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Medical Botany in the Treatment of HIV and AIDS

By

Carolee Buck

An Honors Thesis Submitted in Partial Fulfillment
of the Requirements for Graduation from the
Western Oregon University Honors Program

Dr. Bryan Dutton,
Thesis Advisor

Dr. Gavin Keulks,
Honors Program Director

Western Oregon University

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For Oupa Chris,
thank you for cultivating my love of plants.

Acknowledgements

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Thank you to all my family, who made this thesis possible. And to those in South Africa, thank you for carting me around to interviews and all the help and fun while I was there. Thank you Ouma Joanie, Oupa Chris, Reneé and Edrique for your time and support while I was in South Africa. Thank you Garney and Oupa Doug for your constant encouragement. To my executive editor, Pappa, my official conceptual designer, Mama, and my chief motivator, Tim. You three make a hell of a team.

Thank you all for everything.

I.

Overview of HIV and AIDS

What are HIV and AIDS?

Human Immunodeficiency Virus (HIV) is a virus that specifically targets the T cells of the immune system.² This steadily depletes the immune system over time, and may eventually lead to Acquired Immunodeficiency Syndrome (AIDS).² Though it is not guaranteed to be fatal, there is currently no known cure for HIV infection.²

Transmission

Human Immunodeficiency Virus (HIV) can be transmitted in a number of ways. The most common mode of transmission is infection via blood contact or sexual transmission as an STI (sexually transmitted infection). However, HIV can be “caught” any time a person comes into contact with certain bodily fluids from an already infected individual. Specifically, blood, semen, vaginal secretions, and breast milk can transmit HIV, though the virus may be found in other bodily fluids such as mucus.¹

A common misconception is that HIV can be transmitted simply by touching infected fluids. In reality, the virus must be introduced directly to a mucous membrane or to damaged tissue (such as a cut or scrape in the skin). It can also be transmitted via direct contact with infected blood, such as what occurs in the sharing of injection needles or with contaminated blood transfusions.¹

Review of the HIV Virus and its Actions

After being transmitted, HIV travels through the bloodstream where it does most of its actions. HIV has surface glycoproteins covering its external envelope.² These glycoproteins assist in its identification of and subsequent attachment to a host cell. The target host for HIV is CD4+ helper T cells, which are essential for immune system function.² Helper T cells facilitate the reactions of other immune cells to pathogens in the body. They activate cytotoxic T lymphocytes to kill unwanted cells or pathogens, and are integral to the production of B cells.² Thus, if T helper cells are inactivated, so is part of the body's defense system.

Once HIV binds to a helper T cell, it then transfers its genetic material into the cell to undergo reverse transcription (Figure 1, Label 1).² What this means is that the single stranded viral genetic material, RNA, is transcribed "backwards" into double stranded DNA (Figure 1, Label 2). DNA is the genetic basis for all mammalian cells, and once the viral RNA is reverse transcribed into DNA it can integrate itself into the host T helper cell DNA. After integration, the host cell's new DNA directs it to manufacture HIV instead of performing its intended tasks (Figure 1, Label 3).²

Many known viruses act in this way, including hepatitis B among others.² The difference lies in which cells are targeted. Since HIV targets immune cells, it depletes the very cells that would serve to eradicate the virus from the body.

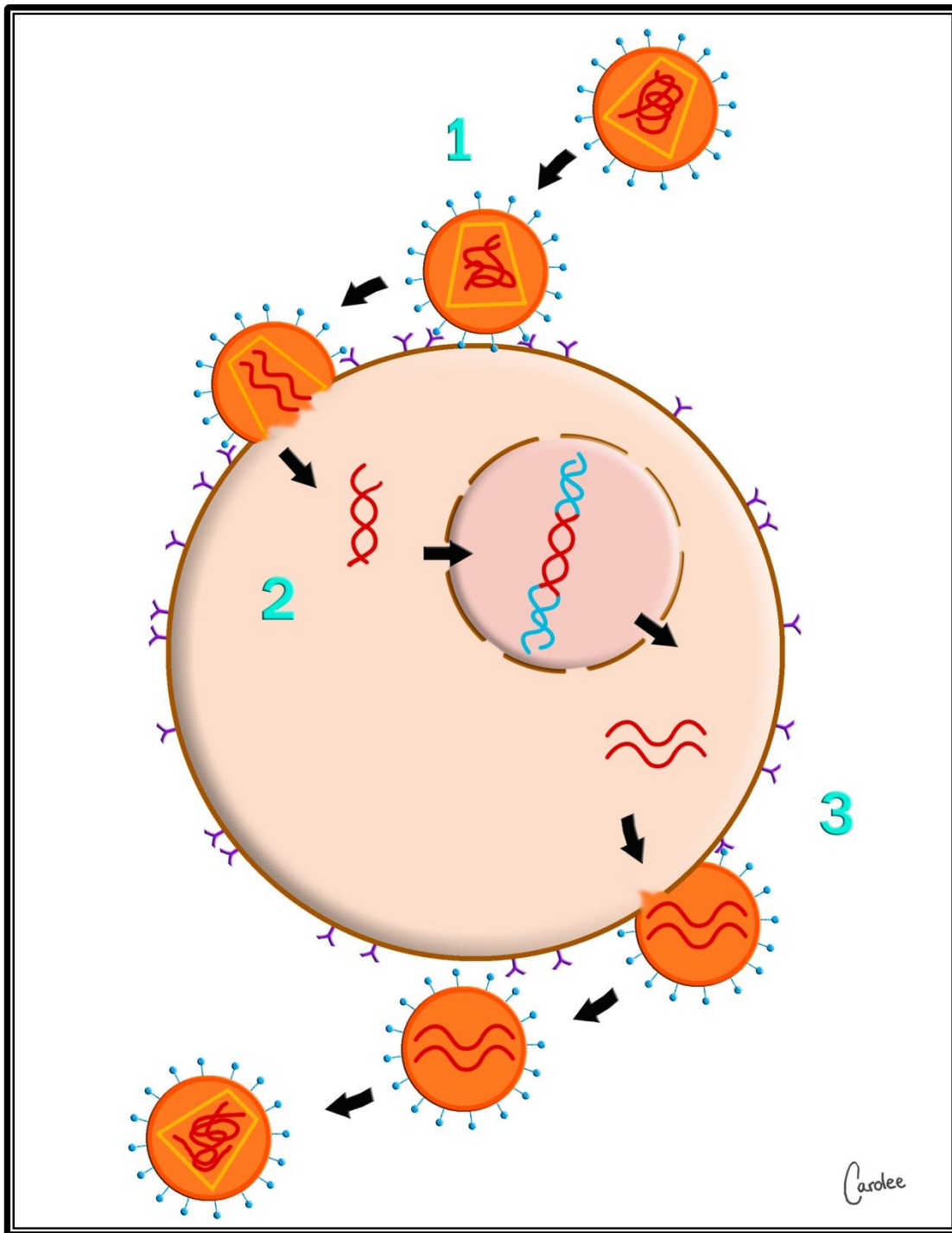


Figure 1 Label 1: Binding of HIV to the host CD4+ T cell. Label 2: Reverse transcription of viral RNA into DNA and subsequent integration into host cell DNA. Label 3: Budding of new HIVs by the host cell.

Symptoms

Once infection has occurred, HIV can progress over many years into acquired immunodeficiency syndrome (AIDS). Initial infection is accompanied by very high levels of HIV in the blood resulting in an increase in contagiousness during the first phase. Unfortunately, this first phase often goes unnoticed due to the symptoms, if any, mimicking those of an average flu. These can often include fever, sore muscles and throat, swollen lymph glands, and headache.¹ After the suspected “flu” passes, the disease enters dormancy, called the latent period. This phase can last on average 8 to 10 years, during which time a person can pass on HIV to others but typically shows only slightly swollen lymph nodes at most.¹

If a person with HIV is not treated, AIDS can set in about 10 years after initial infection.¹ Receiving conventional treatment has been shown to extend the time between initial infection and AIDS.¹ During this 10 year period, HIV will slowly demolish the person’s immune system by killing white blood cells, specifically CD4+ helper T cells.¹ AIDS is, in part, characterized by the number of CD4+ helper T cells in the body declining to fewer than 200 per cubic millimeter.²

HIV in the end is not what directly causes the potentially fatal symptoms of AIDS. Rather, it cripples the immune system to the point that any other infectious agents can much more easily infect the body and thrive. The common cold becomes impossible to cure, and more dangerous diseases such as tuberculosis become easier

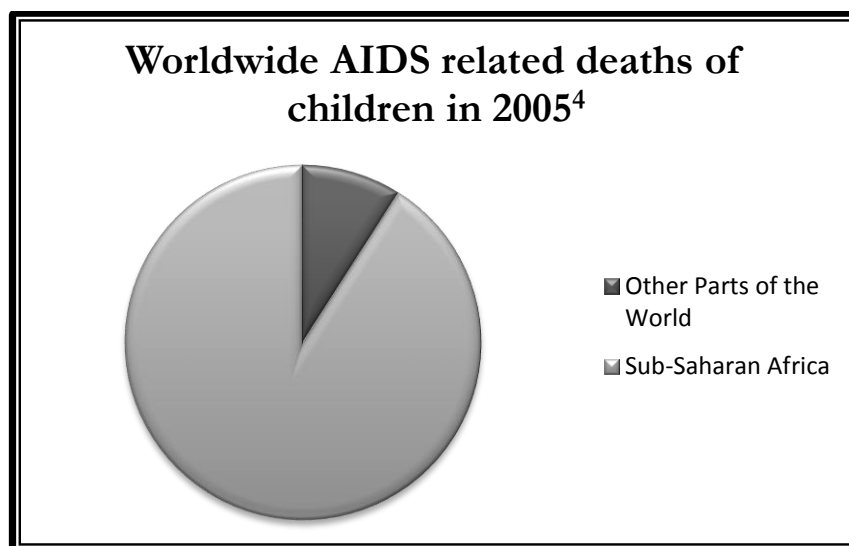
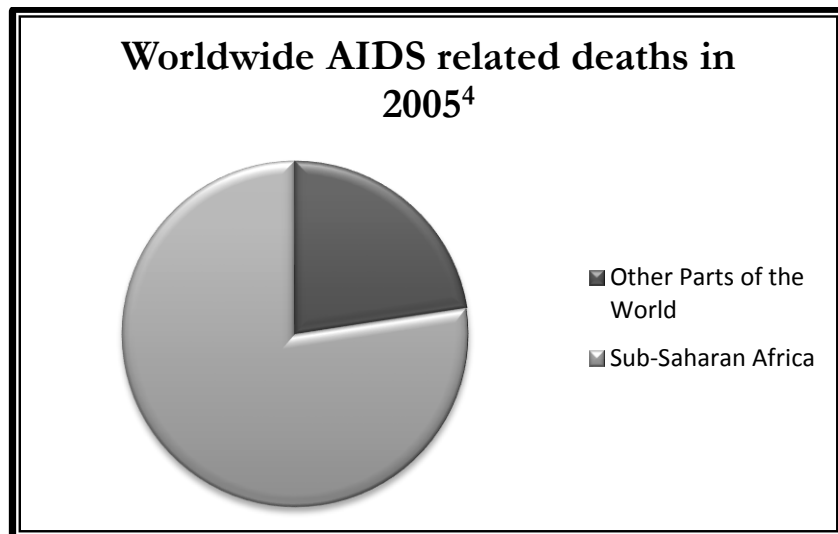
to contract. As such, the symptoms of AIDS can be any number of things, ranging from flu-like symptoms to oral lesions, blurred vision, and extreme (over 100° F) fever for several weeks.¹ These additional infections are called opportunistic, since HIV provides an opportunity for them to act due to a suppressed immune system. In the end, it is more often than not opportunistic infections that lead to the eventual death of HIV and AIDS patients.¹

Common AIDS-related Infections¹

- **Tuberculosis**
 - bacterial infection of the lungs
- **Pneumocystis pneumonia**
 - fungal infection of the lungs
- **Cytomegalovirus**
 - herpesvirus
- **Toxoplasmosis**
 - protozoan parasite which attacks the CNS
 - most often contracted from cats
- **Cryptosporidiosis**
 - protozoan parasite which attacks the intestines

The Influence of HIV in Sub-Saharan Africa and Worldwide

In 2005, 3.1 million people in the world died due to AIDS related complications³. 2.4 million—that is over 77%—of these deaths were in sub-Saharan Africa.³ In 2010, 30.2% of pregnant South African women aged 15 to 49 were living with HIV.³ This means that their children might be born infected with HIV, severely limiting their chances to survive to adulthood.



Social Perspective on Statistics

Statistics decidedly show that HIV related infections and deaths are significantly higher in Africa than in any other part of the world. However, one hypothesis holds that these numbers may be even higher than what is reported. HIV is clearly a common and significant problem in sub-Saharan Africa, and yet the social stigma associated with the disease has led to complications when trying to gather accurate data and provide adequate treatment. It is still generally considered shameful to be afflicted with HIV, which leads to patients trying to conceal their ailment even from doctors⁵. Conversely, medical professionals in South Africa have been known to avoid documenting cases of HIV in an attempt to “save face” for their patients.^{5,6} Many have also been known to record only the immediate cause of death on death certificates without noting that the deceased suffered from HIV or AIDS, instead listing “lung related illness”.^{5,6}

This stigma is also a contributor to the prevalence of HIV in sub-Saharan Africa. Being unwilling to discuss this very important issue leads to lack of education and prevention of spreading. Beyond this, the social stigma may prevent people with HIV from seeking appropriate care.

Thus, even though finding better treatments and a cure is obviously necessary, education about HIV and prevention is just as necessary.

“Social stigma associated with HIV/AIDS, tacitly perpetuated by the Government's reluctance to bring the crisis into the open and face it head on, prevents many from speaking out about the causes of illness and deaths of loved ones and leads doctors to record uncontroversial diagnoses on death certificates.... The South African Government needs to stop being defensive and show backbone and courage to acknowledge and seriously tackle the HIV/AIDS crisis of its people.”⁶

Treatment

There is currently no known cure for HIV. However, there are a plethora of treatments which can be used to manage the illness and improve a patient's quality of life. Currently, a cocktail of antiretroviral drugs is typically used. Due to the immensely high mutation rate (and thus, adaptability) of HIV, a combination of at least three antiretroviral drugs has proven most effective.^{1,5} Though these drugs do not eliminate HIV completely, they attack various aspects of HIV to limit its proliferation and effects.¹

The five general classes of antiretroviral drugs used against HIV are:

Non-nucleoside reverse transcriptase inhibitors (NNRTIs): target and disable reverse transcriptase, an essential enzyme for HIV which conducts reverse transcription of RNA to DNA.¹

Nucleoside reverse transcriptase inhibitors (NRTIs): also target reverse transcriptase, but use a different mechanism than NNRTIs.¹

Protease inhibitors (PIs): target protease, an enzyme which aids in making the proteins necessary for building new HIV copies, thus lowering proliferation.¹

Integrase inhibitors (IIs): disable integrase, which is the enzyme responsible for integrating reverse transcribed HIV DNA into host T cell DNA.¹

Entry or fusion inhibitors: block HIV from initially infecting CD4+ helper T cells through various mechanisms.¹

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- ¹ Staff, Mayo Clinic. HIV/AIDS. mayoclinic.org. <http://www.mayoclinic.org/diseases-conditions/hiv-aids/basics/definition/con-20013732> Accessed January 20, 2013.
- ² Owen J, Stranford S, Punt J. *Kuby Immunology* 7. New York, New York: W. H. Freeman & Company, 2013.
- ³ *AVERT: AVERTing HIV and AIDS*. South Africa HIV & AIDS Statistics. Avert.org <http://www.avert.org/south-africa-hiv-aids-statistics.htm> Accessed January 21, 2013
- ⁴ Halloran N. People Charts (HIV AIDS Statistics). *Aidsinafrica.net* http://www.aidsinafrica.net/people_charts.php Accessed April 18, 2013.
- ⁵ Breedt, Bets. Personal interview. September 2012
- ⁶ *The Lancet*. South Africa Needs to Face the Truth about HIV Mortality. *The Lancet*. 2005; 365(9459): 546. [http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(05\)17918-5/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(05)17918-5/fulltext) Accessed January 23, 2013.

II.

Introduction to Medical Botany

Medical Botany Defined

For the purposes of this thesis, medical botany is defined as the use of plants or plant-derived products as treatment or preventative medicine. This can be in the form of edibles and nutrition, or any other treatment of disease. Drinking a cup of chamomile tea before sleep to using digitoxin (a derivative of the foxglove plant) or treating a heart condition are just two of many examples of how medical botany is used in modern Western life.⁴

Reasons for Using Medical Botany

Use of botany for medical purposes in Africa dates as far back as 3000 BC where it was employed in ancient Egypt.¹ The Papyrus Ebers, an Egyptian pharmaceutical text from 1550 BC, cataloged disease traits and remedies.¹ A significant portion of these remedies are plant-based, and are reflected in later texts from ancient Greece and beyond. Even Hippocrates, the famous “father of medicine”, used remedies akin to those described in the Papyrus Ebers.¹

Clearly, medical botany has ancient roots, but why is it still used today? Certainly, humanity has grown beyond it and has moved on to “improved” modern medicine. Multiple reasons, such as financial constraints, spiritual connections, and even proven effectiveness have led modern patients to sometimes still choose medical botany in Sub-Saharan Africa, and around the world. Personal financial and spiritual concerns often govern patient’s choices in which route of treatment to seek.

Many public hospitals in sub-Saharan Africa are overwhelmed with high numbers of patients and inadequate resources to treat those patients. As such, private medical care is often preferred. Yet, the costs of such private care are often above what people can afford. When faced with this dilemma, use of traditional and botanically based medicine is often sought. While it still costs the patients to seek care from traditional healers, it is not necessarily monetary payment (e.g. many traditional

healers will accept trades for payment) and it is still lower in cost than private medical care.²

Traditions and spirituality are infused in African cultures as a whole, and especially so in South Africa. There is a strong belief that disease may be caused by curses, bewitchment, or possession by ancestors.³ Because of this belief, it is thought that allopathic medicine would not be sufficient to cure a sick individual.³ Thus, even if treatment in a hospital is financially possible, people may seek traditional medicine as well. Traditional healers use a variety of methods, often including medical botany. In this way, the line between medical and spiritual use of plants can become blurred.

Traditional healers in South Africa generally fall into one of three categories:

Inyangas – herbalists who draw upon their knowledge of *muti* (traditional medicines made of herbal or animal products) to heal patients

Sangomas – diviners who obtain guidance from their ancestors (through possession/channeling, throwing bones, and interpreting dreams) to detect illness or provide advice and who also heal with *muti*

Divine Healers – practitioners who prevent or cure disease with spiritual intervention”.³

All three of these healer categories have a strong spiritual influence on the population, and as such, are often utilized. The most applicable profession to this study is the Inyanga, who uses plant-based medicine to treat patients.

Who Uses Medical Botany?

Many medical professionals use medical botany. The professions that most easily come to mind are alternative practitioners such as herbalists and naturopathic doctors. However, even allopathic doctors use botanically-based medicines on a consistent basis. And every time a nutritionist recommends the consumption of more or different combinations of vegetables, that could be considered medical botany. Other modern day professionals known to incorporate botanical medicine in their practices are homeopathic and naturopathic doctors as well as traditional healers.

How is Medical Botany Used?

Medical botany can come in many forms. Plants can be divided into two basic morphological regions that can be used for medical purposes: above ground or aerial (e.g., flowers, seeds, leaves, and stems) and below ground (e.g., roots and tubers).⁴ These parts can be used directly to treat ailments as extracts or essential oils, dried or fresh whole parts, or as tinctures and teas.⁴ It is also possible to isolate active chemicals from plants to be used as medicine, which is the root of many commonly used allopathic medicines.

Scientific Basis for Medical Botany

Scientific studies on the efficacy of directly using plants as medicine are few and far between, whether due to an overall lack of funding or lack of interest in the modern medical world for such endeavors. However, many plant-derived medicines have proven to be effective and are a source of life-saving pharmaceuticals. Many medicines considered “western” today have their origin from earlier experimenting with plants.

Botanical Origins of Some Common Medicines⁴

Many modern medicines are originally derived from botanical sources. Some of the more well known ones include:

- **Aspirin:** Pain relieving and blood thinning drug from willow trees
- **Codeine:** Analgesic and antitussive drug from *Papaver somniferum*, a poppy
- **Digitoxin:** Cardiotonic from *Digitalis purpurea*, the foxglove
- **Morphine:** Analgesic from *Papaver somniferum*
- **Quinine:** Antimalarial and antipyretic drug from *Cinchona ledgeriana*, a small tree

Of the prescription drugs distributed from 1959 to 1980, 25% contained botanical derivatives or plant extracts.¹ It has also been estimated that the botanically-based drugs found thus far represent only a small fraction of those yet to be discovered in rainforests.¹ Consequently, a lot of current research is being geared towards looking

at plants for “new” pharmaceutical compounds by considering traditional uses of plants as a guide.¹ The vast potential of these yet to be developed considering plant-based medicines for the treatment of HIV and AIDS is reason enough for investment in research of this unknown field. In 2011, an estimated 34 million people worldwide were dealing with this devastating disease.⁵ With that many people affected, it is imperative to pursue all potential treatment paths for HIV, including medical botany.

¹ Lewis W, and Elvin-Lewis M. *Medical Botany: Plants Affecting Human Health* 2. New York, New York: Wiley, 2003.

² Rajendra K. Traditional Healers in South Africa: A Parallel Health Care System. *British Medical Journal*. 1995; 310:1182-185. <http://www.bmj.com/content/310/6988/1182> Accessed May 5, 2013.

³ Sharkey A, Chopra M, Jackson D, Winch P, Minkovitz C. Pathways of Care-seeking during Fatal Infant Illnesses in Under-resourced South African Settings. *Nbic.nlm.nih.gov* <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3254810/> Accessed May 5, 2013.

⁴ Taylor L. Plant Based Drugs and Medicines. Rain-tree.com. <http://www.rain-tree.com/plantdrugs.htm#.U4rvHfldWao> Accessed April 18, 2013.

⁵ UNAIDS. AIDSinfo. [unaids.org. http://www.unaids.org/en/dataanalysis/datatools/aidsinfo/](http://www.unaids.org/en/dataanalysis/datatools/aidsinfo/) May 5, 2013.

III.

Methods

The majority of information presented herein is based upon extensive research of available literature through Western Oregon University Library search engines and the PubMed database. In addition, and equally essential, was information from interviews conducted in South Africa. This work, conducted during September 2012, included five in-person and telephone interviews in South Africa. Professionals interviewed included allopathic and homeopathic doctors, nurses and herbalists. Each interview lasted between 15 minutes and 3 hours. Of the people interviewed, the herbalist Margaret Roberts was the most informative. Many of the plants listed in this thesis were recommended by her.

The following questions were asked:

- How do you view HIV and AIDS? Do you believe it is curable?
- Please explain a bit about your profession. Do you work with people with HIV and AIDS?
- What preventative medicines to stop the spread of HIV and AIDS would you recommend and why?
- What treatment for HIV and AIDS would you recommend and why?
- Do you know of any herbs or plants that are used to treat HIV and AIDS?

Detailed notes were taken during the interviews, and were later compiled and analyzed upon return to the United States.

IV.

Plants with Potential Benefit to HIV Patients

The primary goal of using medical botany to treat HIV is to support the body in fighting the virus, or at a minimum suppressing the symptoms. True, there are multitudes of potential antivirals and HIV “cures” found in plants, but currently there is a significant shortage of available studies regarding botanically derived HIV treatments that target the virus itself.

Of the research that is available, only a select few studies revolve around plants traditionally used in sub-Saharan Africa (e.g. 7). While there is vast potential here, we have only barely skimmed the surface in modern treatment research. Thus, the most effective course of treatment for those afflicted with HIV could very well be through a combined course of medical botany to help alleviate side effects and symptoms in conjunction with conventional treatments.

As it stands, HIV is not going to disappear once introduced to the body, but we can make the best of it and even strive to prevent the development of HIV into AIDS. Antiretrovirals are needed for this, but their effects can be aided through medical botany to give the patient the best possible quality of life. Medical botany methods have been shown to aid people in resisting opportunistic infections; for example, it would be unwise to deny that good nutrition supplemented by vegetables is the first step to a healthy life, regardless of present infections. This is the nature of medical botany as defined for this thesis: to use readily available and inexpensive treatments to support the body in fighting ailments.

People in South Africa and other developing African countries are likely open to using medical botany as many already use botanical treatments in combination with conventional medicine.²² It is therefore essential that more research be done into traditionally used medicines to avoid any negative interactions.

Following are two lists of applicable plants which are currently known for the potential treatment of HIV. The first is of plants recommended by South African medical and herbal professionals compiled through interviews conducted for this project and the second is of plants found through extensive review and analysis of available literature. Scientific names were not originally provided by interviewees, but have been included to increase accuracy in communicating about each plant listed.

Plants Recommended By South African Medical and Herbal

Professionals

I. Agathosma betulina

- **Common Names:** Buchu, Boegoe
- **Family:** Rutaceae
- **Native To:** Southern Africa
- **Parts Used:** Aerial, Seeds, Roots⁴
- **Types of Uses:** Culinary, Medicinal¹
- **Traditional Uses:** Buchu is used traditionally to treat kidney and urinary tract disease.⁴
- **Use in Regards to HIV:** Buchu is effective in supporting general health and tea made from Buchu has a very high vitamin content to build up the immune system.¹ It is also helpful in maintaining kidney and urinary tract health and is used to prevent diseases in these areas.¹
- **Interesting Facts:** The word “Buchu” refers to “aromatic plant” and thus the name “Buchu” is also used in reference to other plants, some unrelated to *Agathosma betulina*.¹²

II. *Artemesia absinthium*

- **Common Names:** Wormwood, Absinth
- **Family:** Asteraceae
- **Native To:** Europe, Central Asia
- **Parts Used:** Aerial¹
- **Types of Uses:** Medicinal, Insecticidal¹
- **Traditional Uses:** Wormwood is not used traditionally in sub-Saharan Africa.²
- **Use in Regards to HIV:** See *Artemisia afra*
- **Interesting Facts:** Wormwood is the key ingredient in absinthe, a French liquor. It contains thujone among other potentially dangerous compounds, a chemical which is a narcotic and can cause convulsions in large enough doses.⁴

III. *Artemisia afra*

- **Common Names:** Wilde Als, African Wormwood, Umhlonyane
- **Family:** Asteraceae
- **Native To:** Africa
- **Parts Used:** Aerial²
- **Types of Uses:** Medicinal, Insecticidal²
- **Traditional Uses:** Wilde Als is used traditionally in sub-Saharan Africa.² It is used by the Zulu tribe to treat headaches, colds and fevers by way of tea or

- inhaling crushed leaves.⁴ Wilde Als is also considered a blood purifier and decoctions are used as enemas to treat intestinal parasites and constipation.⁴
- **Uses in Regards to HIV:** Wilde Als is an anti-inflammatory and acts as a pain reliever.² It also has anti-depressant properties.²
 - **Interesting Facts:** Wilde Als is gentler and less addictive than Wormwood (*A. absinthium*), but with similar properties, making it the preferable of the two to use in any preparation.²

IV. *Allium fistulosum*

- **Common Names:** Welsh Onions
- **Family:** Liliaceae¹³
- **Native To:** Unknown
- **Parts Used:** Aerial, Bulbs¹
- **Types of Uses:** Culinary, Medicinal¹
- **Traditional Uses:** Welsh Onions are not used traditionally in sub-Saharan Africa.²
- **Use in Regards to HIV:** Welsh Onions may be effective in treating a variety of opportunistic infections. Among its qualities are antibacterial, diuretic, stomachic, and vermifuge activity.^{1,13} Poultices made from Welsh Onions can be used to treat skin ailments often associated with AIDS, such as skin ulcers.¹

V. *Brassica oleracea var. acephala*

- **Common Names:** Covo, Couve Galega³, Leaf Cabbage
- **Family:** Brassicaceae
- **Native To:** Unknown
- **Parts Used:** Aerial²
- **Types of Uses:** Culinary, Medicinal²
- **Traditional Uses:** Covo is traditionally eaten in much the same way as spinach or kale.²
- **Use in Regards to HIV:** Covo has a high concentration of vitamins and minerals.² Its superior nutrition is excellent for supporting general health.²
- **Interesting Facts:** Related closely to Collard Greens and Portuguese Kale, Covo is frequently confused with both of these vegetables.^{3,20}

VI. *Centella asiatica*

- **Common Names:** Pennywort, Varkoortjies, Waternavel
- **Family:** Apiaceae
- **Native To:** India, Australia, southern Africa, South America
- **Parts Used:** Aerial¹
- **Types of Uses:** Medicinal, Culinary, Cosmetic¹
- **Traditional Uses:** This plant is used traditionally in sub-Saharan Africa.
Pennywort is mostly known for treatment in skin complications and Hansen's

disease.⁴ It has also been used in treating venereal diseases, mental retardation, senility, and malaria.¹

- **Use in Regards to HIV:** Pennywort improves circulation, boosts the immune system, and heals sores and skin faster.¹ It increases collagen production in blood, thus increasing wound healing.¹
- **Interesting Facts:** Pennywort is related to Gotu Kola (*Hydrocotyle asiatica*).¹ Asiaticoside, hydrocyanic acid, and saponin are toxins in Pennywort⁴

VII. *Coix lacryma-jobi*

- **Common Names:** Job's Tears, Chinese Pearl Barley, Jobskrale, Tandkrale
- **Family:** Poaceae
- **Native To:** Southeast Asia
- **Parts Used:** Roots, Seeds⁴
- **Types of Uses:** Medicinal⁴
- **Traditional Uses:** Seeds are given to teething Zulu children to chew on.⁴ The sap of the Job's Tears is thought to relieve itches.⁴
- **Use in Regards to HIV:** Job's Tears is a diuretic, purifier, and is known to expel parasitic worms.⁴ It cleanses toxins and infectious agents from the body to limit opportunistic infections.²

VIII. *Echinacea purpurea*

- **Common Names:** Echinacea, Cone Flower

- **Family:** Asteraceae
- **Native To:** North America¹
- **Parts Used:** Roots, Aerial¹
- **Types of Uses:** Culinary, Medicinal, Cosmetic¹
- **Traditional Uses:** Echinacea is not used traditionally in Sub-Saharan African medicine.
- **Use in Regards to HIV:** Echinacea contains both an antibiotic chemical (echinacoside) and an antiviral agent (echinisen).¹ This gives it the potential to work against HIV by strengthening the immune system as a whole.² Echinacea also aids in the healing process by treating opportunistic infection, and has been shown to increase white blood cell production.¹
- **Interesting Facts:** As a sun loving plant, Echinacea grows well in Southern Africa.²

IX. *Kigelia africana*

- **Common Names:** Sausage Tree, Worsboom, Ibele-ndhlovu, Umzingula⁴
- **Family:** Bignoniaceae
- **Native To:** Africa
- **Parts Used:** Aerial, Seeds, Roots⁴
- **Types of Uses:** Medicinal⁴

- **Traditional Uses:** The Sausage Tree is most commonly used externally for skin complications such as ulcers and is also used to treat rheumatism.⁴ The Sausage Tree is also used in religious ceremonies in sub-Saharan Africa.⁴
- **Use in Regards to HIV:** The seeds of the Sausage Tree, when ground into a powder and mixed into a cream, are especially effective in treating skin irritations and ulcers commonly associated with AIDS and opportunistic infections.¹
- **Interesting Facts:** The Sausage tree gets its name from its sausage-shaped seed pods.²

X. *Medicago sativa*

- **Common Names:** Alfalfa, Lucerne
- **Family:** Fabaceae
- **Native To:** Europe and Asia
- **Parts Used:** Aerial, Seeds¹
- **Types of Uses:** Culinary, Medicinal, Cosmetic¹
- **Traditional Uses:** Not used traditionally in sub-Saharan Africa²
- **Use in Regards to HIV:** Alfalfa boosts immune system activity.¹ High vitamin and mineral content, including vitamin B12 which is very rarely found in plant sources, makes alfalfa a good food source for immune compromised people such as those with HIV.¹

- **Interesting Facts:** Alfalfa is commonly grown as livestock feed and is used as a rotational crop because of its ability to enrich nitrogen in soil.¹

XI. *Moringa oleifera*

- **Common Names:** Moringa, Drumstick Tree, Spinach Tree
- **Family:** Fabaceae
- **Native To:** India, Arabian Peninsula
- **Parts Used:** Aerial, Seeds, Roots¹
- **Types of Uses:** Culinary, Medicinal¹
- **Traditional Uses:** Moringa is not used traditionally in sub-Saharan Africa.²
- **Use in Regards to HIV:** Moringa has strong antibiotic activity and high nutrient value, which aid in maintaining healthy weight as well as preventing opportunistic infections.¹
- **Interesting Facts:** Moringa grows well in dry areas and all aerial parts are edible. Powdered seeds can be used to sanitize water for consumption.¹ Mixed thoroughly, “about 2 or 3 teaspoons of powdered seed treats 20 litres of water.”¹ The powdered seed traps impurities and contaminants in the water. After the powder settles to the bottom, the water above the sediment is food safe.² These traits give Moringa valuable potential for Southern Africa beyond treating HIV patients.²

XII. *Silybum marianum*

- **Common Names:** Milk Thistle, Mary Thistle, Holy Thistle, Silymaria¹⁰
- **Family:** Asteraceae
- **Native To:** Europe¹
- **Parts Used:** Aerial, Seeds, Roots¹
- **Types of Uses:** Culinary, Medicinal¹
- **Traditional Uses:** Milk Thistle is primarily used as a liver tonic.¹⁰ Milk Thistle has also had applications in treating insulin resistance, high cholesterol and cancers.^{2,10}
- **Use in Regards to HIV:** Milk Thistle helps prevent damage to the liver from toxins as well as repairing prior liver damage.² The relevant active ingredient is Silybinin.¹⁰

XIII. *Stevia rebaudiana*

- **Common Names:** Stevia
- **Family:** Asteraceae
- **Native To:** South America¹
- **Parts Used:** Aerial¹
- **Types of Uses:** Culinary, Medicinal¹
- **Traditional Uses:** Stevia is not used traditionally in sub-Saharan Africa as a medicine.

- **Use in Regards to HIV:** Though Stevia has no direct benefits with regard to HIV, it is highly recommended as an alternative to sugar.² Sugar can compromise the immune system and the general health of an individual, and reducing sugar intake will help support the body as a whole.¹ Stevia does not have any known negative side effects, unlike artificial synthetic sweeteners, and this makes it an excellent alternative to sugar.²
- **Interesting Facts:** Stevia is 250 times sweeter than sucrose which means that it takes significantly less of the powdered plant to sweeten food to the same level.²¹

XIV. *Taraxacum officinale*

- **Common Names:** Dandelion
- **Family:** Asteraceae
- **Native To:** Europe and British Isles
- **Parts Used:** Aerial, Roots¹
- **Types of Uses:** Medicinal, Culinary, Cosmetic¹
- **Traditional Uses:** Dandelion is not used traditionally in sub-Saharan Africa.
- **Use in Regards to HIV:** High mineral content in Dandelion helps support general health and strengthens bones, making it essentially like eating a multivitamin that is better absorbed than average supplements.² Dandelion is also a diuretic and is detoxifying which helps “flush out” pathogens.²

- **Interesting Facts:** Dandelion regularly propagates asexually. It purifies the blood and works well as a treatment for anemia.¹

XV. *Trifolium pratense*

- **Common Names:** Red Clover
- **Family:** Fabaceae
- **Native To:** Europe and Asia
- **Parts Used:** Aerial¹
- **Types of Uses:** Culinary, Medicinal, Cosmetic¹
- **Traditional Uses:** Red Clover is not used traditionally in sub-Saharan Africa².
- **Use in Regards to HIV:** Red Clover is useful in treating tuberculosis, a common opportunistic infection associated with HIV.² A tea soothes cough and sore throat as well as bronchitis.¹
- **Interesting Facts:** Red Clover is a known botanical source of estrogen.¹ It contains active compounds for estrogen regulation, including four phytoestrogenic isoflavones: genistein, diadzein, formononetin, and biochanin A.¹¹

Plants Recommended through Review of Available Literature

I. Bulbine alooides

- **Common Names:** Rooistrum, Rooiwortel, Waterpie, Ibhucu
- **Family:** Asphodelaceae
- **Native To:** South Africa
- **Parts Used:** Tubers
- **Types of Uses:** Medicinal⁴
- **Traditional Uses:** Rooistrum is used traditionally to treat syphilis and rheumatism in sub-Saharan Africa.⁴
- **Use in Regards to HIV:** Rooistrum has been shown to inhibit HIV reverse transcriptase and protease.¹⁹ This plant is thought to have high potential to treat HIV due to its effective HIV protease inhibitory activity.¹⁹

II. Croton lechleri

- **Common Names:** Sangro de Drago Tree, Sangre do Grada, Dragon's Blood
- **Family:** Euphorbiaceae
- **Native To:** South America
- **Parts Used:** Aerial¹⁸
- **Types of Uses:** Medicinal¹⁸

- **Traditional Uses:** The Sangro de Drago Tree is not used traditionally in sub-Saharan Africa. The red latex from the tree is used traditionally in South America to seal wounds and promote healing.¹⁸
- **Use in Regards to HIV:** Latex from the Sangre de Drago Tree yields an isolate called crofelemer.¹⁸ This isolate has been approved to treat diarrhea associated with HIV.¹⁸
- **Interesting Facts:** Crofelemer was the second botanical preparation to be approved by the United States FDA as a prescription drug, under the name FulyzagTM.¹⁸

III. *Eclipta prostrata*

- **Common Names:** False Daisy, Yerba de Tago, Bhringraj
- **Family:** Asteraceae
- **Native To:** South America¹⁴
- **Parts Used:** Aerial⁵
- **Types of Uses:** Medicinal, Culinary⁵
- **Traditional Uses:** False Daisy is not used traditionally in sub-Saharan Africa. It is traditionally used in South America as an application to wounds and scorpion bites to promote healing.¹⁴
- **Use in Regards to HIV:** Several compounds within this plant have been shown to have anti-HIV activity.⁵ Two of these compounds, wedelolactone and orobol, target HIV integrase. Another three inhibit HIV protease: these

three compounds are 5-hydroxymethyl-(2,2'5'2'')-terthienyl thglate, ecliptal acetate, and 5-hydroxymethyl-(2 2'5'2'')-therthieryl acetate.⁵ Research into False Daisy indicates it to be a possible source for non-toxic treatments to HIV which target the virus specifically without harming the patient.⁵

IV. *Gasteria bicolor*

- **Common Names:** Dwarf Gasteria, Klein-besstengoprell
- **Family:** Aloaceae
- **Native To:** South Africa
- **Parts Used:** Aerial⁷
- **Types of Uses:** Medicinal⁷
- **Traditional Uses:** Dwarf Gasteria is used traditionally in sub-Saharan Africa to treat fungal infections, which are often associated with HIV.⁷
- **Use in Regards to HIV:** This plant has strong anti-oxidant properties, meaning it inhibits free radicals in the body.⁷ It has not been shown to have direct anti-HIV activity; however, Dwarf Gasteria can be effective in treating opportunistic fungal infections due to its antioxidant properties.⁷

V. *Hemsleya endecaphyllia*

- **Common Names:** None
- **Family:** Cucurbitaceae
- **Native To:** China

- **Parts Used:** Tubers¹⁷
- **Types of Uses:** Medicinal¹⁷
- **Traditional Uses:** *H. endecaphyllia* is not used traditionally in Sub-Saharan Africa. In China, *H. endecaphyllia* is used to treat fever, pain, and inflammation.¹⁷
- **Use in Regards to HIV:** Cucurbitacin B is a compound isolated from *H. endecaphyllia* that has been shown to have high anti-HIV activity.¹⁷
- **Interesting Facts:** *H. endecaphyllia* is a very rare plant.

VI. *Hypoxis soblifera* var. *sobolifera*

- **Common Names:** Creeping Hypoxis
- **Family:** Hypoxidaceae
- **Native To:** Southern Africa⁴
- **Parts Used:** Tubers⁴
- **Types of Uses:** Medicinal^{4,19}
- **Traditional Uses:** *Hypoxis* species are used traditionally in Sub-Saharan Africa to treat a variety of conditions ranging from stomach complaints to mental disorders.⁴
- **Use in Regards to HIV:** Creeping Hypoxis has been shown to inhibit HIV reverse transcriptase as well as HIV protease.¹⁹

VII. *Leonatis leonurus*

- **Common Names:** Lion's Ear, Cape Hemp, Wildedagga, Imunyamunya
- **Family:** Lamiaceae
- **Native To:** South Africa⁴
- **Parts Used:** Aerial⁴
- **Types of Uses:** Medicinal^{4,19}
- **Traditional Uses:** Lion's Ear is used traditionally in Sub-Saharan Africa to treat snake bites through bark decoctions.⁴
- **Use in Regards to HIV:** Lion's Ear has been shown to inhibit HIV reverse transcriptase and HIV protease¹⁹. This plant is thought to have high potential to treat HIV due to its protease inhibitory activity.¹⁹
- **Interesting Facts:** Infusions of Lion's Ear are sprinkled around animal enclosures by the Zulu tribe to repel snakes.⁴

VIII. *Pericampylus glaucus*

- **Common Names:** Broad-leaved Moonseed, Xiyuan Teng
- **Family:** Menispermaceae
- **Native To:** Southwest China¹⁵
- **Parts Used:** Roots¹⁵, Aerial¹⁵
- **Types of Uses:** Medicinal¹⁵

- **Traditional Uses:** Broad-leaved Moonseed is not used traditionally in Sub-Saharan Africa. The plant is used traditionally in China for respiratory problems such as laryngitis and coughs as well as pulmonary complications.¹⁵ Boils and fractures are also treated with Broad-leaved Moonseed.¹⁵
- **Use in Regards to HIV:** Two alkaloids isolated from the aerial parts of this plant have been shown to have anti-HIV activity: norrufscine and (-) 8-oxotetrahydropalmatine.¹⁵
- **Interesting Facts:** Broad-leaved Moonseed also contains compounds which show anti hepatitis B viral activity.¹⁵

IX. *Pittosporum viridiflorum*

- **Common Names:** Cheesewood, Bosboekenhout, Umfusamvu
- **Family:** Pittosporaceae
- **Native To:** South Africa
- **Parts Used:** Aerial, Bark⁴
- **Types of Uses:** Medicinal⁴
- **Traditional Uses:** Cheesewood is used traditionally by the Zulu and Xhosa for stomach complaints and to induce vomiting.⁴
- **Use in Regards to HIV:** This plant has strong anti-oxidant properties, meaning it inhibits free radicals in the body.⁷ It has not been shown to have direct anti-HIV activity; however, Cheesewood can be effective in treating opportunistic fungal infections due to its antioxidant properties.⁷

- **Interesting Facts:** The Sotho tribe traditionally believes that Cheesewood protects people against witchcraft.⁴

X. *Schisandra lancifolia*

- **Common Names:** None
- **Family:** Schisandraceae
- **Native To:** China
- **Parts Used:** Aerial⁸
- **Types of Uses:** Medicinal⁸
- **Traditional Uses:** *S. lancifolia* is not used traditionally in Sub-Saharan Africa.
- **Use in Regards to HIV:** Four compounds have been found in this plant that have, separately, anti-HIV activity.^{8,9} Three of these compounds—nigranoic acid, lancifodilactone H, and lancifoic acid—have weak anti-HIV activity but are promising due to low toxicity to cells.⁸ The other isolated compound is lancifodilactone, which has clear and selective anti-HIV activity while still being minimally toxic.⁹
- **Interesting Facts:** *S. lancifolia* is a rare plant that is relatively unknown outside of Asia.⁸

XI. *Schisandra sphaerandra*

- **Common Names:** None
- **Family:** Schisandraceae
- **Native To:** Southern China⁶
- **Parts Used:** Aerial⁶
- **Types of Uses:** Medicinal⁶
- **Traditional Uses:** *S. sphaerandra* is not used traditionally in Sub-Saharan Africa, though it is traditionally used in China for stomach disorders.⁶
- **Use in Regards to HIV:** Nigranoic acid (3,4-secocycloarta-4(28),24-(Z)-diene-3-26-dioic acid) can be extracted and isolated from the stems of this plant.⁶ It has been shown to have anti-HIV activity by targeting HIV reverse transcriptase as well as polymerase.⁶

XII. *Sutherlandia frutescens*

- **Common Names:** Cancer Bush
- **Family:** Fabaceae
- **Native To:** Sub-Saharan Africa¹⁶
- **Parts Used:** Aerial¹⁶
- **Types of Uses:** Medicinal¹⁶
- **Traditional Uses:** Cancer Bush is traditionally used in Sub-Saharan Africa in a wide variety of ways. Its applications range from treating gastrointestinal

problems to diabetes.¹⁶ It is also used to purify the blood, to relieve stress, and increasingly to treat cancer.¹⁶

- **Use in Regards to HIV:** Cancer Bush has been shown to be beneficial to HIV positive people in many ways.¹⁶ In people with advanced AIDS, treatment with cancer bush resulted in better moods as well as increased appetite and weight.¹⁶ There is also some evidence that AIDS patients have an increase in CD4+ T helper cells and a decrease in viruses present¹⁶. The suspected reason for this is that Cancer Bush targets HIV reverse transcriptase, among other enzymes.¹⁶ Perhaps the most positive attribute of Cancer Bush as treatment for HIV is its apparent lack of side effects with use.¹⁶

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V.

Conclusions

Of the plants recommended by South African herbal and medical professionals for the treatment of HIV, not one overlapped with the plants found through review of available literature on the subject. Only two plants listed in this review belong to the same genus. However, two plant families are particularly prevalent among the plants listed: *Asteraceae* and *Fabaceae*. These plant families both have members recommended by South African professionals and members exhibiting anti-HIV activity and characteristics.

The *Asteraceae*'s anti-HIV member is *Eclipta prostrata*, which acts to inhibit HIV integrase and HIV protease.¹ The other *Asteraceae* recommended have no one overlying use in treating HIV, though all have applications in supporting the body and fighting opportunistic infections more than targeting HIV itself.

The *Fabaceae* includes *Sutherlandia frutescens*, which provides multiple benefits to patients with HIV, including indications that it lowers the load of HIV in the body.² Due to its apparent ability to target multiple facets of illness associated with HIV, this plant could conceivably be a source for new botanical pharmaceuticals to target HIV. The other *Fabaceae* included are all high in vitamins and minerals, which make them excellent in supporting the body through nutrition.

There is a lack of consistency between the plants reviewed in this study, regarding their families, their use, and their mechanisms of action. The reason for this is that there is a lack of peer-reviewed studies into medical botany in the treatment of HIV and AIDS. There may be hundreds of additional applicable botanical treatments, and

perhaps even a cure rooted in a plant somewhere, but without rigorous study these cannot be utilized to their potential. Even among the plants listed here which show anti-HIV activity, the exact mechanisms still need to be elucidated and only two (*S. frutescens* and *Croton lechleri*) have been subjected to clinical trials.^{2,3}

There are two directions for further research that seem to have the greatest potential based upon research currently available. The *Asteraceae* and *Fabaceae* both show great promise in treating HIV due to their own unique benefits. Further exploration of members of these families could yield botanically-based treatments for HIV.

The other area to pursue research is the mechanisms of HIV inhibition exhibited by plants. The two most common enzymatic targets of the anti-HIV plants listed here are HIV protease and HIV reverse transcriptase. One plant, *E. prostrata*, targets HIV integrase and another, *Schisandra sphaerandra*, targets HIV polymerase. Clarifying the unique ways these plants inhibit HIV enzymes could lead to insights into new drug development or improvement of existing antiretrovirals.

As with many fields of medical research, the application of medical botany in the treatment of HIV requires additional study. With further study, the natural world has an excellent chance in assisting modern medicine in the fight against HIV.

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