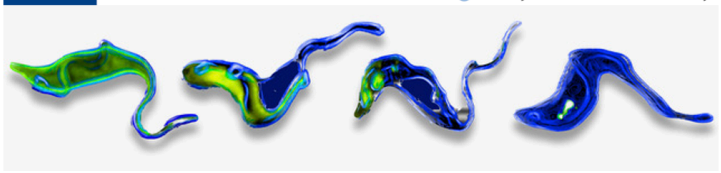

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Microfluidics Approaches for Selection and Enhancement of Sperm Motility for Improved Fertilization

Motility of sperm refers to its ability to swim in a forward direction to reach the oocyte and fertilize it. Normal sperm motility plays a crucial role in couple's reproductive health. Low motility of sperm cells could lead to issues with fertilization. Medical assisted reproduction (MAR) technologies are used to improve fertilization in this case. These imply selecting sperm with the highest motility using various techniques. However, it can occur that the selected sperm does not have the capacity of successful fertilization, due to reduced motility. In this case, it would be desirable to enhance their motility. Thus, it was shown that adding species of higher motility to other species of lower motility could result in an effect called "motility transfer"[1]. The motility transfer was demonstrated in a binary system of artificial microswimmers, i.e., synthetic Janus particles whose motility is caused by the catalytic chemical reactions at the surface of asymmetric microspheres (e.g., recently synthesized high-motility Ag/AgCl Janus particles active in bio-compatible environments [2, 3]). The proposed technique of motility control [1] can be implemented in various biological and medical systems, where one wishes to enhance the motility of insufficiently active nano- or micro-particles. In case of weakly motile sperm cells, this technique has advantages over other similar proposals (e.g., using self-propelled metallic rotors trapping sperm cells), whereby it is substantially less damaging to living sperms and much easier to implement, as it does not require the fast guest swimmers to localize and trap individual sperms one by one. We will also discuss our recent experimental advances in motility sperm selection techniques (with human sperm) using an acoustic microfluidic setup [4].

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