

# Roald Hoffmann

Roald Hoffmann was born in 1937 in Zloczow, Poland. Having survived the war, he went to the U. S. in 1949, and studied chemistry at Columbia and Harvard Universities (Ph.D. 1962). Since 1965 he is at Cornell University, now as the Frank H. I. Rhodes Professor of Humane Letters. He has received many of the honors of his profession, including the 1981 Nobel Prize in Chemistry (shared with Kenichi Fukui). "Applied theoretical chemistry" is the way Roald Hoffmann likes to characterize the particular blend of computations stimulated by experiment and the construction of generalized models, of frameworks for understanding, that is his contribution to chemistry. The pedagogical perspective is very strong in his work.

Notable at the same time is his reaching out to the general public; he participated, for example, in the production of a television course in introductory chemistry titled "The World of Chemistry," shown widely since 1990. And, as a writer, Hoffmann has carved out a land between science, poetry, and philosophy, through many essays and three books, *Chemistry Imagined* with artist Vivian Torrence, *The Same and Not the Same and Old Wine, New Flasks: Reflections on Science and Jewish Tradition*, with Shira Leibowitz Schmidt (translated into six languages). Hoffmann is also an accomplished poet and playwright. He began writing poetry in the mid-1970s, eventually publishing the first of a number of collections, *The Metamict State*, in 1987, followed three years later by *Gaps and Verges*, then *Memory Effects* (1999), *Soliton* (2002), and most recently, in Spanish, *Catalista*. He has also co-written a play with fellow chemist Carl Dierassi, entitled *Oxygen*, which has been performed worldwide, translated into ten languages. A second play by Roald Hoffmann, *Should've*, had its initial workshop production in Edmonton, Canada in 2006.

Unadvertised, a monthly cabaret Roald runs at the Correlia Street Café in Greenwich Village, "Entertaining Science," has become the hot cheap ticket in NYC.

## Making sense of the image in the nanoworld

With a title like *Blow-up*, one cannot escape thinking of Michelangelo Antonioni's 1966 film, made just a few years after Feynman's prophetic talk on "There's Plenty of Room at the Bottom." The film is an existentialist mystery, in which a fashion photographer, desensitized to life itself, is inadvertently drawn into a murder mystery. In a visually stunning sequence, the photographer enlarges a snapshot of two lovers in a deserted park. And enlarges the photo again. In the grainy magnification (we begin to see the silver halide crystals) he sees a man and a gun. Or does he really see them?

*Blow-up*, the film, to me Antonioni's best, is art. It is artifactual, human-made, and unnatural. The remarkable images in this *Blow-up* book show real things, blown-up for sure. But... "image," "show," and "real" in our context are fuzzy words, even for a dyed-in-the-wool (now there's an image!) realist like me. Let's explore what we see here, and the meanings we attach to what we see.

### IMAGE, SHOW

We are so used to photographic images, on film and now digital, that we process mentally the other-worldly mountain landscape of a gold tip of a near-field scanning optical microscope (page 53), or the "stacked sheet"

picture of a layer of fat molecules (page 83), as photographs, perhaps taken through some microscope.

But they are not photographs. Oh, they do share with (digital) photography the eventual recording of an electronic signal on a detector. But the representations of the gold tip and the fat bilayer are not generated by reflected light impinging on an electronic sensor or a silver salt. In the case of the gold tip image they come from a scanning electron microscope, essentially a beam of electrons passing through, the beam recorded electronically. In the case of the stacked bilayers, the process is still more complicated. This is an atomic force microscope image, where a cantilever scans a surface, the force between tip and surface converted by a piezoelectric crystal into an electrical signal.

Is a "real" photograph any more a faithful image than these outcomes of a sequence of interactions of electromagnetic irradiation and electricity with matter? Any one who has developed and printed an image, or tinkered with it electronically in a computer, knows that the answer is "no". The standard photographic processes allow a human being to modify the image, in a process that could at one extreme be termed "deceptive" and at the other, "creative". There is an underlying reality in the kind of images we are discussing. That reality is transformed by the interaction of a sensor of some sort into an electronic signal (in the classical photographic processes some neat

