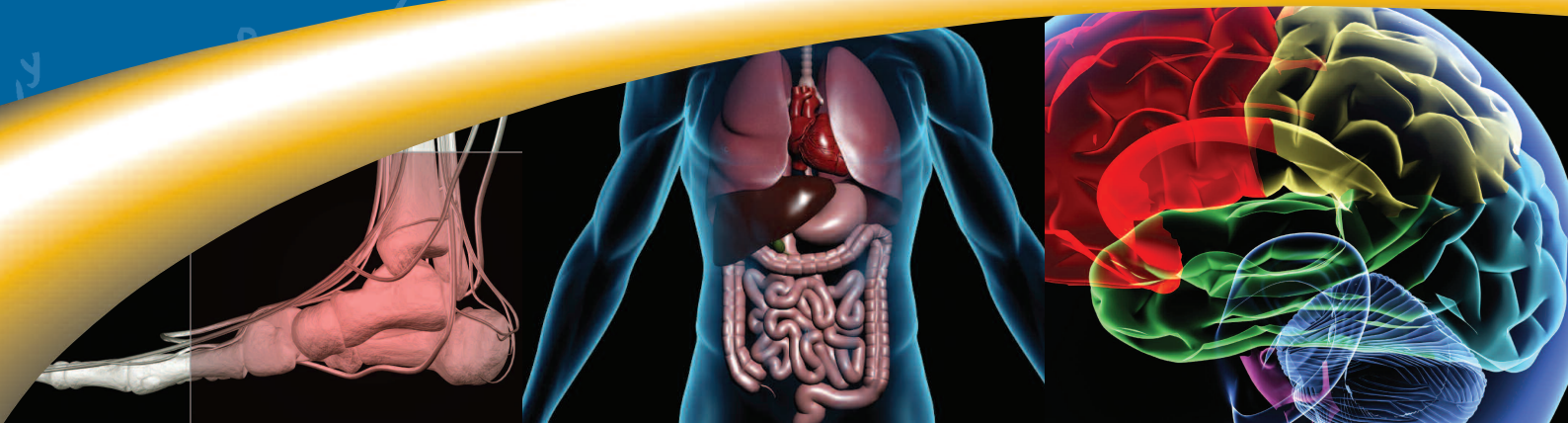


# Hidden maths in your body?

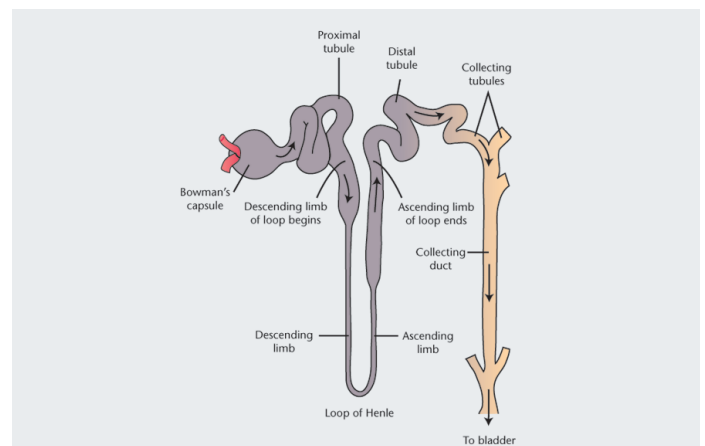


Mathematics and applied mathematics are used in everyday life. Stock markets, mobile phones, car manufacturing, Google, Hollywood special effects, digital TV and satellites all use cutting-edge mathematics tools in their basic functions. The Mathematical Modelling Series presents a number of applications of mathematics in domains as varied as the human body, volcanology, telecommunications or finance.

When something goes wrong inside our bodies we expect doctors to know every single detail of all the processes that take place inside us. Sometimes this is impossible because the human body is too complex and some of its parts are too small or too well hidden, so that it is difficult for scientists to study precisely how they work. In such cases scientists build models and test them using mathematics and computers.

## How it works

One of the most difficult regions to reach and so to study within the body is the inner part of the kidney. The kidney is the organ responsible for 'cleaning' the body of toxic and excess substances, as well as for keeping the correct water balance. If you only drink small amounts of water, the kidney is able to 'clean' the body by using the minimum amount of water. In this case urine will be really concentrated and therefore the water needed for your body's daily tasks will not be compromised. If you drink too much water, the kidney will get rid of all the water excess. The formation of urine takes place in the kidney, inside a million tiny tubular units called nephrons (see figure). Some of these nephrons go very deep into the kidney, and therefore studying what happens in them when you are sick becomes a big challenge. Differential equations can be used to model and test some of the hypotheses that doctors/biologists/physiologists have about what is happening.



Parts of a nephron.

## Conclusion

Maths can be used to explain how the body works. Maths is not only hidden in your kidney but also in other organs such as your heart. Co-operation between mathematicians, biologists and doctors could help to define the future of medicine.

### Parts of the curriculum used in this project:

- Differentiation
- Geometry, volumes and areas
- Ordinary differential equations
- Integration
- Mass conservation
- Biology

### ACKNOWLEDGEMENTS AND MORE INFORMATION

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If you want more information about MACSI and this project:

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