Adult kidneys constantly grow, remodel themselves, study finds

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Contrary to long-held beliefs, a new study shows that kidneys have the capacity to regenerate themselves. Credit: Shutterstock

(Medical Xpress)—It was thought that kidney cells didn't reproduce much once the organ was fully formed, but new research shows that the kidneys are regenerating and repairing themselves throughout life.

Researchers at the Stanford Institute for Stem Cell Biology and Regenerative Medicine and the Sackler School of Medicine in Israel have shown how the kidneys constantly grow and have surprising ability to regenerate themselves, overturning decades of accepted wisdom that such regeneration didn't happen. It also opens a path toward new ways of repairing and even growing kidneys.

"These are basic findings that have direct implications for kidney disease and kidney regeneration," says Yuval Rinkevich, PhD, the lead author of the paper and a postdoctoral scholar at the institute.

The findings were published online May 15 in *Cell Reports*.

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"This research tells us that the kidney is in no way a static organ," said Benjamin Dekel, MD, PhD, a senior author of the paper and associate professor of pediatrics at Sackler, as well as head of the Pediatric Stem Cell Research Institute at the Sheba Medical Center in Israel. "The kidney, incredibly, rejuvenates itself and continues to generate specialized kidney cells all the time."

Irving Weissman, MD, professor of pathology and of developmental biology and director of the Stanford institute, is the other senior author.

The research, which was done in mice, also shows how the kidney regenerates itself. Instead of a single type of kidney stem cell that can replace any lost or damaged kidney tissue, slightly more specialized stem cells that reside in different segments of the kidney give rise to new cells within each type of kidney tissue.

Like a tree

"It's like a tree with branches in which each branch takes care of its own growth instead of being dependent on the trunk," Dekel said.

The scientists also showed that the decision these cells make to grow is made through the activation of a cellular pathway involving a protein called Wnt. Even though populations of kidney epithelial cells look the same, the most robust kidney-forming capacity can be traced back to precursor cells in which Wnt is activated and that can only grow into certain types of specialized kidney tissue, Rinkevich said. "The realization that Wnt signaling

is responsible for the growth of new kidney tissue offers a therapeutic target to promote or restore the regenerative capacity of the kidneys," he said. "We may be able to turn on the Wnt pathway to generate new kidney-forming cells."

This finding will be important for scientists who attempt to create kidney parts in the lab, the researchers said.

However, they cautioned that such advances are not imminent. "To grow a whole kidney in the laboratory would be complicated because we would need to orchestrate the activities of many different kinds of precursor cells using just the right stimuli," Dekel says. "It's not like the blood and immune system, which can be reconstituted from one type of stem cell."

Provided by Stanford University Medical Center