A. PROUST/CEPHAS

against ischaemic stroke and age-related retinal degeneration. Heavy drinking and binge drinking reverses these beneficial effects, although an Italian study of heavy drinkers of wine does not support these findings. There is convincing evidence that wine has better antibacterial effects on gut bacteria and wound infection than ethanol at the same concentration. However, the stilbene derivatives, which have myriad helpful inhibitory effects *in vitro*, are conjugated as glucuronides or sulphates by the human intestinal mucosal cells and are rapidly excreted in urine, so they do not reach effective concentrations in whole animals; perhaps most of these *in vitro* studies can be consigned to "the dust heap of science".

In places one can discern a logical progression of these two themes in succeeding chapters, but in general they are scattered throughout the book with few internal cross references. The editors say (modestly!) that the "authoritative views presented" ought to be "required reading for medical practitioners… as well as for botanists, oenologists and viticulturists, historians of science and simple wine buffs." The contributions are indeed serious reviews of the current literature in the areas they survey, but specialist researchers in both cardiovascular medicine and viticulture will probably already have access to most of the findings elsewhere.

So will the book interest a more general reader? Probably not, given its length and price. But, given some serious professional editing, this compendium could have presented these two themes in a less rigorous but more digestible form and become a popular addition to the bookshelves of many "simple wine buffs" who have a scientific education. ■

John Mowbray is in the Department of Biochemistry and Molecular Biology, University College London, Gower Street, London WC1E 6BT, UK.

London calling

A Thread Across the Ocean
by John Steele Gordon
Walker & Company/Simon & Schuster, 2002. 240 pp. $26, £17.99

Paul M. Grant

It is quite likely that this decade will see the fulfilment of the wired and wireless global village over much of the world, each inhabitant wielding a palm-sized personal organizer with the combined power of a laptop and a mobile phone. The spectacle of teenagers everywhere in constant communication, and our fridge texting us when it finds we've put the beef in the veggie bin, may be part of everyday life.

Such a world was virtually unthinkable barely a century and a half ago — except to a few men of great vision and energy. By the mid-nineteenth century, both America and Europe were rapidly expanding their internal communications by telegraph. But signals between the New and Old Worlds were still transmitted by ship at the speed of men, wind and steam, and an exchange of messages took at least six weeks.

In 1856, Cyrus Field, a New York merchant, began to assemble a collection of financiers, university physicists and practical engineers from America and Great Britain. Over the next ten years they would lay the first transatlantic telegraph cable between North America and the British Isles, an enterprise that ushered in the era of intercontinental communication that we take for granted today.

The chronicle of the failures, frustrations and eventual success experienced by these visionaries is brilliantly recounted by John Steele Gordon in *A Thread Across The Ocean*. A recognized historian of American business and commerce, he not only relates the engineering challenges that had to be surmounted, but delves deeply into the personalities of those involved, the geopolitical barriers placed in their way, and the desperate search for funds that followed failure after failure. This book is an extraordinary treasure for physicists and engineers, and scientists generally, who value the impact of their discipline on human affairs and respect the enormous effort demanded from them in return.

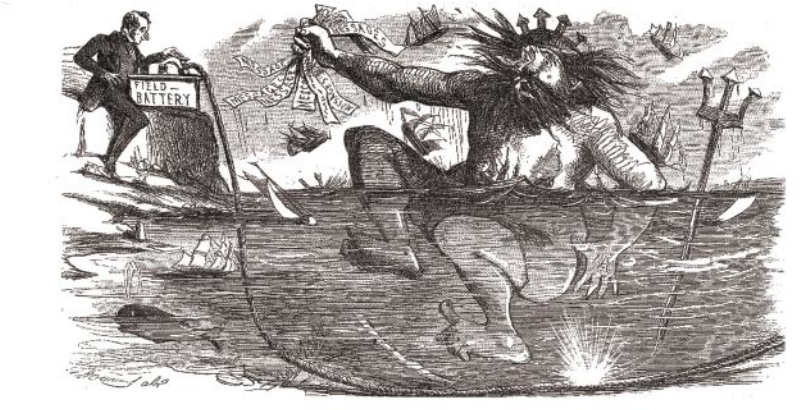
Relations between the United States and Britain were by no means cordial in the 1850s. In the American government of the time, many remembered vividly the disastrous outcome of the war of 1812. Moreover, American claims to parts of western Canada had been thwarted by the British as recently as 1848, under threat of military reprisal.

Despite this, common ties of language, democratic culture and economic interest were enough to circumvent diplomatic and political difficulties and the first project was enthusiastically underwritten by financiers and governments on both sides of the Atlantic. Indeed, the first four attempts all involved both the US Navy and the Royal Navy.

Gordon's book is replete with maps, ocean elevations and technical drawings, and he takes us through some of the solutions to the myriad technical problems encountered, such as the brilliant application of the ballistic galvanometer by the young physicist William Thomson (better known later as Lord Kelvin) to the detection of the weak pulses of current travelling along the cable. Thomson's contributions throughout the project are an excellent illustration that "real physicists engage real problems" as well as the "purer" academic pursuits favoured by many of the present generation.

Perhaps the most important lesson to be learned from this venture is perseverance in the face of recurring failure. Imagine the embarrassment and difficulties faced by its backers when the first successful operation (on the third try) failed after barely three weeks of communication, a period that witnessed celebrations in London and New York, and the exchange of greetings between Queen Victoria and President Buchanan. But Field's raw charisma and the expectation of massive monetary returns from a properly functioning transatlantic cable ensured further attempts.

From the outset it was recognized that the



In a cartoon from 1858, Neptune is shocked by the telegraph cable laid under the Atlantic Ocean.

coordination of American and European equity markets alone would generate sufficient traffic and tariffs to quickly write off its capital investment. Moreover, its critical importance as an instrument of international policy was made apparent during this brief initial period of operation — the British government had been able to send a message to Canada that the Indian Mutiny had been put down and so the dispatch of British troops from Canada to India was no longer necessary, resulting in a significant saving in transport costs. The combination of visionary energy, national interest, an emerging technology and expectation of eventual and substantial returns to investors was then, and remains today, the greatest driving force for innovation.

And then there was luck, in this case the timely availability of the gargantuan steamer *Great Eastern*, designed and built by the British engineer Isambard Kingdom Brunel. The *Great Eastern* was designed to be so large — five times the size of any existing vessel — that it could carry enough coal to circumnavigate the globe without stopping. By the time her keel was laid in 1857, it had already become apparent that the principal problem confronting attempts to lay the cable was its immense length and weight, and the stress that would be placed on vessels carrying it on the tempestuous North Atlantic. This prediction became stark reality, as the first three tries failed. After a chance meeting with Field, Brunel brought him to view the *Great Eastern* under construction, proclaiming, "Here is the ship to lay your cable, Mr Field."

The *Great Eastern* never fulfilled its original intention to transform transoceanic shipping, and hence was available to Field's company nine years later, in 1866, for the fifth, and successful, effort to lay the cable. By this time, the cable used was three times the weight of the initial 1857 line. Without the *Great Eastern*, there would have been no transatlantic cable for many more years.

One could consume Gordon's riveting tale in one go during a transatlantic flight between the United States and Britain, over the path of Field's great endeavour some 13,000 metres below. But I suggest that readers take time to put the text aside now and again to contemplate the enormous consequences of this initial bonding of two nations in the nineteenth century — a bond that would strengthen over time and, as Bismarck foresaw, eventually determine the geopolitical destiny of the twentieth century. ■

Paul M. Grant is an IBM research staff member emeritus, and is at the Electrical Power Research Institute, PO Box 10412, 3412 Hillview Avenue, Palo Alto, California 94303, USA.

Science in culture

Naturally natural

Albrecht Dürer's studies of animals have a life of their own.

Martin Kemp

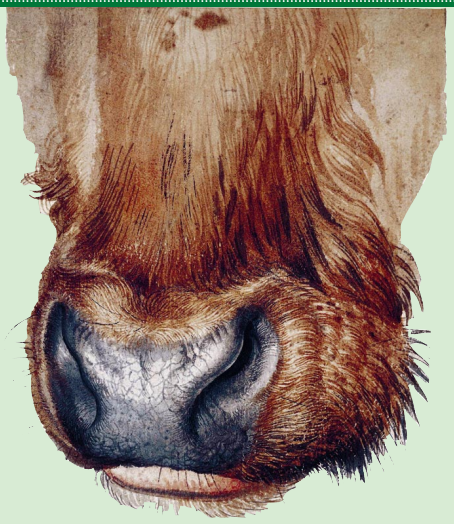
No artist ever exercised a bigger impact on science than the German painter, print-maker, designer and author Albrecht Dürer. Indeed, it is fair to say that he had more effect on the course of the visually based sciences than any 'scientist' of his own day.

His writings on human proportion and geometry remained points of reference for centuries, above all his German treatise on "Instructions on Measurement with Compass and Ruler", which, in its Latin translation as *Geometria* in 1527, was widely influential on three-dimensional geometry and those sciences of nature that sought geometrical foundations.

Less obvious but no less significant was the legacy he left in the natural sciences, in which he may be regarded as the true father of naturalistic illustration. His paternity is both direct, through his training of artists who were to illustrate key Renaissance texts, and general, through the example he set in his virtuoso renderings of nature in woodcuts, engravings and watercolours. Hans Baldung Grien, whose woodcuts of a brain dissection in 1541 set standards across Europe, had worked in Dürer's workshop, and Hans Weiditz, illustrator of Otto Brunfel's innovative *Herborum vivae icones* (1530), may be regarded as a direct follower of the Nuremberg master.

What Dürer pioneered was a graphic technique of such startling naturalism that he appeared to be able to create a 'portrait' of anything, whether it was a person, a hare or a mixed patch of grasses and flowers. Even a demon in Dürer's hands looked as if it were portrayed 'from life'.

Two astonishing studies of the *Muzzle of a Bull*, in the magnificent exhibition now on at the British Museum, show his skill at its highest level. Undertaken in the early years of the sixteenth century, they may have been triggered by the phlegmatic beast in the background of his 1504 engraving of Adam and Eve, but they far transcend any preparatory function. Using a mixture of opaque body colour, inks and watercolour washes, applied with brushes of incredible fineness, he not only captures tiny morphological details — such as the shiny but cracked skin on the beast's snout — but also infuses the specimen with an uncanny sense of life. Few artists have been able to endow naturalistic renderings with such a sense of quivering vitality.



BRITISH MUSEUM

The sixteenth-century painting *Muzzle of a Bull* by Albrecht Dürer has an uncannily lifelike quality.

The potential for the illustration of those sciences that were newly trumpeting their empirical foundations became clear to pioneers of the great Renaissance picture books. Two signal works on plants and animals, Leonhard Fuchs' *De Historia stirpium* (1542) and Konrad Gesner's *Historiae animalium* (1551–87), depend on the techniques pioneered by Dürer to convince the spectator that we are in effect looking at the 'real thing', courtesy of the eye of the artist. So effective became the image that it stood in for direct experience of the specimen, which no longer need be consulted. This of course had its dangers, as Andreas Vesalius recognized. These are exemplified by Gesner's rhinoceros, almost inevitably based on Dürer's famed image — Dürer himself had never seen a living rhino — which came to be perceived over the centuries to be more like a rhino than the real thing.

Another question raised by Dürer's technique centres on the much debated issue of whether the illustrator should show one particular specimen, warts and all, or a synthesis of many specimens in such a way as to represent the archetypal form. The heightened involvement that arises when we sense that we are looking at the individual subject remained a compelling device for empirically minded scientists well into the nineteenth century. After this the role of the renderer of nature was gradually, if not wholly, usurped by photography.

Not the least of the virtues of portraying things with the intensity demanded by Dürer is that it disciplines our looking. We 'learn how to see' through the act of drawing, as art critics such as John Ruskin maintained. This is one of the reasons why scientific drawing is not obsolete, even in this technological age. ■

Martin Kemp is in the Department of the History of Art, University of Oxford, Oxford OX1 2BE, UK.

The exhibition 'Albrecht Dürer and his Legacy: the Graphic Work of a Renaissance Artist' is at the British Museum in London until 23 March 2003.