If there are some faults with the book they don't detract from the main message — that fossils are not ancestors and we know very little about our evolutionary history. The author implies that cladistics is the best method for solving many of the problems of phylogeny. While I agree that cladistics is powerful, other approaches are also useful. It was not just through cladistics that scientists came to believe that hippos are more closely related to whales; other approaches, such as distance methods, yielded the same conclusions. Cladistics should not become the new 'authority'.

As *In Search of Deep Time* is written by a senior editor at *Nature*, the author has been in a position to have seen many of the original manuscripts — and reviews of them — that describe recent advances in our understanding of the evolution of life on Earth. Gee's comprehensive knowledge is clearly evident in his book. He has also added his personal experiences, and imaginings, in East Africa and in the galleries and back rooms of the Natural History Museum.

This book is intended for the informed reader, and as such is to be recommended. As an evolutionary biologist I did not need to be told that many assumptions held by most people are false, yet I think I needed to be reminded that my imagination is limited. We don't know what our ancestors really looked like. ■

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Textiles, bridges, plastics and chips

Technology in America: A Brief History
Alan I. Marcus and Howard P. Segal
Harcourt College: 1999. 400 pp.
$43, £14.95 (pbk)

Gunhard Æ. Oravas

It is a formidable undertaking to write a history of technology that takes full account of cultural, economic, social, political and scientific influences, especially if the history is to be concise as well as precise. This superbly composed history of technology is a result of many decades of scholarly effort. Although the book is loaded with information and explanation, the authors make the technological topics under discussion interesting to the general reader by frequently referring to well-known historical figures.

Their history begins with the colonial period in 1607, when most of the industry consisted of textile manufacture, leather-making, iron production and shipbuilding. In the early nineteenth century, the building of bridges, canals, steamboats and railways and the use of machinery in the textile industry became prominent. The latter part of the nineteenth century saw a mass-production steel industry, the telegraph, telephone, electricity, the organization of factories and engineering and the systematization of technical education.

In the twentieth century, the founding of industrial research laboratories, the development of plastics such as Bakelite and Nylon, the establishment of new delivery technologies such as lorries and public transport after Goodyear tyres were marketed in 1916, and the emergence of commercial aviation as a serious competitor in delivery and travel are delineated with precision.

Of the many entries of interest to computer enthusiasts and general readers, Alan Marcus and Howard Segal's discussion of the development of the programmable microchip, and of integrated-circuit technology and software will be of special note.

The authors have also not overlooked such very recent developments as biotechnology, genetic engineering, cloning, ultrasound, magnetic resonance imaging and computer axial tomography. This history of American technology is a work of great merit which is written very skilfully in an intelligible form that is also easily accessible to the educated general reader. ■

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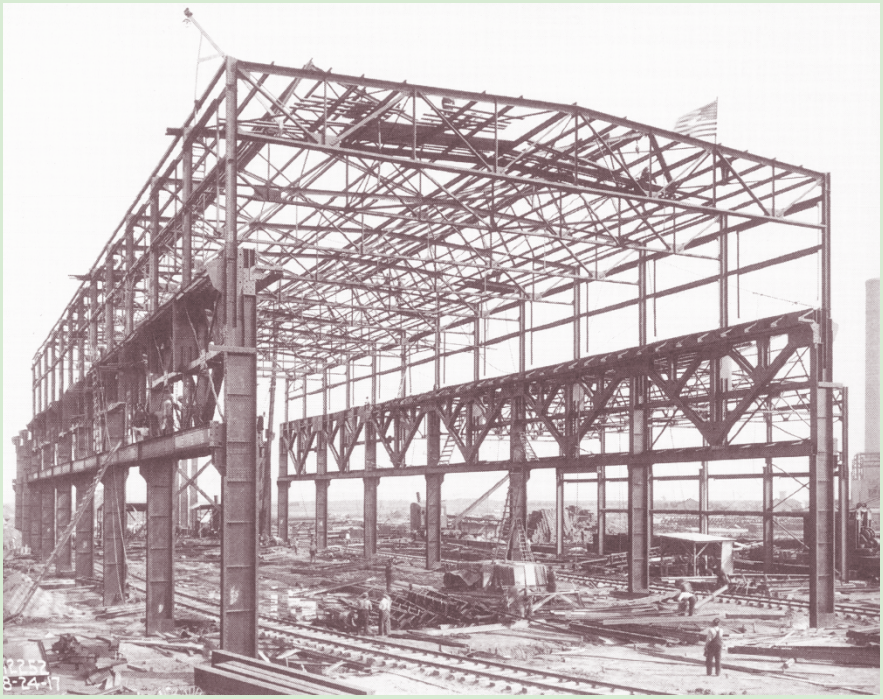

Building industrial art

Developments in factory buildings and works during the nineteenth and early-twentieth centuries reflect a subtle relationship between function and aesthetics. This aspect of the industrialization of the United States is traced in Betsy Hunter Bradley's *The Works: The Industrial Architecture of the United States* (Oxford University Press, £37.50, $45). Above is a 1919 construction photograph of the foundry building of the Westinghouse Electric Company.

Cocktail-party gossip aplenty

Primate Sexuality: Comparative Studies of the Prosimians, Monkeys, Apes, and Human Beings
by Alan Dixson
Oxford University Press: 1998. 656 pp.
£32.50, $60 (pbk)

Jeanne Altmann

During several decades of fieldwork on natural primate populations, I, like many others, have learned that children in tow are a valuable entrée in most parts of the world. Almost as good as an entrée, however, and of considerably more interest at a cocktail party, is the opportunity for people to satisfy their considerable curiosity about the sex lives of our closest relatives. In *Primate Sexuality*, much about primate sex is revealed. Perhaps more is revealed than all but the most devoted even realized they might want to know

about primate sexuality, but not more than many will find of interest. That the book has a foreword by the director of the Kinsey Institute is hardly surprising.

Alan Dixson has drawn together an impressive body of literature in this landmark volume. The book takes a comparative perspective, seeking a seamless review from prosimians through humans, and viewing this taxonomic diversity from a Darwinian and phylogenetic perspective. Moreover, although Dixson indicates that the book's focus was intended to be behavioural, it also devotes much attention to the morphological and hormonal aspects of the behaviour considered. As a result, Dixson's treatment is unusually inclusive across levels of analysis and activity. His reach is impressive, and he has sought to distil and review more than 2,000 sources from a diverse literature.

The book succeeds admirably, although its success is more modest and uneven than its reach. This is perhaps inevitable, given the fact that it is a first edition and has such ambitious goals. Coverage and quality of analysis too often reflect not just the state of the field but also the author's direct or close exposure — geographically, taxonomically and topically. For many topics, Dixson points out disagreements and competing theories and conclusions in the literature, invaluable for those who otherwise would not even know a debate exists. When he takes a stand on a particular point, however, the basis for that stand is too often not obvious or compelling. This is especially unfortunate in situations where many in the field would disagree with Dixson's reading of the weight of the theory or data.

The book is enriched with many comparative tables, most taken directly or almost directly from other publications. There are also a large number of illustrations and data figures from the literature, often redrawn by the author, which tellingly bring to life particular points and examples in the text. Some tables and figures are less successful and valuable than others, sometimes frustrating the author's comparative goals. Future editions, and surely the book will warrant these, will benefit greatly if comparative tables taken from the literature are edited to remove redundancies and resolve contradictions, and if new tables are produced to show the current state of knowledge.

Primate Sexuality is an essential starting point in this field, and a must for every primatologist's library. Its shortcomings should only provide an impetus for the next edition, which will be necessary if for no other reason than the current rapid developments in the field. ■

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Science in culture

NATIONAL GALLERY

Constable's paradoxical rainbow

Why the artist John Constable allowed himself poetic licence when painting rainbows.

John E. Thornes

John Constable's powers of observation and thirst for meteorological knowledge enabled him to paint more realistic skies than any other English artist (see *John Constable's Skies*, University of Birmingham Press, 1999). Constable believed that "painting is a science, and should be pursued as an enquiry into the laws of nature. Why then may not landscape painting be considered as a branch of natural philosophy, of which pictures are but the experiments?" This Baconian view was certainly applied to the clouds and weather in his paintings, but, as we shall see, not to all of his rainbows.

Constable's paintings of rainbows are almost as well known as his paintings of clouds, but whereas clouds are present in some form almost every day in England, rainbows are seen much less frequently and are therefore more mysterious. Constable painted rainbows that were meteorologically accurate, but also used them for artistic effect in situations in which they could never occur in nature, such as in *Salisbury Cathedral from the Meadows* (1831) (see above). Although Constable knew that a rainbow cannot be seen once the Sun is higher in the sky than 42 degrees and that the Sun must be directly behind the observer of a rainbow, it plainly is not so in this view of the cathedral. This enigma is difficult to explain. Why should Constable be such a perfectionist about the weather in his paintings, his dutiful wind and clouds and harmonic daylight, and yet be content to introduce a meteorologically impossible rainbow?

Constable wrote to his friend John Fisher in 1821: "The sky is the source of light in nature — and governs everything ... Their difficulty [clouds] in painting both as to composition and Execution is very great, because with all their brilliancy and consequence they ought not to come forward or be hardly thought about in a picture — any more than extreme distances are — But these remarks do not apply to phenomenon — or what the painters call accidental Effect of Sky because they always attract particularly."

Constable's *Salisbury Cathedral from the Meadows* (1831).

Thus the rainbow, and other optical effects such as crepuscular rays, were given a special exemption by Constable, and although a rainbow cannot 'come forward' in a picture, Constable makes it clear that if he introduces such an effect he wants it to be attractive and 'thought about'.

If one looks at the shadow of the fence-post in the bottom left-hand corner of the picture, the geography and the illumination of the cathedral suggest that the Sun has reached an angle just north of west, which, in mid-August, would be between 6 and 7 p.m. At that time, the height of the Sun in the sky is about 15 degrees, which means the rainbow should have a height of about 27 degrees, significantly smaller than observed. The rainbow is not the bow the artist would see but one that would be seen from the meadow on the right. It is not in the plane of the picture but comes out of the picture at a shallow angle. The lighting suggests that the Sun is to the right of the picture and not, as it should be, behind the observer. It would appear that Constable was quite happy to use an amount of poetic licence for his "accidental Effect of Sky".

Contrast Constable's *London from Hampstead Heath with a Double Rainbow* — painted a few months after *Salisbury Cathedral from the Meadows* was exhibited at the Royal Academy — which showed that he was fully aware of the colour reversal and the size of the secondary bow. ■

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