University of Sciences, Techniques and Technologies of Bamako

Master of Sciences in Bioinformatics

2013-2014

Program Directors

Prof. Mohamed S. Maiga, Ph.D, FST
Prof Seydou DOUMBIA, MD, Ph.D, FMOS

References for the Master

- **Organization**: University of Sciences, Techniques and Technologies of Bamako (USTTB)
- **Main component**: Joint Program FST and FMOS/FAPH
- **Domain**: Biological Sciences and Health
- **Diploma**: Masters
- **Honors**: Bioinformatics
- **Number of semesters**: 4
- 1200 hours/ 120 credits
- Research project realization

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Educational Organization

- **Program Academic Directors**:

  Prof Mohamed Sida MAIGA, Ph.D, FST

  Prof Seydou DOUMBIA, MD, Ph.D, FMOS

- **Academic Coordinator**:

  Mamadou WELE , Ph.D, Associate Professor, FST

- **Technical Advisors**:

  Prof Doulaye DEMBELE, Ph.D, U of Strasbourg, France

  Tram HUYEN, Ph.D., Chief, Bioinformatics and Computational Biosciences Branch (BCBB), OCICB, NIAID/NIH, Rockvilles, MD, USA

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Program justification

- With the accessibility of human's, pathogens and vector's genomes, it is possible to develop effective tools in the prevention and control of communicable and non-communicable diseases.
- The relevant aspects of this Masters program include a training program that integrates biology (*biochemistry and molecular biology*) with mathematics and computer sciences (*mathematical modeling and programming).*
- We have established Research opportunities with NIAID-USTTB International Center of Excellence in Research (ICER-Mali), with research covering malaria, HIV, TB, Insect Vector of diseases, leishmaniasis, filariasis, lassa fever, tickborne diseases, and neurological disorders.

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Goals of the Program

- To address the necessity of preparing young people who are capable of operating in the interfacing domains of biology, mathematics and information technologies.

- The program focuses on addressing the needs of high-level biological research and development for business and health research organizations.

Career Opportunities

- The program allows students to either pursue a doctorate or to look for employment in industry and technological production.

- It prepares one for academic research in genomics, pharmaceutical, medical, and environmental laboratories, as well as for employment in business, research and development (*pharmaceutical or biotechnology*) or for jobs creating specialized software in the life sciences field

Students Recruitment

- Admission is based on a review of academic records that gives information concerning previous academic performance in biology, mathematics, or information technology.

- Applicants allowed to proceed as candidates must have a good English skill, must be no older than forty (40) years of age and may have the following background:

  Bachelor/Master degree in Sciences or equivalent;

  Degree of engineering in applied sciences or equivalent;

  Doctorates in Medicine or Pharmacy or equivalent

- Who pass the record review by the Education Committee will then undergo an exam that will select the best students to fill the number of available spots.

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Costs of Program and Number of Spots

- Registration fees: 150 000 CFA francs ($300)

- Educational expenses: 1 000 000 CFA francs/year, 2,000,000 for the 4 semester (~$4,000)

- The planned number of spots is 15 to 20 students per class with new recruitment taking place each year.

Facility/Environment

- Research Laboratories: ICER encompass more than 20 laboratories specialized in basic Molecular biology, genomics, Immunology, Epidemiology/GIS, Bioinformatics, Database management Center, a BSL-3 for TB and Clinical research Laboratory.
- Three conferences room (seats 60), with video-conference
- Guest House (can house up to 12 guests, with dining facility and computer room),

Information technology (IT/LAN)

- 2 Computer rooms for bioinformatics training with robust Internet connection (VSAT) through the NIH in Rockville, MD, USA.
- The servers include: a] two IBM xServer: Intel Xeon (2.0 GHz) processor, 1GB of RAM, 2 10,000 RPM SCSI hard drives (~20 GB or redundant storage currently available to users- can be expanded easily)

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Human Resources

- Training will be provided by experienced scientists and faculty members from USTTB (FST, FMOS and FAPH) and collaborating international institutions with strong bioinformatics capabilities.
- Training will be conducted through in-class face-to face meeting, videoconference and webinar involving our outside cooperating institutions in France, USA or other African countries (Tunisia, Morocco, Nigeria, and South Africa through H3Abionet).
- **Educational partnership:**

✓ H3Abionet consortium (an African Bioinformatics Network: www.h3abionet.org)

✓ University of Strasbourg (France)

✓ Tulane University (USA)

✓ OCICB/NIAD/NIH

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Faculty Resources of the USTTB,Mali

	Field of expertise	Institution
Pr. Seydou DOUMBIA, MD,Ph.D	Epidemiology/ Research Methodology	FMOS
Pr. Mohamed S MAIGA, Ph.D	Microbiology	FST
Dr. Mamadou WELE, Ph.D	Biochemistry	FST
Doulaye DEMBELE, Ph.D	Bioinformatics	FST/Strasbg
Ouateni DIALLO, PhD	Mathematics,	FST
Pr. Mahamadou DIAKITE, PharmD, Ph.D	Immunogenetics	FMOS
Ibrahim BABER, Ph.D	Bioinformatics	FMOS
Oumar THIERO, MsPH, Ph.D	Biostatistics	FMOS
Mamadou B. COULIBALY, PharmD, Ph.D	Molecular Vector Biology	FAPH
Baminata TRAORE, MS	Informatics	FST
BoubacarTRAORE, PharmD, Ph.D	Immunology	FAPH
Amadou KONE, Ph.D	Molecular Immunology	FST
Mamoudou MAIGA Ph.D	Microbiology/Genomics	FMOS
Ousmane KOITA PharmD, Ph.D	Molecular parasitology	FATH
A Ibrahim AMADOU; Ph.D	Information Technology	FST
Abdoulaye DjJIMDE PharmD, Ph.D	Parasitology/Drug resistance	FATH

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❑ *Participation of National research institutions*

Research laboratories and national partnering businesses will participate in organizing Practical training as well as supervising participants during their final term internship

❑ *Participation of International partner organizations*

In the context of international collaboration, the resources of external universities will be used for courses and other educational support.

NIH (National Institutes of Health - USA) will participate in training trainers as well as lessons via a series of video conferences and webinars.

BioTeam SlipStream Appliance

(through partnership NIAID/Intel)

BIOTEAM
Enabling Science

SLIPSTREAM GALAXY EDITION
APPLIANCE

Galaxy made easy.

	NO WAIT TIMES	NO STORAGE QUOTAS	NO JOB SUBMISSION LIMITS	NO DATA TRANSFER BOTTLENECKS	NO IT EXPERIENCE REQUIRED	NO REQUIRED INFRASTRUCTURE
GALAXY MAIN	✗	✗	✗	✗	✓	✓
LOCAL GALAXY	?	?	?	✓	✗	✗
CLOUD GALAXY	✓	✓	✓	✗	✗	✓
SLIPSTREAM GALAXY	✓	✓	✓	✓	✓	✓

BENCHMARKS

TOOLS	TASK	DATA	RUN-TIME
Bowtie 2	Mapping whole human genome	204 million paired-end 100bp Illumina reads	2 Hours 44 Minutes
SAMTools	SAM-BAM conversion	127GB SAM (41GB resulting BAM)	2 Hours 7 Minutes
TopHat 2	RNA-Seq mapping	24 million 100bp Illumina reads	1 Hours 24 Minutes
Cufflinks 2	Differential Expression Analysis	4.3 GB SAM File	0 Hours 11 Minutes

- INTEL® XEON® E5 PROCESSORS (16 CORES)
- 384 GB RAM
- 100GB SOLID STATE DRIVE
- 16TB INTEGRATED HIGH-SPEED STORAGE
- FLEXIBLE LINUX-BASED SERVER ARCHITECTURE

Galaxy

GET RESULTS FASTER WITH A DEDICATED GALAXY SERVER

SAVE TIME AND MONEY	AVERAGE LAB CAN SAVE > 1 MONTH IN DEPLOYMENT TIME AND >$20,000 IN START-UP COSTS
HARDWARE SPECIFICATIONS Designed for data intensive analysis	CPUs, RAM, network capability, storage, and more are optimally selected and configured
EFFICIENT RESOURCE MANAGEMENT Decreases time to results	SGE and Galaxy installed and configured with appropriate resource management
PLUG-AND-PLAY APPLIANCE Helps to get up and running quickly	Galaxy and underlying computational tools are pre-installed on the appliance
OPTIMIZED DATA TRANSFER Improves performance	Galaxy software and SlipStream hardware have been tuned for faster uploads and downloads
AUTOMATED UPDATES Minimizes IT management overhead	Galaxy and underlying computational tools can be automatically updated
PRE-LOADED DATASETS Makes data analysis more convenient	Commonly used reference datasets for use with Galaxy are pre-loaded on the appliance

SEEKING THOUGHT LEADERS FOR EARLY ACCESS PROGRAM

Limited Availability - CONTACT NOW TO JOIN

slipstream-galaxy@bioteam.net

www.bioteam.net/slipstream/galaxy-edition

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Time table of activities

- Program submission to the advisor comitee of USTTB : On going ….
- Preparation of class rooms at FST for teaching, video conferences and practical courses: On going ….
- Training of trainers: from june 21014
- Program starting date: October 2014

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Training of Trainer Seminars with OCICB/NIAID

Biostatistics	Data Presentation
Curve Fitting in PRISM	Scientific 3D Graphics and Animation with Blender
Design of Experiments using JMP	Molecular Graphics: Illustrations with PyMOL, Chimera, and VMD
Introduction to R	Tips for Creating Video and Animation in PowerPoint
Phylogenetics	**Structural Biology**
Introduction to Phylogenetics and Sequence Assembly	Fundamentals, Data Sources, and Visualization of Macromolecular Structure
Homology Searching and Sequence Alignments	Generating Protein Structures from Homology
Building Trees: Phylogenetics I	Predicting Protein Structures from Amino Acid Sequences
Next Generation Sequencing	**Bioinformatics Development**
Overview of Next Generation Sequencing	Introduction to Perl/BioPerl
Mapping and Assembly	Shell Scripting/UNIX for Scientists
Variant Analysis	Python Scripting for Scientists

Overview of the program contains

Semester	IU Code	IU Title	LH	DW/ TW	PSW	Credits
S1	BIN100	Mathematics for Biology	36	24	60	6
	BIN101	Structural Biology	35	15	50	5
	BIN102	Biostatistics	25	25	50	5
	BIN103	English	20	10	30	3
	BIN104	Genomics and Proteomics	30	20	50	5
	BIN 105	Cellular and Molecular Biology and Bioanalysis	36	24	60	6
S2	BIN200	Sequencing Techniques	36	24	60	6
	BIN201	Sequence Analysis	30	30	60	6
	BIN202	Databases	30	20	50	5
	BIN203	Bioinformatics for Genomics and Post-genomics	25	15	40	4
	BIN204	Molecular Modeling	20	20	40	4
	BIN205	Programming for Bioinformatics	20	30	50	5
S3	BIN300	Development of Therapeutic Targets	30	20	50	5
	BIN301	Phylogenetics	18	6	60	6
	BIN302	Bioinformatics Tools for Public Health	40	10	50	5
	BIN303	Research Methodology	20	20	40	4
	BIN304	Professional Integration	20	10	30	3
	BIN305	Laboratory Internship	0	40	40	4
	BIN306	Scientific Communication	20	30	30	3
S4	BIN400	Research Project	0	150	300	30

Program Budget

	Number	TOTAL
Capital Investment		
Construction/renovation		$20,000
Classrooms/Practical courses	2	
Equipment/ suplies ***(Computer hardware and Teaching materials projectors…)***		$80,000
Operations		*$10,000*
Maintenance and repair of computer hardware/year		
Reprography/year		
Office supplies		
Assignments		*10,000*
Teaching assignments		
TOTAL		$120,000

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