

**SCIENCE AND TECHNOLOGY**

❖ **CAR T-cell therapy**

➤ **CONTEXT:** The three major forms of treatment for any cancer are surgery (removing the cancer), radiotherapy (delivering ionising radiation to the tumour), and systemic therapy (administering medicines that act on the tumour). Surgery and radiotherapy have been refined significantly over time – whereas advances in systemic therapy have been unparalleled. A new development on this front, currently holding the attention of many researchers worldwide, is CAR T-cell therapy.

➤ **Chemo and immunotherapy**

- Systemic therapy's earliest form was chemotherapy: when administered, it preferentially acts on cancer cells because of the latter's rapid, unregulated growth and poor healing mechanisms. Chemotherapeutic drugs have modest response rates and significant side-effects as they affect numerous cell types in the body.
- The next stage in its evolution was targeted agents, a.k.a. immunotherapy: the drugs bind to specific targets on the cancer or in the immune cells that help the tumour grow or spread. This method often has fewer side-effects as the impact on non-tumour cells is limited. However, it is effective only against tumours that express these targets.

➤ **What are CAR T-cells?**

- Chimeric antigen receptor (CAR) T-cell therapies represent a quantum leap in the sophistication of cancer treatment. Unlike chemotherapy or immunotherapy, which require mass-produced injectable or oral medication, CAR T-cell therapies use a patient's own cells. They are modified in the laboratory to activate T-cells, a component of immune cells, to attack tumours.
- These modified cells are then infused back into the patient's bloodstream after conditioning them to multiply more effectively.
- The cells are even more specific than targeted agents and directly activate the patient's immune system against cancer, making the treatment more clinically effective. This is why they're called 'living drugs'.

➤ **How does it work?**

- In CAR T-cell therapy, the patient's blood is drawn to harvest T-cells – immune cells that play a major role in destroying tumour cells. Researchers modify these cells in the laboratory so that they express specific proteins on their surface, known as chimeric antigen receptors (CAR): they have an affinity for proteins on the surface of tumour cells. This modification in the cellular structure allows CAR T-cells to effectively bind to the tumour and destroy it.
- Conventional chemotherapy or immunotherapy comprises molecules that bind to the tumour or block chemical pathways that allow the tumour to grow or multiply – but don't directly affect the immune system.
- The final step in the tumour's destruction involves its clearance by the patient's immune system.
- When there are abnormalities in the immune system or when the tumour finds a way to evade it, the cancer resists these drugs. In CAR T-cell therapy, the immune system is activated when the modified T-cells are reintroduced into the body, which allows a gradual and sustained tumour kill as these cells multiply.

➤ **Where is it used?**

- As of today, CAR T-cell therapy has been approved for leukaemias (cancers arising from the cells that produce white blood cells) and lymphomas (arising from the lymphatic system). These cancers occur through unregulated reproduction of a single clone of cells: following the cancerous transformation of a single type of cell, it produces millions of identical copies. As a result, the target for CAR T-cells is consistent and reliable.
- CAR T-cell therapy is also presently used among patients with cancers that have returned after an initial successful treatment or which haven't responded to previous combinations of chemotherapy or immunotherapy.
- Its response rate is variable. In certain kinds of leukaemias and lymphomas, the efficacy is as high as 90%, whereas in other types of cancers it is significantly lower. The potential side-effects are also significant, associated with cytokine release syndrome (a widespread activation of the immune system and collateral damage to the body's normal cells) and neurological symptoms (severe confusion, seizures, and speech impairment).

➤ **How widespread is its use?**

- The complexity of preparing CAR T-cells has been a major barrier to their use. The first clinical trial showing they were effective was published almost a decade ago; the first indigenously developed therapy in India was successfully performed only in 2021.
- The technical and human resources required to administer this therapy are also considerable. Treatments in the US cost more than a million dollars. Trials are underway in India, with companies looking to indigenously manufacture CAR T-cells at a fraction of the cost. The preliminary results have been encouraging.

➤ **The Indian perspective**

- In India, introducing any new therapy faces the twin challenges of cost and value. Critics argue that developing facilities in India may be redundant and/or inappropriate as even when it becomes cheaper, CAR T-cell therapy will be unaffordable to most Indians. Those who are affluent and require the therapy currently receive it abroad anyway.
- Having access to the global standard of care is every patient's right; how it can be made more affordable can be the next step. A significant fraction of the Indian population incurs out-of-pocket expenses for their treatment since state and private insurance coverage is minimal.

- Investments in developing these technologies in India represent the hope that, as with other initially expensive treatments like robotic surgery, we will be able to provide economies of scale: the sheer volume of patients in India has the potential to drive the cost of treatment down.
- **Evolution of 'cell therapies'**
- The interest in the technology goes beyond providing a new lease of life to people with leukaemias and lymphomas. For solid tumours (like those of the prostate, lung, colon, and some other organs) CAR T-cell therapy has been shown to be able to cure patients with tumours that have recurred or have evaded multiple lines of treatment.
- The challenge with harnessing these techniques for solid tumours remains significant. These are highly heterogeneous cancers that lack a consistent target with which CAR T-cells can bind.
- Progress in the field, however, has the potential to unlock a host of newer treatments on the horizon called cell therapies. They include personalised anti-cancer vaccines and tumour infiltrating lymphocyte therapies (where white blood cells that attack the tumour are extracted, modified, and reintroduced into the patient).
- Cancer constantly evolves to evade treatment; similarly, it need to develop more sophisticated therapies with as few-side effects as possible. Cell therapies hold this promise and will also help us understand this dreaded disease and its complexities better.

### SOCIAL ISSUE/POLITY

#### ❖ **Child marriage**

➤ **CONTEXT: Over the last few days, Assam has arrested over 2,000 men in a state-wide crackdown on child marriages that have taken place in the state. Those arrested have been booked under the provisions of the stringent POCSO Act and the Prohibition of Child Marriage Act.**

- Chief Minister Himanta Biswa Sarma said that the police will retrospectively book people who participated in child marriage in the last seven years and the focus will especially be on “mullahs, kazis, and pujaris” conducting these marriages. The arrests come in the backdrop of growing debate on the minimum age of marriage of Muslim women.

➤ **Under what law are the arrests being made?**

- According to Assam Chief Minister Men who married girls below 14 years of age would be booked under the Protection of Children From Sexual Offences Act, those marrying girls between 14 and 18 years would be booked under the Prohibition of Child Marriage Act.

- **The POCSO Act** of 2012 criminalises sex between a minor and an adult. The law does not recognize a minor's consent as valid. Sexual assault under POCSO is a non-bailable, cognisable offence. This means that the police can make an arrest without warrant. So a presumption of sexual assault is being made in case of child marriage involving minor girls below the age of 14. Sexual assault, that is not penetrative, carries a minimum imprisonment of three years that may extend to five years with a fine.

- ✓ Moreover, under Section 19, POCSO Act imposes a “mandatory reporting obligation” which requires every person who suspects or has knowledge of a sexual offence being committed against a child must report it to the police or the Special Juvenile Police Unit. Failure to do so will result in imprisonment, a fine, or both.

- ✓ These mandatory reporting obligations also require doctors to report cases where minor girls seek medical assistance during pregnancies or for termination of pregnancies. Often doctors are forced to report sexual activity involving a minor girl, even if all parties involved have consented to the marriage.

- **The Prohibition of Child Marriage Act 2006**, says that child marriages are illegal but not void. Instead, they are voidable at the option of the minor party, in the scenario that the minor petitions the court to declare the marriage void.

- ✓ The Act stipulates 18 years as the minimum marriageable age for women, while for men it is 21 years. The Act punishes child marriage with “rigorous imprisonment which may extend to two years or with fine which may extend to one lakh rupees or with both.”

- ✓ The punishment also extends to anyone who performs, conducts, directs, or abets any child marriage and includes rigorous imprisonment of up to two years and a fine which may extend to one lakh rupees unless proven that he had reasons to believe that the marriage was not a child marriage.

➤ **What is the debate on Muslim age of marriage?**

- Under Muslim personal laws, the marriage of a bride who has attained puberty is considered.

- ✓ Puberty is presumed, in the absence of evidence, on completion of the age of fifteen years.

- This gap between Muslim personal law and special legislations prohibiting child marriages or sexual activity of minors puts a shadow on criminality on such marriages.

➤ **What have the courts said on the issue?**

- The Supreme Court is currently examining this issue since different High Courts have ruled differently on it. On January 13 2023, a bench led by CJI Chandrachud-led bench of the Supreme Court agreed to hear an appeal against a 2022 decision of the Punjab & Haryana High Court which allowed a 16-and-a-half-year-old Muslim girl to marry a person of her choice after attaining puberty. The National Commission for Protection of Child Rights (NCPCR) has filed the appeal.

- NCPCR challenged the High Court's ruling on grounds that personal laws can't override special penal statutes. The National Commission for Women (NCW) also filed a petition in the Apex court in December 2022, where it

sought directions to make the minimum marriageable age for Muslims at par with the other communities. The court had issued notice and appointed Senior Advocate Rajshekar Rao as amicus curie to assist in the matter.

- The SC's intervention came after various High Courts ruled differently on this issue.
  - ✓ The Punjab and Haryana High Court in a string of rulings has held that a Muslim girl can legally marry after attaining puberty. Often, the family of such girls file a case under POCSO alleging rape even when the minor girl has decided to marry or elope on her own volition.
  - ✓ In October 2022, the Karnataka High Court quashed a POCSO case against a Muslim man who was arrested after a hospital made mandatory disclosures under the law when his pregnant wife, aged 17 years and two months visited a doctor.
  - ✓ In November 2022, another bench of the Karnataka High Court, while noting the incongruity in law, granted bail to a Muslim man arrested under similar circumstances.
  - ✓ However, in January 2013, the Karnataka High Court had ruled that the Prohibition of Child Marriage Act will have an overriding effect on the provisions of Muslim personal laws where a girl can marry upon attaining puberty, as was the case of a 17-year-old girl in "Seema Begum vs State of Karnataka."
- **What is the central government's stand?**
  - In 2021, the Central government sought to introduce the Prevention of Child Marriage (Amendment) Bill 2021, to raise the marriageable age for women across all religions, from 18 to 21 years. However, the Parliament panel examining this is yet to submit its report, after receiving an extension in October 2022.
  - In line with the Centre's attempts, was the establishment of the Jaya Jaitly Committee in June 2020, by the Ministry of Women & Child Development, following which the committee submitted a report stating that the marriageable age for women should be increased from 18 to 21 years of age, in light of factors like reproductive health, education, etc.
  - In December 2021, Union Minister for Women and Child Development said that the Prohibition of Child Marriage (Amendment) Bill, 2021, which seeks to raise the age of legal marriage for women from 18 to 21, will apply to all communities in the country and, once enacted, will supersede existing marriage and personal laws.
  - At the time of India's independence, the minimum marriageable age stood at 15 years for females and 18 years for men. In 1978, the government increased it to 18 for girls and 21 for men. Years later, in 2008, the Law Commission came out with a report which stated that the minimum marriageable age for both men and women should be 18 years of age, as both are considered eligible to vote as citizens at the time.

### PRELIMS

#### 1. Primary Agricultural Credit Societies

- **CONTEXT:** The Union Budget has announced Rs 2,516 crore for computerisation of 63,000 Primary Agricultural Credit Societies (PACS) over the next five years, with the aim of bringing greater transparency and accountability in their operations and enabling them to diversify their business and undertake more activities.
- **What are PACS?**
  - PACS are village level cooperative credit societies that serve as the last link in a three-tier cooperative credit structure headed by the State Cooperative Banks (SCB) at the state level. Credit from the SCBs is transferred to the district central cooperative banks, or DCCBs, that operate at the district level. The DCCBs work with PACS, which deal directly with farmers.
  - Since these are cooperative bodies, individual farmers are members of the PACS, and office-bearers are elected from within them. A village can have multiple PACS.
  - PACS are involved in short term lending — or what is known as crop loan. At the start of the cropping cycle, farmers avail credit to finance their requirement of seeds, fertilisers etc. Banks extend this credit at 7 per cent interest, of which 3 per cent is subsidised by the Centre, and 2 per cent by the state government. Effectively, farmers avail the crop loans at 2 per cent interest only.
  - A report published by the Reserve Bank of India on December 27, 2022 put the number of PACS at 1.02 lakh. At the end of March 2021, only 47,297 of them were in profit. The same report said PACS had reported lending worth Rs 1,43,044 crore and NPAs of Rs 72,550 crore. Maharashtra has 20,897 PACS of which 11,326 are in losses.
- **Why are PACS attractive?**
  - The attraction of the PACS lies in the last mile connectivity they offer. For farmers, timely access to capital is necessary at the start of their agricultural activities. PACS have the capacity to extend credit with minimal paperwork within a short time.
  - With other scheduled commercial banks, farmers have often complained of tedious paperwork and red tape. For farmers, PACS provide strength in numbers, as most of the paperwork is taken care of by the office-bearer of the PACS.
  - In the case of scheduled commercial banks, farmers have to individually meet the requirement and often have to take the help of agents to get their loans sanctioned. NABARD's annual report of 2021-22 shows that 59.6 per cent of the loans were extended to the small and marginal farmers.
  - Since PACS are cooperative bodies, however, political compulsions often trump financial discipline, and the recovery of loans is hit. Chairpersons of PACS participate in electing the office-bearers of DCCBs. Political affiliations are important here as well.

➤ **Where is computerisation needed?**

- Experts pointed out that while SCBs and DCCBs are connected to the Core Banking Software (CBS), PACS are not. Some PACS use their own software, but a compatible platform is necessary to bring about uniformity in the system.
- Computerisation of PACS has already been taken up by a few states, including Maharashtra. The Maharashtra State Cooperative Bank has plans to directly lend to PACS in districts where the DCCBs are either financially weak or have lost their banking licence. In such a scenario computerisation of PACS would help.

**2. Tele-MANAS Scheme**

➤ **CONTEXT: A total of 43,861 calls have been received up to 31.01.2023 across India under Tele-MANAS this information given by Union Minister of State for Health and Family Welfare in a written reply to Rajya sabha**

➤ **About**

- It's an initiative of Union Ministry of Health & Family Welfare
- NIMHANS will be the nodal centre while National Health Systems Resource Centre (NHRSC), IIT Bengaluru and IITB will provide technology support.
- The services will be available 24x7 on Toll Free Number– 14416, allowing callers to select the language of choice for availing services.
- At least One Tele-MANAS Cell to be established in each State/UT.
- Tele-MANAS will be organised in two tier system; Tier 1 comprises of state Tele-MANAS cells which include trained counsellors and mental health specialists. Tier 2 will comprise of specialists at District Mental Health Programme (DMHP)/Medical College resources for physical consultation and/or e-Sanjeevani for audio visual consultation.
- Presently there are 5 regional coordination centres along with 51 State/UT Tele MANAS cells.
- The initial rollout providing basic support and counselling through centralized Interactive Voice Response system (IVRS) is being customized for use across all States and UTs.
- Specialised care is being envisioned through the programme by linking Tele-MANAS with other services like National tele-consultation service, e-Sanjeevani, Ayushman Bharat Digital Mission, mental health professionals, Ayushman Bharat health and wellness centres and emergency psychiatric facilities.
- Eventually, this will include the entire spectrum of mental wellness and illness, and integrate all systems that provide mental health care.

**3. Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) scheme**

➤ **CONTEXT: Union Minister for Power and New and Renewable Energy in formed Rajya sabha in a written reply the DDUGJY scheme strengthens the electricity distribution system across the country.**

- Under DDUGJY and thereafter under Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya), all the States declared electrification of all Villages on 28<sup>th</sup> April, 2018 and all willing Households on 31<sup>st</sup> March, 2019 respectively. While, a total of 18374 villages were electrified under DDUGJY, a total of 2.86 crore households were electrified under the aegis of Saubhagya, including additional households in two tranches that became willing after 31.03.2019 but were unwilling for electrification earlier

➤ **About**

- The Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) is a scheme that aims to provide continuous power supply to rural India. It was designed to replace the previous Rajiv Gandhi Grameen Vidyutikaran Yojana.
- In November 2014, Prime Minister Shri Narendra Modi announced the launch of DDUGJY, stating that “the government has decided to electrify 18,452 unelectrified villages within 1000 days, by May 1, 2018.”
- Under the DDUGJY scheme, the Union Government intends to invest 756 billion rupees (US\$9.5 billion) in rural electrification.
- The Union Government provides a grant of 60% of the project cost (85% for special states) under the DDUGJY scheme.
- Further, the Union Government provides an additional grant of up to 15% (5% for Special Category States) upon achievement of prescribed milestones.
- Implementing the Deen Dayal Upadhyaya Gram Jyoti Yojana will also help to speed up other social and economic rural reforms. Rural energy requirements include:
  - ✓ Basic lighting
  - ✓ Irrigation
  - ✓ Cooking
  - ✓ Communication
  - ✓ Education
  - ✓ Small Cottage and Agro-based industries.

➤ **Objectives**

- To provide complete electrification to all villages in India.
- To improve the quality of power supply to non-agricultural consumers in rural areas.

- To ensure adequate power supply to agricultural consumers in rural areas via dedicated agricultural feeders.
- Separation of agricultural feeders from combined/common 11 KV feeders to ensure sufficient power for farmers and consistent supply to other consumers.
- To improve the sub-transmission and distribution infrastructure network for rural electricity supply.
- Metering of distribution transformers/feeders/consumers to reduce power losses.

**ANSWER WRITTING**

**Q. Discuss the role of women in controlling population growth in India.**

**Introduction**

- In recent years, population growth has become a major concern for many countries, including India. The population of India is projected to reach 1.7 billion by 2050, making it the world's most populous country.
- One of the keyways to address the issue of population growth is to empower women and give them control over their own reproductive health.
- The Current Scenario:
  - India is the second-most populous country in the world with a population of approximately 1.5 billion people. The population growth rate in India is around 1.2%, which is considered to be high compared to other developed countries.
- The major reason behind the high population growth rate is the lack of education and awareness among women about reproductive health and family planning methods. Therefore, need of the hour to empower women so, that they can play important role in controlling population.
- The role of women in controlling population growth in India:
  - Making informed decision:
    - Women's empowerment is crucial in population growth as it gives women the right to make informed decisions about their own reproductive health.
    - When women are empowered, they have the right to access quality healthcare services, including family planning services, and can choose the number of children they want to have.
  - In India, the government has implemented various programs and initiatives to empower women and provide access to reproductive health services.
    - For example, the Janani Suraksha Yojana (JSY) program provides financial incentives to women who deliver their babies in health institutions and undergo institutional deliveries.
  - Role of Education in controlling population growth:
    - Education plays a vital role in empowering women and controlling population growth.
    - Women who are educated are more likely to be aware of family planning methods and have a higher level of decision-making power within their families.
    - In India, various programs have been implemented to promote education for girls, including the Beti Bachao, Beti Padhao (Save the Daughter, Educate the Daughter) campaign.
      - The campaign aims to promote the education of girls and address the issue of female infanticide and sex-selective abortions.
  - Role in Family Planning Services:
    - Family planning services are crucial for women to control population growth.
    - In India, various family planning methods, including natural and modern methods, are available. However, the availability of these services is limited, and many women do not have access to quality family planning services.
    - The government has implemented various programs and initiatives to improve access to family planning services, including the National Rural Health Mission (NRHM) program. The NRHM program provides funding for the establishment of rural health centers that provide family planning services.

**Conclusion**

- The role of women in controlling population growth in India is crucial. Women's empowerment and reproductive health rights, education, and access to quality family planning services are essential in controlling the population growth rate.
- The government has implemented various programs and initiatives to address these issues, but more needs to be done to ensure that all women have access to these services. It is important to continue to promote women's empowerment and provide quality family planning services to ensure sustainable population growth in India.

**MCQs**

1. Consider the following statements
  1. Primary Agricultural Credit Societies are the grass - root level arms of the short - term cooperative credit structure .
  2. Primary Agricultural Credit Societies can be started with ten or more people belonging to a village .
 Which of the statement given above is / are correct?
 

a) 1 only      b) 2 only      **c) Both 1 and 2**      d) Neither 1 nor 2
2. Consider the following statements about Saubhagya Scheme:
  1. Pradhan Mantri Sahaj Bijli Har Ghar Yojana –“Saubhagya” is a scheme to ensure electrification of all willing households in the country in rural areas only.

2. The beneficiaries for free electricity connections would be identified using Socio Economic and Caste Census (SECC) 2011 data.  
Which of the above statement/s is/are correct?  
a) 1 only                      **b) 2 only**                      c) Both 1 and 2                      d) Neither 1 nor 2
3. With reference to the Tele Mental Health Assistance and Networking Across States (Tele-MANAS), consider the following statements:  
1. Its objective is to provide free tele-mental health services all over the country round the clock, particularly catering to people in remote or under-served areas.  
2. It is an initiative of the Union Ministry of Ayush.  
Which of the statement/s given above is/are correct?  
**a) 1 only**                      b) 2 only                      c) Both 1 and 2                      d) Neither 1 nor 2
4. Consider the following statements regarding the provisions of the Protection of Children from Sexual Offences (POCSO) Act:  
1. The Act defines a child as any person below eighteen years of age.  
2. It is a gender neutral law.  
3. It recognizes consensual sexual acts among children or between a child and an adult.  
Which of the statement/s given above is/are correct?  
a) 1 and 2 only                      **b) 2 and 3 only**                      c) 1 and 3 only                      d) 1,2 and 3
5. With reference to Prohibition of Child Marriage Act, 2006, consider the following statements:  
1. The Act prescribe 18 and 21 years as the minimum age of consent for marriage for women and men, respectively.  
2. Under the act child marriages are illegal but not void  
3. The Act has a specific provision that would override any other laws on the issue.  
Which of the statement/s given above is/are correct?  
**a) 1 and 2 only**                      b) 2 and 3 only                      c) 1 and 3 only                      d) 1,2 and 3
6. Consider the following statements with respect to Chimeric antigen receptor (CAR) T-cell therapy:  
1. It is a way to get immune cells called T cells, a type of red blood cell, to fight cancer by changing them in the lab.  
2. CARs are proteins that assist the T-cells to recognize and attach to a specific protein present on cancer cells.  
3. All lymphocytes begin their development in the bone marrow.  
4. T cells originate in the bone marrow and mature in the thymus.  
Which of the following statements is/are true?  
a) 2 and 3 only                      b) 1,2 and 3 only                      c) 2 and 4 only                      **d) 2,3 and 4 only**
7. Garima Greh scheme is related to which of the following?  
a) Senior citizens  
b) Street vendors  
**c) Transgender**  
d) Domestic violence victims
8. The scheme of Atal Vayo Abhyuday Yojana (AVYAY), being run by Department of Social Justice and Empowerment, includes provision of financial security, healthcare, nutrition, shelter, welfare etc. for which of the following?  
**a) Senior citizens**  
b) Street vendors  
c) Transgender  
d) Domestic violence victims
9. Which of the following schemes are merged and renamed as Pradhan Mantri-Anusuchit Jati Abhyuday Yojna (PM-AJAY)?  
1. Pradhan Mantri Adarsh Gram Yojana (PMAGY)  
2. Babu Jagjivan Ram Chhatrawas Yojna  
3. Special Central Assistance to Scheduled Caste Sub Plan  
4. Pre and post matric Scholarship for SC students  
Choose the correct answer using the codes given below?  
a) 1 and 2 only                      b) 3 and 4 only                      **c) 1,2 and 3 only**                      d) 2,3 and 4 only
10. Recently the term "E20 fuel" mentioned in news, refers to which of the following?  
a) High octane fuel made primarily from algal sources  
b) Fossil fuel created from carbon sequestration  
c) A new type of renewable fuel developed in Europe  
**d) Ethanol-blended fuel**