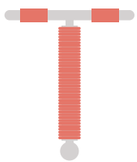
The chemistry of intrauterine contraceptives

The Oxford Chemistry Period Podcast

Types

Interuterine devices (IUDs) are among the most effective forms of birth control. These devices are inserted into the uterus and do not need to be replaced for several years. There are two types of IUD available.



Copper IUD

A T-shaped plastic device with sections coated with copper metal.

Hormonal IUD

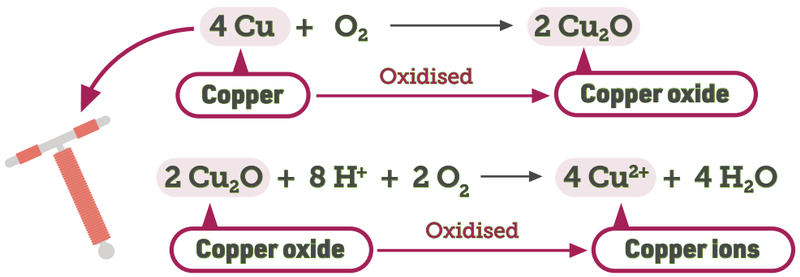
A T-shaped plastic device which contains a synthetic version of the hormone progesterone.

Copper IUDs

Effectiveness	Failure rate of 0.8% for first year
Duration	5-12 years (brand dependent)

How it works

The copper in copper IUDs slowly oxidises in the body, releasing copper ions into the uterine fluid. These copper ions reduce the movement of sperm cells, stopping pregnancy by preventing egg fertilisation.



Rate of oxidation is affected by copper surface area, pH, oxygen levels and the solutes in uterine fluid.

For effective contraception the IUD needs to release a minimum of 2 micrograms of copper ions per day. Initial copper release is much higher than this but reduces over time. Inhibiting compounds in the IUD also reduce copper release.

Initial Cu^{2+} release	**195 µg per day**	**After 6 months**	**40-80 µg per day**

Side effects

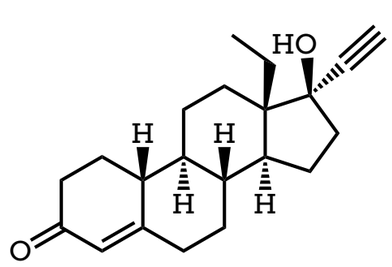
Increased blood loss and cramping during periods are common in the months after insertion. This is an inflammatory response to the high initial release of copper ions.

Hormonal IUDs

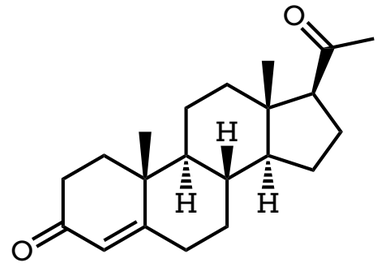
Effectiveness	Failure rate of 0.2% for first year
Duration	3-5 years (brand dependent)

How it works

Hormonal IUDs slowly release levonorgestrel, a synthetic version of the hormone progesterone. This prevents pregnancy by stopping ovulation, thinning the uterus lining, and thickening the cervical mucus to block sperm.



Levonorgestrel



Progesterone

Most hormonal IUDs release around 20 micrograms of levonorgestrel per day, decreasing to half of this initial value over 5 years. The resulting hormone levels in the body are slightly lower than seen with oral contraceptives.

Hormonal IUD	**10-20 µg per day**	**Oral pill**	**20-35 µg per day**

Side effects

Hormonal IUDs can cause irregular periods in the first few months of use. This is in addition to the usual side effects of hormonal contraception.