Immunity

→ Immunity : immunity is resistance exhibited by host against microbes, and its products.

Study of immunity and aspects, mainly called Immunology.

* Different diversity of pathogens are attacking humans from Viruses (small) to giant parasitic worm (kidney worm) named Dioctophyme renale (L=100cm, W=10mm).

* Evolution of immune system is important steps in multicellular organisms lifecycle.

Historic prespective :

① Immunology grew out of obsevation that individuals who had recovered from certain diseases, were thereafter protected from the diseases.

② Latin term "immunis" meaning "exempt" is source of English word 'immunity'.

③ Thucydidies, Greek historian in 250 BC, decribed plague in Athens. He observed those who recovered from plague could nurse the sick person.

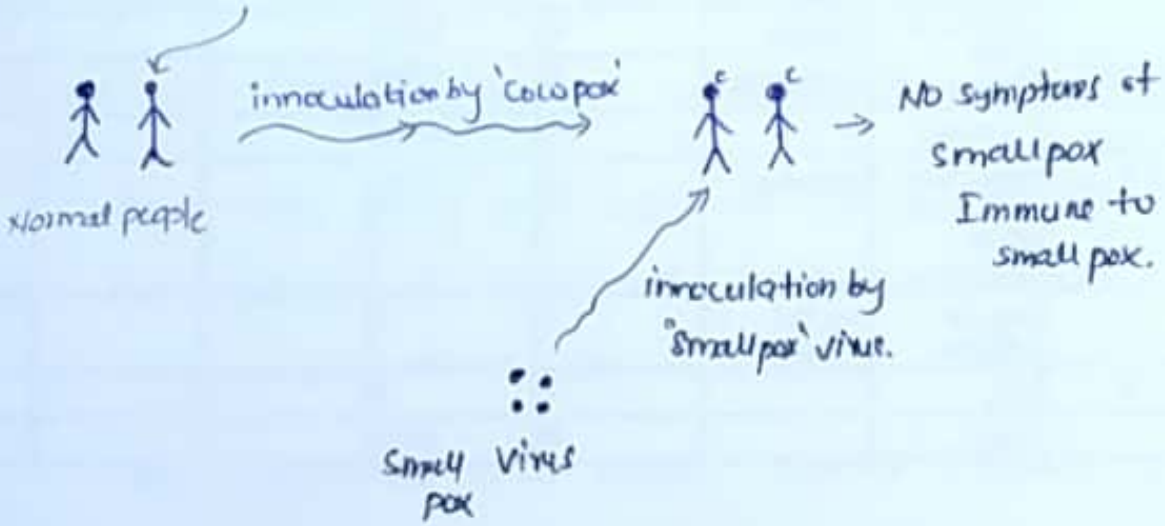
Easly vaccination studies :

① In 15th centuary, chinese and Turks had performed a technique called Variolation on people having smallpox.

Dried crust from smallpox pustules → inhaled or inserted into skin cuts of people.

② Edward Jenner, English physician. had innoculated, people with cowpox virus. Then, when they are re-innoculated, with "smallpox", they found to be immune to small pox.

Edward jenners → milk maid, who are contract with cowpox found to be immune to small pox.



Edward jenner's vaccination for smallpox

These teniques spred throughout Europe. To test his idea he innoculated an 8 year old boy. with cowpox, and lated intentionally infected the child with small pox.

These sort of studies cannot be conducted under current Medical standards of Medical ethics.

③ Induction of immunity to Chlorea (fowl chlorea).

(i) Louis pausteau, had succeded in growing the bacterium that cause fowl chlorea in culture, and confirmed this by injecting in to chickens, then they devolp "fowl chlorea".

foul chlorea culture → chickens → foul chlorea disease.

(ii) He injected old culture of foul chlorea in to chickens, They found to be ill, but recovered.

He then grow, fresh culture of bacterium, in to a mixture of previously exposed chickens and unexposed birds. Freshly injected chickens died but chicken which are exposed to old bacterial culture were protected from disease.

He showed aging had weakned the, virulence of pathogen, such weakened strain called "atteunated stain", could be administred to provide immunity.

This weakened stain called "Vaccine" (Latin "Vacca means "cow".

old culture of bacterium → chicken → ill but recoved.

Fresh culture → Exposed chicken → protected

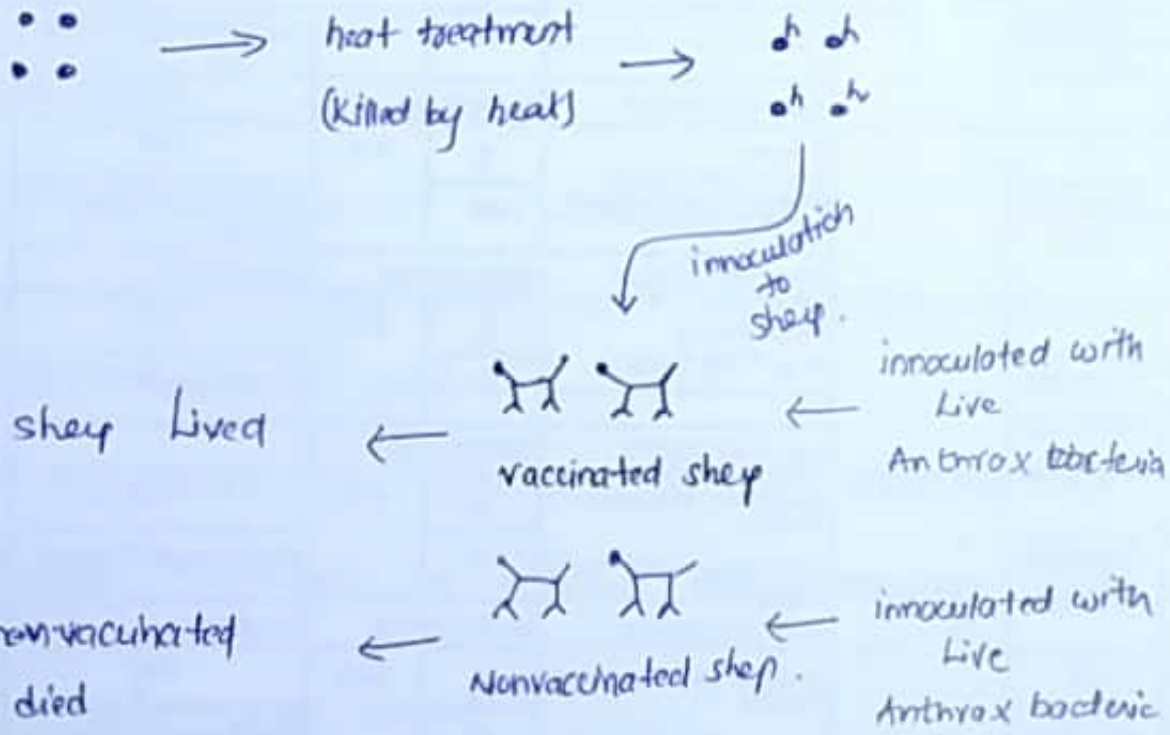
→ unexposed chicken → died.

Effect of Aging on strain.

Attenuated stain / vaccine

(iii) pauster, showed a pathogen can be "atteunated" or weakened, this atteunated stain can be administered as vaccine.

He vaccined a group of sheep with anthrax bacteria that were weakened by heat treatment He innoculated anthrax bacteria in vaccinated cheap and unvaccinated shep. These are begining of immundogy. All vaccinated sheep LIVed and unvaccinated sheep died.



(4) In 1885, pausteaus administered first vacine to human a young boy who had bitten by a dog with robies. The boy Joseph Meister, was innoculated with a series of atteunated robies virus, administred succesfully, shortly after exposure, as long as virus not yet reached central Nervous systeam.

⑤ Many countries had eradicated smallpox, basically through vaccination. As people (acquired protective immunity, either through vaccination / (or) by infection. They acts as buffer for rest. These is herd immunity. overtime, no of people with no immunity, to disease will begin to rise.

vaccination for smallpox, largely ended in mid 1970. leaving half of population susceptable.

Measles, smallpox, pertusis, Mumps → vaccines.

⑥ Vaccination strategies should be changed to avoid infectious diseases in future.

⑦ main challenges for vaccination are Malaria, AIDS.

infectious diseases spred. preventing infection, and transmission should be done.

Antibiotics are introduced in 1920's. worrying trend is Antibiotic resistances in microbes are increasing.

⑧ Immoral and Cellular components:

(i) In 1890, Emil Von Behring and shibasaburo. insights in to mechanism of immunity, earning Behring Nobel prize fd physiology & Medicine in 1901.

Von Behring, Kitasto showed that serum (from animals previously immunised with diptheria could tranfer immune state to uninmunised animals.

Serum → component recovered from coagulated blood,

These serum, previously immunized with diptheria, could Tranfer, immunity to unimmunised animal.

Immunised animal → Tranfes to unimmunised animal
Serum

(immunity is tranfered to unimmunised animal]

→ Elie Metchnikoff (Nobel prize winner, demonstrated that cells also play role in immunity. He found WBC, called phagocytes ingested microbes, and killed it.

humoral immunity: active immune component in blood, could neutralize or precipitates toxins and could agglutinate bacteria.

Elvin Kabat, conducted studies and found that, gamma globulin, responsible for immunity. Soluble component in immunoglobulins called Antibody.

→ Antiserum, (antibody containing serum, fraction from a patrogen exposed individual, derived from horses, had given to patient suffering from dipetheria, tetanus.

Antibody against snake bites, (serum containing) is used.

→ The form of immunity tranfered b/w individuals are called passive immunity.

Newborn individual are protected from maternal antibodies.

passive immunity :- short lived, limited

↓

[cell producing antibodies are not transferred].

Administration of vaccines, (or) natural infection, is said to called active immunity. (production of one's own immunity]

long live protection from specific diseases

Cell mediated immunity:

→ Merrill chase → transfered WBC, from guinea pigs, suffered from ~~im~~ TB. immunity had transfered.

Lymphocyte → identified ↓ (cell played role].

→ Bruce Glick at MSU, performed experiments on chicken, indicated existence of Two Lympocytes, (T-cell, B-cell).

T cell , B-cell.

↓ ↓

Thymus Bone Marrow.

How are foreign substances Recognised by immune systems:

The specificity of immune response, for a foreign body called Antigens.

Jules Bordat, demonstrated even, that non pathogenic substances, RBC, from other species, serves as Antigen.

Injecting nonself substances, produces Antibodies. Even difference in single Amino Acids, also recognised.

→ Two major treory for antibody Specificity.

Selective treory (Paul Ehrlich) (1900):

Explained orgin of Seram antibody.

(i) cells in blood has variety of receptors called side-chain Receptors, which bind to infectious agents and inactivates them

(ii) Receptor - infection agent is like fit between Lock and Key model.

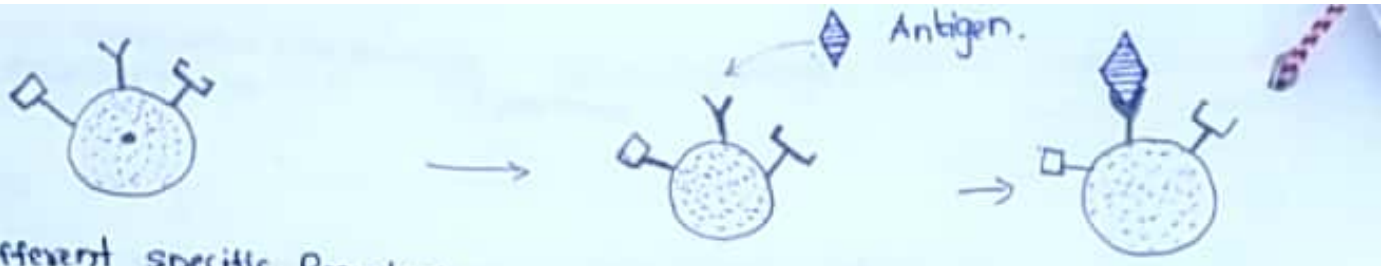
(iii) interaction blw infectious agent and Recepter helps cell to produce more receptors with same Specificity.

cells → pluripotent, expressing no of different receptors. of which indivisualy will be selected.

(iv) Antigen selected the appoiate Receptor.

→ All are proven correct except, (in which one cell making many receptors, each cell makes anany copies of just one membrane bound Receptor (one spetficity

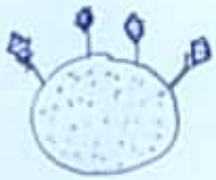
→ selected B-cells, triggers proflirated and produces, many copies of receptor, Antibody are produced.



Different specific Receptors or side chains.

Specific Antigen find Specific receptor on cell. (good fit).

Antigen Fix on Receptor (Antigen-Receptor complex]



Syntesis of Specific Receptors Triggred.

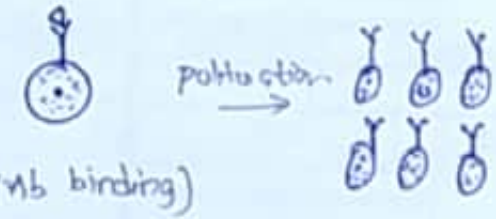
Instructional theory:

Antigen played an important role in determing antibody specificity. Antigen would serve as a template, around which antibody, would fold.

Antibody is assumed to be complementary configuration to Antigen. postulated by F Breinl, Felix Haurowitz in 1930, redefined in terms of protein folding by Linus Pauling.

→ Clonal Selection : Niels Jerne, David Talmadge, Burnet. redefined Selection theory. called clonal Selection.

A single B, T cells expresses many copies of a membrane receptor. that specific to single Antigen. Antigen binding triggers to specific receptor activates cell, causes to proliferate in to clone of daughter cell have same receptor.



(Ag Ab binding) (clone after proliferation)

pathogen must breach Natural Barriers.

microenvironment influence the outcome. pathogen may be treated differently, depending up on the context / surroundings.

→ Some foreign compounds, and some commensal microbes that enter via digestric tract, help us to digest food are tolerated

→ Same foreign entered via blood treated (or) destroyed.

→ different strategies based on nature of invader / and microenvironment in which engagment occurs

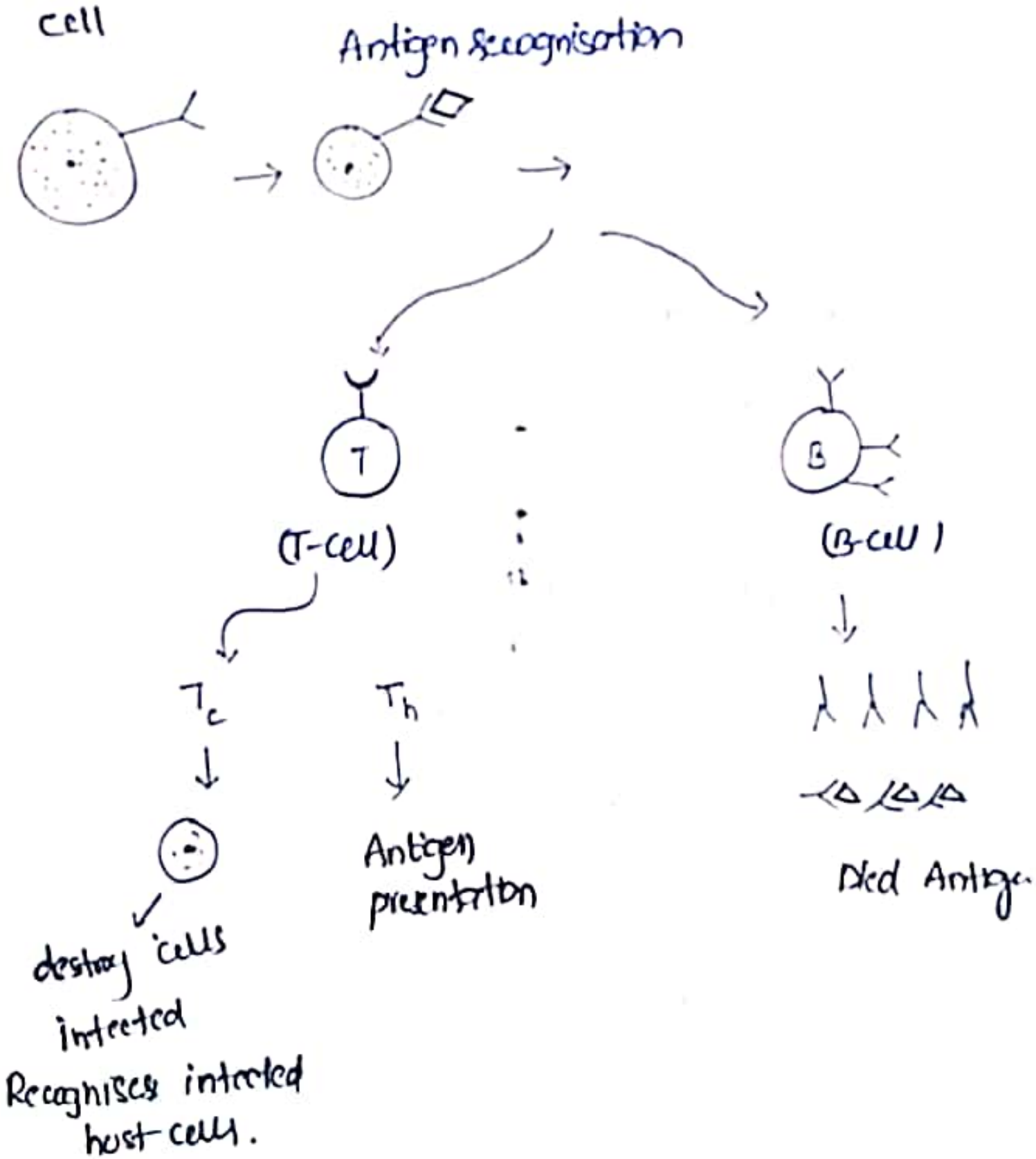
commensable microbe → through food → Tolerated

→ through blood → destroyed.

→ immune system act when foreigner breach natural barrier

Skin, Mucous membrane.

acidity of stomach, vagina → low pH.



→ viruses, small and tiny infection. immune cell must recognise infected cell and find surface of patogen.

T_c → cytotoxic T-cell
↓
identify infected host cell.

T_H → guides the other immune cell B-cells, T-cells.

→ extracellular patogen bacteria, fungi.

cell surface antigen recognised by B cells.

large parasitic worm → affects growth, development of individuals.

Tapeworm, Ringworm, Helminths worm etc.

cells, organs & microenvironment of immune system

primary lymphoid organs - Bone marrow, Thymus.

cell mediated immunity (CMI), cells played an main role. lymphoid system → primary lymphoid cells
→ lymphoid organs

lymphoid organs → primary L.O
→ Secondary L.O

→ primary lymphoid organs, in which precursor lymphocytes proliferate, develop and acquire immunological capacity.

Thymus, Burso of fabricius in bird.
↓
equivalent in humans is
Bone marrow.

primary lymphoid organs!

immune cell proliferate & activated. Regulate development of immune cells from immature precursor.

All mature blood cells (RBC, WBC etc.) arise from Hematopoietic stem cell (HSC). The process called Haemtopoiesis

HSC ⟶ (Hematopoesis) mature Blood cells.

→ primary organs, where stem cells mature to immune cells.

Bone marrow → HSC resides, and give to rise to all cell types.

Thymus → T-cell maturation completed.

→ Stem cells properties (i) ability to regenerated
(ii) ability to differtiate into all cell types

Embryonic stem cells → pluripotent
differtiate into any cell in organism.

Adult stem cell → give rise to diverse cell types that specify a particular tissue.

HSC → Adult stem cell → to all types of blood cells.