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Peter Coy

The Economist Who Helped Patients Get New Kidneys

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An operating room. Surgeons around a table. On it, a stainless steel bucket with something bloody inside. A step or two back, a man in a yellow gown, his brow furrowed and his arms behind his back.

The object in the bucket is a kidney that is being transplanted from one person to another. The man in the yellow gown is Alvin Roth — a doctor, but of operations research, not medicine — and he is keeping his hands out of sight to make sure nobody tries to hand him anything. (Such as the kidney.)

Roth shared the Nobel Memorial Prize in Economic Sciences in 2012 for work he did on practical applications of game theory, including a brilliant system for increasing matches between kidney donors and recipients. He has also worked on better matching of medical students to hospital residencies, children to schools in New York City and Boston and newly minted Ph.D. economists to starting jobs at universities.

Not bad for a guy who never graduated from high school. Columbia University admitted him without a diploma after he dropped out of Martin Van Buren High School in Queens. (The high school relented and gave him an honorary one after he got the Nobel.)

There is a lot to say about Roth, including his honorary seventh-degree black belt from the Japan Karate Association. He is a professor in the economics department of Stanford, having taught previously at the University of Illinois, the University of Pittsburgh and Harvard. He has a long list of publications. But when I interviewed him last week I focused on kidneys. His idea for increasing matches was lifesaving.

It's tragic that thousands of people die each year waiting for a kidney transplant, because there's no reason for there to be a shortage. People are born with two kidneys and need only one to live. The problem is that people don't like giving kidneys to strangers, and don't always match well with loved ones who might need one. The immune system rejects kidneys that aren't good matches.

When Roth showed up in that yellow gown in a Cincinnati hospital in 2006, he was watching an operation that he had helped arrange. Surgeons had gotten the good idea that they didn't always have to depend on a tissue match between a person in need of a kidney and the family member who was willing to donate a kidney. Instead, they could bring two pairs of people together and swap kidneys between them. The willing donor from pair A could give to the recipient in pair B and the willing donor in pair B could give to the recipient in pair A, assuming their tissues were a good match.

But Roth thought that surgeons could do a lot better than that. The system that he observed required four operations at nearly the same time: two simultaneous removals followed by two simultaneous implants. The system could be extended to three donor-recipient pairs, but it wasn't scalable much beyond that. The operations had to be simultaneous because nobody gives a kidney to a stranger if his or her loved one isn't getting one at the same time.

In 2003, Roth, Tayfun Sonmez and Utku Unver released a working paper that discussed how to better coordinate kidney exchanges. They sent it to a number of transplant surgeons. "The only one who replied was my Harvard colleague Frank Delmonico, and we helped him and his transplant colleagues start the New England Program for Kidney Exchange," Roth wrote in December of last year in another working paper, "Market Design and Maintenance."

The next step was a 2006 paper in the American Journal of Transplantation by the same three authors along with Delmonico and another transplant professional, Susan Saidman. The five showed that all it would take to start a long chain of donations between live donors was one kidney from an altruistic donor who had no expectation of getting anything in return. That good Samaritan would give a kidney to the first pair of people in the chain. (In each pair there is someone who needs a kidney and a relative who is prepared to donate one, but isn't a match.) The relative of that first recipient would then give a kidney to the recipient in pair B. Then donor B would give to recipient C, donor C to recipient D and so on. People would be willing to give because their loved ones had already gotten. The team wrote an algorithm for generating the biggest set of matches out of a group of donors and recipients, thereby saving the most lives.

The first long swap chain was reported in 2009, and the idea caught on from there. Chains went from dozens of kidneys in length to more than 100. In 2021, UAB Hospital, the hospital of the University of Alabama, Birmingham, completed a chain of 126 kidney donations, which began in 2013 and which it claimed was the nation's longest.

Long donation chains do have a weakness. They can break if a person whose loved one received a kidney reneges on the agreement to then give one, or is judged medically unsuitable to donate. An alternative is to turn the chain into a pool. When the donor in the pair gives a kidney to the pool, the recipient in the pair receives a voucher that entitles him or her to receive a kidney from the pool. There's no guarantee that a match will be found quickly, but people can typically get a kidney faster than if they hold back until a donation chain is built, Michael Lollo, the chief strategy officer of the National Kidney Registry, which offers a pool-and-voucher alternative, told me. Lollo, by the way, is a former New York City Police Department detective who donated one of his kidneys altruistically.

The National Kidney Registry says it was responsible for facilitating 23 percent of the living-donor kidney transplants in the United States in the last quarter of 2023. The Alliance for Paired Kidney Donation also employs something like vouchers, although it sticks more closely to Roth's concept of building a chain of donors and recipients.

Finding good matches would be easier if every potential donor and recipient were in the same database, but that's unlikely to happen soon because the various registries and transplant networks aren't prepared to merge with one another.

The struggle to come up with a winning formula for kidney transplants is the kind of thing that Roth loves to think about. New rules represent efforts, not always successful, to solve a real-world problem, he told me. As the world evolves, the rules need to evolve with it.

A turning point for Roth, when he changed from a theorist to a practitioner, had come before then, in 1995, when he was asked to work on the problem of assigning medical students to hospital residencies. He had written a scholarly paper saying that the assignments had become more difficult because there were getting to be more two-doctor couples who wanted to be assigned to the same city. Now the medical establishment was asking him to solve the problem he had correctly identified, which had created a crisis of confidence in the matching program.

"I have this visceral memory of picking up the phone and being sorry I picked it up," he told me. "This hard problem was going to be my problem." He and Elliott Peranson, the owner of a Toronto-based matching service, did solve the doctor-couple problem in an approximate way using computation and experimentation rather than pure theory. He said he found that deeply satisfying.

What is it like to straddle the worlds of academia and practice? I asked. “It takes a lot of patience,” he said. “Market design is outward-facing. I learn from trying to persuade people who aren’t economists. It’s a lot of fun also. Sometimes you have to go beyond your completely reliable scientific knowledge.”

Outlook: Mark Zuckerberg

Shares of Meta Platforms, the parent of Facebook, soared last week after the company reported that its earnings in the last quarter of 2023 had tripled from a year earlier and — crucially — announced its first dividend. “We’ve made a lot of progress on our vision for advancing A.I. and the metaverse,” Mark Zuckerberg, the chief executive, said in the earnings announcement. The company said it intends to keep paying dividends each quarter “subject to market conditions and approval by our board of directors.”

Quote of the Day

“There is no such thing as normal. We’re never going back to anything. We’re always going forward.”

— Julia Coronado, president, MacroPolicy Perspectives LLC, during an American Enterprise Institute online panel (Jan. 24)

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