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There are 193 countries in the world.
None of them are energy independent.

So who's holding whom over a barrel?

The fact is, the vast majority of countries rely on the few energy-producing nations that won the geological lottery, blessing them with abundant hydrocarbons. And yet, even regions with plenty of raw resources import some form of energy. Saudi Arabia, for example, the world's largest oil exporter, imports refined petroleum products like gasoline.

So if energy independence is an unrealistic goal, how does everyone get the fuel they need, especially in a world of rising demand, supply disruptions, natural disasters, and unstable regimes?

True global energy security will be a result of cooperation and engagement, not isolationism. When investment and expertise are allowed to flow freely across borders, the engine of innovation is ignited, prosperity is fueled and the energy available to everyone increases. At the same time, balancing the needs of producers and consumers is as crucial as increasing supply and curbing demand. Only then will the world enjoy energy peace-of-mind.

Succeeding in securing energy for everyone doesn't have to come at the expense of anyone. Once we all start to think differently about energy, then we can truly make this promise a reality.

willyoujoinus.com

WHAT NEEDS TO BE DONE

– DIVERSIFY ENERGY SUPPLIES
  • FIND MORE TRADITIONAL FUELS
  • DEVELOP ALTERNATIVES AND RENEWABLES
– FOSTER OPEN MARKETS & TRANSPARENCY
– ENCOURAGE CONSERVATION/ ENERGY EFFICIENCY

Chevron Steps Taken:

- Investing over $15 billion a year to bring energy to market.
- Developing energy through partnerships in 26 countries.
- Committing hundreds of millions annually to alternative and renewable energies to diversify supply.
- Since 1992, have made our own energy go further by increasing our efficiency by 24%.

Chevron

Human energy™

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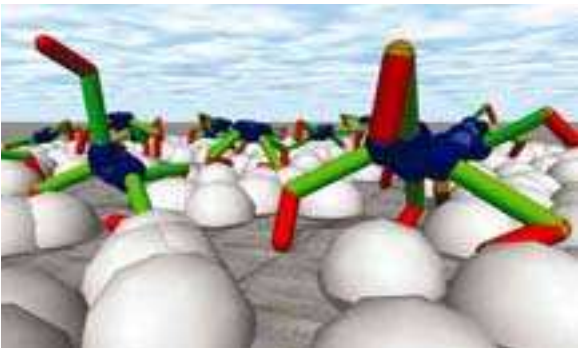
5 Years Ago in *TR*

What's New on Our Website

technologyreview.com/tr35
Learn more about the TR35 honorees on our website. See Josh Bongard's robots explore new terrain in computer simulations *(p. 74)*, or toy with a virtual nanogenerator based on Xudong Wang's research *(p. 72)*. You'll also find mini-documentaries about the TR35 Innovator of the Year, David Berry, and Humanitarian of the Year, Tapan Parikh.



technologyreview.com/prostheses
This issue of the magazine features a beautiful photo essay on amputee athletes who use a range of new, sophisticated prostheses *(p. 38)*. Online, you'll find video of the athletes in action. See Rudy Garcia-Tolson cycle using a prosthetic knee, and watch Hugh Herr easily attach, adjust, and walk on his powered ankle.

technologyreview.com/sirtuins
This issue features a profile of David Sinclair, a controversial Harvard biologist who is testing drugs to fight aging *(p. 78)*. Online, we've posted an explanation of the science behind antiaging genes and how a new class of compounds might activate them. Written by Sinclair and several of his colleagues, including Leonard Guarente, the MIT molecular biologist who discovered the antiaging gene *sir2* more than a decade ago, and Christoph Westphal, CEO and cofounder (with Sinclair) of Sirtris Pharmaceuticals, the article is an excellent technical introduction to this exciting field of research.

technologyreview.com/iphone
This month, *Technology Review* takes the Apple iPhone apart and explains what's inside *(p. 30)*. Check out our website for an animated look at the phone's hardware.

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De Technologia non multum scimus. Scimus autem, quid nobis placeat.

Technology Review, Inc., the authority on the future of technology, identifies emerging technologies and analyzes their impact for technology leaders. Technology Review publishes *Technology Review* magazine (the oldest technology magazine in the world, founded in 1899) and the daily website TechnologyReview.com; it also produces live events such as the Emerging Technologies Conference. Technology Review is an independent media company owned by the Massachusetts Institute of Technology. The views expressed in our various publications and at our events are often not shared by MIT.

Wherever in the world you compete,
Michigan can give you the upper hand.

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IN A SERIES OF THOUSANDS

ePrize is the model for innovation and Internet success. Michigan helped them break the mold.

Josh Linkner
Founder and CEO
ePrize

If you thought you needed a West Coast zip code to make it on the web, think again. Case in point: ePrize — a globally successful interactive promotion company that works with the world's top brands. Not only did ePrize find a great creative talent pool here with some of the best colleges and universities on the planet, they also found a great place to call home in Pleasant Ridge, Michigan. Hot clubs, great restaurants, year-round sports and recreation, friendly tree-lined neighborhoods and a world-class arts community.

ePrize also found financial and economic incentives from the Michigan Economic Development Corporation to put their Internet business out in front. As Josh Linkner, founder and CEO of ePrize, put it…"All the production, all the technology, all the innovation, is happening right here in Michigan."

So is it time to move your entrepreneurial company to Michigan? Absolutely. And we'll do whatever it takes to make that happen. Because wherever on the web you compete, Michigan can give you the upper hand. Let the Michigan Economic Development Corporation show you how to break the mold. **Click on michigan.org/upperhand.**

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James Watson was awarded a Nobel Prize in 1962 for his part in discovering the double-helical structure of DNA—a story recounted here *("Letter to a Young Scientist," p. 84)* in an excerpt from his new book, *Avoid Boring People: And Other Lessons from a Life in Science.* The book, says, Watson, "is my autobiographical romp through academia, including lessons learned that have helped keep me, at 79, more alive than dead." Watson is the author of *Molecular Biology of the Gene* and *The Double Helix*. He is now chancellor of the Cold Spring Harbor Laboratory.

Daniel C. Dennett is a philosopher who has long argued that artificial intelligence might one day produce machines that can be said to be conscious. In this issue, he discusses AI and chess: it was 10 years ago that Deep Blue beat world champion Garry Kasparov *("Higher Games," p. 98)*.

"We're a long way from human-level AI," says Dennett, "but the 'philosophical' arguments against achieving this are all bogus. Could we design and build a robotic bird that could catch insects on the fly and land safely on a twig? It would be an incredibly difficult tour de force of engineering, but not 'impossible in principle.' The same goes for human-level AI. We may never achieve it, but only because it will be too expensive and frivolous to try. We can learn what we need to know by building simpler models."

Dennett is the author of *Consciousness Explained*, *Darwin's Dangerous Idea*, and *Breaking the Spell*. At Tufts University, he is a University Professor and codirector of the Center for Cognitive Studies.

Stephen S. Hall, for this year's TR35 package, profiled David Berry, our Innovator of the Year *(p. 48)*. Though Berry, a Harvard-trained MD, has done a few different things since earning his bachelor's degree from MIT in 2000—he developed a treatment for stroke and worked on a new approach to cancer therapy—he is now concentrating, in his work at Flagship Ventures, on genetically engineering microbes to produce biofuels. His ideas are at the heart of Flagship-backed LS9, a Californina-based renewable-petroleum company. "I was impressed by David," Hall says. "He conveys a very low-key form of energy and high-minded restlessness, yet the breadth of his interests is unusually wide. While he was still attending medical school at Harvard, he organized a fairly high-powered roundtable at MIT on alternative fuel technologies. That says a lot about how broadly he approaches innovation."

Hall is the author of five books about contemporary science. His most recent, *Size Matters*, was published last year and examines the disadvantages of being short. Hall writes frequently for the *New York Times Magazine*, *National Geographic*, and a number of other magazines.

Oliver Hibert illustrated this issue's cover. "I had a fun time designing this," he reports. "Listening to music is an essential part of the way I design, and the music of choice for this project was '60s psychedelia and '80s electro-pop. Good times." Hibert works in many media, but painting is his chief love. He has had shows in museums and galleries around the world, and he currently lives in Phoenix, AZ.

Letters

Second Life

I've been following the virtual world called Second Life for some time, so it was a pleasure to read Wade Roush's thoughtful and intelligent cover story ("Second Earth," July/August 2007). The piece benefited greatly from the fact that your writer entered into the life of the community he was trying to understand.

I'm sure you'll receive some splenetic, sarcastic criticism of the piece from someone disgusted by the very idea of a Second Life. Unlike Roush, though, your critic will almost certainly have spent no time in acquiring one.

Michael Parsons
Editor, CNET.co.uk
London, England

Artificial Intelligence

In his essay arguing against the possibility of producing conscious machines ("Artificial Intelligence Is Lost in the Woods," July/August 2007), is Yale computer science professor David Gelernter arguing against artificial intelligence or artificial humanity? Intelligence does not require all the human interactions with the world or emotions that he lists, unless there is a particular need to provide those for the intended application.

Consciousness is hard to define. Maybe someone should make a replacement for the Turing test, Alan Turing's suggestion that if a computer can answer questions the same way a human would, then it can be considered intelligent. A Helen Keller test, perhaps: it may be possible, after all, that there is or will be a computer in existence that is conscious, but for whom we have not provided the means for input or output that it would need to signal to us that it is conscious. Or maybe it's speaking "Chinese" to an "English" world or broadcasting radio to a television world.

I think we'd better find a more general concept of consciousness than Gelernter's so that, at a minimum, we'll recognize that aliens have landed if they ever do.

Stanley D. Young
Fort Collins, CO

I side with the anticognitivists (and thus David Gelernter). AI software running on von Neumann machines will never be conscious, and without consciousness there can be no experience, human or otherwise. Believing that somehow consciousness will arise like a deus ex machina on your Pentium is an article of religious faith.

Still, while AI software cannot replicate consciousness, networks of artificial neurons have considerably more promise. Consider machines being built by Kwabena Boahen's group at Stanford or earlier by Carver Mead's student Misha Mahowald at Caltech.

There are also hybrids in which real neural circuits are emulated in very large-scale integration (VLSI): Paul Rhodes's group at Evolved Machines in Palo Alto is working on that, as is Theodore Berger's group at the University of Southern California.

Digital computers are so second millennium. As my MIT classmate Ray Kurzweil might say, "Plug that silicon retina into your optic nerve, and you won't know the difference."

Robert Blum
Menlo Park, CA

Good Design

Your design-focused May/June 2007 issue was very interesting and thought-provoking, but I think it missed an opportunity to focus attention on the most pervasive problems of electronic-product design.

Several experts and writers equated operational simplicity with minimal functions, and several cited the iPod as an example of gaining simplicity by avoiding feature creep. But the history of the iPod is feature creep itself. It started out as a music player. Now it plays music, podcasts, video, and games; it can act as a stopwatch or alarm clock, show you the time in other world cities, maintain your contacts and calendar, show photos, allow you to read text files, and serve as a backup hard drive. Why does it remain simple to use? Because all the functions work the same way. The user needs to learn only one rule about the interface and can apply it to every function on the device.

Victor Riley
Point Roberts, WA

Changing Human Nature

I read with interest the essay by philosopher Roger Scruton ("The Trouble with Knowledge," May/June 2007), since I enjoy seeing things in new ways and respect philosophers for their penetrating insight and clear logic. But I found neither in Scruton's piece.

Scruton fears that future technology will enable men and machines to interact in increasingly intimate ways and eventually merge to the degree that human nature itself is altered. He is terrified of this possibility.

But what, exactly, is so great about human nature that he is so scared of its changing? One need only read a newspaper to see, not only that human nature is deeply flawed, but also that it is human nature not to need a reason to believe something that makes you feel good; it is human nature to believe whatever superstitions you were taught as a child. Scruton certainly seems to. When he starts to mention God, and refers to the Fall of Adam, I suspect that nobody is going to get much of a clear and rational discussion from him.

Don Dilworth
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