

In vitro fertilization (IVF): This is an example of assisted reproductive technology (ART) and is used for treatment of different types of infertility in humans. It is also used in the selective breeding programs in the animals such as cattle improvement for increased milk and meat yield etc.

The discussion below is with respect to humans but general principles of the practice remain the same.

Infertility: Infertility is the inability to conceive a child.

Male infertility is typically due to –

- decrease in sperm count/motility resulting from medical conditions (radiation, chemotherapy, diabetes, cystic fibrosis)
- unhealthy habits (heavy alcohol or illicit drug use, anabolic steroids)
- environmental toxins (lead, pesticides).

Female infertility may result from

- complications with fallopian tube (blockage, damage or removal)
- disorders of the ovaries or uterus that may be affected by age, smoking, heavy alcohol or illicit drug use,
- extreme weight loss/gain.

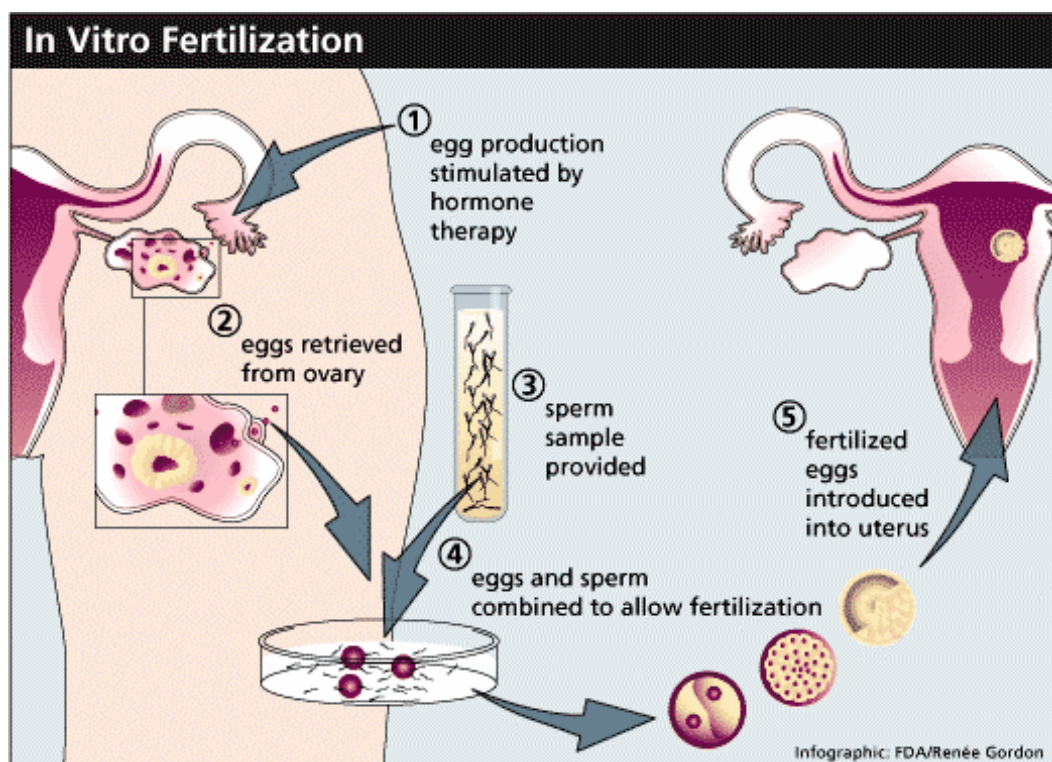
IVF can be used as an effective treatment for infertility of all causes except for women with infertility due to anatomical problems with the uterus, such as severe intrauterine adhesions.

Process of IVF: This is a series of procedures and total set of procedures is referred to as IVF cycle. Steps in one IVF cycle are given below:

One cycle of IVF involves

- 1) administration of follicle stimulating hormone (FSH) to stimulate follicle production in the ovaries. This leads to production of many eggs during ovulation. Thus, it is called as superovulation.
- 2) extraction of mature eggs from a woman's ovaries. This is called as egg retrieval.
- 3) retrieval of a sperm sample from a man.
- 4) manual fertilization of the egg by sperm to produce an embryo in a laboratory dish.
- 5) one or more embryo(s) are implanted in the uterus. This is called as embryo transfer.

Whole process of IVF is summarized in the figure below



It was first successfully performed in 1978, when IVF gave birth to Louis Brown. Lesley Brown, his mother, had been facing infertility issues since 9 years when she took help from Patrick Steptoe and Robert Edwards at Dr Kershaw's Cottage Hospital in Royton, Oldham, England.

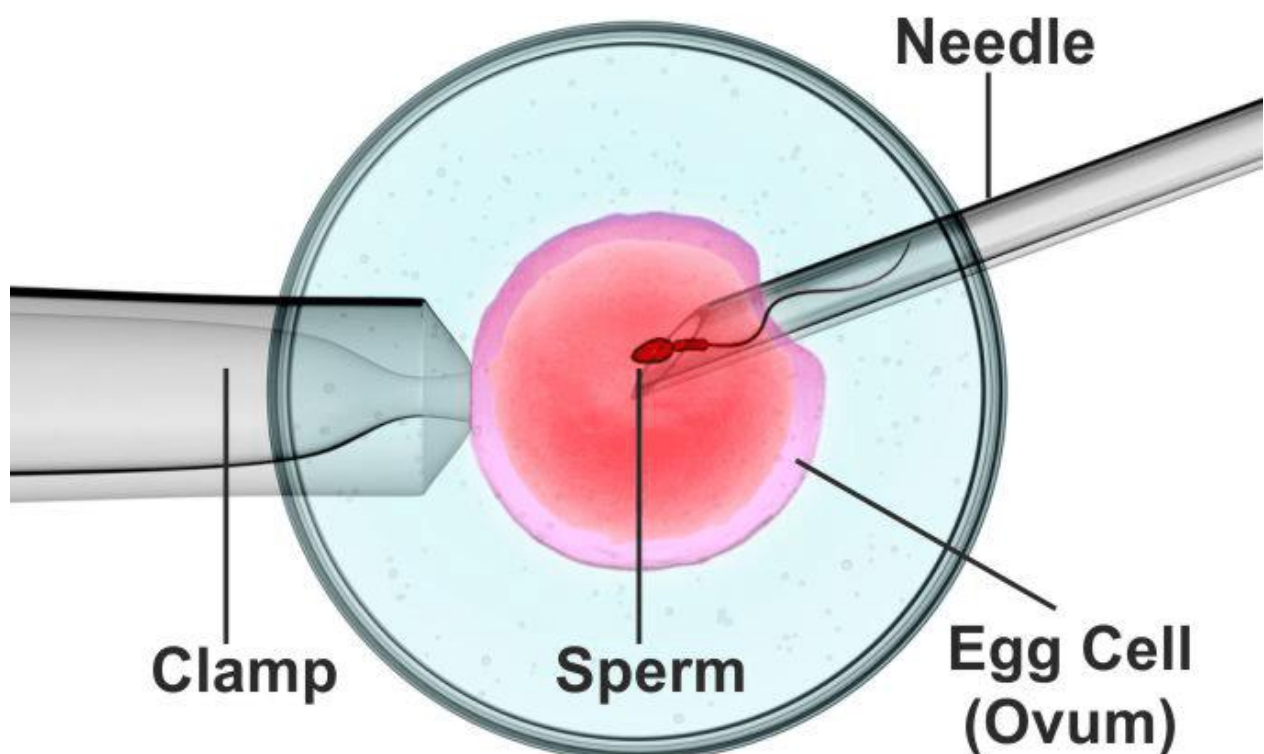
In India, first IVF child was born just 67 days after the birth of Louis Brown and it was in the year 1978. This happened in Kolkata on 3rd October, 1978. The baby was named as Durga and it happened under the watch of Dr. Subhash Mukherjee.

However, due to reasons which remain unclear Harsha Chawda born in August, 1986 is considered as first official test tube baby in India.

Variants of IVF: Above discussed process is general description of IVF process. Many variants have been developed which are now used in different situation. Some important ones are mentioned below.

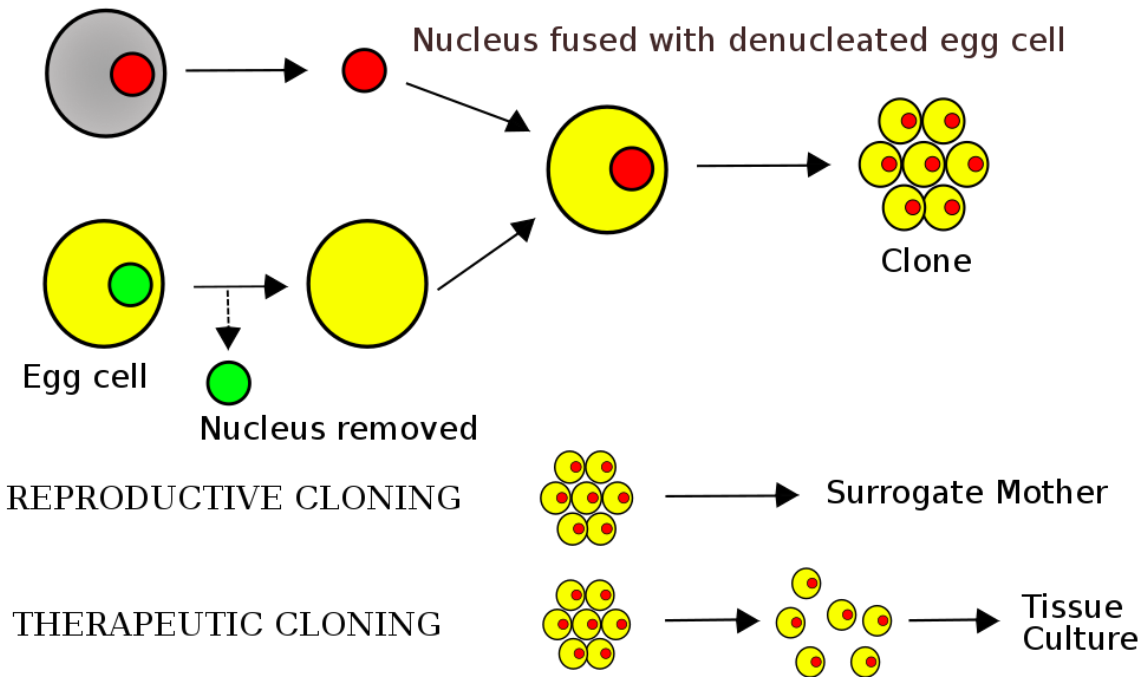
1. Frozen embryo transfer (FET): In this, embryo formed during normal IVF treatment is frozen and transferred at a later time in the mother. This method is used if earlier IVF attempt has failed, either of the parents is undergoing serious illness treatment such as for cancer or by people working in the corporate sector.
2. Elective single embryo transfer (eSET): In this, mother chooses to have only a single embryo transferred when multiple embryos are available. This process can lead to improved pregnancy success and reduce the complications associated with multiple pregnancies.
3. Intracytoplasmic Sperm Injection (ICSI): In this, single sperm is microinjected directly in the cytoplasm of the egg. This is different from normal IVF during which the egg is placed in the culture dish with many sperms and egg is fertilized by one of the sperms naturally.

ICSI is preferred method of choice in case of male factor infertility. The process of ICSI is shown in the figure below:



The processes discussed above are used in case of humans as well as in animal breeding programs. During animal breeding programs we use one more method of IVF for generation of clones. This process is called as somatic cell nuclear transfer (SCNT). This process was used by team of Sir Ian Wilmut to produce the first cloned animal which was a sheep and was named Dolly. The process of SCNT is shown in the figure below.

Somatic body cell with desired genes



In SCNT, we remove the haploid nucleus from the egg cell and inject it with a diploid nucleus which has been isolated from the somatic cell. This reconstructed egg cell is subjected to artificial stimulation to undergo cell division and develop the embryo.

If this embryo is transferred in the uterus of an animal, then the cloning is called as reproductive cloning.

If this embryo is cultured in the lab and is used as a source of embryonic stem cells to be used for treatment purposes, the process is called as therapeutic cloning.