



# In-Vitro Gametogenesis (IVG)

Source: IE

## Why in News?

Researchers have developed **In-Vitro Gametogenesis (IVG)** that enables **lab-based reproduction** from **stem cells** that has many benefits compared to **In-Vitro Fertilization (IVF)**.

## What is In-Vitro Gametogenesis (IVG)?

- **About: IVG** is a new reproductive technology that creates **eggs and sperm** from **stem cells** collected from **skin, hair, or blood**.
  - These lab-grown gametes can be fertilized to create an **embryo**, which is implanted into a **surrogate** to carry the pregnancy.
- **Scientific Breakthroughs:** Scientists in Japan successfully produced **mice** using **IVG**, while the UK researchers expect **human trials within three years**.
  - It could allow **same-sex couples, older individuals, and infertile people** to have **biological children without** the need of a donor as in case of IVF.
- **Significance for India:** Due to several **socio-biological factors** IVG can be helpful in case of India like:
  - Indian women's reproductive age (**ovarian function**) is **declining six years earlier** than Western women.
  - **Men's sperm count** has declined over **50 years** and may reach **minimal levels in four decades**.
  - India's population has fallen **below the 2.1 replacement level**, risking an aging crisis.
- **Difference Between IVG and In-Vitro Fertilisation (IVF):**

Aspect	In-Vitro Gametogenesis (IVG)	In-Vitro Fertilization (IVF)
<b>Gamete Source</b>	Converts <b>stem cells</b> into eggs or sperm of the intended couple itself.	Requires <b>natural eggs and sperm</b> from the <b>intended couple or donors</b> .
<b>Genetic Editing</b>	Allows <b>removal of harmful traits</b> before fertilization ( <b>designer babies</b> ).	Limited to <b>screening embryos</b> for genetic disorders.
<b>Reproductive Age</b>	Could enable parenthood at any age by creating new gametes.	Fertility is limited by age-related as egg and sperm quality <b>declines with age</b> .
<b>Legal Status</b>	<b>Not yet regulated</b> in most countries.	Regulated and <b>widely used</b> worldwide.
<b>Ethical Concerns</b>	Raises concerns about designer babies and <b>genetic selection</b> e.g., <b>selection of physical traits, intelligence etc.</b>	Less controversial, but involves embryo selection.

## Stem Cells

- **About:** Stem cells are unique cells that generate **specialized cells like blood, bone, and muscle**, playing a vital role in **tissue repair and bodily functions**.
- **Types:**
  - **Embryonic (Pluripotent) Stem Cells:** Can become **any cell type**, sourced from **embryos or cord blood**.
  - **Tissue-Specific (Multipotent/Unipotent) Stem Cells:** Generate cells **only for their tissue**, e.g., **blood stem cells**.
  - **Induced Pluripotent Stem Cells (iPSCs):** **Lab-made cells** mimicking embryonic stem cells for **research and drug testing**.

## UPSC Civil Services Examination Previous Year Question (PYQ)

### Prelims

**Q. In the context of recent advances in human reproductive technology, “Pronuclear Transfer” is used for (2020)**

- (a) fertilization of egg in vitro by the donor sperm
- (b) genetic modification of sperm producing cells
- (c) development of stem cells into functional embryos
- (d) prevention of mitochondrial diseases in offspring

**Ans: (d)**

**Q. Consider the following statements: (2020)**

1. Genetic changes can be introduced in the cells that produce eggs or sperms of a prospective parent.
2. A person’s genome can be edited before birth at the early embryonic stage.
3. Human induced pluripotent stem cells can be injected into the embryo of a pig.

**Which of the statements given above is/are correct?**

- (a) 1 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1, 2 and 3

**Ans: (d)**