



IMMUNE THERAPIES IN DEVELOPMENT

NOTE: several fact sheets describe drugs that are being tested against HIV:

- Fact sheet 410: nucleoside analog reverse transcriptase inhibitors (nukes)
- Fact sheet 430: non-nucleoside analog reverse transcriptase inhibitors (NNRTIs or non-nukes)
- Fact sheet 440: protease inhibitors
- Fact sheet 460: attachment and fusion inhibitors
- Fact sheet 470: new classes of antiviral drugs.

These drugs have not been approved by the Food and Drug Administration (FDA) for use against HIV.

WHAT ARE IMMUNE THERAPIES?

Most HIV medications attack the virus to slow down its multiplication. Another approach to treating HIV infection is “defense”, strengthening the immune response of people who are infected. This Fact Sheet describes new immune therapies.

Immune-based therapies (IBTs) include various approaches to improve health by strengthening the immune system:

- **Immune Stimulators** improve overall immune function
- **Therapeutic vaccines** increase the immune response to HIV
- **Anti-inflammatory treatments** reduce markers of inflammation throughout the body and hopefully their negative health effects.
- **Gene therapies** reduce the bad effects of HIV or shut down the virus

IMMUNE STIMULATORS

These are designed to improve overall immune function.

- **Interferon** exists in the body in several forms. Hemispherx Biopharma is testing **Alferon**, a form of interferon, in Phase II and Phase III trials. It is supposed to activate some of the cell's own defenses against viruses.
- **Interleukin-2 (IL-2, Aldesleukin, Proleukin)** by Novartis is the best-known cytokine. Large clinical trials failed to show any health benefits for its use by people with HIV. See Fact Sheet 482 for more information.
- **CYT107 (Interleukin 7, IL-7)** by Cytheris is a cytokine involved in T-cell

development and survival. It is in a phase II trial in combination with Isentress (Raltegravir) and Maraviroc (Selzentry.) CYT107 may be helpful for people whose T-cell counts do not increase despite ART.

- **Maraviroc (Celsentri, Selzentry**, see fact sheet 462) is an approved antiretroviral drug. It is an attachment blocker. Maraviroc is being studied to increase CD4 cell counts in people whose viral load has been controlled by ART. It also reduces some markers of inflammation.
- **TXA127 (angiotensin 1-7)** by Tarix Pharmaceuticals stimulates bone marrow to produce progenitor cells. These can develop into several types of immune cells, including CD4 T cells. It is in Phase I studies.

THERAPEUTIC VACCINES

Therapeutic vaccines improve HIV-specific T-cell responses in patients whose viral load is suppressed by ART. This should permit better control of HIV if the ART is stopped. Another approach is to treat HIV-positive people before HIV infection causes a significant drop in CD4 counts. This should delay the need for ART.

There are many drug candidates in early stages of study. Some of these take a patient's immune cells and genetically modify them. They are then multiplied and given back to the patient to continue growing and fight HIV.

- **AGS-004** by Argos takes a sample of a patient's virus and extracts RNA. The RNA is loaded into dendritic cells that are administered to the patient, stimulating an immune response to the virus. It is in Phase 2a trials.
- **DermaVir** by Genetic Immunity modifies a sample of the patient's dendritic cells. It is applied as a liquid under a skin patch. Phase II trials showed positive results..
- **FIT-06** by FIT Biotech is a therapeutic vaccine. It is administered as an intramuscular injection. It has completed a Phase II trial.
- **GSK 732462** by GlaxoSmithKline is a therapeutic vaccine entering Phase II trials.
- **HRG214** by Virionyx is a genetically engineered group of antibodies to HIV. It is called a “passive immuno-

therapeutic pharmaceutical.” HRG214 is in Phase I/II trials.

ANTI-INFLAMMATORY APPROACHES

Inflammation is associated with many bad health outcomes (see fact sheet 484.) Several methods are being studied to reduce inflammation.

- **Chloroquine phosphate** is a malaria drug. It fights HIV directly and reduces inflammation.
- **Aspirin and pentoxifylline** are being studied in combination with ART to reduce cardiovascular disease risk.
- **Mesalamine** is an anti-inflammatory pill that focuses on the cells of the gut. It is approved for treating several inflammatory conditions. Researchers at the University of California–San Francisco are studying whether mesalamine can reduce leaky gut syndrome (see fact sheet 484) in HIV-positive people on ART.

GENE THERAPIES

Several approaches are being studied to make CD4 cells resistant to HIV infection. Some of these involve taking an HIV-infected patient's immune cells, modifying them, multiplying them and giving them back to the patient to continue growing and to resist HIV infection.

- **HGTV43** by Enzo Biochem is an “antisense” therapy. It completed a Phase II trial. There is no recent news on its status.
- **Lexgenleucel-T (VRX496)** by VIRxSYS also uses an antisense approach. It has completed Phase II studies.
- **SB-728-T** by Sangamo Biosciences uses a zinc finger technology. It modifies a patient's CD4 cells so that they do not express the CCR5 receptor. A Phase I trial showed good results.
- **M87o** by EUFETS AG is a gene therapy that helps CD4 cells resist infection by HIV. It is being studied in a Phase I trial.

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