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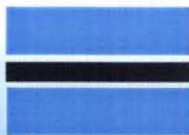
Organisation  
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**AWSE**  
African Women  
in Science and Engineering

# BIOLOGICAL SCIENCES & HIV and AIDS

Integrated Course  
Module (Botswana)





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# BIOLOGICAL SCIENCES & HIV/AIDS

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## INTEGRATION MODULE (BOTSWANA)

### Project Implementation Team

Mrs. Alice Ochanda	– UNESCO
Prof. Mabel Imbuga	– AWSE/ JKUAT
Prof. Caroline Lang'at-Thoruwa	– AWSE/ KU
Dr. Ethel Monda	– AWSE/ KU
Prof. Xiaohua Xia	– University of Pretoria
Prof. Zipporah Ng'ang'a	– JKUAT

## Preamble

The pandemic of HIV/AIDS is a public health emergency of unparalleled magnitude and particularly so in resource strained countries especially those 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 impacts of the scourge will not be felt until 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. The mandate of service to society demands the engagement of every university with HIV/AIDS.

Universities have a special responsibility for the development of human resources and are crucial agents of change and providers of leadership direction in society. Thus, they should be at the forefront in developing a deeper understanding of HIV/AIDS.

In an effort to prepare students to address HIV/AIDS at personal and professional levels, universities must be involved in a proactive and sustainable manner in mitigation of the pandemic through mainstreaming and integration of HIV/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 lives, to address AIDS issues in their professions as managers, policy makers, leaders, politicians, community workers etc..., and to bring AIDS into the open within their societies.

This sample module has been developed from the existing 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. Each teaching unit should be covered in 35 hours as before. The focus of the unit remains the same. It is anticipated that in the course of 35 contact hours the student will not only learn the basic tenets of biology as prescribed but will

also be impacted with some HIV and AIDS knowledge that could influence, the perception, behavioral change, demystification and contribute in the fight against HIV and AIDS in the universities and the communities at large.

This teaching module is an output of the in country training workshop on "Higher Education Science and Curricular Reforms: African Universities responding to HIV and AIDS at the Grand Palm Hotel, Gaborone, Botswana. The module contains input from participants from the University of Botswana and is based on their curricula in the teaching of biology.

## Acknowledgment

This integrated course module has benefited from the input of the participants from the University of Botswana, Colleges of Education, Institute of Health Sciences and Botswana College of Agriculture and Botswana Ministry of Health.

The training workshop was facilitated by **Dr. Zipporah W. Ng'ang'a** from Kenyatta University, Kenya. Technical and editorial input was also received from Profs. Mabel Imbuga and Caroline Lang'at-Thoruwa of African Women in Science and Engineering (AWSE), and Alice A. Ochanda of UNESCO Nairobi Office.

Profound gratitude and further acknowledgement is expressed to UNAIDS who made this work possible through the UBW funds.

AWSE also appreciates secretarial services offered by Mrs. Monica Gammimba.

DESIGN AND LAYOUT BY DESIGNER PRINT

Email: [d.designerprint@gmail.com](mailto:d.designerprint@gmail.com)

# BIO 2103: THE CELLULAR BASIS OF LIFE

## Course Description

Ultra structure of prokaryotic and eukaryotic cells. Cellular organelles. Extracellular fluids, blood and lymph, their composition and relationship to the cells. Integration may be achieved in the teaching of the following topics.

### **Topic 1: Ultra structure of prokaryotic and eukaryotic cells and cellular organelles**

By the end of this topic, students should be able to:

- Describe the ultra structure of cell and cellular organelles
- Describe the detailed structure and function of cellular organelles

*Use the example of the detailed structure of HIV to represent prokaryotes*

The cell membrane- The lipid protein bi-layer arrangement and the functions of cell membranes-

*The cell membrane as a site of HIV attachment, receptors on surfaces of specialized cells (CD 4 receptors on blood cells), glycol proteins (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 nucleus- structure, nucleopores, Nucleus controls the activities of the cell .

*Discus effect of integration of viral DNA with host cell DNA in the nucleus of a cell (A case of CD 4 cells).*

Mitochondria- structure and function. Sites of respiration  
*(Effect of HIV infection on Energy production)*

The cytoplasm- a site for metabolic reactions

*The cytoplasm as a site for HIV replication*

### **Topic 3: Extra cellular fluids**

By the end of this topic, the learner should be able to:

- Distinguish blood and lymph
- Describe the composition and functions of blood and lymph

#### **Entry points for HIV mainstreaming**

- *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.*

**Activity: Determine the composition of blood. Differential staining and count of blood cells. Introduce lymphocytes and their roles in defence (CD4 cells)**

- *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*

**Take Away Assignment: Write an essay on health indices of blood elements**

# BIO 3206: BIOMETRICS

## Course Synopsis

Introduction to quantitative and qualitative treatment of biological data. Biological variations and frequency distribution. Probability and distributions. 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.

Integration of HIV can be achieved in the teaching of the following topics.

### **Topic 1: Quantitative and qualitative treatment of biological data and biological variations**

By the end of this topic, learners should be able to understand quantitative and qualitative treatment of data and biological variations

- *Use HIV related data for quantitative and qualitative treatment of biological data*
- *Prevalence data across sexes, ages, regions, continents*
- *Explanation of the high rates in some regions (Sub Saharan Africa)*
- *Explanation of the high rates among women*
- *The genetic predisposition to HIV that is related to co-receptor polymorphisms of CD4 should be discussed*



### **Topic 3: Statistical Analysis**

By the end of this topic, learners should be able to use appropriate statistical tools in analysis of scientific data.

- *Use statistical analysis to determine relationships i.e Chi-square to determine the relationships between age, sex, geographical regions and HIV prevalence, sex and condom use, gender and drug abuse, gender and occurrence of stigma and discrimination etc*
- *Use of descriptive statistics to analyze HIV related data (Home Based Care, Care and support)*

### **Topic 4: Experimental Design**

By the end of this topic, learners should be able to use appropriate experimental designs random sampling, multi stage, systematic, purposive, snow balling, descriptive cross sectional studies in collection of scientific data.

- *HIV related projects,*
- *Descriptive cross sectional studies in HIV data collection, data on HIV testing (Knowledge, Attitude and Practice)*
- *Medical statistics- Surveillance data, use of ARV's in PMTCT, condom use, HIV testing, financing requirements, hospital admissions, drug supply, infant mortality etc*
- *Describe the experimental design that would be appropriate in collection of data on HIV testing within your province*

### **Topic 5: Computer statistical software**

By the end of this topic, learners should be able to use statistical software such as SAS and SPSS in data analysis

- *Use of computer statistical software in analysis of HIV related data*

- *Simulating models to describe HIV prevalence and the role of Anti Retro Virals in management of HIV*
- *Simulating models to predict outcome of drug therapy*

## Take Away Assignment

### Assignment:

- Using UNAIDS (2005) HIV data in Africa, determine using suitable statistical tools the relationships between gender, age, region and HIV prevalence
  - Describe the experimental design that would be appropriate in collection of data on HIV testing within your institution
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- *Field visit to the Central Bureau of Statistics for retrospective national data*

## BIO 3305: BIOTECHNOLOGY

### Course Synopsis

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.

Integration may be achieved in the teaching of the following topics

### Topic 1: Plant tissue culture

By the end of this topic, learners should be able to:

- *Understand the use of plant tissue culture for the propagation of important medicinal, food and commercial plants for income, food security and as sources of medicine for HIV infected and affected*

## **Topic 2: Animal biotechnology**

By the end of this topic, learners should be able to understand use of biotechnology in animal production and research.

- *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).*
- *Generation of transgenic animal models for HIV research*
- *Hybridoma technology and role of MABs as therapeutic and diagnostic agents*

## **Topic 3: Genetic engineering**

By the end of this topic, learners should be able to understand role of genetic engineering in diagnosis and management of diseases

- *Preparation of plasmids- Use of recombinant vectors in vaccine production*
- *DNA vaccines*
- *Recombinant vector vaccines*
- *SHIV in HIV research in simians*
- *Isolation and cloning of genes- HIV genome*

# **BIO 2204: THE PLANT KINGDOM**

## **Course Synopsis**

Classification of the kingdom. General characteristics of major plant groups, bacteria, algae, fungi, lichens, bryophytes, pteridophytes, gymnosperms, angiosperms.

Topics where HIV/AIDS can be integrated in the teaching of this module

### **Topic 1: Classification of the kingdom**

By the end of this topic the learner should be able to:

- Understand classes of plants important as food, fuel, sources of alternative medicines
- *The role of food plants, their distribution in relation to HIV management should be emphasized*

### **Topic 2: Bacteria, algae, fungi, lichens, angiosperms and gymnosperms**

By the end of this topic learners should be able to:

- Understand the role of algae as a source of gel for HIV diagnosis
- Economic importance of bacteria as agents of disease in HIV infection
- Economic importance of fungi as source of drugs and as agents of disease
- *Opportunistic infections in HIV disease should be emphasized*

## **B 3310 : NUTRITIONAL BIOCHEMISTRY**

### **Course Synopsis**

Basic requirements for human nutrition: proteins, carbohydrates, lipids, minerals and Vitamins. Starvation. Protein Energy malnutrition. Recommended dietary allowances. The role of vitamins and minerals in diets. Assessment of nutritional status.

## Topic 1: Basic Requirements For Human Nutrition

By the end of this topic, students should be able to:

- Understand human nutrition and FAO indicators in surveying food quality

This topic should define nutrition, balanced diet, under nutrition and malnutrition. The role of the following: Proteins, Carbohydrates, Lipids, Minerals and Vitamins in the diet

Nutritional Deficiency and related diseases i.e Protein Energy Malnutrition (PEM)

- *Nutrition in HIV management*
- *Important minerals, vitamins in HIV disease*
- *Important sources*
- *Role of nutritional supplements*

*Practical: Determine the nutritional value of the common vegetables in the nearest market*

*Make recommendations for a menu of a HIV infected individual*

## Topic 2: Assessment Of Nutritional Status

By the end of this topic, learners should be able to:

- Determine nutritional status by use of biochemical assessment vs 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's

*Activity: Nutritional status assessment of primary school children in the nearest pre school.*

*Classify the children on the basis of their nutritional status*

This topic should prepare learners to carry out nutritional surveys

## **Topic 6: Technical aspects in formulating a balanced diet**

By the end of this topic the learner should be able to:

- *Plan a balanced diet*

### **Activity:**

*Formulate a one week menu for a Person Living With Aids*

## **Course Evaluation**

- A teaching unit is equivalent to 40 lecture hours
- All courses are examined at the end of the semester in which they are taken
- Examination consists of Continuous Assessment Tests which shall contribute 40 % and University examinations which shall contribute 60%
- The pass mark is 50%
- Only a student that is registered with the faculty / department shall be allowed to do examinations
- Failure to do a CAT shall lead to fail in the unit
- Each student must attend at least 2/3 of the lectures for a unit in a semester, to be allowed to sit for the examination

## List of Participants

**Dr. Lucky Odirile**

*Careers and Counseling, University of Botswana*

**Prof. A. Ngowi**

*Dean, Engineering and Technology*

**Prof. O. Totolo**

*Dean, Science, University of Botswana*

**Dr. Esther Seloilwe**

*HIV/AIDS coordinator, University of Botswana*

**Ms. M Segwabe**

*Health and Wellness, University of Botswana*

**Mr. R. Mmerekisi**

*School of Business*

**A. Molwantwa**

*Science, Lobatse College of Education*

**M.K. Petso**

*HIV and AIDS Coordinator, Serowe*

**R.B. Mapeo**

*Geology Department, University of Botswana*

**S. Raditloko**

*Environmental Health HIS, Lobatse*

**N.M. Makate**

*Biological Sciences, University of Botswana*

**G. Kgwatalala**

*General Nursing HIS, Francistown*

**D.L. Moruakgomo**

*Science, Molepolole College of Education*

**E. Monnakgosi**

*Science, Tlokweng College of Education*

**L.B. Serumola**

*Science, Tonota College of Education*

**B. Sebolai**

*Basic Sciences, Botswana College of Agriculture*

**F. Nareetsile**

*Chemistry Department, University of Botswana*

**P.E. Lekone**

*Mathematics Department, University of Botswana*

**L. Matseka**

*Science, HIS Molepolole*

**R. Marumo**

*Mechanical Engineering, University of Botswana*

**A.M. Jeffrey**

*Electrical Engineering, University of Botswana*

**D. Mpoeleng**

*Computer Science, University of Botswana*

**J. Tshabang**

*Environmental Health, University of Botswana*

**K. N. Ototeng**

*IHS, Serowe*

**G.S. Lelaka**

*SDA College of Nursing, Kanye*

**N.N. Baeletse**

*Gaborone Technical College*

**L. Nthaga**

*Botswana College of Agriculture*

**W. Motswainyama**

*D.R.M. School of Nursing*

**K.N. Kutuso**

*Physics Department, University of Botswana*

**K. Tlhalerwa**

*Environmental Science, University of Botswana*

**C. Ndolo**

*CDPU: Faculty of Engineering, University of Botswana*

**P. Marole**

*Ministry of Health*

**K. G. Garegae**

*DMSE, University of Botswana*

**K. L. Kumar**

*Head, IDT/FET/UB, University of Botswana*

**V. Vokolkova**

*Civil Engineering, University of Botswana*

**Prof. Xiaohua Xia**

*University of Pretoria*

**Prof. Zipporah Ng'ang'a**

*Kenyatta University*

**Mrs. Alice Ochanda**

*UNESCO*

**Prof. Caroline Lang'at-Thoruwa**

*AWSE/ Kenyatta University*

**Dr. Ethel Monda**

*AWSE/ Kenyatta University*





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**African Women in Science and Engineering**  
United Nations Avenue, ICRAF House  
P.O. Box 30677-00100  
Nairobi, Kenya  
Tel. 254-20- 7224750 or 7224000 Ext. 4750  
Fax. 254-20- 7224001  
E-mail: [awse@cgiar.org](mailto:awse@cgiar.org)