission

NASA's first mission capable of finding Earth-size and smaller planets

Launch March 09
The Quest for Life in the Universe

Almost every star has a planet around it

One in every six stars has an Earth-size planet
**TRAPPIST-1 AND ITS SEVEN PLANETS**

**What we know:**
- The star and its planets are located about 12 parsecs away from the solar system.
- All seven planets have equilibrium temperatures low enough to make the existence of liquid water on their surfaces a possibility.
- All seven planets have sizes and masses similar to those of Earth.

**TRAPPIST-1**
- Host star
- Approximately the size of Jupiter

Orbital period = unknown
Orbital period = 12.35 days
Orbital period = 9.1 days
Orbital period = 6.06 days
Orbital period = 4.04 days
Orbital period = 2.42 days
Orbital period = 1.51 days

Source: Nature.com
Heyun Jeong / Daily Cal Staff
The Past and Future of Life on Earth

Birth of Solar System

-4  -2  0  2  4  6  8
Thousand million years

Today

Sun becomes a Red giant

Sun fades away

Rocks Melt

Ice on Europa melts

Mars Warm

Oceans boil
HOW MANY BIG BANGS?

one

no

no role for anthropic explanations

many

variety in the physical laws/constants

yes

"bylaws" governing our universe should be typical or anthropically allowed subset
Message:

21st century technology should allow us to offer a high quality of life even to 9 billion people, but the science is a doddle compared to the politics and sociology.

We need to focus on the problems we are ourselves causing, and think on a timescale of a century – an instant in cosmic perspective, but an eternity for politicians!