FREE NOTES · NCERT + NEET LEVEL

Biotechnology & its Applications

Kheti me upyog (GM crops, Bt cotton, pest-resistant plants, RNAi), dawa me (genetically engineered insulin, gene therapy, molecular diagnosis), transgenic animals, naitik mudde aur biopiracy.

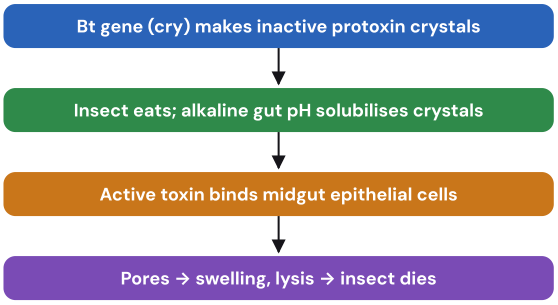
01 Kheti me biotechnology
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03 Pest-resistant plants: RNAi
04 Dawa me biotechnology
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01 Kheti me biotechnology

- Khana badhane ke tareeke: agrochemical kheti, organic kheti, genetically engineered crop kheti.
- **GMOs**: genes badle gaye. Fayde: abiotic stress (thand, sookha, namak, garmi) sahna; chemical pesticides pe kam nirbharta (pest-resistant crops); fasal ke baad nuksaan kam; minerals ka behtar upyog (mitti jaldi khatam nahi); poshan zyada, jaise **Golden rice** (vitamin A wala).
- Industries ke liye starch, fuel, dawa dene wale khaas paudhe banana.

02 Bt cotton

- *Bacillus thuringiensis* keede maarne wale proteins banata: lepidopterans (tobacco budworm, armyworm), coleopterans (beetles), dipterans (makkhi, machhar).
- Bt toxin inactive **protoxin** roop me; keede ke pet ke alkaline pH se active. Bacterium apne toxin se nahi marta (inactive roop).
- Genes **cry IAc** aur **cry IIAb** cotton bollworms; **cry IAb** corn borer.



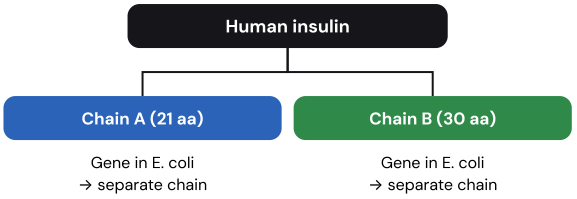
Bt toxin keede ko kaise maarta

03 Pest-resistant plants: RNAi

- Nematode *Meloidogyne incognita* tambaku ki jadon me, paidawar kam.
- **RNA interference (RNAi)**: complementary dsRNA khaas mRNA se judkar translation rokta (silencing). Cells ki natural suraksha (RNA viruses ya transposons ka dsRNA).
- *Agrobacterium* vectors se nematode-specific genes host me; sense aur anti-sense RNA ⇒ dsRNA ⇒ nematode ka mRNA band ⇒ parasite transgenic host me zinda nahi.

04 Dawa me biotechnology

- Duniya me ~30 recombinant therapeutics; Bharat me 12 market me. Surakshit, galat immune response nahi.
- **Insulin**: pehle gaay aur suar ke pancreas se (allergy). Human insulin: chains A aur B disulphide bridges se; **pro-insulin** ke roop me extra **C peptide** ke saath (hata diya jaata). **Eli Lilly** (1983) ne A aur B ke DNA sequence bana kar *E. coli* ke plasmids me daale, chains disulphide bonds se jodi.
- **Gene therapy**: pehli 1990 me 4 saal ki bachchi, **ADA deficiency** (adenosine deaminase; immune system). Lymphocytes ugakar retroviral vector se functional ADA cDNA, wapas daale; baar-baar dena padta. Sthayi ilaaj: shuruaati embryonic stage ke cells me ADA gene (bone marrow cells se).



Human insulin banana (Eli Lilly)

05 Molecular diagnosis aur transgenic animals

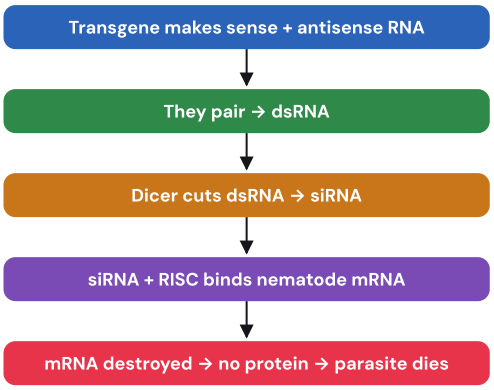
- Jaldi jaanch ke liye bahut kam pathogen dhoondhna: **PCR** (AIDS ke shak me HIV, cancer me mutations, genetic disorders), **ELISA** (antigen–antibody), radioactive tag wala single-stranded DNA/RNA **probe** autoradiography se (mutated gene film pe nahi dikhta).
- Transgenic animals (chuhe, khargosh, suar, bhed, gaay, machhli; >95% mice): normal physiology aur vikas (insulin-like growth factor), bimari ka adhyayan (cancer, cystic fibrosis, rheumatoid arthritis, Alzheimer's), biological products (emphysema ke liye α-1-antitrypsin; pehli transgenic gaay **Rosie** (1997): human protein wala doodh, 2.4 g/L, human α-lactalbumin), vaccine safety (polio vaccine transgenic mice pe), chemical safety (toxicity testing).

06 Naitik mudde aur biopiracy

- Bharat sarkar ne **GEAC** banayi: GM research ki validity aur public ke liye GM organisms ki suraksha tay karti.
- **Patents**: jaise US company ko **Basmati chawal** ka patent (1997) USPTO se; Bharat me Basmati ki 27 documented kismein. Haldi, neem pe bhi patents.
- **Biopiracy**: multinational companies dwara bina ijaazat ya muavze ke desh/logon ke bio-resources ka upyog. Ameer desh paise me ameer par biodiversity me gareeb.
- Bharatiya sansad ne Indian Patents Bill ka doosra sanshodhan paas kiya (patent terms, emergency provisions, R&D).

07 Extra + tricks

- **Flavr Savr tamatar**: polygalacturonase (naram karne wala enzyme) antisense RNA se band ⇒ zyada din tikta.
- **Hirudin** (jonk ka anticoagulant) *Brassica napus* ke beejon me.
- **Tracy** (transgenic bhed): emphysema ke liye α-1-antitrypsin wala doodh.
- Golden rice: β-carotene (pro-vitamin A) genes; Ingo Potrykus aur Peter Beyer.
- Biosafety: GEAC (Bharat); patents vs biopiracy (neem, haldi, basmati).



Nematodes ke khilaaf RNA interference

08 Important Q&A

Q1. Bt toxin bacterium ko kyun nahi maarta?

Inactive protoxin roop me rehta; sirf keede ke alkaline pet me active.

Q2. C-peptide kya aur kyun hataate?

Pro-insulin me A aur B ko jodne wala extra hissa; active insulin banne pe hata diya jaata.

Q3. Pehli transgenic gaay aur uska product?

Rosie (1997); human α-lactalbumin wala doodh (2.4 g/L), bachchon ke liye behtar.

09 Common mistakes

- Kehna ki Bt toxin bacterium ke andar active.
- Kehna ki lymphocyte wali ADA gene therapy sthayi ilaaj (nahi).
- cry IAb (corn borer) aur cry IAc (bollworm) mix karna.
- Sochna ki RNAi naya protein deta (mRNA band karta).

10 Practice (NEET style)

1. RNAi se tambaku me kaunsa nematode?
2. Human insulin (1983) kisne?
3. Pehli gene therapy me kis enzyme ki kami?
4. GM approval ki Bharatiya sanstha?
5. Golden rice me vitamin?

ANSWERS

1) *Meloidogyne incognita* · 2) Eli Lilly · 3) Adenosine deaminase · 4) GEAC · 5) Vitamin A

11 Quick revision: exam se 5 minute pehle

AGRICULTURE

- GMO fayde
- Golden rice vit A
- Bt cotton cry genes

BT AND RNAI

- Protoxin → alkaline pet
- cry IAc bollworm, IAb corn borer
- RNAi vs Meloidogyne

MEDICINE

- Insulin A + B, C-peptide hata
- ADA gene therapy 1990
- PCR, ELISA jaanch

ANIMALS/ETHICS

- Rosie: α-lactalbumin
- GEAC
- Basmati biopiracy

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.