

# 2014

## Annual Report



Director

Centre for Biotechnology & Bioinformatics

## Message from the Director



The Centre for Biotechnology and Bioinformatics, is a shared research facility to facilitate and strengthen research, capacity building and generate marketable products through exploitation of biotechnology and bioinformatics.

The admission level is programmed to gradually expand, as the centre strengthens its research facilities. It is important to note that CEBIB is the only institution of its kind currently offering post-graduate training in biotechnology and bioinformatics in the Eastern and Central African Region. The center's facilities contain basic necessities such as Molecular Biology Laboratory, Bioinformatics Unit and Genomics platforms among other laboratory and office spaces. Currently, the Centre has embarked on a major program to improve its research facilities through the support of a number of development partners.

The Centre for Biotechnology and Bioinformatics operates under the guidance of An Advisory Board and a Centre Director with both academic and non academic staff members offering support.

The future growth plan for the centre is bright, and we look forward to expansion of our research facilities to cater for the planned development of marketable products, among other goals. In the meantime, we wish to assure our clients that we are fully committed to achieve our set goals and objectives of delivering quality academic programs as well as venturing into the development of marketable products to enhance – socio-economic development in our society.

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## Centre for Biotechnology and Bioinformatics

The Centre for Biotechnology and Bioinformatics (CEBIB), located at the College of Biological and Physical Sciences, was founded in 2005 as a virtual centre for Research and Postgraduate Training at MSc and PhD levels in Biotechnology and Bioinformatics to increase capacity and develop manpower for health; agriculture; industry, environmental management and related fields.

The Centre's academic and research programmes have expanded in recent years and include the participation of visiting academics from international links and collaborating institutions. CEBIB currently houses four advanced modern laboratory facilities that comprise of three Biotechnology Laboratories and a state of the art Bioinformatics Laboratory.

### Programmes Offered

CEBIB offers MSc and PhD degree programmes in Biotechnology and Bioinformatics. Students enrolled for Biotechnology major in Agricultural Biotechnology, Health Biotechnology, Environmental or Industrial Biotechnology. The following degree programmes are offered at the Centre:

- **MASTER OF SCIENCE IN BIOTECHNOLOGY**
- **MASTER OF SCIENCE IN BIOINFORMATICS**
- **PHD IN BIOTECHNOLOGY**
- **PHD IN BIOINFORMATICS**

#### **Agricultural & Environmental Biotechnology**

Plant and Crop Biotechnology  
Molecular Taxonomy and Phylogenetics  
Food and Feed Safety  
Plant and Animal Breeding  
Molecular Phenotyping and Model Systems  
Biopolicy, Biosafety and Intellectual Property

#### **Industrial & Environmental Biotechnology**

Environmental Microbial Bioremediation  
Food and Fermentation Technologies  
Industrial Enzymes Technologies  
Biomaterial Technologies  
Natural Products and drug Discovery

#### **Health & Environmental Biotechnology**

Pharmacology Drug Delivery & Pharmacogenomics  
Biosignaling & Molecular Transduction  
Molecular Epidemiology and Dynamics of disease  
Emerging Infections and Poverty Related Diseases  
Forensic Sciences  
Immunotechnology and Molecular Diagnostics

#### **Bioinformatics**

Applied Bioinformatics in Breeding, Genomics and Proteomics  
Designs of Microarrays Experiments  
Computational Methods in Biosciences

## Enrolled Students

In the year 2014, the student admission number also grew from 8 the previous year to 12 in number. This was mainly due to an aggressive marketing towards increased student admission.

Programme	2013/2014		2014/2015	
	M	F	M	F
Post Graduate Students	4	4	6	6

The above table reflects an increase in admission number by **50%** in the New Year

## International Student Component

Apart from national students, the Centre has also registered international enrollment of two students from Rwanda and D. R. Congo respectively. While Jean Piere is sponsored by the Government of Rwanda, Tania Bishola is sponsorship by DFG Fund Project. One other local student is sponsored by The African Union.

## Research Activities Undertaken

Multiple research activities, covering agricultural, health, industrial and environmental biotechnology are carried out at CEBIB. Research activities by staff and affiliates of the centre are implemented both within CEBIB laboratories and in laboratories of collaborating institutions through national and international links. Most of these activities are done with a training component, as such, research students form an integral part of most research activities.

CEBIB has also enhanced its collaboration with local research institutions where we have student doing part of their project with various institutions. In this way we enhance our Appropriations in aid. Already a total of five of our research students are doing/to do their projects with such Institutions using their facilities.

### Research Grants and Scholarships

CEBIB researchers and collaborators endeavor to source for grants to support research activities and scholarship to support postgraduate students enrolled at the centre.

### New Research Grants

In 2014, the Centre managed to secure one new research grant to the tune of USD 64978 from The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). The PI for this grant is Dr Benard Kulohoma who is a lecturer at CEBIB. Through this grant an amount will go towards partial scholarship of two Masters students and the rest towards carrying out the research component.

### Selected Research Activities for the year 2014

NAME	GENDER	MSC. DEGREE	PROJECT TITLE	GRADUATED
PAULINE WAMBUI WANGUNYU	F	MSc. Bioinformatics	<i>In Silico</i> Exploration of 3D Structures of PfMSP3 and PfMSP6 invasion genes and their allelic differences	August, 2014
OKUMU W. ALUOCH	F	MSc. Biotechnology	Nutrient Digestibility and Growth Performance in Pigs fed diets containing steeped Canola Meal with or without Enzyme Supplementation	August, 2014
DICKSON BENNET KINYANYI	M	MSc. Bioinformatics	Protein Structure prediction on a genomic scale: Application to the African Swine Fever virus genome	August, 2014
EVANS SIOMA KATAKA	M	MSc. Bioinformatics	Time Course RNA-seq Differential Expression Analysis of wild type and Jumonji (AtJMJD5) Mutant of <i>Arabidopsis thaliana</i>	August, 2014
KUGO CHEPCHIRCHIR MAUREEN	F	MSc. Biotechnology	Effects of $\beta$ -Mannanase of the Nutrient utilization and performance of laying chicken	August, 2014
NDUTA FAITH MWANGI	F	MSc. Biotechnology	Application of Loop-mediated isothermal amplification (LAMP) in Microbiological water quality analysis	August, 2014
SAMEER ROHIT JESHBHAI PATEL	M	MSc. Biotechnology	Optimisation for production of fish protein hydrolysate from Nile Perch ( <i>Lates niloticus</i> ) by-products	August, 2014
KARIUKI HELLEN WAMBUI	F	MSc. Biotechnology	Molecular Characterization of Phytoene desaturase (CrtI) Gene from <i>Paracoccus bogoriensis</i>	December, 2014
OGOLA CHRISTABEL AWUOR	F	MSc. Biotechnology	Molecular Characterisation of erythrocyte receptor genes, CRI, DARC and Band 3 required for malaria parasite invasion	December, 2014
OTADOH JANE AKINYI	F	MSc. Biotechnology	Characterization and Determination of Efficacy of local <i>Trichoderma</i> isolates as a Biocontrol Agent (BCA) on <i>Fusarium wilt</i> on Beans ( <i>Phaseolus vulgaris</i> L)	December, 2014
WAMAE KEVIN KARIUKI	M	MSc. Bioinformatics	In Silico Prediction of B-Cell and T-Cell Epitopes in <i>Plasmodium falciparum</i> Merozoite Invasion Proteins (EBA175, RH5 AND RIPR)	December, 2014

## International Links and Collaborations

CEBIB has relied on various forms of collaborations and networking arrangements in order to fulfill its core vision and mission in Biotechnology and Bioinformatics research and capacity development. Various forms of Linkages and Collaborations have been developed with international research institutions, regional and national Research and Development systems, advanced laboratories as well as universities. To enhance research and capacity development, CEBIB is currently working with the following networks and partner institutions who have provided grants, staff exchange, student exchange, equipment, sub-awards, and joint grant applications:

<b>INSTITUTION</b>	<b>KIND OF LINK</b>	<b>BENEFIT TO UON</b>	<b>No of Students trained</b>
KEMRI/WELCOME TRUST	Collaboration	Sub-Award, Staff support (APO), Provision of equipment	8
University of Manitoba-KEMRI-UNITID-CEBIB	Collaboration	Student and Staff exchange, Training of CEBIB Students, Use of Collaborator labs.	6
African Biomedical Centre (ABC)	Collaboration	Provision of laboratory equipment	2
Ben Gurion University, Israel	Collaboration	Molecular Diagnostics and antibody research and training	1 (Staff)
Denver Foundation, USA/University of Colorado	Collaboration, Sub-Award	Full Research costs for Training 2 MSc students covered	2
University of Melbourne, Australia	Collaboration	Joint Grant applications, student and staff exchange	
Centres for Disease Control (CDC)	Collaboration	Student and Staff exchange, Training of CEBIB Students, Use of Collaborator labs.	1
Inqaba biotech, South Africa	Collaboration	Joint implementation of Short term Hands-on training	44
ILRI BecA	Collaboration	Student and Staff exchange, Training of CEBIB Students, Use of Collaborator labs.	1
Biozeq-Kenya Ltd	MoU Development	Equipment placement	
MCDC	Collaboration	Capacity Development	

The Centre has also initiated collaboration through the MCDC-KEMRI-Wellcome Trust held at CEBIB. So far through this collaboration CEBIB has gained in terms of appropriations in aid through the following;

- Employment of a contract Post Graduate Research coordinator on a one year contract with a one year salary to the tune of Ksh 581,580 already transferred to the University account in the month of December 2014
- Facilitation of a Brain storming session for key CEBIB staff (4) at Lenana Conference Facility in the month of November 2014 at a cost of approximately Ksh.10,000
- Sponsoring of CEBIB space design reorganization completion to the tune of Ksh 20,000
- Facilitation of CEBIB team building activity to be held at Lukenya Getaway to the tune of Ksh 20,000 in the month of December 2014
- Catering for travelling expenses for Dr Isabella Oyier who is a visiting lecturer to attend a conference in the USA and Tanzania leading to appropriations in Aid to the tune of over Ksh 250,000

The Centre is also in the process of establishing collaboration network with TAU through Prof Fuad. So far the Centre has written a motivation that Prof Fuad be given a position as a Visiting Professor at the Centre and he has agreed in principal to facilitate the shipment of special experimental rats at a cost of 10,000 US dollars. The conditions for this initiative to successfully take off however include;

- CEBIB has through the University of Nairobi has to refurbish and provide an experimental animal house (infrastructural support to house the animal house). An initial approximate costing done through the Universities internal maintenance team is gave an approximate value of Ksh. 2.4 million as the amount of money required to refurbish one of the old dilapidated buildings. The other alternative would be to use one of the buildings around the CEBIB premises which are currently not fully utilized. If this were to be done, the cost for the refurbishment would be approximately one million or less which would be more affordable. CEBIB is in the process of motivating to the Central administration, through the Principal, CBPS to support this initiative
- CEBIB is also in the process of partnering with other renowned Scientist by engaging them as Adjunct professors. Already three appointments letters have been processed to have on board world renowned who are willing to collaborate with CEBIB and mentor both staff and students. With this strategy, CEBIB will be in a better position to apply for meaningful research grants which is a critical means of revenue collection. This process is ongoing.



## Publications for the Year (author, date of publication, title publisher, place of publication)

- **Ochola-Oyier LI**, Okombo J, Mwai L, Kiara S, Pole L, Tetteh KK, Nzila A, Marsh K. The MSPDBL2 codon 591 polymorphism is associated with lumefantrine *in vitro* drug responses in *Plasmodium falciparum* isolates from Kilifi, Kenya. Antimicrob Agents Chemother, 2014. In press.
- Kiboi D, Irungu B, Orwa J, Kamau L, **Ochola-Oyier LI**, Ngángá J, Nzila A. Piperaquine and Lumefantrine Resistance in *Plasmodium berghei* ANKA associated with Increased Expression of Ca<sup>2+</sup>/H<sup>+</sup> antiporter and Glutathione Associated Enzymes. ExpParasitol, 2014; 147:23–32
- Okombo J, Kamau AW, Marsh K, Sutherland CJ, **Ochola-Oyier LI**. Temporal Trends in Prevalence of *Plasmodium falciparum* Drug Resistance Alleles over Two Decades of Changing Antimalarial Policy in Coastal Kenya. Int J. Parasitol, 2014; 4:152–163.
- Busibwa N, Chiyanzu I, **Obiero, G**, Sanette M. Effect of *Saccharomyces cerevisiae* and *Zymomonas mobilis* on the co-fermentation of sweet sorghum bagasse hydrolysates pretreated under varying conditions, Biomass and Bioenergy (2014).

## Number of Staff and their respective designations

CEBIB being a virtual centre has got no direct staff establishment for the academic and non-academic staff. The current staff working at the centre for various positions have been employed on positions borrowed from other departments and their designations are listed below ;

DESIGNATIONS	MALE	FEMALE	TOTAL
Professor	0	0	0
Associate Professor	1	0	1
Senior Lecturer	1	0	1
Lecturer	1	0	1
Visiting Lecturer	0	1	1
Assistant Lecturer	0	0	0
Senior Technician	1	1	2
Technician	0	0	0
Postgraduate Research Coordinator (on Contract)	1	0	1
Office Administrator	0	0	0
Secretary	0	1	1
Messenger	0	0	0
<b>TOTAL</b>	<b>5</b>	<b>3</b>	<b>8</b>

## Number of Graduands in 2014

Post graduate students - 11

## Papers presented at Conferences (title of paper, date presented and location)

	Title of the Paper	Date Presented	Location
1	Evidence of selection in Rh5, MSP1 <sub>42</sub> and EBA181 <i>P. falciparum</i> merozoite antigens after drug treatment of children with uncomplicated malaria	1st November, 2014	Malaria Capacity Development Consortium meeting; New Orleans, USA
2	Using population genetic approaches to understand and estimate malaria transmission in the context of malaria elimination activities in Siaya County, Western Kenya	1st November, 2014	Malaria Capacity Development Consortium meeting; New Orleans, USA
3	Evidence of selection in polymorphic <i>P. falciparum</i> merozoite antigens during the recovery of children from malaria	2 <sup>nd</sup> -6 <sup>th</sup> November, 2014	American Society of Tropical Medicine and Hygiene
4	Genomic diversity of polydnaviruses in tsetse fly species from East Africa	8 <sup>th</sup> -10 <sup>th</sup> November, 2014	The 5 <sup>th</sup> Human Heredity and Health in Africa (H3Africa) Consortium meeting, Dar es Salaam, Tanzania
5	Genomic diversity of polydnaviruses in tsetse fly species from East Africa	26 <sup>th</sup> -31 <sup>st</sup> October, 2014	Next Generation Sequencing' workshop at the European Bioinformatics Institute (EBI), Wellcome Trust Genome Campus, Cambridge, UK
6	Genomic diversity of polydnaviruses in tsetse fly species from East Africa	25 <sup>th</sup> - 31 <sup>st</sup> May, 2014	DFG/ICSU/ISSC Young Scientists Networking Conference on Integrated Science: Ecosystems and human wellbeing in the green economy, Villa Vigoni - Lake Como, Italy
7	Genome Sequence of tsetse polydnavirus (PDV); Insights into symbiotic virus evolution	16 <sup>th</sup> – 17 <sup>th</sup> October, 2014	3 <sup>rd</sup> MVVR Symposium, Hilton Hotel, Nairobi
8	Molecular Epidemiology of simian immunodeficiency virus in wild populations of non-human primates in Kenya	16 <sup>th</sup> – 17 <sup>th</sup> October, 2014	3 <sup>rd</sup> MVVR Symposium, Hilton Hotel, Nairobi
9	Natural History and evolutionary considerations of simian immunodeficiency virus in Kenyan non-human primates	16 <sup>th</sup> – 17 <sup>th</sup> October, 2014	3 <sup>rd</sup> MVVR Symposium, Hilton Hotel, Nairobi

## Corporate Social Responsibility Projects



CEBIB staff participated in the Nairobi International Trade Fair

CEBIB staff, among them Edwin Rono, Ann Owiti and Catherine Kamau – a CEBIB student, participated in this year's Nairobi International Trade Fair. They exhibited a Biofertiliser which was in line with this year's theme: Enhancing technology in agriculture and industry for food security and national growth.

## Any Other Activities

- Malaria Capacity Development Consortium (MCDC) is supporting the development career development group which has been established at CEBIB to embed postgraduate research support for our MSc and PhD students. We are establishing a mentoring, professional development planning and supervision programmes to strengthen our postgraduate training programmes.
- On 24<sup>th</sup> – 28<sup>th</sup> November 2014, CEBIB students attended a “Bioinformatics approaches for Next Generation Sequencing (NGS)” course hosted at the International Centre of Insect Physiology and Ecology (ICIPE). The course was facilitated by TreND (Teaching and Research in Natural Sciences for Development in Africa) volunteers and comprised of participants from 20 different universities in 6 different African countries. NGS analysis topics including de novo genome and transcriptome assembly, ChIP-seq and RNA-seq, rare variant calling and population genetics were taught. Other topics included introduction to R statistical programming language and software development concepts such as databases and version control.
- Ms Nduta Mwangi, a CEBIB student was invited to an all expenses paid trip to attend an international Summer Academy on Spartial Ecotoxicology and Ecotoxicological Risk Assessment-using an open Community Approach to be held at the University Koblenz-Landau, in Germany. The event took place from the 8<sup>th</sup> September to the 21<sup>st</sup> September 2014. Ms Nduta graduated with a Masters Degree in Biotechnology (Health and Environmental option), 2014.
- Kataka Evans Sioma, a CEBIB student was invited to an all expense paid trip to attend a Novartis International Biotechnology Leadership Camp (BioCamp) in Basel, Switzerland. The BioCamp is a seminar that brings the Biotechnology sector closer to talented students from top universities around the world. The event was held at the Novartis headquarters in Basel, Switzerland from the 24<sup>th</sup> August- 28<sup>th</sup> August, 2014. The program offered participants an opportunity to interact with key Novartis Scientists, understand trends and challenges in the Biotechnology sector as well as Network with talented students from other countries. Mr Evans Kataka graduated with a Masters Degree in Bioinformatics, 2014. Kataka's trip was funded by Novartis. He is to pursue his PhD under a DAAD Scholarship.