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1. **Commercial Cord Blood Banking**

Why in News?

Recently, there has been growing concern regarding the aggressively promoted concept of cord blood banking.

- Over the past decade, stem cell banking has been aggressively marketed even as its use is still in experimental stages.
- Enormous fees are charged from parents to preserve cells merely by emotional marketing.
- However, according to **Indian Council of Medical Research (ICMR)**, there is **no scientific basis** for preservation of cord blood for future self-use and this practice therefore raises ethical and social concerns.
- The ICMR does **not recommend commercial stem cell banking**.

Cord Blood Banking

- Cord blood (short for umbilical cord blood) is the blood from the baby that is left in the umbilical cord and placenta after birth.
- It contains special cells called hematopoietic stem cells that can be used to treat some types of diseases.
- **Hematopoietic stem cells** can mature into different types of blood cells in the body.
- Globally, cord blood banking is recommended as a source of **hematopoietic stem cell (derived from bone marrow, peripheral blood, or umbilical cord blood)** transplantation for haematological cancers and disorders where its use is recommended.
- For all other conditions, the use of cord blood as a source of stem cells is not yet established.

Stem Cells

- Stem cells are special human cells that have the ability to develop into **many different cell types**, from muscle cells to brain cells.
- Stem cells are divided into **two main forms**
    1. **Embryonic stem cells** come from **unused embryos** resulting from an **in vitro fertilization** procedure and that are donated to science.
        - These embryonic stem cells are **pluripotent,** meaning that they can turn into more than one type of cell.
    2. **Adult Stem Cells:** There are **two types of adult stem cells.**
        - One type comes from fully **developed tissues**, like the brain, skin, and bone marrow.
            - There are only **small numbers** of stem cells in these tissues, and they are more likely to generate only certain types of cells.
            - For example, a stem cell derived from the liver will only generate more liver cells.

- The second type is induced **pluripotent stem** cells.
  - These are adult stem cells that have been **manipulated in a laboratory** to take on the pluripotent characteristics of embryonic stem cells.
- The stem cells are being researched for healing damaged tissue and treating cardiovascular and neurodegenerative conditions.

2. Red Blood Cells

Why in News?

Recently, a team of Indian researchers have invented a process through which generation of Red Blood Cells (RBCs) outside the body (in vitro) from Hematopoietic Stem Cells (HSCs) can be speeded up.

- The invented process would help to **fasten the process of transfusion of RBCs** in life-saving treatments for numerous conditions such as severe anaemia, transplant surgery, pregnancy-related complications, and blood-related cancers.

Key Points

- The process of generation of RBCs in the laboratory from HSCs can be **speeded up by adding a very low concentration of a small protein molecule called `Transforming Growth Factor β1' (TGF-β1), along with a hormone called `Erythropoietin' (EPO).**
  - The whole process takes **18 days.**
  - Usually, the addition of only Erythropoietin (EPO) to HSCs generate RBCs in **21 days.**
- Indian researchers have found that the addition of TGF-β1 with EPO has cut down the processing time by three days.

Blood

- Blood is a fluid connective tissue that consists of plasma, blood cells and platelets.
- It helps to circulate oxygen and nutrients to various cells and tissues.
- The major types of blood cells include:
  - **Red Blood Cell**
    - The Red Blood Cells (RBCs) are also known as Erythrocytes.
    - RBCs contain the iron-rich protein called haemoglobin that gives blood its red colour.
    - RBCs are the most copious blood cells produced in bone marrow. Their main function is to transport oxygen from and to various tissues and organs.
  - **White Blood Cells**

        - The White Blood Cells (WBCs) are also known as **Leukocytes** and are the **colourless** blood cells as it is **devoid of haemoglobin**.
        - It mainly contributes to **immunity and defence mechanisms**.
- **Platelets**
    - **Platelets are** also called thrombocytes.
    - They are a component of blood whose function is to react to bleeding from blood vessel injury by clumping, thereby initiating a blood clot.
    - Platelets have no cell nucleus.

3. Sahyadri Megha

Why in News?

- The University of Agricultural and Horticultural Sciences(UAHS), Shivamogga, Karnataka has developed 'Sahyadri Megha', a new red variety of paddy.

Sahyadri Megha

- It is developed under the hybridization breeding method by cross-breeding the 'Jyothi' variety with that of 'Akkalu', a native disease-resistant and protein-rich paddy variety.
- **Key Attributes:**
    - High protein content
    - High yield per hectare
    - Short Harvesting season
    - Resistant to Blast disease
- Blast disease is caused by fungus Pyricularia grisea (P. oryzae).
- Also known as rotten neck or rice fever.

4. Methane Oxidising Bacteria

Why in News?

Scientists **at Agharkar Research Institute (ARI), Pune** have isolated 45 different strains of **methanotrophic bacteria.**

- Methanotrophic bacteria have been found to be capable of reducing methane emissions from rice plants.
- Agharkar Research Institute (ARI) is an **autonomous institute** under the **Department of Science & Technology.**

Key Points

- Scientists used some of the **isolated strains of methanotrophs** as bio-inoculants in rice plants.
    - **Bio-inoculants** are **living organisms** containing strains of specific

bacteria, fungi, or algae.
    - These are also known as **microbial inoculants.**
- They found that there was a decrease in methane emissions in inoculated plants with a positive or neutral effect on the growth of the rice.
- Methanotrophs metabolise and **convert methane into carbon-di-oxide.**
- **Why rice fields?**
    - In rice fields, methanotrophs are active near the roots or soil-water interfaces.
    - Rice fields are human-made wetlands and are waterlogged for a considerable period.
    - Anaerobic degradation of organic matter results in the generation of methane.
    - Rice fields contribute to nearly 10% of global methane emissions.
- This finding could lead to the development of microbial inoculants for methane mitigation in rice.
- **Significance:**
    - They can effectively reduce the emission of methane, which is the second most important greenhouse gas (GHG) and 26 times more potent as compared to carbon-di-oxide.
    - Besides methane mitigation, methanotrophs can also be used in methane value addition (valorization) studies.
    - Bio-methane generated from waste can be used by the methanotrophs and can be converted to value-added products such as single-cell proteins, carotenoids, biodiesel, and so on.

5. National Mission on Interdisciplinary Cyber-Physical Systems

Why in News?

The Indian Institute of Technology (IIT) Ropar, Punjab is setting up a Sectoral Application Hub in Technologies for Agriculture and Water.

- The hub is being set up under the **National Mission on Interdisciplinary Cyber Physical Systems (NMICPS)** and is granted by the Union Government's **Science and Engineering Research Board**.
- The application hub will bring solutions for **stubble management**, **water quality improvement** and **mapping of hazardous substances in water**.

NMICPS

- The mission was launched in 2018 by the Department of Science & Technology for a period of **five years**.
- Cyber Physical Systems and associated technologies include:
    - Artificial Intelligence (Al)
    - Internet of Things (loT)
    - Machine Learning (ML)

    - Deep Learning (DP)
    - Big Data Analytics, etc.
- These technologies play a transformative role in almost every field of human endeavour.
- It is necessary for the government and industries to prepare and adopt these emerging and disruptive technologies in order to remain competitive, foster economic growth, improve the overall quality of life and sustainability of the environment.

Objective

- The NMICPS is a comprehensive mission to address:
    - Technology Development,
    - Application Development,
    - Human Resource Development & Skill Enhancement,
    - Entrepreneurship and Start-up Development in **Cyber Physical System (CPS)** and associated technologies.
- The Mission aims to establish:
    - 15 **Technology Innovation Hubs (TIH)**
    - 6 **Application Innovation Hubs (AIH)**
    - 4 **Technology Translation Research Parks (TTRP)**
- These Hubs will function in a hub & spoke model, connecting academics, industry, and governments in developing solutions.

6. National Supercomputing Mission

Why in News?

Recently, a **Right to Information (RTI)** reply has revealed that India has produced **just three supercomputers since 2015** under the **National Supercomputing Mission (NSM).**

- Supercomputing systems are used for specific challenge domains like cryptography, chemistry, molecular dynamics, drug discovery, artificial intelligence and data sciences.

National Supercomputing Mission

- Mission was approved **in 2016.**
- **Implementation**: By the Department of Science and Technology (Ministry of Science and Technology) and Ministry of Electronics and Information Technology (MeitY), through **the Centre for Development of Advanced Computing (C-DAC), Pune** and Indian Institute of Science (IISc), Bengaluru.
- **Aims**: To connect national academic and R&D institutions with a grid of more than **70 high-performance computing facilities at an estimated cost of ₹4,500 crores** over the **period of seven years**

- It is also an effort to improve the number of supercomputers owned by India.
    - These supercomputers will also be networked on the National Supercomputing grid over the National Knowledge Network (NKN). The NKN connects academic institutions and R&D labs over a high-speed network.
- Under NSM, the long-term plan is to build a strong base of 20,000 skilled persons (High Performance Computing(HPC) aware human resources) over the next five years.
    - They will be equipped to handle the complexities of supercomputers.
- It supports the government's vision of **'Digital India'** and **'Make in India'** initiatives.

Progress of NSM:

- First supercomputer named **Param Shivay** has been installed in IIT-BHU, Varanasi, in 2019.
    - It has 837 TeraFlop High-Performance Computing (HPC) capacity.
- The **second supercomputer** with a capacity of **1.66 PetaFlop** has been installed at IIT-Kharagpur.
    - **Teraflops:** It is a unit of computing speed equal to one million million (10^12) floating-point operations per second (FLOPS).
- The **third system, Param Brahma,** has been installed at IISER-Pune, which has a capacity of **797 TeraFlop.**
    - **Petaflops:** It is a unit of computing speed equal to one thousand million million (10^15) floating-point operations per second (FLOPS).
- The NSM envisaged setting up a network of 70 high-performance computing facilities in the country but skewed funding for the mission during the initial years slowed down the overall pace of building supercomputers.
    - Only 16.67 % of the total budget of Rs 4,500 crore, has been utilised during the last four-and-a-half years for execution of the mission.

Global Scenario:

- **China has the maximum number of supercomputers** and maintains the top position in the world, followed by the US, Japan, France, Germany, Netherlands, Ireland and the United Kingdom.

7. National Biopharma Mission

- The National Biopharma Mission (NBM) is an **industry-Academia Collaborative Mission** for **accelerating biopharmaceutical development** in the country.
- The mission was **approved in 2017** at a total cost of Rs 1500 crore and is **50% co-funded by World Bank loan.**
- **Implementation:**
    1. Implemented by **Biotechnology Industry Research Assistance Council (BIRAC).**
    2. Oversight to the mission activities is provided by the **inter-ministerial Steering Committee** chaired by the Secretary-Department of Biotechnology.
    3. The Technical Advisory Group (TAG) provides approval and reviews scientific progress of its components.
- Under this Mission, the Government has launched **Innovate in India (i3) programme.**

Innovate in India (i3)

- Innovate in India aims to create an enabling ecosystem to promote entrepreneurship and indigenous manufacturing in the sector.
- It is focused on the following 4 verticals:
    1. **Development of product leads for Vaccines, Biosimilars and Medical Devices** that are relevant to the public health need by focussing on managed partnerships.
    2. **Upgradation of shared infrastructure facilities** and establishing them as centres of product discovery/discovery validations and manufacturing.
    3. **Develop human capital** by providing specific training.
    4. **Developing Technology Transfer Offices** to help enhance industry academia inter-linkages.