6 How do HIV treatments really work?

There are five main families of HIV treatments currently available in Australia and each one attacks HIV in a completely different way. To understand how each treatment works, you also need to understand the life cycle that HIV goes through to replicate in your body

After HIV enters your body, it starts to replicate and it does this by invading CD4 cells, the cells in our body that fight infections. To do this, it must first bind to one of the receptors that cover the surface of a CD4 cell,

1. Entry and Fusion Inhibitors

These treatments work outside the CD4 cell by stopping HIV from binding to it. Some people are born with a mutated form of receptors on their CD4 cells, so they have a natural immunity to HIV. But 99% of us don't, so it's lucky we have Entry and Fusion Inhibitors like enfurvitide and maraviroc to stop HIV in its tracks.

Once it has attached itself, HIV releases its contents into the CD4 cell. HIV is a retrovirus, meaning that its genetic information is stored on a single strand of RNA instead of the double-stranded DNA found in most organisms. So, once inside the CD4 cell, an enzyme called reverse transcriptase turns the HIV RNA into HIV DNA.

2. Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTI)

These treatments bind to reverse transcriptase and inhibit the enzyme by preventing formation of HIV DNA. NNRTIs or "Non-nukes" we use today include nevirapine, efavirenz, rilpivirine and etravirine.

3. Nucleoside/Nucleotide Reverse Transcriptase Inhibitors (NRTI)

While they work at the same point of the HIV life cycle as Non-nukes, NRTIs or "Nukes"perform in a completely different way. While reverse transcriptase is building strands of DNA from viral RNA, Nukes act as false building blocks, making the DNA chain incomplete and causing it to terminate.

NRTIs were the first generation of drugs licensed for the treatment of HIV and include the early drugs AZT, ddI and 3TC and the more recent ones abacavir, emtricitabine and tenofovir.

The newly-created viral DNA then moves into the cell nucleus, where it is incorporated into the human DNA strand with the help of an enzyme called integrase. The HIV DNA then instructs the cell to make copies of itself.

4. Integrase Inhibitors

This family of drugs block the integration of HIV and cell DNA, thus stopping HIV from replicating. The four Integrase Inhibitors available in Australia are raltegravir, dolutegravir, elvitegravir and bictegravir.

The final stage of the life cycle is when HIV is cut up, assembled and released from the infected CD4 cell with the use of an enzyme called protease.

5. Protease Inhibitors (PI)

As the name suggests, these drugs stop HIV from being assembled and released into the body to infect other CD4 cells. PIs include indinavir, saquinavir, lopinavir, fosamprenavir, atazanavir, tipranavir, darunavir and ritonavir.

HIV is a clever little retrovirus so we need to attack it at multiple stages of its life cycle at once. That's why we take a combination of two, three or even four different types of HIV treatments at the same time. If any of these medications are used alone to treat HIV, resistant strains of HIV will emerge relatively quickly (see Factsheet 2 – HIV Drug Resistance).

What is in your treatment combination?

Check the names of the individual drugs in your regimen. Next time you take your pill/s try to imagine the activity going on in your body as each drug tackles HIV at a different stage in its life cycle.

For a comprehensive list of current HIV treatments and all their names, go to: https://napwha.org.au/wp-content/uploads/2019/03/ARV-pill-chart-2018.pdf

Questions? Ask your HIV doctor at your next visit.