



In-Vitro Gametogenesis (IVG)

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