The New Optimists

Scientists View Tomorrow's World *& What It Means To Us*

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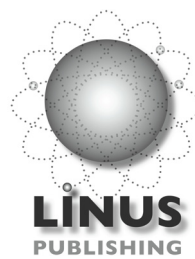

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HIV/Aids – a twenty-five-year rollercoaster

Hazel Barrett

In the spring of 2009 media headlines appeared around the world that doctors in Berlin believed they had found a cure for HIV-AIDS. Bone marrow stem cells had been used to treat leukaemia in an HIV-positive male patient. Three years after the treatment the patient had no detectable signs of HIV, leading to the claim that perhaps marrow stem cells were the silver bullet the world had been waiting for in the fight against AIDS.

This highly optimistic story is just one of many that have been reported over the 25-year history of the global HIV-AIDS pandemic that have raised hopes that a cure or vaccine for HIV-AIDS is close. Too often these hopes are dashed. The search for a cure or vaccine for HIV has been a 25-year roller coaster of optimism followed by despair.

The HIV virus was identified in 1983 by the French scientists

Francoise Barre-Sinoussi and Luc Montagnier, work for which they were awarded the Nobel Prize for Medicine in 2008. We are now entering the third decade of the global HIV-AIDS pandemic and a cure or vaccine is as distant as ever. Since the virus was identified the disease has spread to every corner of the globe. In 2008, UNAIDS reported that 33 million people globally were living with the disease, with 2.7 million people newly infected in that year and 2 million dying. Since the beginning of the pandemic it is estimated that 30 million people have died as a result of the infection. These shocking data make this pandemic the most serious that humankind has faced in its history.

AIDS is caused by HIV, which is a lentivirus, a member of the subgroup of the retrovirus family. One of the main characteristics of the lentivirus is its extensive genetic variability. Two types of HIV have been identified, HIV-1 and HIV-2. HIV-1 is more transmissible and more pathogenic than HIV-2. Each of these HIV types contains virologically related groups comprising subtypes. Scientists have to date identified five groups and 20 subtypes of HIV, with the expectation that more will develop. However, one subtype, HIV-1 Group M Subtype C, is responsible for 55–60% of all global infections.

The HIV virus is highly unstable and susceptible to recombining. There are thus many circulating recombinant forms of the virus which have been formed using the genetic structures from two or more HIV subtypes. This occurs when individuals are exposed to different groups and subtypes of the virus. Within HIV-1 Group M, for example, there are at least 15 recombinant circulating forms. Co-infection with divergent HIV-1 strains is relatively frequent, with over 20% of HIV infections in South-east Asia attributed to recombinant circulating forms of HIV. At present no recombinants have been reported between HIV-1 and HIV-2; however, as the number of recombinant viruses increases the chance that they may contribute to a new HIV group is high. In August 2009, scientists announced the discovery of a new type of HIV in a woman from Cameroon, highlighting the need to monitor for the emergence of new types of HIV.

The genetic variability of HIV is a major factor explaining why finding a cure or vaccine for it has been so elusive. Despite unprecedented efforts on vaccine research, it has proven difficult for scientists to produce a

vaccine to counter so many subtypes of the virus. In addition, any vaccine would have to be unable to recombine with existing HIV viruses to ensure the vaccine did not accidentally produce new infecting HIV strains.

The nature of HIV infection and the long latency period of the infection is another obstacle to finding a cure or vaccine for the disease. It can be months after initial infection before the human body produces antibodies. This is too late to fight the HIV infection, as by this time the virus has stored itself in 'reservoirs', or anatomical sanctuaries in the body, such as the lymph nodes of the intestines. These 'stored' viruses are not destroyed by the body's immune response, even after many years of antiretroviral (ARV) treatment. This is shown in the reactivation of the virus if ARV treatment is interrupted. If a cure or vaccine is to be effective, access to these 'resting cells' during the latent period of the disease is vital.

As a result of these challenges, there have been many disappointments concerning vaccine development. Following the collapse of a major clinical trial of an AIDS vaccine (V520) by Merck at the end of 2007 (which may have actually increased the chances of people developing AIDS), scientists have become very pessimistic about the possibilities of successfully developing an AIDS vaccine in the short to medium term using current approaches.

In a survey of 35 leading UK and US scientists involved in AIDS research undertaken by *The Independent* newspaper in April 2008, many admitted that effective immunisation against HIV may not be possible. There is a mood of deep pessimism amongst scientists researching AIDS and there is currently much debate on the ethics of spending billions of pounds on researching an AIDS vaccine rather than focussing on prevention and treatment, at a time of increasing transmissible HIV resistance to ARVs.

Science has taught us much about the epidemiology of the HIV-AIDS pandemic. We know the disease is transmitted from person to person in infected bodily fluids, such as by using contaminated needles or having unsafe sexual intercourse with an infected person. HIV-AIDS can thus be classified as a 'lifestyle' disease, linked particularly to intimate sexual behaviour, which is the leading route of transmission of the virus. This means we need to pay greater attention to the economic and social factors

that drive risky behaviour and try to understand how these can be effectively altered in a socially acceptable way. As with any lifestyle medical condition, education combined with changing social expectations and norms can lead to behavioural change that reduces the 'risk' environment in which people live, and could ultimately control the spread of HIV.

Behavioural change, especially concerning sexual activity, is not easy to achieve, as the HIV-AIDS pandemic has demonstrated, but it is possible. Some countries in sub-Saharan Africa, the region most severely affected by the pandemic, are reporting stabilisation or declines in HIV prevalence. There is strong evidence that this is attributable to effective changes in sexual behaviour, such as the postponement of sexual debut, reduction in casual sexual relationships and more consistent use of condoms. Effective public health campaigns such as the ABC Approach (where A translates into sexual Abstinence, B is for Be faithful and C stands for use a Condom, for the next letter in the alphabet is D which stands for Death), have been largely responsible for a reduction in risky sexual behaviour in this region.

Education and behavioural change are not easy options. Humans are constantly looking to science and technology to provide solutions so that they do not have to change their behaviour. However, we could stop the spread of HIV-AIDS in its tracks tomorrow before a cure or vaccine is ready and at a fraction of the cost if we changed our behaviour. We just need the will to do so.