Researchers aim to change contraceptive technology with new iron IUDs

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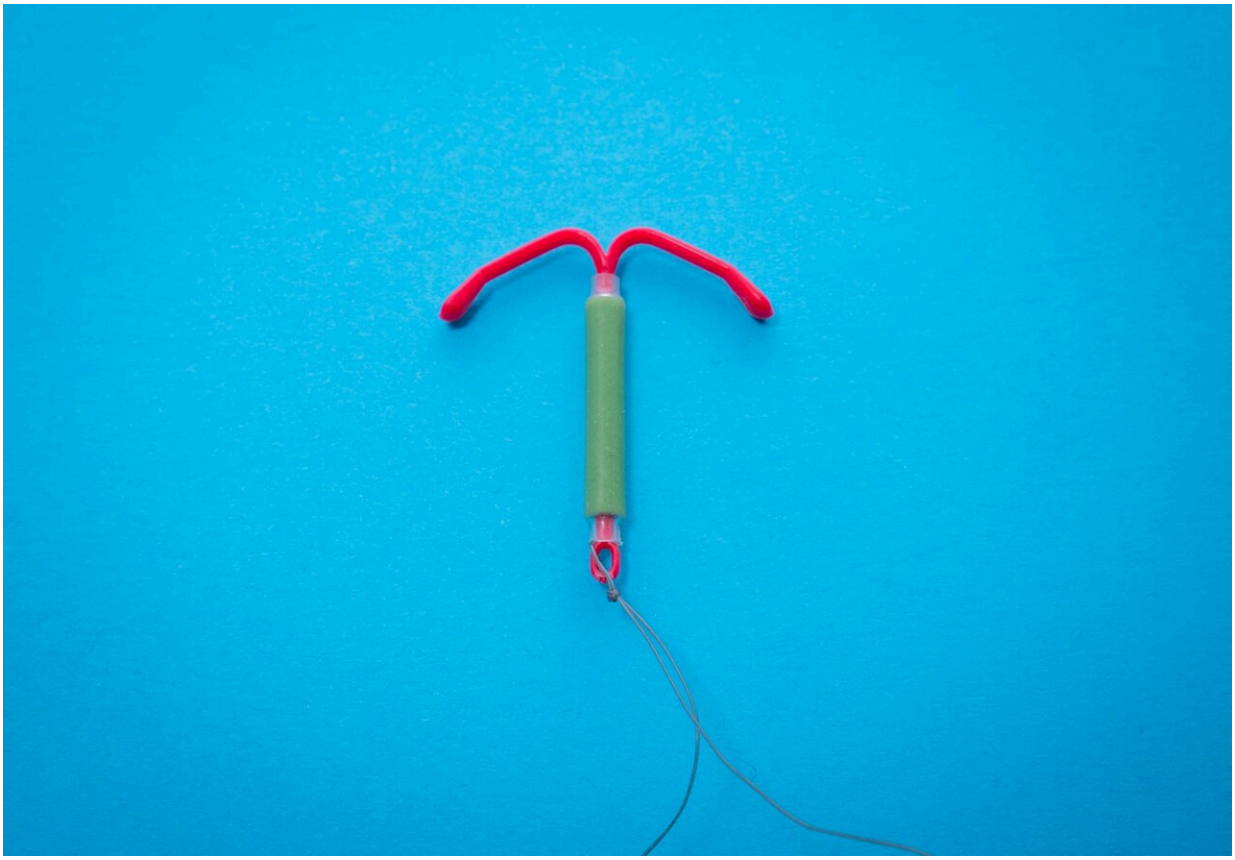

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When chemistry professor Samantha Gateman realized there was no non-hormonal intrauterine device (IUD) on the market without significant side effects, she became inspired to make a change.

As a chemist who studies corrosion, Gateman had no previous experience in contraceptive technology, but was curious about the choice of copper for IUDs and interested in potential alternatives.

"I had tried various hormonal contraceptives and had really bad experiences," Gateman said. "I was looking for something long-term but non-hormonal. The only option available was the copper IUD, which previous research has shown has a whole sleeve of negative side effects."

Now, an interdisciplinary team of researchers at Western—from chemists to medical experts and social scientists—are developing an iron IUD, aiming to provide a gentler alternative to the commonly used copper version.

Previous research has shown that while IUDs are highly effective and long-lasting, they are not without drawbacks.

Although hormonal IUDs use a lower dose of hormones than other contraceptives such as birth control pills, they can still cause side effects such as breast tenderness, headaches, acne, mood swings, depression and weight gain.

Non-hormonal copper IUDs, on the other hand, often lead to more physical side effects including pelvic pain and stomach cramps.

The project, led by Gateman, aims to address the side effects and limitations associated with existing IUDs, potentially transforming the landscape of contraception.

A perspective paper about their motivation to develop new materials for non-hormonal IUDs and outlining current IUD materials literature was recently published in the journal *npj Women's Health*. The paper also explores the experimental considerations and societal barriers to bringing

a new IUD to market.

What is an IUD?

An intrauterine device, commonly known as an IUD, is a small, T-shaped device that is inserted into the uterus to prevent pregnancy.

"An IUD goes through the female cervix and its T-shape allows it to fit snugly in the uterine cavity so that it doesn't fall out," said Gateman.

There are two main types of IUDs: hormonal and non-hormonal. The hormonal IUD releases a small amount of hormones directly into the uterine cavity, which prevents pregnancy by thickening the cervical mucus to block sperm and sometimes stopping ovulation. This type of IUD can also reduce menstrual bleeding and cramping.

The non-hormonal IUD, which is typically made of copper, works differently.

"The copper IUD has a piece of copper wire wound around the main body of the T, and some of the copper becomes oxidized when exposed to the uterine environment. These copper ions interact with spermatozoa and impede them, making them immobile," said Gateman.

"The same copper ions that are responsible for the contraceptive mechanism also cause inflammation," she said.

This revelation led her to explore alternative metals that could provide the same contraceptive benefits without the negative side effects.

Gateman's background studying corrosion chemistry during her Ph.D. informed her approach to developing IUDs with alternative metals.

"Other metals like iron or zinc corrode faster than copper, which means IUDs made of these metals would have to be bigger to last as long, making them uncomfortable," she said.

The new non-hormonal IUD project aims to address these issues by providing an alternative that reduces the inflammatory response caused by copper ions. The goal of using iron or zinc and a specially developed polymer coating is to create a device that offers effective contraception with fewer side effects.

The team frequently meets to discuss progress and challenges. The current focus is on quantifying the concentration of metal ions needed for effective contraception while minimizing adverse side effects.

Interdisciplinary collaboration

The project was initiated through the Western Interdisciplinary Development Initiative (IDI), with funding awarded to the team in 2023. The team of researchers involves medical practitioners, chemists, social scientists and experts in women and gender studies.

Gateman emphasized the importance of this collaboration: "This project requires experts from Schulich School of Medicine & Dentistry as well as gynecologists, polymer chemists and social scientists. It's a team project."

Kate Choi, professor of sociology and director of the Center for Research on Social Inequality, plays a crucial role in ensuring the new IUD's accessibility and acceptability in diverse communities.

"Ensuring that those with contraceptive needs do not encounter prominent obstacles to contraceptive access is a key goal," Choi said.

Her research on fertility across various populations informs the project's aim to provide an effective, affordable and culturally sensitive contraceptive option.

Choi's work seeks to make "equitable access" a focus at each stage of development for the new non-hormonal IUD.

"We want to ensure that once developed, the new IUD is a safe and affordable contraceptive option for all individuals with contraceptive needs, including those from marginalized communities," she said.

The team plans to conduct surveys to understand the history of contraception access and the preferences of diverse sociodemographic groups, ensuring the new IUD meets their needs.

"We need to understand where different groups get their reproductive health care and tailor our distributional strategies accordingly," Choi said.

This approach ensures the benefits and proper use of the new IUD are communicated effectively to all potential users.

"Given the legislative changes affecting women's reproductive rights in many places like the U.S. and Poland, having long-term, low-maintenance contraception is increasingly important," Choi said.

The rising cost of living and economic uncertainty further underscore the necessity of reliable and affordable contraception for family planning.

The next steps

Dean Betts, a Schulich Medicine & Dentistry professor, is another key

collaborator. His work involves using synthetic embryos to study the effects of corrosive metals and polymers on embryo development.

"I have no expertise in metal corrosion, and the chemists have limited knowledge of embryology. But together, we create something special," he said.

Looking ahead, Betts outlined the project's next steps. The team must finalize the polymer coating process, conduct extensive in vitro and in vivo testing, and eventually move toward human clinical trials.

"This project started as a passion and has the potential to make a significant difference," Gateman said.

A large team of researchers is involved in the project including other collaborators Joe Bryan Gilroy, Kirsten Oinonen, Lori Chambers and Basim Abu Rafea.

More information: Jacob John Maclean Bunting et al, Revolutionizing Women's health: the quest for materials for next-generation, non-hormonal intrauterine devices, *npj Women's Health* (2024). DOI: 10.1038/s44294-024-00026-y

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