

# PROSPECTUS

The BecA-ILRI Hub





In building the capacity of African scientists to exploit biosciences opportunities, the BecA-ILRI Hub contributes to a highly developed agricultural sector capable of promoting inclusive and sustainable growth in African countries

biosciences  
eastern and central africa



# Foreword

## Dear partner/stakeholder,

Through the activities at the BecA-ILRI Hub, the ILRI Biosciences program, the other CGIAR centres<sup>1</sup> and African national research programs, we are proud to have built a very strong scientific community at our Nairobi campus.

This scientific community working in our state of the art laboratories, employs the latest biosciences tools to tackle issues related to agricultural productivity. The ultra-modern platforms – for genomics, bioinformatics, vaccine development, diagnostics, genetic transformation, nutritional analysis and molecular breeding – are key enablers of cutting-edge research in Africa.

In addition to offering a supportive environment for agricultural biosciences research, the BecA-ILRI Hub develops tripartite collaborative agreements with advanced research institutions and African national research programs. As part of one such agreement, the John Innes Centre (JIC) in the UK, a leading international centre of excellence in plant science and microbiology, has stationed one of their scientists in Kenya.

This model of engagement is designed to enable African institutions to leverage basic research at advanced institutions in finding practical solutions to regional agricultural challenges. This addresses the capacity-building needs of the national research programs, as well as delivers on the broader CGIAR mission through the CGIAR Research Program (CRP) agenda.

We welcome the opportunity to host an even wider range of partners from Africa and beyond at our facilities with the long-term goal of building synergies that will lead to even greater and swifter improvement in the livelihoods of smallholder farmers in Africa.

## Thank you!

Jimmy Smith  
Director General, ILRI

Appolinaire Djikeng  
Director, BecA-ILRI Hub

<sup>1</sup>The CGIAR centres present at the BecA-ILRI Hub include the International Institute of Tropical Agriculture (IITA), the International Maize and Wheat Improvement Center (CIMMYT), the International Potato Center (CIP), and the International Rice Research Institute (IRRI).

## INTRODUCTION

# What is the BecA-ILRI Hub?

The Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub is a shared research and capacity building biosciences facility located at and managed by ILRI in Nairobi, Kenya. The BecA-ILRI Hub consists of a state of the art suite of shared biosciences platforms established to support the work of African and international agricultural scientists through research, capacity-building and by providing research related services. The BecA-ILRI Hub hosts and supports the work of scientists from African national agricultural research systems (NARS), ILRI, other CGIAR centres and the CRPs.

The activities, supported by the BecA-ILRI Hub, are developed in response to high priority constraints relating to food and nutritional security in Africa. These challenges are identified by governments and continental initiatives, such as the Comprehensive Africa Agriculture Development Programme (CAADP), the Africa Bioscience Initiative (ABI) and the Science Agenda for Agriculture in Africa (S3A), as well as by the CRPs in collaboration with scientists from the African NARS.



## Vision

To contribute to the improvement of the livelihoods of millions of resource poor people in Africa, through the use of bioscience-based technologies to improve agricultural productivity, increase incomes and improve food and nutritional security.

## Mission

Mobilizing bioscience for Africa's development, by providing a centre for excellence in agricultural biosciences. This mission will be achieved by the BecA-ILRI Hub's contributions to:

**Enabling research** to harness the potential of the biosciences to contribute to increasing agricultural productivity and improving food and nutritional safety and security;

**Education:** Contributing to the education and training of the next generation of African agricultural research leaders and scientists;

**Innovation:** Promoting the development, delivery and adoption of new technologies to address key agricultural productivity constraints.



# What does the BecA-ILRI Hub offer?

The BecA-ILRI Hub provides opportunities to increase the capacity of individuals and institutions in Africa to conduct biosciences-related research, and develop and deliver new technologies in the field of food and nutritional safety.

To better meet the dynamic research needs of the region and ensure the continuous availability of an up-to-date suite of specialized bioscience technologies in Africa, the BecA-ILRI Hub has established and continues to upgrade a number of technology platforms including:



## Genomics

The genomics platform is equipped with both capillary and next generation sequencing instruments (Illumina MiSeq Desktop Sequencer, 454 GSFLX™ Titanium pyrosequencer). The research capabilities of the genomics platform include: pathogen detection, diagnostics, metagenomics, transcriptomics, gene expression analysis, viral genomics, molecular breeding and genotyping.

Since 2009, the platform has provided simple sequence repeat (SSR)-based genotyping services and data-analysis support for crop and livestock research. From 2015, capacity will be enhanced to offer an innovative high-density, high-throughput integrated genotyping service and support (IGSS) on the Illumina platform.

## Bioinformatics

The bioinformatics platform leverages the genomics platform to provide advanced computational services, data storage, bioinformatics support and high-performance computing services to NARS scientists and other external users.

The platform handles tens of thousands of molecular data and statistical analysis transactions, and has generated hundreds of terabytes of data since its inception. The modular architecture of the computing infrastructure lends itself well to addressing informatics problems of increasing size, scope and complexity.



## Molecular breeding

This platform comprises the Breeding Management System (BMS) and the IGSS. In partnership with the CGIAR coordinated Generation Challenge Program (GCP), the BecA-ILRI Hub is one of the hubs of the Integrated Breeding Platform (IBP).

Equipped with an all-in-one suite of tools, the BecA-ILRI Hub enables the effective management of breeding activities, from project planning to final decision-making. The enhanced genotyping capabilities available through the IGSS support plant and livestock breeding programs in accelerating the rate of genetic gain.

Through a demand-led variety approach, the breeding platform aims at making plant breeding in Africa a business model, responsive to market demand. The platform generates and manages genomic and marker data, and provides support to breeders and other scientists in integrating

DNA marker technology and genomic tools in the development and release of new varieties.

## Mycotoxin and nutrition analysis

The platform is equipped with ultra-high performance liquid chromatography with mass spectrometer (UHPLC-MS), fluorescence detector (UHPLC-FLD), diode array detector (UHPLC-DAD), atomic absorption spectrometry (AAS), gas chromatography mass spectrometry (GC-MS) and near infrared spectroscopy (FT-NIR). The accessories include: the UV-VIS spectrophotometer, the VICAM fluorometer, ELISA, Romer and Vicam strip readers, and a dedicated biosafety level 2 (BSL2) milling room with Romer II mills, among other sample processing and preparation techniques.

This equipment and the supported technologies provide a combination of qualitative and quantitative





analytical techniques for aflatoxin and other mycotoxin measurements. Proximate analysis, minerals, vitamins, antioxidants and a range of other nutritional analyses can also be conducted. The platform includes an ISO 17025 accredited aflatoxin test, used for third-party verification with Kenyan private sector mills.

### **Plant growth facility**

The 1,400m<sup>2</sup>-facility consists of a greenhouse, a screen house, growth chambers, and growth and culture rooms. The greenhouse contains one biosafety level 1 compartment and five biosafety level 2 containment compartments for non-transgenic and transgenic plant experiments respectively.

The compartments are equipped with computer-controlled roof vents and evaporative cooling mechanisms to regulate temperature and humidity. The facility contains a weather station, light intensity controls, rainwater collection and biosafety chambers. There are two screen houses covered with retractable thermal screens to allow for light intensity. The facility is also equipped with three Conviron CMP6050 growth chambers for the precise control of environmental

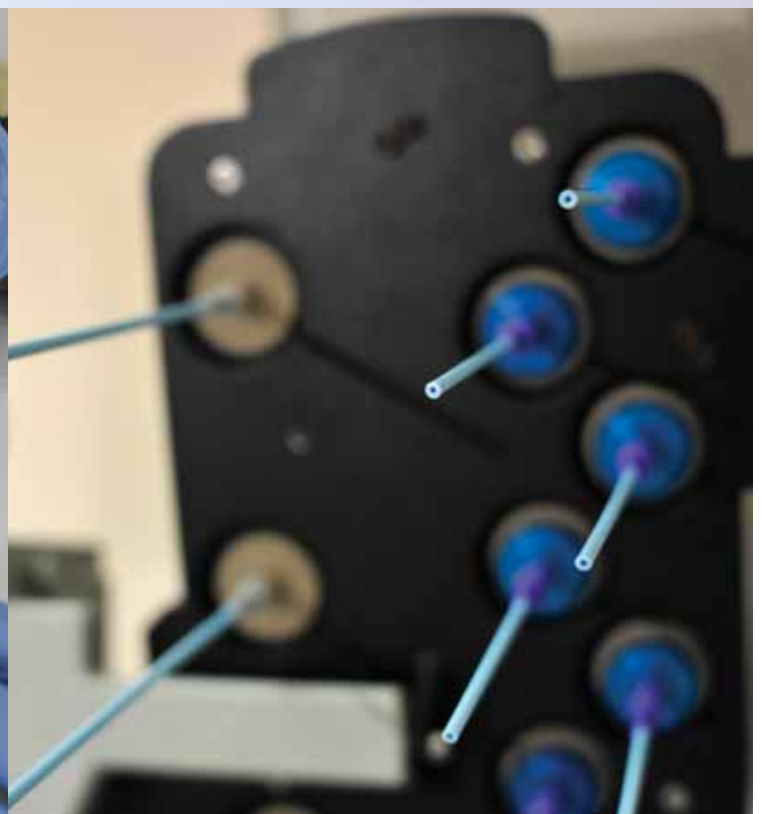
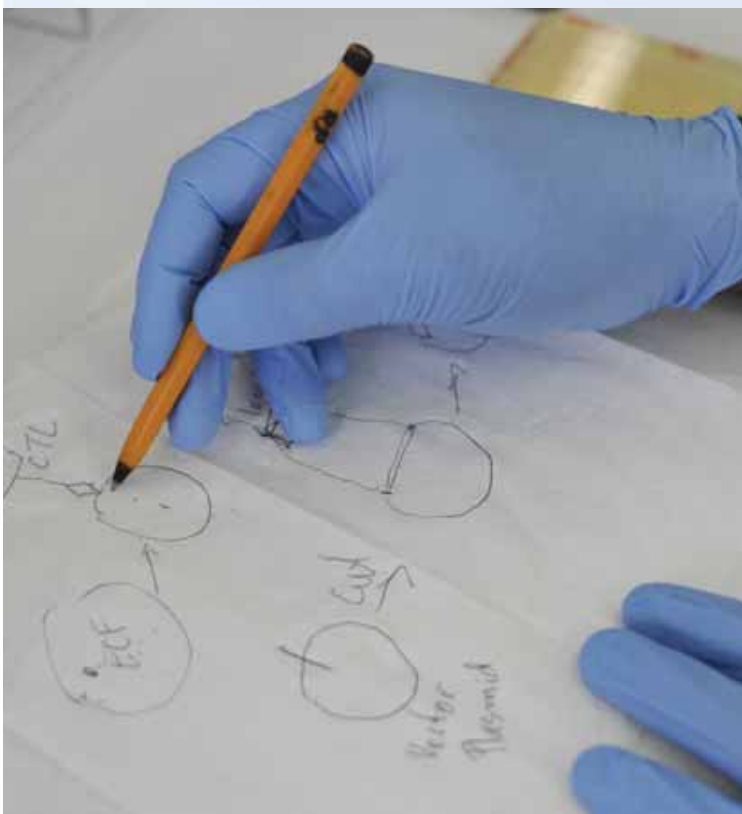
parameters and the cleaning of infected plants by thermotherapy. There are eight growth rooms with programmable controls and sensors to monitor power, temperature and humidity.

### **Tissue culture and transformation**

The tissue culture laboratory enables users to produce disease-free planting materials for a wide range of crop species, as well as reduce regeneration time for plant materials. The facility has a certified genetic transformation laboratory dedicated to the improvement of plants through the addition of economically important traits, and the maintenance of clean materials generated.

### **Golden gate cloning**

In partnership with the John Innes Centre, UK, the Golden Gate platform was established to support scientists develop rapid and efficient strategies of generating DNA constructs for genetic engineering experiments. In plants, previously developed transformation constructs can be adapted to accept multigene Golden Gate inserts and directly used in Golden Gate reactions. The platform has a collection of basic vectors required for Golden Gate manipulations, as well



as universal basic parts, such as fluorescent reporters, standard promoters and terminators, along with online management tools to facilitate construct design and the sharing of new modules.

### **Vaccine development**

The facility is equipped for diagnostics (serology and molecular), cell imaging, molecular immunology and virology including: BD Facscanto II flow cytometer and BD influx™ Cell Sorter, Haematology autoanalyzer, two AID EliSpot Reader Systems with camera, Luminex screening system for detecting and quantifying multiple target analytes, tissue culture systems, fast protein liquid chromatography (FPLC) apparatus, and other equipment required for vaccine development and infectious disease research. Associated with the platform is an enhanced BSL2 large animal facility for contained vaccine trials and a tick unit to support vector and vector-borne disease research.

### **Azizi biorepository**

The biorepository system is equipped with seven Taylor-Wharton LABS-80K freezers, two LS4800 cryogenic refrigerators, a 3,000-litre

bulk holding tank, and an external fill point for drawing liquid nitrogen (LN<sub>2</sub>) for field and laboratory use. Each freezer has a capacity of 75,400 samples in 2ml cryovials, creating an installed capacity of 527,800 biological samples. Liquid nitrogen is generated by a StrirLIN-1 plant from Stirling cryogenics producing 21 litres/hour. Critical events e.g. low LN<sub>2</sub> levels are reported automatically to the biorepository manager via short messaging service (SMS). Non critical events like access to a freezer are logged onto a database. Access to the facility is restricted to authorized staff only. The facility has a robust and secure laboratory information and management system (LIMS) used to track the uniquely barcoded samples along with the associated metadata. Samples stored include semen, blood, serum, tissues, arthropod vectors, cultured cells, plasma, DNA, RNA, among others.

The Azizi platform is designed to foster scientific collaboration by using the repository as a means of sharing valuable biological materials and information.



## The biosafety level 3 laboratory facility

The 120 m<sup>2</sup> biosafety level 3 (BSL3) facility offers the opportunity for scientists to work under containment with highly pathogenic microbes and samples as defined by the World Health Organization, the World Organisation for Animal Health (OIE) and other international and Kenyan standards and procedures.

## Research-related services

A number of specialized facilities with specific technologies and resources further support various biosciences research activities on a cost-recovery basis. These specialized services include:

- The Sequencing Genotyping Oligonucleotide and Proteomics (SEGOLIP) unit which provides: (i) Sanger sequencing (plasmid, PCR products); (ii) full or partial SSR-based genotyping (DNA extraction, PCR and DNA fragment analysis)—the unit accepts multi-well plates containing DNA fragments for size analysis; and (iii) support for procurement of primers.
- The IGSS platform, which in partnership with Diversity Arrays Technology Pty Ltd (DART PL), Australia provides competitively priced complete genome sequencing-based genetic profiling and associated bioinformatics, data management, analysis, and decision support to crop and livestock breeders.
- The Central Core Unit which prepares tissue culture media, microbiological growth media and plates, and buffers. The unit also provides laboratory glass wash, sterilization and waste management services.
- The plant growth facility which offers a wide range of services including the provision of routine greenhouse, screen house and growth chamber sanitation, cleaning and sterilization of benches, pots and labels. It also provides common horticultural consumables e.g. soil mixes, fertilizers and pesticides.
- The procurement unit which supports laboratory users in the purchase of goods (reagents, supplies, equipment) and services to the required specifications and quality standards. The unit also identifies appropriate suppliers with the goal of establishing competitive, reliable and timely sources of quality products.
- Two freezer programs - Roche and Inqaba - which offer convenient access to common molecular biology reagents and kits.
- The Azizi Biorepository which provides support to researchers or projects in: proper sample and data collection; proper labelling of field samples; long-term storage of materials; and retrieving of samples and data in the repository. It also acts as a source of liquid nitrogen to various projects.



## THE FACILITIES

# Laboratory operations

The facility is managed by a team led by the technology manager and comprising a diagnostics platform manager/assistant technology manager, technical assistants, a laboratory procurement assistant and general laboratory assistants. The technology manager ensures the availability of up-to-date equipment across a wide range of biotechnologies. The manager makes informed decisions about the acquisition and/or retention of technologies and the necessity for in-house versus outsourced technologies.

The facility is supported by the ILRI engineering unit whose personnel conduct regular maintenance and repairs on equipment. Risks from power supply fluctuations are greatly minimized by backup systems, including two 1,600KVA and 1,100KVA standby generators. In addition, all sensitive equipment is attached to UPS backups, preventing loss of data.

### Environment occupational health and safety

The BecA-ILRI Hub maintains laboratory facilities, manages material handling procedures and conducts training on best practices in accordance with biosafety level 1, 2 and 3 criteria, in compliance with Kenyan and international guidelines.

Jointly, the ILRI Institutional Biosafety Committee (IBC), the Environment, Occupational Health and Safety (EOHS) staff and the laboratory management team provide:

- 1 Oversight (i.e. for biosafety and blood borne pathogen protocols in the laboratory); and
- 2 Support (to principal investigators and laboratory staff), in ensuring the practices set forth in the biosafety manual are followed. The biosafety program is audited on a periodic basis to assure all requirements are met.

### Handling biological materials

- All work with biological material is registered with the EOHS office and a risk assessment completed on a prescribed form available at <http://www.ilri.org/eohs>.
- Work falling under risk level 1 is reviewed by the EOHS manager and a response given within one week.



- Work falling under risk level 2 and above is reviewed by the full IBC which meets once monthly. A completed risk assessment form and procedure protocol should reach the EOHS office two weeks prior to the IBC meeting.
- All work involving humans is reviewed by the ILRI Ethics Committee (IEC). This committee meets quarterly.
- All work involving animals is reviewed by the ILRI Institutional Animal Care and Use Committee (IACUC). The committee meets at least twice a year and as urgent matters arise.
- The BecA-ILRI Hub works with the EOHS office to facilitate the process of acquiring permits. An import/export permit for plant and animal materials can be obtained from the Kenya Plant Health Inspectorate Service (KEPHIS) and Directorate of Veterinary Services (DVS) respectively.
- All work involving genetic modification requires the approval of the National Biosafety Authority (NBA). The EOHS facilitates applications for genetic modification (GM)-related projects.

### Chemical reagents

All chemicals are handled in accordance with the Institutional Chemical Hygiene Plan. The EOHS manager and the laboratory manager

provide oversight in relation to chemical safety protocols and laboratory practices. The chemical safety program is audited by the EOHS office on a regular basis to ensure that all requirements are met. The requirements of the Chemical Safety Program include: proper use of personal protection equipment (PPE), as specified in the laboratory manual; proper handling of chemicals with moderate chronic or high acute toxicity; proper shipping, receipt and storage; and the disposal of hazardous chemicals.

### Radioactive materials

As defined in the license for use of radioactive materials issued by the Kenyan government regulatory agency, the Radiation Protection Board, ILRI is authorized to possess radioactive materials for research and development purposes. The EOHS manager provides oversight in relation to radiation safety for authorized users named on the license, and provides radiation safety protocols and support to users in assuring adherence with the requirements of the license.

### Recombinant DNA

The IBC assesses the safety of recombinant DNA research and identifies any potential risk to the environment in accordance with the NBA guidelines for research involving recombinant DNA molecules.



## WELCOMING YOU

# Accessing the BecA-ILRI Hub

There are several ways to gain access to the BecA-ILRI Hub facilities:

- Institutions can sign hosting agreements with ILRI.
- Collaborating researchers and private sector users can sign laboratory access and use agreements.
- Visiting scientists can sign visiting scientist contracts with ILRI.
- Students may apply for internships at the platform under specified fellowship arrangements (e.g. African Bioscience Challenge Fund (ABCF), ILRI projects).
- Individuals may participate in workshops or short-term training courses upon request.

Before gaining access to the facility, the EOHS team—in cooperation with the technology & laboratory management team—offer potential users a short induction course on occupational health and safety and ensure they receive the appropriate certification.

Material transfer and confidentiality agreements may also be required for some projects. Potential users are encouraged to contact the laboratory management team well in advance to discuss their work plans and related requirements, and to ensure successful implementation of their projects.

### Laboratory access fees

The current annual cost per full-time equivalent (FTE) for access to the laboratories is USD 12,500 per annum. The minimum acceptable period of access is one week.

*The Laboratory access fees cover:*

- General access to and use of laboratories and equipment;



- Access to glassware cleaning and sterilization services;
- Access to laboratory cleaning and waste management services;
- Access to personal protective equipment (laboratory coats and other materials), and first aid and other safety kits;
- Access to a working environment, restricted to authorized users through an access control system;
- Access to specialized imaging facilities (microscopes, FACS, etc.);
- Access to computers with specialized analysis software (genemapper and other bioinformatics packages);
- The procurement of commercial reagents, consumables and equipment, and access to the on-site comprehensive freezer program;
- Access to storage facilities (refrigerators, freezers, deep freezers, liquid nitrogen storage facility); and
- Access to fee-for-use services offered by specialized units, including the SEGOLIP unit, the BSL3 facility, plant growth facilities, etc.

## Notes

- The pro-rata cost charged for laboratory access takes account of situations where arrivals spend only a fraction of the year at BecA-ILRI Hub, (project/placement starting after 1 January and/or ending before 31 December), periods of leave and other impediments. In such cases, users are required to contact the laboratory management office, relinquish all laboratory access materials (access cards and keys), clean and vacate any assigned laboratory space and storage facilities (fridges and freezers) before the last day of the relevant billing period.
- Individuals planning to use the laboratories for practical courses are encouraged to notify and work with the laboratory management team to: a) receive approval for hosting the event on the specified dates; b) ensure that necessary notice is given to other users who may be affected; c) ensure that all aspects of biosafety are considered and addressed within the context of the procedures to be followed; and d) agree on the cost associated with the use of the laboratories, equipment and specialized units.



## Contacts

### **Appolinaire Djikeng**

Director, BecA-ILRI Hub  
Email: [becadirector@cgiar.org](mailto:becadirector@cgiar.org)  
Tel: +254 20 422 3802

### **Josephine Birungi**

Technology Manager, BecA-ILRI Hub  
Email: [beca-hub@cgiar.org](mailto:beca-hub@cgiar.org)  
Tel: +254 20 422 3384

Biosciences eastern and central Africa-International Livestock Research Institute Hub  
PO Box 30709 Nairobi 00100 Kenya | Tel: +254 20 422 3805  
[BecA-Hub@cgiar.org](mailto:BecA-Hub@cgiar.org) | <http://hub.africabiosciences.org>

[ilri.org](http://ilri.org)

*better lives through livestock*

ILRI is a member of the CGIAR Consortium

Box 30709, Nairobi 00100, Kenya  
Phone: +254 20 422 3000  
Fax: +254 20 422 3001  
Email: [ILRI-Kenya@cgiar.org](mailto:ILRI-Kenya@cgiar.org)

Box 5689, Addis Ababa, Ethiopia  
Phone: +251 11 617 2000  
Fax: 251 11 617 2001  
Email: [ILRI-Ethiopia@cgiar.org](mailto:ILRI-Ethiopia@cgiar.org)