



# **Bioinformatics Degree Curriculum Development: The African Challenge and Lessons Learned UB, Gaborone, Botswana March 11<sup>th</sup>, 2014**

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LESSONS LEARNED

# WHERE WE STAND IN FU?

## Future University, Sudan

**Faculty of  
Computer  
Science**

Faculty of  
Engineering

Faculty of  
Telecommunication

Faculty of  
Information  
Technology

Faculty of  
Geoinformatics

# NUMBER OF STAFF

Designation	Total
Professors	Zero
Associate Professors	1
Assistant Professors	3
Lecturers	5
Assistant Lecturers	3

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# OFFERED PROGRAMMES

- Bachelor of Computer Science
  - Bachelor of Artificial Intelligence
  - Bachelor of Bioinformatics
  - Bachelor of Software Engineering
  - Master of Computer Science
    - Specializations:
      - Artificial Intelligence
      - Computer Graphics
      - Software Engineering
      - Bioinformatics
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# PROGRAM PHILOSOPHY

- ❖ Provides the students with an opportunity to enhance their knowledge, skills, and experience to become successful practitioners and leaders in the field of Bioinformatics.
- ❖ The Program is designed to prepare the students to pursue their careers as Bioinformatics professionals. It is suitable for students with a background in computing, medicine and/or biology.
- ❖ The Program is organized to enhance students' understanding of the theories, concepts and practices of Bioinformatics, enabling them to develop new skills and competencies.

# AIMS OF THE PROGRAM

- ❖ To develop an understanding of the theoretical concepts and principles, underlying the science of bioinformatics.
- ❖ Application of the theories to the practices of genomic computing as well as other evolving “Omics.
- ❖ Assume responsible positions and apply skills in industry and government at the research, planning, and development levels,
- ❖ To develop a strong foundation and enthusiasm in students for the growth of their skills and knowledge in Bioinformatics through independent research and study.

# LEARNING OUTCOMES

- ❖ The emphasis of the program is on both theoretical and practical techniques for the design and development of bioinformatics applications;
- ❖ Enabling graduates to apply their knowledge and skills in a variety of bioinformatics software development processes.



# CAREER PROSPECTS

- ❖ Bioinformatics System Analyst
- ❖ Bioinformatics Analyst/Programmer
- ❖ Bioinformatics Analyst/Scientist
- ❖ Bioinformatics Research Specialist
- ❖ Bioinformatics System Design Analyst/Programmer
- ❖ Bioinformatics Research Analyst
- ❖ Bioinformatics Information System Developer
- ❖ Bioinformatics Service Analyst/Programmer
- ❖ Bioinformatics Quality Assurance Supervisor
- ❖ Bioinformatics Analyst/Programmer
- ❖ Bioinformatics Information System Administrator
- ❖ Biotechnologist
- ❖ Academician

# Course Structure

- ❖ The Master of Science in Bioinformatics is composed of three semesters of course work and one semester of project for a total of 39 credit hours.

Course	Credit Unit
Core	15
Specialization	18
Project	6

# Course Structure

## Semester 1

Courses	Credit Hours
Core I	3
Core II	3
Core III	3
Specialization I	3
<b>TOTAL</b>	<b>12</b>

## Semester 3

Courses	Credit Hours
Specialization IV	3
Specialization V	3
Specialization VI	3
<b>TOTAL</b>	<b>9</b>

## Semester 2

Courses	Credit Hours
Core IV	3
Core V	3
Specialization II	3
Specialization III	3
<b>TOTAL</b>	<b>12</b>

## Semester 4

Course	Credit Hours
Project	6
<b>TOTAL</b>	<b>6</b>

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# Course Structure

## **Bioinformatics Core Courses:**

These courses are required for the students enrolled in MSc Bioinformatics program. These are common to the three tracks.

Course Code	Course Title	Credit Hours
MSCS01	Theory of Computing	3
MSCS02	Advanced Computer Architecture	3
MSCS03	Advanced Algorithm Design and Analysis	3
MSCS04	Advanced Operating Systems	3
MSCS05	Principles of Programming Languages	3

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# Course Structure

## Bioinformatics Specialization Courses

Course Code	Course Title	Credit Hours
MSCBI01	Genomics & Gene Expression	3
MSCBI02	Proteomic Informatics	3
MSCBI03	Simulating Biological Systems	3
MSCBI04	Informatics for Metabolomics	3
MSCBI05	Data Analysis & Essential Statistics	3
MSCBI06	Data Integration and Interaction Networks	3

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# Course Structure

## **Master's Project:**

Students in the Master of Science in Bioinformatics (MSCBio) program are required to do a Master's Research Project.

To opt for a Master's Research Project, a student must have at least three B Grades in all core courses.

Students who have not completed their core course requirements or low grades, they will be not allowed to register for the research project or required to repeat the courses with low grades in order to satisfy these requirements.

To complete a research project student must have to follow these steps:

**Step1 - Find an Supervisor/Advisor**

**Step 2 - Form a Committee**

**Step 3- Carry out the Work and Defend It**

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# African Challenges

## ❖ Degree approach

- Course-based vs. research-based degree

## ❖ Faculty

- Qualification; Quantity; and Sustainability

## ❖ Scholarships for M.Sc. students

- Few governments in Africa provide funding for graduate students

## ❖ State-of-Art Bioinformatics laboratory

## ❖ Library and eBooks

## ❖ Subscription to international Journals

# Lessons Learned

## ❖ **Course-based degree**

- In case of the availability of:
  - adequate and enough qualified Bioinformatics instructors;
  - the supporting computing infrastructure;
  - Fellowships
- Then, the course-based degree would be the correct option to be adopted by the concerned University/Faculty.
- Another option, will be to integrate the MSc degree as a tracking/specialization within existing computer master.



# Lessons Learned

## ❖ **Research-based degree**

- In case of the unavailability of:
  - adequate and enough qualified Bioinformatics instructors;
  - the supporting computing infrastructure;
- **Then, the Research-based degree would be the correct option to be adopted by the concerned University/Faculty.**

# Lessons Learned

## ❖ **Scholarships for MSc students**

- To secure more annual scholarships for postgraduate studies especially from the lower and middle income countries through support from the AU Science, Technology and Innovation grants or other relevant International funding.
- Encourage exchanging of Bioinformatics postgraduate students within African Universities/Research Centres.

# Conclusion and Recommendation

- ❖ To replicate the experience of the African Institute for Mathematical Sciences (AIMS) that was founded in 2003 in Cape Town, South Africa.
- ❖ To establish the "**African Institute for Bioinformatics (AIB)**" with the support of the AU, EU, WHO, CIDA, SIDA grants for at least the first 5-10 years that could support establishing Bioinformatics Centres of Excellence within the African countries.
- ❖ AIB will be a pan-African network of centres of excellence for postgraduate education, research and outreach in Bioinformatics. The AIB will then call annually for 20-30 fellowships for postgraduate (MSc PhD) in Bioinformatics across

# Conclusion and Recommendation

- ❖ AIB will offer an intensive one-year postgraduate course leading to a structural Master's in Bioinformatics, formally accredited by the Universities in the hosting country, the programme is taught in association with the Faculty from the Regional and International Universities.
- ❖ AIB will plan to expand the concept to 15-20 centres by 2025.
- ❖ Each centre/station is managed by a Director/President with competent staff.

# Conclusion and Recommendation

- ❖ The model delivers top international and African lecturers who volunteer to teach three-week course in the host country.
- ❖ In addition, AIB developed a unified B.Sc. in Bioinformatics due to the recent demands for mathematical modeling in Systems biology, Bioinformatics and genomics.
- ❖ The AIB network if established will be training around 150 master students within the 5 years of its establishment.



# Thank You !

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