



Curing the Achilles Heel

TakeAIM 2019 Runner-Up:

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Achilles – there’s no one else who could fulfil his role. He’s strong, he’s quick, his endurance is incredible

...and he’s a little bit gooey.

I’m referring to your Achilles tendon of course, not the Trojan warrior. Your Achilles tendon is one of many tendons in your body acting as a spring to connect muscles to bones. Tendons consist of a bunch of fibres surrounded by cells and a sticky elastic fluid. Tendinopathy - disease resulting from tendon overuse - is a painful and poorly understood condition. It is the most common musculoskeletal presentation to GPs in the UK and there is no gold standard treatment.

Tendon fluid exhibits interesting behaviour in that, unlike water, how easily it flows depends on the stress applied. Imagine a scenario where you have a delicious bowl of chips waiting to be devoured. All it needs is a squeeze of ketchup ... but nothing comes out. You bang the bottle in frustration and suddenly it all comes flowing. We must understand this ‘non-Newtonian’ behaviour in order to predict how tendons function and respond to exercise.

I am developing a mathematical model of the human tendon. Using data provided by patients, this model will predict fluid flow and associated tendon cell stresses in the tendon under different forms of exercise. This will provide us with a cheap and non-invasive tool to optimise rehabilitation exercises regimes and fitness tracking apps. We can also investigate the benefit of injecting lubricating fluids, aimed at improving sliding between tendon components.

The Smith Institute, enabled by the generous sponsorship of our leading corporate partners, ran the TakeAIM competition in 2019 to make visible the crucial role that mathematics will increasingly play in all aspects of our lives. The competition was open to undergraduate and postgraduate students working in the mathematical sciences. First prize was £1,000 of Apple or Amazon vouchers, with second prize winners receiving £200 and 8 runners-up receiving £25 in their choice vouchers.

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