New Hope In Battle Against HIV

By Sean McLennan

Earlier this year, researchers at the University of Alberta made a new breakthrough in the struggle against HIV/AIDS. Dr. Stephen Barr, a post-doctoral fellow in the Department of Medical Microbiology led the team that identified a gene, TRIM22, which has the ability to block the replication of HIV. Although far from being a miracle cure for HIV, it is an exciting discovery because it means that potentially our own bodies have the ability to stop the spread of the disease.

The gene was first identified about three years ago as possibly having antiviral properties, and just recently Dr. Barr and his team have demonstrated that this is the case. TRIM22 is not always active; it is one of many genes that are turned on by interferons—a class of chemicals produced by our immune system in response to a viral infection. It's been known for a long time that interferon treatment of cells can block HIV infection, but it wasn't known why. Now they know that interferon stimulates TRIM22, which interacts with the major protein required for HIV assembly, preventing the virus from maturing. Ultimately the incomplete virus is trapped in the host cell and can't infect other cells.

This certainly isn't the first HIV treatment that focusses on disrupting the assembly of the virus, but it is the first time it has been shown that assembly can be disrupted quite late in the process. When HIV infects a cell, it co-opts that cell's resources for its own replication essentially turning the cell into a virus factory. If you push the analogy a little further, a reasonable summary of the process might be:

1. HIV fuses with and infects the host cell.

2. Host cell's raw materials are used to create the base materials of a new virus.

3. New base materials are formed into the basic building blocks of the virus.

4. A new virus is constructed.

Viral entry inhibitors and Integrase inhibitors (a new drug class under development) interrupt the replication process at step one by trying to prevent the virus from attaching to the healthy cell and integrating its RNA into the cell's chromosome. At step two, there are two classes of drugs—NRTIs and NNRTIs—in use. The first, NRTIs act sort of like fake raw materials which render the base materials useless; NNRTIs on the other hand attack the virus's machinery preventing it from building the base materials at all. Finally, Protease inhibitors act at step three, preventing the base materials from being converted to usable building blocks.

Thus far, there have been no treatments at step four, but the discovery of TRIM22 opens a number of possibilities for attacking the virus in an entirely new way. Perhaps it will be possible to artificially turn on or increase the response of TRIM22, or perhaps a new drug could be developed that mimics its behaviour. One important outstanding question is why, if TRIM22 is part of our natural immune system response to viral infections, it doesn't seem to be working in people infected with HIV.

A new potential avenue of HIV treatment is welcome news; HIV mutates very quickly and drug resistance can develop very easily in individuals. HIV drug regimens have to be strictly adhered to; regularly missing even a couple of doses a month can be enough to give the virus the opportunity to develop immunity. In developing countries where drugs are hard to obtain consistently, or in individuals who may have other addictions, economic problems, or serious depression, adherence can be extremely challenging. As long as we are finding new options, we can keep hope that we will stay one step ahead of the disease and eventually overcome it.

From a completely different perspective, it is gratifying that this discovery was made in Alberta. Increasingly it seems that Alberta's universities are making international headlines in the scientific community—there have been a number of other innovations coming out of the University of Alberta and University of Calgary recently. The U of A's department of Electrical and Computer Engineering announced in January that they had developed a revolutionary portable unit for genetic testing—a "lab-on-a-chip" as it were—which stands to save millions in health care costs while making the testing more accessible. A team of physicists at the U of C announced in March that it demonstrated it is possible to "store a special kind of vacuum in a puff of gas and then retrieve it a split second later". Apparently, this demonstration has important implications in the field of quantum computing. And last year a team at the U of C announced the "NeuroArm"—a robotic, surgeon-controlled arm that can perform microsurgery from within an MRI giving the surgeon unprecedented feedback on the surgery while it's happening.

It's nice to see Alberta garnering attention for more than just oil—strong communities are built not just on the diversity of people that comprise them, but also the diversity of industries that drive them. Recognition and vanity aside, we can be proud that our community is positively contributing to humanity's scientific knowledge and especially that we are actively contributing to the fight against HIV/AIDS. ▼

Sean McLennan is a native Calgarian with (nearly) a PhD in Linguistics and Cognitive Science from Indiana University, where he was heavily involved in GLBT education. He currently has a full time gig in software for mobile technology.