

The end of the 'Lily of the Valley phenomenon' in sperm research?

February 28 2012

According to a 2003 study by German and American scientists, a component of the Lily of the Valley scent known as Bourgeonal alters the calcium balance of human sperm and attracts the sperm. The "Lily of the Valley phenomenon" – also the title of a book about smelling – was born as a result of this discovery that sperm act as swimming olfactory cells which follow a "scent trail" laid by the egg. However, a detailed explanation for the Lily of the Valley phenomenon remained illusive as neither Bourgeonal nor other scents could be identified in the female sex organ. Scientists from the caesar research centre in Bonn, an Institute of the Max Planck Society, have now discovered that sperm do not function like olfactory cells - a finding that casts doubt on the assumption that scents play a role in fertilisation.

Sperm have a long journey ahead in their quest for the egg cell or ovum, and just a few of the million [sperm](#) reach their destination. The ovum supports the sperm in their quest by transmitting "chemical signposts", known as attractants. Researchers first discovered this ingenious system in sea urchins and found out that attractants control the swimming movement of the sperm by altering their calcium balance. The attraction of the sperm to the egg is referred to as "chemotaxis". Unlike in sea urchins, which release sperm and eggs into the seawater, the conditions in the narrow human [fallopian tube](#) are very difficult to emulate in experiments.

According to another model, the female sex hormone progesterone – which is formed by cumulus cells near the ovum – attracts the sperm.

CatSper (cation channels of sperm) ion channels are responsible for the effect of the progesterone. The CatSper channels, which are found only in sperm, play an indispensable role in reproduction: men who carry a gene defect for CatSper are infertile. In a 2011 study, which was seen as a sensational breakthrough, scientists from the caesar research centre succeeded in showing that progesterone opens the CatSper channels directly and calcium flows through the channels into the sperm cell.

In their current study, the Bonn researchers demonstrate, in cooperation with scientists from the Forschungszentrum Jülich, that the Lily of the Valley scent imitates the effect of progesterone on sperm: Bourgeonal opens the CatSper channels directly – that is without deviation via olfactory receptors and complex biochemical signalling pathways as found in olfactory cells. However, the scents only work at concentrations over 1000 times higher than progesterone. Therefore, scents only work if overdosed. The "Lily of the Valley phenomenon" is a laboratory artefact: sperm do not have an olfactory signalling pathway.

These findings provide important new insights for the sperm researchers. Why are the CatSper channels so unselective, and even react to menthol if the concentration is high enough? This "promiscuous" characteristic is probably crucial for reproduction. Using different "chemical signposts", the sperm must repeatedly reassure themselves on their difficult journey to the ovum that they are still on the right track. With the help of the CatSper channels as versatile and highly perceptive sensors, sperm can "read" the chemical milieu in the fallopian tube and find the ovum in this way. The Bonn-based researchers are now concentrating on identifying other attractants in the fallopian tube in addition to progesterone. One thing is clear at this stage: it is very unlikely that these are scents.

The new insights are also significant in medical terms. If the scientists succeed in disrupting the effect of female factors on the CatSper

channels, it could lead to the development of an innovative contraceptive: the pill for men. However, such a development is still a very long way off.

More information: Brenker C, Goodwin N, Weyand I, Kashikar ND, Naruse M, Krähling M, Müller A, Kaupp UB, Strünker T. The CatSper channel: a polymodal chemosensor in human sperm. *EMBO J*. Online publication: 21 February 2012. [doi: 10.1038/emboj.2012.30](https://doi.org/10.1038/emboj.2012.30)

Provided by Max-Planck-Gesellschaft

Citation: The end of the 'Lily of the Valley phenomenon' in sperm research? (2012, February 28) retrieved 4 May 2024 from

<https://medicalxpress.com/news/2012-02-lily-valley-phenomenon-sperm.html>

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