for misrecognizing scientists in industry as merely instances of "role strain," a result of Merton's slavish commitment to functional theories that declare the values of science and those of the market to be inherently incompatible. Shapin distrusts theory and, for that matter, sociological methods that are not grounded in up-close "naturalistic" attention to the radically unstable and contingent particulars visible most accurately (he believes) in the words and actions of scientific insiders as they make practical everyday decisions. In his discussion of venture capitalists and entrepreneurial scientists, Shapin makes no use of sophisticated network analyses of who hooks up with whom, probably because those rely on statistical analyses and seek wider patterns underneath the surface heterogeneities of everyday practical life. The words of Mees and Kettering (or later scientific entrepreneurs) become for him privileged windows on the real story by virtue of their practical-mindedness and distance from academic theorizing or ideological enthusiasms. But surely they too had axes to grind and ledger books to balance, and if theorists suffer from a "metonymic bias," those in the trenches have their own "abridgments of the social realities they purport to describe."

What makes Shapin's attention to industrial and entrepreneurial research so compelling is how different today's technoscience looks when contrasted with histories in which pure science in universities becomes the gold standard. In these other sites of science, Shapin finds the paradox that gives the book its spring. Research managers at Bell Labs or General Electric judge scientists not only on their impressive credentials and technical skills but also by their personal dispositions for working well in large, variegated, transient, and loosely organized teams. Venture capitalists must, in the face of massive uncertainties about whether an invention will yield profits, rely on character judgments about the personal trustworthiness and dedication of this particular scientist or engineer, who may differ little from a thousand others in terms of bench skills or academic achievements. *The Scientific Life* provokes us to discard worn-out understandings that science outside universities is necessarily aberrant and that the credibility of scientific knowledge no longer depends upon moral judgments about the experts who make reality claims. In that task, the book succeeds masterfully.

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AGRICULTURE

Organic and GM—Why Not?

Mark Tester

The organic movement's opposition to genetically modified (GM) crops is causing it to miss an opportunity. Like agriculture across the planet, organic farming needs all the technological help it can get to be both sustainable and high-yielding. As with many recent innovations, GM technologies provide myriad possibilities for reducing the impacts of agriculture on the environment and the need for chemical inputs to maintain yield. But from the start, the organic movement rejected the use of GM crops. Genetic engineering is a technology, and like so many technologies, its benefits, costs, and risks depend on how it is used. A comparison with nuclear technology is not unfair: most of us benefit from medical applications of nuclear technologies, while many of us have major concerns with the large stockpiles of nuclear weapons that still threaten the planet. So, the risks of GM depend on the genes being put into the plants, not on the technology per se. Yet the numerous potential applications of GM to reduce chemical inputs to agriculture are flatly rejected by most organic farmers.

Tomorrow's Table
Organic Farming, Genetics, and the Future of Food

by Pamela C. Ronald and Raoul W. Adamchak

Oxford University Press, New York, 2008. 226 pp. $29.95, £17.99. ISBN 9780195301755.

In *Tomorrow's Table*, we now have the positive aspects of both organic and GM approaches discussed logically and clearly. The delightfully constructive book was written by a talented wife-and-husband team: Pamela Ronald, a very successful plant geneticist at the University of California, Davis, and Raoul Adamchak, an organic farmer who teaches at the same university. The authors are eminently qualified to present authoritative descriptions of their respective disciplines, which they do in a readable and accurate manner. But the noteworthy aspect of the book is the way they then marry their separate fields to argue logically for the use of GM technologies to improve organic agriculture. As Gordon Conway (a former president of the Rockefeller Foundation) comments in his foreword, "The marriage is long overdue."

The authors describe the possibilities for GM to assist organic agriculture with examples drawn from their own and others' research. Pest control is a particular focus. Ronald was centrally involved in the genetic engineering of flooding tolerance in rice (*1*). She describes lucidly how this would enable farmers to flood a paddy field in which the rice has been established, thus killing the weeds that inevitably afflict the crop but not the rice itself. When the water is subsequently lowered, the rice has a head start on any weeds that eventually emerge, which provides a simple, cheap, and clearly organic method for weed control. How can the organic movement turn its back on such opportunities?

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To increase harvests and efficiency. The authors propose that combining genetic engineering with organic farming offers the best path to sustainable food production.

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The false dichotomy that has been constructed between GM crops and organic farming can be illustrated with numerous similar examples. Another discussed by the authors is *Bacillus thuringiensis* (*Bt*) toxin, which has been successfully commercialized by Monsanto. These small insecticidal proteins, synthesized by widespread soil bacteria, can be applied in an almost unregulated way by organic farmers. This has been done for many decades. Yet when genetic engineering is used to place the gene encoding the *Bt* toxin in a plant's genome, the resulting GM plants are vilified by the very people willing to spray the product encoded by this same gene over otherwise similar plants. The organic movement's sustained rejection of this current application of GM appears increasingly illogical as evidence continues to accumulate that it does reduce pesticide use. In fact, this reduction is the principal reason farmers pay more for the biotech seeds—their lowered expenditures on pesticides are saving them money.

The authors marshal many additional examples to support their thesis that GM technologies and organic agriculture are quite compatible. Their discussion of these two topics exposes the complexity of the biological systems in which the issues surrounding them have to be addressed. This highlights the superficial nature of much of the GM debate, in which both sides make oversimplifications that support unnecessarily polarized standpoints. The biology is more complex. Unlike most protagonists, Ronald and Adamchak do not crudely lump together every GM crop as though they are all the same. That oversimplification blurs the issues (*2*, *3*) to the detriment of fruitful consideration of topics that are increasingly important in a world in which we need to produce more food, fiber, and fuels in the face of global environmental change. In contrast, the authors calmly argue something that makes perfect sense to me, but their book will be controversial.

All proponents of organic agriculture, especially the noisier ones such as Prince Charles, should read *Tomorrow's Table*. Ronald and Adamchak's clear, rational approach is refreshing, and the balance they present is sorely needed in our increasingly polarized world. In addition, plant scientists—who have the privilege of greater knowledge than most in this area and who therefore have a responsibility to share their understanding with a wider audience—will find the book provides useful information and arguments to help them when doing their next "science in the pub" talk.

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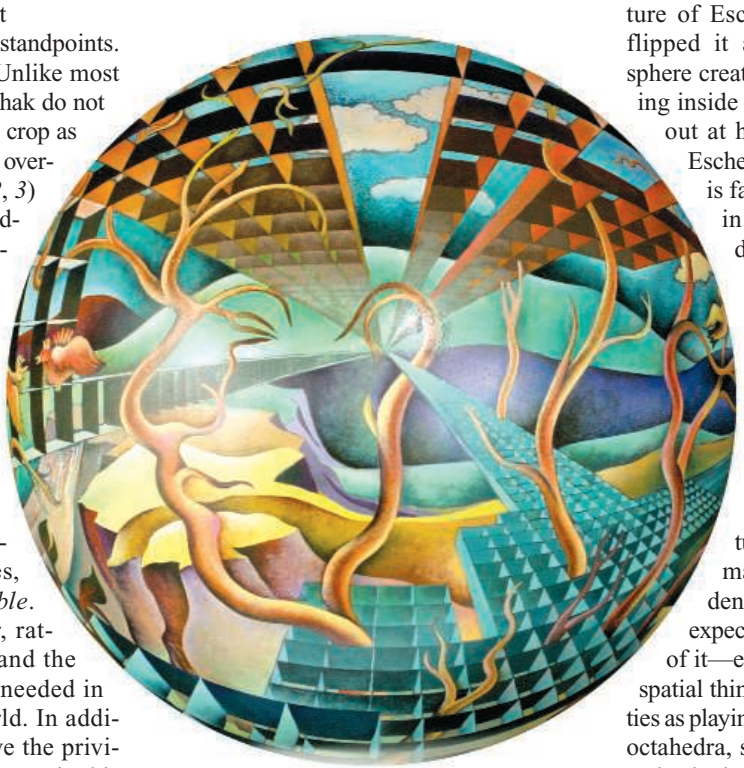
10.1126/science.1165961

EXHIBITIONS: ART

Global Perspectives

You wouldn't necessarily think of the Black Hills of South Dakota as the place to find innovations in communicating mathematics through art. However, the small town of Spearfish offers visitors an extraordinary gallery owned by a man who has devoted his life to capturing the total visual world. Painter Dick Termes creates Termespheres, pictures on globes that provide what Termes calls a sixfold perspective. As he describes them, "What you are seeing when you look at a Termesphere painting is an inside-out view of a total physical world around you on the outside surface of the hanging and rotating sphere. If you were on the inside of the sphere this painted image around you would seem normal, but I make you read it from the outside."

The Termesphere Gallery
1920 Christensen Drive,
Spearfish, SD 57783, USA.
www.termespheres.com



The Six Senses.

CREDIT: COURTESY DICK TERMES

The gallery itself is a wooden geodesic dome. Walking inside feels like floating in space past planets that capture pieces of different realities. Among the many works on view are a spherical model of Shakespeare's Globe Theatre, a surreal portrayal of the senses "not so much outside as within ourselves," and a cityscape based on a rhombic dodecahedron. Optical illusions abound, and the viewer's perspective seems to snap from inside to outside the scenes.

Termes has exhibited his spheres in one-man and group shows, and they also appear in the permanent collections of art and science museums, mathematics departments, local governments, and corporations. For example, Science Centre Singapore includes Termes's *Life in a Fish Bowl* in The Mind's Eye, an exhibition on optical illusions. *Human Cage*, acquired by the Glasgow Science Centre, also presents an illusion. Are you, the observer, looking at birds in a cage? Or are you in the cage itself, surrounded by strange birds and animals? Your perspective shifts as you look at the sphere.

One of the artist's creations became part of the 100th birthday celebration for M. C. Escher in 1998. Termes took the famous picture of Escher holding a mirror ball and flipped it around: The 36-inch-diameter sphere creates the illusion that one is standing inside of Escher's mirror ball, looking out at his room. According to George Escher, Termes's recreation of the room is faithful (even to the lack of a door in the attic room, as that was hidden in the floor).

Currently Termes divides his time between creating designs on the surfaces of transparent spheres and developing a traveling display called "Up, Down, and All Around: Geometry in Your Visual World." That exhibit (sponsored by the Hands-On Partnership for Science, Literature, and Art in South Dakota) primarily targets middle-school students, but children of any level are expected to be able to get something out of it—especially in terms of developing spatial thinking skills. Through such activities as playing with mobius strips and building octahedra, students should be turned on by and to both math and art. **–Barbara Jasny**

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