BOOKS & ARTS

The making of the modern world

The end of the Second World War heralded a revolution in the use of technology in the West.

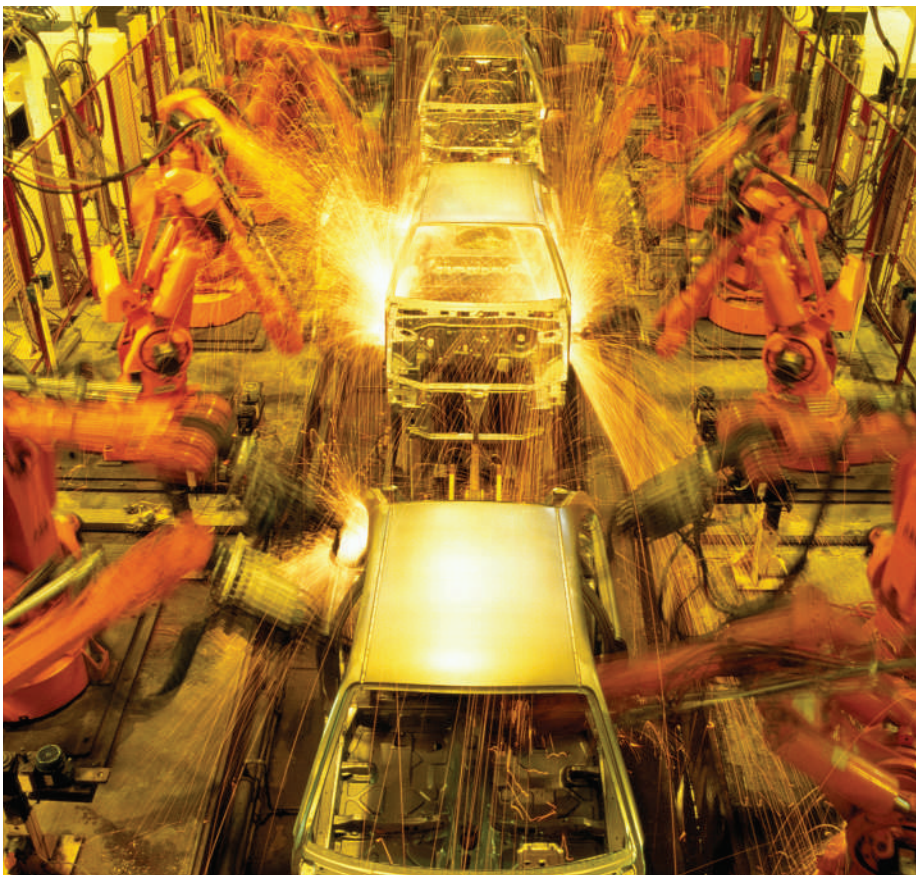
Transforming the Twentieth Century: Technical Innovations and their Consequences
by Vaclav Smil
Oxford University Press: 2006. 358 pp.
$45, £26.99

Nasir Tyabji

The Industrial Revolution was accompanied by a fundamental change in the evolution of technology in Western society. In technological terms it is the historical dividing line between an era of heuristic advances in production systems and a time of focused application of the scientific approach to increasing productivity. But historians also recognize the importance of the chemical revolution of the late nineteenth century. This saw the introduction of continuous industrial processing, signalling a new relationship between human labour and the materials on which they worked, although the manufacturing process was still dominated by batch production. The next major change, just after the Second World War, was the scientific and technological revolution, which potentially heralded the end of the millennia-old systems of the mechanical processing of materials, replacing them with biological, chemical and molecular-level production processes.

J. D. Bernal was the key figure behind studies of technology's role in history, influenced heavily by the decisive interventions of the Soviet delegation to the 1931 Congress of the History of Science in London. In particular, Boris Hessen's paper, by demonstrating how even Newton's most abstract concerns in *Principia* were profoundly influenced by the political economy of the time, reshaped the way in which the history of science would be viewed. Bernal's ideas were subsequently developed in the Soviet Union and the Eastern bloc, where some very interesting work was done in the 1970s and 80s. However, no significant work on this has emerged from there since the collapse of the Soviet Union.

The imprint of that Eastern European tradition seems to remain with Vaclav Smil, even though he moved from Czechoslovakia to North America in 1969. His book *Creating the Twentieth Century* (Cambridge University Press, 2005) described the impact of post-1870s technological developments on society, and his new book, *Transforming the Twentieth Century*, carries on where the first left off. Between them they cover both the continuous-processing, and the scientific and technological revolutions.



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The automated production line symbolizes the manufacturing advances of the late twentieth century.

In *Transforming the Twentieth Century*, Smil describes in detail the changes brought about by two distinct processes. The first is the development of innovations originally introduced between 1867 and 1914, whose full impact only became apparent after the Second World War. He then describes the effects of the post-war introduction of microelectronics, new materials and different methods of processing. In separate chapters he presents case studies of changes in energy conversion, in the development and uses of new materials, in the methods of production and, finally, in means of transportation, communication and information processing. He includes real technological change (which involves changes in the knowledge systems of material production), along with advances in technological artefacts (such as aircraft and means of railway locomotion) and technological systems (the Internet). The book, in effect, examines the making of modern society through technological change. This approach, which was pioneered by Siegfried Giedion some 60 years ago in his book *Mechanization Takes Command*, has the advantage of making the overwhelming impact of technological change more easily apparent by considering its effects on everyday life. (Giedion, incidentally, is absent from the bibliography.)

In developing his reasons for writing the book, Smil raises several interesting points. He notes that the great increase in the fuel efficiency of North American cars after 1973 came not from market-based competition, but from government legislation that required greater economy in the use of fuels. Equally important is his methodological observation that innovations are often the result of

"successful transformative engineering: a system assembled from proven ingredients whose synergies change a mundane experience to such an extent that it becomes not just new but highly desirable".

These comments, and others scattered throughout the introductory chapter of the book, raise expectations of broader insights to be drawn from the detailed case studies presented later. However, subsequent chapters give an unmistakeable sense that Smil has lost control of the process by which his argument might develop, among the details of the case at hand. As a result, the case studies remain in the form of encyclopaedic entries, rather than instances by which the nuances of a more general and complex argument might have developed. To be fair to Smil, he notes in the preface that he has no intention of proposing a great thesis. But the reader cannot help feeling that the enormous effort expended in collecting information throughout the book deserves a rather greater degree of conceptual closure. ■

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Science uncut

Sex, Drugs and DNA: Science's Taboos Confronted
by Michael Stebbins
Macmillan Science: 2006. 360 pp.
$15.72, £16.99

Lee M. Silver

I have fond memories of my middle years as a graduate student working in the Harvard Bio Labs during the mid-1970s. Behind the life-size bronze rhinos that guarded the building, lights burned all night long as my fellow students and I pipetted solutions, ran gels and played with expensive equipment, all to the beat of blasting rock music. Like kids in a sweetshop, we would 'do science' to our hearts' content until we dropped from exhaustion. The next day, we'd wake at some point, throw on some tatty clothes, and think up new experiments. Our chief diversion was smoky weekend parties where a few hip professors would join us, often with an eye for female grad students. On one occasion, a lab-mate synthesized mescaline — following a recipe from *Nature* — and we had a grand time tripping through Harvard Square and along the banks of the Charles River. The only laws that mattered were the laws of nature, and as far as we were concerned, even those were ripe for attack.

Why was the US government footing the bill for our anarchic endeavours? As long as money flowed into experimental reagents, lab supplies and our measly stipends, we didn't have a clue and we didn't care. With no classes or exams, no children to feed, no possessions of any worth, and not much thought for the future, we could occupy ourselves completely with the subjects covered by *Sex, Drugs and DNA*, Michael Stebbins' book-length rant about the irreverent lives and world-views of molecular biologists.

Stebbins tells us at the start that he intends to "address the litany of bullshit and lies" that other scientists are afraid to talk about in public. What are some of the hushed-up truths? Genes play a role in behaviour; men and women have anatomically distinct brains; professors can sleep with grad students, as long as they're discreet about it; students entering grad school have no idea what they're in for, and how small their chances are of getting a coveted academic position; there's no good time for an aspiring woman scientist to have a baby; scientists can be selfish and petty; and they can curse with as much abandon as a drunken football fan. Many colleagues will find nothing to quarrel about in these accounts. But how many others will be interested in the anthropology of the cultish molecular-biology tribe is not clear.

Stebbins' ruminations run far beyond work practices, dancing across nearly every major intersection of biological science with society. Some of his observations are right on the mark, such as an in-depth look at the corrupt politics and fraudulent marketing of 'dietary supplements'. Sometimes, however, particularly when he glibly dismisses objections voiced by the 'religious right', Stebbins is guilty, in reverse, of the sin he pins on his 'ignorant' opponents. He writes, for example: "there is nothing in the theory of evolution that really threatens the Christian faith"; opposition to contraception is based on "ridiculous hypocrisy and religion-based stupidity"; and "none of the arguments" made against embryonic stem-cell research "made much sense". Comments such as these fail to provide much insight into these raging controversies.

Scientists should be more suspicious when Stebbins readily accepts the simplistic conventional wisdom spouted by people on the political left about complex environmental issues. He demonizes DDT, for example, as an agent of human birth defects, without providing any quantitative information and without mentioning the role it played in eradicating malaria from US and European shores. Indeed, DDT could save the lives of millions of African children, if used wisely, without any significant negative impact on the environment or health.

Stebbins also reflects the naivety I expressed as a graduate student regarding the larger purpose of government funding of university research. And like many academic scientists, he hasn't delved into economics sufficiently to understand that market forces and intellectual-property rights provide the greatest incentive for the rapid exploitation of basic science, with respect to the development of pharmaceuticals and other biotech products.

Nevertheless, if you want a taste of the off-the-cuff, vulgarity-tinged musings you're likely to hear after hours in a pub from a bunch of sometimes-uninformed molecular biologists, then, by all means, read this book. ■

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Science and society: students have often engaged with political issues by mounting protests to wars.