4/8/23 # VACCINES & VACCINE PRODUCTION SBDG

1. Dead microbes
2. Weak microbes
3. mRNA
4. Protein directly

Toxoid	Vaccine
• short term immunity	• long term immunity

covaccine attenuated ✓ Sars-CoV-2
covishield spike protein genes from Adenovirus
26 → spike proteins produced
↓
antibodies are produced.
↓ but has a half-life/shelf-life
↷ need to be produced in the future when the microbe is encountered.

Memory T-cells : Immunological Memory
↳ keep memory of a particular antigen.
on exposure later on, a response is illicited.
↓
destroyed before the antigen cause a disease/effect

Vaccines → producing immunological memory to elicit immune response against microbes

Best vaccine?

getting infected with the antigen

✓ **Formulation** → properly triggering the immune system

adjuvent → add-ons that can promote immune response to antigens

✓ **Stabilization**

↳ stabilizers → for storage, transport & for longer shelf-life.

✓ **Clinical trials**

↳ verifying whether vaccines actually work in humans

eg: macroclots of blood on covishield injection

do not cause violent & lethal immune response

mice → monkey → humans

✓ **Regulation**

Why does vaccination start at a young age?

immune system } → takes around 5-6 yrs. to develop properly.

allow more precise immunological memory

History of vaccines

Edward Jenner: small pox vaccine

Louis Pasteur: vaccine against chicken cholera, anthrax, rabies.

Eradication v/s Elimination Paradigm

- wiped out from the society.
- not caused anymore

eg: small pox polio

- wave-specific reducing such that alarming number of people are not affected

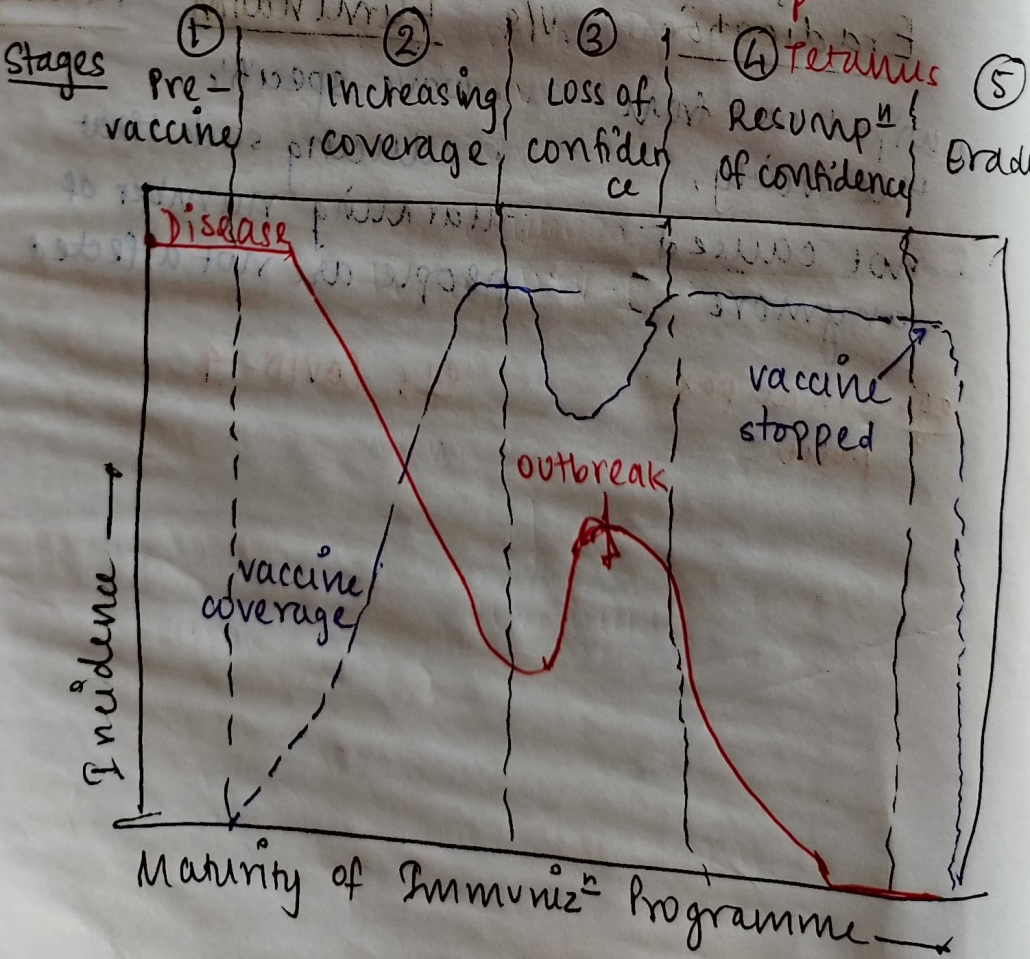
eg: COVID-19

Valence

Monovalent / Univalent
single strain / single antigen
↓
measles

Multivalent / Polyvalent
two / or more strains / serotypes of the same antigen
↓
OPV – Oral Polio Vaccine

Combination Vaccines
antigens corresponding to different diseases combined into a single shot so as to protect against these different diseases
↓
DPT
Diphtheria
Pertussis
Tetanus



Elimination v/s **Eradication**

a particular sporadic spread in a part. area has stopped

has not been seen for a long period of time anywhere in the world.

Long-term protection

ample amount of memory T-cells that are regenerated

the amt. of trigger required to activate the memory cells

Antigen **Epitope**

a part of an antigen against which antibodies are produced.

endorphins
encephalins

immuno-logical memory

neuronal memory

Pre-clinical : Animal models

Phase I 50-100

Phase II 200-1000

Human subjects.

Proof of Concept

Phase III 5000 - 10,000 samples → proper demographic knowledge

Live attenuated vaccines

varicella, MMR, OPV, Jap. encephalitis, Rotavirus, Yellow fever, Dengue

Killed/ inactivated vaccines

BCG, IPV, Cholera Pertussis

classical & recombinant subunit vaccines

DPT, HPV, HIB, HepB

conjugate vaccines

HIB, Pneumo-coccal, menin-gococcal

Plasmid DNA/peptide vaccines

HIB, Meningo, Malaria, HIV

mRNA vaccines

Influenza, Zika, Toxo-plasma, Ebola, HIV-I

Recombinant adenoviral vaccines

TB, influenza, Ebola, HIV-I

Adeno-26
Adeno-5
↓
Sputnik

Adeno-26
↓
Covishield

29/8/23

Live attenuated vaccines

↳ lost their virulence
↳ cannot cause disease further

Genetic stability : → low mutations
→ so that they do not become a new virulent strain.

Compicated Downstream Processing:
→ we have to keep them alive.

BCG vaccine
↳ against TB
↳ M. tuberculosis

M. bovis
(less harmful than M. tuberculosis)

① **Passage through animal cell lines** → since it is not in its natural host → lose their capability to cause diseases → attenuation

② **Genetic modifn** →

Reverse Genetics:

to change a phenotype, we go back to the genes & make changes.

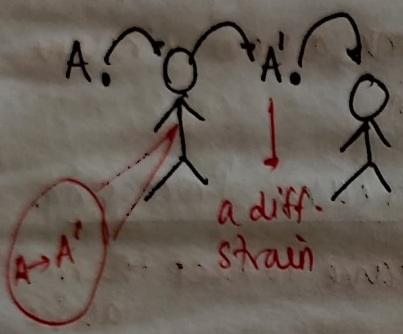
Quasi-species → in a particular cell of a patie

↓

RNA Polymerase modifies the viral genome } cause polymer

↓

more virulent genome



∴ ↑ polymerase fidelity

Attenuation

can replicate but not cause the disease

Virus inactivation → does not replicate in a host

Heat inactivⁿ | chem. inactivⁿ | UV irradiation

destruction of the RNA-dependent RNA polymerase which replicates viral RNA

VERO → kidney cell line from African Green Monkey

↳ influenza
Sars-Cov2

Microcarrier. → adsorbs the viral particles on itself

Candidate Vaccine Virus (CVV):

Determination of attenuation:

↓

animal tests

↓

Pathogenicity Test in Chickens

↓

Pathogenicity testing in ferrets