

The frugal way

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The promise of cost-conscious science

Western science, particularly academic science, is culturally obsessed with superlatives, and often separated from technology: the most accurate measure of time, the most detailed accounting of a genome, the most distant star, the highest-energy particle. Why? Superlatives are necessary in some areas, and easy to keep score with in others. And there are technologies (such as GPS) that absolutely require extreme precision.

But superlatives tend to be expensive. Should cost be an issue in science? If knowledge is a treasure beyond price, perhaps obtaining it should be similarly cost-unconstrained—an idea enthusiastically supported by expensive fields such as high-energy physics. And even the most expensive science is cheap relative to, say, a war or a tsunami. Yet science in 2012 and beyond will be evolving a new variant of itself: frugal science, designed to generate knowledge (and technology based on that knowledge) with cost as an integral part of the subject.

The idea of including “cost” in science is perhaps *déclassé* in Western research universities, but it is based on an important change in the world. The 80% of the global population that is poor (and has long been excluded from science, technology and the benefits of both) would like to join the party. China, India and Brazil have already muscled their way into technology, and other less-developed countries will follow.

Behind the argument between “superlative” and “cost-effective” lie differences of opinion about the purpose of science. Is it the job of science to generate knowledge as an abstract good, with the benefits to the society that pays for it unpredictable, or should science at least think of serving society?

In the West, the answer is often two words: “quantum mechanics”. Its development revolutionised both science and technology, and was indeed a product of pure curiosity. But there have been only one or two such events in fundamental science in the past century (genomics may eventually be as important); and the birth of quantum mechanics was not expensive, although its applications in technology were.

In the rich world, maintaining a distinction between curiosity-driven science and applications-driven technology may or may not be an affordable luxury. In the developing world, there are pressing problems whose solutions require relevant science and technology now.

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2012 IN BRIEF

Computer geeks and universities salute and mourn Alan Turing, born a century ago

Health care is one example. Western medicine does many things well, but it is not affordable in, or very useful to, most poor populations. What then should be the technology base for affordable health care? Answering that question requires the development of science that is conscious of cost from the beginning—a frugal health care that might, perhaps, be more related to Western public health than to end-of-life, high-tech medicine. What about other problems: the management of megacities, development of radically effective ways of delivering education, or providing water and energy? All of these problems can be phrased as technologies, which will require an appropriate foundation in science—and that must include cost. The race may not be to the swift, but rather to the cheap.

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There is another reason to be encouraging frugal science: jobs. Frugal science has a chance of yielding cheap products, and thus jobs and other understandable benefits. The developing world is pioneering telecoms systems with structures quite different from those used in the rich world. The Shenzhen gene factories, using American technology, are among the lowest-cost producers of genomic information. The Tata Nano car represents a creative step towards low-cost personal transport. And the science that leads to affordable health care for Africa may provide some of the best approaches to reducing the no-longer-affordable cost of health care in America.

Foundations (Gates, Wellcome and others) are already developing frugal medicine, and much of the health-care spending in developing countries is on technology that is, of necessity, frugal. The science base for this—low-cost diagnostics, epidemiology and nutrition informed by mobile-phone reporting—is developing rapidly. Tata, GM, Toyota and their kin are all thinking about radically different concepts for the car: smaller, lighter, cheaper. To sell in world markets, affordability may in future be the first requirement, not an afterthought.

“But is it science?” ask the sceptics. Perhaps “No”, under the old definitions of chemistry, physics and biology. But “Yes”, as a new discipline, with an intellectual skeleton based on understanding complexity and simplicity, and on developing strategies for integrating information, including economic information, originating in entirely different fields. It will probably get a reluctant welcome at first in the mandarin research universities of America and Europe, but it may flourish in Beijing, Mumbai and Cairo. And where it flourishes best may determine whose grandchildren have jobs. ■

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