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A Sperm Glycoprotein-based Contraceptive Vaccine

A novel vaccine-based contraceptive utilizing a sperm protein analogue significantly reduces fertility in mammalian models, providing a less inflammatory alternative for managing wild animal and pet populations.

Researchers at Purdue University have developed a novel vaccine-based contraceptive capable of reducing fertility by 59-67% in a female mouse model. Animal overpopulation is becoming more frequent due to mismanaged resources and invasive species. Gonadotropin-releasing hormone - a hormone that affects the development and function of the gonads â€“ has previously been utilized to control animal populations. However, the utilization of this hormone requires the use of strong adjuvants that can cause severe inflammation. As this is not an ideal broad-spectrum solution for animal overpopulation, there is a need for the development of better contraceptives with less side effects.

The researchers developed a novel contraceptive that is based off the well-characterized mammalian sperm protein, called IZUMO1. It has been found that naturally occurring anti-IZUMO1 antibodies cause infertility in women, therefore, the researchers sought out to design a synthetic analogue that could cause the same effect in female mice. This was done by designing a recombinant mouse anti-IZUMO1 peptide (mIZUMO1) with either AddaSO3 or AddaSO3 combined with a novel nanoparticle adjuvant (NanoST). After two injections of the experimental groups with the different contraceptive formulations, it was found that both vaccines induced a significant reduction (59-67%) in fertility.

Technology Validation:

The successful production and purification of mIZUMO1 was validated via SDS-PAGE and Western Blot analysis of the proteins. It was observed that the band corresponding to the mIZUMO1 had a molecular weight of ~30 kDa, very close to its estimated molecular weight.

Technology ID

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Category

Biotechnology & Life Sciences/Synthetic Biology & Genetic Engineering
Chemicals & Advanced Materials/Specialty & Performance Chemicals
Pharmaceuticals/Drug Discovery & Development
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies
Pharmaceuticals/Drug Delivery & Formulations
Pharmaceuticals/Other

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The fertility reduction ability of each formulation was experimentally observed by administering female outbred CD-1 mice with 50 uL of contraceptive in each hindleg in the beginning of the study, and again 4 weeks in. Of these mice, there were three experimental groups (n = 6 mice/group), the control, mice injected with mIZUMO1 and AddaSO3, and mice injected with mIZUMO1, AddaSO3, and NanoST. Following this, the female mice were mated with male mice and after ~18 days of pregnancy the female mice were euthanized and the number of viable pups were counted. Both vaccines caused a significant reduction in the number of pups.

Advantages:

- Significantly reduced fertility in female mouse model

- Less strong adjuvants required

Applications:

- Wild animal population control

- Contraceptives for mammalian pets

TRL: 3

Intellectual Property:

Provisional-Patent, 2024-04-02, United States | PCT-Patent, 2025-03-25, WO

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