

Building science leadership in Africa

biosciences
eastern and central africa



NEPAD Planning and Coordinating Agency
Agence de Planification et de Coordination du NEPAD

INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE

Biosciences eastern and central Africa 2012 annual letter

Dear Friends,

It gives me great pleasure to share with you the exciting progress made in 2012 by the BecA-ILRI Hub and our partners. Thanks to the support from our devoted partners and investors, we have again made great strides in expanding research for Africa's agricultural development, our capacity development activities are building and empowering African science leaders and institutions, and our research related services cater to the region and beyond.



The year 2012 marked a decade of the BecA-ILRI Hub's existence. To ensure that we capitalize on our successes and lessons learned for the benefit of African agriculture, we've started to refresh our business plan. The new plan outlines our strategies to adapt to the changes in the CGIAR Consortium and to strengthen our alignment to the regional research priorities identified in the African Union-New Partnership for Africa's Development (AU-NEPAD) Science and Technology Strategy and the Comprehensive African Agricultural Productivity Programme (CAADP).

The BecA-ILRI Hub (hereafter referred to as the Hub) has continued to find ways of working more closely with our African and international partners. We have expanded our research activities to include more collaborative and national partner-led research projects and added new capacity building activities. The year 2012 saw the formulation of new research programs under a partnership with Sweden. The support from the Swedish Ministry for Foreign Affairs through the Swedish International Development Agency (Sida) is focused on tackling food security issues. With additional funding received from Sweden in November 2012, we have begun a project that focuses on developing climate-smart grasses for improved livestock productivity. In response to feedback from national partners obtained during our visits to laboratories in the region, we have introduced a new

About the BecA-ILRI Hub

Located at and managed by ILRI in Nairobi, Kenya, the BecA-ILRI Hub provides a common biosciences research platform, research-related services and capacity building opportunities in Africa. The Hub increases access to affordable, world-class research facilities, while creating and strengthening human resources in biosciences and related disciplines. These activities focus on addressing key constraints in African agriculture.

The Hub is developed as one of four biosciences centres for excellence that are part of the African Union-New Partnership for Africa's Development (AU-NEPAD) African Biosciences Initiative. It has been created under the Comprehensive African Agricultural Productivity Programme (CAADP) to service the needs of countries in eastern and central Africa. CAADP's goal is to support agriculture-led development that eliminates hunger and reduces poverty and food insecurity, generating agricultural growth.



Outgoing BecA-ILRI Hub Director, Seget Kelemu, receives a gift from the Hub's interim Director Appolinaire Djikeng. (photo credit: BecA-ILRI/Ethel Makila)

annual training workshop; Introduction to Principles in Laboratory Management and Equipment Operations. This course brings together BecA scientists, biotechnology private sector trainers and ILRI engineers to train partners on overcoming operational gaps that exist in managing research facilities in Africa.

BecA in numbers for 2012

Funds raised: USD 7,330,233

Income generated USD 1,842,721

African research fellows: 65 from 15 countries

Training workshops: 5 with 171 participants from 12 countries

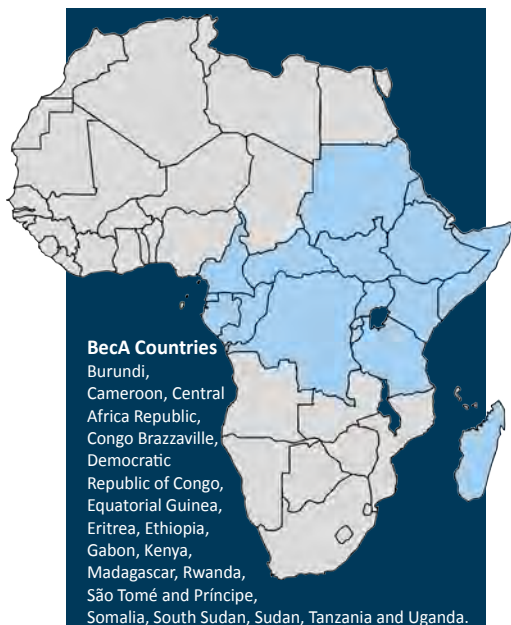
Research services provided to 62 institutions in 20 African and non-African countries and 9 international research institutions

Core staff: 44

Affiliated scientists / technical staff: 58

Seminars: 57

Visitors to the Hub: over 450



Who funds Beca?

The Hub owes its existence primarily to the significant financial contribution from the Government of Canada through the Canadian International Development Agency (CIDA), the visionary support of the AU-NEPAD and the core donors of ILRI. CIDA supported renovation of existing laboratories and construction of new facilities, helping us better accommodate the needs of the region. The Syngenta Foundation for Sustainable Agriculture (SFSA), a long-time supporter of the Hub, is providing substantial financial and technical support critical to our sustainability.

We are also grateful for substantial financial support from AusAID through the partnership with CSIRO; the Bill & Melinda Gates Foundation (BMGF); the Swedish Ministry for Foreign Affairs; Sida; the Government of Kenya and many others who have supported our partners and students. With the help of our key partners and investors, the Hub continues to grow as a focal point for the African agricultural biosciences research community and their global partners.

Additional supporters in 2012 have included the United Nations Educational Scientific and Cultural Organisation (UNESCO), African Women in Agricultural Research and Development (AWARD), Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and Helica Instruments Ltd.

Last year also saw the departure of the Hub Director, Dr Segenet Kelemu, who led the team since 2007. Her visionary leadership, dedication to the promise of African biosciences and unwavering passion to inspire African scientists and their partners to great achievement is appreciated and will be dearly missed. Segenet has taken on a new role at the Alliance for a Green Revolution in Africa (AGRA) as Vice President-Programs, while the Hub team continues to provide an environment that fuels optimism and enthusiasm, inspiring researchers to dream and act on the scale necessary to help usher in the coming African agricultural revolution.

As we continue to work for the advancement of African agriculture with our regional partners, farmers, private sector and governments, we hope you enjoy this highlight of our collective achievements from 2012.

Beca-CSIRO partnership

Funded by the Australian Agency for International Development (AusAID), the partnership between the Hub and Australia's National Science Agency, Commonwealth Scientific and Industrial Research Organisation (CSIRO) supports a program of biosciences research focused on enhancing food security through nutrition via improved quality of foods, food safety, and better management of animal diseases in sub-Saharan Africa.

Research focus

The project portfolio consists of seven projects that bring together scientists from 10 countries in Africa as well as Australia, USA, France, Sweden, Scotland and Spain. Three projects, Cavies, Mushrooms and Amaranth, are led by African partners in Cameroon, Tanzania and Kenya, respectively. All projects have engaged a broad network of stakeholders from disciplines outside the core bioscience component, including regional agencies such as the African Union's - Inter African Bureau for Animal Resources (AU-IBAR); smallholder agribusiness enterprises; farmers and farming cooperatives; national seed traders; national veterinary officers; government ministries; CGIAR centres; National Agricultural Research Institutes (NARIs); African universities; NGOs and others.

Leading Australian scientists are key collaborators in these projects. They include researchers from CSIRO and other Australian institutions with core skills ranging from bioscience, biometrics, food processing, analytical chemistry, biosensors, human nutrition, farming/ecological modelling and social science. CSIRO is also contributing invaluable communication and stakeholder engagement expertise



A blood sample is taken from a pig during a field survey by the African swine fever project team in Busia, western Kenya. (photo credit: CSIRO/Larelle McMillan)



Amaranth project leader Dr Daniel Sila (left) from the Jomo Kenyatta University of Agricultural Technology (JKUAT), Kenya, shows Australian Beca-CSIRO partnership project reviewers the different varieties of amaranth in the university demonstration plot (photo credit: Beca-ILRI/Ethel Makila).

to assist projects to capitalize on opportunities for exposure and increased impact for resource-poor farmers and other stakeholders in Africa.

Highlights

- **Capacity and Action for Aflatoxin Reduction in Eastern Africa (CAAREA Project):** Food safety is an essential component of food security. Approximately 4.5 billion people in the developing world are chronically exposed to high levels of aflatoxins, a highly toxic fungal metabolite (generally termed mycotoxins) produced by species of *Aspergillus* fungi. Maize, a staple food for over 100 million people across eastern Africa, is highly prone to aflatoxin contamination. Aflatoxins cause cancer, and are associated with stunting of infants, immunosuppression, reduced nutrient absorption and are lethal at high doses. The CAAREA project, led by the Hub and involving a number of key partners from the region and internationally, is assessing the aflatoxin risks in maize in Kenya and Tanzania to fill the information gaps that exists on the pathogen, toxin prevalence and levels of maize resistance to fungal and aflatoxin accumulation pre-harvest. This information will help in the development of mitigation strategies including breeding for aflatoxin resistance by the Kenya Agricultural Research Institute (KARI) and Tanzania Agricultural Research Institute (ARI) national maize breeders who are leading the first aflatoxin resistance field trials in the region (supported by the Open University of Tanzania and other collaborators). The project team is also developing novel diagnostics to detect the toxin in the laboratory, in the field and at the mill, and is conducting modelling to produce risk maps. Together, these will contribute to the development



Cavy project leader Félix Meutchieye (standing centre) from the University of Dschang, Cameroon records cavy culture practices from farmers. These farmers have joined the cavy project Innovation Platform in Cameroon (photo credit: Idriss Gabriel Nyebe Mvogo).

of real-time tools for surveillance and detection of potential aflatoxin outbreaks in maize. The team has established regional mycotoxin research platforms (Biosafety level 2 mycology laboratory and diagnostics) and nutritional analysis platforms available to African national research programs and their partners. Through the project, the capacity of the Hub and CAAREA partner institutions is being significantly strengthened to tackle this largely unaddressed threat to human health and trade. The platform is already in use by researchers from several African countries and their international partners, including four fellows fully funded through the Africa Biosciences Challenge Fund (ABCF). Thanks to the platform, they are now able to conduct their research locally to address the spectre of mycotoxins in Africa. Other partners include CSIRO, University of Queensland/Queensland Alliance for Agriculture and Food Innovation (UQ/QAAFI), Tanzania Ministry of Agriculture and Food Security, HarvestChoice, the Queensland Department of Agriculture, Fisheries and Forestry (QDAFF), Cornell University and the University of Pretoria.

- **Adding nutrition to African diets through low cost sustainable processing of amaranth (Amaranth project):** In sub-Saharan Africa, many people are faced with severe food and nutrition insecurity. Amaranth, a traditional vegetable, is a vital source of macro/micro-nutrients and bioactive compounds of health benefits and offers low cost complementary nutrition for starchy staples. The amaranth project, led by the Jomo Kenyatta University of Agriculture and Technology (JKUAT) in Kenya, aims at addressing the main challenges to production, processing and marketing of amaranth in order to increase its consumption in eastern Africa.



Post doctoral scientist Benoit Gnonlonfin (seated) from the CAAREA project calibrating diagnostic equipment with CSIRO scientist Glen Fox. (photo credit:CSIRO/Larelle McMillan)



Hussein Juma (left) and Hussein Ibrahim study and collect mushrooms in Magamba forest, Tanzania. (photo credit: University of Dar es Salaam/Donatha Tibuhwa)

Other partners in the project include Sokoine University of Agriculture and AVRDC (The World Vegetable Center) in Tanzania and CSIRO in Australia. The project has established collaborations with a range of partners from private industry (especially in food processing), government agencies, NGOs and farmer groups. With the help of six graduate students, the project has conducted nutritional analysis of 26 amaranth varieties, and two leaf varieties have been selected for their superior nutritional properties, consumer taste preferences and suitability to agricultural conditions in the region.

- **Exploring opportunities for domestication of wild edible mushroom species in eastern Africa (Mushroom project):** Mushrooms are an important source of micro-nutrients that could be used to complement cereal diets for millions of people in eastern Africa. Domestication of wild mushrooms can provide year-round food with key nutrients and increase household incomes, particularly for women who are the main collectors and growers. The mushroom project, led by the University of Dar es Salaam in Tanzania, seeks to explore the potential for wild mushroom production by small holder farmers. Other partners include the University of Burundi, the

Kenya Industrial Research and Development Institute and CSIRO. Baseline studies to determine the genetic pool of wild mushrooms in Kenya, Burundi and Tanzania have been conducted and field collections obtained. Many of the collected species have been identified and two have been successfully cultivated. Work on optimal conditions for fruiting is ongoing with some promising results.

- **Improving protein and household income through better husbandry of domestic cavy (Cavies project):** Domestic cavy (Guinea Pigs) are a good quality meat source with high levels of protein. Cavy farming is a low input livestock development that has served as the only source of protein for Africans in conflict areas and has the potential to improve the lives of resource-poor people through income generation and improved nutrition. The cavies project led by the University of Dschang in Cameroon, is conducting baseline studies that are providing key information on cavy farming practices including cavies' diet, the role of gender, the economic and nutritional uses of cavies and the extent of farmer/community knowledge on cavies farming. Together with genetic diversity studies being conducted at the Hub, this information will contribute to improved cavy production, potentially improving the nutrition and income for smallholder farmers in Cameroon and DRC. Partners in the project include CSIRO; the Ministry of Livestock, Fisheries and Animal Industries (Support Programme for Non-Conventional Breeding and National Programme for the Improvement of Competitiveness of Family-run Farms), Cameroon; Institute of Agricultural Research for Development (IRDA); Farmer's Voice, International Center for Tropical Agriculture (CIAT); Université Evangelique en Afrique (UEA); Women for Women; Institut National de Recherche Agricole (INERA) and Vétérinaires Sans Frontières in the Democratic Republic of Congo (DRC).
- **Diagnostics, surveillance, epidemiology and control of African swine fever (ASF Project):** ASF is a devastating disease of pigs that causes enormous income losses to farmers, and pig/pork traders. The disease is highly contagious and causes up to 100% mortality in pig herds. The project, led by the ILRI Biosciences Theme, is aimed at better understanding the prevalence and spread of the ASF virus across countries in eastern Africa. A multidisciplinary team of social scientists and bioscientists are spread over the Uganda-Kenya border and have put together an essential field laboratory that enables sampling and rapid diagnosis of ASF in pig blood samples in the field. The team has also carried out surveys that will help in the understanding of the role of pig management in disease transmission in the study regions. Partners include CSIRO; Centro de Investigación en Sanidad Animal – Instituto Nacional de Investigación Agraria y Alimentaria (CISA-INIA), Spain; Department of Veterinary Services (DVS), Kenya; Laboratoire National Veterinaire, Cameroon; Makerere University, Ministry of Agricultural Industries and Fisheries in Uganda; Swedish Agricultural University (SLU), Sweden and the University of Edinburgh, Scotland.

- **Providing proof of concept for the development of an inactivated vaccine for Contagious Bovine Pleuro Pneumonia (CBPP project):** CBPP is a serious bacterial disease affecting cattle and water buffalo in sub-Saharan Africa. It is highly contagious with a mortality rate of up to 50 per cent in animals not previously exposed to the disease. The aim of the ILRI Biosciences Themed project is to develop improved vaccine delivery via the respiratory tract (inhaler). Partners in this project include CSIRO; Centre of Animal Biotechnology, the University of Melbourne; and KARI.
- **Developing a pan African strategy for the control of Peste de Petite Ruminant (PPR project):** PPR or small ruminant plague is a viral disease primarily affecting sheep and goats. It is a major threat to the livelihoods of smallholder farmers across Africa. Current PPR vaccines are not heat stable, which limits deployment in many areas where the disease occurs. Led by the ILRI Biotechnology Theme, this project has made progress towards thermo-stabilisation of the existing PPR vaccine. Attention is now turning to field testing and deployment strategies for successful scale out. Partners in this project are the AU-IBAR; KARI; National Veterinary Institute (NVI), Ethiopia; AU-Pan African Veterinary Vaccine Centre (AU-PANVAC); Global Alliance for Livestock Veterinary Medicines (GALVMed) and CSIRO.

Capacity building

The BecA-CSIRO partnership strongly supports bioscience innovation in the region through the establishment of and support for the competitive Africa Biosciences Challenge Fund fellowship program (described fully on page 8). The partnership has also delivered a new model of partnership in which Australian scientists directly contribute a range of experts to the Hub's research and training activities as significant project collaborators. To date, the Hub has benefited from the expertise of 26 Australian staff from CSIRO, UQ/QAAFI and QDAFF.

Looking forward

The third phase of the partnership presents an exciting opportunity to progress research and capacity building toward significant impact on the ground for farmers and communities throughout the region. This will be achieved through augmenting the strong, largely science-focused teams with additional partners including development agents, NGOs, the private sector and others.

BecA-Sweden partnership

In November 2011 the Hub received a SEK 40 million (USD 12 million) grant from the Swedish Ministry for Foreign Affairs through Sida. This funding supports a portfolio of research projects on crop and livestock improvement; provides core funding to support management of the Hub facilities and reinforces the development of new technology platforms and the ABCF fellowship program to provide fellowships, training courses and mentoring to visiting scientists and post-graduate students.

Research focus

The research portfolio under the BecA-Sweden partnership brings together scientists from many African countries, the United Kingdom, United States of America and France. It focuses on improving food and nutritional security across Africa by improving the productivity of a range of underutilized plant species and of livestock through improved health and breeding practices. The projects also encompass capacity building elements, to increase the knowledge and skills of researchers in African NARIs and universities to increase technical capability within the Hub and the region.

Harnessing genetic diversity for improved goat productivity

Goats are a significant component of the livelihood of smallholder farmers and pastoralists in Cameroon and Ethiopia. In this project, partners in both countries aim to increase goat productivity through strengthening the capacity of national



Crops in the green house at the BecA-ILRI Hub, Nairobi. (photo credit: BecA-ILRI/ Valerian Aloo).



Karin Andersson, Director for Regional Development Cooperation in Nairobi, Sida and Jimmy Smith, ILRI Director General, sign agreement documents for funding of research on climate-smart livestock feeds at ILRI campus, Nairobi. Looking on is Gity Behravan, First Secretary/Senior Science Advisor, Embassy of Sweden/Sida (photo credit: BecA-ILRI/ Valerian Aloo).



BecA-ILRI Hub research technician Mercy Macharia processes samples from a project developing diagnostics for Cassava mosaic disease. (photo credit: BecA-ILRI/Valerian Aloo)

goat breeding programs. This includes studying the goat diversity in these countries, knowledge of which is critical to empower breeders to develop better goats suited to resource-poor people; and developing ICT-based tools to support management decisions through the production chain. Partners in the goat project include the Ethiopian Institute of Agricultural Research (EIAR), Institute of Biodiversity Conservation (IBC), Tigray Regional Agricultural Research Institute (TARI), Amhara Regional Agricultural Research Institute (ARARI), Ethiopian Wildlife Conservation Authority (EWCA) and South Regional Agricultural Research Institute (SARI) in Ethiopia; University of Dschang, Institute for Agricultural Research for Development (IRAD) and Small Ruminant Support Programme (PADPR) in Cameroon; and the Nelson Mandela African Institute for Science and Technology (NM-AIST), Tanzania.

Household surveys are underway to characterize goat production systems in Ethiopian and Cameroon. A panel of molecular markers for use in studying genetic diversity is under development at the Hub. These molecular tools will be deployed to support parentage testing of elite bucks, surveillance of possible inbreeding in goat populations and to ascertain genetic composition of elite crossbreed bucks before exchange or sale. The team is also investigating the genetic basis of the extraordinary reproductive capacity of West African Dwarf goats, to accelerate their use in breeding of non-dwarf goats with similar high capacity to reproduce.

The possibility of using mobile telephony to help farmers to improve recording and farm enterprising management is also being explored. The tools and breeds developed by this project will enhance the food security of the millions of farmers who depend on goats for their livelihoods.

Fighting diseases through improved planting materials and tools for crop and livestock disease detection

A total of five plant tissue culture/transformation projects and eight plant and animal diagnostics projects were developed following a project inception workshop held at the Hub in February, 2012. A number of unique projects aimed at addressing food security issues were designed in a series of discussions among the NARIs, African universities and regulatory bodies, private sector, international research institutes, foreign universities, the CGIAR and other participants.

Clean and resistant planting materials: plant tissue culture and transformation projects: Many of the crops grown in the region are severely affected by a crippling range of diseases. The Hub is working with African and international partners to develop tissue culture methods for production of disease-free, high-performing, farmer-preferred varieties of crops of importance to African food, nutritional and medicinal security. Tools to detect the pathogens causing these diseases are also being developed to ensure that planting materials produced are clean. The tissue culture projects include:

- Development of enset with resistance to bacterial wilt: Over 15 million people rely on enset, or “false banana”, which is Ethiopia’s most important ‘root’ crop. This

project includes partners from EIAR and International Institute of Tropical Agriculture (IITA). This project focuses on developing transformation protocols that can be applied to produce enset resistant to bacterial wilt, a devastating disease for which no source of resistance in enset is known.

- Tissue culture methods for *in vitro* multiplication of the indigenous tree species baobab (*Adansonia digitata*) and rose apple (*Syzygium jambos*) being carried out in partnership with the Mikocheni Agricultural Research Institute (MARI) in Tanzania.
- Tissue culture methods for the production of virus-free garlic with EIAR in Ethiopia.
- Tissue culture for the production of quality yam planting material with the National Crops Resources Research Institute (NACRRI) in Uganda. Yam is a critical staple for food security and is an attractive alternative crop in areas currently being decimated by cassava diseases. The lack of quality planting material is a key gap that is leading to reduced yam cultivation in the region.
- Tissue culture methods for the production of quality passion fruit planting material, with Makerere University in Uganda. Passion fruit is a source of nutrition and income for many women farmers in the region.

Healthy crops and livestock: tools to detect and address disease:

This set of projects focuses on the development of tools which can be used to detect and address critical crop and livestock diseases which are posing a significant threat to food security in the region. Appropriate rapid diagnostic tools for screening of “clean” planting materials and detecting livestock diseases are being developed for use in national programs and private laboratories in the region. The diagnostic projects include:

- Development, validation and technology transfer of a lower-tech laboratory and field assay - Loop-mediated isothermal amplification (LAMP) for Capripoxviruses and Contagious Caprine Pleuropneumonia (CCPP), with the Department of Veterinary Services (DVS), Kenya; National Animal Disease Diagnostics and Epidemiology Center (NADDEC), Uganda; Tanzania Veterinary Laboratory Agency (TVLA); Foreign Animal Disease Diagnostic Laboratory United States Department of Agriculture/Animal and Plant Health Inspection Service/Foreign Animal Diagnostics Laboratory (USDA/APHIS/FADDL), USA.
- LAMP assays for the production of quality passion fruit planting material, with the University of Nairobi in Kenya.
- Developing virus detection tools for the production of virus-free yam planting material, with Mikocheni Agricultural Research Institute (MARI) in Tanzania.
- Developing virus detection tools for the production of virus-free garlic planting material, with EIAR in Ethiopia.
- Developing tissue culture methods suited to the production of quality taro planting material by NARIs, African universities and the private sector, with EIAR in Ethiopia, the University of Burundi and the Institut des Sciences Agronomique du Burundi (ISABU).

- Fighting bacterial diseases of rice through the development of diagnostic tools from genomic information, with partners from Institut de recherche pour le développement (IRD), France; Colorado State University (CSU), USA; and MARI in Tanzania.
- Understanding the landscape of viruses in mixed cropping system African smallholder farms: plant virome ecology and its implications for food security in the face of climate change, with the Food and Environment Research Agency (FERA) UK; Cornell University, USA; University of Nairobi and KARI in Kenya.

Capacity Building

Through the BecA-Sweden partnership, training in specialized areas has been conducted to enhance research skills of national partners. This included a workshop in designing rapid diagnostic kits for livestock diseases conducted in collaboration with the USDA/APHIS/FADDL, and a two day workshop on the phenotypic characterization of goats organized jointly by ILRI and the International Center for Agricultural Research in the Dry Areas (ICARDA). The BecA-Sweden partnership avails technical advice and enhanced capacity from SLU to the Hub bioinformatics platform. This includes an infrastructure upgrade carried out to facilitate better bioinformatics support to more researchers in the plant virome, goat genetic diversity and diagnostics projects.

Increasing production of major food crops through cutting-edge science

The Hub is involved in two projects funded through a grant awarded by the Biotechnology and Biological Sciences Research Council (BBSRC) under the Sustainable Crop Production Research for International Development (SCPRID) programme, a joint multi-national initiative of BBSRC and the UK Government's Department for International Development (DFID), together with (through a grant awarded to BBSRC) the Bill & Melinda Gates Foundation (BMGF), and the Department of Biotechnology (DBT) of India's Ministry of Science and Technology. These are two of eleven projects funded under the highly competitive SCPRID initiative. Its purpose is to support high-quality basic and strategic biological and biotechnological research to improve the production of major food crops in developing countries.

Leaving a bad taste in aphids' mouths

Beans are a vital crop in eastern and central Africa, both as an essential part of the diet, rich in protein and micronutrients such as iron, and as a natural fertilizer, enriching the soil with fixed-nitrogen. However, aphid-transmitted viruses pose a serious risk to beans, resulting in large losses for smallholder farmers.

Previous work by researchers from the University of Cambridge has demonstrated that virus infection alters the biochemistry of plants to make them smell and taste different to insects, including aphids, which results in

insects spreading the virus further. The project led by the University of Cambridge, UK includes partners from the Hub; Rothamsted Research; and the Eastern and Central African Bean Research Network (ECABREN) coordinated by CIAT, Uganda. The team is surveying bean growing areas in three distinct ecological zones within Uganda to look at how virus infection shapes the distribution of aphids under natural conditions. In addition, the team will use a combination of molecular analyses, mathematical models and field observations to identify how to select and deploy plants that could act as decoys for aphids by attracting them.

New blast-proof rice for Africans

At least 70% of the world's poorest people rely on rice as their staple food and it is estimated that by 2050, 50% more rice will need to be produced. But rice production is under threat from the devastating 'rice blast' disease. Precise figures for the impact of rice blast disease on yields are not known, but losses of 50-80 per cent are not uncommon.

In recent years, rice development programmes across Africa have produced new high-yielding varieties of rice that have been grown widely in sub-Saharan African countries. Many of these varieties are susceptible to rice blast disease. Through a four year project led by the University of Exeter, UK, researchers from the University of Arkansas; KARI; the Hub; Makerere University Uganda; the Ohio State University, USA; and Station de Recherches de Farako-Bâ, Burkina Faso, will join forces to identify sources of resistance to rice blast by screening a wide selection of rice varieties from around the world. Rice blast resistance genes will then be bred into varieties that are specifically adapted to thrive in African countries, to produce durably resistant rice varieties.



*ABCF fellow, Parfait Kouakou, takes a picture of domestic cavities at a home in Ivory coast. Kouakou conducted his research on the genetic diversity of cavies at the BecA-ILRI Hub in 2012.
(photo credit: Joseph Gnenissongui)*



Participants of BecA-ILRI Hub's 2012 annual training workshop on Advanced Genomics and Bioinformatics attend a lab session at the ILRI campus in Nairobi. (photo credit: BecA-ILRI/Ethel Makila)

Empowering Africa's science leaders

A strong program in capacity building and training is central to the Hub's activities in order to address the lack of sufficient expertise in science and technology in Africa, relative to the scope of constraints facing the continent's agriculture. The Hub is building science capacity in Africa by providing opportunities for research and training to scientists from national agricultural research institutions and universities in the region.

Capacity building at the Hub continues to be implemented in three ways: (1) hands-on training workshops, (2) provision of research fellowships to early career African scientists with placements for a period of 3-6 months at the Hub to undertake priority food and nutritional security research projects under the guidance of the Hub scientists, technical staff and partner institution scientists and (3) institutional capacity building and visits to BecA countries (with emphasis on the underrepresented countries) to raise awareness of the Hub, identify training needs and expertise.

The Africa Biosciences Challenge Fund

Through the Africa Biosciences Challenge Fund (ABCF) program, early career scientists receive fellowships

which enable them to spend up to six months at the Hub addressing key agricultural constraints through research, while building their scientific and leadership skills. The ABCF program has grown by 1200% since its inception in 2010. In 2012, the Hub hosted 52 researchers from national universities and agricultural research institutions in 15 countries across the region. Thirty five per cent of the ABCF fellows were women, and for the first time the program received researchers from South Sudan, Eritrea, Democratic Republic of Congo, the Republic of Congo, Central African Republic, Rwanda, Burundi and Madagascar. Thirteen fellows with funding from regional partners were also able to conduct their research at the Hub.

In addition to increased research fellow numbers, the donor support base for the ABCF program has substantially expanded. The initial donors to the fund included AusAID (through the BecA-CSIRO partnership), the BMGF, SFSa and the Swedish Ministry for Foreign Affairs through Sida. In 2012, additional partners have supported a number of jointly-funded fellowships and workshops. Our investor-partners include the African Women in Agricultural Research & Development (AWARD) program; ASARECA; International Foundation for Science (IFS); UNESCO; and Helica Biosystems, USA.

An innovative approach to building science leadership is the foundation for collaborative work among scientists conducting research on similar areas through the ABCF program. In 2012, thematic groups created through the ABCF program included Cassava virus epidemiology (Congo Brazzaville, DRC), Passion fruit virus diagnostics development (Kenya, Rwanda), Taro tissue culture and disease diagnostics (Burundi, Ethiopia), Napier grass diversity (Kenya, Uganda), mycotoxins in food and feed (Cameroon, Kenya), Cavies, goat and chicken diversity for improvement (Cameroon, Central African Republic, Cote d'Ivoire, DRC, Uganda, Sudan), and Control of theileriosis in East Africa (South Sudan, Sudan, Tanzania, Uganda). Some of these groups are assembled and led by returning BecA alumni, evidence of the evolving cascade of capacity building from the last ten years of BecA activities. The Hub will continue building linkages and encouraging collaborative research projects in the region.

The nurturing environment at the Hub has led to the development of crop and animal disease diagnostic tools by ABCF research fellows which will improve farming practices by small holder farmers. Donatien Bigirimana from the National University of Burundi is one member of the taro team that is developing clean taro planting

materials to be produced at the Hub. The clean materials will be transferred back to Burundi for multiplication and distribution by the Burundi national programs and private sector partners. Esther Kanduma, an Assistant Lecturer at the University of Nairobi and also an AWARD Fellow, is developing a rapid field based diagnostic test for use in rapid East Coast Fever (ECF) detection which will greatly improve the epidemiology, management and control of ECF among smallholder livestock farmers and pastoralists. Tajelser Idris Badri, a researcher at the Veterinary Research Institute, Khartoum, worked with the PPR project team at ILRI on the production of a thermostable PPR vaccine. Batches of PPR vaccine will be tested in an endemic area in Sudan to assess the efficacy and potency of the vaccine against the natural infection in a hot climatic environment.

Training workshops

Training workshops continues to be a key part of our strategy to strengthen the regional biosciences capacity. The Hub holds four demand-driven annual workshops in key skills areas: Molecular Biology, Bioinformatics, Science Paper writing, and Laboratory Management and Equipment Operations.

Overall, the training workshops were attended by 171 participants from 12 countries - Burundi, Cameroon, Congo Brazzaville, Democratic Republic of Congo, Ethiopia, Gabon, Kenya, Republic of South Sudan, Rwanda, Sudan, Tanzania and Uganda. These workshops were facilitated by trainers from Kenya, South Africa, Australia, Sweden, Germany and Spain.

Raising awareness and institutional support

The expanded capacity of scientists and institutions in the region to conduct biosciences research and to develop and deliver new technologies at their own institutes remains a top priority for the Hub. While we continue to receive applications and interest from a wide range of institutions in the region and globally, we actively reach out to and partner with institutions from under-represented countries. Hub staff

members travel within the BecA region, raising awareness and identifying key laboratories and individuals who are strategically placed to benefit from support from the Hub and impact food security for resource-poor farmers.

In 2012 the Hub team members conducted institutional visits in Ethiopia, Gabon, Tanzania, São Tomé and Príncipe. In Tanzania, three Hub team members visited Mikocheni Agricultural Research Institute (MARI) to give training in data analysis and the use of laboratory equipment which had been in storage for lack of technical know-how. In São Tomé and Príncipe, Post-doctoral scientist Dr. Benoit

The ABCF programme is opening new frontiers in research for African scientists as evidenced by the feedback:

"When I came to the BecA-ILRI Hub, I did not know much about aflatoxins. Thanks to my supervisors and the support of the research technicians, I can now carry out experiments and use equipment like the Vicam without any assistance!"

Esther Marijani from the Open University of Tanzania

Gnonlonfin held discussions with faculty members of the Fishery Department of the Ministry of Agriculture, Institut Supérieur Polytechnique (ISP), Centre of Investigation and Agronomic Technology, gave presentations on the Hub and recorded an interview on the national radio where he shared the opportunities at the Hub with listeners. In Gabon, Dr. Gnonlonfin visited the University of Science and Technology of Masuku where he met researchers from the Agricultural Research and Forestry Institute (IREF), the Research Institute of Tropical Ecology (IRAT), and the Institute of Traditional Medicine and Pharmacopoeia (IPHAMETRA) who have laboratories within the University. This visit to Gabon helped inform the Hub of the specific challenges related to lack of equipment and need for

advanced training. Following these trips, Hub scientists are working with researchers from each country to develop plans for research and capacity building.

Seminars

The Hub seminar series is a vibrant forum for research fellows, Hub scientists and visiting scientists, to present their latest research findings. In total, 57 seminars were delivered on diverse topics including population and conservation genetic research; next-generation sequencing in clinical diagnostics; chromosome engineering for plant genetics; population genetics of *Aspergillus flavus* in soils and pre- and post-harvest maize kernels; application of molecular genetics for sustainable wheat production; impact of tick-borne diseases in Sudan and Tanzania; and the genetic diversity and population structure of various livestock and crops. A typical seminar at this forum is attended by researchers from more than a dozen institutions across the region and internationally, fuelling lively debate on food security issues.

Expanded technology platforms and services

Mycology/mycotoxin and nutritional analysis platform

An exciting expansion at the Hub in 2012 was the establishment of a mycology/mycotoxin and nutritional analysis platform, in response to the many requests for these capacities by our partners over the last several years. Through funding received for the BecA-CSIRO partnership, the Hub acquired many advanced technologies to create mycology, mycotoxin diagnostics and nutritional analysis laboratories. The equipment acquired for this platform include an Atomic Absorption Spectrophotometer which can test for metals including heavy metals and residues; a UV-VIS Spectrophotometer to test for sugars, vitamins, carotenoids, colour, turbidity and structural changes; and an Ultra Performance Liquid Chromatography

system to test for nutrients, mycotoxins including aflatoxin, plant toxins, amino acids, antibiotics, antioxidants, pesticides and herbicides residues.

Already, the mycology/mycotoxin and nutritional analysis platform has hosted several projects, and received numerous requests for services including testing of maize for aflatoxin in mills, nutritional analysis of various food crops and capacity building in the use of the new technologies. While we are not currently offering research services outside the Hub, we plan to include this activity in the future so researchers can use the platform for their own research projects.

The Bioinformatics platform

The Hub bioinformatics platform provides support for research projects using modern bioinformatics tools, databases, data storage and high-performance computing. In 2012, research projects from 14 African and international institutions and two international research organizations received support from this platform. The bioinformatics platform is also actively engaged in strengthening bioinformatics skills in the region through annual training workshops (“Introduction to Molecular Biology and Bioinformatics” and “Advanced Genomics and Bioinformatics”); group training of ABCF fellows, hosting post-graduate students and collaborative workshops with institutions.

The platform is continually evolving to meet dynamic research needs. A mobile phone-based data collection and delivery system to support field research, and a GIS-based information system for collecting, analysing and reporting viral data related to small farm ecosystems have been developed.

Genomics platform strengthening

The DNA sequencing, genotyping and oligonucleotide services unit (SEGOLIP) has continued to expand its capabilities through the acquisition of an illumina MiSeq genome sequencing machine and a Roche Light Cycler Nano. The MiSeq complements the existing Roche 454 pyrosequencing platform while significantly reducing per-base sequencing costs, and the Light Cycler Nano, an ultra-fast real-time PCR instrument, is being used for genotyping, SNP/mutation detection and discovery.



Segolip research technician Francis Wamonje in the data sequencing room at the BecA-ILRI Hub. (photo credit: ILRI/David White)

In 2012, this robust genomics platform provided services to 62 institutions from 20 African and non-African countries, and nine international organizations conducting research in pathogen discovery, crop improvement and food security. It has also supported capacity building activities in the BecA region and beyond.

The growing team

The Hub’s team of core scientific staff and technical staff continues to grow with the increased research and capacity building activities. In 2012, the Hub recruited Berine Atieno Ada (Project accountant); Pauline Asami (Research technician-Tissue culture); Mercy Macharia (Research technician-Diagnostics); Sarah Osama (Research technician-Genetic studies); Rachael Mwangi (Program management officer); Joyce Njuguna Nzioki (Bioinformatician); Wilson Kimani (Research technician-Capacity building); Jacqueline Mayira (Program assistant); Dr. Laura Purdie (Post Doctoral Scientist - Molecular diagnostics); Dr. Timothy Holton, (Scientist - Plant Transformation/ Tissue Culture); and Dr. Solomon Benor (Post Doctoral Scientist-Molecular geneticist). This expansion has significantly enhanced the BecA team’s range of expertise and capacity to serve the region.

Increasing awareness

The reworked 2012 communication strategy has helped the Hub to showcase its research and capacity building activities to a much broader audience on the world stage. The Hub now has a webpage dedicated to the Hub’s research projects (<http://hub.africabiosciences.org/about-us/food-and-nutrition-research-focus.html> and <http://hub.africabiosciences.org/about-us/animal-health-research-focus.html>) and the ABCF (<http://hub.africabiosciences.org/about-abcf>).

The crop and animal research activities have featured widely in regional and international media as diverse as The New Agriculturalist, Reuters Alert Net, Stock Journal, Radio Okapi and La Voix du Paysan, Ouest Littoral.

Press releases coinciding with high level international engagements by Hub staff members have given rise to very broad international coverage. The Hub has also received journalists from Sweden, South Korea and Kenya, which generated a number of news articles and featured radio interviews.

Visitors

We have been privileged to host over 450 visitors to the Hub including policy makers, private sector leaders, donors, scientists, journalists and students. In February, Dr. John McMurdy, International Research and Biotechnology Adviser in the US Agency for International Development (USAID) Bureau for Food Security visited the Hub to learn more about the research and capacity building activities. The discussions begun during his visit have led to deeper exploration on potential co-funding of training activities at the Hub. In



*The BecA-ILRI Hub team during a planning and strategy retreat in Taita Hills, Kenya.
The team has 44 members from eight countries - Australia, Benin, Cameroon, Ethiopia, Italy, Kenya, UK and USA*

May, Mr. Aki Enkenberg, Counsellor (Science, Technology and Innovation), Embassy of Finland, Pretoria, toured the lab facilities to see first-hand how the Africa Biosciences Initiative program is being implemented in the eastern and central Africa region. This engagement resulted in a team of consultants appointed by the Ministry for Foreign Affairs of Finland to develop a program document for the proposed extension of the Finnish Southern Africa Partnership Programme to Strengthen NEPAD/SANBio Network (BioFISA), visiting the Hub and holding discussions with team members, scientists working at the Hub and investors as part of their assignment.

Other visitors included Mr Greg Benova, from the AusAID PhD Scholarships Programme; Professor Sir Brian Heap, University of Cambridge; Dr David Bennett, University of Cambridge; Dr Bernie Jones, University of Cambridge; Dr Claudia Canales Holzeis, University of Cambridge; Dr. Patrick Guilbaud, Chief of Party of the USAID/ERA Program, Virginia Tech; Louisa Cass, First Secretary, Food Security, Tesfaye Legesse, Senior Program Manager, Food Security, and Shannon Ryan, Senior Program Manager, Food Security and Climate Change, AusAID East and Horn of Africa - Regional Office; Lisa Rauter, Assistant Director General, Africa and Community Programs Division, and Naomi Dumbrell, Director Eastern Africa section, AusAID Canberra; Prof B. N. Okolo, Chancellor, University of Nigeria, Nsukka; Dr. Rivka Hadas, Head of the Israel Plant Gene Bank at the Agricultural Research Organization Volcani Center; David Theriault, Chief Operations Officer, the International Potato Center (CIP); Peter VanderZaag, Chairman of Board of Trustees, CIP; Amy Caster, Program Coordinator, BMGF; Jana Fry, Grants Management operations team, BMGF; Dr Jenny Gu, International Research and Biotechnology Advisor for USAID, Office of Agricultural Research and Policy, Bureau for Food Security – Research Division; Susan Johnson, Program Director, Norman E. Borlaug Leadership Enhancement in Agriculture Program (Borlaug LEAP); Dr Ylva Hillbur, Deputy Director General Research for Development, International Institute of Tropical Agriculture (IITA) Ibadan; Dr David

Mayer, Dr Cindy Ernst and Dr Nathan Miller, Scientists at the Dow Agrosiences in Indianapolis, Indiana, USA; Ms Sahle-Work Zewde, Director-General of the United Nations Office at Nairobi; Mr Mpyisi Edson, Principal Agro-Economist in the Agriculture and Agro-Industries Department (OSAN) 1 of the African Development Bank (AfDB); Mary Jane Potter, Chief Investment Officer Innovare Advisors, LLC.; Linh Trinh, First Secretary (Development - Pan Africa Regional Program) Canadian High Commission; Dr. Katherine Kahn, Senior Program Officer, Science & Technology Agricultural Development, Bill & Melinda Gates Foundation; Dr. Daniel Barthelemy, Director of the Biological Systems Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France; Dr. Jacques Lançon, Regional Director CIRAD-eastern and southern Africa (CIRAD-AFORA), Kenya; Dr. Ian Barker, Head of Agricultural Partnerships, Syngenta Foundation for Sustainable Agriculture; Dr. Claude M. Fauquet, Director International Laboratory for Tropical Agricultural Biotechnology (ILTAB); Jim Gaffney, Biotech Affairs and Regulatory team of DuPont



*Director-General of the United Nations Office in Nairobi, Sahle-Work Zewde (centre), learns more about the research conducted at the BecA-ILRI Hub from former Hub Director, Segenet Kelemu (left). Looking on is ILRI Director General, Jimmy Smith(right)
(photo credit: BecA-ILRI/Ethel Makila)*



*Finnish consultants Hannu Mölsä (left) and Kimmo Halme (2nd left) talk to ABCF fellow Nehemie Donfagsiteli. Donfagsiteli from Cameroon conducted his research on the African Plum tree at the BecA-ILRI Hub in Nairobi.
(photo credit: BecA-ILRI/Ethel Makila)*

Pioneer; Linh Trinh, First Secretary (Development - Pan Africa Regional Program) Canadian High Commission; Mr. Michael Brownell, Senior Director, Canadian International Development (CIDA) Pan-Africa Regional Program; Mr. Peter Newton, Manager, CIDA's Pan-Africa Regional Program; Achim Dobermann, Deputy Director General-Research, International Rice Research Institute (IRRI); Dr Rosemary Mutegi Murori, IRRI rice breeder and many others. There were also visitors from the Jomo Kenyatta University of Agriculture and Technology, Kenyatta University, Moi University, the Masinde Muliro University of Science and Technology, Kenya Plant Health Inspection Service (KEPHIS) and many more local and regional institutions.

We are grateful for the interest shown by all our visitors. Not only have they taken the time to learn more about what we do at the Hub, but many have served as our enthusiastic ambassadors, spreading the word of our collective achievements, giving rise to more collaboration in the region and beyond.

Forging ahead

As the Hub's interim Director, I am in awe of the hard work and dedication that is evident in the corridors at the Hub. I am also deeply grateful for the dedication of our partners and investors in working with the Hub to build a strong platform for strategic growth. My personal reasons for coming back to Africa from the USA were to see change for this continent, to enable science in Africa to advance so that it can contribute to the critical food security issues faced by so many Africans. Already, I can see these changes occurring and have personally witnessed the professional and personal growth of so many African scientists.

None of this would be possible without you.

As we look to 2013, the key focus for the Hub is the consolidation of all our existing activities and our new projects to achieve real impact on food and nutritional security in Africa. Our research and capacity strengthening efforts must ensure that the foundation for cutting edge research is strengthened and that biosciences innovation continues. At the same time, supporting our scientists with the resources and partnerships to ensure impact is critical to tackle the region's food security challenges. Our teams will increasingly work closely with farmers, regional institutes, governments and the private sector to achieve this impact.

The wheels are turning for Africa's future and the Hub will continue to play its role in empowering the next generation of science leaders. We know that many of you share our vision for a tomorrow where Africa's vibrant culture of innovation ushers in a new era of prosperity, when Africa feeds herself and becomes a breadbasket for the world.

Sincerely,

Appolinaire Djikeng

Interim Director, BecA-ILRI Hub



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