

Public Health. He is also the author of *Complications: A Surgeon's Notes on an Imperfect Science*, which was a finalist for the 2002 National Book Award for Nonfiction.

"The learning curve is something you think about from the very first day you put on a white coat," he explains, "and for good reason. It has terrors, important consequences, and vexing moral dilemmas. A perfect subject for an essay, I thought. I was nervous talking on the topic, though. There are only untidy solutions to the dilemmas. And no matter how carefully I explain why the opportunity to practice upon human beings is vital to good medicine, I (and many of my colleagues) feared the essay would just increase the number of people turning up in doctors' offices insisting that only the most experienced take care of them. But in truth, people have already figured out that experience matters. And offering an understanding of where it comes from and how seemed to me the only chance of leading anyone to accept the limits inherent in what we do and also our constant need to learn."

MARCELO GLEISER holds the Appleton Professorship of Natural Philosophy and is professor of physics and astronomy at Dartmouth College, where he leads an active research group in theoretical physics. To date, he has published over sixty-five papers in refereed journals and has participated in many domestic and international conferences as an invited speaker. He is the recipient of the Presidential Faculty Fellows Award (PFF) from the White House and the National Science Foundation and is a Fellow of the American Physical Society. His first book, *The Dancing Universe: From Creation Myths to the Big Bang* (Dutton, 1997), received the 1998 Jabuti Award, the highest literary award in Brazil. He has appeared in several science documentaries, including the PBS/BBC *Stephen Hawking's Universe*. He received the 2001 José Reis Award for the Popularization of Science, offered every two years by the Brazilian Research Council (CNPq). His second book, *The Prophet and the Astronomer: A Scientific Journey to the End of Time* (W. W. Norton, 2002), received the 2002 Jabuti Award. Since September 1997, he has written a widely popular weekly column in *Folha de São Paulo*, one of the top newspapers in his native Brazil.

He writes, "When Charles Harper invited me to contribute an essay to the volume celebrating Sir John Templeton's ninetieth birthday, I was elated. He suggested I write on the general topic of 'emergence' from the point of view of a physicist. Nothing could be more appropriate; the emergence of form from substance, be it of living matter from inorganic molecules, of mind from brain, or of the universe itself (from nothing?), is a topic at the forefront of scientific research. And it is also a very old question, much older than what we today call

science. As such, it represents very uniquely the drive we all have to ask questions about Nature's mysteries and to try and answer them as best we can. This essay is an effort to communicate my own personal drive, a scientific drive fueled by a sense of awe which is also much older than science."

ROALD HOFFMANN was born in 1937 in Zloczow, Poland. Having survived the war, he came to the United States in 1949 and studied chemistry at Columbia and Harvard Universities. Since 1965 he has been at Cornell University, now as the Frank H. T. 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. Dr. Hoffmann is also a writer of essays, nonfiction, poems, and plays. The latest of his four poetry collections is *Soliton*, published in 2002. His nonfiction writing includes a unique art/science/literature collaboration with artist Vivian Torrence, *Chemistry Imagined: The Same and Not the Same*, a thoughtful account of the dualities that lie under the surface of chemistry; and, with Shira Leibowitz Schmidt, *Old Wine, New Flasks: Reflections on Science and Jewish Tradition*, a book of the intertwined voices of science and religion. Dr. Hoffmann is also the presenter of a television course, *The World of Chemistry*, aired on many PBS stations and abroad. A play, *Oxygen*, by Carl Djerrasi and Roald Hoffmann premiered at the San Diego Repertory Theatre in 2001, and has had several productions since.

"This one was easy," he comments. "Have I not been peddling theories all my life? I should know what I preach."

"It was easy, but not for that reason. Scientists are mostly unreflective about what they do as they do it. Oh, they're very good at spotting lack of logic, obfuscation, and hype in other scientists. But not in their own work. And perhaps it's just as well—we all know too much thinking and talking about the process undermines creation. There is cognition and thought, mind working with hands, in the heat of making the new, yes. But not all that much stand-back-and-ponder-why thinking. At some point, it's just 'do it!'; as other theorists, I did what comes naturally. Does the reflective tone of this article then mean that I am through doing real science?"

"I am not going to answer that question."

"I have been fortunate to have to rise to the occasion of writing *American Scientist* columns for a dozen years, alternating between popularized chemistry, chemical stories with a point, history or social issues, and amateur philosophy

