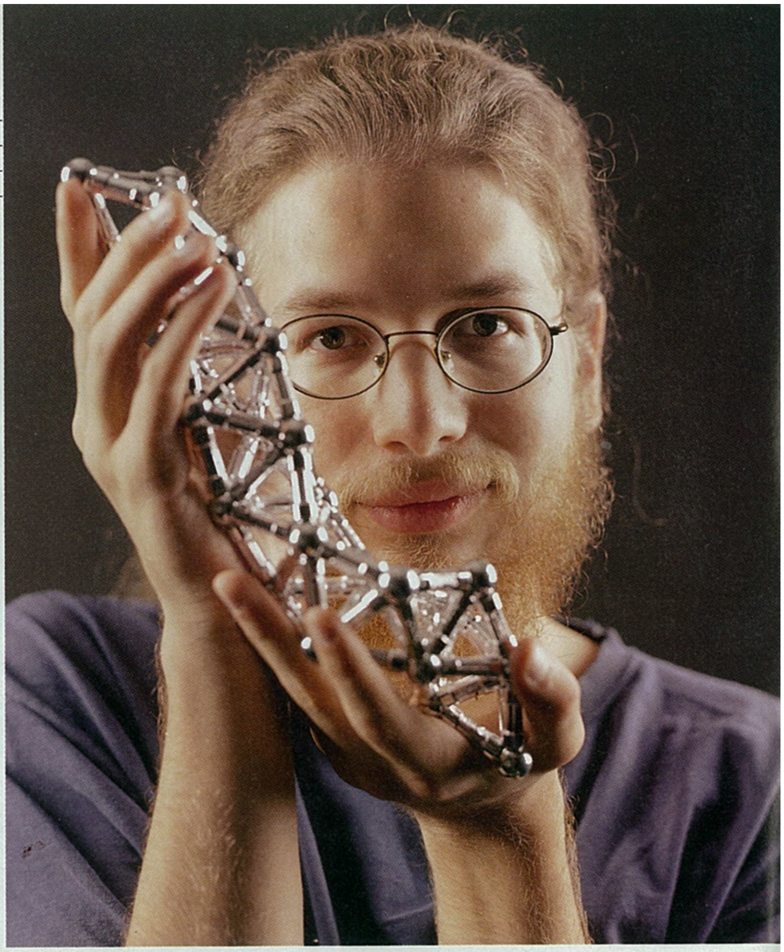
WHY ORIGAMI IS CRITICAL TO NEW DRUGS

THE FOLDED UNIVERSE

IT'S NO SURPRISE THAT ERIK DEMAINE counts juggling among his hobbies. The 24-year-old—a home-schooled child prodigy who became M.I.T.'s youngest professor ever at age 20—picks off one arcane math problem after another. "I work on anything I consider fun," he says. "I'm a geek." Demaine, who has already co-written more than 100 papers, specializes in the computational theory of folded structures, most notably the mathematics underlying origami.

What does the Japanese art of paper folding have to do with higher math? Plenty. Demaine's origami work provides insights as readily into the problems of sheet-metal engineering as it does into those of robotics and molecular biology. He made his mark while still a teen by solving two major conundrums: the "fold and cut" and "carpenter's rule" problems. The former asks what types of shapes you can make by folding a sheet of paper and cutting it just once. The answer, Demaine helped prove, is any shape you like. The latter, a long-standing and deceptively complex problem, asks whether every shape formed by folding lines linked by hinges, as in a carpenter's rule, can be unfolded. Demaine helped show it can. Now he's tackling the hottest folding problem of the day: finding the rules that govern how protein molecules twist into the complex shapes that are key to their biological function. Predicting how they do that would help pharmaceutical firms design more effective drugs. ***—By Unmesh Kher. Reported by Matt Smith/New York***



JASON GROW FOR TIME

ERIK DEMAINE

Origami isn't just his hobby. The young M.I.T. scholar—officially a theoretical computer scientist—explores the mathematics behind the art he has mastered

MATH MAKES A MATCH

Pairing came naturally to Dorry Segev, a transplant surgeon, and his wife Sommer Gentry, a mathematician. After meeting in 1999 at a swing-dance competition in Stamford, Conn., the couple became dance partners and went on to win British lindy-hop competitions before getting hitched in 2003. Last year the duo partnered to devise a system that could save hundreds of lives a year by more efficiently matching kidney donors with the 62,000-plus Americans waiting for a transplant.

More than 3,000 people die each year waiting for a kidney. Although many patients have loved ones who are willing to donate a kidney, incompatible blood types or antibodies often make the transplants impossible. As a result, most patients wait three to seven years for a kidney from a cadaver—which lasts only half as long as an organ from a live donor. To help solve this problem, Segev and Gentry devised a way to improve kidney-paired donation, which involves matching a patient who has a willing but incompatible donor with a donor-patient pair who have the same dilemma. In a swap, the donor from the first pair gives a kidney to the patient in the second pair, and the donor in the second pair gives a kidney to the patient in the first pair.

While paired donation is growing (around 25 hospitals, including Johns Hopkins, where Segev works, now use it), fewer than 100 matches have been made since 2001, in part because no national program has been put into place. That means the number of organs actually donated is less than the number being offered. "The matching programs that exist are not efficient," says Segev, whose optimized matching system, developed with Gentry, was published in the *Journal of the American Medical Association* in April. Based on an algorithm created by the Canadian mathematician Jack Edmonds in 1965, the system improves paired donation by ensuring the maximum number of matches while still factoring in age, location and willingness to travel. Segev estimates that if only 7% of kidney-transplant hopefuls participated in a national program, the health-care system would save $750 million annually, since fewer patients would spend years on dialysis waiting for that perfect match. ***—By Anita Hamilton. With reporting by Matt Smith/New York***