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ILLUSTRATIONS BY RICHARD WILKINSON

A book for our time, from all time

Seven leading scientists, historians and scholars choose classic works that speak to now.

From planetary change to geopolitical recalibrations, 2019 has been convulsive. The year saw millions worldwide protesting against governmental inaction on the cascading crises in the global environment. Anxiety over nuclear annihilation vied with concerns over the

repugnant resurgence of 'race science' and the emergent ethics of gene editing. Amid the tumult, *Nature* asked seven scientists, scholars and historians to pluck a book from all time that speaks to our time.

Freeman Dyson, Alondra Nelson, Emilie Savage-Smith, Ann Pettifor, Callum Roberts,

Ismail Serageldin and Chikwe Ihekweazu chose science-inflected volumes – on the often-forgotten lessons of Hiroshima, the rise of unregulated markets, the ubiquity of plastic, mapping the eleventh-century world, and more. Together, they offer a composite lens on our complicated present.

FREEMAN DYSON MESSAGES OF HIROSHIMA

John Hersey's *Hiroshima*, published in 1946 – one year after the destruction of the city by a US atomic bomb – gave the world an enduring vision of nuclear war that has remained the dominant image in the minds of later generations. On the threshold of 2020, the 75th anniversary of the bombing, nuclear war is seen as crowds of half-naked and horribly burnt victims, fleeing from the flames of the burning city, lying down to die of wounds and thirst and radiation sickness. Hersey recorded that scene with unforgettable words in the first part of the book. But that is only half of the US journalist's message.

Hiroshima also shows us an image of nuclear war as a tragedy with heroes as well as victims. Hersey's heroes were doctor Terufumi Sasaki and Methodist pastor Kiyoshi Tanimoto. Sasaki worked with barely a break for three days and nights, using whatever bandages and medicaments he could find in the wreckage of his hospital, easing the pain and hoping to save the lives of an unending stream of sick and dying people pouring in from the surrounding ruins. Tanimoto ran through the burning city to Asano Park, where thousands of victims covered the ground. Soon, the flames advanced across the park. He found a boat on a nearby river and spent a day ferrying sick and dying people to safer ground. He stayed in the park for five days and nights, organizing teams of able-bodied people to bring food and cook meals for the wounded.

The two never knew how many lives they had saved. Each certainly saved several hundred.

After the first days of horror and heroism, Hersey shows the destroyed city coming back to life, with fresh green grass and wild flowers quickly covering the ashes. For weeks, people who have been within a kilometre and a half of the explosion are dying of radiation sickness. After a month, those who are still alive slowly recover. After two months, the survivors are mostly back at work. The city is reborn as a community, with rich and poor sharing the hardships, and widows, widowers and orphans starting new lives.

Hiroshima ends with a quote from an essay written a year later by Toshio Nakamura for his teacher at school. Nakamura was ten years old when he lived through the disaster at Asano Park. "The neighbors were walking around burned and bleeding," he wrote. "We went to the park. A whirlwind came. At night a gas tank burned and I saw the reflection in the river. We

stayed in the park one night. Next day I went to Taiko Bridge and met my girl friends Kikushi and Murakami. They were looking for their mothers. But Kikushi's mother was wounded and Murakami's mother, alas, was dead."

The second half of Hersey's message is that we are a tough species, evolved to survive all kinds of calamities, including the calamity of nuclear war. Individuals die, but communities survive. Unfortunately, the public heard only the first half: the picture of doom. The response was to rush into a frenzy of bomb-building that made the dangers of nuclear war a hundred times worse.

Had we heard the whole message, we would perhaps have chosen a wiser course: saying no to nuclear weapons as we have said no to biological weapons, building a saner world with manageable risks.

Freeman Dyson, retired professor in the School of Natural Sciences, Institute for Advanced Study, Princeton, New Jersey, on **Hiroshima** *John Hersey* Alfred A. Knopf (1946).

ALONDRA NELSON THE RETURN OF EUGENICS

Some three decades ago, as global concern was tuned to the reunification of Germany, Nelson Mandela's release from a South African prison and the launch of the Human Genome Project, sociologist Troy Duster published a quiet but prescient primer for the dawning age of DNA.

Backdoor to Eugenics foretold a world in which the power of genetics extends well beyond its therapeutic potential. In this world, genetic explanations are offered for issues better explained by politics and social structure, such as inequality; the impact of genetic screening programmes depends on the resources of patients; and the state and businesses fund genetic testing, assembling large caches of personal data, with high stakes for the medical and criminal-justice systems.

These developments did materialize, laying the cornerstone for the social science of genetics. The book also anticipated some of the thorny ethical and political questions we face in today's post-genomic era. For instance, how did screening of newborn babies for medical conditions – once seen as radical, now ubiquitous in the United States – become legitimized? Do we own our own DNA data – and should they be readily available to clinical researchers and the police without oversight?

In the new genetics, Duster argues,

human life is seen through a narrow lens (a phenomenon he calls the "prism of heritability"). He uses the metaphor of front and back doors to illuminate cases in which that lens is used, respectively, in overt or covert ways. And he shows how genetics slides into eugenics.

For Duster, eugenics through the "front door" was exemplified by Nazi Germany's mobilization of science, technology, propaganda and statecraft to demonize people with traits deemed 'unfit'. That culminated in the genocide of Jewish people, people with disabilities and others. There were echoes of this in the United States, with exclusionary immigration policies and the forced sterilization of people including those considered 'feeble-minded'.

Lessons were learnt in the wake of this reprehensible history, and by 1990 it seemed as if scientific racism was highly unlikely to repeat itself. Duster noted that the front door to eugenics was effectively closed. However, the back door was at risk of being opened: emergent thought and practice formed a slim 'wedge'. This insidiously associated genetics with 'target' or 'at-risk' populations that mapped onto vulnerable and marginalized communities.

Once this wedge was inserted, Duster argued, a whole infrastructure of surveillance could be set in place. It might begin with turning some voluntary genetic testing into social requirements. (The mandatory sampling and analysing of DNA from certain criminal suspects in many US jurisdictions is a case in point, as is genomic surveillance in China.) It might involve increasing what was tested, from acute medical conditions to social phenomena such as 'educational attainment'. With new norms in place, data collection and scrutiny could be expanded.

Duster's "backdoor" genetic analyses share qualities with today's direct-to-consumer DNA testing. Both are voluntary, tout the value of individual and community participation, and seem to be benign agents of self-knowledge and health information. But the issue of data misuse and surveillance is now unavoidable.

The increasingly crucial message of *Backdoor to Eugenics* is that genetic disorders and social orders are inextricably linked. Duster made a provocative argument about the way in which intertwined political, cultural and technical forces were giving rise to broad and potentially dangerous uses of genetics. He cautioned, for instance, that the seemingly benign medical surveillance of newborn screening risked diverting attention from challenges that confront black and low-income mothers in the United States, such as access to high-quality prenatal care.

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Duster's concerns have been borne out in many ways – for instance, the growing acceptance of genetic scrutiny of embryos through processes such as fetal DNA screening for Down's syndrome. More dramatically, an untested gene-editing procedure was used last year to make heritable changes to the world's first 'CRISPR babies'.

Then, as now, key questions remain. What kind of genomics should we have, and for whom? What assumptions are being made about patient populations, ported into genetics analysis and reified as research findings? In this moment, the back door seems more gaping than ajar.

Alondra Nelson, Harold F. Linder Chair at the School of Social Science, Institute for Advanced Study, Princeton, New Jersey, on **Backdoor to Eugenics** Troy Duster Routledge (1990).

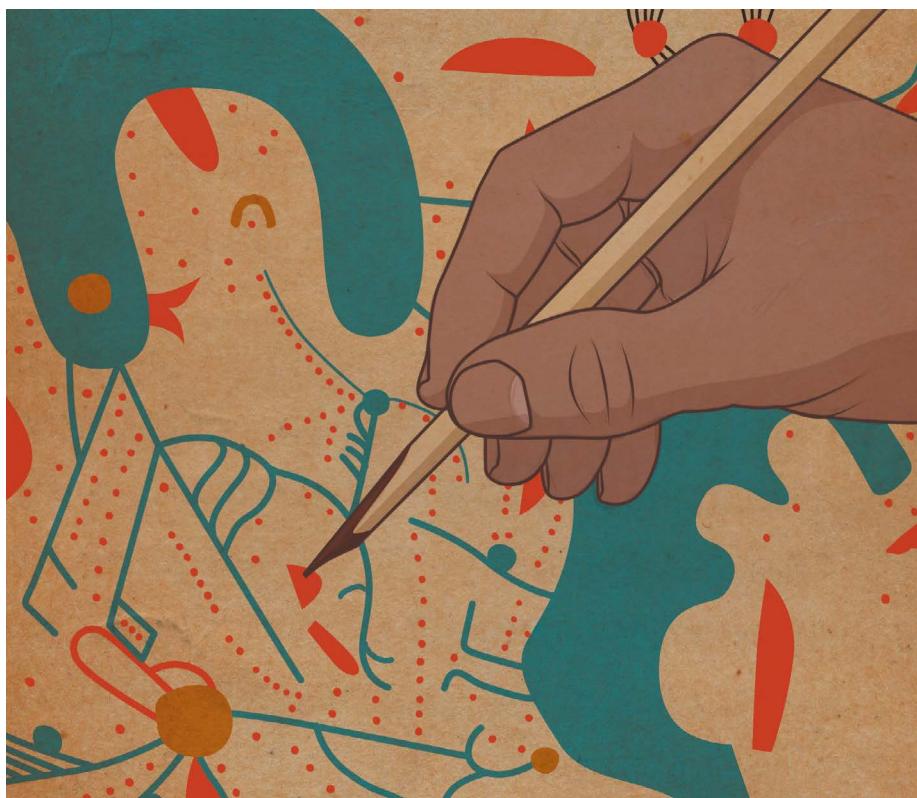
EMILIE SAVAGE-SMITH MAPPING UNCERTAINTIES

Despite vast advances in many fields of science, we live with uncertainties, from the progress of climate change to the nature of consciousness. As we try today to understand and explain the world, a book written 1,000 years ago can still speak to us – not least in its concern with predicting everything from flooding to war. In *The Book of Curiosities of the Sciences and Marvels for the Eye*, a well-educated Egyptian tried to draw together everything he could learn about the structure of the heavens and Earth.

His precise identity is unknown, but he had a love of maps and diagrams. In these, beginning with the fixed stars and Saturn – the outermost planet visible to the naked eye – he worked his way down to Earth's surface, with its vast oceans surrounding landmasses occupied by peoples of varying appearances and customs.

Compiled between 1020 and 1050, *The Book of Curiosities* exemplifies the intense intellectual voraciousness of scholars in Egypt during the era. Cairo was then the centre of a global maritime power, with tentacles stretching from the eastern Mediterranean to the Indus Valley and down the East African coast. The city boasted some of the best-known figures in the history of Islamic science, including the highly original observational astronomer Ibn Yunus, and Ibn al-Haytham (Alhazen), renowned today for his work on optics. The book is preserved in a richly illustrated Arabic manuscript acquired in 2002 to mark the 400th birthday of the Bodleian Library in Oxford, UK. Over the subsequent decade, it was fully translated and analysed.

With neither telescopes nor microscopes to help them, scholars of the early medieval Arabic-speaking world tried to make sense of the Universe and the constantly changing seas



and lands around them. As they knew from the scientific writings of the day, Earth was without question spherical. Various attempts were made to calculate its circumference. The ninth-century caliph al-Mamun sent astronomers into the desert of what would become Iraq to determine the length of a meridian arc of one degree. The eleventh-century Persian scholar al-Biruni applied trigonometry to the problem – as well as tackling the relative size of the five planets visible to the naked eye.

All events in the skies were thought to affect those on Earth; the microcosm mirrors the macrocosm, it was believed. So celestial mapping became something of an industry, not only for timekeeping but for the prediction of earthly events. The ability to forecast winds, earthquakes, storms, droughts, famines and wars was of great importance in that vulnerable era. Some concerns of our medieval Egyptian author are strikingly similar to ours. When discussing the futility of trying to portray on a map any coastline in precise detail, he says: "Sometimes the lower parts of a region are inundated, and we have witnessed in our short lifetime wastelands and passable lands overcome by sea."

Most of his correlations and explanations have been long rejected. In reading *The Book of Curiosities*, however, you cannot but have respect for the observational skills on show, as well as for his logical reasoning. For instance, he argued that the Nile floods were the result of snow melting on equatorial mountains. The work is a much-needed reminder that we are not the only intelligent people to have inhabited this planet. And it makes you wonder: what

will generations 1,000 years hence think of our scientific theories and explanations?

Emilie Savage-Smith, a retired professor of the history of Islamic science at the University of Oxford, UK, on **The Book of Curiosities of the Sciences and Marvels for the Eye** Anon (1020–1050).

ANN PETTIFOR THE MARKET FOR DYSTOPIA

We live in turbulent and uncertain times. Political insurgencies have erupted from Santiago to Hong Kong. Citizens have risen up in anger against ruling elites. Institutions trusted for upholding democracy, the law and public discourse are undermined daily by political leaders on both sides of the Atlantic. More and more public space and wealth are being privatized. Everywhere there is fear: of financial and economic collapse, of a loss of national identity and sovereignty, of political upheaval, of trade wars and real wars. And there is a growing fear that our ecological life-support systems are poised to collapse. These fears, along with the marketization of society, fuel the rise of protectionism, nationalism and even authoritarianism.

Are we witnessing the dissolution of economic globalization, the international system on which Western prosperity and political stability has depended for more than 40 years?

For an understanding of the forces at play, there is no text more illuminating

than Karl Polanyi's 1944 classic, *The Great Transformation*. In this, his most famous book, Polanyi sought to explain the economic, social and political forces that led to the twentieth century's catastrophic world wars and the march of fascism.

Polanyi – an Austro-Hungarian economic historian and social philosopher – noted that nineteenth-century society rested on two pillars: liberal capitalism and representative democracy. Liberal capitalism, in turn, rested on the gold standard, a system of governance that embraced world markets in capital, currencies and commodities. Thus, both domestic and international markets were effectively governed by private, not public, authority. Governments were gradually stripped of autonomy in key economic policy decisions. This internationalized market system demanded that society be subordinated to its needs, argued Polanyi in his lectures (see go.nature.com/2pajnpd). Markets then became detached from political systems of regulatory democracy, which were necessarily bound by borders.

For Polanyi, that separation was the system's deep flaw and "the clue to its rapid downfall" in 1933. The idea of self-adjusting international markets, detached from societal regulation and oversight, implied a bleak utopia indeed. Such an institution could not exist, he argued in *The Great Transformation*, without annihilating the human and natural substance of society. The

gradual changes leading up to its dissolution in 1933, as part of US president Franklin Delano Roosevelt's response to the Great Depression – were in progress long before the start of the First World War, Polanyi explains. But they remained unnoticed at the time. In a reflection apt for our times, he notes that "a society does not become conscious of the true nature of the institutions under which it lived until those institutions have already passed".

Today, Big Oil, Big Tech and Big Banks effectively police themselves. They have moved "from offering utopia to selling dystopia", as economic analyst Rana Foroohar argues (see go.nature.com/3822vkb).

The effective organization of the world today is economic, not political. As Polanyi predicted, citizens are belatedly discovering that their politicians and political institutions are impotent against these forces. His book is truly one for our times.

Ann Pettifor, director of Policy Research in Macroeconomics (PRIME) in London, on **The Great Transformation** Karl Polanyi Farrar & Rinehart (1944).

CALLUM ROBERTS DAWN OF THE PLASTIC WORLD

Books that predict the future, particularly one 70 years distant, are usually memorable for how far-fetched or quaint their prophecies seem today, not for their veracity. *Plastics*, a slender volume published in 1941 by two British chemists, Victor Yarsley and Edward Couzens, is exceptional in a different way. It is both uncannily prescient and marred by an enormous blind spot.

Yarsley and Couzens were at the forefront of the plastics revolution, making rapid advances in the field of polymer chemistry and the manufacture of original products from these near-miraculous new materials. Plastics, they wrote, cannot corrode and are sturdy, lightweight and "of a clarity exceeding that of glass if required". Good insulators, the materials are pleasant to the touch and exceptionally resistant to acids and oils. "The manufacturer of the future will say, not 'of what material shall I make this article?' but what kind of plastic shall I use?" they declare.

Taking this as their lodestone, Yarsley and Couzens describe the future for 'Plastic Man'. For children, it will be a world "of colour and bright shining surfaces", almost unbreakable, safely rounded and easily cleaned. In this polymer utopia, the growing child "cleans his teeth and brushes his hair with plastic brushes with plastic bristles", wears "synthetic silk and wool fastened with plastic zip fasteners" and sits on moulded plastic furniture. In old age, plastic dentures and plastic-lensed

spectacles beckon. The material will, in short, be ubiquitous.

Yarsley and Couzens conclude their homage by writing that when the smoke and mess of the Second World War have dissipated and the world begins to rebuild, the return of a newly powerful, industry-driven science will lead to "a new, brighter, cleaner and more beautiful world". That line jars today. In fulfilling their utilitarian promise, plastics have become a blight of modern life, invading soils, waterways, seas and even the atmosphere. Some 150 million tonnes of plastic circulate in our oceans now, and in the United States alone, more than 26 million tonnes reached landfill in 2017.

One of the great lessons of history is that scientists, in running away with their enthusiasms, perceive the consequences of their inventions only selectively. There is not a word in the book on plastic waste. Perhaps the writers thought plastics would last forever. Nor is there a single sentence on recycling; that is odd, in the Second World War world of 'make do and mend', cooking from scraps and saving cardboard. The idea of recycling was gaining traction in the oil industry of the time, but perhaps it didn't fit with the authors' vision of a shiny new consumer paradise. Ultimately, if Yarsley and Couzens had had the vision, their prophecy of a plastic world might have extended to the tide of plastic waste now choking the planet.

The biographical sketch of Couzens provides one of the best lines of the book: "Though he is a firm believer in the future of plastics, he himself prefers glass and metals."

Callum Roberts, professor of marine conservation at the University of York, UK, on **Plastics** V. E. Yarsley and E. G. Couzens Pelican Books (1941).

ISMAIL SERAGELDIN A MIND FOR RADICAL EQUALITY

We are challenged today by the results of our past actions and current lifestyles. They are complex and tangled: climate change, biodiversity loss, water shortages and regions beset by both swift population growth and potential famine. We are in a battle to live sustainably.

Some might say that this is a moment for English cleric Thomas Malthus's 1798 *An Essay on the Principle of Population*. Yet that book assumes that humans are no different from animals, and respond to resource availability in the same way. I look to a very different work by a contemporary of Malthus's: the remarkably optimistic *Sketch for a Historical Picture of the Progress of the Human Mind*. Its author, the mathematician and philosopher



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Nicolas de Caritat, Marquis de Condorcet, saw no limits to the capacity of human intelligence, and called on his readers to use it to build a better society.

Condorcet wrote the *Sketch* while hiding from the extremist wing of the French Revolution. In March 1794, its forces captured him, and possibly murdered him. The essay was published posthumously.

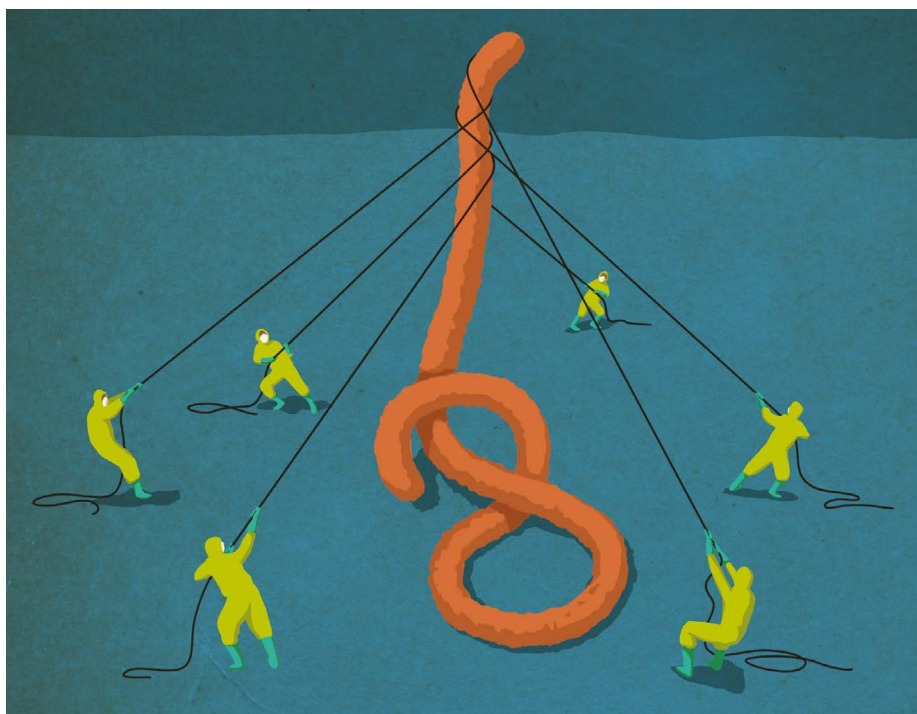
Condorcet had a brilliant and far-ranging mind; his early work included the pioneering *Essay on the Application of Analysis to the Probability of Majority Decisions*, in 1785. His world view was a vision of what could – and should – be, if we aspire to a world of reason and respect for our common humanity. His views are striking even for the late eighteenth century, when sociopolitical radicalism abounded. Condorcet advocated the abolition of slavery and equal rights for women, including women's suffrage. He wanted economic freedom, religious tolerance, legal and educational reform. In the 1790 essay *On the Admission of Women to the Rights of Citizenship*, he argued for human rights generated by virtue of our shared intellectual and ethical capacities:

The rights of men stem exclusively from the fact that they are sentient beings, capable of acquiring moral ideas and of reasoning upon them. Since women have the same qualities, they necessarily also have the same rights. Either no member of the human race has any true rights, or else they all have the same ones; and anyone who votes against the rights of another, whatever his religion, colour or sex, automatically forfeits his own.

Condorcet wanted a classless French republic of citizens protecting their freedom through voting. He designed voting systems, including one based on comparative ranking to satisfy majority rule (a method favoured by Nobel-prizewinning economists Amartya Sen and Eric Maskin). At the global scale, Condorcet called for equality among nations. That included improving people's physical health and longevity, education and moral development. But he recognized that the equality he was describing, both for nations and for individuals, is not absolute: it is equality of freedom and of rights.

This remarkable thinker believed that human ingenuity can overcome all obstacles, and that human goodness can steer us away from tyranny and greed. In this time of global challenge and national turbulence, his wise, inspiring ideas deserve to be remembered.

Ismail Serageldin, founding director of the Bibliotheca Alexandrina, Alexandria, Egypt, on **Sketch for a Historical Picture of the Progress of the Human Mind** Nicolas de Caritat, Marquis de Condorcet (1795).



CHIKWE IHEKWEAZU LOCALIZING PUBLIC HEALTH

Peter Piot's *No Time To Lose* is a passionate account of his leading roles in the discovery of Ebola, the most consequential emerging disease of this decade, and in the global response to HIV and AIDS. I find it speaks profoundly to the current situation in Africa.

As a public-health epidemiologist, I have grown up professionally in the era of AIDS. I have visited Yambuku in the Democratic Republic of the Congo, site of the Ebola virus's first appearance, while supporting the response to a 2004 Ebola outbreak in what is now South Sudan. Thus, *No Time To Lose* felt very immediate to me. Piot draws you in as he describes the appearance of the then-unknown and unnamed Ebola virus in a sample delivered to his laboratory in Belgium in 1976; his first fact-finding trip to Africa; and his professional stint in Yambuku, treating infected people in a hospital run by Catholic nurses. Piot's account of the conversation that led to the naming of Ebola seems almost too simple to be true; despite the virus's severity, there was no naming convention at the time.

In the 1980s, he worked with other scientists investigating many infectious diseases, including HIV infection. As his career pivots to global health politics, he describes in lucid detail his role in the establishment of the Joint United Nations Programme on HIV/AIDS (UNAIDS), and his leadership of the agency between 1994 and 2008. From laboratories to field epidemiology, boardrooms and political chambers, the book charts an incredibly

impactful career in science and the fine arts of diplomacy, communication and political engagement in difficult situations.

The Democratic Republic of the Congo is now grappling with the second-largest recorded outbreak of Ebola, which began in 2018. Despite new tools, more than 3,000 people have been infected and over 2,000 have died in the past year.

New viruses, such as MERS coronavirus, continue to emerge; old ones persist. At the same time, the population of Africa grows and socio-economic progress has plateaued. As I reflect on the gripping descriptions in *No Time to Lose*, I try to make sense of the paradox of what is happening on the continent.

One of the biggest lessons from Piot's book is that we must focus on building strong, resilient local institutions with a sustainable capacity for infectious-disease prevention, detection and response. Although it was exhilarating to read his account, I caught myself wishing for a different ending: the emergence of a great research institution in Africa. This could train the virologists, epidemiologists and public-health leaders of the future, on the continent where they are most likely to emerge.

A lot of progress has been made since Piot first travelled to Yambuku, more than 40 years ago. As we continue to experience large outbreaks affecting lives and economies in Africa, we must persist in blazing the path towards building local capacity. For that, there really is no time to lose.

Chikwe Ihekweazu, director-general of the Nigeria Centre for Disease Control, Abuja, on **No Time to Lose: A Life In Pursuit Of Deadly Viruses** Peter Piot W. W. Norton (2012).