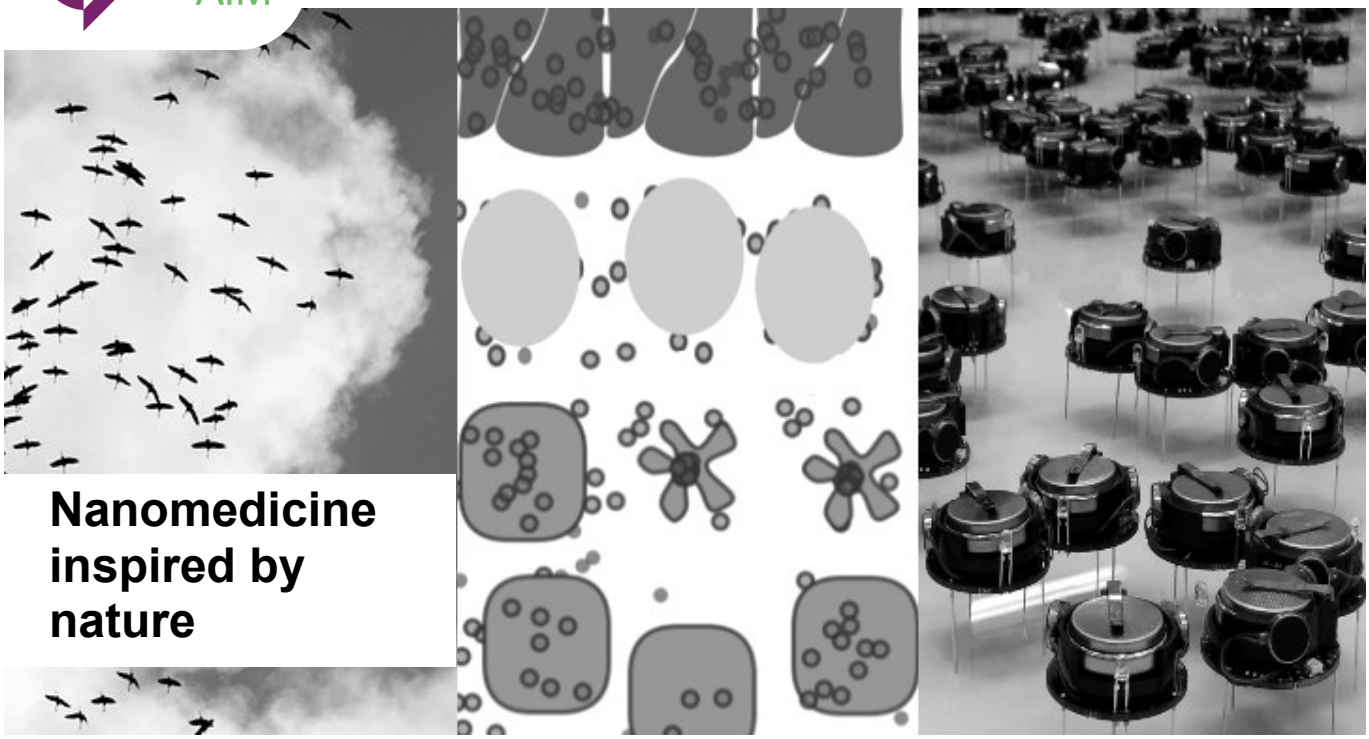
Take AIM

Smith institute
for industrial mathematics and system engineering



Nanomedicine inspired by nature

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Have you ever seen a flock of birds dance in the sky? While individuals behave rather simply, the patterns emerging can be quite complex! These are called swarm behaviours. What if I told you that one day, this kind of phenomenon might happen somewhere in your body?

Nanomedicine is a promising field for cancer treatment. Nanoparticles, with a diameter a thousand times smaller than a hair, can be loaded with drugs and sent to a tumour, via direct injection or through the bloodstream. The nanoparticles are engineered to bind to cancer cells, which avoids side effects usually encountered with current treatments.

The final behaviour of nanoparticles in the tumour is hard to predict. Testing all possible formulations in the lab is unthinkable because of the costs and the time it would take. Mathematical models are needed to evaluate the potential efficiency of a treatment. We're talking about millions of trillions of nanoparticles here! Could these nanoparticles “swarm” in the tumour, as a “smart treatment”? That's what our team is trying to figure out.

Our simulations model the speed of the nanoparticles, depending on their size, and their ability to stick to cancer cells. Results can be counterintuitive! Turns out that nanoparticles that are too sticky may all be eaten up by the same cancer cell, preventing them from killing other cells deep in the tumour. To see this effect in action, we do experiments on a swarm of a thousand coin-sized robots that are easy to program.

The use of mathematics has profound consequences in all walks of life, but the opportunities that it opens up often go unrecognised or underexploited. The Smith Institute, enabled by the generous sponsorship of our leading corporate partners, ran the fifth annual TakeAIM competition in 2015 to make visible the crucial role that mathematics will increasingly play in all aspects of our lives. The competition was open to all undergraduate and postgraduate students working in the mathematical sciences. The authors of the two best entries each received £1,000 of Apple vouchers as their prize, with £100 of Amazon vouchers being awarded to four runners-up.