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ACTIVE MATTER

Dynamical networks of worms

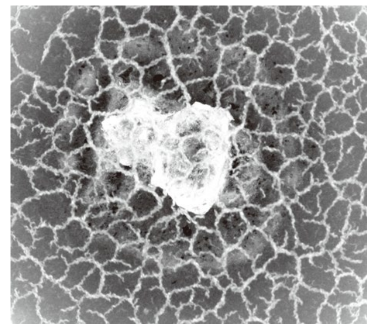
The worm *Caenorhabditis elegans* is a 'model organism' in biology, meaning that it is a common lab animal that has been studied extensively and characterized well. But let enough of these little worms crawl on a surface and their behaviour becomes surprising — they form a dynamical network that can be understood using active matter physics, and controlled using genetic manipulation.

Writing in *Nature Communications*, Takuma Sugi and colleagues report on dynamical networks formed by bundle-shaped aggregates of *C. elegans*. These networks had not been seen before because they only form when the worms are packed tightly enough. This condition is hard to meet using standard *C. elegans* feeding protocols, but Sugi and co-workers achieved it by 'borrowing' methods developed for other worms.

The networks form when worms collide and align nematically, that is, either head-to-head or head-to-tail. The worms attach to each other because of the surface tension of the water around them. Increasing the humidity of their environment made the network coarsen into thicker strands surrounding larger holes. The worms' collective behaviour is reproduced with a simple active matter model with short-range repulsion, medium-range attraction and nematic alignment between nearby worms.

Whereas many biological systems, from components of cells to flocks of birds, can be understood using active matter ideas, an exciting aspect of building an active material out of *C. elegans* is that many aspects of the worm's behaviour can be controlled via its well-characterized genetics. Sugi and colleagues found that mutant worms that move on curvier trajectories than non-mutants form tighter networks. These networks could be transiently perturbed by controlling the worm's motility using optogenetics (a technique that uses light to control genetically modified cells). This controllability means that *C. elegans* may become a model organism for understanding animal collective behaviour.

Zoe Budrikis



Credit: Adapted from Sugi et al. (2019), CC-BY-4.0

ORIGINAL ARTICLE Sugi, T. et al. *C. elegans* collectively forms dynamical networks. *Nat. Commun.* **10**, 683 (2019)