1. What is immunotherapy? What are its applications? Illustrate.

Demand of the question:

It expects students to write about the immunotherapy and its applications with relevant examples.

Introduction:

Immunotherapy, also called biologic therapy, is a type of treatment designed to boost the body's natural defences against any disease or infection. It uses substances either made by the body or in a laboratory to improve or restore immune system function.

Body:

In recent years, immunotherapy has become of great interest to researchers, clinicians and pharmaceutical companies, particularly in its promise to treat various forms of cancer.

- Immunotherapy tries to help the immune system recognise cancer as a threat, and attack it.
- Rather than attacking the disease directly, as chemotherapy does in cancer, immunotherapy tries to rally the patient's own immune system to fight the disease.
- Immune system is a network of cells, tissues and bio chemicals they secrete. It defends the body against the viruses, bacteria and other invaders.
- For example, Immunotherapy involves drugs that free immune cells to fight cancer. These drugs blocks a mechanism called checkpoint. Checkpoint is used by cancer to shut down the immune system.

Applications of Immunotherapy:

- Recent use of immunotherapy to treatment of AIDS: Scientists used two prevalent anti-HIV antibodies which were inserted in test animal i.e. here Monkey after it is infected with the virus similar to HIV . In response to these anti-biotic monkeys showed improved immunity to fight with the virus in linger period .
- Novel developments in immunotherapy have led to a new era in cancer treatment. Immunotherapy looks like a promising new strategy for cancer treatment . It may be able to control tumour growth and has fewer side effects than chemotherapy.
- A sub part of Immunotherapy is Immune enhancement therapy. Autologous immune enhancement therapy use a person's own peripheral blood-derived natural killer cells, and other relevant immune cells are expanded in vitro and then re-infused.
- The therapy has been tested against Hepatitis C and Chronic fatigue syndrome.
- Suppression immunotherapy's: Immune suppression dampens an abnormal immune response in autoimmune diseases or reduces a normal immune response to prevent rejection of transplanted organs or cells.

- Immunosuppressive drugs help manage organ transplantation and autoimmune disease. Immune responses depend on lymphocyte proliferation.
- Immune tolerance therapies seek to reset the immune system so that the body stops mistakenly attacking its own organs or cells in autoimmune disease or accepts foreign tissue in organ transplantation.
- Immunotherapy is used to treat allergies. While allergy treatments (such as antihistamines or corticosteroids) treat allergic symptoms, immunotherapy can reduce sensitivity to allergens, lessening its severity.

Though Immunotherapy shows prospects of promising future in strengthening the immune system of the body, it has some drawbacks too:

- The area where the medication goes into body could hurt, itch, swell, turn red, or get sore.
- Some types of immunotherapy rev up immune system and make the person feel like having a flu, complete with fever, chills, and fatigue.

Conclusion:

New advancements in the field of healthcare have improved the life expectancy of a person. The emerged field of immunotherapy in the healthcare sector has shown promising trends in healing cancer like incurable diseases. Further investment in research and creating a necessary skilled workforce can immensely benefit the health of a person in turn contributing for socio-economic welfare.

2. How does plasma therapy work? Explain.

Demand of the question:

It expects students to give a clear account of the basics of plasma therapy. It also expects students to write about the working mechanism of plasma therapy and its recent health sector needs and probable applications.

Introduction:

Several countries, including India, are seriously looking at plasma therapy as a potential treatment for Covid-19, the disease caused by the novel coronavirus. Plasma therapy uses blood donated by recovered patients to introduce antibodies in those under treatment.

Body:

This therapy's concept is simple and is based on the premise that the blood of a patient who has recovered from disease contains antibodies with the specific ability of fighting virus. The theory is that the recovered patient's antibodies, once ingested into somebody under treatment, will begin targeting and fighting the virus in the second patient.

Working mechanism of plasma therapy:

- The plasma therapy uses antibodies developed within an infected person while he/she is infected with the virus.
- These antibodies are developed in a patient as part of the body's natural immune response to a foreign pathogen.
- These antibodies are highly specific to the invading pathogen and so, work to eliminate the foreign pathogen from the patient's body.
- Once the patient has recovered, they donate their blood so that their antibodies can be used to treat other patients. The donated blood is then checked for the presence of any other disease-causing agents such as Hepatitis B, Hepatitis C, HIV etc.
- If deemed safe, the blood is then taken through a process to extract 'plasma', the liquid part of the blood that contains antibodies. The antibody-rich plasma, once extracted, is then ingested into the body of a patient under treatment.
- Earlier, the United States used plasma of recovered patients to treat patients of Spanish flu. In 2009, the Swine flu (H1N1) patients were treated with plasma. It has also been used to treat critically ill patients during Ebola as well.
- It is also proved effective in the COVID-19 outbreak when COVID-19 patients treated with convalescent plasma have garnered good results.

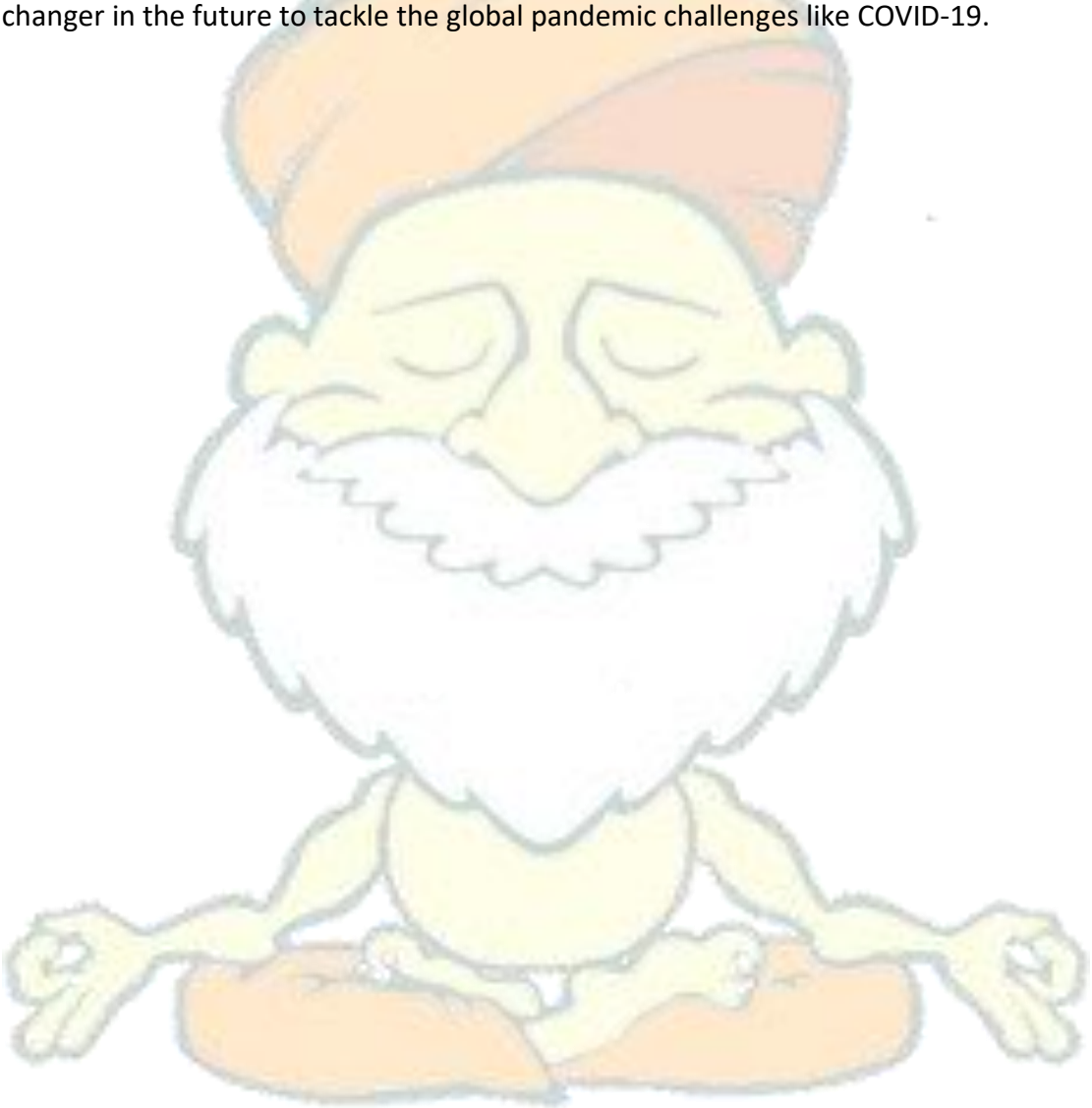
Besides the success of the convalescent plasma therapy, the study by John Hopkins immunologists stated some of the risks associated with it:

- Transfer of blood substances: As the blood transfusion takes place, there are risks that an inadvertent infection might get transferred to the patient.

- Enhancement of infection: The therapy might fail for some patients and can result in an enhanced form of the infection.
- Effect on immune system: The antibody administration may end up suppressing the body's natural immune response, leaving a Covid-19 patient vulnerable to subsequent re-infection.

Conclusion:

Plasma therapy's potential as treatment for Covid-19 has already been explored in limited trial improvement in clinical status. With its wide scale and flexible application for other disease treatments, plasma therapy can prove to be a game changer in the future to tackle the global pandemic challenges like COVID-19.



3. How does ball tracking technology work in Cricket? Explain.

Demand of the question:

It expects students to give a clear account of mechanism of ball tracking technology in cricket. It also expects students to put forth its lacunas in short and write improvement as way forward.

Introduction:

Ball tracking technology is in numerous sports such as cricket, tennis, Gaelic football, badminton, hurling, rugby union, association football and volleyball, to visually track the trajectory of the ball and display a profile of its statistically most likely path as a moving image.

Body:

Working mechanism of ball tracking technology:

- Ball tracking technologies work on the principles of triangulation using visual images and timing data provided by a number of high-speed video cameras located at different locations and angles around the area of play.
- The system rapidly processes the video feeds from the cameras and ball tracker.
- A data store contains a predefined model of the playing area and includes data on the rules of the game.
- In each frame sent from each camera, the system identifies the group of pixels which corresponds to the image of the ball. It then calculates for each frame the position of the ball by comparing its position on at least two of the physically separate cameras at the same instant in time.
- A succession of frames builds up a record of the path along which the ball has travelled. It also "predicts" the future flight path of the ball and where it will interact with any of the playing area features already programmed into the database.
- The system can also interpret these interactions to decide infringements of the rules of the game.
- The system generates a graphic image of the ball path and playing area, which means that information can be provided to judges, television viewers or coaching staff in near real-time.
- The tracking system is combined with a back-end database and archiving capabilities so that it is possible to extract and analyse trends and statistics about individual players, games, ball-to-ball comparisons, etc.
- Its major use in cricket broadcasting is in analysing leg before wicket decisions, where the likely path of the ball can be projected forward, through the batsman's legs, to see if it would have hit the stumps.

Benefits of ball tracking technology in cricket:

- Due to its real-time coverage of bowling speed, the systems are used to show delivery patterns of a bowler's behaviour such as line and length, or swing/turn information.

- It helps the umpire to take the right decision, as one wrong decision can change the fate of game.
- Batsmen also benefit from the analysis of ball tracking technology, as a record can be brought up of the deliveries from which a batsman scored.
- Information such as the exact spot where the ball pitches or speed of the ball from the bowler's hand (to gauge batsman reaction time) can also help in post-match analysis.

Lacunas of ball tracking technology:

- In the 2007 Wimbledon Championships a shot that appeared to be out, was called by Hawk-Eye as in by 1 mm, a distance smaller than the advertised margin of error of 3.6 mm. Hence, it has received criticism on the ground of accuracy.
- Another doubt raise is that, that ball tracking technology may struggle with predicting the trajectory of a cricket ball after bouncing; the time between a ball bouncing and striking the batsman may be too short to generate the three frames (at least) needed to plot a curve accurately.

Conclusion:

The large scale developments in technology and their wide scale application have proved to be beneficial to ease the living of people. The ball tracking like technologies have helped to have a fair and unbiased decision making in sports game, hence, if the newly emerged technologies if implemented in the sports, can develop the sports to its true spirit of a fair play game.