ANTIGEN

- Any substance when introduced in body stimulate the production of antibody and react with the specific antibody and antigen receptor on lymphocytes are called antigen.
- *IMMUNOGEN* –are molecules which induce an immune response.
- All antigen are immunogen but all immunogen are not antigen.

ANTIGEN

- *Most natural occurring antigen are protein, polysaccharide followed by lipid and nucleic acid.*
- *All protein are not antigen in nature.*

TYPES OF ANTIGEN

- *ON THE BASIS OF IMMUNOGENICITY*--
- complete antigen
- Hapten
- *Based on origin*

1. Exogenous antigen-- present outside the cell.
2. Endogenous antigen – antigen of self immune system.
3. Microbial antigen – Flagellar H-antigen
4. Tissue antigen -- Blood group antigen, Transplant antigen.

ADJUVENT

- *Substance when mixed with an antigen and injected with it , boost the immunogenicity of antigen.*
- *Eg-Aluminium potassium sulphate.*

VACCINE.

- Vaccine is any preparation intended to produce immunity to a disease by stimulating the production of antibodies .
- Administration vaccine by injection, or given by mouth, nasal spray.
- Vaccination benefits---vaccination intend to provide individuals with immunological protection before an infection actually takes place.

VACCINE.

- Vaccine is a part of immunization.
- Immunization is the process of becoming immune.
- IMMUNIZATION-
- *ACTIVE*
- a. Natural - exposure to infection
- b. Artificial- vaccination
- *PASSIVE*
- Natural -Natural maternalAb
- Artificial -Ab therapy, serum

VACCINE.

- Vaccination for prevention of disease not for cure
- Vaccination reduced burden of illness and death
- Vaccine is a suspension of organism or fraction of organism that is used to induce immunity.
- Vaccine teaches the immune system by mimicking a natural infection.

CLASSIFICATION OF VACCINE

- **1.classical vaccine**
- **2. modern vaccine**
- *Classical vaccine*—
- Traditional or conventional. eg-small pox vaccine.
- Not product from genetic or chemical engineering technology.

CONCEPT OF EDIBLE VACCINE.

- *Introduce gene of interest into plant.-----* ***(Transformation)***===*Gene expressed in plant tissue edible part(* ***Transgenic plant****).*
- |
- Gene encode protective vaccine antigen from viral, parasitic....pathogen that causes disease in human being.
- |
- Ingestion of edible part of the transgenic plant(oral delivery of vaccine).

HOW DO VACCINE WORK

- The immune system recognise the vaccine as foreign, an immune response to it. The vaccine serves as an antigen and causes the immune system to response to it.
- One part of immune system create antibodies and that is called humoral response.
- Antibodies are specific to the vaccine and have the ability to remember it so vaccine or very similar antigen is seen again immune system become active and protect the person from infection.

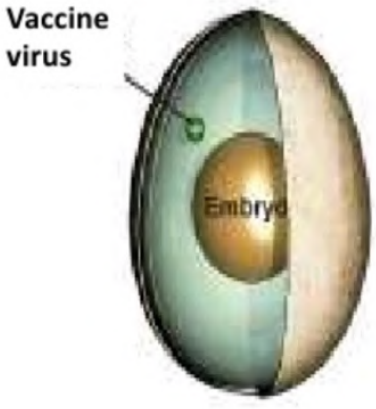
Conventional vaccine production method.

PATHOGEN,SELECTION OF **STRAIN**

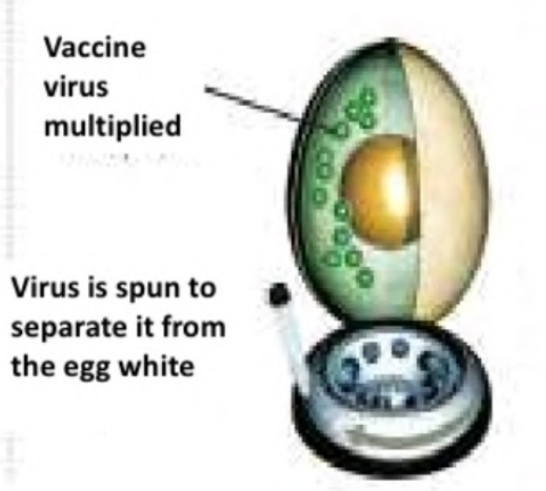
CULTURE, GROWING OF MICROORGANISM

PURIFICATION,INACTIVATION, *VACCINE*.

VACCINE PRODUCTION.

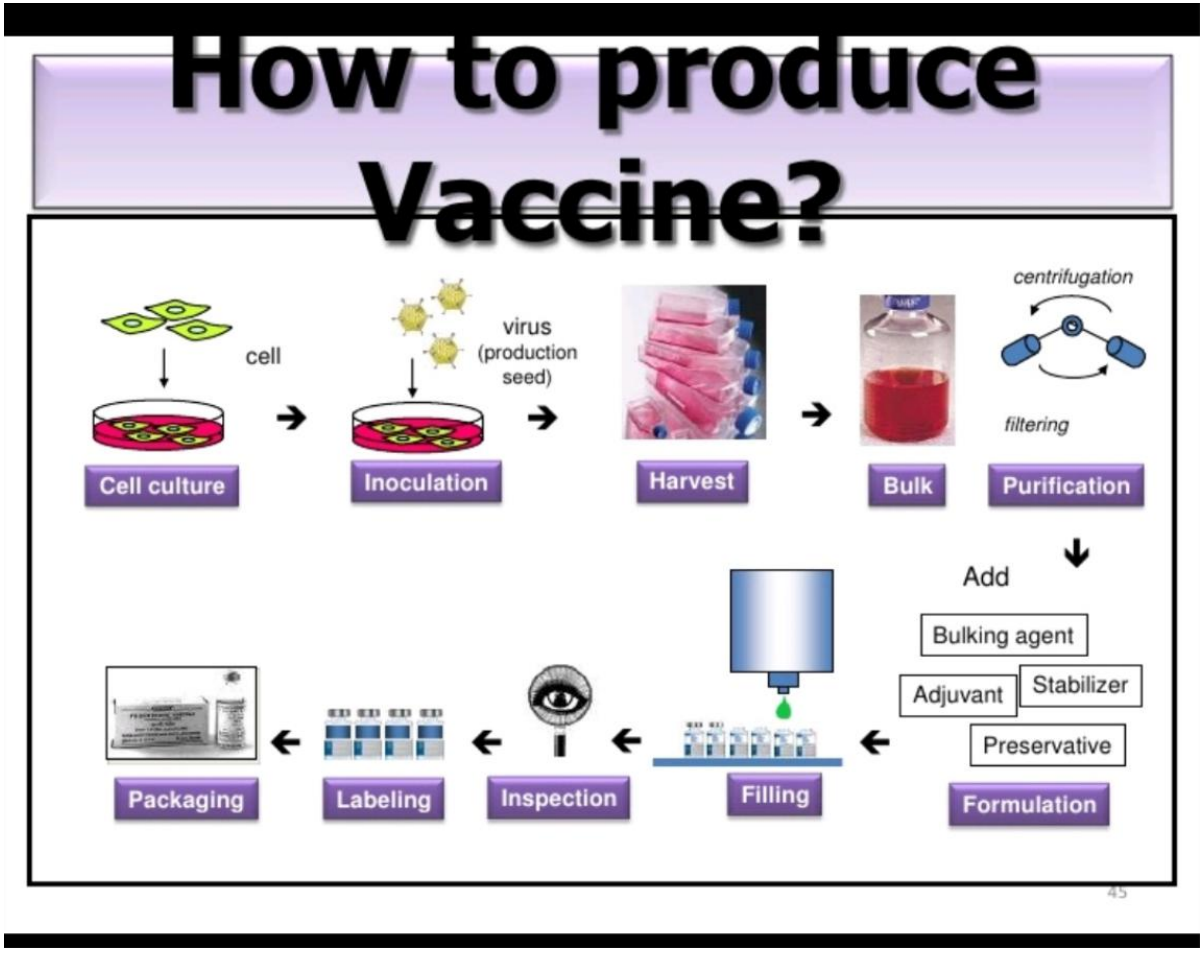


The vaccine virus is injected into a 9 to 12 day old fertilized egg and incubated for 2 to 3 days.(during this time the virus multiplies)

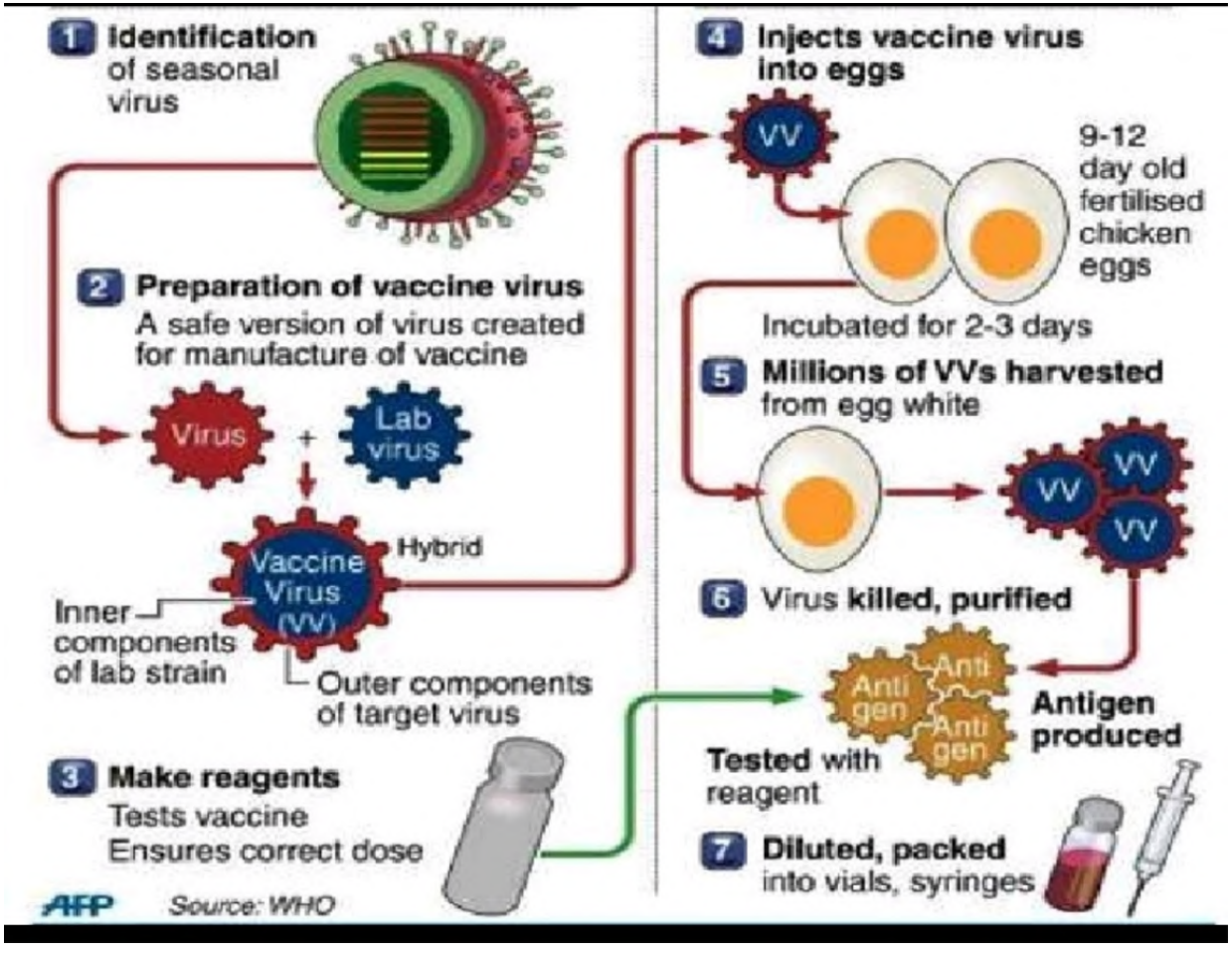


After incubation the egg white contains millions of vaccine viruses which are harvested and then separated from the egg white.

VACCINE.



VACCINE PREPARATION METHOD.



VACCINE

TREND IN VACCINE DEVELOPMENT >

>

Modern molecular biology

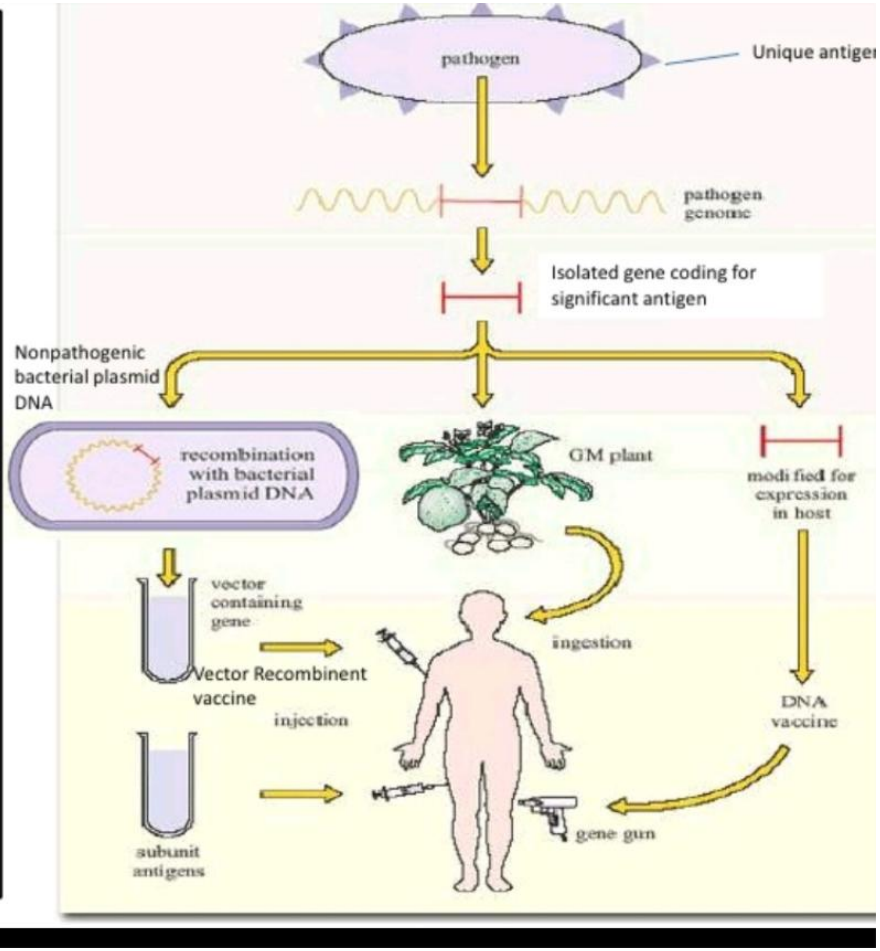
>*Recombinant DNA technology*

>and genetic engineering have opened the road for alternative vaccine production.

GENETIC APPROACH.

Genetic approaches to vaccine development:

One or more genes encoding pathogen-specific antigens are isolated and
-recombined with a harmless or disabled vector for delivery by injection,
- or incorporated into food plants for ingestion,
-or modified for injection as naked DNA.
-subunit antigens can be produced by genetic engineering.



CONCEPT OF VACCINATION.

- Disease causing *microorganism*

  |

  disease

  |

- Recovery, Death, disability, ***immune response.***

- Vaccnination ----- no disease-----immune response ----immunity.

TYPE OF VACCINE

- WHOLE ORGANISM VACCINE
- killed(pertusis, cholera,rabies)
- Live attenuated(BCG,OPV,MMR)-living but weakened microbes.

PURIFIED MACROMOLECULES AS A VACCINE

Toxoid- -Inactivated toxin.

capsular polyssacharide --- (pneumococcal)

Cell wall polyssacharide --- (meningococcal)

Surface antigen ----- (HEP – B)

COMBINATION.

➢NEWER APPROACH

- NEWER VACCINE

1.Recombinant vaccine.

2.DNA VACCINE (Nucleic acid vaccine).

- According to microorganism
- Bacterial .
- Viral(OPV, MMR)
- Rickettsial (epidemic typhus).

➢FUTURE PROSPECT

- ***Use of recombinant DNA technique to insert the gene coding for the protein of interest into the genome of avirrulent virus that can be administered as vaccine.***
- NUCLEIC ACID---

  > is obtained from collected and lysed cell.
- Nucleic acid is purified by chromatography technique.
- Nucleic acid vaccine can be a region of RNA or DNA that code for disease associated protein.

Recombinant vaccine.

RECOMBINANT VACCINES:

- The vaccines are produced using **recombinant DNA technology or genetic engineering.**
- Recombinant vaccines are those in which genes for desired antigens of a microbe are inserted into a vector.

Different strategies are:

- **Using the engineered vector** (e.g., Vaccinia virus) that is expressing desired antigen as a vaccine
- **Introduction of a mutation by deleting a portion of DNA** such that they are unlikely to revert can create an attenuated live vaccine.

Live attenuated vaccines can also be **produced by reassortment of genomes** of virulent and avirulent strains.

DNA VACCINE A PROMISING FUTURE

- *DNA VACCINE*-------(***NUCLEIC ACID VACCINE).***

  > Are third generation vaccines and are made up of small , circular piece of bacterial DNA (Called as plasmid) that has been genetically engineered to produce one or two specific protein(antigen) from microorganism. The vaccine DNA is injected into the cells of body where the " inner machinery" of the host cell reads the DNA and convert it into pathogenic protein.

ADVANTAGE OF DNA VACCINE

- Cheaper and easier to produce
- No need to handle infection during production
- Safer
- Induce both CMI and humoral.
- No cold chain required.

IMMUNIZATION.

- Immunization : method by which artificial immunity
- TYPE OF VACCINE-
- Live attenuated vaccine—containing live microorganism with reduced virulence.
- Prepared by using attenuated strain of microorganism.
- Live vaccine initiate infection without causing disease.

- Booster doses are not required.
- Single dose is required. Induces cmi and humoral immunity.
- Longer and effective immunity.

KILLED VACCINE.

- Containing killed or inactivated microorganism.
- Inactivation of agent by heat, phenol.
- Induces active immunity but level of immunity induced is less as compared to live vaccine.
- Short duration so booster is required.

Killed vaccine

- Safe and stable.
- Can be given with polyvalent vaccine.
- Multiple injection are needed.
- Oral route is not suitable.
- Local and CMI can not be induced.

TOXOID.(inactivated toxin).

- FEW microorganism Diptheria, tetanus bacilli , produce exotoxin which play important role in causing disease.
- Toxin can be detoxified and used for immunisation.
- Detoxified toxin is known as toxoid, which is non toxic but antigenic.
- Prepared by toxin with formaline.

TOXOID VACCINE

- Toxoid produces antitoxin which react with toxin and neutralises it.
- Eg- Tetanus toxoid, Diptheria toxoid.
- Antigenecity of toxoid can be potentiated by an adjuvent.

Immunizing agent.

- 1. vaccine
- 2.immunoglobulins
- 3. Antisera.

TYPE OF VACCINE

- Live attenuated vaccine(harmless)
- Killed vaccine
- Cellular fraction
- Recombinant vaccines
- Combined vaccines(MMR,DPT).

CELLULAR FRACTION

- Vaccine prepared using extracted cellular fraction.
- Meningococcal vaccine from antigen of the cell wall.
- Pneumicoccal vaccine from the capsular polyssacharide.

RECOMBINANT VACCINE

- Gene responsible for specific antigen are cloned in organism.
- Technique is known as recombinant technology. Eg- Hepatitis B vaccine.

COMBINED VACCINE

- Vaccine are prepared containing more than one immunizing agent. Also known as mixed vaccine.
- DPT.
- DT.
- DP.
- MMR.
- DPTP.

IMMUNOTHERAPY

- *Immunoglobulins and antisera are used for immunotherapy.*
- ***NORMAL HUMAN IMMUNOGLOBULIN***
- ***SPECIFIC HUMAN IMMUNOGLOBULINS***

Normal human Immunoglobulins

It is antibody rich fraction derived from blood, Plasma, or serum or human donor.

Contains high level of antibody specially IgG.

ROLE ----

Used against highly susceptible individuals and to provide temporary protection. Eg— Measles, Hepatitis A, immunodeficiency diseases.

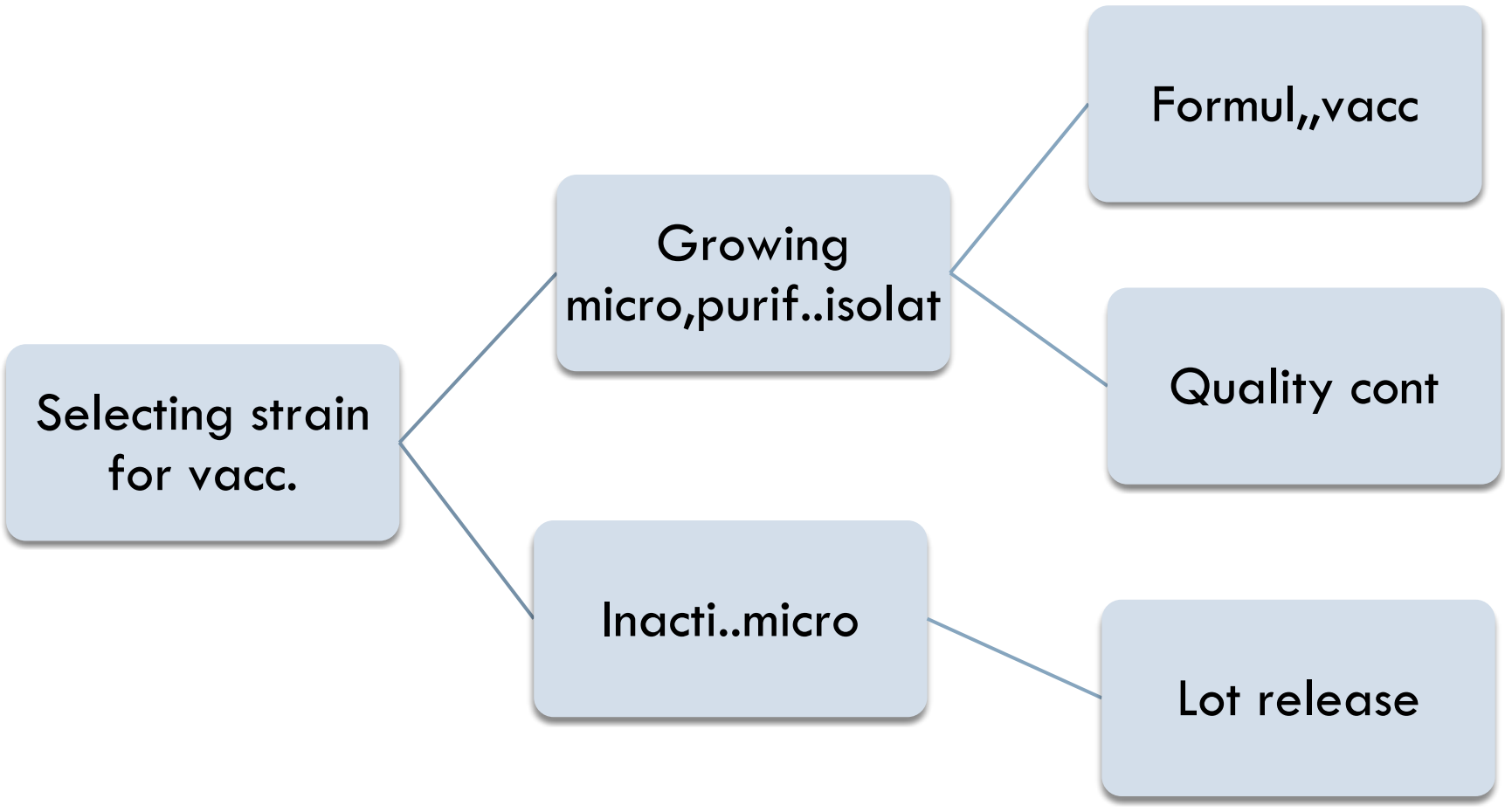
SPECIFIC IMMUNOGLOBULINS.

- *Prepared from serum or plasma of convalescent individuals(patient who have recently recovered from infection.)or Those who have have been hyper immunized with specific antigen and are used for passive immunization.*
- *These preparation contains high level of specific antibody.*
- *Rabies Ig, Hep B Ig, tetanus Ig, Rhd Ig.*

ANTISERA and ANTITOXINS.

- Applied to materials prepared in animals
- Antiserum is prepared by injecting specific antigen that leads to formation of specific antibody formation eg, Rabies antiserum.
- ANTITOXIN is prepared from injecting toxins or toxoid. Eg – anti tetanus toxin, anti snake venum....
- anti sera and antitoxins are used for passive immunization only in clinical situation in which there is no alternative.

Vaccine developement.



GROWING THE MICROORGANISM

- GROWING BACTERIA...

  Method....

- ***BATCH CULTURE ----***

  microbes is grown in closed vessels, test tube or flask.

- ***Continuous culture----***

  microbes grown in a closed vessels which has medium constantly added...

GROWING VIRUS

Methods used are---

CELL CULTURE / TISSUE CULTURE= cultured cells are grow in sheets that support viral replication ....

BIRD EMBRYOS- Incubating egg is an ideal system. Virus is injected through cell..

ISOLATION AND PURIFICATION.

- Product ***isolation***—is the removal of those component whose properties vary from that of desired product.
- ***Purification***=== selectively separates and retain the desired product..
- CENTRIFUGATION –process by which solid particle separated from liquid. Eg-cell, debris, dead cells.
  Differential centrifugation—for cell organelles.
- FILTERATION –separation of particle from liquid by applying pressure to the solution to force solution through a filter.
- CHROMATOGRAPHY.

FORMULATION OF VACCINE

- Other than microorganism or its part a vaccine contain the following substance.
- ***Suspending fluids*.-**liquid which contain the chemical used during production which kills or weakens the organism for use in vaccine.
- Sterile water, saline,or fluid containing protein.

PRESERVATION AND STABILIZERS

- ***VACCINE REMAINS UNCHANGED-------***

  Albumin, phenol, Glycine, Antibiotics.

- ***INACTVATING AGENT***

  Formaldehyde, Glutarldehyde etc.....

ADJUVENT ENHANCE VACCINE IMMUNOGENICITY.

- *Aluminium gells.*

- *Used in.....* *DPT*
- *DT*
  HPV

- *ADJUVENT OR ENHANCERS.....*

QUALITY CONTROL

- STERLITY = No live organism present in product.
- CHEMISTRY== For correct amount of preservative, adjuvent.
- SAFETY=== Overdose of product not causes harm.
- LOT RELEASE=== Prior to release , the manufacturer must test each batch, serial for purity, safety , and potency. (purity means testing contaminants).