

UNIVERSITY OF NAIROBI

COLLEGE OF BIOLOGICAL AND PHYSICAL
SCIENCES

**CENTRE FOR BIOTECHNOLOGY AND
BIOINFORMATICS (CEBIB)**

ANNUAL REPORT, 2012/2013

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UNIVERSITY OF NAIROBI
COLLEGE OF BIOLOGICAL AND PHYSICAL SCIENCES
CENTRE FOR BIOTECHNOLOGY AND BIOINFORMATICS (CEBIB)

ANNUAL REPORT, 2012/2013

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.



Prof. James Ochanda, Director

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

To support research and teaching, the centre endeavors to source research and development grants. Current donors include USAID, Denver Foundation, as well as sub-awards from the National Council for Science Technology and other institutions. This has enabled the centre to implement a nationwide Biotechnology Outreach Programme for the Agriculture Sector through workshops, hands-on training, professional meetings and conferences for stakeholders in the Biotech sector. Research and teaching at the centre are implemented by academic staff from the College of Biological and Physical Sciences, College of Agriculture and Veterinary Sciences, and College of Health Sciences, as well as collaborating institutions.



Part of CEBIB office and Labs

Student enrolment per year has continued to improve steadily over the years. The centre currently has a total student population of 48. CEBIB admissions are gender sensitive, with student numbers remaining nearly equal by gender, indicating the Centre's emphasis on the role of women in research and development. The Centre established an Academic Board to provide oversight and manage an expanding Academic and Research Programme, consistent with the University strategy of enhancing Biotechnology growth and development in Kenya and the entire region.

STUDENT ENROLMENT

CEBIB has continuously grown in enrollment of National students and a number of others from the African region, translating into increased cumulative income to the University. The increase in applications may indicate the confidence the public has in the programme as well as relevance of skills in Biotechnology and Bioinformatics in the industry. Indeed, some of the students are sponsored by government departments and Development agencies such as DAAD.

CEBIB admissions have taken a gender sensitive dimension with student numbers remaining nearly equal by gender, indicating the Centre's emphasis on the role of women in research and development. The high enrolments and accrued fees supplement other financial support for teaching research.

All enrolments by programme and gender, and revenue collected as fees in five academic years													
PROGRAMME	2007/2008		2008/2009		2009/2010		2010/2011		2011/2012		2012/2013		TOTAL
	M	F	M	M	M	M	M	F	M	F	M	F	
MSc	5	3	4	5	4	4	5	6	4	4	3	1	48
PhD	0	0	0	0	0	0	0	2	0	3	1	5	11
TOTAL	5	3	4	5	4	4	5	8	4	7	4	6	54
INCOME (KSHS)	6,048,000		6,804,000		6,048,000		6,012,000		6,372,000		7,468,000		38,752,000

INTERNATIONAL STUDENTS: Apart from national students, the Centre has International enrollment which currently has students from Rwanda. Mr. Jean Pierre Musabyimana is sponsored for his MSc in Biotechnology (health option) study by the Government of Rwanda.

GADUATES AND ALUMNI OF THE CENTRE

CEBIB graduated the first postgraduate student with an MSc in Bioinformatics from a Kenyan University in 2010. One other student who undertook her research at the centre was awarded an MSc in Health Biotechnology in 2009. Since then CEBIB has continued to graduate students annually as indicated below.

Year	2008/2009		2009/2010		2010/2011		2011/2012		
Gender	M	F	M	F	M	F	M	F	Total
Master of Science	0	1	1	0	2	1	3	1	9
Doctor of Philosophy	0	0	0	0	0	0	1	0	1

CAREER DEVELOPMENT PROSPECTS

CEBIB continues to build and strengthen its capacity to establish an attractive career path for emerging young scientists. The fates of the first two graduates of CEBIB have indicated a promising career path: A recent Bioinformatics MSc graduate (December 2010) has been offered two PhD positions in University of Pretoria, South Africa, and University of Queensland, Australia, while the other has enrolled into a PhD programme with the Centre.

Further, CEBIB has an internship programme where interns are encouraged to follow a career in research and have the opportunity to join the centre through applying for schemes advertised at the Centre or taking up a Masters and PhD programmes. One of the centre's former (2010) interns is now employed at the KEMRI Kilifi research programme, another was awarded scholarship to study in the UK, while two have now enrolled into MSc programme in Biotechnology, indicating that the programme is meeting its objectives and interns are taking a career path. The centre is currently putting in place a career structure that allows for full time researchers and research with lectureship positions so as to attract young local and international Kenyan researchers into a career in research.

DEGREE PROGRAMMES

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

Bioinformatics

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

Health & Environmental Biotechnology

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

Industrial & Environmental Biotechnology

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

The above highlighted a sample of courses offered at CEBIB

RESEARCH ACTIVITIES

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. Currently, students are involved in the following research projects:

RESEARCHER	AREA OF RESEARCH	RESEARCH TOPIC	SUPERVISORS	STATUS
Graduate Fellow (PhD) Kennedy Muinamia UON-Reg I80/9276/2005	Health Biotechnology	<i>Isolation of dynein light and determination of their potential as schistosoma vaccine candidates</i>	Prof. J.O. Ochanda (CEBIB-UON) Dr. E. Nguu (Dept. of Biochemistry) Prof. C. Omwandho (Dept of Biochem)	Research ongoing
Graduate Fellow (PhD) Dorcas Lusweti UoN – Reg J80/8729/2005 (ANP)	Genetics and Aquatic Management	<i>Using quantitative and DNA data to delineate management units and trace species origin for Nile perch of Lake Victoria, Kenya</i>	Dr. Joel W. Ochieng (CAVS- UoN) Dr. PK Kinyanjui (Biochemistry, UoN) Dr. Joyce Maina (ANP, UoN)	Thesis Preparation
Graduate Fellow (PhD) Bethwell Onyango Owuor UoN – Reg I80/7687/2006	Biotechnology (Ethnobotany)	<i>Usage consensus guided bioactivity exploration of and Luo and Abakuria ethnopharmacopoeias.</i>	Prof. J.O. Ochanda (CEBIB, UON) Prof. J. Kokwaro (SBS, UON) Prof. Bhutt (Chemistry, UON)	Graduated (2012)
Graduate Fellow (PhD) Mrs. Imelda Muramba Juma UoN – Reg I80/80017/2007	Bio-control and Agricultural Biotechnology	<i>Management of pythium species using Soil amendments and Biological control methods</i>	Dr. S. Okoth (SBS, UON) Prof. J.O. Ochanda (CEBIB, UON)	Research ongoing
Graduate Fellow (PhD) Hellen Ogot UoN – Reg I80/81281/2009	Bio-control and Agricultural Biotechnology	<i>Screening of Kenya Soybean cultivars for resistance to various races of Phakopsora pacryrhizi (oybean rust) and determination of molecular basis for rust resistance</i>	Prof James Ochanda (CEBIB- UoN) Dr. Sheila Okoth (SBS- UON) Dr. Mabel Makasi (KARI)	Data Collection and analysis
Graduate Fellow (PhD) Ms. Cesily K. Meeme UoN – Reg I80/80083/2010	Health Biotechnology HIV/ AIDS	<i>Evaluation of Drug Resistance Profiles and Viral Characteristics in HIV-1 Non-subtype B Virus in Patients Receiving and Failing Antiretroviral Therapy.</i>	Prof. J.O. Ochanda, (CEBIB, UON) Dr. Maritim Songok (KEMRI) Dr. Blake Ball (University of Manitoba)	Data collection and Analysis
Graduate Fellow (PhD) Phanice Kheseli Otieno	Bio-control and Agriculture Biotechnology	<i>Field and post harvest control of aflatoxin fungi and larger grain borer in maize using native bacillus thuringiensis and its products</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Okoth, SBS, UON	Proposal development
Graduate Fellow (PhD) Irene Adhiambo Onyango	Health Biotechnology (HIV / AIDS)	<i>The Role of Innate Immune factors in susceptibility to HIV-1 in cohort of HIV-1 highly exposed seronegative (HESN) individuals from majengo cohort Nairobi, Kenya</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. Blake Ball, University of Manitoba;	Proposal development
Graduate Fellow (PhD) Rachel Akinyi Okeyo	Agriculture Biotechnology	<i>Genetic improvement of vigna unguiculata (cow pea) foe enhancement of drought tolerance through tissue culture and agrobacterium mediated transformation</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. Njoroge, SBS, UON Dr. Amugune, SBS, UON	Proposal development
Graduate Fellow (PhD) Bosire Carren Moraa	Agriculture Biotechnology	<i>Isolation and characterization of lignocellulose biodrading enzymes from marine wood-borers: potential in bio-ethanol production</i>	Prof. J.O. Ochanda, CEBIB, UON; prof. L. Abubakar, Biochem, UON Dr. J. Bosire, KMFRI	Data collection

Graduate Fellow (PhD) Josephine W. Kimani UON-Reg. (I80/82781/2012)		<i>Development of dromedary antibody-based immunoassay for detection of Chikungunya virus infections</i>	Prof. F.J. Mulaa, Biochemistry Dept., UON; Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Osanjo, CHS-UON	Data collection
Graduate Fellow (PhD) Langat Kibet Bernard		<i>Characterization of prevailing hepatitis viruses and correlation of hepatitis B vaccine efficacy in Western Kenya</i>	Dr. E.K. Muge, Biochem-UON Dr. E.M. Songok, KMRI DR. F. Okoth, KMRI	Data collection
Graduate Fellow (MSc) Mr. Paul Visendi UoN – Reg I56/9273/2005	Bioinformatics	<i>TparvaDB: A database to support Theileria parva vaccine development</i>	Dr. W. Ng'ang'a, SCI, UON Dr. Ettieue de Villers, ILRI; Prof. J.O. Ochanda, CEBIB, UON,	Graduated (2010)
Graduate Fellow (MSc) Mr. Dickson Bennet Kinyanyi UoN – Reg I56/9274/2005	Bioinformatics	<i>Protein Structure Prediction on a Genomic Scale: Application to the African Swine Fever Virus Genome.</i>	Dr. Ettieue de Villers, ILRI; Prof. J.O. Ochanda, CEBIB, UON, Dr. W. Ng'ang'a, SCI, UON	Research ongoing
Graduate Fellow (MSc) Ms. Winnie Apidi UoN – Reg I56/9275/2005	Health Biotechnology (HIV/ AIDS)	<i>Expression analysis by quantitative real time Polymerase Chain Reaction (PCR) of genes associated with resistance to HIV-1 infection in highly exposed uninfected commercial sex workers in Pumwani Sex Worker Cohort</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. Martim Songok, KEMRI; Dr. Blake Ball, University of Manitoba	Graduated (2009)
Graduate Fellow (MSc) Mr. Johnstone Otieno Omia UoN – Reg I56/P/9282/2005	Genetics and Animal Biotechnology	<i>Genome Sequence Determination of Nairobi Sheep Disease Virus to Underpin Vaccine Development</i>	Prof. F.J. Mulaa, Biochemistry Dept., UON; Dr. W. Bullimo, Biochemistry Dept., UON	Research ongoing
Graduate Fellow (MSc) Mr. John Njoroge Mwangi UoN – Reg I56/9284/2005	Genetics and Plant Biotechnology	<i>Genetic Structure analysis of wild rice populations (Oryza longistaminata) from Kwale District of Kenya using microsatellite markers.</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Kiboi, SBS, UON	Graduated (2011)
Graduate Fellow (MSc) Ms. Jane Akinyi Otado UoN – Reg I56/7651/2006	Bio-control and Plant Biotechnology	<i>Virulence Efficacy of Local Trichoderma Isolates as Biocontrol Agent (BCA) on Soil Pathogenic Fungi Embu Benchmark Site, Kenya.</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Okoth, SBS, UON; Dr. V. Ochieng, Biochemistry Dept., UON	Thesis Preparation
Graduate Fellow (MSc) Phanice Kheseli Otieno UoN – Reg I578/70401/2007 (SBS)	Bio-control and Agriculture Biotechnology	<i>Isolation, Characterization and Evaluation of Potency of Native Bacillus Thuringiensis against major Maize Borers and Mycotoxin producing Fungi.</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Okoth, SBS, UON	Graduated (2010)
Graduate Fellow (MSc) Irene Adhiambo Onyango UoN – Reg I56/70808/2007	Health Biotechnology (HIV / AIDS)	<i>Innate Mucosal Immune Response to Live Attenuated Influenza Vaccine among Highly Exposed uninfected Commercial Sex Workers</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. Blake Ball, University of Manitoba; Dr. Adrienne Meyers, University of Manitoba	Graduated (2011)
Graduate Fellow (MSc) Dennis Odhiambo UoN – Reg J56/71046/2007(ANP)	Genetics and Animal Biotechnology	<i>Determining gene flow patterns and genetic diversity in the endangered Grevy's zebra to elucidate the impacts of climate change</i>	Dr. Joel W. Ochieng (CEBIB- UoN) Dr. Brenda Larison (University of Colorado) Dr. Siva Sundaresan (Denver Foundation)	Data Collection

Graduate Fellow (MSc) Hellen Butungi I56/71340/2007	Bioinformatics	<i>Research and development of most recent common ancestor estimation strategies for pathogen profiling pipeline</i>	Prof. J.O. Ochanda (CEBIB, UON) Dr. Wanyoike Nganga (SCI –UON) Dr.Garry Domselaar (Uni of Manitoba) Dr.Ettiende deவில்லர் (ILRI)	Graduated (2012)
Graduate Fellow (MSc) Grace Mukiri Mariene UoN – Reg I56/71795/2008	Bioinformatics	<i>Testing ascertainment bias and RNA secondary structure morphometrics as phylogenetic signals</i>	Dr. Joel W. Ochieng (CEBIB- UoN) Dr. Anne Wangombe (SoM, UoN) Prof. J.O. Ochanda (CEBIB, UON)	Thesis Preparation
Graduate Fellow (MSc) Waititu Samwel Mwangi I56/71970/2008	Animal Biotechnology	<i>Application of Enzyme technology to improve the nutritive value of high fibre feedstuffs of non-ruminants</i>	Prof. J.O. Ochanda (CEBIB, UON) Dr. Joyce G Maina (CAVS) Prof. C.M. Nyachoti (Uni of Manitoba)	Graduated (2011)
Graduate Fellow (MSc) Rosaline 7238671970/2008	Bioinformatics	<i>An improved method for assigning operational taxonomic units for metagenomic experiments</i>	Dr. P. Mireji (Egerton University) Prof. J.O. Ochanda (CEBIB, UON) Dr. Gary Van Domselaar (National Microbiology Laboratory)	Graduated 2012
Graduate Fellow (MSc) Melvin Atieno Obuya UoN – Reg I56/76462/2009	Genetics and Aquatic Management	<i>Investigation of genetic structure and evidence of intrinsic reproductive barriers and speciation in Tilapia of L. Baringo</i>	Dr. Joel W. Ochieng (CEBIB- UoN) Prof. Bonie Dunbar (CEBIB- UoN) Prof James Ochanda (CEBIB- UoN)	Thesis Preparation
Graduate Fellow (MSc) Rosevalentine Bosire UoN – Reg I56/76712/2009	Genetics and Aquatic Management	<i>Evaluation of Duckweed as an alternative source of omega-3 fatty acids for aquaculture</i>	Prof. Bonie Dunbar (CEBIB- UoN) Prof. F.J. Mulaa (Biochem, UoN) Prof J.O. Ochanda (CEBIB- UoN)	Graduated (2012)
Graduate Fellow (MSc) Judith Oloo UON-Reg I56/75853/2009		<i>Evaluation of local trichoderma isolates for their efficiency in biological control of fusarium oxysporum f.sp phaseoli</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Okoth, SBS, UON	Thesis Examination
Graduate Fellow (MSc) Charles Mazereku UON-Reg I56/76655/2009		<i>Evaluation of Trichoderma enhanced fertilizers on growth of common beans (Phaseolus vulgaris L.)</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Okoth, SBS, UON, Dr. Joseph Mwafaida Mghalu (Pwani Univ.)	Graduated (2012)
Graduate Fellow (MSc) Wilberforce Zachary Ouma UON-Reg I56/77774/2009		<i>Source of Unaligned ChIP-seq Short Sequence Reads</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. Erich Grotewold, Ohio Univ Dr. L. Isabella Oyier, CEBIB	Awaiting Letter of Award
Graduate Fellow (MSc) Akello Sundy UON-Reg I56/78407/2009		<i>Characterization of native bacillus thuringiensis delta-endotoxin active against prostephanus truncates and fusarium verticillioides</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. S. Okoth, SBS, UON, Dr. V. Wang'ondy (SBS)	Thesis Examination
Graduate Fellow (MSc) Semeer R.J. Patel UON-Reg I56/74922/2009		<i>Optimization for production of fish protein hydrolysate from Nile perch (Lates niloticus) by-products</i>	Prof. F.J. Mulaa, Biochem-UON Prof. J.O. Ochanda, CEBIB, UON; Dr. B. Mbatia, KPU	Data collection

Graduate Fellow (MSc) Nduta Mwangi UON-Reg I56/63485/2010		<i>Loop mediated isothermal amplification for drinking water analysis</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. D. Masiga, ICIPE	Data collection
Graduate Fellow (MSc) Omedo Irene Akinyi UON-Reg I56/64991/2010		<i>Characterization of Erythrocyte Receptor polymorphisms in a Malaria Endemic Population in Kilifi, Kenya</i>	Prof. J.O. Ochanda, CEBIB, UON; Dr. V.O. Ochieng, UON Dr. L. Isabella Oyier, CEBIB	Thesis Preparation
Graduate Fellow (MSc) Irene Njeri Githinji UON-Reg I56/65000/2010		<i>Screening and Isolation of organochlorine pesticide degrading microorganisms and their genes from contaminated environments</i>	Dr. B.M. Wamalwa, Chem.-UON Dr. E.K. Muge, Biochem.-UON	Data collection
Graduate Fellow (MSc) Milugo Trizah Koyi UON-Reg I56/64074/2010		<i>Anti-tumor properties of some selected medicinal Plants from Kenya</i>	Dr. L. Kerubo, Chem-UON Dr. F. Wamunyokoli, JKUAT Prof. J.O. Ochanda, CEBIB, UON	Data collection
Graduate Fellow (MSc) David Kiliko Kiuluku UON-Reg I56/61002/2010		<i>Development of mycobacterium tuberculosis ribosomal RNA (rRNA) as a possible drug target</i>	Prof. F.J. Mulaa, Biochem-UON Dr. B. Mbatia, KPU	Thesis preparation
Graduate Fellow (MSc) Awino Maureiq Edith UON-Reg I56/64134/2010		<i>In silico identification of universal HLA stimulating B cell and T-cell restricted mage epitopes for vaccine development</i>	Prof. A. Dormer, Wsshington Adventist Univ. Prof. J.O. Ochanda, CEBIB, UON;	Data collection

SHORT TERM TRAINING

Deploying Biotechnology and Bioinformatics to enhance food security, betterment of health, industrial production and environmental management requires knowledgeable human resource. Hence there is a need to invest in programmes that create and apply relevant knowledge, strengthen skills and enhance attitudes of researchers and academic in the applications of Biotechnology and Bioinformatics. CEBIB undertakes to strengthen both human and institutional capacity through group trainings on application oriented hands-on Biotechnology and Bioinformatics program held twice a year, with the first of such training having been held early 2010. The training, which takes between 5 days and 2 weeks, draws participants from other African countries, National Agricultural Research systems, Universities, International Research Institutes, Government sectors, Private research and service laboratories, and individuals.

INTERNSHIPS

CEBIB aims to strengthen research capability of next-generation researchers by availing a functioning, well-equipped and well-staffed facility for conducting high quality research locally, transfer of technology and knowledge, as well as providing established national and international collaborative links. Interns are encouraged to follow a career in research and have the opportunity to join the centre through applying for schemes advertised at the Centre or taking up a Masters and PhD programmes.

Interns	University of Lubeck, Germany	Moi University	Egerton University	Kenyatta University	Jomo Kenyatta University	Maseno University	University of Nairobi
National		4	1	2	1	3	2
International	1						

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. Currently, the centre holds over 10 million shillings both in grants and in kind from various agencies. Some of the institutions and organizations providing support for CEBIB research are tabulated below:

AGENCIES AND INSTITUTIONS SUPPORTING CEBIB RESEARCH/OUTREACH ACTIVITIES	NO OF STUDENTS SUPPORTED
USAID KENYA (Biotech Outreach Programme)	1
UNIVERSITY OF MANITOBA, CANADA	6
BILL AND MELINDA GATES PROJECT	2
NATIONAL COUNCIL OF SCIENCE& TECHNOLOGY	2 students & 2 staff
DAAD SCHOLARSHIP	3
AFRICA BIOMEDICAL CENTRE (ABC)	1
OMEGA FARMS	2
PHAC & WORLD FEDERATION	1

MINISTRY OF AGRICULTURE, GOVERNMENT OF KENYA	2
GOVERNMENT OF BOTSWANA	1
DENVER FOUNDATION, USA	2
FARMCHEM COMPANY	1
CATHOLIC UNIVERSITY OF EAST AFRICA	1
UNIVERSITY OF NAIROBI	3

USAID SUPPORTED BIOTECHNOLOGY OUTREACH PROGRAMME

As most parts of the world adopt genetically modified products, there remains uncertainty, confusion and resistance to the technology in many parts of Africa, mainly due to low knowledge levels among citizenry, deliberate misinformation by anti-biotech groups and lack of exposure of the actual benefits of GM commercial crops. To address this problem, USAID Kenya has funded a project (USAID/KENYA Strategic Agricultural Biotechnology Outreach Support Programme - SO No 615 - 0007- 01), to create public knowledge and awareness in Biotechnology in Kenya. This National programme is implemented at the Centre for Biotechnology and Bioinformatics.

The goal of the biotechnology outreach programme is to create an enabling environment for biotechnology research and development, adoption and enhanced agriculture in Kenya through improved knowledge and awareness in biotechnology and biosafety, with the following objectives:

- (i) Improve knowledge in biotechnology and biosafety among stakeholders
- (ii) To enhance balanced reporting on biotechnology and biosafety in electronic and printed media
- (iii) To enhance knowledge in biotechnology and biosafety among key policy advisors and decision makers

Date	Region	Venue	Target group	No of Participants
13 th to 14 th January 2012	Lower Eastern	Machakos	Farmers, agric extension staff, consumer networks, NGOs, CBOs	77
20 th to 21 st January 2012	North Rift	Kitale	Farmers, agric extension staff, consumer networks, NGOs, CBOs	73
27 th to 28 th January 2012	North Nyanza	Kisumu	Farmers, agric extension staff, consumer networks, NGOs, CBOs	61

COLLABORATION AND INTERNATIONAL LINKS

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:

INSTITUTION	KIND OF LINK	BENEFIT TO UON	No of Students trained
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

RECENT HIGH PROFILE GUESTS OF THE CENTRE AND OTHER ACADEMIC ACTIVITIES BY CEBIB STAFF

CEBIB has hosted a number of high profile visitors in recent times, including

1. Dr. Kedest T. Hancock from the Global Competitive Grant Challenges Program of the Bill & Melinda Gates Foundation on August 2, 2011.
2. Dr. Hulda Swai from Council for Science & Industrial Research (CSIR) – South Africa, on August 18, 2011
3. Dr. Sarah Schaack from Lewis & Clark College of Howard Hughes Medical Institute, USA on June 18-July 2, 2011.
4. Dr. Isabella Oyier from KEMRI-Wellcome Trust (KWT) Collaborative Programme, Kilifi. Dr Oyier joined the CEBIB faculty as a visiting lecturer from KEMRI-Wellcome Trust (KWT) Collaborative Programme, Kilifi, on October 2011, where she is a post-doctoral scientist. Her research interest is on genetic variation of the malaria parasite, *Plasmodium falciparum*; with a focus on the polymorphisms found in merozoite genes, which are involved in the invasion of the host's erythrocytes and evasion of the immune system. She joined CEBIB under an MOU between the university and KWT to develop a research laboratory, while at CEBIB her role is to oversee the students' research activities and manage the laboratories.
5. Prof Stephen Isaacs, Chairman and CEO, ADURO BIOTECH visited Cebib. The visit was facilitated by the Kenya National Academy of Sciences (KNAS) in **July 2012**. Prior to Aduro, Prof. Isaacs was founder (1991), President and CEO of Cerus Corporation (NASD: CERS), a biomedical products company commercializing the Intercept Blood Systems. He is a renowned international expert in psoralen photochemistry
6. **Professor Klaas van 't Riet**, Professor Emeritus of Process Engineering in Wageningen and of Bio Product Design at Delft, Netherlands on the 14th **November 2012**. The renowned academic and industrial consultant gave a stimulating presentation at Cebib's Seminar Room. The title of the lecture was; **Mixing and Mass Transfer in Stirred and Non Stirred Production Bioreactors**. The visit by Prof, funded by the European Union and was facilitated through **real IPM Company ltd**
7. Dr George Obiero attended a Biogas sub-committee meeting on standardization of bioenergy as a technical member of the technical sub-committee of the Kenya bureau of standards IN 9TH October 2012

8. Dr George Obiero invited to the school of Chemical and Minerals Engineering, NWU University, South Africa from the 24th September to 2nd October 2012. Gave lecturers on Bioreactors and Bioprocessing to post graduate students.

RECENT PUBLICATIONS AND THESIS TITLES

Researchers at the Centre for Biotechnology and Bioinformatics are involved in high quality and high impact research both at CEBIB laboratories in Chiromo and in collaborating and affiliated institutions, resulting in publications in high impact journals. The following are recent publications made last year alone:

1. Paul Visendi, et al. TPARVADB: A public Resource for Housing and Analyzing Genomic Data Extracted from *Theileria Parva* and other Apicomplexan Species to Facilitate Vaccine and Diagnostic Development.
2. Ochieng, et al. Genetic Structure of Hartbeest populations straddling a transition zone between Morphotypes. J. Basic Appl. Sci. Res. 2011 1 (3) : 131-149.
3. F.J. Mulaa. Biosensors in : Handbook of food safety engineering – 2011
4. F.J. Mulaa. Enrichment of PUFA in Nile perch free fatty acids by selective enzymatic esterification and subsequent analysis using HPLC-ELSD – 2011. European Journal of Lipid Science and Technology.
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6. F.J. Mulaa. The 'Lipo Yeasts' project: using the oleaginous yeast *yarrowia lipolytica* in combination with specific bacterial genes for the bioconversion of lipids, fats and oils into high-value products – 2011. Microbial Biotechnology. 1751-7915.
7. Innate immune response among HIV-1 highly exposed sero-negative (HESN) individuals to live attenuated influenza vaccine as a model for mucosal viral infection. MSc thesis by Ms. Irene Adhiambo Onyango.
8. Prof. J.O. Ochanda and Dr. J. Ochieng attended and presented a conference paper on “ Towards National Implementation of Biosafety and Biotechnology Regulations in Agricultural sector” on March 10-12, 2011 - Nakuru.
9. *Application of Enzyme technology to improve the nutritive value of high fibre feedstuffs of non-ruminants. MSc Thesis by Waititu Samwel Mwangi*
10. *Innate Mucosal Immune Response to Live Attenuated Influenza Vaccine among Highly Exposed uninfected Commercial Sex Workers. MSc Thesis by Irene Adhiambo Onyango*
11. Genetic structure analysis of wild rice populations (*Oryza Longistaminata*) from Kwale District of Kenya using Microsatellite Markers. MSc Thesis by Mr. John Njoroge Mwangi

Papers presented in conferences and other academic fora

	Staff Name	Title of the Paper	Conference	Date
1	Dr. G.O. Osanjo	Adherence to anti-tuberculosis treatment among paediatric patients at Kenyatta National Hospital	1 st International Scientific Conference	2011
2	Dr. G.O. Osanjo	Characteristics of study proposals at the Kenyatta National Hospital and College of Health Sciences	1 st International Scientific Conference	2011
3	Dr. G.O. Osanjo	Carbohydrate-active enzymes (Cazymes) as drug targets and tools for synthesis of medicinal compounds	1 st International Scientific Conference	2011
4	Prof. F.J. Mulaa			
5	Dr. G.O. Osanjo	Recovery of carotenoids from microorganisms using edible vegetable oils	1 st International Scientific Conference	15-17 June, 2011
6	Prof. F.J. Mulaa			
7	Dr. G.O. Osanjo	Identification and characterization of the microbial contaminants of Herbal Medicines in Kenya	1 st International Scientific Conference	2011
8	Ochieng, J.W.	Gene mapping in plant species complexes. In: Biotechnology (2) Ed. Agbo, E.C. Intech, ISBN 979-953-307-671-2 in press.		2011
9	Joel W. Ochieng,	Prospects for transgenic and molecular breeding for cold tolerance in Canola (<i>Brassica napus</i>). Biotechnology (3) Ed. Agbo, E.C. Intech, ISBN 979-953-307-671-3 in press.		2011

FUTURE PROSPECTS

CEBIB, The University of Nairobi and Academic institutions in general, are moving into a challenging future but with remarkable prospects. Particularly in Sub-Saharan Africa, the agricultural sector, particularly conventional farming is challenged by unreliable rainfall patterns resulting into intermittent droughts and famine, while the health sector struggles to contain emergent health problems such as the ravaging AIDS pandemic. CEBIB has positioned itself with strategies that will see an upscale of its operations to contribute in finding solutions to some of these problems.

Academic Programme expansion: The centre will expand its programmes to address specific needs, and this appears possible with the high student enrolment seen in the last few years. It is hoped that the student numbers will continue to increase in response to forces in the job market as well as needs in the society to provide solutions in health, agriculture and environmental management. The centre's response to these needs will contribute to the realization of the Millennium Development Goals (MDG) as well as the country's Vision 2030.

Strengthening of Research Programmes: In line with expansion of academic programmes research areas will be strengthened to provide solutions to local problems in health, agriculture and environmental management. Research staff and collaborators will source for new grants to support research and to provide scholarships/fellowships to next generation scholars. New collaborations and links will enhance technology transfer and increase the bargaining power of centre staff in grant applications.

Infrastructure Upgrade: An expanded academic programme and research themes will require improved physical and academic infrastructure. CEBIB will endeavor to provide the needed expansion to accommodate emerging research teams and laboratories. The laboratories will be upgraded to accommodate new research areas as well as improvement in their ability to house classified operations (PC 2 and PC3 facilities).

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