

13.2 Biotechnology



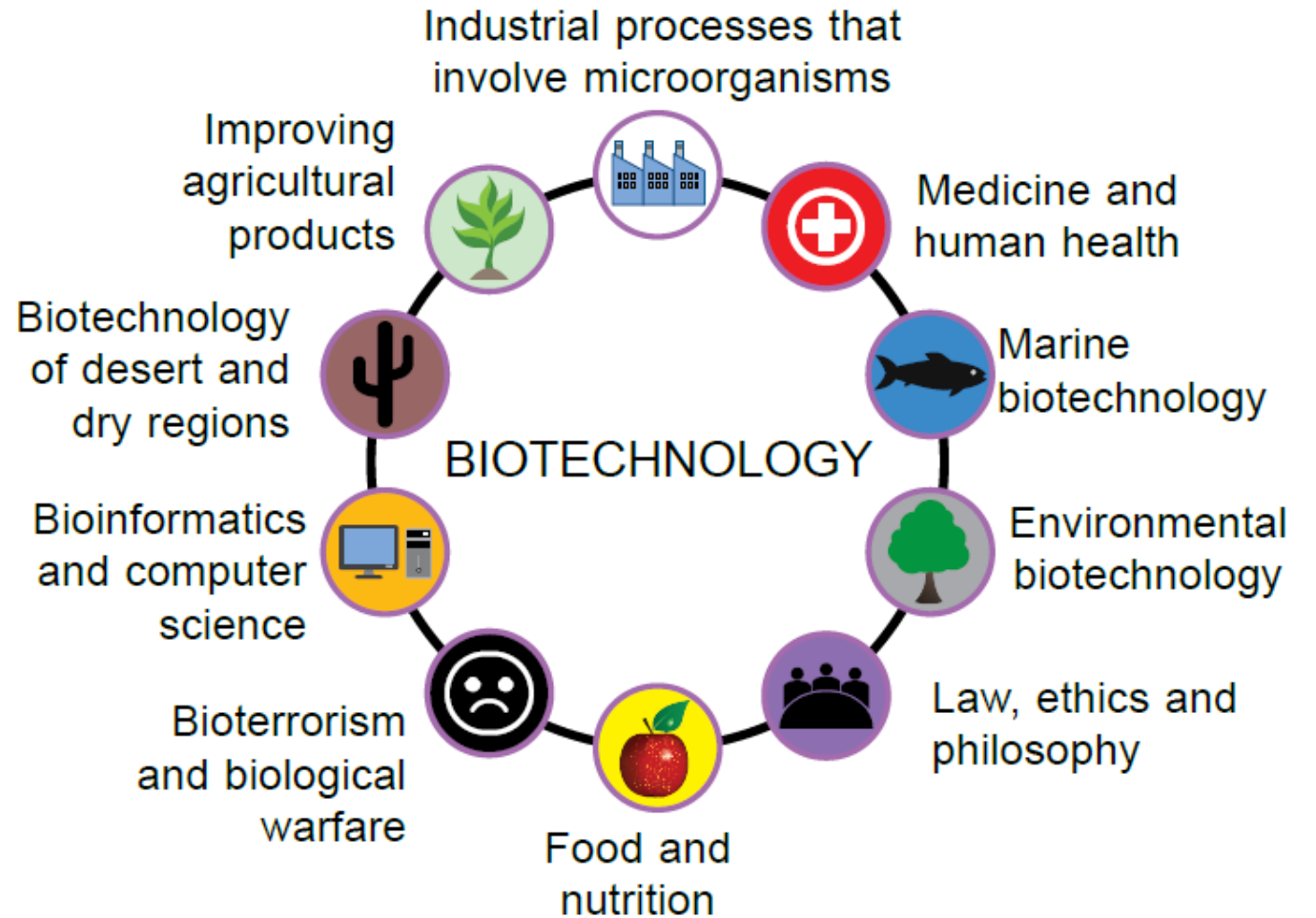
Biotechnology

- is a field which utilises technology or method to manipulate organisms for the production of biological products

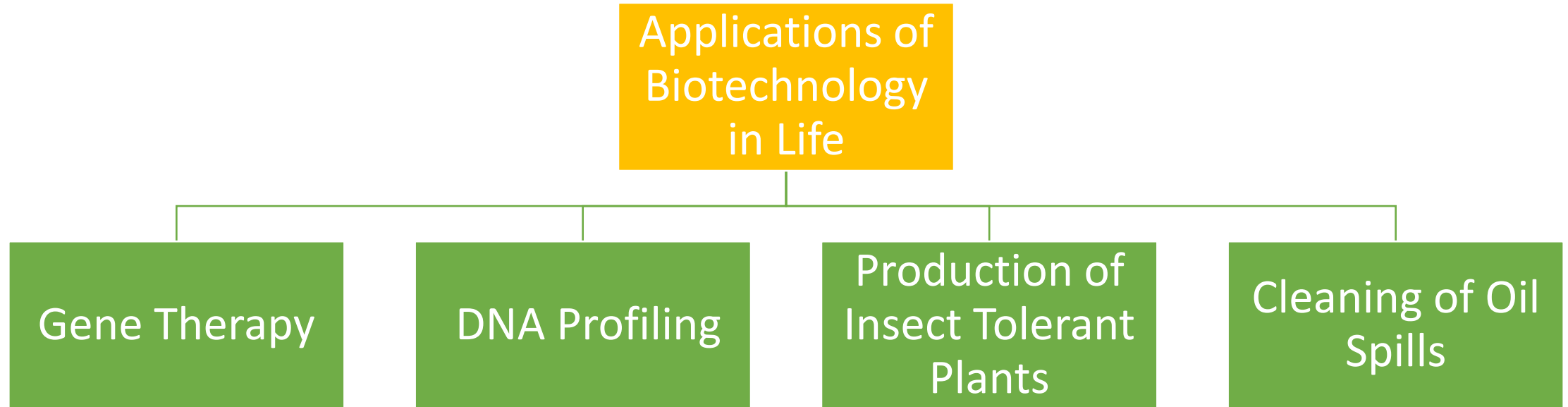


Biotechnology

- aims to improve the quality of livestock and crops as well as to develop the application of microorganisms for specific purposes.
- biotechnology involves various disciplines of science
- each discipline that involves the use of living organisms for a specific purpose is given a specific colour code

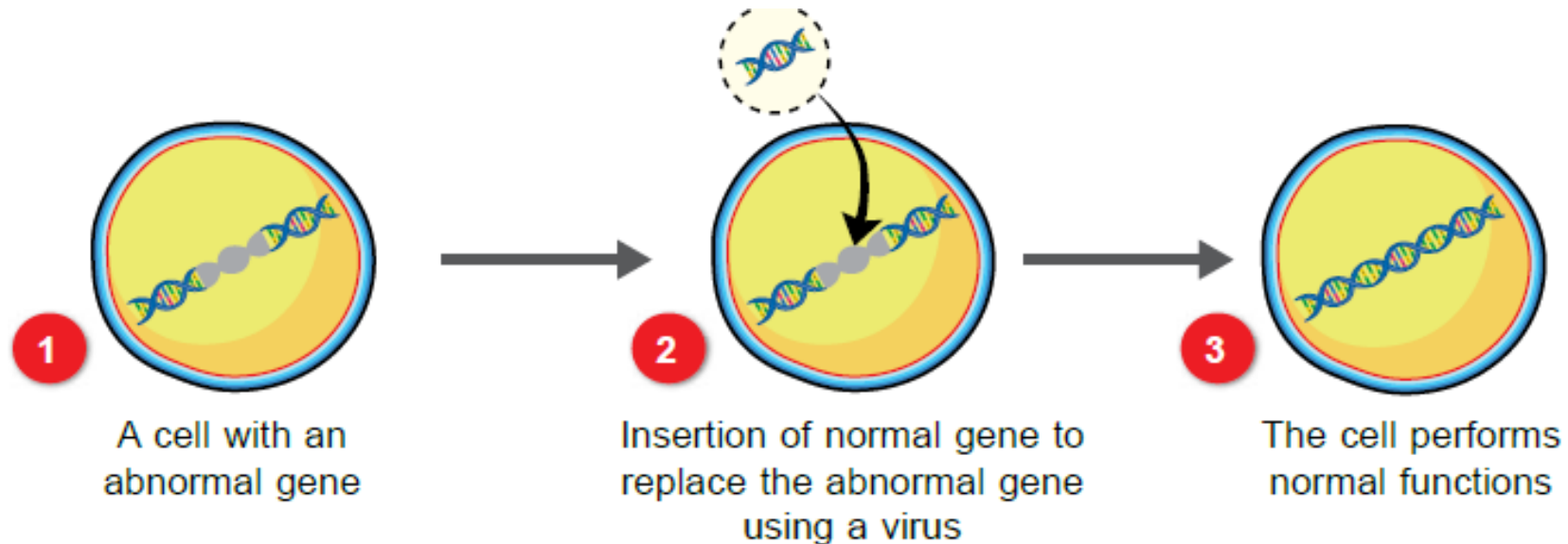


Applications of Biotechnology in Life



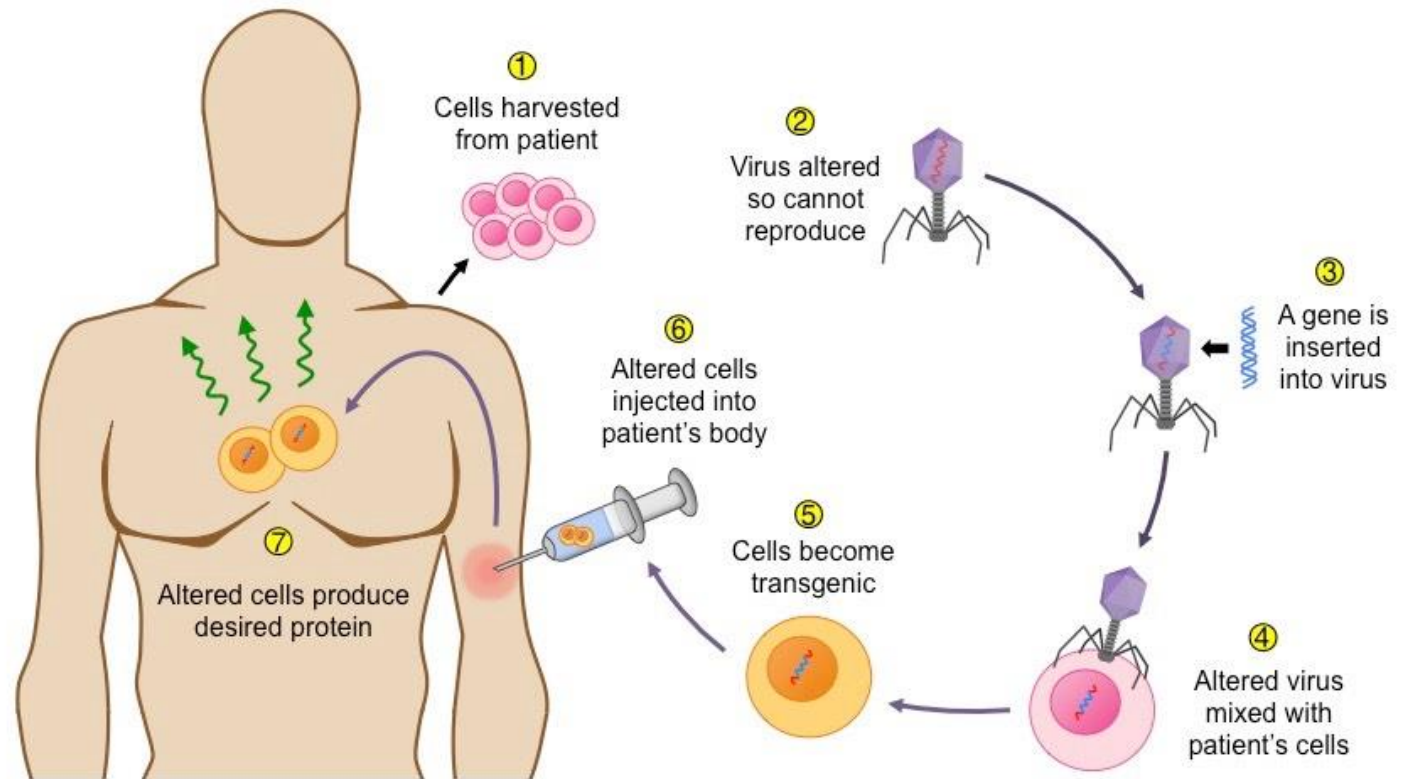
a) Gene Therapy

- is used to treat or prevent genetic diseases.
- normal gene is inserted into the patient to replace the abnormal gene



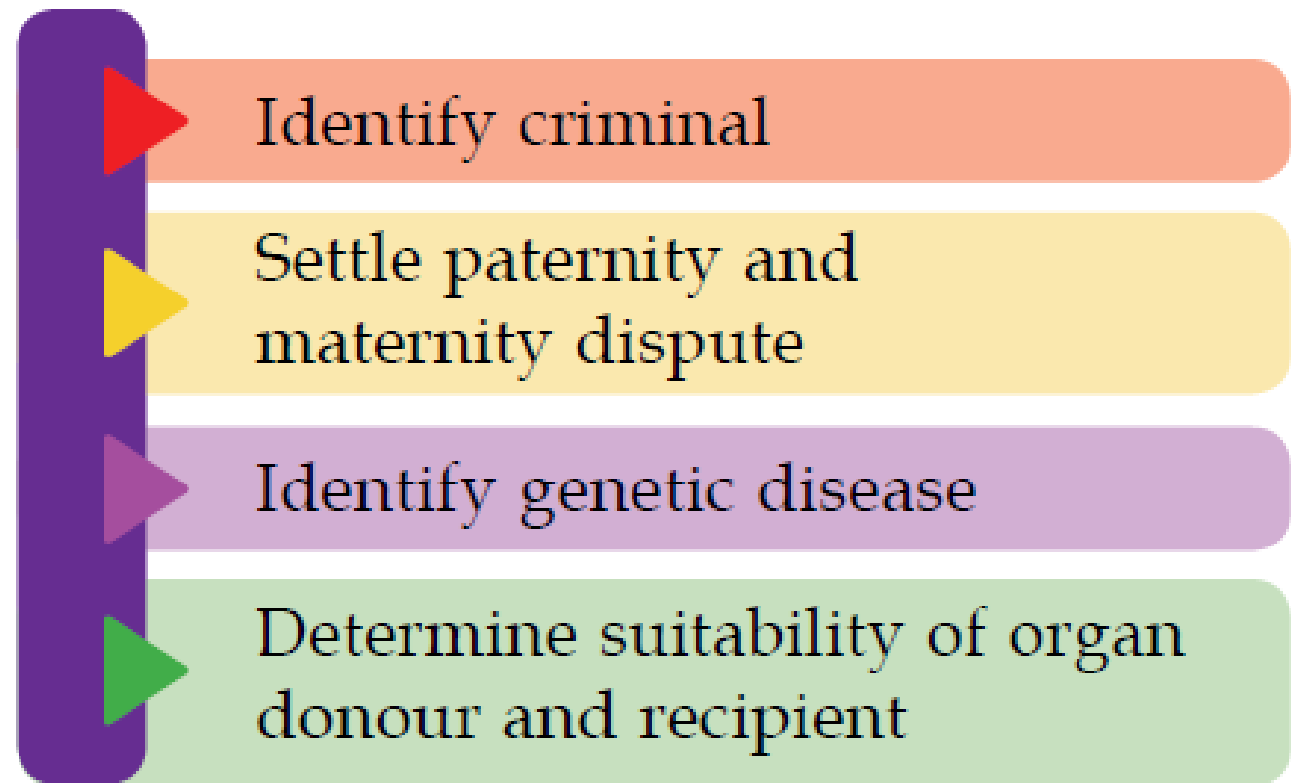
a) Terapi Gen

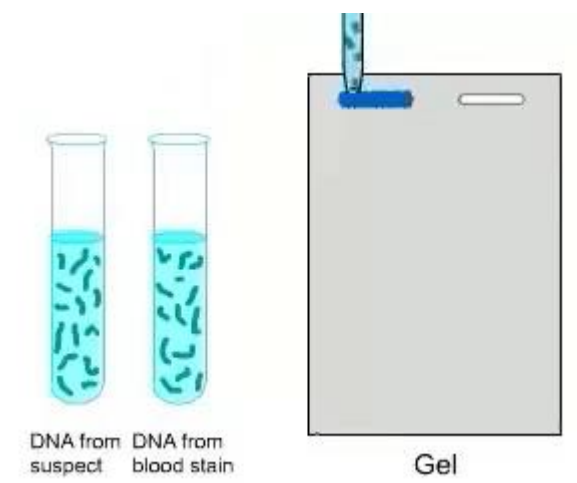
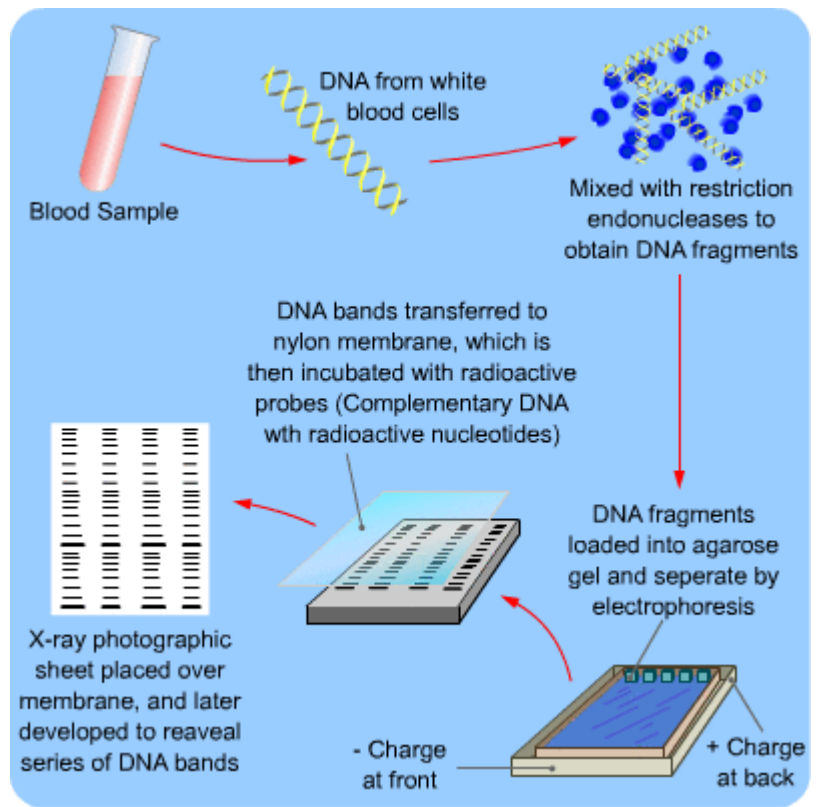
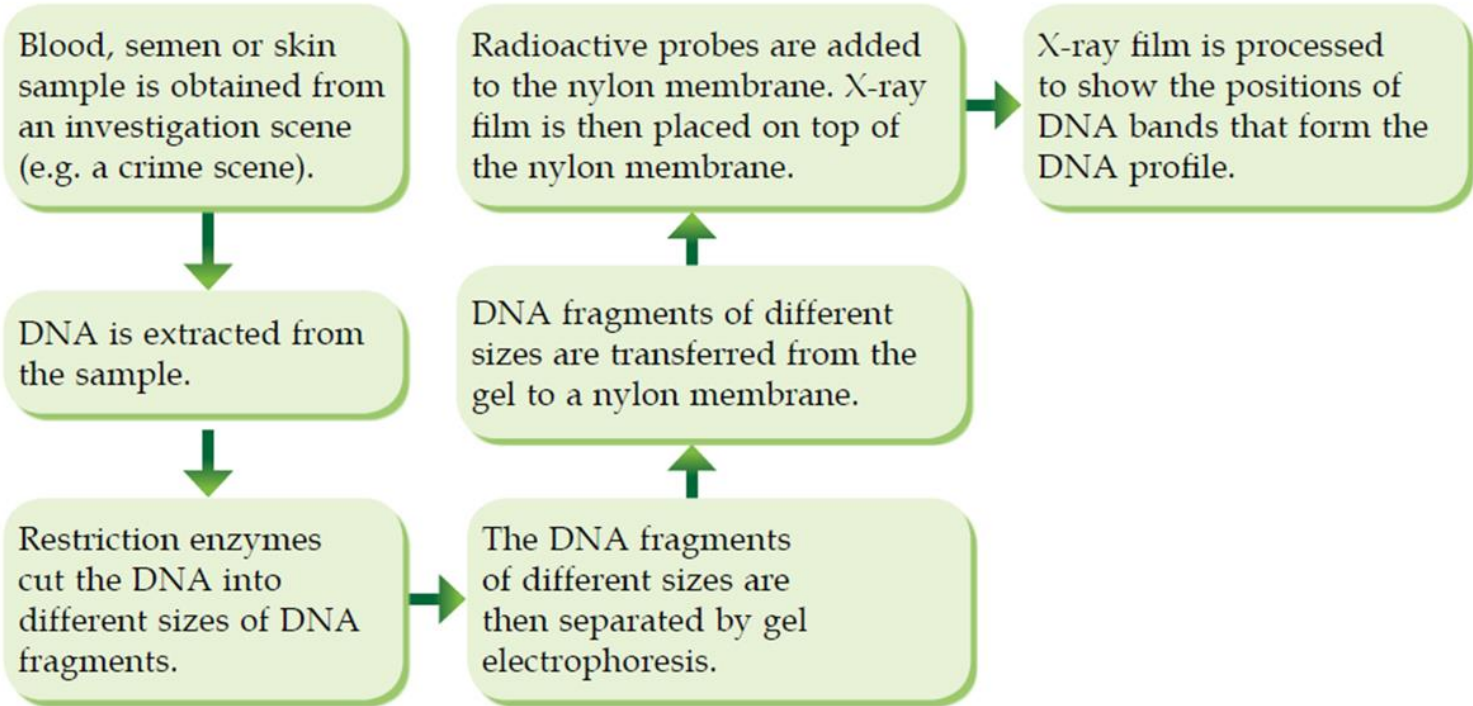
- The diseases that can be cured by gene therapy are cystic fibrosis, muscular dystrophy and a few types of cancer.



b) DNA Profiling

- is a technique used in forensic to identify individuals, based on their DNA.
- An individual can be identified based on the DNA obtained from his/her blood, semen (for male) or skin.







Victim



Crime Scene



Suspect 1



Suspect 2



Suspect 3



Production of Insect Tolerant Plants

- Farming cotton breed with high yield and resistant to pests such as Bt cotton in cotton farms has reduced the use of pesticides.
- The Bt crop is injected with genes from *Bacillus thuringiensis* (Bt), a type of soil bacteria that secretes toxins



Bt cotton and cotton from an untreated control plot. Source: California Agriculture

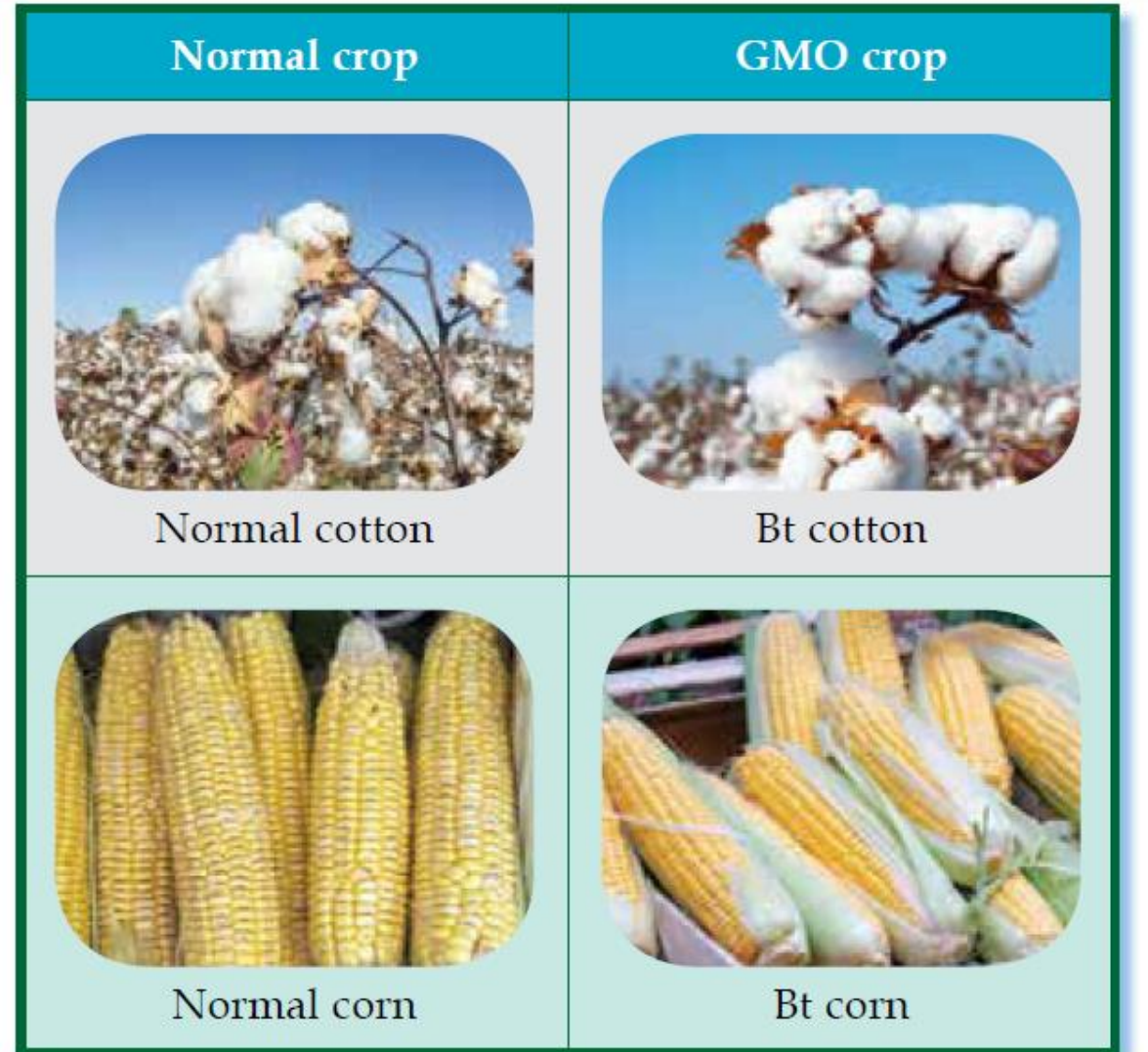
Gene that produces Bt toxins from *Bacillus thuringiensis* is inserted into the plant's genome.

Pest feeds on the plant which produces Bt toxins.

The toxins affect the digestive system of the pest and kills it.

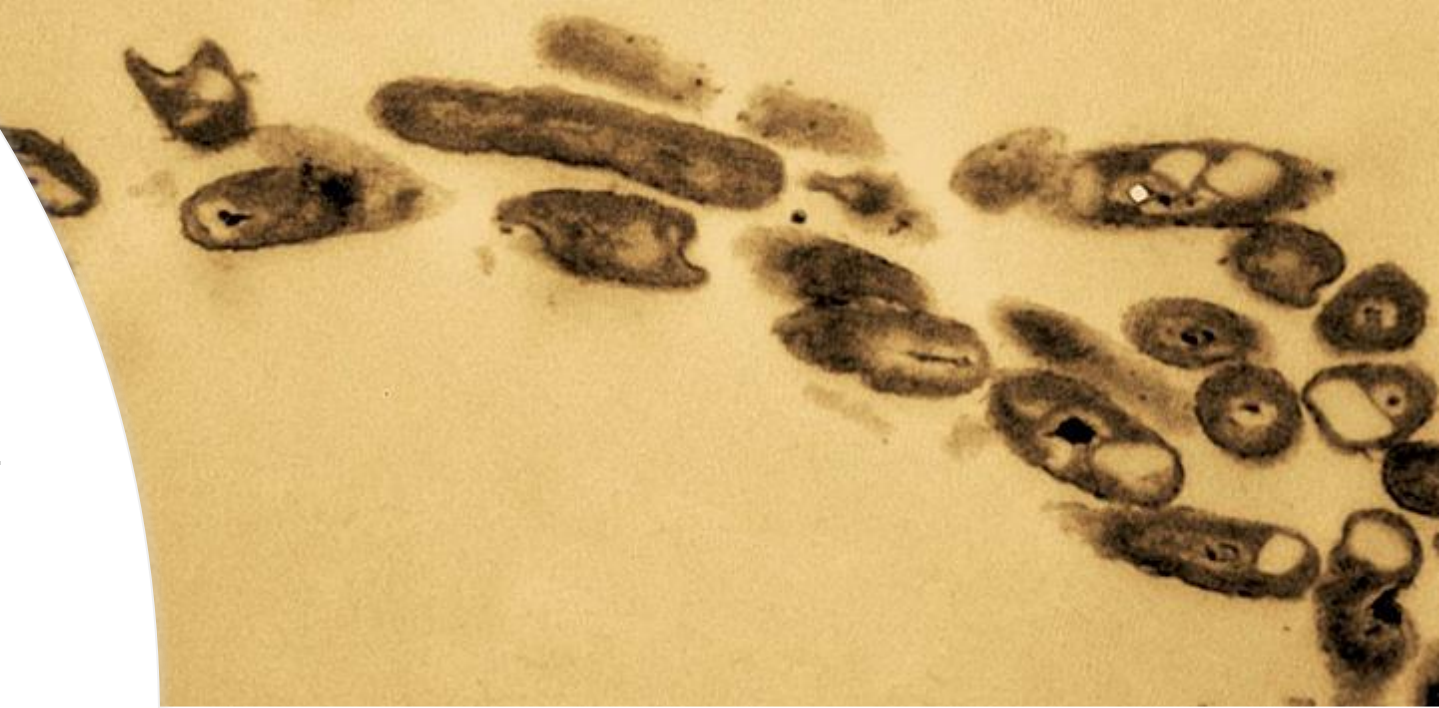
Production of Insect Tolerant Plants

- This effort has saved cost by reducing the use of pesticides and also increases cotton yield.
- Besides cotton, other Bt crops are corn and brinjal.



Cleaning of Oil Spills

- Bioremediation is a method which uses bacteria to clean up environmental pollutants.
- It is effective to treat oil spillage in the ocean.
- Most molecules in crude oil and purified oil products can be degraded by bacteria.
- For example, *Alcanivorax borkumensis* a type of bacteria that depends on oil for its source of energy is widely used to treat oil spills.



Importance of Biotechnology in Life

Field	Contributions
Agriculture	<ul style="list-style-type: none"> • Produce the best livestock and crop breeds. The tissue culture method and cloning technique have expedited plant reproduction. • Produce paddy varieties which give more yield and mature faster. • Animal cloning enables mass reproduction and produces disease-resistant clones. • Use of hormones expedite animal growth and maturity.
Medicine	<ul style="list-style-type: none"> • Can modify the genetic contents of an individual. • Reduce risk of mental disease. • Prevent specific diseases such as cancer and inherited diseases. • Human with dwarf genetics can have normal children. • Assist mothers with difficulty to conceive.
Forensic	<ul style="list-style-type: none"> • Can identify criminal based on tissue or body fluid such as blood, semen, skin or hair follicle.
Environment	<ul style="list-style-type: none"> • Microbes can expedite decay of waste products created by humans. • Microbes can also degrade faeces completely. • Reduce pollution to protect humans and the environment.