



The

Great Challenges of the Twenty-First Century

By James Martin

PATRICK TUCKER WITH PHOTOS FROM NICK INVERSO AND ISTOCKPHOTO.COM

By some estimates, humanity has only a 50% chance of surviving the next hundred years. It will be the job of today's young people to put the odds in our favor.

Young people sometimes ask me, "If you were to pick any time in history to be alive, which time would you pick?" I reply to their question, "If I could choose any time to live, I would want to be a teenager now (in a country where great education is available)." The reason I would choose to be a young person today, rather than during some earlier period in history, is that now, more than at any other time, young people will make a spectacular difference.

We are heading toward an inflection point of epic significance, when scientific advances will be beyond anything we've ever before experienced. Simultaneous to this technological revolution, fresh water will run out in many parts of the world. Global warming will bring hurricanes far more severe than Katrina and will cause natural climate-control mechanisms to go wrong. Rising temperatures will lower crop yields in many parts of the world's poorest countries, such as those in central Africa. The immense tensions brought about by such catastrophes will occur in a time of extremism, religious belligerence, and suicidal terrorism, and this will coincide with terrible weapons becoming much less expensive and much more widely available.

Solutions exist, or can exist, to most of the serious problems we will face in the decades ahead. The bad news is that the most powerful people today have little understanding of the solutions and little incentive to apply them. Politicians are anxious to find votes—the next election dominates their thinking. Powerful business executives are eager to achieve profits—it is their job to increase shareholder value, and shareholders will judge them by this quarter's results. So for the powerful people who control events, the desire for the short-term benefits overwhelms the desire to solve long-term problems. The job of today's teenagers, the "Transition Genera-

tion" if you will, is to get humanity through the coming instability as quickly and safely as possible.

If we are to survive, we have to know how to manage this situation. We need to put in place rules, protocols, methodologies, codes of behavior, cultural facilities, means of governance, treaties, and institutions of many types that will enable us to cooperate and thrive on planet Earth. If we can do that with whatever the twenty-first century throws at us, we'll probably be able to survive. If our twenty-first-century world falls apart at the seams, civilization will be set back many centuries.

The twenty-first century, then, brings these 17 challenges, which are all interlinked and mutually reinforcing. Together they constitute the twenty-first-century transition. As our knowledge improves, our challenges, too, will be refined and added to.

1. SAVING THE EARTH

A change in the capability to manage the Earth well is coming from the deployment of vast quantities of micro-instruments, which feed voluminous data to computer systems. Humanity is changing from being ignorant about the planet to having vast quantities of information linked to supercomputer models.

In the second half of the century, we will have learned how to live within nature's trust fund. One hopes that we will learn this by science and good teaching. If not, we will learn from catastrophe—first patterns of events. The Earth's climate will change, and we will learn to live with the changes.

2. REVERSING POVERTY

While rich nations become richer, billions of people live in extreme poverty with short, brutal lives. In his book *An End to Poverty: Economic Possibilities for Our Time* (Penguin, 2005), Jeffrey Sachs lays out nine

steps for solving global poverty. They are: commit to the task, adopt a plan of action, raise the voice of the poor, redeem the United States' role in the world, rescue the International Monetary Fund and the World Bank, strengthen the United Nations, harness global science, promote sustainable development, and make a personal commitment.

3. STEADYING POPULATION GROWTH

Much of the extreme poverty on the planet relates to the population being too high. It is estimated that the Earth's population will soon be increased by 2.5 billion people, most of them in the countries least able to grow enough food. There are now nonoppressive ways to lower the birthrate. Population declines strongly in countries where almost all women can read and full women's liberation is in effect. Population also tends to decline when GDP is high. The challenge of improving lifestyles equates to the goal of lowering population.

4. ACHIEVING SUSTAINABLE LIFESTYLES

Most people (almost 9 billion) will eventually want to participate in the affluence of the planet. This cannot happen with twentieth-century lifestyles. We need higher-quality lifestyles that are environmentally harmless. Rich, affluent, globally sustainable lifestyles, more satisfying than today's, can be achieved at the same time as healing the environment.

5. PREVENTING ALL-OUT WAR

All-out war in the twenty-first century could end everything. No economic or political benefit can justify the risk of an all-out war with nuclear and biological weapons. We

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Challenge 10: CONQUERING DISEASE

We need to be ready, with all our technological resources, to stop bird flu, and future pandemics that are a surprise. We are not ready today, warns author James Martin.



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absolutely must prevent war between nations with arsenals of mass destruction. There will either be no war among high-tech nations or no civilization. The existence of weapons capable of ending civilization makes this a very different century from any before.

6. DEALING EFFECTIVELY WITH GLOBALISM

Globalism is here to stay. The planet is shrinking and bandwidth is increasing, but globalism should be designed to allow local unique cultures to thrive and be protected. The right balance between what is global and what is local needs to be achieved.

Global business will continue to expand, and it needs to benefit everyone rather than bypassing some countries and leaving them destitute. Failed nations must be helped until they become developing nations.

7. PROTECTING THE BIOSPHERE

We are losing species of plants and creatures at a shocking rate. Many endangered species can be protected by identifying and preserving hot spots, those places with a high density of endangered species.

Today, 90% of the edible fish in the oceans have been caught. It is possible to create conditions in which ocean life will slowly recover. This requires well-designed marine protection areas, combined with well-managed fishing. Laws are needed for transforming the oceans from their appallingly depleted state today to a vigorous, healthy state.

Different challenges to the biosphere include reduced agricultural biodiversity to achieve high-yield farming and the increasing use of genetically modified crops.

Global management of the biosphere is essential. This requires thorough, computer-inventoried knowledge of all species.

8. DEFUSING TERRORISM

The dawn of an age of terrorism coincides with the rise of weapons of mass destruction that will become progressively less expensive. It is vital, therefore, to address the reasons why people want to become terrorists and to achieve cooperation among potentially hostile cultures.

9. CULTIVATING CREATIVITY

The technology of the near future will lead to an era of extreme creativity. Young people everywhere should participate in the excitement of this creativity. Different cultures are likely to accept one another as exciting jobs spread and rich countries help young people around the planet to be entrepreneurs. The world is becoming finely laced with supply chains of electronically connected businesses that will eventually interlink all countries and become very valuable.

10. CONQUERING DISEASE

We must thwart the rapid spread of infectious diseases that could kill many millions of people, as has happened numerous times in history. We now have sensors that can detect the existence of a dangerous virus in the air, as well as medical procedures to prevent it from spreading. We need to be ready, with all our technological resources, to stop bird flu and future pandemics that are a surprise. We are not ready today.

11. EXPANDING HUMAN POTENTIAL

A tragedy of humankind today is that most people fall outrageously

short of their potential. A goal of the twenty-first century ought to be to develop the capability latent in everybody by harnessing powerful technologies that accelerate learning potential.

12. THE SINGULARITY

Decades from now, computer intelligence that is quite different from human intelligence will feed on itself, becoming more intelligent at a rapidly accelerating rate. This chain reaction of computer intelligence is referred to as the Singularity. Humanity needs to discover how to avoid being overwhelmed by accelerating change that is totally out of control and harmful. Technical controls will be needed for computing, perhaps in the form of hardware design, to ensure that, when computers become incomparably more intelligent than we are, they act in our best interests.

The main impact of the Singularity will be that the cleverest professionals will use it to achieve extraordinary results. By the time it happens, the capability for handling the Singularity will be distributed globally, particularly among appropriately educated young people. It will enable many different self-evolving technologies to become "infinite in all directions."

13. CONFRONTING EXISTENTIAL RISK

The twenty-first century is the first in which events could happen that terminate *Homo sapiens*. These are referred to as existential risks (risks to our very existence) and include such possibilities as the unleashing of a genetically modified pathogen. In his book *Our Final Hour* (Basic

Books, 2004), Martin Rees describes such risks in detail and gives humanity only a 50% chance of surviving this century.

If we do survive, our accomplishments by the end of the century will be awesome. The magnificence of what human civilizations will achieve if they continue for many centuries is beyond all imagining—so magnificent that it would be too tragic for words if humanity were terminated. To run the risk of terminating *Homo sapiens* would be the most unspeakable evil. We should regard any risk to our existence as totally unacceptable. We need to take whatever actions are necessary to bring the probability of extinction to zero.

14. EXPLORING TRANSHUMANISM

This is the first century in which we will be able to radically change human beings, and this fact alone gives very special meaning to the twenty-first century. Technology will enable us to live longer, learn more, and have interesting prostheses. Neuroscience will blossom spectacularly when we can map the brain, recording the transmission of signals among individual neurons and then emulating parts of the brain with technology millions of times faster than the brain. A new world will open up when we can connect diverse neurons in our brain to external devices. We'll connect the brain directly to nanotechnology objects on or in our skulls and to supercomputers far away. This will change human capability in extraordinary ways.

Transhumanism will be highly controversial. It will raise major ethical arguments. We might harm some of the qualities that make humanity wonderful. It will lead to fundamental advances in what humans are capable of but will create extreme differences between the haves and have-nots.

We need to understand where changes to *Homo sapiens* can be made without net-negative consequences. Transhumanism will be a prime enabler of civilizations far beyond those of today.

15. PLANNING AN ADVANCED CIVILIZATION

The twenty-first century will experience a major increase in real wealth

(adjusted for inflation). Sooner or later, machines will do most of the work. What we do with our leisure will be a huge issue. A big question that we ought to be asking now is: "What could truly magnificent civilizations be like at the end of the century?" Because of transhumanism and the Singularity, the changes will be more extreme than are generally realized.

16. MODELING THE PLANET'S SYSTEMS

Because we need to make sure that we are not close to the limits beyond which runaway global warming occurs, earth system science needs to be a thorough academic discipline that comprehensively measures and models the Earth's control mechanisms. There will be uncertainties in the models, but we should not take the slightest risk of upsetting the immense forces that make our home planet livable.

Perhaps the greatest catastrophe that could befall us would be that we inadvertently push Gaia so that positive feedback causes it to become unstable or to change to a different state. The twenty-first century must put the science in place to regulate human behavior to live at peace with Gaia. This will be essential for future centuries.

17. BRIDGING THE SKILL AND WISDOM GAP

Deep wisdom about the meaning of the twenty-first century will be essential. A serious problem of our time is the gap between skill and wisdom. Science and technology are accelerating furiously, but wisdom is not. Today, deep reflection about our future circumstances is eclipsed by a frenzy of ever more complex techniques and gadgets and preoccupation with how to increase shareholder value. The skill-wisdom gap is made greater because skills offer the ways to get wealthy. Society's best brains are saturated with immediate issues that become ever more complex, rather than reflecting on why we are doing this and what the long-term consequences will be.

THE TAPESTRY OF BIG ISSUES

The story of what is happening to humanity and its home planet can largely be put in place now. It is not sharply in focus; our knowledge in

Challenge 2: FIGHTING POVERTY

Global GDP increased by an average of 2.8% per year from 1985 to 2000, but not all countries were able to share in the bounty. Below is a list of what the United Nations calls Least Developed Countries, whose GDP per head is less than \$2 per day. In these places, GDP declined more than 1% per year on average between 1985 and 1998.

| Nation | Average Annual Decline GDP per Head (%) |
|---------------------------------|--|
| Angola | -9.5 |
| Democratic Republic of Congo | -4.5 |
| Nigeria | -4.2 |
| Zambia | -3.6 |
| Sierra Leone | -3.1 |
| Belarus | -2.7 |
| Algeria | -2.3 |
| Ivory Coast | -2.2 |
| Madagascar | -2.2 |
| Nicaragua | -2.2 |
| Niger | -2.2 |
| Slovak Republic | -2.1 |
| Cameroon | -2.0 |
| Jordan | -1.5 |
| Namibia | -1.4 |
| Estonia | -1.0 |
| Mali | -1.0 |
| Mozambique | -1.0 |
| Rwanda | -1.0 |

Source: *The Meaning of the 21st Century* by James Martin (Penguin, 2006), Exxon Mobil Global GDP Outlook Comparison, www.exxonmobil.com/corporate/files/corporate/partner12.pdf.

many areas is sketchy. Yet the tapestry of big issues is visible. We are damaging our future in diverse ways, but there are resolutions to these problems—numerous solutions in different disciplines. A massive transition is needed, and the agenda can be created for the generation who is going to bring about the transition. Broadly speaking, we

Challenge 14: EXPLORING TRANSHUMANISM

A new world will open up when we can connect diverse neurons in our brain to external devices. We'll connect the brain directly to nanotechnology objects on our skull and to supercomputers far away.



know what needs to be done. It involves all nations. The issues are global. There is no place to hide.

There is a problem, however. Much of what needs to be done is not happening. The grand-scale transition of the twenty-first century could occur gently. There could be step-by-step replacement of carbon-based fuels, steady improvement of food-growing capability, measures to conserve water, a lockdown of sources of fissile uranium, growth of antiterrorist measures, a drive for eco-affluent lifestyles, and so on.

It's a long list, but today's computer models make clear that we are not changing our ways fast enough. We are drifting toward irreversible climate change faster than we are taking any actions to keep this from happening. Water is essential for food production, but we are taking water from aquifers at a rate that will cause many of them to run dry. In addition to water depletion and soil degradation, food production will also be seriously lowered in some countries by drought and heat waves caused by the rising quantity of greenhouse gases. As if that weren't bad enough, we are diverting huge amounts of water from farms and cities, and that trend will grow because there are massive migrations of people from the countryside to cities.

To make the twenty-first-century transition as painless as possible, we need to make positive changes before the problems become too bad. In almost all areas, however, this is not

happening. Where steady transitions are possible—for example, with the change to noncarbon fuels—almost nothing is being done. The U.S. Environmental Protection Agency tries to repair environmental damage after it has occurred, but seems to have almost no ability to change the economic practices that cause the damage in the first place. World summits on sustainable development have had agendas of immense importance but have taken almost no action on anything. Their follow-up can be described as studied avoidance of any changes that are controversial. The acronym UNCTAD (United Nations Conference on Trade and Development) is often said to stand for Under No Circumstances Take Any Decision.

The subsidies for fuels that damage the environment are massive, but subsidies for fuels that would help the environment are small. Ecology expert Norman Myers catalogued \$2 trillion per year of “perverse subsidies”—subsidies that do more harm than good. They leave the environment or the economy worse off than if the subsidy had never been granted. If voters and taxpayers were given a listing of subsidies they pay, along with the net harm from those subsidies, they would revolt. Not surprisingly, governments tend to hide that information. The longer the transition is delayed, the more difficult it will be.

Unlike their predecessors, the Transition Generation will not sit idle and see their world go down the drain. The twenty-first-century transition could become revolution, not evolution. As often before in history, revolution will be the consequence of complacency. Craig Venter, the legendary genome mapper, commented to me that the danger to our society is not science—it's apathy.

WHEN WOULD YOU WANT TO BE ALIVE?

When I say I would rather be a young person now than during any other time in history, there's a reason. The twenty-first-century revolution is absolutely essential, and today's young people will make it happen. But there needs to be an absolute crusading determination to bring

about the changes we describe. Today's young people will collectively determine whether civilization survives or not. It will be a time of revolution establishing the processes by which humankind can achieve levels of greatness never before dreamed of.

With technologies that are infinite in all directions, what can humanity become? Our future wealth will increasingly relate to knowledge in the broadest sense of the term. We might use the term “knowledge capability” to refer to the quantity of available knowledge multiplied by the power of technology to process that knowledge. The quantity of usable knowledge is rising fast (for example, precisely mapping the genome of everything biological), and the power of technology to process the knowledge capability is increasing exponentially. Combining these, knowledge capability is approximately doubling every year. It seems likely that this doubling will go on throughout the century (if there is no catastrophic disruption). That means that, during the twenty-first century, knowledge capability will increase by two to the power of 100, a thousand billion billion.

The individual is immersed in such an expanding ocean of capability to process knowledge. That makes the twenty-first century both more exciting and more perilous than any other century so far. We are heading toward an inflection point, but our leaders are not preparing to make the passage smoother for us. That will be the job of the Transition Generation. □



About the Author

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