Centre for Tropical Livestock Genetics and Health

Strategy to build capacity for animal biotechnology research in West Africa

Professor Appolinaire Djikeng
Director, Centre for Tropical Livestock Genetics and Health
The University of Edinburgh, Scotland, UK

West Africa Animal Biotechnology Workshop
Dakar, July 23-25, 2018

THE UNIVERSITY of EDINBURGH

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Outline

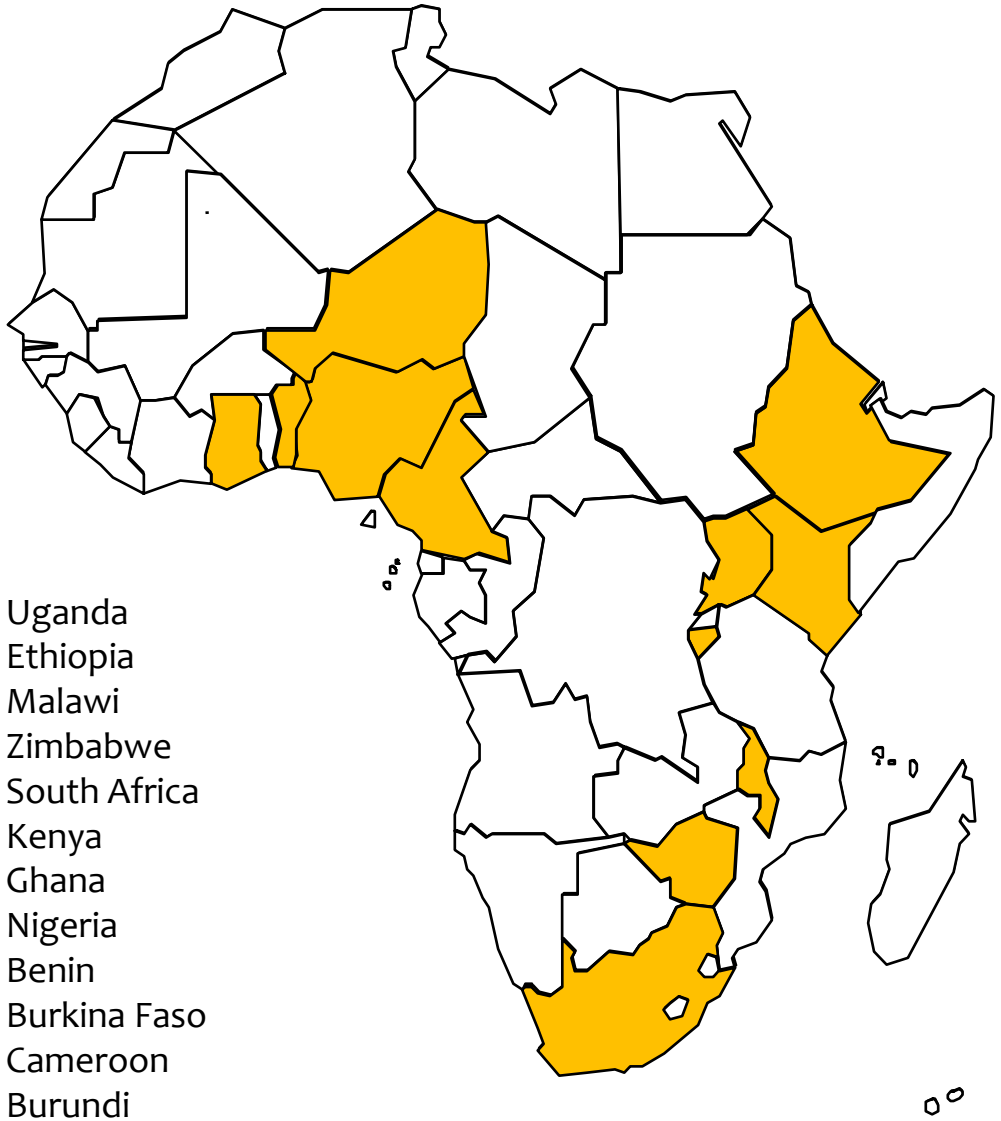
I. **Highlights of 2 key studies on biotechnology research capacity in Africa:**

   i) A strategic framework for transgenic research and product development in Africa (2015)

   ii) Landscape study on biosciences research capacity in West Africa (2015)

II. **Some options (examples and key recommendations)**

i) A strategic framework for transgenic research and product development in Africa



1. Uganda
2. Ethiopia
3. Malawi
4. Zimbabwe
5. South Africa
6. Kenya
7. Ghana
8. Nigeria
9. Benin
10. Burkina Faso
11. Cameroon
12. Burundi

Romano Kiome (Consultant), Appolinaire Djikeng (BecA), Suzanne Bertrand (ILRI), Marc Ghislain (CIP), Stephen Mugo (CIMMYT), Leena Tripathi (IITA), Joseph Bigirimana (IRRI), Kiran K. Sharma (ICRISAT)

https://cgspace.cgiar.org/bitstream/handle/10568/67891/pr_transgenics-africa.pdf;sequence=1

ii) Landscape study on biosciences research capacity in West Africa

How to harness the potential of the biosciences to increase agriculture (crop and livestock) productivity and to improve food and nutrition security and safety?

Five countries (Nigeria, Burkina Faso, Mali, Ghana and Senegal)
23 Institutions (National, regional, international)

Commissioned by the Bill & Gates Foundation (2015)

SWOT/FFPM analysis

Strengths/Forces

Presence of international/regional research organizations
Physical and human capacity
Donor support

Weaknesses/Faiblesses

Communication
Weak or less strategic partnerships (national/regional – international)
Limited interaction with policymakers

Opportunities/Possibilités

Potential to increase productivity and nutritional value
Chronic and endemic production constraints
Potential for private sector support and participation

Threats/Ménaçes

Lack of information
Intellectual property rights
Trade issues
Restriction from external donors

Agricultural biotechnology: Status in various countries

Table 3. Status of biotechnology policies, legislations, regulations and implementing institutions

Country	Policy	Legislation	Regul.	Institution
Kenya	National biosafety policy 2002	Biotechnology and biosafety Act 2009	In place	National Biosafety Authority
Uganda	National biotechnology policy 2008	Biotechnology and biosafety bill 2012 in parliament	Interim	UNCST-Biosafety Committee
Ethiopia	None	Biosafety Proclamation No 655/2009	None	Ministry of Environment
Zimbabwe	National biotechnology policy 2005	The National biotechnology Authority Act (ACT 3/2006/2011 (s8)	In place	National Biotechnology Authority
Malawi	Biotechnology and biosafety policy 2008	Biosafety Act 2002	In place	Ministry of Environment and NCST, MOA, MOE.
South Africa	White paper on science and technology 1997	Genetically modified organisms act 1997 (Act no 15 of 1997), amended in 2006	In place	Ministry of Research Science and Technology
Ghana		Biosafety Act 2011	None	National Biosafety Secretariat.
Nigeria		Biosafety bill in parliament	Interim	Ministry of Environment
Burkina Faso		Revised biotechnology Act 2013	None	National Biosafety Authority
Cameroon	Science and Technology policy 2003	Biosafety *Law N° 2003/006 in 21 April 2003*	None	Ministry of Research Science and Technology
Benin	None	None	None	Ministry of Environment
Burundi	None	None	None	Ministry of Environment

Agricultural biotechnology: Physical capacity

Table 4. Physical capacity for transgenic research in sample countries in Africa

Country	Institution	Laboratories				BSF Level		
		Mol.	Seq.	TF	BIF	1	2	3
Kenya	KALRO; universities	2	0	1	0	2	2	0
Uganda	NARO universities	2	0	1	0	1	1	0
Ethiopia	EIAR, universities	2	0	0	0	0	0	0
Malawi	Department of Agricultural Research Services and universities	1	0	0	0	1	0	0
South Africa	Biotechnology Research Institute, (ARC)	2	1	2	1	1	1	1
Zimbabwe	Department of Agricultural Research and universities	1	0	0	0	1	0	0
Ghana	NARS and universities	1	0	1	0	1	1	0
Nigeria	NARS and universities	3	0	1	0	1	1	0
Cameroon	National Biotechnology Research Institute (University of Yaoundé)	0	0	0	0	0	0	0
Burkina Faso	INRAB	1	0	0	0	1	1	0
Benin	ENIRA	1	0	0	0	1	0	0
Burundi	USABU	1	0	0	0	0	0	0

Note: Mol = Molecular, Seq = sequencing, TF = Transformation; BIF = bioinformatics platform; BSF = Biosafety facilities.

Agricultural biotechnology: Human capacity

Table 5. Human capacity for transgenic research in sample countries in Africa

	Crop geneticists				Molecular biologists				Animal geneticists				Animal mol. scientists			
	MSc and BSc		PhD		MSc/BSc		PhD		MSc/BSc		PhD		MSc/BSc		PhD	
Country	Total	Fte	Total	Fte	Total	Fte	Total	Fte	Total	Fte	Total	Fte	Total	Fte	Total	Fte
Kenya	17	4	9	3	4	2	4	1	2	0	3	0	1	0	1	0
Uganda	7	3	5	1	3	1	2	0.3	0	0	0	0	0	0	0	0
Ethiopia	12	0	5	0	2	3	0	0	4	0	4	0	2	0	0	0
Malawi	2	0	2	0	1	1	1	0.3	0	0	0	0	0	0	0	0
South Africa	10	3	8	3	10	3	6	2	3	0	3	0	2	0	2	0
Zimbabwe	3	0	3	0	2	0	1	0	0	0	0	0	0	0	0	0
Ghana	5	1	3	1	3	3	2	1	4	0	0	0	0	0	0	0
Nigeria	22	2	15	4	11	2	7	2	7	0	4	0	0	0	0	0
Cameroon	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Burkina Faso	4	2	4	2	0	2	2	1	3	0	0	0	0	0	0	0
Benin	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Burundi	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	89	15	61	14	38	17	26	7	23	0	14	0	5	o	3	0

Other important findings

1. Exclusively animal health related issues addressed (Vaccine production and quality monitoring)
2. Limited interest/strength in animal breeding, reproductive physiology and artificial insemination (ref. Okeyo Mwai)
3. No use of the latest tools in research and development activities
4. Limited funding

II. Some options (examples and key recommendations)

1. Develop national research biotechnology capacity
2. Strengthen regional research biotechnology capacity
    - BecA/ILRI
    - WABI/UEMOA
3. Create dynamic research systems (North – South & South – South collaborations)
4. Harness the power of animal biotechnology for agricultural development

Capacities to improve animal agriculture in SSA

Health

Feed/Nutrition

Genetics/Genomics

Others

Financing
Markets
Access to tailored genetics
Gender and youth
Innovation
Regulations

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A research partnership to develop genetic tools to accelerate genetic improvement in tropical livestock systems

CTLGH operations (nodes in Edinburgh and in Nairobi)

development and application

New technologies

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Grand challenge:
Inclusive agricultural (tropical livestock) transformation

Possible interventions:

- Technologies for harness the potential of genetic gains in tropical livestock production systems
- Improve national breeding programs to support the application of novel technologies to increase genetic gains

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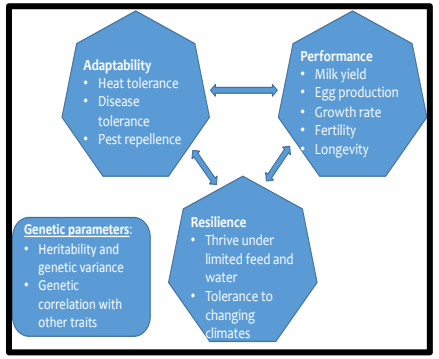
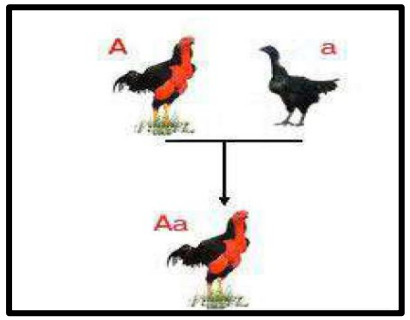
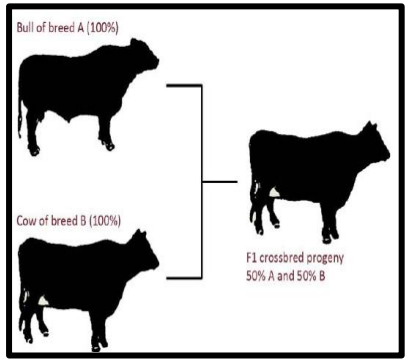
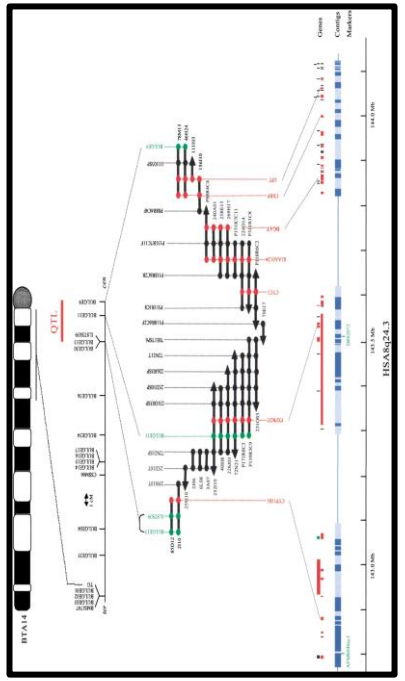
Strategy to accelerate genetic gains for tropical livestock development









On-farm phenotype recording

DNA/tissue sampling

Data and biorepository

Management information

Genetic profiling (host genome and microbiome)

Definition and characterization of traits

Matching breeds to ecology/environment

Breeding/Selection (exotic and locally adapted animals)

Tools and Algorithms (breeding values)

Breeding information and decisions

Identification of putative QTLs, genes, SNPs with effects key traits

Fine-mapping, identification of putative causal alleles affecting each trait

Markers for selection

Promotion of multiple favorable causal alleles impacting tropical adaptability and resilience including genome editing

Application and utilization of markers

Systems for selecting and introducing tropically-adapted parent stock back into the genetic gain and multiplication system

Accelerated and sustained genetic gains

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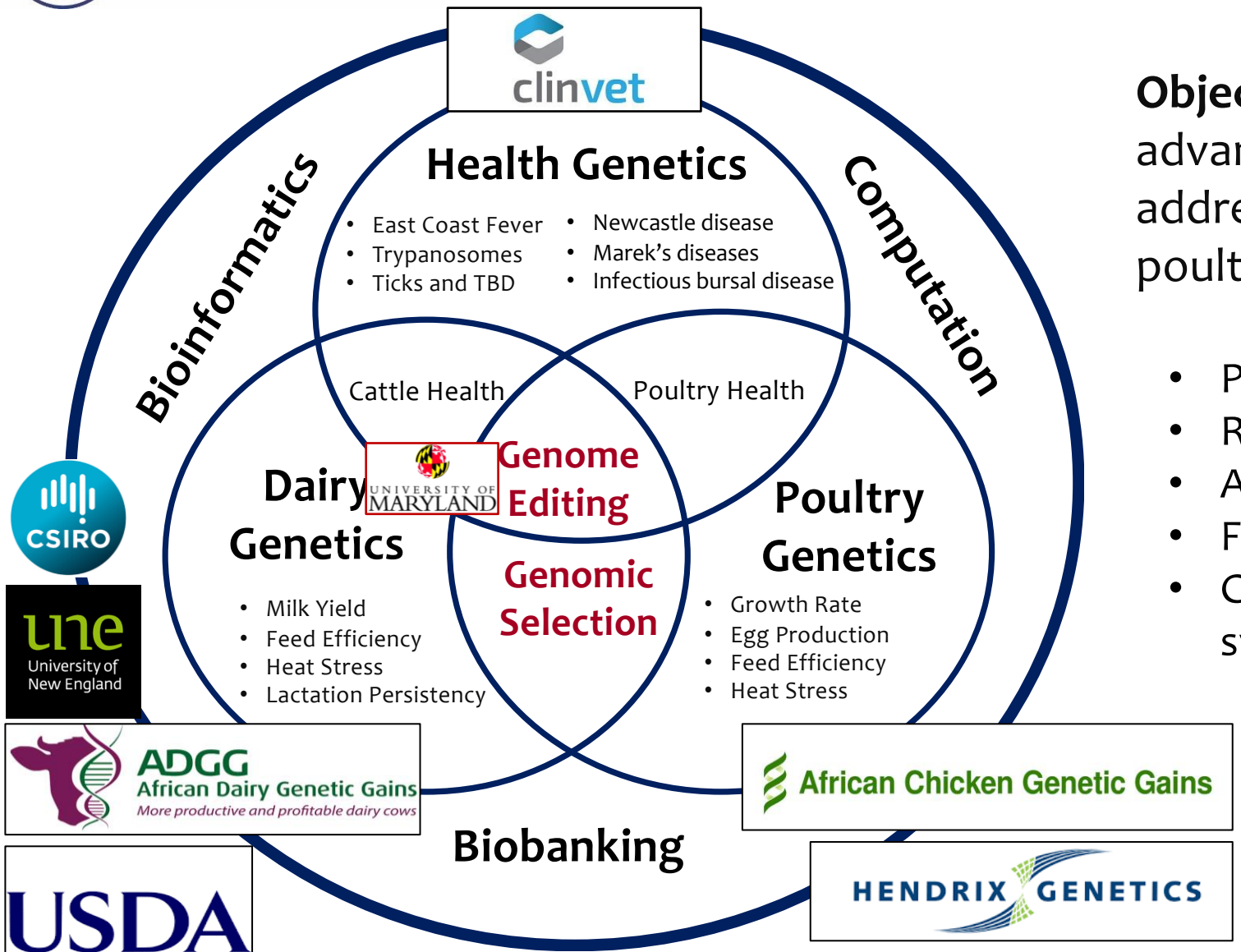
Current focus



Objectives – Develop and apply genomic and advanced reproductive technology tools to address tropical livestock (dairy cattle and poultry) development challenges:

- Productivity
- Resilience
- Adaptability
- Feed efficiency
- Capacity in national livestock development systems

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UKaid from the British people
BBSRC bioscience for the future

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Collaborators …

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BBSRC bioscience for the future

Capacity building program (2018 – 2021)

Increasing research skills and capacity to support the implementation of national livestock development plans

Ethiopia
(EIAR)

Kenya
(Egerton University)

Tanzania
(TALIRI)

Malawi
(Lilongwe University)

In country training (summer masterclasses)

- Genome Technologies and Bioinformatics
- Quantitative Genetics and Animal Breeding
- Mathematical Modelling
- Data in Agriculture

UK research placements

- From one month

Country capacity

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