Anti Viral Agents

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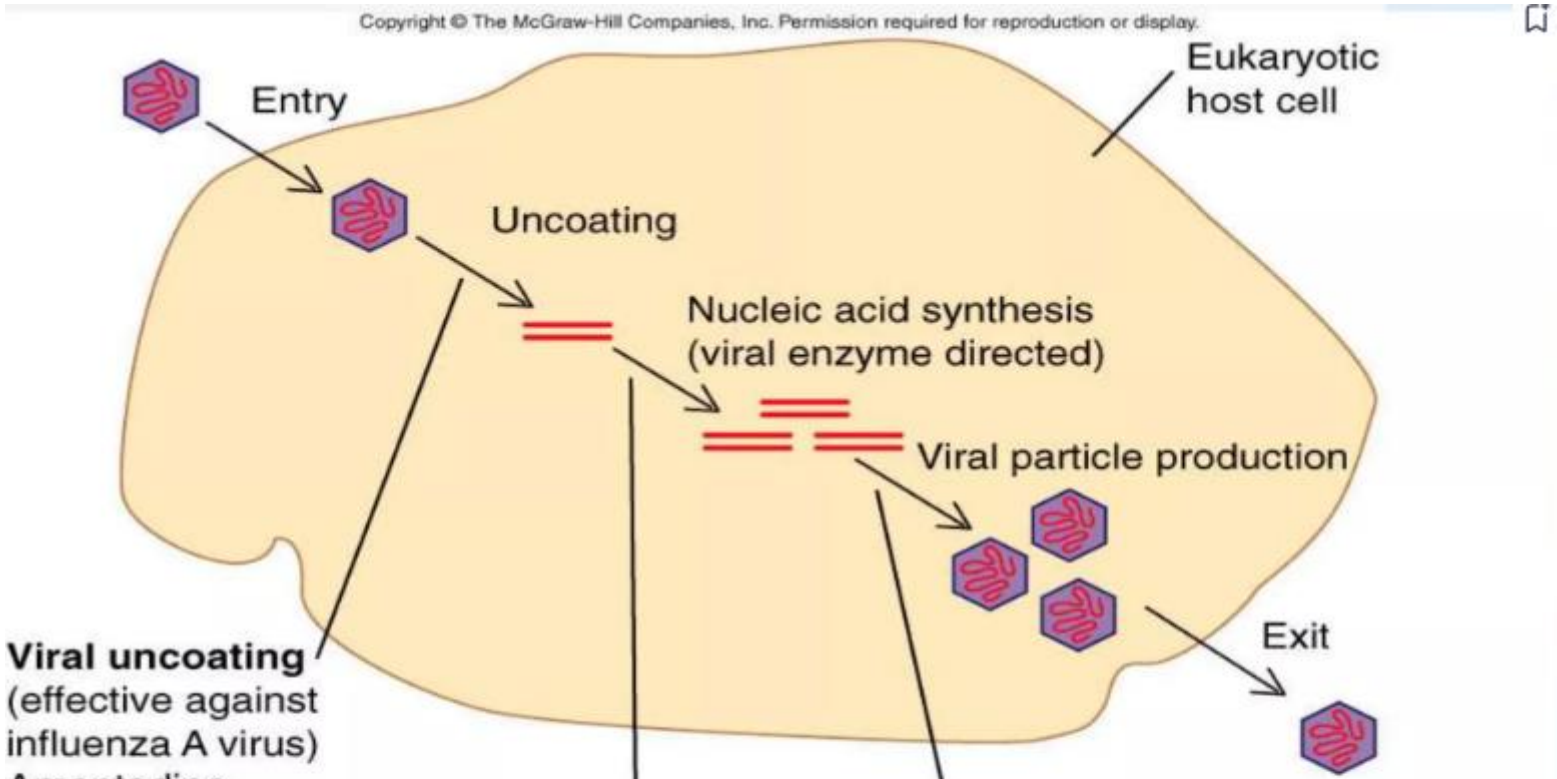
Anti Viral Agents

- **Antiviral drugs/ Virucide** are a class of medication used for treating viral infections.
- Most antivirals target specific viruses, while a
- Broad-spectrum antiviral is effective against a wide range of viruses.
- Centers for Disease Control and Prevention (CDC), a virucide is "An agent that kills viruses to make them noninfective
- Antiviral agents are presented in numerous molecular forms, including small molecules, peptides, neutralizing antibodies, interferons (IFNs), CRISPR-Cas systems, si/shRNA, and other nucleic acid polymers (NAPs)
- DrugVirus.Info database allows tracking the development of antiviral combinations and can be used to identify potential combinations for the treatment of emerging viruses



Stages of Virus Replication and Possible Targets of Action of Antiviral Agents

STAGE OF REPLICATION	CLASSES OF SELECTIVE INHIBITORS
Cell entry	
Attachment	Soluble receptor decoys, antireceptor antibodies, fusion protein inhibitors
Penetration	
Uncoating	Ion channel blockers, capsid stabilizers
Release of viral genome	
Transcription of viral genome[a]	Inhibitors of viral DNA polymerase, RNA polymerase, reverse transcriptase, helicase, primase, or integrase
Transcription of viral messenger RNA	
Replication of viral genome	
Translation of viral proteins	Interferons, antisense oligonucleotides, ribozymes
Regulatory proteins (early)	Inhibitors of regulatory proteins
Structural proteins (late)	
Post-translational modifications	
Proteolytic cleavage	Protease inhibitors
Myristoylation, glycosylation	
Assembly of virion components	Interferons, assembly protein inhibitors
Release	Neuraminidase inhibitors, antiviral antibodies, cytotoxic lymphocytes
Budding, cell lysis	

[a]*Depends on specific replication strategy of virus, but virus-specified enzyme required for part of process.*

https://doctorlib.info/pharmacology/manual/59.html

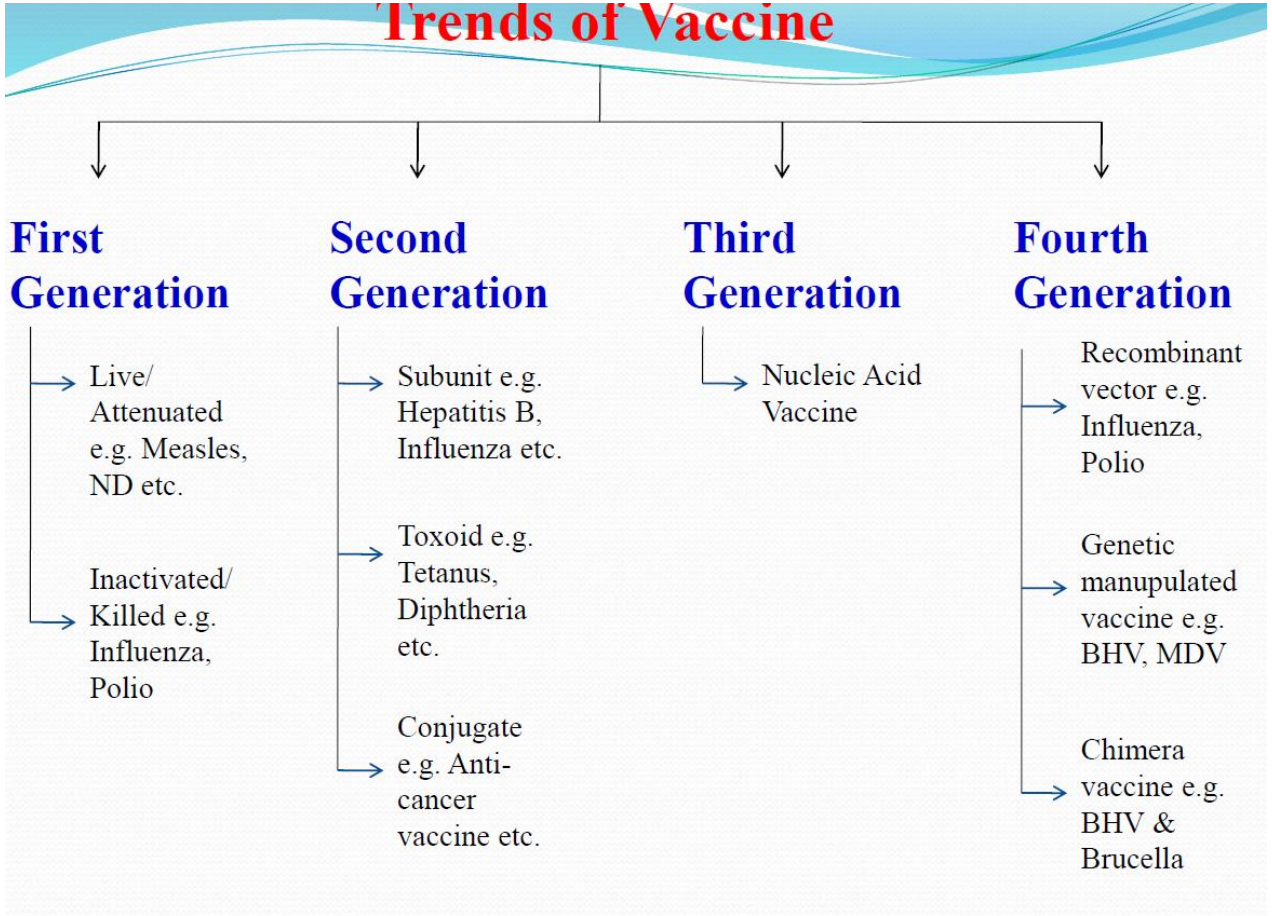
Immunomodulators

- Interferons (IFNs) are a group of signaling proteins made and released by human cells in response to infection with several viruses causing degradation of viral nucleic acids in infected cells and triggering antiviral responses in nearby non-infected cells
  - Interferons alpha
  - Interferon Inducing agents: Polyriboinosinic acid
- Virus-neutralizing antibodies (nAbs) stick to the viral surface proteins and stop virus from getting inside our cells

Interferon as antiviral

	Type	Immune response	Produced by	Antiviral
Interferon alpha	I	Innate	All cell types- epithelial cells, Innate immune cells	Protein kinase RNA-activated also known as protein kinase R (PKR), interferon-induced, double-stranded RNA-activated protein kinase upregulated Rnase L- Degrades ds RNA
Interferon beta	I	Innate	fibroblasts infected with virus	-do-
Interferon gamma	II	Acquired	Macrophages, Dendritic Cells, T cells, NK cell	Inducing T cell activation and IgG production
Interferon lambda	III	Innate	epithelial and immune cells	

Viral Vaccines



Live virus vaccines

- Live virus vaccines contain an attenuated (weakened) form of the virus that is capable of reproducing for a limited period of time, but can no longer cause the infectious disease associated with the wild-type virus. An example of this type of vaccine is the live-attenuated influenza vaccine, which is authorised for children and adolescents and is delivered via intranasal administration.
- The varicella-zoster vaccine, oral poliovirus (OPV) vaccine and yellow fever virus vaccine.

Inactivated vaccines/dead vaccines

- Inactivated virus vaccines, also called dead vaccines, contain either the entire virus in inactivated form or individual virus components. They are often combined with an adjuvant to stimulate not only the humoral but also the cellular immune response.
- Examples of inactivated vaccines include: inactivated poliovirus (IPV) vaccine, whole cell pertussis (whooping cough) vaccine, rabies vaccine and the hepatitis A virus vaccine.

SubUnit Vaccine

- To produce the vaccines known as split vaccines, viruses are broken up with the help of solvents and the remaining fragments are purified.
- A more comprehensive purification of individual viral components is used in the production of subunit vaccines. In this process, the surface of the viruses is completely dissolved and the desired proteins are extracted in a targeted manner via purification.
- Both methods are used for flu vaccines, meaning that there are split and subunit vaccines against seasonal flu
- hepatitis B (recombinant protein)

Viral vector vaccine

- Viral vector vaccines use a harmless virus to deliver to the hosts cells the genetic code of the antigen you want the immune system to fight.
- Viral vector vaccines usually trigger a strong immune response. Typically, only one dose of the shot is needed to develop immunity. Boosters may be needed to maintain immunity.
- Ebola vaccine, COVID-19 vaccine (AstraZeneca and Johnson & Johnson)

CDC.gov. Vaccines: The Basics. Available at: https://www.cdc.gov/vaccines/vpd/vpd-vac-basics.html

Genetic Vaccines

- Genetic vaccines operate via the transfer of nucleic acids (DNA or RNA). The nucleic acids are applied in vivo, meaning within the body. They are either packaged in lipid particles or are part of the genetic material of virus particles that act as gene shuttles.
- DNA vaccines:Vector viruses can be known vaccine viruses such as the measles virus (live attenuated vector vaccine) or attenuated, harmless cold viruses (adenovirus vector-based vaccines). The vector viruses are modified in such a way that they do not cause disease in humans.
- mRNA vaccines:mRNA vaccines in the world to be authorised by a drug regulatory agency were BioNTech/Pfizer's Comirnaty and Moderna's Spikevax COVID-19 vaccines.

Recombinant protein vaccines and VLP vaccines

- Proteins for vaccines can also be made using biotechnological methods in cell cultures (in yeast cells, for example). This is the process for producing recombinant protein vaccines. An example of a recombinant protein vaccine is the hepatitis B vaccine.

- Certain viral proteins can join together into virus-like particles (VLPs), which enhances the immune response. VLPs are not capable of reproduction. An example of a VLP vaccine is the HPV (human papillomavirus) vaccine.