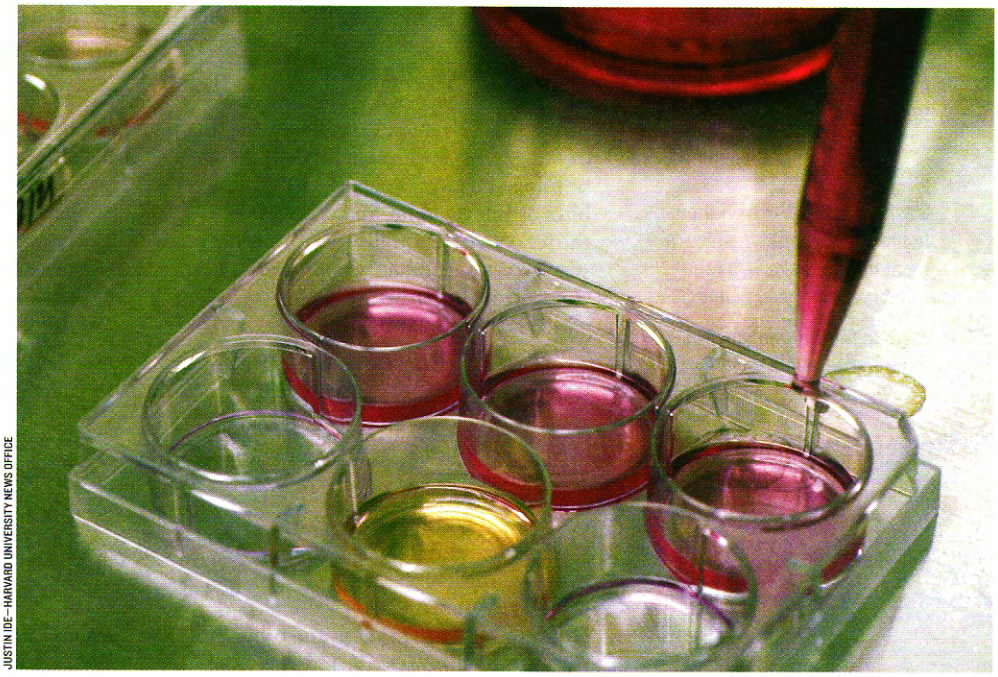
Top of the Week

Newsweek

Cover Story

The war over embryonic-stem-cell research is pitched and complex, touching on **science and health, faith and politics.** The death of Christopher Reeve has given the debate new energy as the presidential race enters its final stage—**a race that could determine the future** of stem-cell work. **Page 42**



JUSTIN IDE—HARVARD UNIVERSITY NEWS OFFICE

CELLULAR DIVIDE: After Reeve, more stem-cell debate

PHOTOGRAPH BY KHUE BUI FOR NEWSWEEK

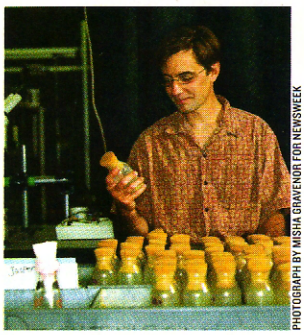
THE ENDGAME: The heat is on in the homestretch

COVER: Photograph by Mary Ellen Mark
Inset: Photograph by Moshe Brakha for NEWSWEEK
STYLED BY JEANNE YANG. GROOMING BY JETTY STUTZMAN.

THE NEXT FRONTIERS

ARTS & ENTERTAINMENT

DEPARTMENTS

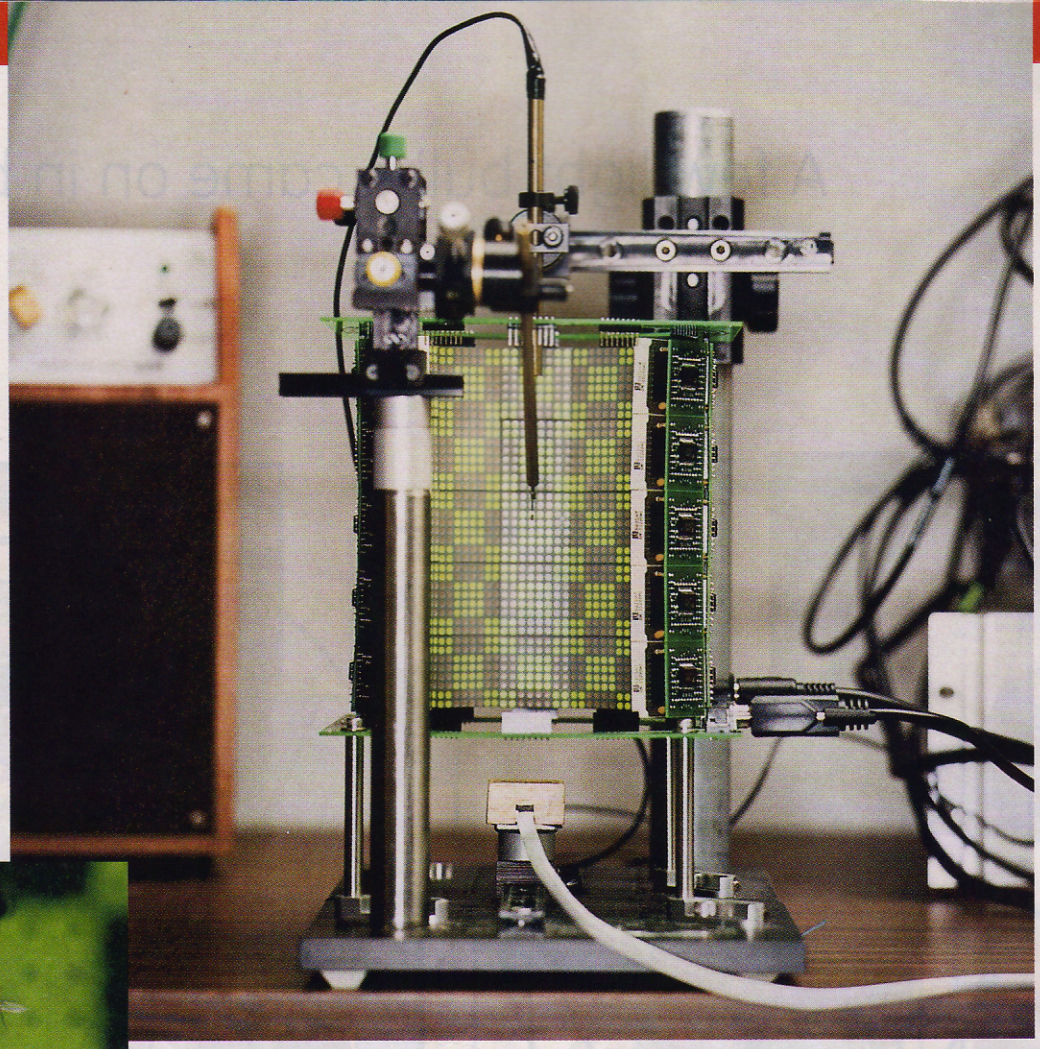


PHOTOGRAPH BY MISHA GRAVENOR FOR NEWSWEEK

INVENTING THE FUTURE: Innovation's Next Frontiers

Newsweek **(ISSN 0028-9604)**, October 25, 2004, Volume CXLIV, No. 17. In the U.S. send subscription inquiries to Newsweek, P.O. Box 5571, Harlan, IA 51593-1071. In Canada: Newsweek, Inc., P.O. Box 4067, Postal Station A, Toronto, ON M5W2K1. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 40051822. Canadian GST No. 123-321-309. All changes of address: **800-634-6850**. All other inquiries: **800-631-1040**. Unless otherwise indicated by source or currency designation, all terms and prices are applicable in the U.S. only and may not apply in Canada.

Newsweek is published weekly, except for two issues combined into one at year-end, for U.S. $41.08 a year and Canadian $61.88 a year, by Newsweek, Inc., 251 West 57th Street, New York, NY 10019-1894. Richard M. Smith, Chairman and Editor-in-Chief; Stephen Fuzesi Jr., Chief Counsel and Secretary. Periodicals postage paid at New York, NY, and at additional mailing offices. **POSTMASTERS: send address changes to Newsweek, P.O. Box 5572, Harlan, IA 51593-1072.** Printed in U.S.A. We may make a portion of our mailing list available to a select group of companies. If you would prefer that we not include your name, please contact subscriber services by mail, phone or e-mail at nwsub@newsweek.com.



2 What A Fly Knows

BY JERRY ADLER

SOMETIMES, AT THE start of a lecture, Michael Dickinson will set a wineglass of vinegar or whisky down on the edge of his lectern. Dickinson, a professor of bioengineering at Caltech, is one of the world's experts on the flight mechanics of fruit flies. He has spent years fitting them with tiny harnesses, rotating them in a virtual-reality chamber, filming their wings with ultrahigh-speed cameras to catch them as they change direction in one fifth the duration of an eye blink. He has modeled their aerodynamics with an oversize robot fly whose wings flap mechanically in a fluid-filled tank. As he has begun to understand how they fly, his interest has turned to the related question of how they know where to go. How, with eyes so simple that they render the world in a matrix of just 25 by 25 pixels, can they find a wineglass in a classroom and land unerringly on its edge? To demonstrate the point, he holds up the glass at the end of his lecture, and there they are.

FLIGHT SIMULATOR: Fruit fly (inset) tracks odors in Dickinson's virtual-reality chamber

Entomologists have long been fascinated by the ability of insects to track odors to their sources from as far as one kilometer away. Dickinson sees a potential application. Consider the problem of finding a lost hiker in the woods. Who will reach him first—the park police or the mosquitoes? But now suppose we could deploy a fleet of drone aircraft equipped, like mosquitoes, with sensitive detectors for carbon dioxide. Could we build such devices, and make them cheap and robust enough to cover a large territory? In part, this is a software problem: how to conduct a search in the real world of three dimensions, with its shifting wind currents and unpredictable obstacles. Insects solve it with a brain—in the case of fruit flies—the size of a poppy seed, containing perhaps 300,000 neurons. The average human has 100 billion.

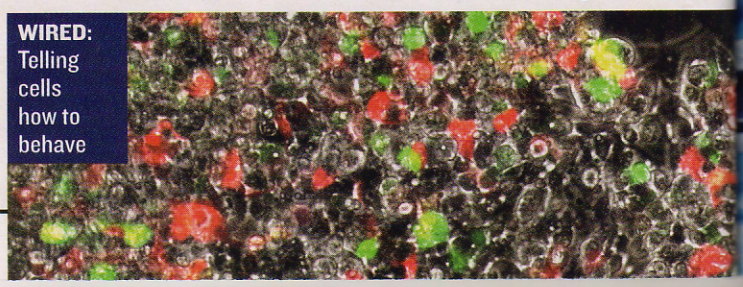
To investigate how they do it, Dickinson has built a miniature fly world, a cylindrical cage about a meter across and high, with varying obstacles and background patterns projected on the walls, and electronic cameras recording the fly's movement at speeds up to 6,000 frames per second. The fly's task is to find an odor source on the floor of the apparatus. "The animal wants to track the plume to its source. So the first thing it has to do is orient upwind. But the plume is snaking around, the fly may have to avoid a visual obstacle, so there's a good chance it will lose it. What does it do then?" Dickinson is in effect reverse-engineering a living creature, taking it apart to see how it was built and how it functions, with the goal of someday replicating at least part of its behavior. We are far from being able to build machines that can walk upside down or hover like an insect, at least on those size scales, he says. But it would be nice to be able to think like them. ■

FROM TOP: PHOTOGRAPH BY MISHA GRAVENOR FOR NEWSWEEK (2), COURTESY OF WEISS LABORATORY—PRINCETON UNIVERSITY

3 How to Program A Cell

BY CARL ZIMMER

A LOT OF TODAY'S engineers got their start as kids playing with electronics kits, wiring together resistors or capacitors. Depending on how you put the pieces together, you could build a simple switch or make bulbs blink like a movie marquee.



WIRED: Telling cells how to behave