points are perceptually convincing. This makes the book less compelling than it would otherwise have been. I do not see the poppies in the Monet painting reproduced on page 152 as moving or changing position, nor can I detect an illusory motion in the ice floes on page 161. There are several such examples in the book of a conflict between what the text says and what the visual brain experiences.

The coverage itself also sometimes causes problems. It is not easy, for example, to accept the proposition that one's gaze is drawn to the face or eyes in a painting because these are painted in greater detail than the surroundings. There are many counter-examples, unfortunately not given here, where the face is very sketchily drawn but still constitutes the immediate focus of attention. The reason for this is simple. The face carries more information and, correspondingly, the brain has devoted a specialized area to the processing and perception of faces.

There are, happily, many other illustrations that are perceptually much more convincing. Prominent among these are the many visual illusions, some well known and others less so, that are scattered throughout the book. Collectively, these should give the visual scientist a great deal of interesting material to think about. Above all, I hope that through works such as these, visual scientists will come to realize what a rich resource they are provided with by artists who exploit the potential of the visual brain in their creations. Such material is well worth studying scientifically. ■

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A rounded view of Faraday

Faraday: The Life

by James Hamilton

HarperCollins: 2002. 448 pp. £25

Jacqueline Reynolds & Charles Tanford

In the introduction to his monumental work on the life of Isaac Newton, *Never at Rest* (Cambridge University Press, 1981), Richard Westfall asserted his desire to avoid a detailed factual essay on newtonian science. He chose instead to make Newton himself, the scientist and the man, the central character in the drama of his unfolding life. Treading this fine line between yet another account of well-known scientific discoveries and providing a portrait of the individual who made such discoveries is a difficult path, which Westfall negotiated with great skill.

Hamilton's life of Michael Faraday is of

this genre. It is a portrayal of Faraday from his early days as an enthusiastic, observant young man through to his declining years — a man living actively through the intellectual and industrial explosion of the Victorian age. His friends and associates included not only other scientists, but many of the artists and literati of the day. All the influences of the time and the intellectual developments in Britain and mainland Europe were part and parcel of Faraday's life. The 'drama', as Westfall would have it, unfolds through the medium of his correspondence, laboratory notebooks and writings that were intended only for his own use (which today we might categorize as diaries, although they were far more extensive than that commonplace word suggests).

The strength of this book lies in the carefully constructed characters surrounding Faraday: the not always admirable Humphry Davy and his appalling wife; the young men who were part of Faraday's youthful ventures into science; his supportive but non-intellectual wife; unusual women such as Mary Somerville and Ada Lovelace, with whom Faraday had intellectual and emotional encounters. Faraday himself becomes a more real and sympathetic individual in this book than in some other accounts that concentrate primarily on his science or his unusual religious background as a member of the fundamentalist Sandemanian sect.

Hamilton reiterates and provides support for Faraday's formal devotion to the strict rules of this sect, as described by other writers (notably Geoffrey Cantor), but here Faraday's day-by-day activities reveal another side of him. As a young man on his European tour with Davy, he is described as a "bon viveur, enjoying good food and wine"; 35 years later he still enjoyed regular visits to the theatre.

Less satisfying is the presentation of

Bon viveur: Michael Faraday had strict religious beliefs, but also enjoyed good food and wine.

Faraday's prodigious achievements in the areas of analytical chemistry, electricity and magnetism, optics and organic chemistry. To have matched the more detailed and insightful essays on this subject that exist elsewhere in the Faraday literature would have required a much longer book and perhaps greater familiarity with these specific scientific areas. Hamilton's descriptions of experiments and their outcomes are marvelously pictorial and often humorous, relying heavily on Faraday's own notebooks — the reader might almost have been there through the course of numerous explosions and emanations of noxious fumes. But Hamilton, whose earlier work includes a biography of the landscape painter J. M. W. Turner, is less sure-footed when placing Faraday's achievements in a historical perspective.

That said, there are plenty of 'scientific essays', but it is hard to find a sympathetic and intriguing account of the life of a great scientist. If people and their peculiarities interest you less than the science, this is probably not the book for you. But if you enjoy having the great and the good from the distant past brought back to life (warts and all), then this is recommended reading. ■

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The temperature of everything

A Matter of Degrees: What Temperature Reveals About the Past and Future of Our Species, Planet, and Universe

by Gino Segre

Viking: 2002. 320 pp. \$24.95

Vaclav Smil

Book publishing, like designer clothes and the most-cited scientific articles, follows fashion. Generic-topic books are now definitely in. The recipe is simple: pick an object or an idea and examine it from just about any conceivable angle. The result is a crop of books that includes volumes on dust and on longitude, on fire and on childhood, on salt and on excrement (yes, the title of the translation from the French original is a four-letter word). And, although not quite identical, the pitch of these books is clearly similar — they aspire to be science 'lite', accessible to the masses and hence fashionably promoted. *A Matter of Degrees* is one of the latest additions to this popular genre; the thread, in the author's words, is temperature.

As an incorrigible interdisciplinarian I am generally positively predisposed towards these amoebic topics. So why am I not

robustly enthusiastic about this book? Certainly not because of its quality — the author, a theoretical physicist and well-known contributor to high-energy research, skates on the solid ice of his own discipline, and has diligently studied the biological literature, which is essential to understanding the book's first and fourth chapters, and used it accurately. And also not because the book is a chore to read, for it is well written, interesting and informative. And, needless to say, the book's big topic is about as fundamental, and hence as important, as it gets in studies of both the living and the inanimate Universe.

This may actually be the book's main problem. Books about longitude or dust have a huge area of reality to explore, and the topics lend themselves to pursuing some fascinating connections and consequences. Yet, as wide-ranging as they are, their scope is inherently limited. Enzymatic catalysis is unaffected by longitude, and Saharan dust is irrelevant to the radioactive decay in the Earth's crust. But what does not fall under the influence of temperature? What object or process can be seen and studied as devoid of it or unaffected by its change? So a book about temperature really aspires to be a book about everything.

This is clearly impossible, but Segrè

cannot be faulted for not trying. He crams in a great deal yet, inevitably, even some fundamental realities get no mention at all: temperature's distribution on the Earth and its effect on the evolution of life and on the fate of ecosystems are among the most obvious omissions. (An important aside: Segrè uses almost exclusively annoying, antiquated units; of course, as this is a US book intended for a wide readership, the publisher may have insisted on Fahrenheit and feet, but I feel that the author should have resisted.)

And so the book opens with: "Ninety-eight point six. It is extraordinary how alike we are," and goes on to discuss thermoregulation in organisms and its problems. We are then offered chapters dealing with the history of temperature measurement, the origins of thermodynamics, temperature and the Earth (including the greenhouse effect) and life in extreme environments. Finally, there are brief excursions into astrophysics and studies of low-temperature and other superconductivity. Along the way the text encompasses mammalian scrotal sacs, the precession of the Earth's rotation axis, hydrothermal vents at the bottom of the Pacific Ocean, magnetic fields of rapidly rotating neutron stars, foraminifera (badly misspelled in the original)

and superconducting using YBCO (yttrium barium copper oxide).

People who make a fleeting appearance include, predictably, many icons of twentieth-century physics, including the author's famous uncle Emilio; Subrahmanyan Chandrasekhar, puzzling out the death of stars; Leo Szilard, designing a better refrigerator with Einstein; and Arno Penzias and Robert Wilson, measuring background radiation. Additions to this *mélange* of topics and people can be made *ad libitum*, as there is nothing that qualifies for exclusion.

This book is being promoted in the United States by national print and radio interviews to show how such an everyday concept as temperature "underlies our understanding of how the Universe works". As I have no illusions about the scientific literacy of the US public, I doubt that they will appreciate some of the finer points from the book. Only those with a fairly solid grounding in several key scientific disciplines will appreciate this book for its brisk and wide-ranging treatment of many fundamental temperature-related concepts. Those less well equipped will see too many trees in such an infinite forest.

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Science in culture

Life in a drop of water

A display of sculptures by Sarah Parker-Eaton and Louise Hibbert was inspired by plankton.

Liz Hoggard

For the past 18 months, jeweller Sarah Parker-Eaton and woodworker Louise Hibbert have been working together on a series of hand-sized sculptures and boxes inspired by the microscopic world of plankton. The works are mostly fashioned from sycamore, with decorative details in silver, resin and acrylic ink.

The two artists have been collaborating with biological oceanographer David Thomas of the University of Wales, Bangor, who shares their enthusiasm for plankton. All three acknowledge their debt to the nineteenth-century German zoologist Ernst Haeckel — in particular for the outstanding images in his book *Kunstformen der Natur*. Haeckel was both an accomplished artist and scientist, whose somewhat stylized representations of

planktonic organisms informed part of the Art Nouveau movement. René Binet's design for the elaborate main entrance of the

1900 World Exposition in Paris, for example, made direct reference to Haeckel's drawings of radiolarians.

Thomas provided the two artists with the opportunity to explore under the microscope the shapes, forms and sublime movements of different types of living plankton, including diatoms and dinoflagellates, as well as radiolarians. Parker-Eaton says that this opened up for her "a miraculous underwater world. We never realized that a drop of water could contain such a variety of life."

Planktonic organisms have myriad forms. They can be multicoloured spheres or cubes, with sturdy spines or fine, elongated needles that deter predators. Some form delicate spiralling chains, whereas others, such as dinoflagellates, have whip-like flagella to help them move in the water. The artists try to reflect this richness in their work. In one sculpture, for example, they represent armour-plated dinoflagellates as tactile spheres made from ancient bog oak covered in heavy silver plates.

The vivid colour that Hibbert and Parker-Eaton use in their work highlights the extraordinary ability to refract light of planktonic organisms such as diatoms and radiolarians, whose cell walls are constructed from silicate. "The walls are basically glass," says Thomas. "And they are etched with intricate patterns, which under the microscope refract light, like crystal,

into a kaleidoscope of colour." Thomas believes that a scientist who fails to see the aesthetics in his or her science, or the artist who fails to perceive (often without realizing it) the mathematical form in their subject, "will always fall short in their respective interpretations of nature's design".

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Plankton can be seen at the Crafts Council Shop at the V&A Museum in London until 15 September, and will be at Chelsea Crafts Fair at Chelsea Old Town Hall in London on 15–20 October.