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Hasta la Vista Infertility?

By Lila Abassi — January 13, 2016

Spermbots [1] sounds like the premise of another series in the Terminator franchise (or RoboCop or Iron Man in a mad science kind of way). Scientists in Dresden have developed the ultimate sperm, body armor and all, to battle the age old problem of infertility.

Though there are misconceptions about gender differences, infertility [2] is an equally shared problem. The fertility of a couple depends upon several factors in *both* the male and female partner. Among all cases of infertility in developed countries, about 30 percent can be traced to male factors, 33 percent can be traced to female factors, 33 percent can be traced to factors in both the male and female partners, and 4 to 5 percent cannot be traced to obvious factors in either partner.

While many men with infertility have oligozoospermia (decrease in number of sperm cells in the ejaculate) or azoospermia (no sperm cells), some infertile men have normal sperm counts - which means something else is causing the problem, and that is the target for Spermbots. Over 80 percent of men with infertility have low sperm concentrations associated with a decrease in sperm motility (asthenozoospermia) and spermatozoa with normal morphology (appearance)(1) and so researchers at Chemnitz University of Technology in Germany have developed the John Connor of sperm. If you still have no idea what I am talking about, I will explain. About the engineering, not "The Terminator" movie, you can rent it on Netflix to understand the metaphor.

In the case of asthenozoospermia, there is nothing actually wrong with the sperm cell; it just has difficulty motoring toward the egg for fertilization to occur. Scientists have developed a microhelical armor for the tail for the sperm (flagella) that allows for artificial propulsion. These metal-coated polymer microhelices (coils wrapped around the tail of the sperm) are potent, controllable, and [have] nonharmful 3D motion behavior.

There are two main challenges to ensuring the success of this process: (1) precise, active transport in three dimensions and, (2) biocompatibility. The transport system has to be fast and capable of being controlled in both space and time. Biocompatibility means that the micro-motor system is not toxic to cells and that they are able to partake in physiological cellular interactions.

The micro-helices are magnetic and under the influence of rotating magnetic fields that allow for 3D control of movement.

In artificial laboratory settings the scientists were able to capture, transport and release sperm cells (under conditions similar to the temperature and viscosity of seminal fluid) at the cell wall of the egg for fertilization to occur, however, they were unable to achieve success with this. In an actual living system, there are a number of key limitations such as imaging technology. What can be visualized in a petri dish is much more difficult in a living being. There are proposed theoretical modalities (i.e. optical fluorescence, infrared emission, x-ray, MRI, or ultrasound) but none that have been applied.

Another limitation is that although physiological conditions can be simulated and controlled in a laboratory setting, to be able to replicate the artificially motorized sperm delivery in real life is still a long way away. As the paper's authors admit, the novelty of the micro-motor system is its application in a living system, whereby the in vitro nature of the fertilization process could be bypassed. Otherwise, all it really does is complicate the pre-existing process of in vitro fertilization (where the egg is fertilized with a sperm selected in a lab and transplanted into the uterus of the female).

The science-fiction nature of this research is what makes it intriguing. Certainly, the innovation of providing sperm the equivalent of artificial legs so they can sprint (not walk) instead of remaining paralyzed is a promising advance in the field of infertility treatments.

NOTE:

(1) Others may have a decrease in sperm motility and abnormal sperm morphology (teratozoospermia).
