

# BIOLOGICAL SCIENCES

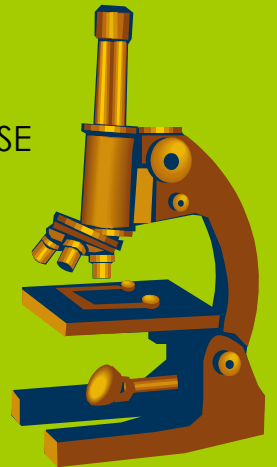


# HIV AND AIDS



A GENERIC INTEGRATION COURSE  
MODULE FOR UNIVERSITIES  
IN SUB-SAHARAN AFRICA

Revised Edition

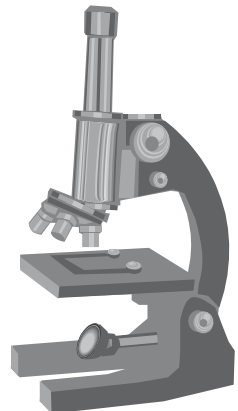


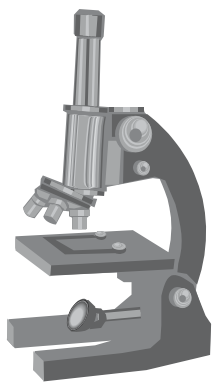
Revised Edition

# BIOLOGICAL SCIENCES HIV AND AIDS



**A GENERIC INTEGRATION COURSE MODULE FOR  
UNIVERSITIES IN SUB-SAHARAN AFRICA**





## PREAMBLE

The AIDS pandemic is one of the most disastrous health and development issue in our world today. Between 5 and 6 deaths occur every minute, one of them being a child below 15 years. There are 500 new HIV infections every hour. HIV and AIDS have left a sea of orphans without parents. Since HIV was first diagnosed in 1981, the pandemic has spread at a rate never thought possible.

The AIDS pandemic continues to ravage populations across the world, and most particularly in sub-Saharan Africa. Despite efforts to curb the spread of the pandemic, there are reports of increased prevalence rates and deaths due to HIV in the last 2 decades. It is estimated that the real impact of the scourge will only be felt in 2050.

Universities have not been spared by the scourge. The disease has the potential to impair institutional functioning. The long lead time between initial HIV infection and development of AIDS has major implications for universities. This being the case, the mandate of service to society demands the engagement of every university with HIV and AIDS.

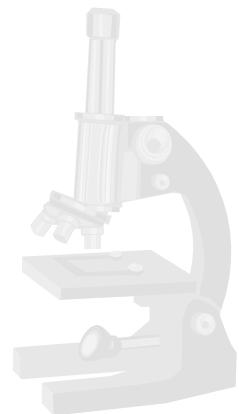
Every university should recognize that HIV and AIDS are vital university issues that demand a coordinated university response. A society with AIDS needs special assistance that only a university can give. Universities have a special responsibility for the development of human resources and are crucial agents of change and providers of leadership directions in society. Thus, they should be at the forefront in developing a deeper understanding of HIV and AIDS.

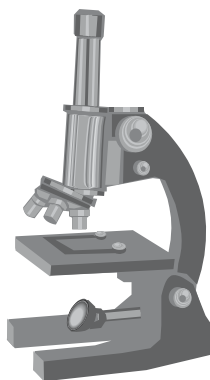
In an effort to prepare students to address HIV and AIDS at personal and professional levels, universities must be involved in a proactive and sustainable manner in mitigation of the pandemic through integration of HIV and AIDS in the teaching curriculum of every university faculty. This will ensure development of AIDS-educated and AIDS-competent graduates who will be adequately qualified to carry AIDS concerns into their subsequent life, to address AIDS issues in their professions as managers, policy makers, leaders, politicians, community workers and to bring AIDS into the open within their societies.



In recognition of the above, the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the African Women in Science and Engineering (AWSE) organized training workshops in Ghana, Rwanda, Botswana and Kenya for lecturers in tertiary institutions on Mainstreaming and integration of HIV and AIDS in the teaching of Engineering, Physical and Biological Sciences. This generic module has been developed from the existing country specific modules in selected areas of Biological Sciences. The content of the current teaching units remains the same but there is HIV and AIDS education and HIV related examples. The duration of the teaching unit is as stipulated in the requirements of each individual institution. The focus of the unit remains the same. It is anticipated that in the course of the unit contact hours the student will not only learn the basic tenets of Biology as prescribed but will also be impacted upon with some HIV and AIDS knowledge that could influence, the perception, behaviour change, demystify issues and contribute to the fight against HIV and AIDS in the universities and communities at large.

This integrated teaching module is an output of the in-country training workshops for lecturers on “Higher Education Science and Curricular Reforms: African Universities responding to HIV and AIDS, held in Kumasi, (Ghana) Kigali, (Rwanda) Gaborone, (Botswana) and Nairobi, (Kenya). The module contains input from participants from public and private institutions of Higher education and is based on their curricula in the teaching of biological sciences.





# ACKNOWLEDGMENT

This generic integration module has benefited from the inputs of participants at the UNESCO/AWSE in-country Training Workshops for Universities in Ghana (6-8 December, 2006), Rwanda (28 - 30 March 2007), Botswana (17 - 19 April 2007) and Kenya (08 - 10 May 2007), on Mainstreaming of HIV and AIDS into Engineering, Biological and Physical Sciences. Further technical and editorial input came from Professors Mabel Imbuga and

Caroline Lang'at Thoruwa of AWSE, and Alice A. Ochanda of UNESCO Nairobi Office.

The training workshops were facilitated by **Professor Zipporah W. Ng'ang'a of Jomo Kenyatta University of Agriculture & Technology, Department of Medical Laboratory Sciences**. Professor Ng'ang'a also compiled information from all the training sessions to come up with this generic intergration module.

Profound gratitude and further acknowledgement is expressed to UNAIDS who made the production of these modules a reality through their Unified Budget Work plan (UBW) funds.

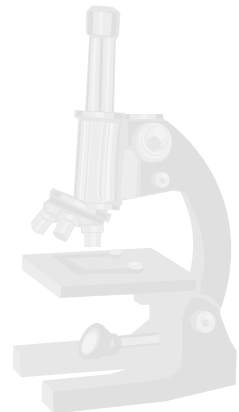
## Project Implementation Team

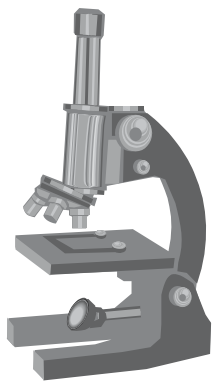
Alice A. Ochanda, PhD (Project Co-ordinator)	- UNESCO
Prof. Mabel Imbuga	- AWSE
Prof. Caroline Lang'at -Thoruwa	- AWSE
Prof. Xiohua Xia (consultant)	- University of Pretoria, South Africa
Dr. Anna Mandu Jeffrey (consultant)	- University of Botswana
Prof. Zipporah Ng'ang'a (consultant)	- Jomo Kenyatta University of Agriculture and Technology (JKUAT), Kenya



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# THE CELL AND ITS EXTERNAL ENVIRONMENT

Ultrastructure of prokaryotic and eukaryotic cell organelles, nucleus, cell membrane, plasma membrane, mitochondria, golgi bodies, ribosomes, lysosomes and peroxisomes. Cytoplasmic organelles, biochemistry of some specialized cells; red blood cells, nerve cells, muscle cells, renal tubular cells. Extracellular fluids, blood and lymph, their composition and relationship to the cells.

## Entry points for HIV integration

- prokaryotes – the example of HIV.
- Use the example of the detailed structure of HIV to represent prokaryotes.
- The role of cellular organelles in the HIV life cycle (the plasma membrane, cytoplasm and nucleus). The cell membrane as a site of HIV attachment, receptors on surfaces of specialized cells (CD4 receptors on blood cells), glycoproteins (gp 120 and gp 41) on the surface of envelopes of prokaryotes and their importance in attachment and penetration of cells (Example of HIV).
- The effect of integration of viral DNA with host cell DNA in the nucleus of a cell (A case of CD4 cells).
- Discuss the effect of HIV infection on hemoglobin content, oxygen transport (fainting, anemia), white blood cells (immunosuppression), nerve cells (paralysis in advanced stages of HIV infection) and kidney function (HIV pathogenesis).
- Discuss the role of blood in defense (Acquired immunity).
- Role of blood in transmission of pathogens (HIV transmission, sexual contact, blood contact, MTCT). Blood cells as targets of attack by pathogens (CD4 cells). Consequences of destruction of CD4 cells by HIV (immunosuppression and opportunistic infections), lymphadenopathy



(Enlarged lymph nodes). Other blood borne pathogens (Toxoplasma and Plasmodium) and their relationship with HIV.

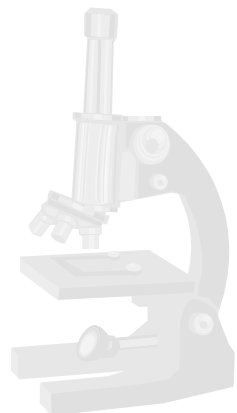
- Distinguish B and T lymphocytes. CD markers on the surfaces of cells for differentiation. The T cell as target for HIV. The counts in health and indicators of immunosuppression. The role of HIV in destruction of elements of blood and health implications with reference to HIV among other blood borne pathogens.

**Activity:**

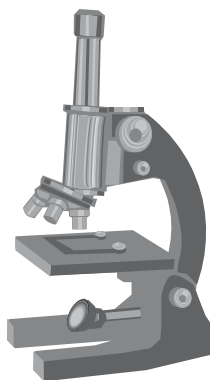
A haemogram to show composition of blood.

**Take Away Assignment:**

Write an Essay on composition and functions of blood elements.







# INVERTEBRATE ZOOLOGY

*Introduction:* origin and diversity of animals classification, kingdoms of living organisms, the species, embryonic features used in animal classification, the rise of zoology, where animals are found, animals of the past and their distribution through geological times.

*The scope of zoology:* The Invertebrata: a survey of invertebrate groups emphasizing their habits, structural features, functional anatomy, and evolutionary relationships using Eastern African examples. Kingdom Protista, Sub-kingdom Protozoa, Phyla Sarcomastigophora, Labyrinthomorpha, Apicomplexa, Microspora, Ascetospora, Myxozoa and Ciliophora. Origin of Metazoa. Kingdom Animalia: Subkingdom Phagocytellozoa Phylum Placozoa; Subkingdom Parazoa Phylum Porifera; Subkingdom Metazoa: phylum Mesozoa. The Radiata: Cnidaria and Ctenophora. The Bilateria: the Acoelomata: Platyhelminthes, Nemertea and Gnathostomulida. The Pseudocoelomata: Nematoda and minor pseudocoelomates. The Coelomata: Annelida, Mollusca, Arthropoda, Echinodermata, the unsegmented coelomates, and other minor coelomates. Differences between the Protostomata and Deuterostomata phyla. Invertebrate phylogeny.

## Entry points for HIV integration

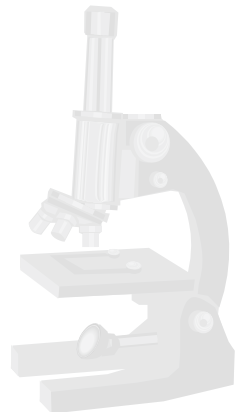
- Origin and evolution of retro viruses with reference to HIV. The theories of origin and history of HIV.
- Sub-types and viral strains in relation to geographical regions.
- Phylogeny and viral strains/types. Implications of HIV subtypes on progression to AIDS, HIV prevalence across the world, therapy and prospects for vaccination. The relationship between multiple sexual partners and mixed infection with different sub-types.
- The HIV structure. Functions of each structural components. The relationship between structure and function. The role of viral enzymes in replication and as targets of drug action.
- Why viruses are not living things.

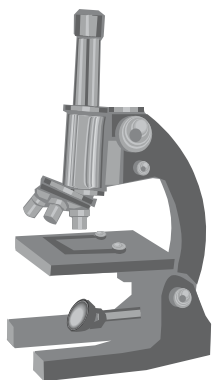
**Activity:**

Using the number of T cells in blood, and the rate of HIV replication, predict the viral load and the CD4 count in an infected individual 5 years post infection.

**Take Away Assignment:**

Describe HIV replication in relation to disease progression and use of Anti Retro Virals in management.





# DIVERSITY OF LIVING ORGANISMS

## Course Description

*Origins of the universe, earth and life forms:* Principles and significance of protistan and Animal kingdoms. An evolutionary and taxonomic review of the main phyla of these two Kingdoms: Brief overview of membranes, cells, resistance to diseases, homeostasis, thermoregulation, respiration, nervous system, skeletal system, excretion and osmoregulation, circulatory system, micro and macro-evolution

## Entry points for HIV integration

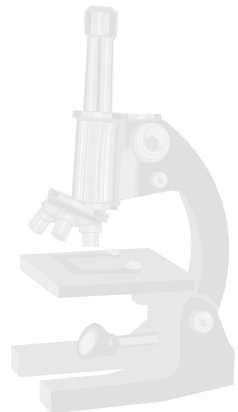
- The theories of the origin of HIV should be used to describe origin of life forms. The history of HIV: the past, present and the future.
- Classification of viruses: basis of genetic material, presence or absence of coats, shape of the envelope, etc. The classical example of HIV. Phylogenetic tree to describe evolution of HIV. The different strains and sub strains of HIV. The implications of strain diversity on transmission, disease progression, resistance to ARV therapy, prospects for vaccination. The role of multiple infections (multiple sexual partners, condom use).
- Viruses are exclusively intracellular. How do they penetrate membranes? HIV transmission and life cycle.
- Relationship of cells and HIV. Who is the target for HIV? What are the characteristics of the target cells? Presence of CD4 receptors. Overview of the membrane, role in attachment and penetration of target cell, as targets of drug action, role in resistance to ARVs.
- The consequences of HIV infection on resistance to disease (disease progression in HIV infection, immunosuppression and opportunistic diseases (AIDS): HIV pathogenesis.

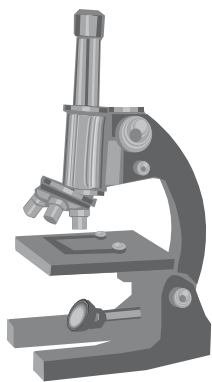
**Activity:**

Outline how HIV affects body processes. General tiredness, weight loss, fever, HIV dementia, confusion, memory loss, breathlessness, fainting, irregular menstrual flow in women, anemia etc (signs and symptoms that typify AIDS (WHO classification)).

**Take Away Assignment:**

Write an essay on the economic importance of viruses, bacteria and fungi in the face of HIV and AIDS.





# BIOSTATISTICS

## Course Description

This course applies statistical methods to biological information. It deals with sampling techniques, data presentation, analysis, and interpretation. Introduction to quantitative and qualitative treatment of biological data. Biological variations and frequency distribution.

Basic descriptive statistics. Probability and distributions. Types of distribution (example normal, binomial, Poisson) are also discussed. Analytical procedures including T-tests, Chi-square, F-Ration, correlation and regression will be used to analyze biological data. Standard error and confidence limits. Chi-square and student t-test. Regression and correlation. Experimental design and analysis of variance. Multiple comparisons of means. LSD (Least Significant Difference) and SNK (Student Neuman-keul). Experimental designs (e. g. CRD, RCD, Factorial design). Use of computer statistical software. Basic experimental designs (e. g. CRD, RCD, Factorial design). Types of distribution, probability and tests of significance, differences between means, association of two variables, parametric and non-parametric tests and variation under different conditions.

## Entry points for HIV integration

- Use of medical statistics for quantitative analysis and practical use of HIV related data. Data on uptake of VCT, MTCT, ARV therapy, condom use, TB screening and treatment. STD treatment, mortality due to HIV related complications among schools, universities, industry etc. This creates the realia of HIV and AIDS. Data on relationships between HIV infection and age, gender, rural and urban environments.
- Variations in infection, prevalence rates across sex, age gender, geographical areas, race, etc. A comparison between prevalence in developing and developed countries. Reasons for the higher rates among Africans and among women compared to men. Intervention measures to reduce the high rates. Tests of significance between rates of infection among circumcised and uncircumcised males. The role of circumcision in mitigating the spread of HIV.
- Efficacy of data on condom / ARV usage.



- Bio-geographical survey.
- Use of experimental design in HIV related research such as vaccine testing, factors influencing VCT uptake among the youth, condom use, factors influencing behavior, factors hindering behavior change, factors hindering PMTCT, ARV use etc.
- Use appropriate experimental designs such as simple random sampling, systematic, purposive, snow balling, descriptive cross sectional studies in collection of scientific data.
- Methods of data collection. Use of different tools in collection of HIV related data i.e. Questionnaires, desk reviews, FGD's, key informant interviews etc.
- Epidemiological surveillance. Survey to determine HIV prevalence and the factors influencing prevalence.
- Error reduction techniques in relation to HIV/ AIDS data.
- Statistical / prediction models for projecting future trends, response to ARV therapy using single therapy as well as combined therapy. The effect of dosage on outcome i.e. CD4 count and viral load.
- Use of computer statistical software in analysis of HIV related data and in simulating models to describe HIV prevalence and the role of Anti Retro Virals in management of HIV.

## Teaching methodology

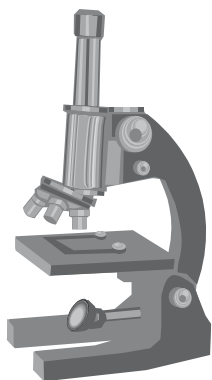
- Seminars
- Assignment

### **Activity:**

Using UNAIDS (2005) HIV data in Africa determine using suitable statistical tools the relationships between gender, age, region and HIV prevalence.

### **Take Away Assignment:**

Describe an experimental design that would be appropriate in collection of data on HIV testing within your institution.



# INTRODUCTION TO BIOTECHNOLOGY

## Course Description

Plant cell, tissue and organ culture and their application methods of creating recombinant DNA molecules, isolation and cloning of genes. Genetic engineering of plants, viral vectors, haploids, protoplasts, hybrids and fusion. Genetic engineering, Biosensors, formation and recovery of biologicals. Applications to agriculture, medicine, industry and health care. Production of monoclonal antibodies. Mechanisms of virus transformation. Virus association with human tumors, virus prevention and control by vaccination. Applications to agriculture, medicine, industry, health care and food processing with Development of DNA vaccines. Ethical considerations in regard to DNA manipulation

## Entry points for HIV integration

- Use of plant tissue culture for the propagation of important medicinal plants, (cell culture for secondary metabolites) e.g. banana tissue culture for food security, income, and nutrition.
- Use animal biotechnology in production of monoclonal antibodies for diagnosis and as therapeutic agents in management (diagnostic tests/ production of vaccines for management of HIV). Production of chimera HIV such as SHIV for study of HIV in animal models, generation of transgenic animal models for HIV research.
- Genetic engineering: mutations, sequencing, vaccines, diagnostics (The role of genetic antigen testing for confirmatory and paediatric HIV testing, Importance of PCR, ELISA, western blot), recombinant vaccines and current DNA vaccines under trial.
- Preparation of plasmids- Use of recombinant vectors in vaccine production.
- Viral vectors- Engineering of viruses into carriers such as yeast cells, larger viruses and bacteria. Hybridoma technology and prospects



of its application in vaccine production. Use of biotechnology for alternative fuel sources. Isolation and cloning of genes- HIV genome.

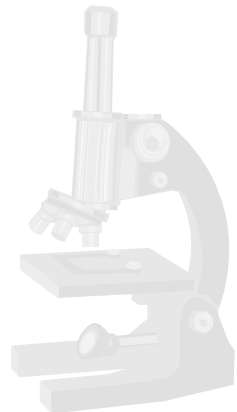
- Biosensors (formation and recovery) for tracing drug action, for detection of diseased organs and tissues. Biotechnology and food processing- role of processed foods in PLWA.
- The HIV virus transformation, replication and variability. Common cancers in HIV disease – Kaposi sarcoma, cervical cancer. HIV prevention and protection. The ABC of HIV prevention and protection. The prospects of development of a DNA vaccine against HIV. The current vaccine trials. The constraints in development of HIV vaccine. HIV as an example of a retrovirus.
- Ethical implications in use of DNA vaccines and testing in humans. Handling and disposal of HIV DNA in laboratories.

**Activity:**

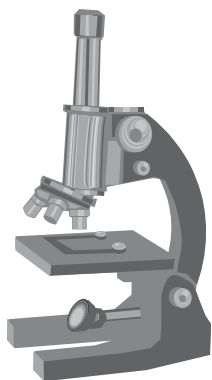
A 40 minute video show of HIV budding off CD4 infected cell.

**Take Away Assignment:**

Discuss the recent developments in development of a vaccine against HIV.







# HISTORY AND PHILOSOPHY OF BIOLOGY

*History:* the growth of biological thought from the ancient Greeks to the present day. From Alcmaeon and the Hippocratic school to Aristotle. Aristotle's biology and his scientific method. Theophrastus to Crataeus and Galen.

The eclipse of ancient science in the West. Transmission of Greek science by the Christian Syrians to the Arabs. Islamic biology and medicine from the 9th to the 12th centuries. Re-transmission to the West and the rise of Western science in the 12th and 13th centuries. The Western Universities. Leonardo and Vesalius to Borelli and Harvey. The classical microscopists. The early taxonomists to Linnaeus.

*The overthrow of spontaneous generation theory:* Redi, Spallanzani and Pasteur; modern ideas on the origin of life. Organic evolution: Buffon, Lamarck to Darwin and Wallace; modern controversies. Mendel and modern genetics and research. The new synthesis. Watson and Crick and molecular biology. Philosophy: the presuppositions of science. The nature of scientific law and the meaning of scientific explanation. The hypothetico-deductive method. Scientific proof: verificationism and falsificationism. Reductionism in science. The unity and diversity of scientific methods. Role of concepts and their refinement in biological explanation.

## Entry points for HIV integration

- Theories and origin of HIV
- Nature and biology of HIV (The biology of HIV: structure, characteristics, replication, adaptations).
- HIV virus- HIV 1 and HIV 2. The different subtypes of HIV. Distribution worldwide. Implications of HIV variability in treatment and prospects of a vaccine.
- Discovery of the HIV virus. A line history of HIV from 1981 to present and the future.



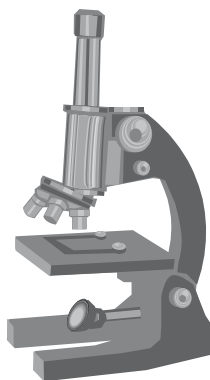
- Various religious perspectives towards HIV – The relationship between religion and AIDS. The role of religion in mitigating the spread and reduction of stigma and discrimination reduction through education, care and support, lobbying and advocacy. African traditional religion and AIDS. The role of polygamy, Female genital Mutilation in the spread of HIV. The conflict between HIV mitigation measures religion.
- Ethical implications (homosexuality, wife inheritance and role of cultural practices in preventing or promoting HIV transmission) Ethical implications of mandatory testing, denial of care, drugs, employment and all forms of discrimination. Ethical implications in use of humans fro testing of drug efficacy and vaccine trials.
- Moral implications (shame, guilt, stigma) of HIV infection.
- Legal and human rights issues in HIV infection (mandatory testing, breach of confidentiality, stigma, abuse, discrimination and denial of care, retrenchment, dismissal, denial of insurance, denial of hospital admission and drugs, abandonment, violence etc ). The rights of HIV infected persons. The HIV and AIDS Act.
- Impact of HIV on national development. The impact of HIV on demography, households, agriculture, education, industry, culture, health. The relationship between HIV and poverty.
- Discordant couples. Genetic resistance to HIV.
- Gender disparity and HIV and AIDS. Gender differences between men and women in education, economic empowerment, information and implications in HIV transmission. Intervention measures in reduction of HIV prevalence among women.

**Activity:**

Divide yourselves in groups of 10 and discuss the role of religion in HIV transmission.

**Take Away Assignment:**

Write an essay on Women and AIDS (statistics, reasons for higher vulnerability among women and intervention measures to reduce the high risk.



# CELL METABOLISM

*Ultrastructure of prokaryotic and eukaryotic cell organelles: nucleus, cell wall, plasma membrane, cytoplasmic inclusions and intracellular attachments. Extracellular fluids, blood and lymph, their composition and relationship to the cell. Biochemistry of specialized cells- renal tubular cells, red blood cells, nerve cells and muscle cells.*

## Entry points for HIV integration

- prokaryotes – the example of HIV.
- The role of cellular organelles in the HIV life cycle (the plasma membrane, cytoplasm and nucleus).
- Biochemistry of some specialized cells- WBC.
- WBC's are immune cells which contain CD4 receptors. The HIV virus attaches to the CD4 receptors to gain entry to the human cell.
- The role of extra cellular fluid in HIV transmission. The composition of extracellular fluids with reference to cells containing CD4. T lymphocytes, langerhans cells, dendritic cells and macrophages. Consequences of destruction of CD4 cells by HIV. Immunosuppression leads to AIDS.
- Effects of HIV on muscle and nerve cells (wasting, paralysis).
- Exercise in positive living with HIV.
- Effects of antiretroviral drugs on renal tubular cells.

### **Activity:**

Describe the structure and life cycle of HIV. Classify the virus accordingly.

### **Take Away Assignment:**

Discuss the role of HIV, Anti Retro Viral drugs on cellular processes.



# PHARMACOGNOSY AND PHARMACOLOGY

Geographical distribution, habitat, collection, curing, drying, cultivation, storage of medicinal plants. Natural products in medicine either as crude drugs or in pure form. Active constituents from the. drugs. Distribution, biosynthesis, extraction, isolation from crude drugs. Principles of drug action, absorption, distribution, biotransformation, and elimination of drugs. Laboratory methods of studying drug actions using animals and isolated organs.

## Entry points for HIV integration

- Medicinal plants in HIV management, distribution, active components. The role of herbalists.
- Anti Retro Viral drugs- types, mode of action, side effects, barriers hindering use and methods of overcoming them. Antibiotics and fungicides used in management of opportunistic infections associated with HIV disease.
- Methods of studying ARV action using animal models and specific effects of ARVs on the liver, kidneys and brain. The use of biosensors in monitoring the side effects associated with ARVs.

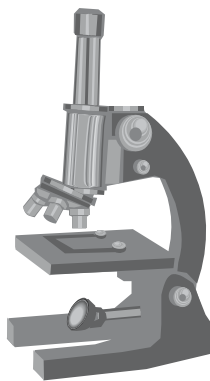
### **Activity:**

Establish a garden of common medicinal plants used by the local community.

### **Take Away Assignment:**

Describe the common herbs that are used in management of AIDS within the local community. Obtain the specimens and prepare them for preservation.





# COMPUTER APPLICATIONS IN BIOSCIENCES

*Computer simulation techniques to design molecular models:* Application of computer simulation techniques in pharmaceutical industry. Design of synthetic genes coding for specific proteins. Computer software for selecting primers, reagents and equipment for genetic engineering.

Computer programming languages and fundamental techniques of using such languages in problem solving. Use of the computer in solving a series of scientific problems. Electronic mail and internet.

## Entry points for HIV integration

- Computer simulation in predicting the effects of different doses of either mono or combined ARV therapies on viral load and CD4 counts.
- Computer simulation models predicting the pattern of transformation of HIV with time and the phylogenetic relationships between the different strains and the circulating clades within a population.
- Design of synthetic genes for the gag, pol and env genes of HIV. The role of these genes in HIV diversity and prospects of vaccine production.
- Selection of HIV primers for use in molecular characterization particularly bDNA PCR in paediatric diagnosis. The role of PCR in confirmatory HIV testing. Approaches to vaccine production.
- The use of computers in obtaining and sharing information on HIV (Internet browsing, e mail).
- Computer programs in design and analysis of HIV related data with practical examples. The use of SPSS, SAS, Epi Info in data analysis.
- Computer networking analogous to sex networks. Viruses that affect and corrupt computers can be compared with HIV in the human body. The severity of computer viruses can be compared with the different strains of HIV.

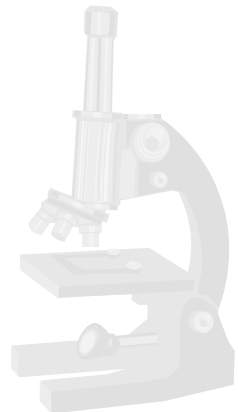


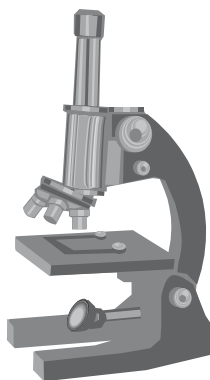
**Activity:**

Use the example of a virus program to simulate how sexual networks spread HIV.

**Take Away Assignment:**

Design an appropriate E- learning site for information sharing among members of your school.





# POPULATION ECOLOGY

Growth and regulation of populations. Intra specific and inter specific interactions. Evolution of ecological strategies. Community ecology, delimitation of communities locally geographically, energy flow and its regulation. Determinants of community structures and diversity

## Entry points for HIV integration

- Diseases as regulators of populations e.g. Impact of HIV on human populations, demography, life expectancy.
- Age and gender dimensions in HIV and implications on population dynamics.
- Polygamy and its role in HIV transmission
- Geographical variations in HIV prevalence, locally and worldwide. Africa as the epicenter of the HIV pandemic. Reasons for HIV prevalence in Africa compared to the rest of the world. Energy loss in humans due to HIV infection.
- Cultural practices e.g. polygamy, wife cleansing, wife inheritance, female genital mutilation, moranism etc. The effects of cultural practices on HIV transmission, comparison with other modes of transmission. The impact of HIV on cultural values and customs.
- The conflict between HIV mitigation measures and culture.

**Topics should be given a mathematical treatment whenever appropriate.**

- Modeling of population dynamics.
- Survival analysis.

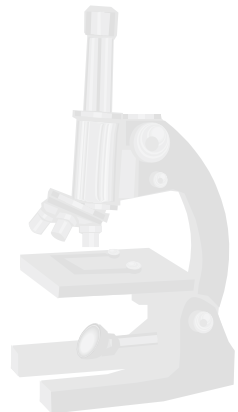


**Activity:**

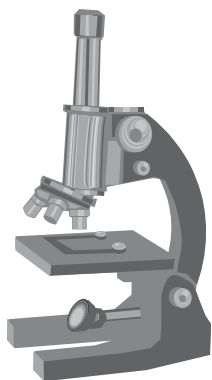
Discuss the role of culture in HIV transmission

**Take Away Assignment:**

Use the UNAIDS HIV and AIDS data to show the trends in HIV infection and deaths due to AIDS in Africa. Illustrate this using survival curves







# LABORATORY TECHNIQUES

## Course Description

An introduction to the scientific method, basic methods and instrumentation in biology, emphasizing fundamental laboratory procedures. Techniques to be studied include light and electron microscopy, spectrophotometry, gel electrophoresis (for the identification of viruses Southern blot and ELISA), chromatography, sectioning and staining. Laboratory specimen: collection, classification, nomenclature, storage, preservation and processing (in relation to bioactive components especially medicinal plants used in management of opportunistic infections). Blood sample collection methods, Records and inventory. Laboratory reagents, preparation and storage. Safety (safety in relation to HIV) in the lab, rules and regulations.

## Teaching Methodologies

- Lectures, tutorials, class presentation, practicals, assignments, resource person

### **Activity:**

Carry out a Western Blot Assay to confirm discordant HIV results

### **Take Away Assignment:**

- Establish the diagnostic techniques used in clinics, hospitals and VCT centers for HIV diagnosis.



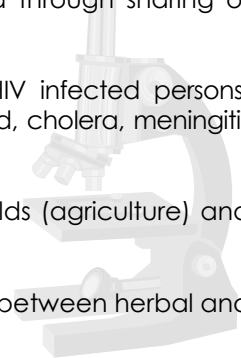
# PLANT ECOLOGY

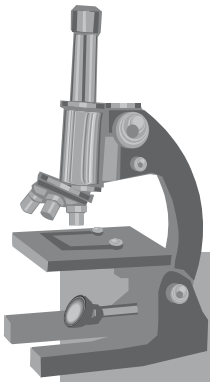
## Course Description

A study of the ecosystems will be done. The abiotic environment; minimums, tolerances and the medium; isolation, precipitation, and climate; soils, nutrients, and other factors will be looked into. Species interactions. Energy flow in ecosystems: energy fixation by autotrophs; energy flow beyond the producers will be examined. Biogeochemical cycles and ecosystems: gaseous and sedimentary nutrient be examined, so will be community ecology (habitat locations of plants with bioactive molecules), its structure, function; stability and change. The nature of human ecology, the human population. Impact of pollutants on human health and other living systems. Risk assessment of chemicals in the environment will be examined together with global approach to solution of environmental problems. Techniques used in terrestrial and aquatic environments to gather ecological data and quantitative data analysis using computers will also be examined.

## Entry points for HIV integration

- Parasitism – The relationship between HIV and the human host - Biotic environment.
- The relationship between HIV and the biotic environment. HIV is exclusively intracellular. Modes of HIV transmission through contact with the biotic environment (fluids of infected persons). Methods through which HIV is not transmitted. Relationship between HIV and the abiotic environment. HIV is not transmitted through sharing of clothing utensils, seats etc.
- The role of air, water pollutants on health in HIV infected persons. Opportunistic infections in HIV disease (TB, typhoid, cholera, meningitis etc).
- Analysis of impact of HIV on land use, crop yields (agriculture) and implications for food security and income.
- Herbal remedies in HIV disease. The relationship between herbal and modern medicine.





## Teaching Methodologies

- Lectures, tutorials, class presentation, field trips, assignments, resource person (herbalists).

### **Activity:**

Field trip to list plants claimed to have medicinal and nutritional value.

### **Take Away Assignment:**

Determine the common land uses among the communities neighbouring your institution. What is the impact of HIV on land use?



# PLANT BIOCHEMISTRY AND PHYSIOLOGY

## Course Description

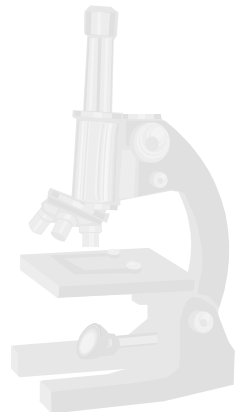
The course examines the basic principles of plant physiology including cell structure and function together with hereditary and environmental influences on plant behaviour. Respiration: biological oxidation; respiratory metabolism; photophysiology; and photochemistry will be looked into. Biochemistry that is role of ATP and NADPH, chloroplast as unit of photosynthesis; factors influencing photosynthesis; photorespiration: characteristics and biochemistry of CAM, C3 and C4 plants will be examined. The course will also look into mineral nutrition –essential and beneficial elements, solutions and soils as nutrient sources; elemental analysis of plant tissues; nutritional disorders; chemical fertilizers in crop production; foliar nutrition. Biosynthesis: primary and secondary metabolites (secondary metabolite diversity: The physiological and biochemical actions of plant growth substances and genetics of plant will be studied. Physiology of seeds – development, germination, dormancy will be examined. Quality together with factors affecting plant growth and reproductive growth will be examined.

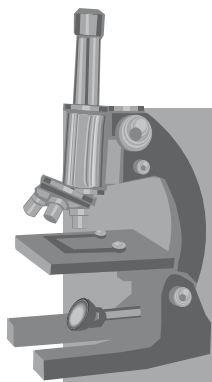
## Entry points for HIV integration

- Usefulness of secondary metabolites in management of HIV-AIDS).
- reliance of HIV virus on host cell's energy.
- latency of HIV before the onset of AIDS.

## Teaching Methodologies

- Lectures, tutorials and practical sessions.





**Activity:**

Discuss the modern techniques to improve plants as sources of food among HIV infected persons.

**Take Away Assignment:**

Report on secondary plant metabolites used to boost immunodeficiency in HIV-AIDS (Use electronic and bibliographic literature).



# NUTRITIONAL BIOCHEMISTRY

## Course Description

*Basic requirements for human nutrition: proteins, carbohydrates, lipids, minerals and Vitamins. Starvation. FAO indicator in surveying food quality essential amino acids. Protein requirements during growth and recovery. Protein Energy malnutrition. Recommended dietary allowances. The role of vitamins and minerals in diets. Importance of vegetables, legumes, cereals and fruits. Assessment of nutritional status. Vegetarian diets.*

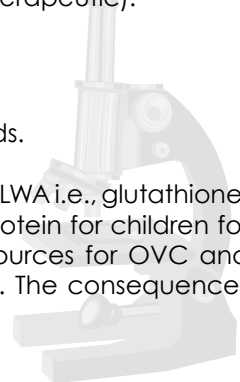
## Entry points for HIV integration

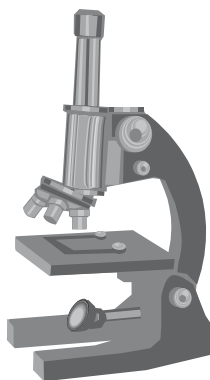
- Understand human nutrition and FAO indicators in surveying food quality.
- Define nutrition, balanced diet, under nutrition and malnutrition. The role of the following: Proteins, Carbohydrates, Lipids, Minerals and Vitamins in the diet.
- Deficiency and deficiency diseases.
- The importance to adopt healthy eating habits and the special nutritional needs of PLWA (i.e. HIV affects food intake, HIV affects weight, PLWA have increased requirements for minerals and vitamins) should be emphasized in this topic (nutrition is therapeutic).

## Activity:

Quality assessment of selected locally available foods.

- The importance of special amino acids in diet of PLWA i.e., glutathione, lysine, alanine, arginine. Important sources of protein for children for growth with emphasis on protein needs and sources for OVC and PLWA for recovery from opportunistic infections. The consequences of Protein Energy Malnutrition (PEM).





- Important vitamins in the diet and particularly in HIV disease (Vitamin A, B complex, C, K etc. Important minerals: Iron, selenium, calcium, magnesium, Zinc etc. Dietary sources of vitamins and minerals. Recommended dietary allowances.
  - The role of supplements and dangers of over dosage.
  - The role of vegetables, fruits, legumes, cereals and fruits in the diet.
- What is in foods? Emphasis should be on traditional fruits and vegetables as sources of vitamins and minerals. The importance of whole grains as a source of nutrients. Handling of vegetables, preparation and storage.
  - Determine nutritional status by use of biochemical assessment versus use of anthropometric measurements.
  - Understand WHO Indicators of wasting, stunting particularly among children.
  - Consequences of malnutrition (a common feature in HIV) with emphasis on PEM (Protein Energy Malnutrition) among children and PLWA.
  - Plan a balanced diet.

**Activity:**

Collect traditional fruits and vegetables commonly used by your local community.  
Formulate a one week menu for a Person Living With Aids.

**Take Away Assignment:**

Nutritional status assessment of orphaned and vulnerable children in orphanages in the local community.  
Calculate the Z- scores and classify the children on the basis of their nutritional status.



# ETHOLOGY

## Course Description

*The evolution and development of animal behavior:* The problems and methods of describing behavior. Causation and behavioral function including their genetic basis. Communication and socio-biology.

## Entry points for HIV integration

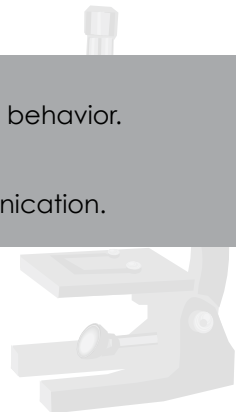
- Factors that influence behavior with reference to risk behavior in transmission of HIV should be discussed.
- Theories of Behavior Change. Health Belief Theory. Models used to influence behavior change (HICDARM approach- A means of painting the future).
- Communication. Behavior Change Communication (BCC) in HIV.
- Appropriate communication skills in breaking the silence in HIV with factual, evidence based, correct and adequate information (Myths and misconceptions of HIV).
- The role of Information Education and Communication (IEC) and preparation of appropriate IEC materials in reducing HIV transmission and in reduction of stigma and discrimination.
- Causes of communication break down.

**Activity:**

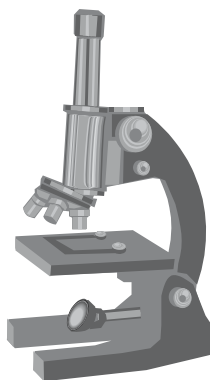
Discuss the role of the media in influencing human behavior.

**Take Away Assignment:**

Describe the models of Behavior Change Communication.







# URBAN ECOLOGY

## Course Description

Urban environment as human ecosystems. Ecological effects of urbanization. Pollution in cities. Sewage and solid waste disposal problems. Methods of treating sewage effluent. Land ecology: management, microbial succession, landfill.

## Entry points for HIV integration

- Urbanization. Rural-urban migration, unemployment, idleness and the increased risk of HIV.
- Poverty, human rights abuses, gender imbalances (root causes of HIV). Crime including drug abuse (IDU), rape etc. Prostitution (STD's co factors in HIV transmission).
- Pollution– Air and water pollutants. Causes of opportunistic infections in HIV disease (URT infections, diarrhea).
- Congestion- The effects of congestion on spread of TB (a health emergency following the HIV pandemic).
- Sewage and solid waste disposal. Poor hygiene and sanitation practices- hygiene related diseases (typhoid, cholera, shigella, amoebic dysentery, giardiasis etc). Importance of clean drinking water for PLWA.

### **Activity:**

Using data from the local health facility, list the common hygiene related diseases affecting the local community

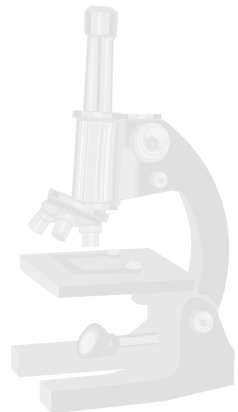
### **Take Away Assignment:**

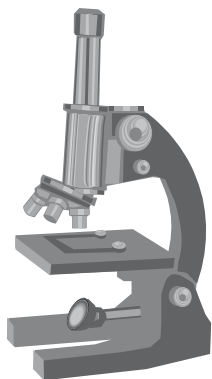
Visit an urban slum in your country. What are the effects of urbanization? How does this influence HIV transmission?



## Course Evaluation

- The time for the teaching unit is as described in the curriculum for each university.
- All courses are examined at the end of the semester in which they are taken.
- Examination consists of Continuous Assessment Tests and University examinations. The marks allocation and pass mark is as per the regulations governing courses in the respective universities.





# NOTES

**A publication of the UNESCO Nairobi Office in partnership with the African Women in Science and Engineering**

**Printed at UNON Publishing Service Section**

**Reprint, December 2008**



United Nations  
Educational, Scientific and  
Cultural Organization

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