



## Stem Cells in Menstrual Blood

**For Prelims:** [Stem cell](#), Menstrual Blood Stem Cells, Insulin, [In Vitro fertilization](#)

**For Mains:** Importance of research and study on Menstrual Blood, Issues Related to Women Health, Biotechnology

[Source: TH](#)

### Why in News?

Recently, researchers have unveiled the **regenerative potential of stem cells in menstrual blood**, stemming from studies conducted roughly two decades ago.

- This discovery has opened new avenues for understanding the complex interplay between the **female reproductive system and regenerative processes**.

### What are Menstrual Blood Stem Cells?

#### ▪ About:

- Menstrual blood-derived stem cells (MenSCs), known as **endometrial stromal mesenchymal stem cells**, possess multipotent properties, meaning they can differentiate into various tissue types such as **fat cells, bone cells, and smooth muscle cells**.
- MenSCs are an ethical source of adult stem cells that can be collected painlessly from women.
  - MenSCs can be collected through a **menstrual cup**, providing a less **invasive alternative** to surgical biopsies.
- MenSCs can be obtained from women's menstrual blood derived from the **endometrium** (lines the inside of the uterus).

#### ▪ Role in Women's Health:

- **Regenerative Potential:**
  - MenSCs exhibit multipotent characteristics. This means they can differentiate into various cell types, including neurons, cartilage, fat, bone, heart, liver, and skin cells.
- **Treating Endometriosis:**
  - MenSCs offer potential avenues for treating gynaecological disorders such as endometriosis and infertility.
    - **Endometriosis** is a disease in which tissue similar to the lining of the uterus (endometrium) **grows outside the uterus**. It can cause severe pain in the pelvis and make it **harder to get pregnant**.
      - Endometriosis can start at a person's first menstrual period and last until menopause (end of menstrual cycles).
    - Common symptoms of endometriosis include **pelvic pain**, especially during menstruation, painful intercourse, infertility, heavy menstrual bleeding, and gastrointestinal issues such as diarrhoea or constipation.
    - The cause and ways to prevent endometriosis are unknown. There is no

cure, but its symptoms can be treated with **medicines or, in some cases, surgery.**

- The contributing factor to endometriosis is the backflow of menstrual blood into a woman's fallopian tubes.
- This backward flow carries blood into the **pelvic cavity**, a funnel-shaped space between the bones of the pelvis.
- Endometrial stem cells deposited in these areas may prompt the **growth of endometrial-like tissue** outside the uterus, resulting in **painful lesions, scarring, and often infertility.**

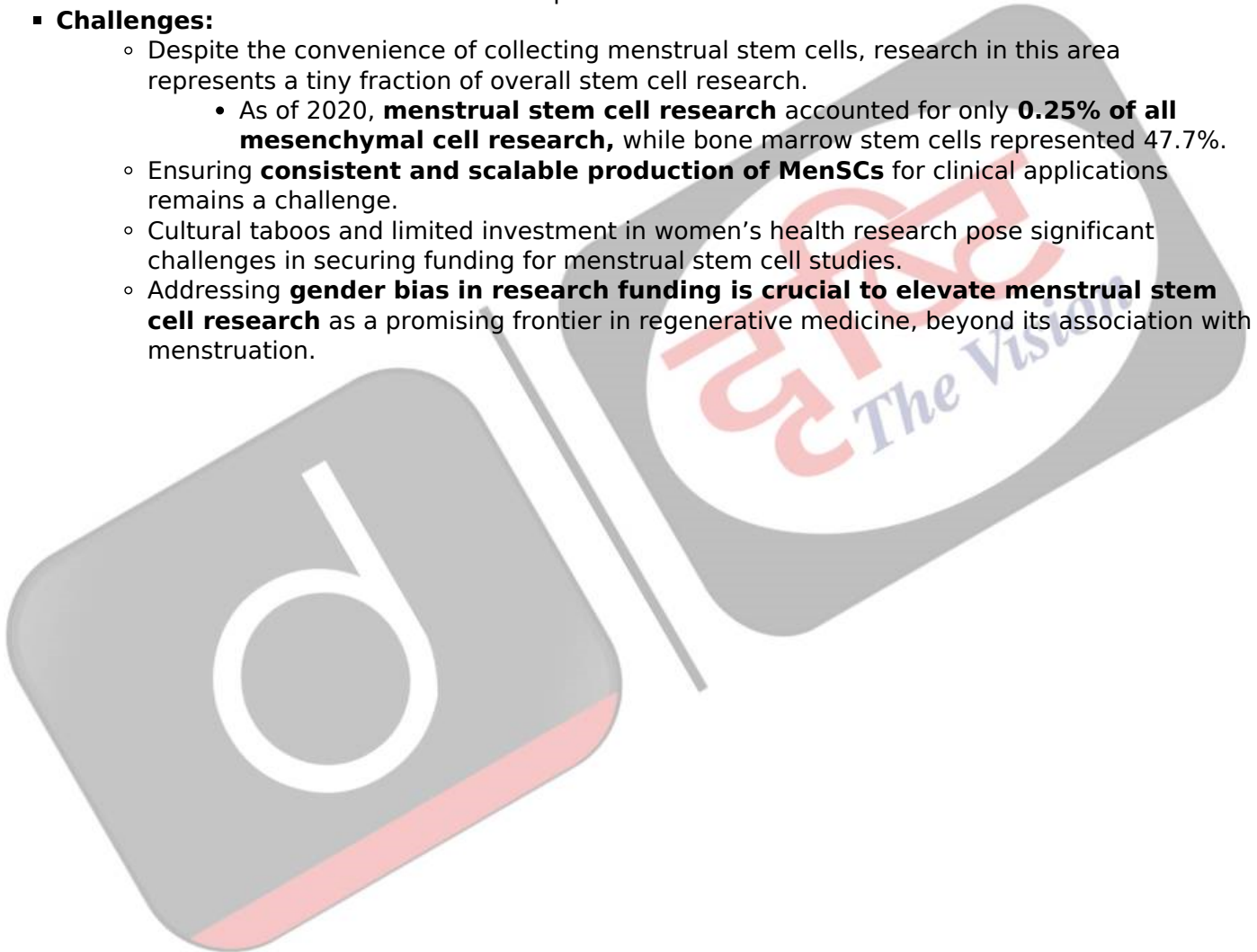
▪ **Broader Therapeutic Applications:**

- Menstrual stem cells have potential therapeutic applications beyond gynaecological diseases.
- Injecting menstrual stem cells into **diabetic mice stimulated** the regeneration of **insulin-producing cells** and improved blood sugar levels.
  - Treating injuries with stem cells or their secretions helped heal wounds in mice.
- Menstrual stem cells can be transplanted into humans without adverse side effects.

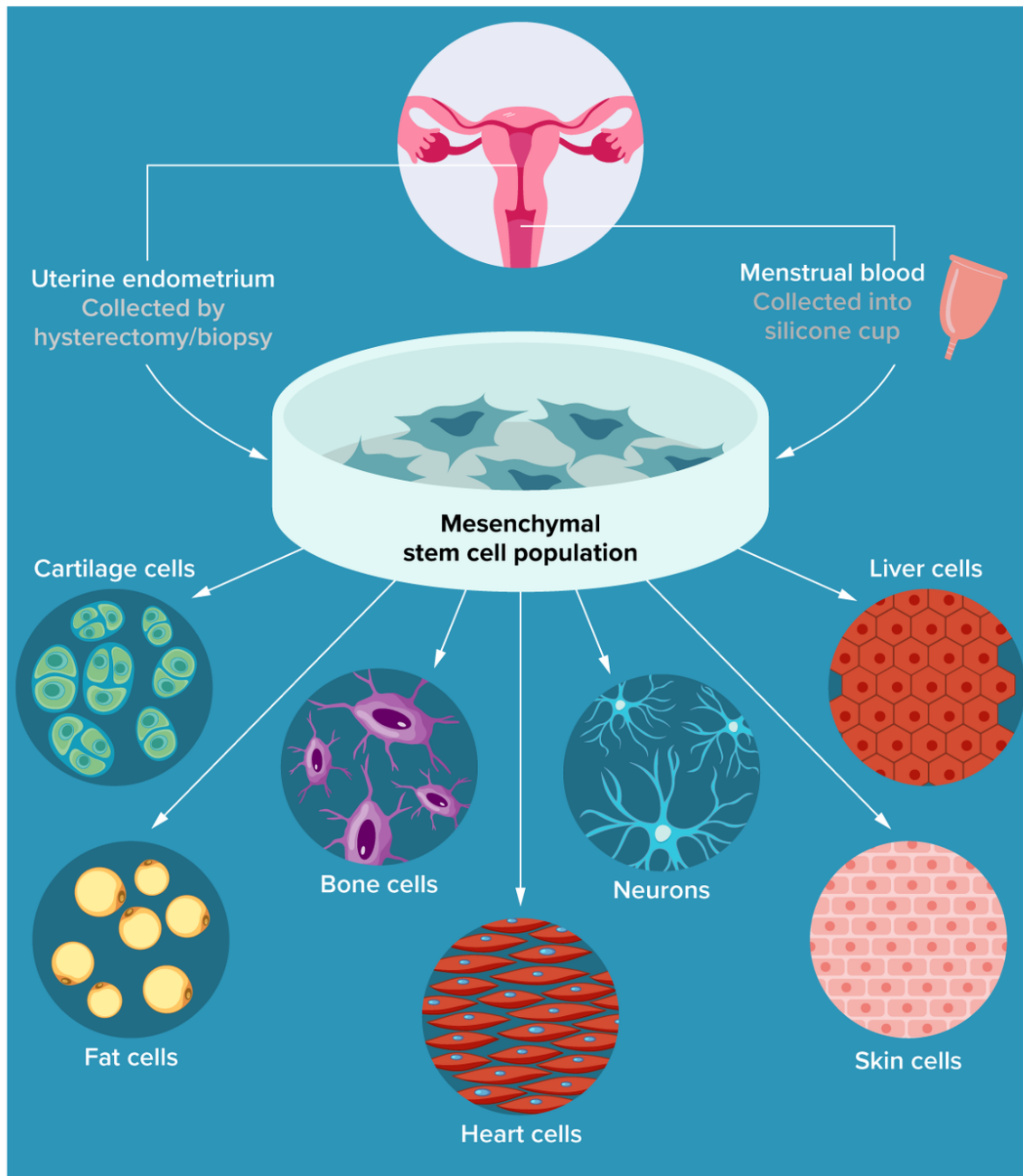
▪ **Challenges:**

- Despite the convenience of collecting menstrual stem cells, research in this area represents a tiny fraction of overall stem cell research.
  - As of 2020, **menstrual stem cell research** accounted for only **0.25% of all mesenchymal cell research**, while bone marrow stem cells represented 47.7%.
- Ensuring **consistent and scalable production of MenSCs** for clinical applications remains a challenge.
- Cultural taboos and limited investment in women's health research pose significant challenges in securing funding for menstrual stem cell studies.
- Addressing **gender bias in research funding is crucial to elevate menstrual stem cell research** as a promising frontier in regenerative medicine, beyond its association with menstruation.

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## The diverse fates of menstrual stem cells



### Endometriosis and Fusobacterium bacteria:

- There is a significant **association between Fusobacterium bacteria and endometriosis.**
  - Fusobacterium was found in **64% of endometriosis patients compared to only 7% in healthy individuals.** Studies suggest that **Fusobacterium exacerbates endometrial lesions.**
- A 2022 research paper found that people with endometriosis had an imbalance of microbe populations in the gut, known as **gut dysbiosis.**
  - This altered microbiota could contribute to the progression of endometriosis.

### What are Stem Cells?

- **About:**
  - Stem cells are special human cells with the ability to develop into various cell types, such as muscle cells or brain cells.

- They have the potential to repair damaged tissues, offering hope for treating serious illnesses like **paralysis** and **Alzheimer's disease**.

▪ **Types of Stem Cells:**

- Stem cells are usually categorized as **multipotent** (able to give rise to multiple cells within a lineage), **pluripotent** (able to give rise to all cell types in an adult) and **totipotent** (able to give rise to all embryonic and adult lineages).

Type of Stem Cell	Source	Potential of the Stem Cell
<b>Embryonic Totipotent Stem Cells</b>	These stem cells are found in the very early stages of a fertilized embryo, typically within the first few days after fertilization.	Can become any cell in the body even form the placenta(an organ in the uterus during pregnancy that provides oxygen and nutrients to the growing baby)
<b>Embryonic Pluripotent Stem Cells</b>	Derived from the inner cell mass of a slightly more developed embryo (around 4-5 days after fertilization).	Can become many different cell types in the body but cannot form the placenta.
<b>Adult Multipotent Stem Cells</b>	Found in various tissues in the human body, like bone marrow or skin.	Multipotent stem cells are more specialized.They can only differentiate into a limited range of cell types specific to the tissue they are found in. For example, bone marrow stem cells can develop into different blood cell types, but not into skin cells.

▪ **Stem Cells in Medicine:**

- Hematopoietic stem cells, found in bone marrow, are currently used to treat diseases like cancer and anaemia by producing new blood cells.
- Potential future applications include treating **chronic heart disease**, type 1 diabetes, spinal cord injuries, and Alzheimer's disease.
- Pluripotent stem cells offer opportunities for testing new medicines and creating new tissues.

## UPSC Civil Services Examination, Previous Year Questions (PYQs)

### ***Prelims***

#### **Q.1 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)**

**Q1. With reference to 'stem cells', frequently in the news, which of the following statements is/are correct? (2012)**

1. Stem cells can be derived from mammals only
2. Stem cells can be used for screening new drugs
3. Stem cells can be used for medical therapies

**Select the correct answer using the codes given below:**

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

**Ans: (b)**

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### **Mains**

**Q.1** Stem cell therapy is gaining popularity in India to treat a wide variety of medical conditions including Leukaemia, Thalassemia, damaged cornea and several burns. Describe briefly what stem cell therapy is and what advantages it has over other treatments? **(2017)**

**Q.2** What are the continued challenges for women in India against time and space? **(2019)**