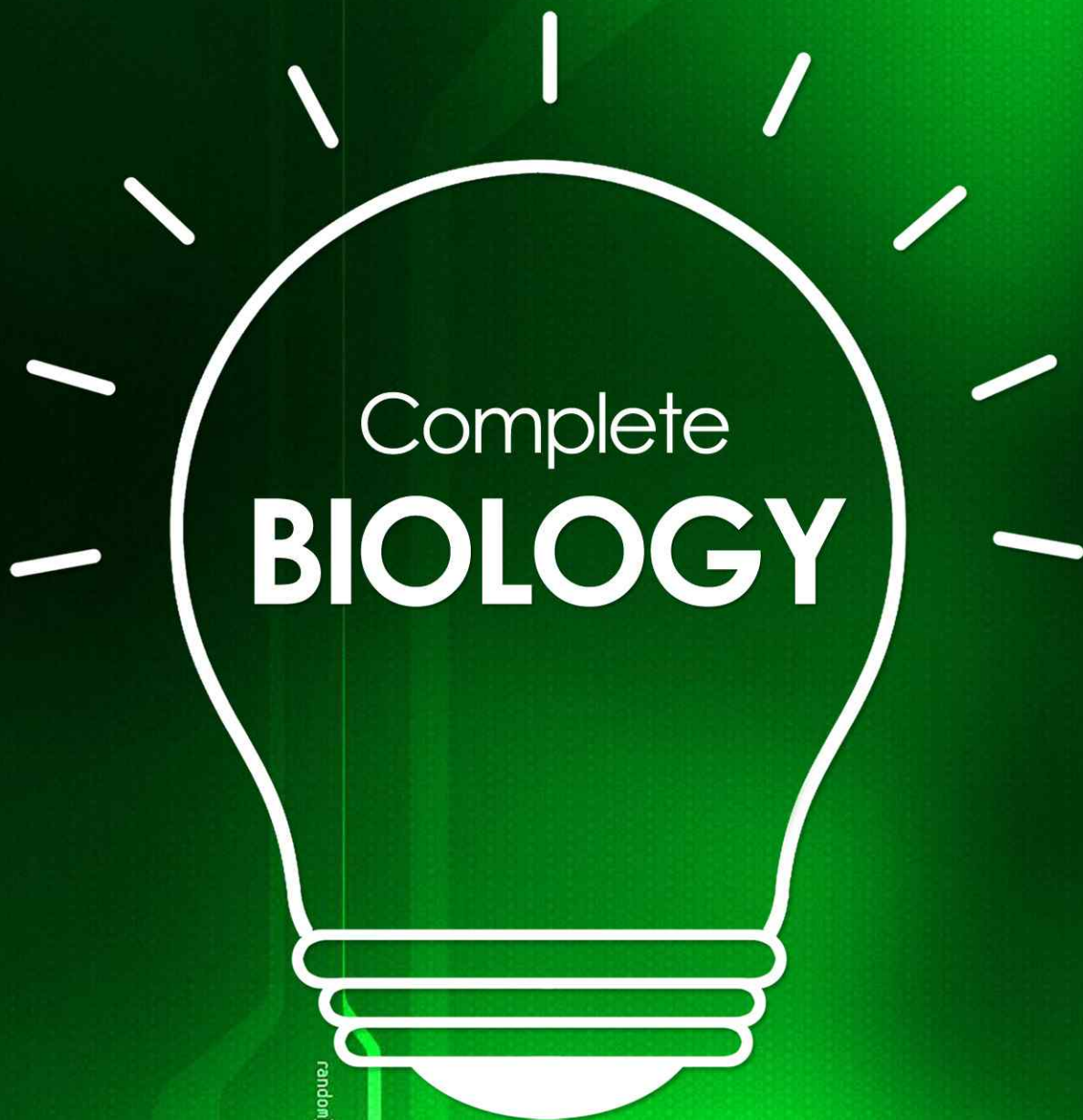




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CLASS 12th

Biotechnology Applications

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01. Introduction

Biotechnology essentially deals with industrial scale production of biopharmaceuticals and biologicals using genetically modified microbes, fungi, plants and animals. It finds application in medicine, therapeutics, diagnostics, bioremediation, agriculture, waste treatment, food science (process food) and energy production. The thrust areas of biotechnologies include:

- (i) Improved organism mostly a microbe or pure enzyme acting as the best catalyst.
- (ii) Providing optimum conditions through engineering for catalyst to act.
- (iii) Downstream processing technologies to purify the protein/organic compound.

Knowledge Cloud

Norman Ernest Borlaug (March 25, 1914 – September 12, 2009) was an American **agronomist, humanitarian, and Nobel laureate** who has been called “the father of the Green Revolution”.

What is Green Revolution?

Period in which significant increase in agricultural productivity of grains (particularly wheat and rice) was observed in 20th century, resulting from

- (i) Introduction of improved crop varieties *i.e.*, high-yielding varieties.
- (ii) Better management practices (irrigation, mechanisation and soil conservation technique).
- (iii) Use of agrochemicals (fertilisers or pesticides).

Use of genetically modified crops is a possible solution

Gene cloning provides a new dimension to crop breeding by enabling direct changes to be made to the genotype of a plant, circumventing the random process inherent in conventional breeding. Two general strategies have been used:

- (a) **Gene addition** : In which cloning is used to alter the characteristics of a plant by providing it with one or more new genes.
- (b) **Gene Subtraction** : In which genetic engineering techniques are used to inactive one or more of the plant's existing genes.

Transgenic plants have been useful in many ways. For instance genetic modification has:

- (i) Made crops more tolerant to abiotic stresses (cold, drought, salt, heat).
- (ii) Reduced reliance on chemical pesticides (pest-resistant crops).
- (iii) Helped to reduce post harvest losses.
- (iv) Increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).
- (v) Enhanced nutritional value of food, *e.g.*, Vitamin ‘A’ enriched rice.

The Science behind Golden Rice : Golden rice was developed by **Ingo Potrykus** and Peter **Beyer** to combat vitamin A and Iron deficiency as this could accumulate more β -carotene.

Golden rice is a transgenic variety of rice (*Oryza sativa*) which, contains good quantities of **β -carotene (provitamin A** – inactive state of vitamin A). β -carotene is a principal source of vitamin A. Since the grains (seeds) of the rice are yellow in colour due to β -carotene, the rice is commonly called **golden rice**.