



Synthetic Human Embryos: A Breakthrough or A Dilemma

This editorial is based on the Article "[Without sperm or egg, how scientists grew whole model of human embryo](#)" which was published in The Indian Express on 08/09/2023. It talks about the development of Synthetic human embryos and the ethical issues raised around it.

For Prelims: [Synthetic human embryos](#), or SHEEFs (Synthetic Human Entities with Embryo-like Features), [Egg or Sperm Cells](#), [Genetic Disorders](#), [Three-dimensional structures](#), [placenta-like tissue](#), Gastrulation, Ectoderm, Mesoderm, Endoderm, International Society for Stem Cell Research, [Indian Council of Medical Research \(ICMR\)](#), Universal Declaration on Bioethics and Human Rights, [UNESCO](#), [Universal Declaration on the Human Genome and Human Rights, of UNESCO](#), [IVF embryos](#).

For Mains: Issues related to genetic engineering and biotechnology, Issues related to human cloning, and others.

The recent announcement of the creation of synthetic human embryos using stem cells has sparked a lot of interest and debate in the scientific and ethical communities.

[Synthetic human embryos](#), or SHEEFs (**Synthetic Human Entities with Embryo-like Features**), are structures that resemble early human embryos but are made from stem cells without the direct contribution of [egg or sperm cells](#).

These structures have the potential to provide valuable insights into human development, [genetic disorders](#), and pregnancy loss, but also raise serious ethical and legal questions about their status, use, and regulation.

What are Synthetic Human Embryos and How are They Made?

- **About Synthetic Human Embryos (SHE):** These are not formed by the fusion of an egg and a sperm cell. They are made from **pluripotent stem cells**, which are cells that can develop into almost any cell type in the body.
 - **These stem cells can be derived from embryos, or reprogrammed from adult cells, such as skin or blood cells.**
- **Creating SHE:** By manipulating the culture conditions and the signals that guide cell differentiation, researchers can coax **stem cells to self-organize into three-dimensional structures** that mimic some aspects of early embryonic development.
 - **For example**, these structures can **form a blastocyst-like cavity, a placenta-like tissue, and a primitive streak-like structure**, which marks the **beginning of gastrulation, the process by which the three germ layers (ectoderm, mesoderm, and endoderm) are formed.**
- **First SHE:** **The first synthetic human embryos** were reportedly created by a team at the University of Cambridge and the California Institute of Technology and their work was presented at

the **International Society for Stem Cell Research** in June 2023.

- According to the report, these **synthetic human embryos were grown to a stage equivalent to just past 14 days old**, which is the legal limit for studying natural human embryos in many countries.

What are the Rules Related to the Development of Synthetic Human Embryos?

- The laws and rules related to the development of synthetic human embryos vary widely across different countries and regions of the world.
 - **Complete Prohibition:** Some countries have **strict regulations that prohibit or restrict** any form of human embryo research, such as Germany, Italy, Ireland, Poland, and Slovakia.
 - **Research Allowed:** Other countries have **more permissive regulations that allow some forms of human embryo research** under certain conditions and oversight, such as Australia, Canada, France, Japan, Singapore, South Korea, Sweden, the UK, US.
 - However, most of these regulations do not explicitly address synthetic human embryos or other types of stem cell-based embryo models.
- **India's Context:** In India, there is **no specific legislation that regulates synthetic human embryo research**. However, there are **some guidelines that apply to stem cell research in general**.
 - The [Indian Council of Medical Research \(ICMR\)](#) issued the **National Guidelines for Stem Cell Research in 2017**, which provide ethical principles and norms for conducting stem cell research involving humans or animals.

What are the International Agreements Related to the Development of SHEs?

- **At the international level**, there is **no binding treaty or convention that regulates synthetic human embryo research**. However, there are **some non-binding declarations** and recommendations that provide some guidance and standards for this field. For example:
 - The [Universal Declaration on the Human Genome and Human Rights \(UNESCO\), 1997](#):
 - It states that **“practices which are contrary to human dignity, such as reproductive cloning of human beings, shall not be permitted”** and that “interventions on the human genome should only be undertaken for preventive, diagnostic or therapeutic purposes and only with the informed consent of the person concerned”.
 - **The Universal Declaration on Bioethics and Human Rights (UNESCO), 2005**:
 - It states that **“human dignity, human rights, and fundamental freedoms are to be fully respected”** in any scientific research involving human beings, and that “the interests and welfare of the individual should have priority over the sole interest of science or society”.
 - **Guidelines by the International Society for Stem Cell Research**:
 - Issued for Stem Cell Research and Clinical Translation in 2021, which provide detailed recommendations for conducting ethical and responsible stem cell research involving human embryos, stem cells, organoids, and other models.

What is the Significance of Synthetic Human Embryos?

- **Study Human Development:** Synthetic human embryos can **provide a powerful tool for studying human development**, especially the early stages that are difficult to access or observe in natural embryos.
 - This can help researchers understand how different cell types and tissues are formed, how genes are regulated, how diseases are caused or prevented, and how pregnancy is established or lost.
- **Alternative to Human Embryos for Research:** Synthetic human embryos can offer a valuable **alternative or complement to natural human embryos for research purposes**.
 - This can **reduce the reliance on donated IVF embryos**, which are often scarce or

unavailable, and avoid some of the ethical concerns associated with their use or destruction.

- **Application in Regenerative Medicine:** Synthetic human embryos can **enable novel applications for regenerative medicine and biotechnology.**
 - For example, synthetic human embryos could be used to generate specific cell types or tissues for transplantation or therapy, such as blood cells, nerve cells, heart cells, liver cells, etc.
 - Synthetic human embryos could also be **used to create models of disease or injury for drug testing or screening.**

What are the Issues Involved in the Development of Synthetic Human Embryos?

- **Unclear Regulations:** Synthetic human embryos may pose ethical challenges regarding their moral status, use, and regulation.
 - As discussed above, synthetic human embryos raise questions about whether they have any **interests or rights that need to be respected**, how they should be used and regulated, who should have access to them, and who should oversee their use.
- **Setting Unrealistic Expectations/False Notions:** Synthetic human embryos may **create social problems regarding their public perception and acceptance.**
 - They may elicit negative reactions from some segments of society who may view them as unnatural, immoral, or dangerous.
 - Synthetic human embryos may also generate **unrealistic expectations or false hopes among some patients or consumers who may seek them for unproven or inappropriate purposes.**
- **Issues of Cloning and Synthetic Life Forms:** Synthetic embryos may pose some safety and social challenges.
 - There is still a lot of **uncertainty about the long-term effects** and consequences of **manipulating stem cells and creating synthetic life forms or cloning.**
 - There is a need for more rigorous testing and monitoring before applying these technologies to humans or animals.

What can be Done to Address the Issues Related to SHE?

- **Need a Comprehensive Discussion:** There is no simple or definitive answer to the ethical questions related to the development of SHE, as they involve complex and diverse perspectives and interests.
 - Therefore, there is a need for more dialogue and debate among various actors and sectors, such as researchers, ethicists, policymakers, regulators, clinicians, patients, donors, advocates, media, and the public.
- **Need Collaboration Across the Regions:** There is also a need for more collaboration and coordination among different countries and regions, as these technologies have global implications and applications.
 - There is a need for more harmonised and standardised laws and guidelines that govern this field, as well as more transparency and accountability of the practices and outcomes that occur in this field.
- **Need to Balance the Risks:** Ultimately, there is a need for more balance and caution in pursuing this field, as it involves both opportunities and risks. There is a need for more respect and care for the synthetic embryos that are created, as well as for the natural embryos that are used or affected by this field.
 - There is a need for more wisdom and foresight in using this field, as it has both benefits and costs for humanity.

Conclusion

Synthetic human embryos are a new frontier of science that offers both promise and peril. They have the potential to enhance our understanding of human development and improve our health, but they also pose ethical dilemmas and social challenges. They require careful consideration and regulation to ensure

that they are used for good and not for evil. They demand more dialogue and debate to ensure that they are accepted and respected by society. Likewise, they challenge us to rethink our views and values on human life.

Drishti Mains Question:

Q. Discuss the scientific, ethical, and legal implications of creating and using synthetic human embryos for research and therapy.

UPSC PYQ

Q. What are the research and developmental achievements in applied biotechnology? How will these achievements help to uplift the poorer sections of the society? **(2021)**

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