A GRAND PLAN FOR SOLAR ENERGY
By 2050 it could free the U.S. from foreign oil and slash greenhouse emissions. Here’s how ...

Nanotech Power
Tiny Devices
Reclaim Wasted Energy

Cancer Drug Paradox
It Kills Tumors by Repairing Them

Sing Out!
The Physics of the Voice
BIG IDEAS

A Solar Grand Plan
By Ken Zweibel, James Mason and Vasiliis Ethenakis
An ambitious scheme would enable solar power to end U.S. dependence on foreign oil and slash greenhouse gas emissions by 2050.

TECHNOLOGY LEADERSHIP

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The SciAm 50
Which researchers, companies and architects of industrial and government policy are leading the most important trends shaping tomorrow’s technologies? Our annual roundup of world shakers gives credit where it is due.

MEDICINE

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Taming Vessels to Treat Cancer
By Rakesh K. Jain
Drugs that restore order to the chaotic blood vessels inside a tumor open a window of opportunity for attacking it.

PUBLIC HEALTH

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Second Thoughts about Fluoride
By Dan Fagin
New research indicates that a cavity-fighting treatment could be risky if overused.

ENGINEERING

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Self-Powered Nanotech
By Zhong Lin Wang
Tiny systems that draw waste energy from their surroundings could power nanosize machines.
Technological 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.

—The Editors
See-Through Technology and Better Sleep

A mix of technology accompanies the doings of a maverick researcher

T-ray Vision
In principle, terahertz radiation—which lies between the microwave and infrared segments of the electromagnetic spectrum—could help people safely peer through flesh, plastic, fabrics and ceramics to detect anomalies, from tumors to bombs, for medical or security applications. But for decades, so-called t-ray devices were impractical outside the lab because they were fragile and because they weighed 45 kilograms (100 pounds) or more. Yet after just a few months of work, Brian Schulkin of the Rensselaer Polytechnic Institute created a rugged t-ray imager dubbed the “Mini-Z” that is less than 2.3 kilograms (five pounds) in weight and can fit in a briefcase. A prototype detected flaws purposely embedded in samples of foam used to insulate the space shuttle. Schulkin next plans to develop a handheld t-ray device.

—Charles Q. Choi

Load-Lightening Backpack
A few hardcover textbooks in a school backpack are enough to cause muscle strain. Lawrence C. Rome of the University of Pennsylvania and of the Marine Biological Laboratory in Woods Hole, Mass., and his colleagues have developed a backpack suspension system that minimizes stress on its wearer. As people walk, they typically bob up and down by several centimeters, which causes a pack to swing up and down. A 2.3-kilogram (five-pound) laptop slams down with 3.7 kilograms (eight pounds) of force when walking and as much as 6.9 kilograms (15 pounds) when running. Using pulleys and bungee cords, the new backpack damps this motion by half or more. In effect, the pack feels about a fifth lighter.

One version even generates electricity—more than seven watts, enough to recharge phones. Rome has set up a company, Lightning Packs, to develop the idea.

—George Musser

Better Sleep Aid
About nine years ago researchers discovered that the sudden spells of sleepiness called narcolepsy were caused by a deficit of a brain peptide called orexin. Actelion Pharmaceuticals in Allschwil, Switzerland, used this knowledge to create a type of sleeping pill that works by blocking two orexin receptors. Drug tests have shown that the compound known as ACT-078573 induces sleep in both animals and humans.

—Gary Stix

Antiparasite Weapon
The debilitating parasitic illness known as schistosomiasis infects roughly 200 million people worldwide, making it second only to malaria in importance for public health. Currently just one drug, praziquantel, commonly treats the chronic disease, raising fears that the parasite could evolve resistance against it. Now Conor R. Caffrey of the University of California, San Francisco, and his colleagues have found a new drug that can kill the blood flukes that cause the ailment. They investigated the drug K11777, which interferes with the flukes’ digestive enzymes, and discovered that it could eliminate the parasites in lab mice.

If effective in humans, K11777 could work in tandem with praziquantel, with the former taking care of early-stage illnesses and the latter killing later-stage infections.

—Charles Q. Choi

Bird Flu Research for All
Until recently, laboratories doing bird flu research often kept their findings private, with access to many avian influenza gene sequences confined to just 15 facilities globally, potentially hindering them from doing research that could provide new insight into the virus. Instead of entering her avian influenza findings into this database, Ilaria Capua of Viale University in Padua, Italy, disclosed the results of her studies in the publicly accessible GenBank and boldly rallied her colleagues to follow.

Her efforts helped to pave the way for the Global Initiative on Sharing Avian Influenza Data, a consortium through which findings can be freely shared while giving credit to researchers involved.

—Charles Q. Choi
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 Soljačić, 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 Ultraceasurement
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)

Material World
18. Nancy R. Sottos and Scott R. White, University of Illinois at Urbana-Champaign (research)
19. Benoit 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 Rajasapran Jain, University of Windsor, Ontario (research)
21. Sergej Demokritov, University of Munster, 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. Yuriy 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. Malucci, 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. McKeen, 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 Schullkin, 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. Iliara Capua, Viale University, Italy (policy)

Scientific American
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