



Category II Centre  
Under the Auspices of  
UNESCO

# INTERNATIONAL CENTRE *for* BIOTECHNOLOGY NSUKKA, NIGERIA



## Overview: History, Programmes, and Activities

Umezuruike Linus Opara, CEng CFS FIAgrE  
Distinguished Professor &  
Executive Director



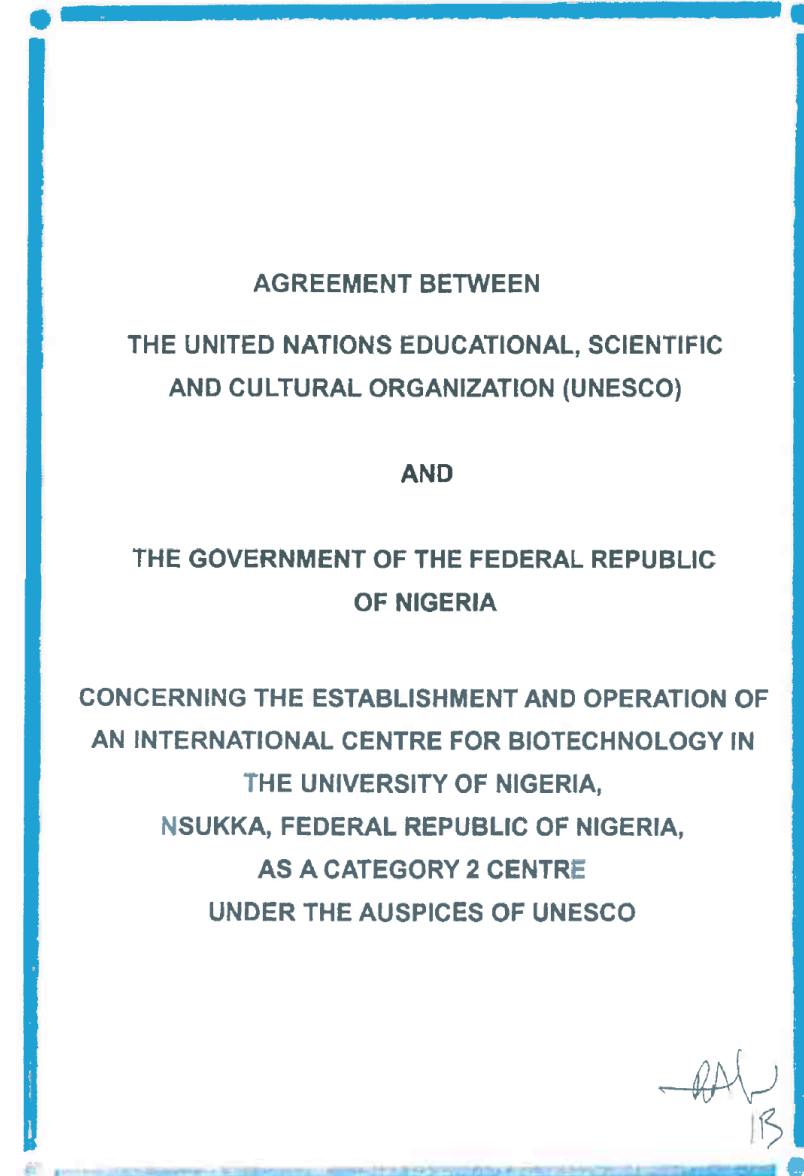
[Unesco.icb.Nigeria@gmail.com](mailto:Unesco.icb.Nigeria@gmail.com)

+27 603266564

# History

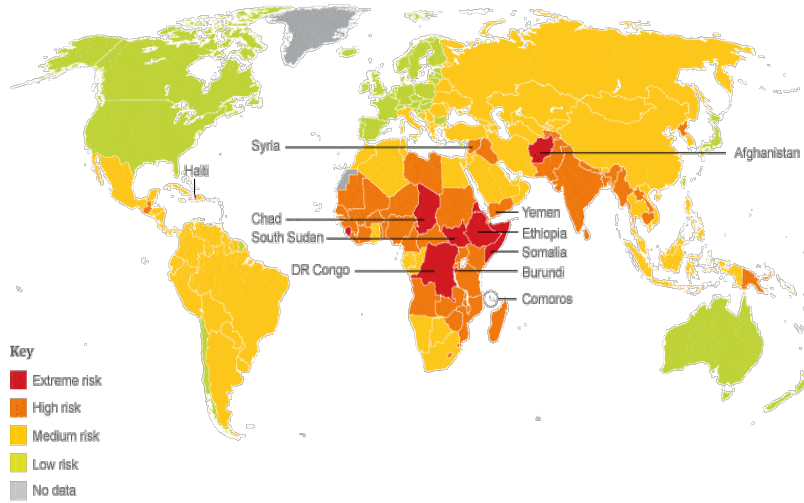
UNESCO ICB, NSUKKA,  
NIGERIA

- **2010:** Exploratory visit to Nigeria by UNESCO delegation
- **15 October 2012:** Agreement between the Federal Government of Nigeria and UNESCO signed in Paris to establish the Centre at the University of Nigeria, Nsukka (UNN) as a Category II Centre under the auspices of UNESCO
- **2014:** Centre's new building completed
- **2017:** Executive Director appointed
- **11 November 2020:** Agreement ratified by the Federal Government of Nigeria
- **08 September 2021:** Ratified Agreement communicated to UNESCO



# Thematic Areas

## Food Security Risk Index 2013



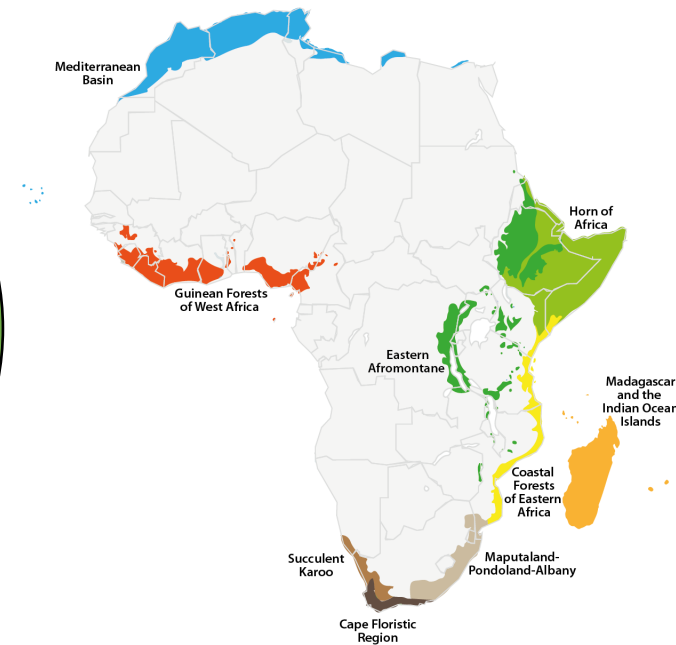
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**FOOD  
SECURITY**

**BIORESOURCES  
CONSERVATIONS**

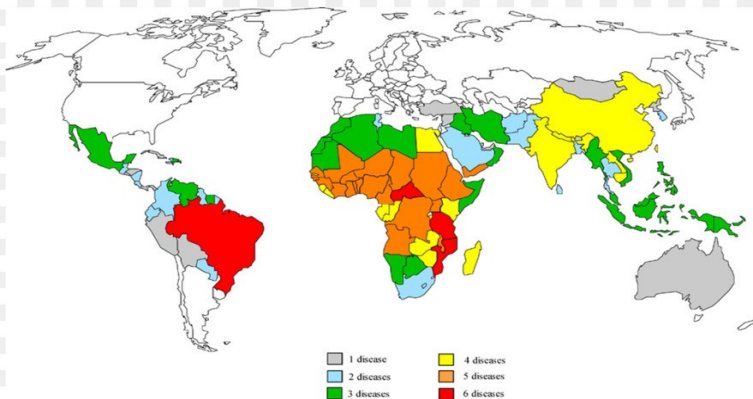
**TROPICAL  
DISEASES**

## Africa's Biodiversity Hotspots



## Global distribution of NTDs

Approximately 1 billion people are affected by more than one of NTDs



Source: Savioli, L. (2010). *Neglected Tropical Diseases (NTDs): Yesterday's drain, tomorrow's gain for global health*. Retrieved July 27, 2010, from <http://ndt.ri.org/publications/index.cfm?section=threpps&id=5220>

# Our Mandate

## • Objectives

Provide high-level training, education and research in biotechnology

related particularly to food security and related bio-resource conservation, and tropical diseases

to scientists from the **African region and internationally.**

## • Functions

- a) Organize **training workshops** in these fields on a regular basis using local and international experts, to include both introductory and specialized sessions on cutting edge technology, in collaboration with national, regional and international universities and specialized centres and organizations;
- b) Foster knowledge transfer, **build capacity** and promote scientific **collaboration** in these fields both regionally and internationally by **providing advanced infrastructure and expertise** in biotechnology;
- c) Provide training and retraining **attachments and exchange visits for scientists** on fields covered by the Centre, to be hosted at the University;
- d) Build programmes for **postgraduate and post-doctoral research and training, scholarships and awards** in the fields specified;
- e) Facilitate **collaboration and exchange** among scientists in the region and internationally including with **industry.**

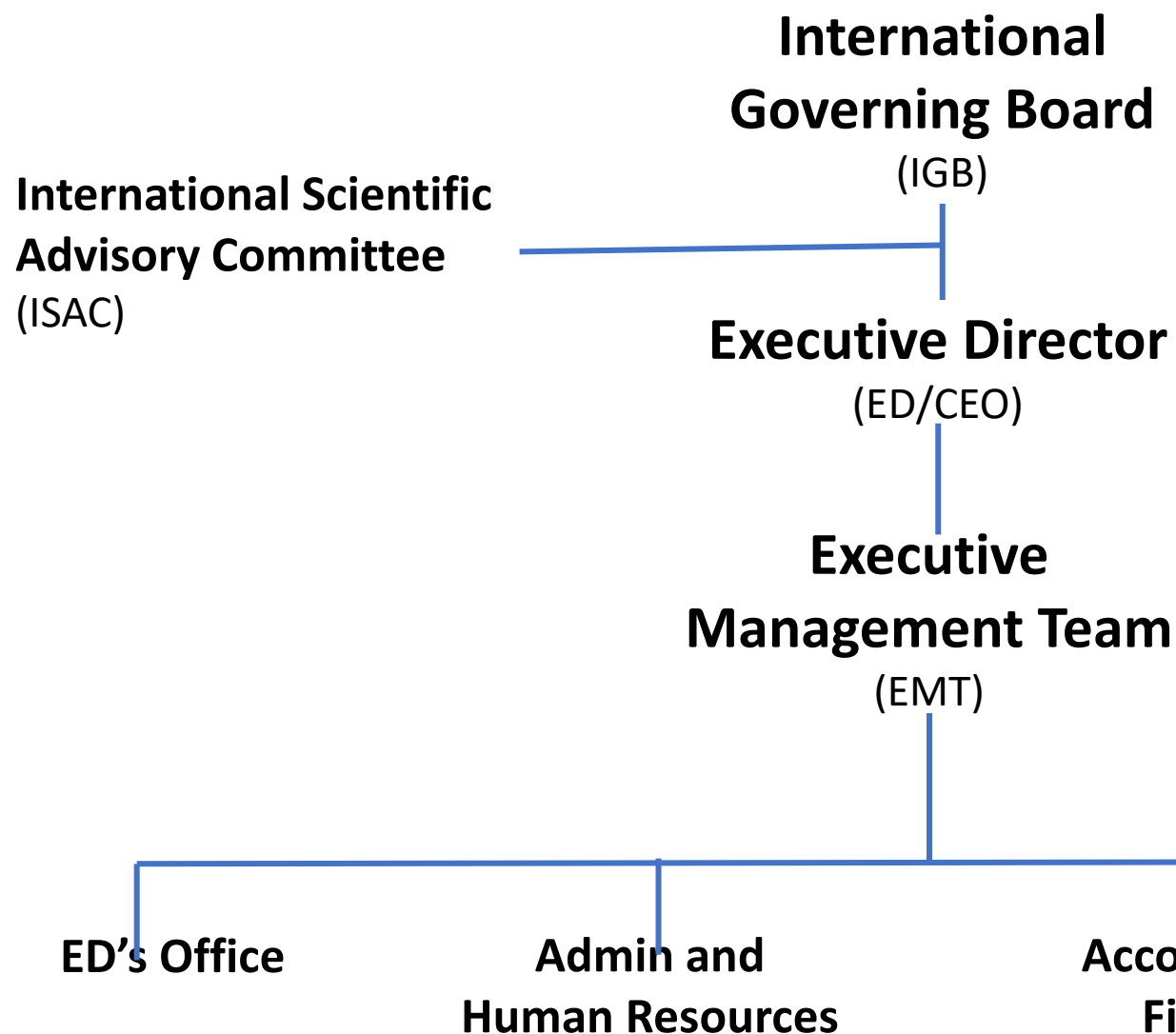
# Developmental Goals and Aspirations



# Centre's Developmental Phases

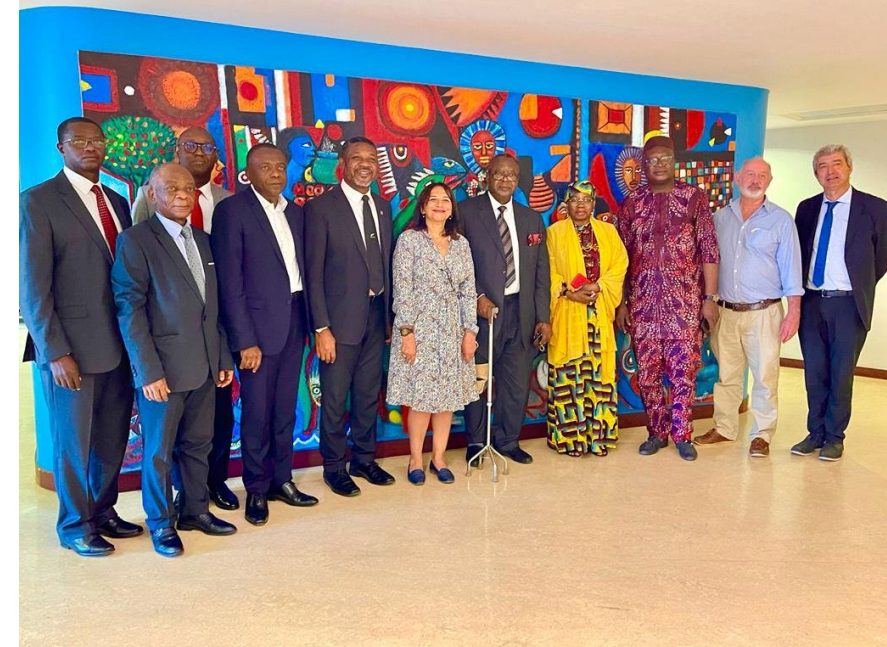
- I. Agreement: 2010-2012
- II. Ratification: 2017-2020
- III. Infrastructure & Personnel: 2019-2023
- IV. Programming: 2022-





Staff: 69 Male:47 Female:22

Research: 37, M 22, F 15, PhD 5, MSc 9, BSc 23



# Infrastructure Development

- Power: generators, solar
- Water: borehole
- Cold store (solar)
- Greenhouse
- Security: perimeter fence
- Transport: project vehicles
- Laboratory equipment
- Conference facilities
- *Tissue culture Lab*





Biodetection and Diagnostics Lab



Postharvest Biotech Lab



Bioproducts Innovation Lab



Molecular Biology Lab



# Programming

## Research

*Strategy, themes, programmes, projects, publications*

## Training and scholarships

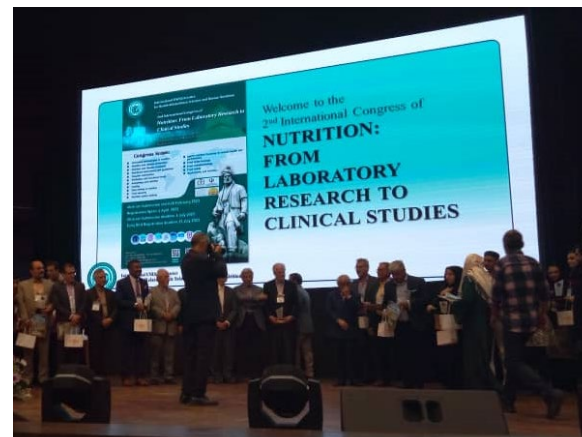
*In-house, partners; student awards*

## Partnerships/Networks

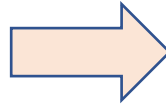
*Equipment suppliers, C2Cs, universities, professional associations*

## Conferences/Symposia/Workshops

- i. *International Conference on the Role of Biotechnology in Food Security & Human Health*
- ii. *Regional Symposium on Intellectual Property and Commercialisation*
- iii. *Workshop on Ethics in Research and Publications*
- iv. *Lab Techniques and Procedures in Postharvest Biotechnology*



**FOOD AND  
NUTRITION  
SECURITY**

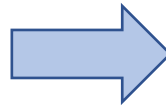


SAVE THE HARVEST FOR FOOD SECURITY

ENHANCE YIELD AND MAINTAIN POSTHARVEST QUALITY

PROCESSING AND VALUE-ADDITION

**TROPICAL  
DISEASES**



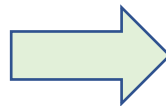
EPIDEMIOLOGY AND NOVEL TREATMENTS

RAPID DIAGNOSTIC TOOLS FOR EARLY DETECTION

BOOSTING HUMAN IMMUNE SYSTEM

DRUG RESISTANCE

**BIORESOURCES  
CONSERVATION**



SAVE THE FUTURE: A GENE BANK OF CULTIVATED AND WILD PLANTS

ETHNOBOTANY: CHARACTERISATION AND CONSERVATION

BIOPROSPECTING AND SUSTAINABLE UTILIZATION

## 2023 BOOK PUBLICATION: UNESCO ICB

### Book chapters

1. Opara, UL., Pathare, PB. 2023. [Mechanical Damage of Fresh Produce: An Overview](https://doi.org/10.1007/978-981-99-7096-4_1) Pages 1-19. [https://doi.org/10.1007/978-981-99-7096-4\\_1](https://doi.org/10.1007/978-981-99-7096-4_1). In: Pathare PB and Opara UL. (Editors) 2023. Mechanical Damage in Fresh Horticultural Produce - Measurement, Analysis and Control. Springer. <https://doi.org/10.1007/978-981-99-7096-4>
2. Opara, UL., Hussein Z. 2023. [Factors Affecting Bruise Damage Susceptibility of Fresh Produce](https://doi.org/10.1007/978-981-99-7096-4_2) Pages 21-44. [https://doi.org/10.1007/978-981-99-7096-4\\_2](https://doi.org/10.1007/978-981-99-7096-4_2). In: Pathare PB and Opara UL. (Editors) 2023. Mechanical Damage in Fresh Horticultural Produce - Measurement, Analysis and Control. Springer. <https://doi.org/10.1007/978-981-99-7096-4>
3. Opara UL, Okere, EE, Ambaw, A. 2023. [Hyperspectral Imaging and Related Machine Learning for Postharvest Bruise Damage Detection and Analysis of Fresh Food Produce](https://doi.org/10.1007/978-981-99-7096-4_5) Pages 91-113 [https://doi.org/10.1007/978-981-99-7096-4\\_5](https://doi.org/10.1007/978-981-99-7096-4_5). In: Pathare PB and Opara UL. (Editors) 2023. Mechanical Damage in Fresh Horticultural Produce - Measurement, Analysis and Control. Springer. <https://doi.org/10.1007/978-981-99-7096-4>
4. Opara, UL, Hussein Z, Fawole OA. 2023. [Bruise Damage Susceptibility of Pomegranates](https://doi.org/10.1007/978-981-99-7096-4_8) Pages 149-172. [https://doi.org/10.1007/978-981-99-7096-4\\_8](https://doi.org/10.1007/978-981-99-7096-4_8). In: Pathare PB and Opara UL. (Editors) 2023. Mechanical Damage in Fresh Horticultural Produce - Measurement, Analysis and Control. Springer. <https://doi.org/10.1007/978-981-99-7096-4>
5. Opara, UL., Pathare, PB. 2023. [Bruise Damage Susceptibility of Banana](https://doi.org/10.1007/978-981-99-7096-4_14) Pages 289-309. [https://doi.org/10.1007/978-981-99-7096-4\\_14](https://doi.org/10.1007/978-981-99-7096-4_14). In: Pathare PB and Opara UL. (Editors) 2023. Mechanical Damage in Fresh Horticultural Produce - Measurement, Analysis and Control. Springer. <https://doi.org/10.1007/978-981-99-7096-4>
6. Fadiji, T., Kaseke, T, Lufu R, Li Z, Opara UL, Fawole, AO. 2023. [Impact of Packaging on Bruise Damage of Fresh Produce](https://doi.org/10.1007/978-981-99-7096-4_15) Pages 311-336. [https://doi.org/10.1007/978-981-99-7096-4\\_15](https://doi.org/10.1007/978-981-99-7096-4_15). In: Pathare PB and Opara UL. (Editors) 2023. Mechanical Damage in Fresh Horticultural Produce - Measurement, Analysis and Control. Springer. <https://doi.org/10.1007/978-981-99-7096-4>
7. Pathare, PB and Opara, UL., 2023. [Importance of Bruise Assessment and Control in Fresh Produce Industry](https://doi.org/10.1007/978-981-99-7096-4_16) Pages 337-350. [https://doi.org/10.1007/978-981-99-7096-4\\_16](https://doi.org/10.1007/978-981-99-7096-4_16). In: Pathare PB and Opara UL. (Editors) 2023. Mechanical Damage in Fresh Horticultural Produce - Measurement, Analysis and Control. Springer. <https://doi.org/10.1007/978-981-99-7096-4>

Pankaj B. Pathare  
Umezurike Linus Opara *Editors*

# Mechanical Damage in Fresh Horticultural Produce

Measurement, Analysis and Control

 Springer

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NIGERIA

## 2024 BOOK PUBLICATION: UNESCO ICB

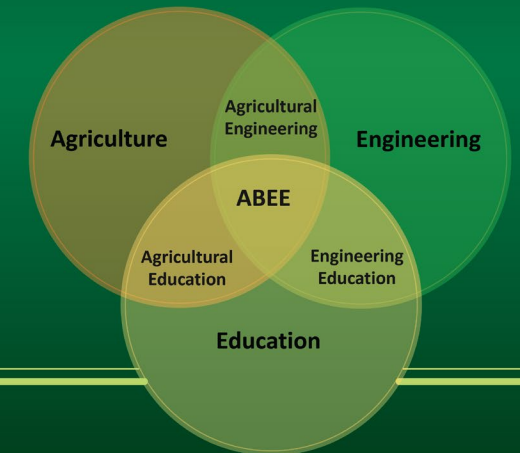
### Book chapters

1. Opara, UL. Introduction – Revisiting and Rethinking Agricultural, Biosystems, and Biological Engineering Education for Sustainable Development. DOI: 10.1201/9780429150111-2
2. Opara, UL. Emergence and Advancement of Agricultural Engineering Education, Research and Practice – A Historical Perspective. DOI: 10.1201/9780429150111-3
3. Fomunyan, KG & UL Opara. Agricultural Engineering in the Context of SDGs: A Quest for Global Relevance. DOI: 10.1201/9780429150111-4
4. Opara, UL. Top 100 Questions of Importance to the Future of Agricultural Engineering Education, Research, and Practice in Africa. DOI: 10.1201/9780429150111-5
5. Opara, UL & Y. Al-Mulla. Agricultural Engineering Education at Sultan Qaboos University, Sultanate of Oman – Historical Evolution, Curriculum Design and Reform, Students' Perceptions, and Future Prospects. DOI: 10.1201/9780429150111-19
6. Opara, UL. Nomograph-based Models for Introductory Undergraduate Teaching and Research in Selecting Agricultural Power and Machinery-Ownership Systems in Developing Countries. DOI: 10.1201/9780429150111-34
7. Opara, UL. CAM-SAM: A Computer-aided Tool for Education and Research on Selective and Sustainable Agricultural Mechanisation Development. DOI: 10.1201/9780429150111-39
8. Opara, UL. Growing Agricultural Engineering in Africa: Students' Attitudes, Perceptions, and Expectations on Agricultural Engineering Education. DOI: 10.1201/9780429150111-44
9. Opara, UL. Prospects for Agricultural and Biosystems Engineering Education and Research for Knowledge-Intensive, Data-Driven, Climate-Smart, and Sustainable Agriculture. DOI: 10.1201/9780429150111-45



# Agricultural, Biosystems, and Biological Engineering Education

## Global Perspectives and Current Practice



Edited by

**Umezuruike Linus Opara**



CRC Press  
Taylor & Francis Group

**UNESCO ICB, NSUKKA,  
NIGERIA**

1. Lufu R, Ambaw A, Opara UL. 2024. Mechanisms and modelling approaches to weight loss in fresh fruit: a review. *Technology in Horticulture* 4: e006 doi: 10.48130/tihort-0024-0003
2. Lufu, R, Ambaw, A., Opara, U.L. 2023. Determination of moisture loss of pomegranate cultivars under cold and shelf storage conditions and control strategies. *Sustainable Food Technology*, **1**, 79-91. DOI: [10.1039/D2FB00017B](https://doi.org/10.1039/D2FB00017B)
3. Maphosa B, Ambaw A, Opara UL. 2023. Review of the effects of various pretreatment and drying techniques on the qualities of dried pomegranate (*Punica granatum* L.) arils. *Technology in Horticulture*, 3: 26, doi: 10.48130/TIH-2023-0026
4. Mahdi Rashvand, M., Matera, A., Altieri, G., Genovese, F., Fadiji, T., Opara, UL., Mohammadifar, MA., Feyissa, AH., Di Renzo, GC. 2023. Recent advances in the potential of modeling and simulation to assess the performance of modified atmosphere packaging (MAP) systems for fresh agricultural product: Challenges and Development. *Trends in Food Science and Technology*, <https://doi.org/10.1016/j.tifs.2023.04.012>
5. Nturambirwe, JFI, EA Hussein, M Vaccari, C Thron, WJ Perold, UL Opara. 2023. Feature Reduction for the Classification of Bruise Damage to Apple Fruit Using a Contactless FT-NIR Spectroscopy with Machine Learning. *Foods*, 12(1): 210; <https://doi.org/10.3390/foods12010210>
6. Okere EE, Ambaw A, Perold WJ and Opara UL. 2023. Vis-NIR and SWIR hyperspectral imaging method to detect bruises in pomegranate fruit. *Frontiers in Plant Science*. 14:1151697. <https://doi.org/10.3389/fpls.2023.1151697>
7. Okere EE, Ambaw A, Perold WJ, Opara UL. 2023. Early bruise detection on pomegranate (*Punica granatum* L.), using hyperspectral imaging coupled with artificial neural network algorithm. *Technology in Horticulture* 3: 27, doi: 10.48130/TIH-2023-0027

# OVER 70 INVITED KEYNOTE PAPERS/LECTURES (2017-2024)

1. Opara, U.L. 2024. Transforming African Agriculture for Sustainable Development: Challenging Old and Current Paradigms that focus on Smallholder and Developing a Blueprint for Industrialization of Agri-food Systems. International Conference on Business, Society, and African Futures, Nelson Mandela University, South Africa, 10-12 April.
2. Opara, U.L. 2024. Building Africa's capacity for research and innovation to reduce postharvest losses and food waste. Food and Nutrition Security in Africa International Conference, Natural Resources Institute, Greenwich University, UK, 20-21 February.
3. Opara, U.L. 2023. Advances in postharvest biotechnology research and innovation and prospects for commercialization. Regional Workshop on Intellectual Property and Commercialization of Biotechnology Research and Innovation. UNESCO International Centre for Biotechnology, 19-20 October 2023, Nsukka, Nigeria.
4. Opara, U.L. 2023. An interdisciplinary approach to research development – the case of pomegranate biotechnology. International Conference on Biotechnology for Food Security. UNESCO International Centre for Biotechnology, 18-20 October 2023, Nsukka, Nigeria.
5. Opara, U.L. 2023. Making university education count – the role of capacity building in research and innovation. Graduation Ceremony Lecture, 13 October 2023, Department of Microbiology, Faculty of Biological Sciences, University of Nigeria, Nsukka,
6. Opara, U.L. 2023. Harnessing postharvest technology for food and nutrition security – the pomegranate story. 2nd International Conference of Nutrition: From laboratory research to clinical studies, 4-6 October 2023, Mashhad, Iran.
7. Opara, U.L. 2023. Transitioning to research-led academic programmes: Perspectives on moving from short-lived projects to programme-based research Agenda. 19th Annual General Meeting (AGM), Regional Universities' Forum for Capacity Building in Agriculture (RUFORUM), "Transforming Higher Education to Sustainably Feed and Create Prosperity for Africa". 28 October – 02 November 2023, Yaounde, Cameroon.
8. Opara, U.L. 2023. Reducing food losses, evening supply, and creating market opportunities for Africa's food systems. 19th Annual General Meeting (AGM), Regional Universities' Forum for Capacity Building in Agriculture (RUFORUM), "Transforming Higher Education to Sustainably Feed and Create Prosperity for Africa". 28 October – 02 November 2023, Yaounde, Cameroon.
9. Opara, U.L. 2023. Global perspectives on agro-processing: Drivers and triggers for transformation using the pomegranate as example. Global Agricultural Mechanization Congress (GAMC), with the theme "Efficiency, Inclusiveness and Resilience" from 27 to 29 September 2023. Food and Agriculture Organization of the United Nations, Italy, Rome.
10. Opara, U.L. 2023. Building capacity of food supply chain actors for better postharvest management for AfCFTA. Sustainable Postharvest Management: Boosting Intra-African Agricultural Trade and Enhancing Food and Nutrition Security. The 4th All Africa Postharvest Congress and Exhibition, 19 to 22 September 2023, African Union Commission HQ, Addis Ababa.
11. Opara, U.L. 2023. The role of basic sciences in postharvest technology research and innovation. The African Continental Conference on Basic Sciences for Transformation, for the Celebration of the International Year of Basic Sciences for Sustainable Development, 13-14 June, 2023, Serena Hotel, Kigali, Uganda.



“Recognizing the world's most influential researchers of the past decade, demonstrated by the production of multiple highly-cited papers that rank in the top 1% by citations for field and year in Web of Science”.

<https://recognition.webofsciencegroup.com/awards/highly-cited/2019/>

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## A TRAINING WORKSHOP



**ON**  
**BIOPROCESSING & VALUE ADDITION OF INDIGENOUS FOOD MATERIALS**

VENUE: UNESCO - ICB CONFERENCE ROOM 1, KWAME NKURUMAH WAY, UNIVERSITY OF NIGERIA NSUKKA CAMPUS ENUGU STATE.

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## A TRAINING WORKSHOP



**ON**  
**NEGLECTED TROPICAL DISEASES**

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## A TRAINING WORKSHOP



**ON**  
**POSTHARVEST BIOTECHNOLOGY - TECHNIQUES AND PROCEDURES**

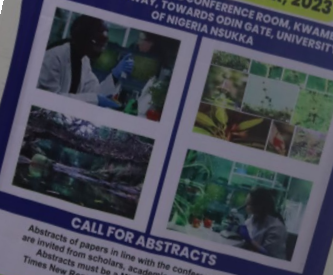
VENUE: UNESCO - ICB CONFERENCE ROOM 1, KWAME NKURUMAH WAY, UNIVERSITY OF NIGERIA NSUKKA CAMPUS ENUGU STATE.

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## 2023 Regional Workshop on Intellectual Property and Commercialization of BIOTECHNOLOGY RESEARCH AND INNOVATION

18TH - 20TH OCTOBER, 2023

VENUE: UNESCO ICB CONFERENCE ROOM, KWAME NKURUMAH WAY, TOWARDS OOH GATE, UNIVERSITY OF NIGERIA NSUKKA



**CALL FOR ABSTRACTS**

Abstracts of papers in line with the conference theme are invited from scholars, academic and policy makers. Abstracts must be a Microsoft word document, Times New Roman, Font size 12, single line spacing, and not more than 250 words.

Abstracts can be submitted to [conferences@unescoicb.org.ng](mailto:conferences@unescoicb.org.ng) using WPCP 2023 as the subject of the mail.

**PROF. UNESURUKE UNUS OF ARA** **PROF. BENJAMIN UBI**

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## HUMAN CAPITAL DEVELOPMENT PROGRAMME

1st Regional Conference



**ON**  
**ROLE OF BIOTECHNOLOGY IN FOOD AND NUTRITION SECURITY**

VENUE: UNESCO - ICB CONFERENCE ROOM 1, KWAME NKURUMAH WAY, UNIVERSITY OF NIGERIA, NSUKKA ENUGU STATE.

DATE: 4-5 OCTOBER 2021 TIME: 9:00AM

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## Achieving Food and Nutrition Security

Second Regional Conference on Role of Biotechnology in

Date: 28-29 September, 2022  
Venue: UNESCO ICB Conference Room  
Time: 8am Daily

Abstracts of papers in line with the Conference theme are invited from scholars, academia and policy makers. Abstracts must be a Microsoft word document, Times New Roman, font size 12 and not be more than 300 words. Deadline for abstracts submission is 26th September, 2022. Abstracts can be submitted to [conferences@unescoicb.org.ng](mailto:conferences@unescoicb.org.ng)

REGISTER IN ADVANCE FOR THIS MEETING:  
<https://us02web.zoom.us/j/8492486042086QFuxxy9th5AvY>  
/register/AZUic



A CATEGORY II CENTRE UNDER THE AUSPICES OF UNESCO

## Second Regional Conference on Role of Biotechnology in Achieving Food and Nutrition Security

Date: 28-29 September, 2022  
Venue: UNESCO ICB Auditorium  
Time: 8:00am Daily

REGISTER IN ADVANCE FOR THIS MEETING:  
<https://us02web.zoom.us/j/8492486042086QFuxxy9th5AvY>  
/register/AZUic

A CATEGORY II CENTRE UNDER THE AUSPICES OF UNESCO  
International Conference on

## Biotechnology For Food Security & Human Health.

Date: 16-17 November 2022. Time: 09:00 AM  
Venue: UNESCO ICB Conference Room, Nsukka

Abstracts of papers in line with the Conference theme are invited from scholars, academia, and policy makers. Abstracts must be a Microsoft word document, Times New Roman, font size 12 and not more than 300 words. Deadline for submission of abstracts is 7th November, 2022. Abstracts can be submitted to [conferences@unescoicb.org.ng](mailto:conferences@unescoicb.org.ng)



❖ Conferences

❖ Seminars



❖ Workshops



# Ongoing & Future Plans

## **I. Human capacity development of research staff**

- i. MSc, PhD
- ii. Lab/field research skills and expertise
- iii. Grant writing skills
- iv. Paper writing skills – journal articles, books/chapters, popular articles

## **II. Large research equipment: access, procurement**

## **III. Joint/collaborative projects and programmes**

- i. C2Cs, research and training agencies
- ii. Universities, private sector

## **IV. External grants**

❖ **THANK YOU**

❖ **UNA WELDONE**