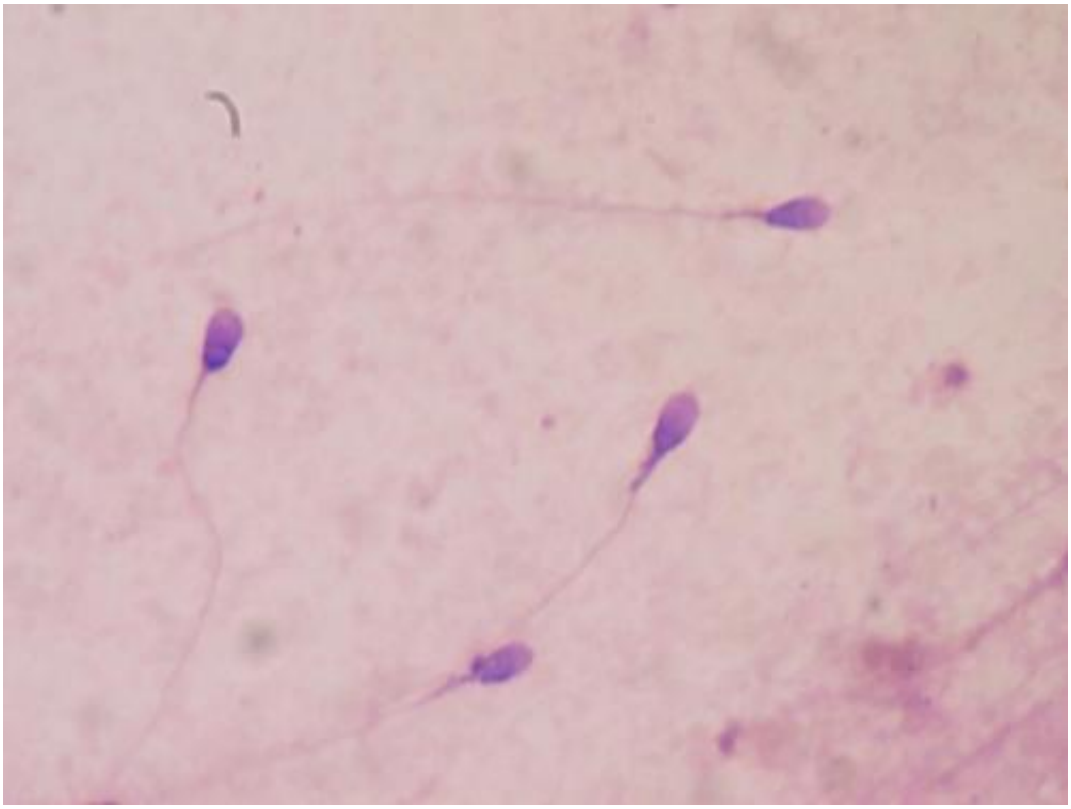
Let the sperm races begin

March 4 2019



Human sperm stained for semen quality testing in the clinical laboratory. Credit: Bobjgalindo/Wikipedia

Faster, cheaper and less damaging to DNA, a microchip device that pits sperm racing against one another is being developed by Afrouz Ataei from Florida Atlantic University and may help to improve IVF success rates in the future.

Ataei is presenting the fitness stats on the sperm sorted by her device this week at the American Physical Society March Meeting in Boston, and she will also participate in a press conference describing the work. Information for logging on to watch and ask questions remotely is included at the end of this news release.

"An integral part of in vitro clinical procedures is the isolation of motile and morphologically normal viable sperm from the semen," said Ataei, who explained that this step increases the chances of successful egg fertilization in plastic dishes outside the body (in vitro).

However, the conventional method used to sort the speediest sperm involves centrifugation and several high-speed, G-force inducing spinning steps, which can damage the delicate DNA encased within a sperm's head. And an egg fertilized with sperm damaged in this manner is unlikely to progress to a viable embryo for implantation into the womb.

In women under 35 there is only a 21.5 percent chance of a single round of in vitro fertilization, or IVF, resulting in a full-term live birth. And with each round of IVF in the U.S. costing an average of $10,000-$15,000, this makes improving the odds of IVF success key for the financial and emotional well-being of many of the couples who experience fertility problems.

Ataei's device manages to select the faster swimmers without any damaging centrifugation steps. Instead, her device exploits the observation that sperm swim against an opposing flow of liquid at certain flow rates. The microchip is designed to induce hydrostatic pressure, which generates liquid flow without the use of other equipment.

"No other devices generate the flow in this way, and our device is much

easier to use," said Ataei.

An unprocessed semen sample is injected into the chip's inlet until it fills the lower microchamber, and the sperm gradually swim upstream against the flow. If fit and fast enough, the sperm make it past the ultrathin membrane filter, which acts as the finish line, and into the top chamber. Ataei has analyzed the winner's fitness stats.

"After 45 minutes we collect the sample from the top retrieval chamber and start observing and analysing the sperm's velocity, whether they have DNA fragmentation, and what's the percentage of this compared with current methods like centrifugation," said Ataei. "We found that at a specific flow rate, we get the most motile sperm with highest motility."

"I think this device has potential for clinical use," Ataei added.

The team at Florida Atlantic University is continuing to optimize the microfluidic device, hoping to increase the concentration of sperm collected in the top chamber before they file a patent on their design.

More information: The 2019 APS March Meeting presentation "Development of a Microfluidic Device to Sort Sperm based on their Swimming Potential against the Flow," by Afrouz Ataei, Andy W.C. Lau and Waseem Asghar, will take place Monday, March 4, at 8:12 a.m. in room 251 of the Boston Convention and Exhibition Center. Abstract: meetings.aps.org/Meeting/MAR19/Session/A48.2

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