African Nutritional Sciences Research Consortium (ANSRC)

Strengthening Capacity for Science and Innovation in Africa

- Build local capacity for science – linking health with nutrition, agriculture, and “biotechnology”
- Use graduates for TOT – trainers of trainers, …and students
- Economic development with scientific development
- Diminish “brain drain”
- Bring African universities into the respected group of top science training institutions
The “Double Burden”

ONE GLOBAL ISSUE!
AfDB High 5s and ANSRC
Many children are still undernourished

Underweight prevalence worldwide
Percentage of children under 5 years old who are moderately or severely underweight

Age-standardized BMI in men by country in 1975 and 2014
Stunting – Different Solutions Needed

*Does one size fit all?*

- Prepregnancy
- Intrauterine – SGA/LBW
- Postnatal
  - infancy
  - childhood
  - adolescence
Stunting and brain development

**Normal**

Typical brain cells
Extensive branching

**Stunted**

Impaired brain cells
Limited branching
Abnormal, shorter branches

Source: Cordero E et al, 1993
How much does undernutrition cost?
A 1% loss in adult height as a result of childhood stunting is associated with a 1.4% loss in productivity

(JM Hunt, 2005)

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Male</th>
<th>Female</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>50th</td>
<td>177 cm</td>
<td>164 cm</td>
<td>8%</td>
</tr>
<tr>
<td>3rd</td>
<td>163 cm</td>
<td>151 cm</td>
<td>8%</td>
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</tbody>
</table>

8% ↓height = ↓11.2% productivity!!
GDP per Capita and Dietary Energy Supply (DES)*


* kcal per day
Social and Economic Impact of Child Undernutrition

(Annual Losses)

- **Egypt**: $3.7 billion, 1.9% GDP
- **Ethiopia**: $4.7 billion, 16.5% GDP
- **Uganda**: $899 million, 5.6% GDP
- **Swaziland**: $92 million, 3.1% GDP

COHA Study, WFP, 2014
Estimated % Contribution Underlying Determinants to Underweight Women's Food Availability

- Food Availability: 26%
- Health: 19%
- Women's Status: 12%
- Women's Education: 43%

4th WNR, SCN
Soil Fertility Depletion

N 132 million tons
P 15 million tons
K 90 million tons
worth $11 billion/year!

LOST from cultivated land in 37 African countries during the last 30 years

Smaling, 1993
Sanchez, 2002
Health, Agriculture, Environment, Poverty
A need for econutrition programming

AGRICULTURE
poor management

ENVIRONMENTAL DEGRADATION
Loss of nutrients, soil erosion, biodiversity

MALNUTRITION, ILLNESS
Declining labor productivity
Decreased food production

Deckelbaum RJ, Palm C et al, 2006
Agriculture’s roles have benefits beyond just food production

“Soil to Seed to Plant to Fork to Health”

Source: Bread for the World 2010
Projected deaths by cause in high, middle, and low income countries, 2004 to 2030

Deaths (millions)

- High income
- Middle income
- Low income

Causes:
- Intentional injuries
- Other unintentional
- Road traffic accidents
- Other NCD
- Cancers
- CVD
- Mat//peri/nutritional
- Other infectious
- HIV, TB, malaria

Global Burden of Disease 2004 Update, WHO
The Bill, Please
(for 5 chronic diseases for 20 years)
N.B. These numbers are TRILLIONS

Table 14: The anticipated economic toll of NCDs is staggering

Economic burden of NCDs, 2011-2030 (trillions of US$ 2010), based on EPIC model 1

<table>
<thead>
<tr>
<th>Country income group</th>
<th>Diabetes</th>
<th>Cardiovascular diseases</th>
<th>Chronic Respiratory diseases</th>
<th>Cancer</th>
<th>Mental Illness*</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>High</td>
<td>0.9</td>
<td>8.5</td>
<td>1.6</td>
<td>5.4</td>
<td>9.0</td>
<td>25.5</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>0.6</td>
<td>4.8</td>
<td>2.2</td>
<td>2.3</td>
<td>5.1</td>
<td>14.9</td>
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<tr>
<td>Lower-middle</td>
<td>0.2</td>
<td>2.0</td>
<td>0.9</td>
<td>0.5</td>
<td>1.9</td>
<td>5.5</td>
</tr>
<tr>
<td>Low</td>
<td>0.0</td>
<td>0.3</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>0.9</td>
</tr>
<tr>
<td>LMIC</td>
<td>0.8</td>
<td>7.1</td>
<td>3.2</td>
<td>2.9</td>
<td>7.3</td>
<td>21.3</td>
</tr>
<tr>
<td>World</td>
<td>1.7</td>
<td>15.6</td>
<td>4.8</td>
<td>8.3</td>
<td>16.3</td>
<td>46.7</td>
</tr>
</tbody>
</table>

*The numbers for mental illness were obtained by relating the economic burden of all other diseases to their associated number of DALYs. Then the burden for mental illness was projected using the relative size of the corresponding DALY numbers to all the other conditions.
Tackling under- and overnutrition in Africa requires strengthening capacity for quality higher education and integrated basic scientific training and research in nutrition and agriculture.
Fewer Researchers in Sub-Saharan African Countries
Priorities for Higher Education in Africa

- Inadequately qualified staff/faculty to undertake teaching, supervision and mentorship of students;

- Limited laboratory infrastructure including shortage of skilled staff to undertake state-of-the-art research investigations;

- Poor translation of research findings into policy;

- Limited public and private funding portfolios for higher education and research to enable sustainability of science and innovation initiatives.

African Nutritional Sciences Research Consortium (ANSRC) responds to the training and research challenges faced by African institutions.
ANSRC Goals

To strengthen regional capacity to conduct PhD and, further enhance opportunities for post-doctoral training and research in human nutritional sciences, agriculture and related fields in East Africa.

ANSRC is being implemented in a consortium model comprised of >12 academic and research institutions in East Africa.
The African Nutritional Sciences Research Consortium (ANSRC)
Health, Agriculture, and Biologic Areas of Relevance

Link to Local Public Health and Agricultural Problems
(Examples -1)

Under- and Overnutrition
– Molecular actions of nutrients in soil, plants, animals, humans
– NCDs: metabolic syndrome, Type 2 diabetes, CVD, cancer
– Reproductive health, stunting

Nutrition and Emerging Health Problems
Seasonal starvation and epigenetics,
- Resilient crop selection and genetics
- Food safety (aflatoxins, microbes, water)
- Provision of quality nutrients/foods
- Integrating with One Health
Seasonal hunger and public policy; intersectoral solutions needed

New approaches to climate change needed to prevent hunger and undernutrition

- Food production could shrink by as much as 50% by 2020 in some African countries, and by 30% in Central and South Asia - *high risk of hunger*
- If temperatures rise by more than 3°C, calorie availability in 2050 will decline back to the 2000 level - *increasing child malnutrition by 20%*
Health, Agriculture, and Biologic Areas of Relevance

Link to Local Public Health and Agricultural Problems
(Examples - 2)

Nutrition and Climate Change – Root Drivers
- Lipomics and other “omics” in human/plant/livestock research
- Systems biology
- Agro-bioinformatics

Microbiome and the “double burden”
- In undernutrition
- In obesity, NCDs
- In soil health
<table>
<thead>
<tr>
<th>Country (Headquarters)</th>
<th>Institutions</th>
<th>Nature of collaboration/partnership</th>
<th>Contact person(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria (Lagos)</td>
<td>Pan African University (PAU)</td>
<td>Collaborates with ANSRC on graduate student training, training of academic staff, and joint research projects</td>
<td>Dr. Oluwole Abatan, Director</td>
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<tr>
<td>Kenya, Tanzania, Uganda, Burundi</td>
<td>AfDB Centers of Excellence in Health Sciences</td>
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<tr>
<td>Italy (Trieste)</td>
<td>The World Academy of Sciences (TWAS)</td>
<td>Collaborates with TWAS on the following specific three aspects: Fellowships, research grants and visiting scholar exchange programs</td>
<td>Dr. Romain Murenzi, Executive Director</td>
</tr>
<tr>
<td>Kenya (Nairobi)</td>
<td>African Population and Health Research Center (APHRC)</td>
<td>APHRC implements CARTA Training program for post-graduate training in select African countries. ANSRC collaborates with CARTA on curriculum development, faculty training, training and progress monitoring of graduate students</td>
<td>Dr. Alex Ezeh, Director</td>
</tr>
<tr>
<td>Kenya (Nairobi)</td>
<td>African Economic Research Consortium (AERC)</td>
<td>AERC implements a number of masters and PhD training programs in agriculture and economics. ANSRC collaborates with AERC on curriculum development, faculty training, training and progress monitoring of graduate students</td>
<td>Dr. Lemma Senbet, Executive Director</td>
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<tr>
<td>Kenya, Uganda, Tanzania, Rwanda and Burundi</td>
<td>National Commissions of Education (CUEs) Academies of Science</td>
<td>Active engagement with CUEs in partner countries to facilitate ANSRC program and training curriculum approval/accreditation. Secondly, to collaborate in conducting regular assessments of doctoral programs in the partner institutions</td>
<td>Directors/Executive Secretaries of CUEs in Kenya, Rwanda, Uganda, Tanzania and Burundi</td>
</tr>
<tr>
<td>USA (Madison)</td>
<td>University of Wisconsin-Madison’s Departments of Biochemistry and Nutritional Sciences (DBNS-UWM)</td>
<td>Collaborate on curriculum development, student and faculty exchange programs, and serve as a member of the ANSRC eternal scientific advisory committee (SAC)</td>
<td>Dr. James Ntambi, Chair, Department of Nutrition</td>
</tr>
<tr>
<td>USA (New York)</td>
<td>Institute of Human Nutrition-Columbia University (IHN-CU)</td>
<td>Collaborate on curriculum development, student and faculty exchange programs, and serve as a member of the ANSRC eternal scientific advisory committee (SAC)</td>
<td>Drs. Richard Deckelbaum and Debra Wolgemuth, Institute of Human Nutrition, Columbia University</td>
</tr>
<tr>
<td>Uganda</td>
<td>The Inter-University Council of East Africa (IUCEA)</td>
<td>Government body partnering with and overseeing ANSRC</td>
<td>Dr. Alexandre Lyambabaje</td>
</tr>
<tr>
<td>Tanzania</td>
<td>East African Community (EAC)</td>
<td>To facilitate regional uptake of ANSRC by the five EAC countries, and to enable successful</td>
<td>Dr. Richard Sezibera, Secretary General</td>
</tr>
<tr>
<td>Country</td>
<td>Institutions</td>
<td>Contact person(s)</td>
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<tr>
<td>Rwanda</td>
<td>National University of Rwanda</td>
<td>Dr. Antoine Nsabimana</td>
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<tr>
<td>Kenya</td>
<td>Egerton University</td>
<td>Dr. Elizabeth Kamau-Mbuthia</td>
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<td>Kenyatta University</td>
<td>Dr. Judith Kimiywe</td>
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<td></td>
<td>Technical University of Kenya</td>
<td>Dr. Fiona Mbai</td>
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<td></td>
<td>University of Nairobi</td>
<td>Drs. Bonnie Dunbar &amp; Joel Ochieng</td>
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<td>Moi University</td>
<td>Dr. Simeon Mining</td>
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<td>Maseno University</td>
<td>Dr. Collins Ouma</td>
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<td>Masinde Muliro University</td>
<td>Dr. Gordon Nguka</td>
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<td>Burundi</td>
<td>University of Burundi</td>
<td>Dr. Theodore Niyongabo</td>
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<td></td>
<td>Institut National de Sante Publique</td>
<td>Dr. Pierre Claver Kazihise</td>
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<tr>
<td>Tanzania</td>
<td>Sokoine University of Agriculture</td>
<td>Dr. John Msuya</td>
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<td></td>
<td>Nelson Mandela Inst. of Science and Technology</td>
<td>Dr. Martin Kimanya</td>
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<tr>
<td>Uganda</td>
<td>Makerere University</td>
<td>Dr. Archelio Kaaya</td>
<td></td>
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<tr>
<td>Regional (Africa)</td>
<td>The Biosciences Eastern and Central Africa (BecA)-ILRI Hub</td>
<td>Dr. Appolinaire Djikeng</td>
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</tbody>
</table>
ANSRC Working Groups

- Admissions
- Curriculum
- Research and Student Monitoring
- Human and Physical Infrastructure
- Coordination with development agencies and private sector
ANSRC Recent Progress

- ANSRC office continues at Nairobi CGC
- ANSRC website, ANSRC at STI conferences (SSA, USA)
- Program Manager - Dr. Murugi Ndirangu
- ANSRC registration as a regional entity…done!
- Working group reports drafted
- Nairobi ANSRC/EAC meeting to plan Burundi CoE in Nutrition – funds allocated by ADB for 2017
- ADB Project Concept Note
- Meetings with World Bank, USAID, ADB
- Funding by CU’s President’s Global Innovation Fund
Implementation Infrastructure

- Columbia Global Centers/Africa (CGC) – Nairobi ANSRC offices
- Ministries of Health and Ministries of Higher Education in the partner EAC Countries
- EAC Secretariat and the IUCEA
- Partner academic and research institutions
ANSRC PROGRAMME DIRECTOR
Prof. John T. Kakitahi

ANSRC SECRETARIAT (Columbia Global Center, Nairobi)
1. Programme Manager: Dr. Murugi Ndirangu
2. Administrative Assistants (2)
3. M&E Officer

EXTERNAL ADVISORY COMMITTEE
AERC, CARTA, TWAS, AAS, IUCEA, AVU, EAC, Columbia University, University of Wisconsin

STEERING COMMITTEE
TWO representatives from each of the five EAC countries,

REPRESENTATIVES OF INSTITUTIONS from member countries
Rwanda, Kenya, Uganda, Burundi, Tanzania

WORKING GROUP 1:
Student admission

WORKING GROUP 2:
Curriculum

WORKING GROUP 3:
Research and student monitoring

WORKING GROUP 4:
Human and physical infrastructure

WORKING GROUP 5:
Liaison with development agencies and private sector
Resource Mapping and Training of Trainers
Resource Mapping Survey (RMS)

1. Human Resources
   • Available faculty
   • Administrative and teaching commitment
   • Research funding
   • Publication records

2. Program resources
   • Enrolment
   • Research administration and oversight
   • Student recruitment and admission
   • Student financial aid and support services
   • Thesis (preparation, monitoring, defense)
   • Program evaluation

3. Laboratory Resources
   • Document existing equipment inventory
   • Establish usage pattern and maintenance of equipment
   • Assess existing procurement procedure, supply chain and stock replacement
   • Assess training adequacy and competence of lab personnel
Human Resources

- Identify **needs for human resource/ICT/Infrastructure**
- **Training** of program and grant administrators
- **Workshops/online resources** for training mentoring faculty - ToT
- Develop **gender mainstreaming** policy
- **Protected mentor time**
- **Use US faculty** on sabbatical to train in East Africa
- Develop **incentives/attractive packages** to retain trained faculty/bind trained faculty
- Develop **“sandwich” collaborations** for short term training in USA
Curriculum Development and Implementation

“The Single Class Room”
Entry Requirements

- Entry requirements: includes MSc. in nutritional sciences or related fields, e.g., microbiology, immunology, biochemistry, genetics, molecular biology, and food science and technology.

- Selection of additional courses tailored to the individual graduate student’s interests, relying on the advice of his/her advisor/research mentor and Dissertation Committee

- Course requirements: to meet institutional and ANSRC minimum course units for the PhD program
Laboratory Rotations and Credit Transfer

• Laboratory rotations – initiated in 1st year (3 months each)

• Draw from existing programs (AERC, APHRC) on pathways for credit transfer

• Examinations at the individual university to be moderated at the consortium level
Core Courses
(Potential examples)

Program Core Courses (minimum of 12 credits)

Genomics and Epigenetics – Lectures/workshops

Molecular and Cell Biology of Nutrients - Lectures

The Microbiome; Soil, Plants, Livestock, and Humans – Lectures/workshops

Biostatistics – Lectures

Biosafety in Research Laboratories (Workshops or Seminars)

Applied Research: Planning/Design/Analysis (Workshops or Seminars)

Communicating Science & Technology (Workshops or Seminars)

Introduction to Research Ethics (Workshops)
Centers of Excellence (CoEs)
CoE - Rationale

• Will enable EAC countries to have well trained leaders in nutrition, agriculture and biotechnology to define better policies and strategies to drive inclusive green growth

• Establish state-of-the art training and research centers

• One CoE already exists:
  – (BecA/ILRI, Nairobi)
CoEs – ANSRC Plans

• Establish new CoEs to support basic research in nutritional and agricultural sciences (for core curriculum and for support of individual research projects)

• Potential CoEs – “Omics” (lipidomics, proteomics, metabolomics) in Uganda; Microbiome (Ethiopia or Tanzania)

• Proposals from universities and institutions to justify their capabilities to host CoEs
ANSRC - Integrating Biotechnology into Nutrition and Agricultural Sciences

Laboratory Based Education/Training

“Path to Action”

Public Health/Food Security

Building Human and Economic Capacity

Links to the private sector
Why PhD Training?

• Severe shortage of doctoral trained individuals to teach Masters level programs and lead research in East African universities
  – In Kenya less than 1% of university learners are enrolled in PhD programs
  – Situation worse in nutritional and agricultural sciences

• Quality of existing doctoral programs in the region has been questioned
  – Quality doctoral training imparts critical thinking skills, inculcate independence, enhances innovation and invention, and develops leadership skills.
Commission for University Education (Kenya)

• “For example, a student took 11 years to graduate with a PhD…”

• “…half of PhD students dropped out.”

• “A person with a doctoral degree with no quality is not important”

Daily Nation (Kenya); April 2, 2017
ANSRC – Higher Education for Africa

- Partnerships ongoing:
  - Pan African University
  - BECA COE in Health Sciences and Bioengineering
  - New Einstein Initiative
  - AERC, CARTA(APHRC), African Academies of Science, CU, UW (Madison), African universities

- Political buy-ins established and in progress

- Ready to operationalize in 3-4 months