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A BOOK FOR ALL SEASONS



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The wind shook the house with a roar like that of a low-flying jet. Moments later we were in darkness. The storm with gusts reaching 110 miles per hour was more than the wooden poles of the power lines could stand. Such storms do happen on the Atlantic coast of England. What was unusual was having to go 30 hours without light or heat in the dark midwinter month of January. By the end of it we were aware how much we depend on electricity and how fragile is the civilization it brings.

Perhaps the late Julian Simon, noted economist and optimist, was right to think that, apart from natural misfortunes, the next century will continue unperturbed. He sees resources growing sufficiently to meet demand; the air may become warmer and still be polluted, but not enough to cause discomfort. There may be more of us in some places. There *will* be more cars, but they will be smaller and more efficient. Others, like ecologist and environmentalist Paul Ehrlich, see a much gloomier future with disaster global in scale and a direct consequence of our own actions. Most of us feel some anxiety but believe in the maxim "business as usual." So, we behave like the inhabitants of Tokyo and Los Angeles. They put thoughts about a possible earthquake at the back of their minds. We act in the hope that the world will continue into the 21st century much as it is now.

Few travelers would go to sub-Saharan Africa, or Bosnia, with such insouciance. They would at least take antimalarial and other drugs and check on the state of local wars. By comparison, we are amazingly unprepared for our journey into the future. We try to guard against local hazards, but tend to ignore threats global in scale. We seem especially unconcerned about natural geophysical events that are a normal part of the Earth's history. I have in mind volcanoes like Tambora (1815) and Laki (1783). These were more powerful than Pinatubo (1995) or Krakatau (1883), but minor in effect compared with Toba 74,000 years ago. Even so, their effects on the climate were severe enough to cause harvests to fail across the Northern Hemisphere. There was famine, even when our numbers were only a tenth of what they are now. Should one of these volcanoes stage a repeat performance, do we now have enough stored food for today's multitudes? If global warming takes place, there may be a slow or even a sudden rise in the sea level. Are we prepared for the refugees from the inundated land? Do we have the food and shelter needed for them when their coastal cities become uninhabitable?

We see ourselves as sensible and do not agonize over hy-

potheses of doom. We prefer to assume that global disasters will not happen in our lifetime. We take them no more seriously than our forefathers took the prospect of hell. What we do fear is appearing foolish. An old verse goes, "They thieve and plot and toil and plod and go to church on Sunday. It's true enough that some fear God but they all fear Mrs. Grundy." In science, we have our Drs. Grundy and they are eager to scorn any departure from orthodoxy. Scientists and science advisers are afraid to admit that sometimes they do not know what will happen. They are cautious in their predictions and shy from pronouncements that might threaten business as usual. This tendency leaves us unprepared for extreme natural events and for surprises, like the ozone hole, that might come from significant perturbations in the Earth's processes.

We have confidence in our science-based civilization and think it has tenure. In so doing, I think we fail to distinguish between the life-span of civilizations and that of our species. In fact, civilizations are ephemeral compared with species. Humans have lasted at least a million years, but there have been 30 civilizations in the past 5000 years. Humans are tough and will survive; civilizations are fragile. It seems clear to me that we are not evolving in intelligence, not becoming true *Homo sapiens*. Indeed there is little evidence that our individual intelligence has improved through the 5000 years of recorded history. I prefer sociobiologist E. O. Wilson's view of us as unfortunate tribal carnivores that have acquired intelligence. Our evolution is more like that of social insects; the advances in knowledge and understanding that we prize are more a property of the human nests we call civilization than of its individual members. The nest is always more powerful than a collection of individuals. Who dares disturb the hornet's nest? Small bees easily destroy the huge and powerful but solitary Japanese hornet when it invades their nest. They cluster around it in a ball and cook it to death at 50°C. A large brain offers no protection for the sperm whale when attacked by possibly less-intelligent human hunters.

As individuals, we are amazingly ignorant and incapable. How many of us, alone in a wilderness, could make a flint knife? Is there anyone now alive who knows even a tenth of everything there is to know in science? How many of those employed in the electricity industry could make any of its components, such as wires or switches? The important difference that separates us from the social insects is that they carry the instructions for nest building in their genes. We have no permanent ubiquitous record of our civilization from which to restore it should it fail. We would have to start again at the beginning.

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Organisms that face desiccation often encapsulate their genes in spores so that the information for their renewal is carried through the drought. Could we encapsulate the essential information that is the basis of our civilization to preserve it through a dark age? My wife Sandy and I enjoy walking on Dartmoor, a mountain moorland near our home. On such a landscape it is easy to get lost when it grows dark and the mists come down. Our way to avoid this fate is to make sure that we always know where we are and how we got there. In some ways, our journey into the future is like this. We cannot see the way ahead or the pitfalls, but it would help to know our present position and how we got here, to have a record that is always kept up to date and is written in clear and simple language that any intelligent person could understand.

No such record exists. For most of us, what we know of the Earth comes from books, journal articles, and television programs that present either the single-minded view of a specialist or the persuasive arguments of a talented lobbyist. We live in adversarial, not thoughtful, times and tend to hear only the views of special-interest groups. None of them are willing to admit that they might be mistaken. They all fight for the interests of their own group while claiming to speak for humankind. This may be fine entertainment, but of what use would a book of this kind be to the survivors of a future flood or famine? When they draw it from the debris, they would want to know what went wrong and why. What help would they get from the tract of a Green Party lobbyist, the press release of a multinational power company, or the report of a governmental committee? Even science itself has to lobby for its support. Worse for our survivors, the language of contemporary science would appear to them as an incomprehensible babble. Scientific papers are so arcane that scientists can understand only those of their own specialty. I doubt if there is anyone, apart from the authors and their fellow specialists, who can understand more than a few of the papers published in specialized scientific journals.

Scan the shelves of a bookshop or a public library and you will see that most of the books are about the evanescent concerns of today. They may be well written, entertaining, or informative, but almost all deal with superficial and contemporary topics. They take so much for granted, while forgetting how hard won was the scientific knowledge that gave us the comfortable and safe lives we enjoy. We are so ignorant of the facts upon which science and our scientific culture are established that we give equal place on our bookshelves to the nonsense of astrology, creationism, and junk science. At first, they were there to entertain, or to indulge our curiosity, and we did not take them seriously. Now they are too often accepted as fact. Imagine a survivor of a failed civilization with only a tattered book on aromatherapy for guidance in arresting a cholera epidemic. Yet, such a book would more likely be found amid the debris than a comprehensible medical text.

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Creating a permanent record of our civilization may not be as difficult as we imagine. What we need is a primer on science, clearly written and unambiguous in its meaning—a primer for anyone interested in the state of the Earth and how to survive and live well on it. One that would serve also as a primary school science text. It would be the scientific equivalent of the Bible. It would contain practical information such as how to light a fire, and things to wonder about when it was lit. It would explain the natural selection of living things and what we know about the universe. Among its contents would be the principles of medicine and surgery with an account of how the blood circulates and the role of the organs. We take for granted the facts of pharmacology and the existence of bacteria and viruses, but this knowledge could easily be lost and take centuries to recover. Equally vulnerable are the facts of engineering and ther-

modynamics—even basic instructions on how to measure temperature and pressure. A glance at the history of chemistry shows how long it took to discover the periodic table of the elements and to provide an account of the air, the rocks, and the oceans. The book would present science to schoolchildren and to adults in a relevant and interesting way. It would be more than a survival manual; it would help restore science as part of our culture and be passed down as an inheritance to future generations.

It is no use even thinking of presenting such a book on magnetic or optical media, or indeed any kind of medium that needs a computer and electricity to read it. Words stored in such a form are transient and have no tenure. Not only is the storage medium itself short-lived, but reading documents stored in these media depends on specialized hardware and software. In this technology, rapid obsolescence is usual. Modern media are more fallible instruments for long-term storage than was the spoken word. They require the support of a sophisticated technology that we cannot take for granted. What we need is a book written on durable paper with long-lasting

print. It must be clear, unbiased, accurate, and up to date. Most of all we need to accept and to believe in it at least as much as we in the United Kingdom believed in, and perhaps still do believe in, the World Service of the BBC.

In the Dark Ages, the religious orders of monasteries were the bearers of our culture. Much of this knowledge was contained in books, and the monks took care of them and read them as part of their discipline. Sadly, science is no longer a calling where scientists are the guardians of knowledge, but rather has become a narrowly specialized employment. Apart from a few isolated institutions, like the National Center for Atmospheric Research, science has no equivalent of the monasteries. So, who would guard the book? A book of science written with authority and as splendid a read as Tyndale's bible might need no guardians. It would earn the respect needed to ensure it a place in every home, school, library, and place of worship. It would then be on hand whatever happened.

