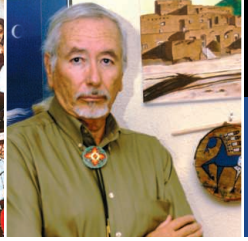


Although some still see IVF as controversial—the Vatican criticized the Nobel Committee's pick this week—the treatment has become mainstream in most developed nations. But it's still far from perfect. Only about 30% of attempts end in a live birth, despite the fact that doctors routinely place multiple embryos in patients to boost the chances of pregnancy. That's in part because even in nature only 20% of all embryos successfully implant in the womb—a fact that frustrated Edwards.

A prolific writer, Edwards was actively involved in the ethical debates around IVF from the start. As early as 1971, he published a paper in *Nature*, still regarded as a classic, that laid out the ethical, social, and regulatory issues in human embryology. He liked taking provocative positions, if only to flush out counterarguments, Johnson says. He disagreed with the scientific community's decision to declare human cloning off-limits without discussing the potential benefits. "I've never met anyone worth cloning, including myself," Edwards once quipped. "But to him, closing the debate was the antithesis of scientific inquiry," says Johnson.

–GRETCHEN VOGEL AND MARTIN ENSERINK

NOBEL PRIZES

Still in Its Infancy, Two-Dimensional Crystal Claims Prize

This year's recipients of the Nobel Prize in physics earned that honor with the most wafer-thin of discoveries and with the help of some Scotch tape. Andre Geim and Konstantin Novoselov of the University of Manchester in the United Kingdom share the prize for their discovery in 2004 of graphene, a one-atom-thick material made of carbon. Only a few years later, the material promises revolutionary advances in electronics and other technologies. "My hope is that graphene … will change our everyday lives the way plastics did," Geim says.

Graphene had humble beginnings. Geim and Novoselov first produced flakes of it by peeling them off a chunk of graphite using cellophane tape. "It just started as a Friday evening experiment," Novoselov recalls. "We were enjoying doing it." Others had been trying more complicated methods of liberating a single sheet of atoms, says Philip Kim, a physicist at Columbia University. "I was shocked that they were able to get a single layer with such a simple method," Kim says. "We were completely scooped."

Early on, graphene fascinated primarily theoretical physicists. Because of the material's two-dimensional nature, the electrons in it conspire to move as though they have no mass, much like particles of light. So just like photons, the electrons must always move, cruising along at their own specific "speed of light." All of this was predicted decades ago, but graphene provided the first example of such odd behavior.

Quickly, physicists, engineers, and chemists began to see the potential for applications. Graphene has many bizarre and often contradictory properties. For example, it is flexible like plastic but stronger than diamond, and it conducts electricity like a metal but is transparent like glass. Researchers have figured out how to make sheets measuring tens of centimeters across. They have developed methods to cut the sheets into nanometer-scale patterns and to change graphene's electrical properties by, for example, affixing hydrogen to its surface.

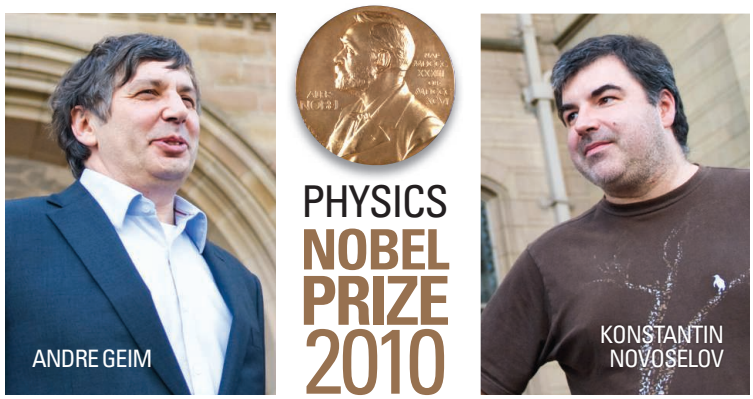
That's opened the way to scads of possible applications. The South Korean electronics company Samsung has developed a touch screen from graphene, whereas researchers with IBM have fashioned ultrafast transistors from the stuff. A sieve of graphene might also serve to sequence DNA. Even Novoselov says it's too early to say exactly what uses graphene will find. "Whatever I say now will be wrong because there has been so much progress in its properties and mass production," he says.

In that regard, this year's prize could be considered an anomaly. In the past, a few prizes have quickly spotlighted discoveries that upended the prevailing theory; others have recognized advances that over decades had led to ubiquitous applications. This year's prize, by contrast, honors physics that by all accounts is beautiful but not revolutionary. "You don't need a new theory" to understand graphene, says Jeroen van den Brink, a theorist at the Institute for Materials Sciences at the Dresden University of Technology in Germany. At the same time, it celebrates the potential for applications yet to come. "Will this really come into the market?" Kim says. "I think it's really difficult to say." Still, everyone interviewed by *Science* says Geim and Novoselov thoroughly deserve the prize.

The prize is also unusual because one recipient has another claim to fame. In 2000, Geim won a share of an Ig Nobel Prize, a satirical award given out by the publishers of the *Annals of Improbable Research*, for magnetically levitating a live frog. Geim is the first person to win both prizes. During a press conference announcing the Nobel Prize, Geim reacted with unusual candor to his latest award: "When I got the telephone call, I thought, 'Shit!' because it is a life-changing event."

–ADRIAN CHO

With reporting by Daniel Clery.



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