Computer kidney could provide safer tests for new medications

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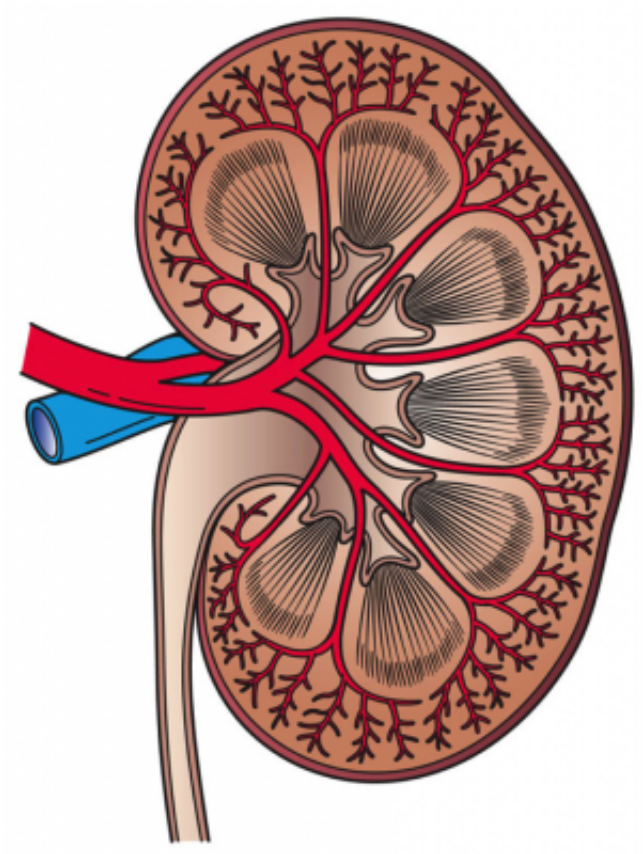

This image shows a cross section of a kidney. Credit: Holly Fischer/Wikipedia

A University of Waterloo researcher has spearheaded the development of the first computational model of the human kidney.

The new model will allow scientists to gain better insights into how new

drugs that target the kidney, such as diabetes medication, may work. It will also enable researchers to better learn about the functions of the kidney, including the how the organ regulates the body's salt, potassium, acid content without having to employ invasive procedure on a patient.

The new development replaces previous models that were based on rodent kidneys.

"While the computational model is not an actual person, it is very inexpensive to run, and presents less of a risk to patients," said Anita Layton, lead author of the study and professor of Applied Mathematics, Pharmacy and Biology at Waterloo. "Certain drugs are developed to target the kidney while others have unintended effects on the kidney and computer modelling allows us to make long-term projections of potential impacts, which could increase patient safety."

In developing their computational model of the human kidney, the researchers incorporated anatomic and hemodynamic data from the human kidney into the published computational model of a rat kidney.

They then adjusted key transporter data so that the predicted urine output is consistent with known human values. Due to the relative sparsity of data on the renal transporter expression levels in humans, they identified a set of compatible transport parameters that yielded model predictions consistent with human urine and lithium clearance data.

"The computational model can be used to figure out things like the cause of kidney failure," said Layton, who is the Canada 150 Research Chair in Mathematical Biology and Medicine."Your doctor might have a hypothesis that it is this drug that you took or this disease that you have that has caused your kidney to fail.

"The computational model can simulate the effects of the drug to see if

it is bad for the kidney, and if so, which part of the kidney it is actually killing."

The paper, titled A Computational Model of Epithelial Solute and Water Transport along a Human Nephron, co-authored by Layton and Duke University's Professor Harold Layton, was recently published by the online journal *PLOS Computational Biology*.

Provided by University of Waterloo