

Sperm crawl and collide on way to egg, researchers say

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Scientists at the Universities of Birmingham and Warwick have shed new light on how sperm navigate the female reproductive tract, 'crawling' along the channel walls and swimming around corners; with frequent collisions.

Research results published today in the [Proceedings of the National Academy of Sciences](#) (*PNAS*) provide fresh insight into how [sperm](#) might find their way to the egg that will help to inform future innovation in the struggle to treat [infertile couples](#).

Scientists led by Dr Petr Denissenko, of the School of Engineering at the University of Warwick, and Dr Jackson Kirkman-Brown, lead in [reproductive biology](#) at the University of Birmingham, explored what properties distinguish the tens of cells which make it to the egg from the millions of [sperm cells](#) ejaculated.

Contrary to popular belief, the authors report, sperm rarely swim in the central part of the three-dimensional female tract, instead travelling along the walls, meaning in the body they are negotiating complex and convoluted channels filled with viscous fluids.

To study cell behaviour in confined space, cells were injected into hair-thin microchannels.

"When the channel turns sharply, cells leave the corner, continuing ahead until hitting the opposite wall of the channel, with a distribution of

departure angles, the latter being modulated by fluid viscosity," the reports' authors said.

"Specific wall shapes are able to preferentially direct motile cells," the authors report.

"As a consequence of swimming along the corners, the domain occupied by cells becomes essentially one-dimensional.

"This leads to frequent collisions and needs to be accounted for when modelling the behaviour of populations of migratory cells."

Dr Kirkman-Brown, who is also Science Lead for the Birmingham Women's Fertility Centre, comments: "Two key questions in reproduction are:

- how are the millions of sperm selected down to around ten that reach the oocyte?: and
- Can we use a similar method to select sperm for fertility treatments?

"In basic terms – how do we find the 'Usain Bolt' among the millions of sperm in an ejaculate. Through research like this we are learning how the good sperm navigate by sending them through mini-mazes. "

Dr Denissenko of the University of Warwick added: "Sperm cell following walls is one of those cases when a complicated physiological system obeys very simple mechanical rules.

"I study fluids in a variety of environments, but moving to work with live human sperm was quite a change.

"I couldn't resist a laugh the first time I saw sperm [cells](#) persistently swerving on tight turns and crashing head-on into the opposite wall of a micro-channel.

"More seriously, it's great being part of an internationally leading team based out of the Midlands addressing a key problem."

Dr Kirkman-Brown concludes: "Previous research from the group indicates that the shape of the sperm head can subtly affect how the sperm swim.

"Combined with this data we believe new methods of selecting sperm, perhaps for quality or even in certain non-human species for sex may become possible."

The researchers suggest that the combined effect of the fluid rheology and three-dimensional architecture should be taken into account in future in-vitro studies.

More information: Human sperm swimming in micro-channels, *Proceedings of the National Academy of Sciences* (2012).

Provided by University of Warwick

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