

Anti-viral drugs and viral vaccine

Antiviral drugs are a class of medication used specifically for treating viral infections. Like antibiotics for bacteria, specific antivirals are used for specific viruses. Designing safe and effective antiviral drugs is difficult, because viruses use the host's cells to replicate. This makes it difficult to find targets for the drug that would interfere with the virus without harming the host organism's cells. Moreover, the major difficulty in developing vaccines and anti-viral drugs is due to viral variation.

The number of antiviral drugs is very small because:

1. The virus is obligate intracellular parasite, difficulty in obtaining selective toxicity against virus.
2. Relatively ineffective, because many cycles of viral patients are well. by the time the patients have systemic viral disease.
3. Some virus remain latent in cell e.g., Herpes virus family
4. The emergence of viral drug resistance viral mutates.

Scientific Content

Antiviral drugs are available to treat **only a few viral diseases**. The reason for this is the fact that viral replication is so intimately associated with the host cell that any drug that interferes significantly with viral replication, is likely to be **toxic to the host**. Most of the antiviral drugs now available are designed to help deal with HIV, herpes viruses, the hepatitis B and C viruses, and influenza A and B viruses. Researchers are working to extend the range of antivirals to other families of pathogens.

Two useful antivirals are: One way of doing this is to develop nucleotide or nucleoside analogues (**Nucleotide analogues:** These are **synthetic compounds which resemble nucleosides**, but have an incomplete or abnormal deoxy-ribose /or ribose group) that look like the building blocks of RNA or DNA, but deactivate the enzymes that synthesize the RNA or DNA once the analogue is incorporated.

This approach is more commonly associated with the inhibition of reverse transcriptase (RNA to DNA).

Stages in virus replication which are possible targets for chemotherapeutic agents:

- Attachment to host cell □ Uncoating - (Amantadine) □ Synthesis of viral mRNA
- Translation of mRNA (Interferon) □ Replication of viral RNA or DNA (Interferon) □ Maturation of new virus proteins (Protease inhibitors)
- **Assembly**, release: Protease inhibitors can be developed to prevent the final maturation of viral proteins in viruses that use a polyprotein expression strategy

Rifampicin and Tamiflu.

vaccine: is a biological preparation that provides active acquired immunity to a particular disease. A vaccine typically contains an agent that **resembles** a disease-causing micro-organism and is often made from **weakened** or **killed** forms of the microbe, its **toxins** or **one of its surface proteins**. Vaccines can be prophylactic or therapeutic (e.g., vaccines against cancer).

Vaccines are very effective on stable viruses, but are of limited use in treating a patient who has already been infected. They are also difficult to successfully deploy against rapidly mutating viruses, such as influenza (the vaccine for which is updated every year) and HIV. Antiviral drugs are particularly useful in these cases.

Attributes of a good vaccine

1. Ability to elicit the appropriate immune response for the particular pathogen.
2. Long term protection. 3. Safety. 4. Stable. 5. Inexpensive.

Types of Vaccines

- 1- Live, attenuated vaccines 2- Inactivated vaccines (killed vaccine)
- 3- Subunit vaccines 4- Toxoid vaccines 5- DNA vaccines
- 6- Recombinant vector vaccines

Attenuated Live Vaccines vaccines contain **live, attenuated** microorganisms. Many of these are active viruses that have been cultivated under conditions that **disable their virulent properties**, and become less dangerous organisms to

produce a broad immune response. Although **most** attenuated vaccines are **viral**, some are bacterial in nature. **Examples** include the viral diseases measles, rubella, and mumps, and the bacterial disease typhoid.

2- Killed Viral Vaccines

Vaccines contain **inactivated** virus, but previously virulent, micro-organisms that have been **destroyed** with chemicals, heat, radiation, or antibiotics **without** destroying the **antigenicity** of the virus. **Examples** are influenza, cholera, hepatitis A, and rabies.

3- Subunit vaccines:

viral **proteins** or groups of proteins are used. These proteins can be **purified** directly from viral particles. However, this is **expensive**, since it is difficult to prepare virus in large enough quantities for protein purification, and potentially **dangerous** since there is the possibility of contaminating virulent virus.

4- DNA- Based Vaccines

genes (DNA) encoding specific viral proteins are injected into an animal (either in muscle or skin). The DNA is then taken up by cells, where it is **transcribed** into **mRNA** which is then **translated to give rise to the viral protein**. This protein is **expressed** on the surface of cells, either alone or in association with MHC molecules. It is **recognized** as a foreign molecule by the immune system, and **elicits an immune response**.

5- Toxoid Vaccines:

For bacteria that secrete toxins, or harmful chemicals. These vaccines are used when a bacterial toxin is the **main cause** of illness. they can **inactivate** toxins by **treating** them with **formalin** Such “detoxified” toxins, called toxoids, and are **safe for use in vaccines**.

6-Recombinant vector vaccines

Immunogenic proteins of virulent organisms may be synthesized artificially by introducing the gene coding for the protein into an expression vector, such as E-coli or yeasts.