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The prophets of climate change doom have been advised to rein it in. At the September Gordon Institute of

Business Science Forum on Energy Security and Climate Change, Sir David King, Chief Scientific Advisor to Her Majesty's government, was celebratory in announcing the innovation emerging from the UK in the face of the climate challenge.

We live, as the Chinese put it, in interesting times. While we must

more astonishingly, the precedent for climate change does as well. Innovation has been the response of Earth's earliest living ancestors to the energy question. In fact, it appears to be the hallmark of life itself.

Earliest innovators

Four billion years ago, life emerged in the organisms known as prokaryotes. As living things, they required energy which they found in the turbulent chemical reactions of primal Earth. Eventually, the turbulence began to decrease and life faced an

eyes, without hands, without blueprints, without foresight, without reflective consciousness."

Innovation leads to destruction

There was a concern, however. Cleaving hydrogen from water molecules releases oxygen into the atmosphere; further oxygen was emitted as a waste product of photosynthesis. Oxygen is a voracious element, in perpetual need of electrons, ripping them from even stable compounds. As oxygen concentrations rose and seeped into every nook and cranny of the Earth, energy-rich carbohydrates were rendered chemically useless. Cell membranes were broken apart, leaving the living organism burning from within.

Two billion years after its emer-

ANCESTORS OF INNOVATION

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Appreciating the inherent innovation of organisms formed on earth billions of years ago could hold the key to our engagement with climate change.

seek ways to mitigate the danger of climate change, we have already passed the point requiring the entire human community to adapt to its implications.

Faced with significant change, our approach tends to fall into three categories. In decreasing preference, we resist by denying the need; we handle it by installing some form of management system; or we get creative by changing ourselves.

The latter option draws on an aspect of human intelligence called innovation, which has been a uniquely human expression for the last hundred thousand years, but the precedent for which goes even further back. And, perhaps

energy crisis and even extinction. This presents the first rough tenet of innovation: the potential for innovation is greatest when living organisms are under significant threat.

Indeed, instead of sinking into obscurity, the bacteria innovated. New blue-green varieties emerged that could draw hydrogen power from sea-water. Around 3.9 billion years ago, some developed a molecular net to capture photons of light directly from the sun. Photosynthesis was an act of "unsurpassable elegance" writes cosmologist Brian Swimme, "from a being one millionth of a metre across, weaving a molecular power astounding to behold, and doing so without a brain, without



gence, life faced extinction again, this time having created the conditions itself. It was coming to know the second rough tenet of innovation: all creation is based on destruction.

Powerful innovations shatter paradigms

True to life, another innovation emerged. Blue-green algae invented enzymes that rendered oxygen harmless to their cells; some hid under great dying colonies for shelter from the harmful element. Perhaps the most astounding innovation of all was a process that embraced the threat, rather than protecting or hiding from it. By using the destructive energy of oxygen to break down or burn food molecules, a continuous source of energy became available to life-forms that developed the

capacity to breathe it in.

The process of respiration introduced a paradigm change. Whereas previous innovations depended on switching sources of energy, respiration enabled a diversification of sources. Life-forms now got their energy from the sun, hydrogen from the water and carbon from the atmosphere. Activities were powered with a controlled process of combustion using oxygen as fuel, and the waste gas (carbon dioxide) was exactly what was needed to sustain the earlier invention of photosynthesis. So emerged the third rough tenet of innovation: solutions that engage with diversity are more robust.

The challenge for innovators today

Studying the Earth's most ancient living ancestors, we find three tenets

of innovation that appear to hold true today. We also find a compelling precedent for life-sustaining innovation arising naturally in living things. The prokaryotes did not disappear. They are prolific today in nearly all environments. Their next great innovation was teamwork: by entering into relationship with other cells and working together, prokaryotes were the first communities of life.

It leads one to think that if bacteria could do it, humans might too. Although, as systems thinker and writer Molly Young Brown muses rather bleakly, "Bacteria have one advantage over us: presumably, they don't do 'denial'." In other words, presumably, they don't have fear.

Stories of our ancestors are fireside tales that carry possible truths. From this one, we learn that life finds ways to re-balance the conditions neces-

sary for its continuance. In the warm flicker of firelight with the dark night beyond, we may catch a fleeting thought that our present and paradoxical human challenge depends on finding ways to overcome our resistance to this natural impetus.

We are a long way from the bacteria that emerged with the origin of life. We have a self-reflective consciousness that enables all sorts of profound experiences and an ability to make meaning of them. Something ineffable surfaces here, as the basis of what some call faith: we have a choice of whether to use that self-reflective consciousness to justify our continued denial or to feed the deeply innovative, natural expression of the human spirit. ■

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