Stem Cell and Cloning - 02

Cloning

- Cloning is a process of making a genetic copy of an organism or biological structure by an asexual method.
- Carbon copy of any type like organ, tissue, gene and organism, etc can be made by asexual production.

- **There are 2 types of production :**
  - **Asexual:** In this mode of reproduction, sperm and ovum are required.
  - **Sexual:** In this mode of reproduction, there is no need of sperm and ovum.

Clone

- It is a Genetic copy of an organism or biological structure where all physical, biological, and genetic characters are the same as the single parent.

Note

- Clone is the organism created and cloning is a process.
- Human cloning is banned all over the world and cloning of wild animals is also possible.

Types of Cloning

- **Therapeutic Cloning:** This type of cloning is done for medical or treatment purposes. For Example; Gene cloning: production of insulin by genetic engineering, Tissue and organ cloning: use of stem cells.
- **Reproductive Cloning:** Organism cloning.
- In 1996, Ion Wilmut of Scotland developed the first animal clone Dolly sheep.
- Dolly sheep was developed by SCNT (Somatic Cell Nuclear Transfer) technology.
- Somatic Cell Nuclear Transfer (SCNT) is the most popular technology for the development of clones of an adult organism.

Process of Dolly Clone Birth

- A somatic cell is taken out of the mother sheep and from another egg donor sheep, one egg is taken.
- Then from the somatic cell of the mother sheep, only the nucleus was taken and the empty cell was left out.
- And from egg donor sheep, only an empty egg was taken and the nucleus of the donor sheep was left out.
- Now the nucleus of a somatic cell is added to the empty egg of the donor sheep and now this egg is called a reconstituted egg. This reconstituted egg is transferred to the embryo of a surrogate female in lab condition and hence embryo transfer is done to the surrogate mother.
- Now, this surrogate mother starts pregnancy and then embryonic development takes place and finally it leads to the birth of a dolly clone.
- So, this was done with the help of 3 female sheep.
- Scientist Ian Wilmut of Scotland succeeded after 277 attempts.
- Dolly clone is a female sheep.
- In the female, there will be presence of somatic cells and an egg, however, in the male there will be only somatic cells but not eggs and thus, no pregnancy.

Cloning in India

- Cloning was started in 2007 by NDRI (National Dairy Research Institute), Karnal, Haryana.
- In India, cloning programs started in 2009, and NDRI developed the world's first buffalo clone called GARIMA.
- Then GARIMA-2 was cloned and then MAHIMA, later KARISHMA. Like this, the evolution of cloning continued.
- In 2012, NDRI in the association of Sher-e-Kashmir University developed the Pashmina goat clone and it was named as NOORIE.
- In 2014, NDRI developed a clone of critically endangered wild buffalo in Chhattisgarh and it was named as DEEPASHA. It was taken after the combination of Deepak and Asha where Deepak was a male buffalo and Asha was a female buffalo. Once the male Deepak buffalo died and Asha was left with the option of cloning, so it was done to get Deepasha.
- In 2015, NDRI developed two buffalo clones APURVA and SWAROOPA. SWAROOPA has a high milk yielding capacity as it can give 25.1 liters of milk per day.
- NDRI has also developed a male buffalo clone to increase sperm production which will help in the artificial insemination programs that are running in India.
- In 2020, NDRI developed a clone of the Murrah buffalo named as Tejas which is a male buffalo. It is a high-yield variety (HYV) breed. It was developed to increase sperm production.

Purpose of cloning in India

- To increase milk production in the country.
- To increase the production of commercially valuable items like Pashmina.
- To save a species from extinction.

India has got the maximum number of cattle in the world. India is the biggest producer as well as largest consumer of milk in the world. But still, India is deficient in milk production. That's why there is a need to increase the milk production capacity of the country.

According to the National Dairy Development Board (NDDB), to meet the demand, one crore ton milk production needs to be increased every year.

Issues Related to Cloning

- Low success rate which is 10% only. Due to its low success, there is doubt regarding the economic viability of cloning.
- Many scientists believe that the genetic age (DNA age) of a clone is equal to the age of the parent organism at the time of birth of the clone. And this old DNA will bring some defects and diseases at an early stage of life. And the clone will suffer from situations that occur in old age.
- Dolly sheep died due to arthritis only after 2 years of cloning.
- Garima died due to a heart attack.
- These are all due to genetic age.