

acted as searchlights. As a confirmation of this theory, he appealed to the overwhelming evidence that cats can see at night!

For what, indeed, is this thing we call light? It brings life to the world around us, and it is the means by which most of us see and act. At the end of the twentieth century, physicists call light a quantized electromagnetic field. But what is that? We understand the mathematical theory very well, but how to translate its rarefied jargon into the rich and specific language of the everyday world of common sense? A quantized field has a mathematical description in terms of waves or in terms of particles. It is a matter of convenience, for the two descriptions are in every way equivalent. If we want to talk about it with someone not interested in calculation, what should we say? In plain words, what is actually light? This is the story of how scientists have tried to answer this question. It is a fascinating account, brilliantly told, full of digressions that are useful because they help us to enter the intellectual and social climate where ideas about light were born. It is also a story with a moral: we come from darkness and end in darkness, but we must never stop saying, "Lead on, kindly light". □

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**Also on history**

*Einstein: A Life* by Denis Brian. A well-researched biography first published in hardback last year. Wiley, \$19.95, £11.99 (pbk).

*Galileo on the World Systems* edited by Maurice A. Finocchiaro. A new abridged translation and guide. University of California Press, \$19.95 (pbk).

*Equivalence and Priority: Newton Versus Leibniz* by Domenico Bertoloni Meli. Includes Leibniz's unpublished manuscripts on Newton's *Principia*. OUP, £25 (pbk). Reviewed by W. R. Shea in *Nature* 364, 681 (1993).

*Victorian Science in Context* edited by Bernard Lightman. Wide-ranging essays, from Maxwellian physics to science fiction to zoological taxonomy, that look at how science influenced and was influenced by the larger Victorian culture. University of Chicago Press, \$70, £55.95 (hbk); \$22.50, £17.95 (pbk).

*Discovering Birds: The Emergence of Ornithology as a Scientific Discipline, 1760–1850* by Paul Lawrence Farber. First published in 1982, the book begins by looking at the influence of Buffon's *Histoire naturelle*. Johns Hopkins University Press, £12.50 (pbk).

*A Chronology of Medicine and Related Science* by Leslie T. Morton and Robert J. Moore. Entries cover historical events; the establishment of institutions, hospitals, societies and journals; the publication of important books and papers; and biographical information for individuals. Scholar/Ashgate, £75

## Truth on the outside

### On the Surface of Things: Images of the Extraordinary in Science

by Felice Frankel and George M. Whitesides  
*Chronicle Books: 1997. Pp. 160. \$35 (hbk), \$22.95 (pbk)*

**Roald Hoffmann**

On reading this book one gets the immediate feeling that one's eyes and mind have truly feasted, that one holds in one's hands an obvious classic at the nexus of art and science. It's the feeling I had when I first read Primo Levi's *The Periodic Table*, or saw Irving Geis's protein structures, or looked at Peter S. Stevens's *Patterns in Nature*.

The meeting point here is of photography and surface science, the latter field itself a commons of chemistry, engineering and physics. Felice Frankel is an internationally recognized photographer, whose previous work has been in photographing landscape architecture (also surfaces, also natural and unnatural). George Whitesides is an outstanding chemist, versatile in the extreme, as savvy to the applied as he is to the pure. This modestly priced book contains about 60 photographs by Frankel, and short accompanying texts by Whitesides.

The photographs are startlingly beautiful. In fact, two readers of *On the Surface of Things* are likely to fall into this dialogue: "Did you see that photo of a ferrofluid, those weird spikes caught between surface tension and magnetism?" "Yes, I did. But

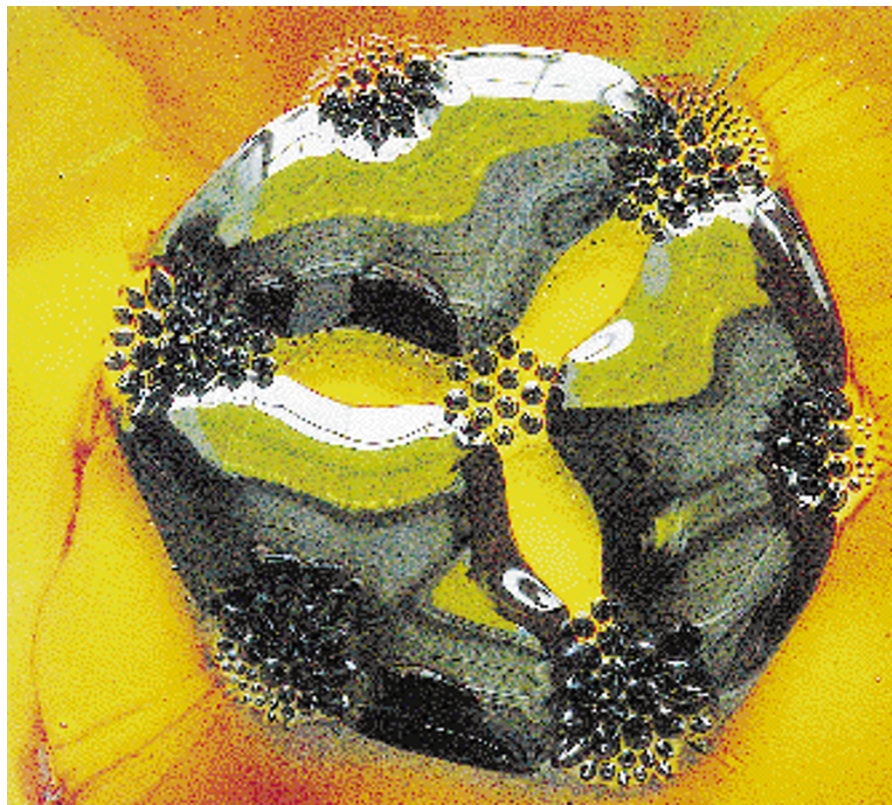
what I liked best were the mauve and red-brown rings in the Belousov-Zhabotinsky reaction!" "Really? Did you see that film chaotically peeling off a silicon crystal?"

At the end of the book are little paragraph notes by Frankel on the photographic techniques she used. These are written in an engaging personal style, and, once one discovers them, one is drawn to reading them in tandem with each image.

Frankel's spectacular photographs are the heart of this book, to be sure. But Whitesides also surprises. First, he succeeds (in too small a font, the only design failure of this book) in explaining complex matters of spectroscopy, electronics and the properties of materials without the impediment (to some) and the crutch (to others) of mathematics. Second, he writes of surfaces evocatively, really crafting prose poems around each image.

Art is no more an accident than science. The serious play of the mind, what Immanuel Kant called "the mutual relations of the imagination and the understanding" (and the hand, and the eye), is central to both human enterprises. It is then no surprise that a different way of representing (therefore seeing) an object of scientific investigation — through the artist's sensibility — should be of scientific value. This, just as much as the sheer beauty of the images, is the importance of what Frankel and Whitesides are doing. □

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Ferrofluid – "a gryphon in the world of materials: part liquid, part magnet"