By the 'Numb3rs'

A Baltimore husband-and-wife team creates a formula for matching kidney transplant donors with recipients.

Tonight, the equation has a starring role on a network TV show.

In the real world, organ transplant physicians use sophisticated computer programs to find scarce donors of medically compatible kidneys for desperately ill patients. It's math saving lives.

But in Hollywood, writers for the hit CBS crime drama 'Numb3rs' wondered whether the FBI could use the same organ-matching mathematics in reverse—to track down the most likely recipient of a black-market kidney, so they can nab the criminals behind the scheme.

That's math catching crooks, and it's the premise of tonight's episode of 'Numb3rs,' with a script inspired by organ-pairing mathematics done at the Johns Hopkins University School of Medicine.

Hopkins gets a mention in the script, but not Hopkins transplant surgeon Dr. Dorry Segev, nor his wife and collaborator, Sommer Gentry, a Naval Academy math professor and Hopkins researcher.

Their combined work in "optimization theory" inspired the mathematical solution to tonight's mystery.

"It's much more important for me that the concepts and excitement behind organ donation and saving lives through mathematics are reaching a national audience," Segev said. "I hope it creates more interest for this program, and any other programs that increase organ donation and awareness."

Math teachers, too, are thrilled by the success of 'Numb3rs,' and by the positive light it has cast on math and mathematicians.

"Most of the math teachers I know who watch TV latch onto to this right away as something [they] can use to motivate students," said Cathy Seeley, president of the National Council of Teachers of Mathematics, which represents 300,000 math instructors in the United States.

More than 22,000 teachers across the country are downloading classroom materials linked to each new 'Numb3rs' episode. They've been prepared with help from the teacher's council and Texas Instruments [Please see NUMB3RS, pg 19]
‘Numb3rs’ solution

David Krumholtz is genius Charlie Eppes, who uses math to help his brother solve crimes on “Numb3rs,” which airs on CBS.

CLIFF LIPSON (CBS)

whiz Charlie Eppes is a superhero,” said Lordon.

“He can do things with practically no data, and if it’s epidemiology or earthquake engineering or aerodynamics — you name it and Charlie knows it. ... He can do things more mortals at universities can’t.”

The math concepts that figure in their plots are derived from the news, academic journals, popular articles and books, and then researched by the show’s writers.

Tonight’s episode was born when writer J. David Harden was exploring reports of a growing overseas black market in human organs.

What if someone brought poor people here from the Third World, took their kidneys and sold them to desperate Americans willing to pay a price to sidestep the long wait for donated organs?

While researching immune system compatibility, along with the many factors of age, location, blood type and tissue proteins that must be matched to find suitable organs for desperate patients, Harden happened across the work done by Segev and Gentry.

The couple had tackled a problem that arises when a healthy organ donors to donate one kidney to an ailing friend or family member, only to find their tissues are incompatible. In such cases, the donor can’t help, and the patient remains without an organ.

But what if doctors could find a second mismatched pair whose tissues would provide matches to the first pair? Both kidney patients would get suitable organs from strangers, and each donor would help two sick people get well.

The mathematical model by Segev and Gentry demonstrated that an optimized, national system for paired organ donations could produce thousands of additional matches annually. It would save hundreds of lives and hundreds of millions of dollars spent on kidney dialysis as patients wait for organs.

Efforts are underway to build such a national system. But for now, only a handful of regional centers are doing paired donations, limiting the results.

Segev said about 60 transplants from paired donations have been done nationally, half of them at Hopkins.

That’s out of 16,000 kidney transplants performed each year, mostly from deceased donors. About 61,000 U.S. patients are on waiting lists.

The organ shortage is the primary issue facing transplantation right now,” said Gentry.

What Harden’s fictional FBI agents ask in tonight’s episode of “Numb3rs” is whether such a matching system could enable them to take the unique blood and tissue types of a rescued black-market donor, and use them to identify the most likely recipient on the organ waiting list.

“They’re feeling is if they can find who [the organ] is going to, they are going to find the person who’s doing this,” said Heaton.

Segev said the idea makes reasonable sense, provided the FBI could gain access to the information, which is protected by federal privacy rules.

The script was already finished when the writers called Hopkins and asked to consult with Segev and Gentry to make sure they got the details right.

Gentry used a holiday visit with her parents in Los Angeles to talk with the show’s writers. “Of course they had to work within the constraints of their story line,” she said. So it “ends up dealing with something that happens very seldom, if ever — black-market organs.”

But the producers wanted to make their filmed shots of computer screens look as much like the real tissue-matching system as possible. (Sometimes, they even use real mathematicians as stand-ins for the actors as they scan equations on a blackboard.)

“They wanted to represent the mathematics of what we were doing faithfully,” Gentry said. “That is important for their show. There are a lot of math-savvy people watching.”

What’s more, she said, “I think it’s wonderful to make math something glamorous, because in the real world I think that is it. I do math that might save someone’s life. Math is not just equations in a book.”

So does that put Segev and Gentry among Numb3rs’ many devotees? Not exactly.

“We don’t own a television,” Segev confessed. “We don’t have time to watch.”

Frank Roylance is a staff writer for The Baltimore Sun and is on the Web at frank.roylance@baltimoresun.com