MIT'S MAGAZINE OF INNOVATION
TECHNOLOGY REVIEW

TR100/2002

All hail the TR100! These 100 brilliant young innovators—all under 35 as of Jan. 1, 2002—are visitors from the future, living among us here and now. Their innovations will have a deep impact on how we live, work and think in the century to come.

This is the second time *Technology Review* has picked such a group. The first was in 1999, our magazine's centennial year. That was a wonderful experience, but we've learned a lot in the last three years, and we think this installment is even more exciting than the first.

For one thing, we've chosen a special theme for this version of the TR100: transforming existing industries and creating new ones. We looked for technology's impact on the *real economy*, as opposed to the now moribund "new economy." The major hot spots where we think a fundamental transformation is in progress include information technology, biotechnology and medicine, nanotechnology and materials, energy, and transportation. The bulk of the TR100, who are profiled in the following pages, come from those five areas. These innovators are first grouped alphabetically and then indexed by their areas of work *(p. 95)*.

In addition to this offering in our magazine, we've posted an augmented version of the TR100 special section on our Web site, with more information about all the honorees and a rich set of links to sites pertaining to their original research (www.technologyreview.com/tr100/feature). Choosing this group has been a painstaking process that began more than a year ago. We could not have succeeded without our distinguished panel of judges *(p. 97)*. But it's been worth it. We promise that as you watch the careers of these 100 people unfold, you will be able to accompany them back to their home: the future.

SUSAN HAGNESS | AGE 31

MEDICINE

UNIVERSITY OF WISCONSIN-MADISON

Breast cancer will strike more than 200,000 women in the United States this year, and 40,000 will die. X-ray mammography is the best way to detect early tumors, but the technique misses one in five cases, and women find the test uncomfortable. Susan Hagness and collaborators have invented a better breast-imaging technique. A woman lies on her back so that her breasts flatten naturally, and an instrument Hagness is developing scans the breast tissue with very-low-power microwaves, which are safer than x-rays. Hagness's preliminary measurements on breast biopsy specimens indicate that microwave imaging makes malignant tumors stand out better than x-rays do. The energetic Hagness developed sophisticated computer algorithms—which process data collected by the imaging instrument—to enhance the detection and discrimination capabilities of microwave imaging. So far, her computational studies indicate that her approach should detect tumors just a couple of millimeters across, an improvement on the five-millimeter limit of x-ray mammography. The first version of Hagness's instrument will be used for research.

DEREK HANSFORD | AGE 29

MATERIALS

OHIO STATE UNIVERSITY

Derek Hansford's unobtrusive bearing is just what you'd expect from someone who designs ways to sneak drugs past the immune system. Hansford has been fabricating tiny polymer particles that can hold drugs and be injected into a patient's bloodstream. Once there, they could hunt down tumors and release their drugs, without affecting healthy cells. Along the way, the particles would shield the drugs from degrading enzymes and would not elicit attacks from the immune system—a common problem for cancer drugs—because they do not attract immune cells. Although other bioengineers are making polymer drug-delivery devices, none has made large numbers of uniform particles small enough to travel in the bloodstream; each of Hansford's particles is about the size of a red blood cell. The scientist has adapted a technique called soft lithography to make the particles, casting hundreds of millions of them in varied shapes out of reusable molds. Startup company iMedd plans to license his technology. Hansford will now try to make particles for inhalable drugs—an alternative to injections.

MICHAEL HANSEN | AGE 32

HARDWARE

SARNOFF

As a child, Michael Hansen hung out at Radio Shack and wrote such good programs on the store's computers that the salespeople ran them as demos. Software mastered, he learned hardware, earning a graduate degree in electrical engineering. In 1993 he joined Princeton, NJ-based Sarnoff to tackle visual processing—"the hardest darn problem I'd ever seen." Before he knew it, Hansen, who also found time to become a private pilot, was leading a $5 million-a-year group. In 2000 his team developed a chip that lets inexpensive portable devices process visual data collected by surveillance cameras. The chip provides hundreds of times more visual processing than a general-purpose Pentium microprocessor at one-tenth the cost, says Peter Burt, director of the vision technologies lab at Sarnoff. The for-profit R&D company believes networks of such simple devices will have great commercial value in military surveillance, law enforcement and auto safety. In order to, as he puts it, "shorten the path from technology development to new products," Hansen is now working on his MBA.

RAMESH HARIHARAN | AGE 32

SOFTWARE

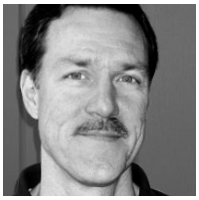
STRAND GENOMICS

In school, Ramesh Hariharan found biology boring. But once he became a computer science professor at the Indian Institute of Science, he got excited about the race to map the human genome. So he cofounded Strand Genomics in Bangalore, where he designs software tools to efficiently analyze the ever increasing volume of data about the makeup of genes. One U.S. customer is applying Hariharan's data-crunching innovations to proteomics—the analysis of protein structures to aid in the discovery of new drugs. Strand Genomics expects to grow from 35 to 100 employees this year. Wearing another hat, Hariharan also works to bridge the digital divide. With colleagues from the university and from a local software firm, he started the nonprofit Simputer Trust to develop a simple, cheap (under $200), portable, battery-operated computer to bring the Internet to the developing world. The trust's first targets are rural Indian village schools, hospitals or community centers that have phone lines. Villagers get smart cards that give them access to a shared Simputer, while touch-screen icons and the Dhvani text-to-speech system Hariharan developed empower illiterate users.

HARIHARAN: CHRISTOPHER BROWN/CORBIS SABA

TR100 CONTRIBUTORS

PROJECT EDITORS



Choosing 100 young innovators and profiling each and every one of them would be an all-hands-on-deck effort for any magazine. In fact, *Technology Review* needed many more hands than we actually had on our staff. Fortunately, we didn't need to look far for them. Mark Fischetti, who honchoed the whole project, is a known commodity in these parts. Mark has written for us before, most notably his excellent cover story "The Future of TV" in the November 2001 issue. Fischetti is used to working smoothly to get big projects organized, having edited special issues for other publications and worked with notables such as Michael Dertouzos and Tim Berners-Lee on their books. For the TR100, Mark helped us set up the panel of judges, obtained the judges' comments, and, his biggest task, assigned and edited the flood of profiles.

Mark did a lot, but he couldn't have finished the job without Brad Stenger. Brad has been through this process before; a Georgia Tech graduate student and an inveterate fan of innovators, he came to *TR* in the summer of 1999, when he offered himself up as a summer intern. His interests and talents were perfectly suited to the first TR100 project, and he spent that summer and fall identifying hundreds of candidates. He did much the same this time, as well as providing research on candidates, soliciting letters of recommendation, writing profiles and writing a story that follows a group of the first TR100 from then until now *(see "Where Are They Now?" p. 98)*. To Mark and Brad, and to all of those who contributed, we offer heartfelt thanks. —*The Editors*

PROFILE WRITERS

Yudhijit Bhattacharjee
Herb Brody
David Cameron
Daniel Cho
Elizabeth Corcoran
Rebecca Dorr
Peter Fairley
Larry Hardesty
Kevin Hogan
Marguerite Holloway
David Holzman
Erika Jonietz
Carly Kite
Alan Leo
Mike May
Robert McGarvey
Melissa Mertl
Steve Nadis
David Rapp
David Rotman
Wade Roush
Lisa Scanlon
Evan I. Schwartz
Sarah Simpson
Tracy Staedter
Alexandra Stikeman
David Talbot
Reinout van Wagtendonk
Joe Verrengia
Celia Wolfson
Rebecca Zacks

COPY DESK SUPPORT

Miriam Boon
Daniel Cho
Katharine Dunn
Gabriel Phifer

TR100 JUDGES

DAVID BALTIMORE
President, California Institute of Technology; Nobel laureate, medicine

ALFRED BERKELEY
Vice chairman, NASDAQ

SABEER BHATIA
Cofounder, Hotmail;
TR100 finalist, 1999

RICHARD DEMILLO
Vice president and chief technology officer, Hewlett-Packard

R. JOHN HANSMAN
Professor of aeronautics and astronautics, MIT

UNNA HUH
Member, National Assembly, Republic of Korea

JOSEPH JACOBSON
Associate professor, MIT Media Laboratory;
TR100 finalist, 1999

PHILIPPE JANSON
Member, IBM Academy of Technology

NATALIE JEREMIJENKO
Director, Experimental Product Design Lab, Yale University;
TR100 finalist, 1999

CHRISTINE KARMAN
Founder, Tryllian, the Netherlands

ROBERT LANGER
Professor of chemical and biomedical engineering, MIT;
Professor, Harvard-MIT Division of Health Science and Technology

RICHARD K. LESTER
Director, Industrial Performance Center, and professor of nuclear engineering, MIT

ROBERT M. METCALFE
General partner, Polaris Venture Partners;
Inventor, Ethernet;
Founder, 3Com

JUZAR MOTIWALLA
Partner, Green Dot Capital, Republic of Singapore

CHERRY A. MURRAY
Senior vice president, research strategy, wireless physical science research, Bell Labs, Lucent Technologies

NICHOLAS NEGROPONTE
Professor of media technology, MIT;
Chairman, MIT Media Laboratory

KIM POLESE
Chairman, Marimba

JUDITH RODIN
President, University of Pennsylvania

DARI SHALON
Partner, Shalon Ventures, Israel;
TR100 finalist, 1999

PHILLIP SHARP
Institute Professor and director of the McGovern Institute for Brain Research, MIT; Nobel laureate, medicine

ALAN SPOON
Managing general partner, Polaris Venture Partners

ANTHONY SUN
Managing general partner, Venrock Associates

LARRY WEBER
Founder, Weber Shandwick Worldwide;
Chairman and CEO, Interpublic's Advanced Marketing Services

ANN WINBLAD
Cofounding partner, Hummer Winblad Venture Partners