Scientific American Magazine - January, 2008

SciAm 50

This year's SciAm 50 awards are replete with instances of new machines or chemicals that come close to the true meaning of innovation as something entirely new.

By Alan Hall, Adrian R. Morrison and Alan E. Rubin

echnological overoptimism lurks as a persistent risk to both professional and amateur watchers of advances, from artificial intelligence to the flying car. But sometimes new technologies actually live up to some of the wildest expectations for them.

This year's SciAm 50 awards are replete with instances of new machines or chemicals that come close to the true meaning of innovation as something entirely new. One winner has created an instrument that measures fluids in zeptoliters, or sextillionths of a liter. (You know, the zeptoliter, the measurement unit that is 1,000th of an attoliter?)

Another innovator has devised a method that could recharge a phone without plugging it in. All you would have to do is sit at the dining room table, phone in pocket, a few feet away from a recharging coil hidden in the ceiling. Still another visionary is paving the way for treating mysterious and deadly prion diseases such as mad cow and kuru.

Award winners highlighted here have the potential to contribute much more to human health, consumer electronics and numerous other fields than if they were simply offering another antidepressant that tweaked serotonin levels or ratcheting up the speed of a microprocessor. What they have done is decidedly new.

SciAm 50 for 2007

Research Leader of the Year

1. The Wellcome Trust Case Control Consortium

Business Leader of the Year

2. Amyris Biotechnologies

Policy Leader of the Year

3. X Prize Foundation

Other Research, Business and Policy Leaders

Connections to an Untethered Future

4. Marin Soljacic, Massachusetts Institute of Technology (research)
5. Apple (business)
6. Robert Ghrist, University of Illinois at Urbana-Champaign, and Vin de Silva, Pomona College (research)

Getting from Here to There

7. Manjunath N. Swamy, Immune Disease Institute, Harvard Medical School (research)
8. Hans Boumans, Netherlands Organization for Applied Research (research)

Fueling Alternatives

9. James A. Dumesic, University of Wisconsin–Madison (research)
10. Radoslav R. Adzic, Brookhaven National Laboratory (research)
11. Shelley D. Minteer and Tamara Klotzbach, Saint Louis University (research)

Fighting Toxins in the Home

12. Patricia A. Hunt, Washington State University (research)
13. American Pharmacists Association and the U.S. Fish and Wildlife Service (policy)

Advances in Ultrameasurement

14. Peter W. Sutter and Eli A. Sutter, Brookhaven National Laboratory (research)
15. Groups of physicists at Hokkaido University, Japan, and the University of Bristol, England (research)

Mosquitoes Enlisted to Beat Malaria

16. Marcelo Jacobs-Lorena, Johns Hopkins University (research)
17. Bruce A. Hay, California Institute of Technology (research)

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Material World
18. Nancy R. Sottos and Scott R. White, University of Illinois at Urbana-Champaign (research)
19. Benoît Roman and José Bico, City of Paris Industrial Physics and Chemistry Higher Education Institution (research)
20. Robin G. Hicks, University of Victoria, British Columbia, and Rajsapan Jain, University of Windsor, Ontario (research)
21. Sergej Demokritov, University of Muenster, Germany (research)

Neurological Insights
22. Itay Baruchi and Eshel Ben-Jacob, Tel Aviv University (research)
23. Richard D. Smith, Pacific Northwest National Laboratory, and Desmond J. Smith, University of California, Los Angeles (research)
24. Stina M. Tucker, Esther Oh and Juan C. Troncoso, Johns Hopkins University School of Medicine (research)
25. Beka Solomon, Tel Aviv University (research)

Light Manipulation
26. Yurii A. Vlasov, IBM Thomas J. Watson Research Center (research)
27. Takasumi Tanabe, NTT Basic Research Laboratories, Japan (research)
28. E. Fred Schubert, Rensselaer Polytechnic Institute (research)
29. Eugene S. Polzik, Niels Bohr Institute, University of Copenhagen, and Ignacio Cirac, Max Planck Institute for Quantum Optics, Germany (research)

Progress against Prions
30. Giovanna R. Mallucci, Institute of Neurology, London (research)
31. Robert Rohwer, Veterans Affairs Medical Center, Baltimore (research)

Sun Power Gets a Boost
32. Gregory S. Engel, University of Chicago (research)
33. Steven Van Dessel, Rensselaer Polytechnic Institute (research)

Stem Cell Control
34. Shinya Yamanaka, Kyoto University (research)
35. Peidong Yang, University of California, Berkeley, and Bruce R. Conklin, Gladstone Institute of Cardiovascular Disease, San Francisco (research)
36. Frank D. McKeon, Harvard Medical School (research)
37. Kevin Eggan, Harvard Stem Cell Institute (research)

Squirt and Spin
38. Masahiro Furusawa, Seiko Epson Corporation, Japan (business)
39. Hanan Dery, University of California, San Diego (research)

Making Them Whole
40. Todd A. Kuiken, Rehabilitation Institute of Chicago (research)
41. Dean Kamen, DEKA Research & Development Corporation (research)
42. Cato T. Laurencin, University of Virginia (research)

The Fastest Way to Get There
43. Dominik Schultes, University of Karlsruhe, Germany (research)
44. Google (business)
45. IntelliOne (business)

See-Through Technology and Better Sleep
46. Brian Schulkin, Rensselaer Polytechnic Institute (research)
47. Lawrence C. Rome, University of Pennsylvania and Marine Biological Laboratory, Woods Hole, Mass. (research)
48. Actelion Pharmaceuticals, Switzerland (business)
49. Conor R. Caffrey, University of California, San Francisco (research)
50. Ilaria Capua, Vialle University, Italy (policy)

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December 16, 2007

SciAm 50: Material World

Scientists take inspiration from nature and instill novel magnetic properties

Cut your finger, and your body starts mending the wound even before you have had time to go and find a Band-Aid. Synthetic materials are not so forgiving, but Nancy R. Sottos, Scott R. White and their colleagues at the University of Illinois at Urbana-Champaign are looking to change all that. They developed a self-healing plastic that contains a three-dimensional network of microscopic capillaries filled with a liquid healing agent. When the material is cracked, the released fluid is hardened by particles of a catalyst that are also sprinkled throughout. The new material can repair minor cracks up to seven times at each location, improving on the group's previous system (in which the fluid was located in individual pockets) that could repair only one injury at each place.

Another feature of natural organisms that scientists have been seeking to emulate is self-assembly. Benoît Roman and José Bico of the City of Paris Industrial Physics and Chemistry Higher Education Institution used the surface tension of evaporating water droplets to fold flea-size origami cubes, pyramids and other structures. Their work used shapes measuring about a millimeter across cut out of a rubbery polymer a mere 40 to 80 microns thick. Thanks to the way that surface tension scales with size, the technique may be effective for self-assembling micron- or nanometer-scale objects made of thinner sheets of polymer.

Electronic components based on plastic or organic materials have become increasingly common in recent years, but the same cannot be said for magnets. Now Robin G. Hicks of the University of Victoria in British Columbia, Rajsapan Jain of the University of Windsor in Ontario and their co-workers have produced a new class of magnets that combine nickel with a variety of organic compounds. The dark, powdery substances remain magnetized up to 200 degrees Celsius. The researchers' ultimate goal is to produce magnetic organic compounds that can be easily molded into thin films or other useful shapes for electronics.

It was thought that the only way to see the exotic state of matter known as a Bose-Einstein condensate—in which a collection of particles essentially behaves as one superparticle—involved forbidding, near-absolute-zero cold. Sergej Demokritov of the University of Muenster in Germany and his colleagues were the first to create such condensates at room temperature. Demokritov used small, ephemeral packets of magnetic energy known as magnons, which he generated in yttrium-iron-garnet films by exposing them to microwaves. Magnons are far less massive than atoms and thus can form condensates at much higher temperatures.

—Graham P. Collins and Charles Q. Choi

FURTHER READING

SciAm 50 for 2007