

INNOVATION

REPORT

DRIVING
INNOVATION &
ENTREPRENEURSHIP
AS A 21ST CENTURY
UNIVERSITY



Professor Johnson Nyarko Boampong
Vice-Chancellor

RESEARCH AND INNOVATION IN 21ST CENTURY UNIVERSITIES

Since its establishment in 1962, the University of Cape Coast (UCC) has continuously contributed immensely to humanity in various ways. Our focus over the past 60 years has been informed by the global trends in addressing complex existing and emerging challenges. In fulfilling its mandate, the University has produced internationally competitive research and scholarly outputs and innovations across all its main disciplinary domains: the social sciences; arts and humanities; physical sciences; life sciences and education.

Today, it is undebatable that excellence in higher education nationally, regionally and globally has become a defining characteristics of UCC. The prestigious Times Higher Education (THE) World University Rankings for 2022 has placed UCC as the number 1 University in Ghana and West Africa, among the top 4 in Africa, among the top 350 universities globally and number 1 globally for research influence. In the 2022 THE World University Rankings, UCC was the only Ghanaian University in the top 1000. These achievements demonstrate our excellence and leadership in higher education across the globe.

Research and innovation hold the promise for the future in dealing with the complexity of developmental challenges fronting society including food security and safety, climate change, safe environment, sanitation, equity and security. Research and innovation are at the fulcrum of socio-economic growth and development of any country. Intense pertinent transdisciplinary research which leads to innovation and discovery has become the sine qua non of universities in the 21st century. They are the places where originality flourishes, and where exchange of knowledge and ideas is unconstrained. Indeed, 21st century universities, through research and innovation provide, engines for change and transformation in our complex and fast changing world.

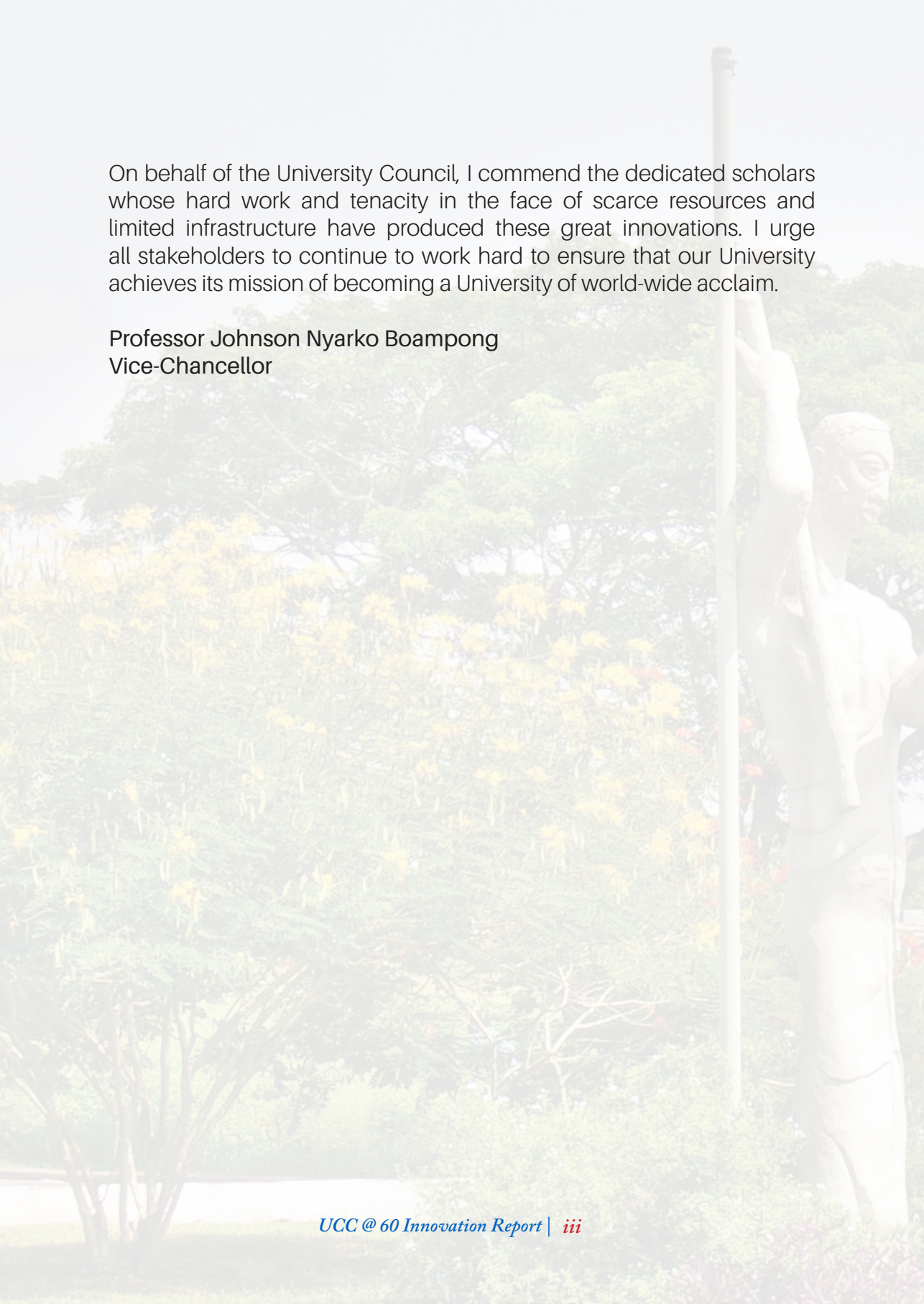
Emerging challenges in the past several decades and those of the 21st century have brought to the fore the need for African universities to engage in critical research and innovations, which will translate into tangible and usable outputs to improve the quality of life and society on a

sustainable basis. African universities and researchers are best placed to lead in the identification of their own developmental needs and produce social and technological innovations through the conduct of relevant research which will provide solutions to local, national and regional problems and advance the course of humanity. UCC must be one of these 21st century universities which is an epicentre for the creation of new knowledge, discovery and innovation.

As we celebrate 60 years of our existence as a university, showcasing our contribution to humanity through innovations over the years gives expression to the quality of human capacity and intellectual endowment of our University. The University, through the Directorate of Research, Innovation and Consultancy (DRIC) has compiled this UCC at 60 Innovation Report to celebrate our achievements in the past as well as guide future commitment to our call. This report covers innovations in the Arts, Education, Social Sciences, Medical Sciences and the Natural Sciences undertaken by UCC faculty members over the past 60 years.

This Innovation Report further demonstrates the University's contribution to humanity in diverse ways over its 60 years of its existence. It provides evidence to our commitment to research and scholarly outputs of international repute. This maiden innovation report is envisaged to improve the University's visibility, attract more research collaborations and partnerships with key industry players and other academic and research institutions.

These achievements came through hard work and dedication of both past and present staff and management of the University and it can only be sustained through same. We must not rest on our oars. It behoves on us-the current and future staff and management of UCC-to work hard in order to sustain these enviable achievements and even greater laurels. We must pursue excellence in all our endeavours. We must conduct cutting-edge research, strengthen our local and international research collaborations to build research capacities, forge strong academia-industry partnerships and harness innovations for entrepreneurial drive and sustainable development. I am happy to be leading these processes at this time in the history of the University.



On behalf of the University Council, I commend the dedicated scholars whose hard work and tenacity in the face of scarce resources and limited infrastructure have produced these great innovations. I urge all stakeholders to continue to work hard to ensure that our University achieves its mission of becoming a University of world-wide acclaim.

Professor Johnson Nyarko Boampong
Vice-Chancellor



Professor (Mrs.) Rosemond Boohene
Pro Vice-Chancellor

THE LINK BETWEEN ENTREPRENEURSHIP, UNNOVATION AND INNOVATION IN GLOBALLY COMPETITIVE UNIVERSITIES

These are interesting times for higher education (Higher ED): from the purely academic ideals of decades past, the Higher ED landscape has now morphed into a hyper-competitive environment where universities have become ranking-conscious and constantly strive for recognition. It is no secret that survival in such an environment requires something out of the ordinary. Many universities have responded to this existential threat by embracing entrepreneurship as part of the academic experience. They have invested in creating and nurturing a culture of innovation, and more recently, unnovative thinking.

Unnovation; that might be a new word to some and it is a concept which has evolved in recent years. Previous definitions have implied that unnovation involves all factors which work against innovation thus giving the term a negative connotation. The concept of unnovation being adopted in this context involves “thinking laterally to solve new and emerging problems with existing and widely adopted technology, platforms and systems”. This implied being ‘innovative’ with what is already available to you (“doing more with less”) especially in times of crisis. Unnovation solves emerging problems using what is available. This has become even more relevant in this time of crisis facing all sectors, including the higher education sector.

Although we are not yet out of the woods of COVID-19 pandemic, nations have begun groping frantically for the path(s) to economic recovery. For lower- and middle-income countries (LMICs) like Ghana that were not in great economic health pre-pandemic, the groping is even more darkly. The way to economic recovery will not be straightforward but as the world is betting on, the entrepreneurial and innovative disposition of the human spirit show the way; driving productivity, creating employment and ultimately lighting our path to economic recovery. It is important to note that universities, being the cradle of learning, research and innovation are expected to play a vital role in this endeavor. Universities are expected to build capacity in innovation, develop entrepreneurial cultures and equip learners with the requisite soft skills that make entrepreneurs tick. Thus, universities have become key actors in local

innovation ecosystems and important partners for national and local governments as they contribute to job creation and poverty reduction through knowledge and technology creation and transfer.

Through entrepreneurship, universities become the agent of industrial innovation and unnovation, technological and economic development, especially in growing knowledge-based economies and globalization. Such entrepreneurial universities see opportunities when others see problems, cherish creativity and flexibility, can live with risks and failures, and have the motivation to excel. They have to participate in problem-solving activities in the industry and community through technology licensing, and faculty consultancy engagements. The University of Cape Coast recognizing this has over the years, taken concrete steps towards being a hub for breeding entrepreneurial and innovative thinkers.

Universities are expected through entrepreneurship to develop new partnerships which are not just about transferring knowledge from lab to practice but also provide critical funding for talented faculty and students to pursue foundational research, exchange ideas with the very best minds inside and outside academia, and perhaps most importantly, help to prepare students for the outside world. Academic entrepreneurship results in research and technology commercialization. This is because it facilitates and encourages university technology transfer between the university and the industry. Thus, a higher degree of academic entrepreneurship orientation will result in a greater number of technology transfer and commercialization activities between the university and the industry.

Through innovative academic programmes at both undergraduate and graduate levels, UCC has made strides in its 60 years of existence towards incorporating entrepreneurial mindset and character in both students and faculty. The pages of this report are filled with numerous heartwarming accounts of innovations and discoveries made in UCC in the last 60 years. But beyond what is in print, I hope you also see in your mind's eye, the culture, environment, struggles and the exigencies that gave birth to these innovations and unnovation.

Professor (Mrs.) Rosemond Boohene (*Professor of Enterprise Development*)
Pro Vice-Chancellor



Professor Frederick Ato Armah
Director, DRIC

THE ROLE OF DRIC IN FOSTERING AN INNOVATION ECOSYSTEM THAT IS SUSTAINABLE

“In the long history of evolution, those who have learned to collaborate and improvise most effectively have always prevailed”
- Charles Darwin

Since the Directorate of Research, Innovation and Consultancy (DRIC) was established in 2013, it has initiated a plethora of activities such as raising awareness on funding opportunities and requirements, customised support to individuals when applying for funding, skills and development training, industrial relationship development, improving and clarifying faculty processes and governance, and preparing for university rankings as well as maintaining a cross-University view of research, expertise and capability. DRIC provides a one-stop shop for enquiries, support, and guidance across the whole research and innovation development pathway. Specifically, DRIC has stimulated high-quality activities by publishing opportunities for research funding and collaboration, and by promoting specific calls for funding proposals; supported departments by providing training in writing and costing proposals, and by providing access to specialist support staff to assist in managing projects; monitored the development and progress of research and knowledge transfer activities at the University, benchmarking against comparable institutions; reported on all relevant activities on behalf of the University to outside agencies and funding bodies; and overseen research governance within the University through the development of relevant research and innovation-related policies, procedures and institutional guidelines. These initiatives have cumulatively fostered a sustainable innovation ecosystem that resonates with societal needs.

One of emerging foci of DRIC is intellectual property and commercialization, which is hitherto underserved. We hold the view that our researchers should not just stop at knowledge creation. They need to work with partners from business, government, academia and community to turn our cutting-edge research into practical solutions, with impact spanning the globe. For this reason, DRIC equips faculty with the skills and support needed to accelerate ideas through the entire innovation lifecycle, from

idea to impact. Research application at UCC ranges from developing new products, services and processes to improving quality and efficiency, and promoting social and economic development.

Sixty years in the life of a higher education institution is relatively short. However, UCC has much to celebrate. Today the University is internationally networked and a collaborator of choice in key areas of research from bench top science to community engagement.

In the years ahead, it is critical that we not only maintain this position but strive to build upon it, in a context where there is fierce global competition. Research and innovation at UCC must be shaped towards consolidation and critical mass in key areas to make a contribution at the local, national and global level. The broad narrative for our research and innovation is that it is cross-disciplinary in nature and substance, with inspiration coming from our local community and industry-based partnerships, as well as from national and international collaborators with whom we tackle some of the major challenges of our time.

Critical mass and excellence bring with them research reputation and profile. Each is vital because they have an important influence on student choice and impact greatly on our ability to attract and retain high-calibre staff and students locally as well as globally. Building long-term relationships with business and industry and collaborative research partnerships on a local, national and international level are vital to underpin and direct research efforts to address the complex and unique global challenges.

In an ever-changing world, universities play a critical role in developing free-thinking and enterprising graduates, with skills needed for success or simply, for living a good, productive life. As a University, we have a pivotal role in helping to prepare our graduates for a future in which passion and commitment to learning will stand them in good stead as they navigate their futures, often characterised by multiple careers and change, where agility, adaptability and creativity will be essential for success. Research and innovation are critical to preparing our students for the challenges of today and of the future.

During the past 60 years, a plethora of innovations have characterized UCC as an institution. These include the nature and scope of academic disciplines and courses as well as the degree structure. In the UCC @ 60 Innovation Report, the first ever in UCC, we showcase the sterling innovations of UCC faculty and their local and international collaborators. These innovations are remarkable when viewed against the background of limited infrastructure, equipment and research tools.

UCC's research and innovation ecosystem is diverse consisting of entrepreneurs, investors, researchers, university faculty, venture capitalists as well as business development and other technical service providers such as accountants, designers, contract manufacturers and providers of skills training and professional development. All of these stakeholders have played a pivotal role in positioning UCC as the foremost university in Ghana and West Africa. We seize this veritable opportunity to acknowledge them for jointly making UCC a citadel of research and innovation excellence. We anticipate that the centennial edition of the UCC Innovation Report will have many more groundbreaking research and innovation by UCC faculty. I know you share in this expectation.

Professor Frederick Ato Armah
Director, DRIC

INAUGURAL ENTRY OF UCC IN THE TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS

-- UNIQUE ACHIEVEMENTS AND HIGHLIGHTS --

1st

No. 1
University
in Ghana

Ghana

1st

No. 1
University
in West
Africa

West Africa

Top
5

Among the
Top 5
Universities
in Africa

Africa

1st

No. 1
University
globally for
research
influence

Global

1st

No. 1
out of the 138
new entrant
universities in
the THE World
University
Rankings - 2022

Global

INNOVATIONS FROM UCC:

Presenting a chronological presentation of
discoveries by UCC Faculty during the past 60 years

1984 | NEW METHOD FOR SELECTIVITY COEFFICIENT

A new method for the determination of selectivity coefficient of ion selective electrodes called the Matched Potential Method was developed by Prof. V. P. Y. Gadzekpo and Prof. G. D. Christian. That method was widely accepted and recommended by the International Union of Pure and Applied Chemistry.

1988 | ATTENUATION OF HYPERSOUND IN SUPERLATTICE

Prof. S. Y. Mensah and his supervisor, Shmelev, G. M, in 1988, pioneered the proposition that attenuation of hypersound was a Two-dimensional superlattice in the presence of an electric field, and then presented it at a conference of Semiconductor Physics. That was the first ever study of hypersound in superlattice after it was designed by Esaki and Tsu. Consequently, Prof. S. Y. Mensah was the very first person to have predicted the following:

1. Low frequency region application of ac field results in a shift of the maximum current-voltage curve towards larger voltages in superlattices.
2. The current-voltage characteristic of superlattice should show at strong static fields by an exponential rise of current due to ionization of impurities.

1989 -2011 | PRODUCTION OF LENSMETER AND ALPHA TRACK ANALYSIS USING LASERS

Prof. Paul Kingsley Buah Bassuah and his team, including Prof. Moses J. Eghan, OC Oppon, and KB Nyarko then applied lasers to industry for alpha track analysis, automatic inspection of roads, and subsequently produced a lensmeter.

1989-2014 | FRAGMENTATION OF A LIQUID DROP FALLING INTO A SOLUBLE FLUID

Prof. Paul Kingsley Buah Bassuah's seminal works were generally in the areas of quantum optics and laser applications. He and his team conducted detailed studies into liquid-drop fragmentation in miscible fluids dynamics leading to fractalization for the first time, which explains the processes of infusion as applied in medicine.

1992 | SPECTROPHOTOMETRIC REAGENTS AS IONOPHORES

Prof. V. P. Y. Gadzekpo and Dr. E. K. Quagrainne were among the first group of people to use spectrophotometric reagents as ionophores to formulate ion-selective electrodes with dioctylphenyl phosphate as solvent mediator to measure Pb^{2+} , Cu^{2+} , Co^{2+} , Cd^{2+} , Ni^{2+} and Fe^{2+} in solution.

1992 | THERMOELECTRIC EFFECT IN A SEMICONDUCTOR SUPERLATTICE

Prof. S. Y. Mensah pioneered theoretically the study of thermoelectric effect in Semiconductor Superlattice in a non-Quantized Field, and used the results to predict a giant Thermoelectric effect in the material. That feat was really a novelty and an eye opener in the quest for thermoelectric materials in two dimensional materials.

1992 | DETERMINATION OF LITHIUM, SODIUM, POTASSIUM AND CALCIUM SIMULTANEOUSLY

Li^+ , Ca^{2+} , K^+ and Na^+ had always been measured separately in the past. Prof. V. P. Y. Gadzekpo and Dr. G. N. Doku, however, succeeded in designing and constructing a Flow Injection Analysis (FIA) System to analyze those ions in blood serum simultaneously using a flame photometer as detector.

1994 | CALCIUM MEASUREMENT

Calcium determination was quite laborious and time consuming. That led Professor V. P. Y. Gadzekpo and Dr. Osmond D. Ansa-Asare to discover the use of 5- chloropiazselenol as a neutral carrier in a PVC membrane in Calcium ion-selective electrode for the determination of calcium.

1996 | BLEACHING EARTHS

Prof. V. P. Y. Gadzekpo, Dr. F. Okai-Sam, J. A. Appiah, and G. Aganu collected clay samples from all the regions of Ghana. Those clay samples were then activated and their bleaching properties determined. Some of the clays were discovered to be very good bleaching earths and have since been used to bleach palm kernel oil on a commercial scale.

1996 – 2005 | TWO VARIETIES OF CASSAVA

Prof. Jonathan Padi Tetteh and his colleagues in 2005 released two varieties of cassava: 'Capevars bankye' and 'Bankye botan' and those varieties were duly registered in 2015. Capevars matured within 8 -12 months and could remain in the soil for up to 18 months. It was high yielding (20 -60t/ha) and produced mealy roots all year round. Besides, it was relatively sweet, hence, it was mostly preferred for fufu and ampesi. Its starch yield was above 20%, and it was recommended for food and industrial use. Bankye Botan also matured within 9 -12 months and could stay in the soil for up to 15 months. Its root yield was between 20 – 60t/ ha depending on the growing condition. The root was mealy during the dry season.

1998 | SELENIUM ION SELECTIVE ELECTRODE

Ion selective electrodes were designed for selenium ions determination. Prof. V. P. Y. Gadzekpo and Dr. J. Kambo-Dorsa developed the electrode from various diamine and related compounds as ionophores that were sensitive to selenium by forming piaszelenol.

1999 | SYMMETRIC BIS-BENZIMIDAZOLES: NEW SEQUENCE SELECTIVE DNA-BINDING MOLECULES

Prof. Y. Opoku-Boahen was among a group of researchers that synthesized a novel compound that bound to the minor groove of the DNA at A/T sites with enhanced cytotoxic and antitumor effects and had anticancer properties.

2000 | A NOVEL INHIBITOR OF HUMAN TELOMERASE DERIVED FROM 10H-INDOLO(3,2-B) QUINOLINE

Prof. Y. Opoku-Boahen was among a group of researchers that synthesized a derivative of an alkaloid which had been known to exist in a West African medicinal plant. The novel compound had been shown to have cytotoxicity as well as inhibitory activity against telomerase enzyme, which made the compound a potential anti-cancer drug.

2000 | A NEW CLASS OF SYMMETRIC BIS- BENZIMIDAZOLE BASED DNA MINOR GROOVE BINDING AGENTS SHOWING ANTITUMOUR ACTIVITY

Prof. Y. Opoku-Boahen was among a group of researchers that synthesized a series of novel compounds that bound to the minor groove of the DNA and showed antitumor activity. We were able to obtain an X-ray crystal of one of the compounds with DNA. That compound showed potent growth inhibition of cancer cell lines.

2000 | X-RAY CRYSTALLOGRAPHIC DATA OF 3/SYMMETRIC BIS-BENZIMIDAZOLE COMPLEX

Prof. Y. Opoku-Boahen was among a group of researchers that obtained an X-ray crystallographic data of a novel compound bound to DNA. The information is at the Protein Data Bank at the University of Oxford.

2001 | GIANT ELECTRICAL POWER FACTOR IN CARBON NANOTUBE

The theoretical study of Acoustic effects in Single Walled Carbon Nanotubes (SWCNT), a one-dimensional material, was pioneered by Prof. S. Y. Mensah and his PhD students. That included the electronic properties, the hypersound absorption and the amplification in SWCNT. He was equally the first person to predict Carbon Nanotubes may serve as good Thermo electrical material.

2000 – 2019 | FIVE VARIETIES OF CASSAVA

The Department of Crop Science, UCC, in collaboration with the Biotechnology and Nuclear Agriculture Research Institute of Ghana Atomic Energy Commission (GAEC-BNARI), developed five cassava varieties. Those seven varieties were released by the Seed Council of Ghana, based on a recommendation by the National Varietal Release and Registration Committee. All the seven varieties have been registered in the Catalogue of Crop Varieties Released and Registered in Ghana (2019). Three of those varieties are yellow-fleshed, and they have high beta-carotene. The remaining two varieties are white-fleshed and are resistant to cassava mosaic virus disease. These have high dry matter content and are high yielding.

Cassava varieties developed by the Department of Crop Science, UCC.

Cassava Genotype	Varietal Name	Date Released	Date Registered
UCC 504	Bankye Botan	2005	2015
UCC 505	Capevars Bankye	2005	2015
GAEC 14/A1235	Nyonku Bankye	2019	2019
GAEC 14/B1368	Kponu bankye	2019	2019
GAEC 14/E1610	Tetteh Bankye	2019	2019
GAEC 12/HO008001	Fufuohene	2019	2019
GAEC 12/HO008002	Ampesihemaa	2019	2019

2001 | CONDIMENT FROM FISH

Cooking in traditional Ghanaian homes involves the use of fermented, salted and dried fish. It is cumbersome to use this as you have to buy the fermented, salted and dried fish and flake it into the food being cooked. Professor V. P. Y. Gadzekpo and Vida Akwetey prepared the powdered and preserved version of this condiment and called it momone powder. It is very easy to use, and can be poured in the food while it is on the stove or after the cooking. The nutritional value of the momone powder is high.

2001 | MALTED MAIZE DRINK

Malted maize drink has been in existence for many years in the Ghanaian local community. It is mainly prepared and drunk during funerals. This drink is high in vitamin B but has a short shelf life of just one day. After a day, it ferments and is no more suitable for consumption. Prof. V. P. Y. Gadzekpo and Elizabeth Ahadzi used a scientific method to prepare and preserve the malted maize drink that now has a long shelf life.

2002 | ION-CHANNEL SENSOR IN DETECTING METAL IONS

Prof. V.P.Y. Gadzekpo and Prof. R. Zugle successfully used ion-channel sensor which was created by gold electrodes chemically modified with

thiotic acid monolayer, and designed to mimic biological ion-channel membranes to determine alkali, alkaline earth, thallium and lanthanum cations as analytes.

2004 | LASER-INDUCED CHLOROPHYLL FLUORESCENCE FOR CROP YIELD ASSESSMENT OF COWPEA

Prof. B. Anderson, Prof. P. K. Buah-Bassuah and Prof. J. P. Tetteh assessed the crop yield performance of five different cowpea varieties using Laser-induced chlorophyll fluorescence as compared to the conventional technique.

2004-2012 | FORMULATION AND CONSTRUCTION OF LASER DIODE FOR APPLICATION IN AGRICULTURE

Prof. Paul Kingsley Buah Bassuah and his team, including Dr. Ebenezer T. Tatchie, Prof. J.P. Tetteh, Prof. Benjamin Anderson, Prof. Moses J. Eghan, and Prof. Elvis Asare-Bediako formulated and constructed a LED/Laser Diode Fluorometer and applied it for the first time in agriculture to evaluate chlorophyll in pre/post-harvest fruits and to select cow-pea variety.

2005 | ISOLATION OF CANCER INHIBITING PURE LABDA DITERPENE COMPOUND FROM THE LEAVES OF TURRAEANTHUS AFRICANUS

(+)-12,15-Epoxyabda-8(17),12,14-trien-16-yl acetate were isolated from the seed kernels of *Turraeanthus africanus* (Nelw. ex DC), a West African native plant, for the first time by Prof. V. Y. A Barku, Prof. F. S Tayman and Prof. Y. Opoku-Boahen. Cytostatic/cytotoxic test of that pure compound on the growth of cancer cells in vitro yielded positive results.

2005 | A CONCISE APPROACH TO CAGED SEROTONIN FOR FOURIER TRANSFORM INFRARED (FTIR) DIFFERENCE PHOTOLYSIS STUDIES

Prof. Y. Opoku-Boahen was among a group of researchers that synthesized a novel derivative of serotonin. This compound is a neurotransmitter and helpful in the management of psychiatric conditions of inmates with brain ailments.

2007 | TRACK ANALYSIS OF LASER-ILLUMINATED ETCHED TRACK DETECTORS USING AN OPTO-DIGITAL IMAGING SYSTEM

Prof M. J. Eghan, Prof. P. K. Buah-Bassuah and O. C Oppong developed an Opto-digital imaging system for counting and analyzing tracks on an LR-115 detector. The Opto-digital imaging system measured and estimated other track parameters at an average process time of 3–5 s.

2007-2018 | INDUSTRIAL APPLICATION OF INFRARED LASER IN DIGITAL HOLOGRAPHY

Prof. Paul Kingsley Buah Bassuah and his team used infrared laser in digital holography to solve industrial applications for 3-d imaging and profiling of surfaces in diverse areas of utilisation, thereby giving new possible discoveries in that large scenery sector.

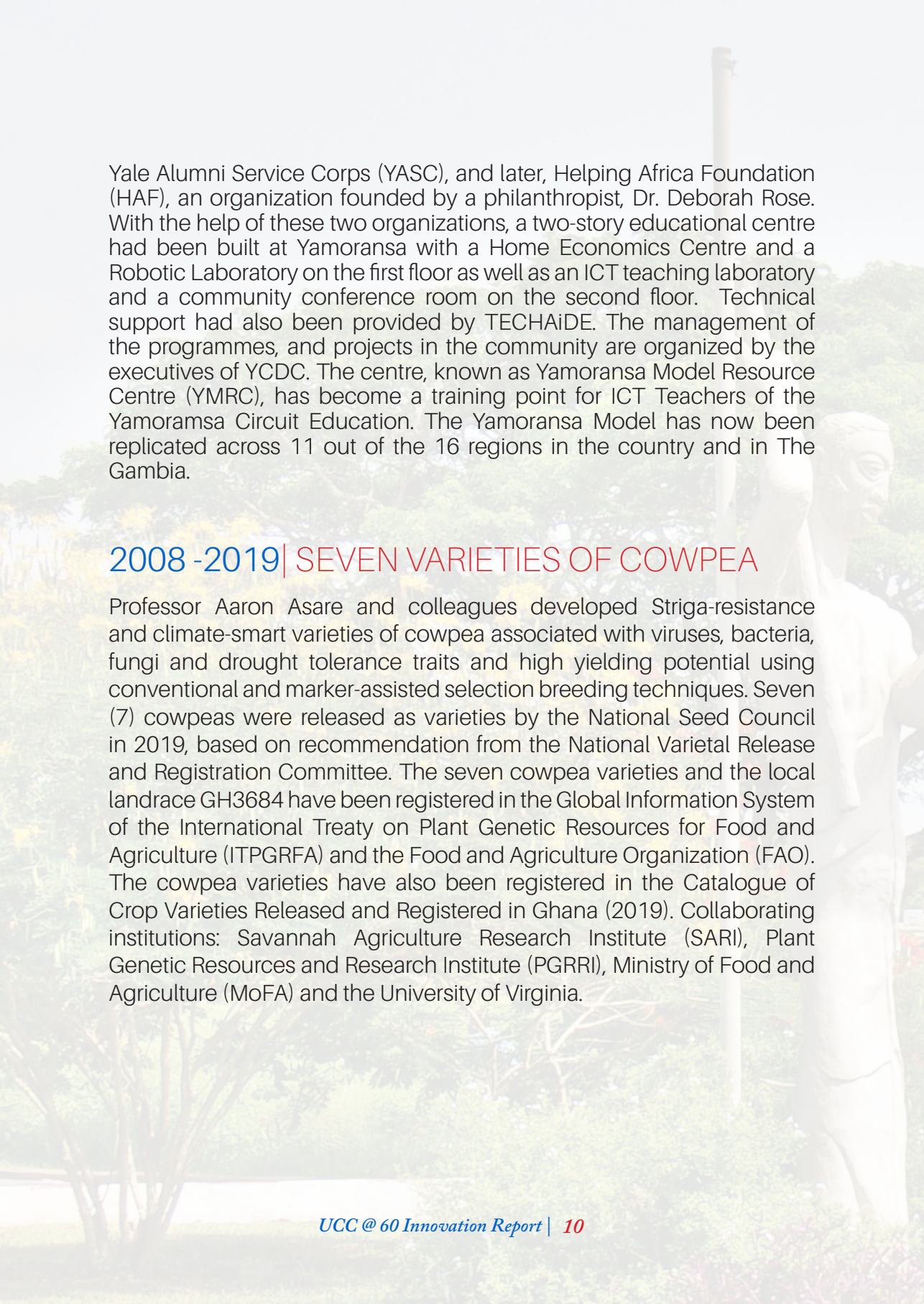
2008 | THE YAMORANSA MODEL

That innovative approach to sustainable development was initiated by Prof Kofi Awusabo-Asare and the Department of Population and Health, and designed with the community in 2008. The project comprised the adoption of Yamoransa as a social research laboratory for the Department of Population and Health. The package consisted of (1) student from

the Department who was to spend 10-14 days living in the community just after the long vacation at Level 300; (2) assisting the community to identify its needs; (3) setting up structures for the implementation of community-identified projects. For the third component, the process involved five stages —Need, Design, Install, Learn and Sustain (NDILS) (www.yamoransamodel.org):

- Need (Visited proposed community-held user meetings; Learnt the context; Collected initial community and population characteristics; took technical measurement of community resources and potential);
- Design (Designed programmes and projects based on context familiarization and data collection; iterated design, validation, discussion and approval of projects; and refined the design, including funding for implementation).
- Install (Established various community committees with signposting for implementation of activities for completion and dedication; detailed the technology, training and maintenance regimes for sustainability; and developed a constitution to guide the activities of the groups);
- Learn (Discussed and established feedback framework for iteration with community; Implemented strategies for maintenance regimes in order to prolong the life span of equipment; Wrote impact assessment report and related documentation for dissemination); and
- Sustain (Continued engagement within the community and for technology maintenance regimes; Continued impact assessment report and related documentation; and Responded to what was learned by making appropriate changes).

The first batch of students were received in the community in 2010. And, with the support of the Department, the community established a Yamoransa Community Development Committee (YCDC) as well as six sub-committees: Health, Education, Sports, Environment, Gender and Youth. YCDC membership consists of representatives from various identified groups in the community (chiefs and elders, young people, women, artisans and professionals, religious leaders, The Assembly Member and other selected members of the community, and representatives from the Department). This important Social Innovation, known as the Yamoransa Model, has become a tool for empowering communities to drive their development agenda. Projects are identified and implemented by the community, and funded by a combination of community, the Department and outside donor support. From 2012, YCDC has received support from the Association of Yale Alumni (AYA),

The background of the page features a faded image of a white statue of a person, possibly a historical figure, standing in a park-like setting with green trees and a clear sky. The statue is positioned on the right side of the page, and the overall scene is brightly lit, suggesting a sunny day.

Yale Alumni Service Corps (YASC), and later, Helping Africa Foundation (HAF), an organization founded by a philanthropist, Dr. Deborah Rose. With the help of these two organizations, a two-story educational centre had been built at Yamoransa with a Home Economics Centre and a Robotic Laboratory on the first floor as well as an ICT teaching laboratory and a community conference room on the second floor. Technical support had also been provided by TECHAiDE. The management of the programmes, and projects in the community are organized by the executives of YCDC. The centre, known as Yamoransa Model Resource Centre (YMRC), has become a training point for ICT Teachers of the Yamoransa Circuit Education. The Yamoransa Model has now been replicated across 11 out of the 16 regions in the country and in The Gambia.

2008 -2019| SEVEN VARIETIES OF COWPEA

Professor Aaron Asare and colleagues developed Striga-resistance and climate-smart varieties of cowpea associated with viruses, bacteria, fungi and drought tolerance traits and high yielding potential using conventional and marker-assisted selection breeding techniques. Seven (7) cowpeas were released as varieties by the National Seed Council in 2019, based on recommendation from the National Varietal Release and Registration Committee. The seven cowpea varieties and the local landrace GH3684 have been registered in the Global Information System of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Food and Agriculture Organization (FAO). The cowpea varieties have also been registered in the Catalogue of Crop Varieties Released and Registered in Ghana (2019). Collaborating institutions: Savannah Agriculture Research Institute (SARI), Plant Genetic Resources and Research Institute (PGRRI), Ministry of Food and Agriculture (MoFA) and the University of Virginia.

The Registered Cowpeas with assigned Digital Object Identifiers (DOIs)

Cowpea genotype	Varietal/ local name	Meaning	Language	DOI
UCC-32	Asare-Moya	Well done Asare	Kusal	10.18730/SAM4T
UCC-328	Kum-Zoya	Hunger has run away	Dagbani	10.18730/SAM2R
UCC-241	Saka-Buro	Striga-killer	Sissala	10.18730/SAM3S
IT10K-819-4	Aluba-Kpole	Cowpea-large grains	Nzema	10.18730/SAM5V
UCC-473	Yor-Kpitio	Dwarf cowpea	Dangbe	10.18730/SAM0P
UCC-Early	UCC-Early	Early maturing cowpea	English	10.18730/SAKZN
UCC-366	Aduapa	Good cowpea	Twi	10.18730/SAM1Q
GH3684	Asedua	-	Twi	10.18730/SA-KYM

2010 | A THREE-TIER TEACHING MODEL FOR TEACHING MATHEMATICS IN CONTEXT

Prof. Ernest Kofi Davis together with Prof. Alan John Bishop and Prof. Wee Tiong Seah, developed a teaching model that draws on everyday mathematical conceptions to scaffold pupils' higher understanding of school mathematics. The three tiers of the model involve the enculturation of pupils into their own mathematical culture, transition from everyday mathematics to school mathematics, and acculturation into school mathematics. These three tiers come together in each lesson to help pupils to understand the mathematics they learn in school, and make connections between the mathematics they learn in school and the mathematics in their society.

2011 | LASER-INDUCED CHLOROPHYLL FLUORESCENCE: A TOOL FOR ASSESSING MOSAIC DISEASE SEVERITY IN CASSAVA

Cassava (*Manihot esculenta* Crantz) experiences cassava mosaic disease, which generally affects its economic yield. That issue was investigated by Prof. B. Anderson, Prof. M. J. Eghan, Prof. E. Asare-Bediako and Prof. P. K. Buah-Bassuah using Laser-induced chlorophyll fluorescence. Their results predicted the severity levels of the disease in the plants and the corresponding average yield per plant.

2011 | DEPLOYMENT OF A QUANTUM CASCADE LASER OPEN-PATH GAS SENSOR FOR WATER VAPOUR AND WOOD SMOKE ANALYSIS

Dr. E. N. Bentil, Dr. C. L. Y. Amuah, Dr. A. P. M. Michel, Prof. M. J. Eghan, Prof. J. A. Smith and Prof. C. F. Gmachl built a multi-stage third-generation gas sensor and a quantum cascade laser open-path system (QCLOPS) for multi-species sensing. The sensor was deployed in Elmina, Ghana, for the first time to measure trace gas (water vapour) and two harmful gases (2-methyl phenol and Benzyl alcohol) from wood smoke in the summer of 2010, during the peak fishing season in the. Those gases were prevalent in ten wood species targeted and have fingerprints in the emission region of the quantum cascade laser ($965 - 1260 \text{ cm}^{-1}$).

2011 | NEW APPROACH FOR SIMULATING SECOND HARMONIC (2F) ABSORPTION SIGNAL

Dr. P. Osei-Wusu Adueming, Prof. M. J. Eghan, and Prof. B. Anderson simulated 2f WMS absorption signal using MATLAB, a new approach based on numerical integration to investigate the influence of normalized modulation amplitude, m and the optimal 2f absorption signal was found to occur at 2.1.

2011 | NOMINATED TO PRESENT PROPOSAL FOR 2011 NOBEL PRIZE (PHYSICS)

Prof. S. Y. Mensah was nominated by the Nobel Prize committee to present a proposal of his works in acoustoelectric effect in low dimensional materials as a result of his outstanding works in the field of physics, where he had pioneered a lot of novel theories and ideas which had been verified by other researchers worldwide.

2012 | A BOOTSTRAP APPROACH TO EVALUATING THE PERFORMANCE OF AKAIKE INFORMATION CRITERION (AIC) AND BAYESIAN INFORMATION CRITERION (BIC) IN SELECTION OF AN ASYMMETRIC PRICE RELATIONSHIP

Prof. Henry Nana De-Graft Acquah evaluated the performance of the two commonly used model selection criteria, Akaike information criteria (AIC) and Bayesian information criteria (BIC) in discriminating between asymmetric price transmissions models under various conditions in using Bootstrap samples. He developed and implemented R algorithms to evaluate model selection performance via Bootstrap simulations.

2012 | ACOUSTIC EFFECT IN GRAPHENE AND GRAPHENE NANORIBBON

Prof S. Y. Mensah, and his PhD students were among the first group of people to research into the acoustic effect of Graphene and its Nanoribbons. The topics on which they focused included: Acoustic wave amplification, hypersound absorption in Graphene Nanoribbon, General Scattering Mechanism and Transport in Graphene, Terahertz Generation and Amplification in Graphene Nanoribbons in multi-frequency Electric Fields.

2013 | DISCOVERY OF STRIGA GESNERIOIDES RESISTANCE LOCAL LANDRACE COWPEA, GH3684

Professor Aaron Asare and colleagues discovered a resistance genotype that controlled the parasitic weed, *Striga gesnerioides* in Ghana with confirmed molecular markers associated with the trait in the local landrace cowpea GH3684. The genotype GH3684 had been validated and reported as a novel source of *Striga*-resistance for the first time in Ghana. GH3684 is currently being used for introgression of the resistant gene to improve commercial varieties of cowpea.

2013 | DESIGN AND DEVELOPMENT OF A SAFE POLY ANTI-CANCER AGENT

The side effects of conventional cancer drugs have always been a problem to health practitioners and policy makers alike. Dr. C.K. Adokoh, Prof. R. Narain, and Prof. James Darkwa designed and developed glycopolymeric decorated gold nanoparticles functionalized with Gold-triphenyl phosphine as potential anti-cancer agents.

2013 | DISCOVERY OF NEW-NON EDIBLE RESOURCE FOR BIODIESEL PRODUCTION

Dr Mohammed A. Takase and Prof. Yang Liuqing discovered *Silybum marianum* oil as a new non-edible feedstock for biodiesel. The physico-chemical composition as well as the kinetics model of the oil was also studied for the first time.

2013 | DEVELOPED NEW METHOD FOR PREPARING KOH (32%)/ZRO₂-5 CATALYST

Dr Mohammed A. Takase and Prof Yang Liuqing developed novel methods and steps involved in preparing zirconia loaded with KOH (KOH(32%)/ZrO₂-5) as heterogeneous solid catalyst for biodiesel production.

2013 | AUTOMATED PROTOCOL FOR COUNTING MALARIA PLASMODIUM FALCIPARIUM PARASITE FROM DIGITAL MICROSCPIC IMAGE

In most hospitals and clinics, malaria parasites diagnosis, especially in developing countries, which is manually done, is strenuous and time-consuming. This problem has led to the development of an automated protocol for counting malaria parasites (*P. falciparum*) from digital microscopic red blood cells (RBCs) images using MATLAB by Dr. J. Opoku-Ansah, Dr. P. Osei-Wusu Adueming, Dr. C. L. Y. Amuah, Dr. A. G. Akyea, Prof. J. N. Boampong, Prof. B. Anderson and Prof. M. J. Eghan

2014 | CONFLICT MAPPING INNOVATION TOOL

The Peace and Development Research Group (PDRG) at the School for Development Studies developed an innovative tool to map all violent hotspots in Ghana between 2007 and 2013: a period that covered two national election years. The digital online maps are now used extensively by the security agencies in monitoring to pre-empt and prevent conflicts in Ghana. That innovation was credited for the peaceful nature of the national elections in 2016. Prof Stephen B Kendie, Dr Patrick Osei-Kufour and Prof Kwaku A. Boakyewere instrumental in developing the innovation. Several African countries are now employing the methodology to map violent conflicts in their own countries as a tool to sustain peace. The PDRG continues to receive delegations from other African countries to study the innovation.

2014 | DESIGN AND DEVELOPMENT OF A SAFE ANTI-CANCER AGENT

The side effects of conventional cancer drugs have always been a problem to health systems, clinicians, policy makers and practitioners. Dr. C.K. Adokoh and Prof. James Darkwa designed and developed a safe glyco anti-cancer phosphinogold(I) thiocarbohydate agent in response to this pressing health challenge.

2014 | ETHNOBOTANICAL STUDY OF WOUND HEALING PLANTS IN THE KPANDO TRADITIONAL AREA OF GHANA

An ethnobotanical survey on wound healing plants undertaken by Prof. V. Y. A. Barku and Prof. Y. Opoku-Boahen for the first time in that area identified 27 plant species from 20 families used traditionally for the treatment of wounds in the Kpando Traditional area. The survey also identified, for the first time, ten (10) plants species that had previously not been documented for the treatment of wounds in Ghana.

2014 | DEVELOPMENT OF MODIFIED TRADITIONAL KILN FOR EFFECTIVE SMOKING OF FISH

Prof. D.K. Essumang and Dr. Joseph K. Adjei were among the first to develop a traditional Kiln for effective reduction of PAH contamination in smoke cured fish products. The method has since been accepted nationally and internationally.

2014 | *BACILLUS THURINGIENSIS* MC28 AS AN ADSORBENT FOR MERCURY REMOVAL

Artisanal and small-scale goldmining (Galamsey) has increased tremendously culminating in environmental contamination and increase in cases of Kidney diseases. Prof. D.K Essumang and Dr. E. A. Asare designed and developed *B. thuringiensis* MC28 as an adsorbent in a water treatment procedure to remove mercury and restore mercury contaminated waters to their pristine states.

2014 | WAVELENGTH MARKERS FOR MALARIA (*PLASMODIUM FALCIPARUM*) DIAGNOSIS.

Dr. J. Opoku-Ansah, Prof. M. J. Eghan, Prof. B. Anderson and Prof. J. N. Boampong investigated malaria-infected RBCs and uninfected RBCs-ring and trophozoite stages using multispectral imaging technique, and established four spectral bands that offered potential diagnostic markers for identifying infected and uninfected RBCs.

2014 | APPLICATION OF HUMAN URINE FOR MAIZE AND OKRO CULTIVATION

The use of other organic fertilizers for crop production is well known and applied elsewhere other than Ghana. Dr. Isaac Mbir Bryant together with Miss Belinda Adu-Poku investigated the application of both concentrated and diluted human urine for maize and okro production with amazing crop yield and output.

2014 | NOVEL METHOD FOR PREPARING TiO₂ DOPED WITH POTASSIUM BITARTRATE CATALYST

Dr Mohammed Takase and Prof Yang Liuqing developed a method used to prepare powdered modified TiO₂ doped with potassium bitartrate (Ti-0.7-600-6) catalyst for the very first time for green energy production.

2014 | PREPARED NOVEL POWDERED MODIFIED TiO₂ DOPED WITH POTASSIUM BITARTRATE (Ti- 0.7-600-6) CATALYST

Dr Mohammed Takase prepared a novel powdered modified titanium doped with potassium bitartrate catalyst (Ti-0.7-600-6) for methanolysis of vegetable oil to fuel.

2014 | ACOUSTOELECTRIC AMPLIFICATION

Numerous works on acoustoelectric amplification on low dimensional systems such as Carbon Nanotube, GaAs superlattice, Graphene were carried out. Among the various publications, Prof S. Y. Mensah predicted the use of the GaAs superlattice as an acoustic wave resonator.

2015 | DIAGNOSIS OF SCHISTOSOMA HAEMATOBIIUM INFECTION WITH A MOBILE PHONE-MOUNTED FOLDSCOPE AND A REVERSED-LENS CELLSCOPE IN GHANA

A new method for the diagnosis of urogenital schistosomiasis was evaluated by Dr. Richard K.D Ephraim, Dr. Isaac Bogoch, James Cybulski and Evans Duah using the mobile phone mounted foldscope and single ply paper towel as filtration material.

2015 | HOT ELECTRONS ON THE ELECTRICAL CONDUCTIVITY OF CARBON NANOTUBES

Prof. S. Y Mensah was the one who supervised the effect of Hot electrons injection in carbon nanotubes (CNTs), where in addition to applied dc field, there existed simultaneously a quasi-static ac electric field. The investigation was done theoretically by solving semi-classical Boltzmann transport equation with and without the presence of the hot electrons source to derive the current densities.

2015 | NOVEL PREDICTION OF COCOA BEANS QUALITY AND INTEGRITY

Based on effective spectral selection and chemometric techniques, Dr. Ernest Teye and his colleagues predicted Cocoa Beans Integrity for the first time using cocoa beans quality parameters.

2015 | DESIGN AND DEVELOPMENT OF BIO-FRIENDLY AND NON-TOXIC THIOCARBOHYDRATE STABILIZERS OF GOLD NANOPARTICLES

The use of nanomaterials has attracted attention and interest from all fields, especially in the health care delivery system. But the toxicity and stability of the nano composite is an enduring challenge. As a result of this, Dr. C.K. Adokoh and Prof. James Darkwa have developed bio-friendly and non-toxic thiocarbohydrate stabilizers/composites of gold nanoparticles.

2015 | OPTICAL IMAGING METHOD FOR SEVERITY CASSAVA MOSAIC DISEASE (CMD) DETERMINATION

The severity of CMD symptoms on cassava leaves is usually assessed visually using an arbitrary scale, which is semi-qualitative. Consequently, Prof. B. Anderson, Prof M. J. Eghan, Prof. E. Asare-Bediako and Prof. P. K. Buah-Bassuah have developed a quantitative method to assess the severity of CMD plant for scientists to obtain accurate and reliable data, forming the basis of better diagnostics and decision making.

2015 | SPECTROSCOPIC STUDY OF UV TRANSPARENCY OF SOME MATERIALS

The transparency suitability of materials for food storage, windows and windscreens to block UV light: UVB and UVA has become an exciting topic in contemporary times. Dr. S. S. Sackey, Dr. M. K. Vowotor, Dr. A. Owusu, Mr. P. Mensah-Amoah, Dr. E. T. Tatchie, Dr. B. Sefa-Ntiri, Dr. C. O. Hood and Dr. S. M. Atiemo had investigated some of those common materials used in Ghana. The team has established that LLDPE materials used for food storage are transparent to UV sources. In contrast, the PET plastic materials used for water, fruit juice and beverage storage are opaque to UVB but transparent to UVA.

2015 | APPLICATION OF THE VASCULAR ENDOTHELIAL GROWTH FACTOR RECEPTOR 2

Prof. Desmond O. Acheampong, Prof. M. Wang, Prof. M. Tang, Prof. J. Zhang, Prof. Y. Wang, Prof. Z. Xin, and Prof. B. Yangxi prepared a method and applied VEGFR2 (Vascular Endothelial Growth Factor Receptor 2) single-chain antibody and MICA fusion protein.

2015 | TREATMENT OF WASTEWATER FROM HAIR SALON

Slow sand filtration system has existed for a long time. Its efficiency, however, for the treatment of highly polluted municipal wastewater like wastewater from salons had never been tested. Hence, Dr. Isaac Mbir Bryant and Miss Roberta Tetteh-Narh have designed and developed a slow sand filtration system embedded with activated charcoal for the treatment of wastewater from hair salons. The treated wastewater could be used for all other non-potable domestic purposes.

2015 | NEW SPECIES OF LEISHMANIA CAUSING CUTANEOUS LEISHMANIASIS IN GHANA

A new *Leishmania* species had been identified in Ghana, and was unofficially called “*Leishmania Ghana*”. This *Leishmania* species is now part of the new subgenus in *Leishmania* taxonomy called *Leishmania (Mundinia)* subgenus. The species was discovered by Dr. Godwin Kwakye-Nuako and his colleagues: Mba-Tihssommah Mosore, Christopher Duplessis, Michelle D. Bates, Naiki Pupilampu, Israel Mensah-Attipoe, Kwame Desewu, Godwin Afegbe, Richard H. Asmah, Manal B. Jamjoom, Patrick F. Ayeh-Kumi, Daniel A. Boakye, Paul A. Bates. That unofficially named-species was published in the *International Journal of Parasitology*; 45: 679–684. <http://dx.doi.org/10.1016/j.ijpara.2015.05.001>

2015 | MSP COMPOSITE FLOUR

Maize-sweet potato (MSP) composite flour had been developed. It was a fermented dried product from combined maize and yellow-fleshed sweet potato. That was used in feeding experimentation among lower primary (1-3) pupils. Apart from the increases in anthropometric indices such as weight-for-age and height-for-age, severe to moderate undernutrition decreased after the feeding trial. Again, the retinol binding protein, a surrogate of serum retinol, and a measure of vitamin A, increased by about 30% above cut-off of the National Health and Nutrition Examination Survey (NHANES) of the United States of America. Prepared food from the flour could be used as one way to address vitamin A deficiency among

infants aged 6 – 59 months. The flour could be made into different foods such as kenkey, etsew, banku, koko (porridge) and doughnut. Unlike the raw material for those food which was usually in the wet form, the dried product could be stored for several months without any issues of spoilage by bacteria or fungi. That innovation was developed by Dr. Enoch T. Quayson, Dr. Martin Bosompem, Prof. Henry DeGraft Acquah, and Anna Amoako-Mensah.

2016 | CONFIRMATION OF ETHNOBOTANICAL USE OF POLYSCIAS FRUTICOSA AS AN ANTI-ASTHMA AGENT

The aerial parts of *Polyscias fruticosa* is claimed by many local people for its use against upper respiratory disorders. Dr. Alex Boye, Prof. V.Y.A Barku, Prof. Desmond Omame Acheampong, Prof. George Koffuor, and Dr. Samuel Kyei scientifically confirmed the folk claims on *Polyscias fruticosa* and recommended its adoption as a herbal medicine.

2016 | LOW-COST RAMAN SPECTROMETER (FRUGAL INNOVATION)

A simple Raman setup that offered a cost-efficient alternative to a commercial Raman system was designed and developed by Mr. A. A. Huzortey, Prof. B. Anderson, and Dr. A. Owusu.

2016-2020 | OPTICAL MICROSCOPY FOR DETECTING MALARIA AND OTHER PLANT AND ANIMAL DISEASES

Buah-Bassuah and his team, including Dr. CLY Amuah, Prof. Moses J Eghan, Prof. Benjamin Anderson, Dr. Peter OW Adueming, Dr. Jerry Opoku-Ansah and Prof. Johnson Nyarko Boampong used optical microscopy (a unique tool in optical imaging) to detect malaria and other diseases in plants and animals.

2016 | PARASITE DENSITY ESTIMATION FOR MALARIA DIAGNOSIS USING LASER-INDUCED FLUORESCENCE TECHNIQUE

Estimating Plasmodium falciparum parasite density in blood samples have been done manually in our hospitals, introducing many human errors in the process. Dr. J. Opoku-Ansah, Prof. M. J. Eghan, Prof. B. Anderson, Prof. J. N. Boampong and Prof. P. K. Buah-Bassuah have developed a laser-induced fluorescence technique that can automatically count and estimate the parasite density objectively for quick and informed malaria diagnosis.

2017 | DEVELOPMENT OF ANTI-DIABETIC HERBAL DRUG FROM ABRUS PRECATORIUS LEAVES

α -amylase and α -glucosidase are key enzymes involved in carbohydrate metabolism, and are, therefore, implicated in hyperglycemia. Most conventional anti-diabetic drugs target these two enzymes in order to restore glycemic control. However, conventional anti-diabetics that inhibit these two enzymes are fraught with many side effects. Accordingly, Dr. Alex Boye, Prof. DO. Acheampong, and Prof. VYA. Barku had isolated compounds from the leaves of Abrus precatorius which had demonstrated potent α -amylase/ α -glucosidase inhibitory activity. On the basis of that finding, leaves of Abrus precatorius were recommended for use in formulation of diabetic diets.

2017 | MULTISPECTRAL IMAGING APPLICATION DISCRIMINATES CATARACTOUS LENSES FROM HEALTHY ONES

Histopathologists, during preclinical studies, use invasive, time-consuming techniques and subject judgements to discriminate cataractous eye lenses from healthy ones. For non-invasive as well fast and objective discrimination, Dr. P. Osei-Wusu Adueming, Prof. M. J. Eghan, Prof. B. Anderson, Dr. S. Kyei, Dr. J. Opoku-Ansah, Dr C. L. Y.

Amuah, Dr. S. S. Sackey and Prof. P. K. Buah-Bassuah had developed a multispectral imaging technique.

2017 | A NEW MICROSCOPIC IMAGING SYSTEM (MSI) USING LED FOR MULTISPECTRAL IMAGING

Most microscopic imaging system (MSI) systems use continuum light sources and filters for imaging purposes. These light sources and filters are relatively expensive and unstable due to extreme pressure and temperature. Dr. J. Opoku - Ansah, Prof. B. Anderson, Prof. M. J. Eghan Dr. P. Osei - Wusu Adueming and Dr. C. L. Y. Amuah had developed a microscopic based multispectral imaging system employing nine (9) LEDs for biomedical, ocular and entomological research with the help of their collaborators.

2017 | LASER-INDUCED FLUORESCENCE CLASSIFIES ANTIMALARIAL HERBAL PLANTS

For the first time, Dr. C. L. Y Amuah, Prof. M. J. Eghan, Prof. B. Anderson, Dr. P. Osei-Wusu Adueming and Dr. J. Opoku-Ansah were able to use laser-induced fluorescence combined with multivariate analysis to characterize and classify some selected antimalarial herbal plants samples.

2017 | CRITERIA FOR ASYMMETRIC PRICE TRANSMISSION MODEL SELECTION BASED ON KULLBACK'S SYMMETRIC DIVERGENCE

Prof. Henry Nana De-Graft Acquah introduced and explored the Kullback's Symmetric Divergence (KICc and KIC), as a reliable and useful criterion in asymmetric price transmission model selection via Monte Carlo Experimentation. He developed and implemented R algorithms to evaluate model selection performance via Monte Carlo experimentation.

2017 | NOVEL CLAY BASE BI-FUNCTIONAL HETEROGENEOUS CATALYST

Dr Mohammed Takase prepared novel clay base modified HCl-treated attapulgite functionalized with $C_4H_4O_6KNa$ and $Na_2C_2O_4$ as catalysts for biodiesel production.

2017 | NON-LINEAR BASED UTAUT MODEL

Fourteen years after the development of the UTAUT model which was purely linear, it took Dr. Brandford Bervell and his PhD supervisor Prof. Umar to propose a non-linear UTAUT and verified it through advanced partial least squares structural equation modelling technique. That model better explained the nuances in the non-linear relationships that existed in the exogeneous variables within the original UTAUT model before predicting the final endogenous variable. That non-linear UTAUT model was really a novelty and an eye opener in information systems research with special emphasis on Learning Management System (LMS) fostered blended learning acceptance research in distance education.

2017 | RANK-BASED ESTIMATION FOR ASYMMETRIC PRICE TRANSMISSION MODELLING

Prof. Henry Nana De-Graft Acquah introduced and explored Rank-based estimation for modelling the Granger and Lee asymmetric price transmission model in the presence of outliers. Monte Carlo experimentation suggests that proposed Rank-based estimation promises to do better when the dataset has outliers within the asymmetric price transmission modelling context. He developed and implemented R algorithms in a Monte Carlo Simulations.

2018 | MODIFIED LOW-DENSITY LIPOPROTEIN (M-LDL-C) FRIEDEWALD'S EQUATION AS A SUBSTITUTE FOR DIRECT LDL-C MEASURE IN A GHANAIAN POPULATION

A new formula to estimate LDL cholesterol among Ghanaians had been developed by Prof. Richard K. D. Ephraim, Emmanuel Acheampong, Swithin M Swaray, Enoch Odame Anto and colleagues.

2018 | TECHNOLOGY PERSONALITY FACTORS-BASED MODEL

In 2018, Dr. Brandford Bervell and his PhD supervisor, Prof. Umar, again saw a chasm in the literature on how technology personality factors extensively related within and among themselves in a definite model exclusive to those factors, and their overall variance explained in information system usage intentions. They developed a model solely based on technology personality factors and verified it through advanced partial least squares structural equation modelling technique. They were able to determine how technology personality factors alone determined intention behaviors of LMS uptake in distance education based on their importance-performance map analysis (IPMA).

2018 | RESIDUAL LIKELIHOOD APPROACH FOR ASYMMETRIC PRICE RELATIONSHIP SELECTION

Prof. Henry Nana De-Graft Acquah introduced and explored the Residual Likelihood Approach (RIC) as a reliable and useful criterion in asymmetric price transmission model selection via Monte Carlo Experimentation. He developed and implemented R algorithms for model selection methods and Monte Carlo Simulations. RIC, which has both BIC's useful property of consistency and efficient property of AIC, is a very reliable and useful criterion in asymmetric price transmission model selection.

2018 | SWEET POTATO FLOUR FORTIFIED WITH INDIGENOUS UNDERUTILIZED SEASONAL VEGETABLES

Under-nutrition and micronutrient deficiencies are high on the agenda of many developing countries and international development partners, as it affects more than one-third of the global population. To this end, Dr. Ernest Teye and his team developed and examined Sweet Potato Flour Fortified with Indigenous Underutilized Seasonal Vegetables. This innovation ultimately reduces under-nutrition and malnutrition in underprivileged and vulnerable communities.

2018 | AFLATA-MIX FOR INSTANT KENKEY

Kenkey is a wet-cooked fermented maize dough dumpling that is popular among many Ghanaians. It can be served as lunch, dinner and even for some people, breakfast. An important intermediate to the product is aflata, which is a partially cooked maize dough that is added to uncooked dough for the purpose of flavour and texture development as well as easy handling of the dough. The entire process for the making of kenkey, takes three to five days from cleaning and soaking of the maize to the cooking of the aflata-mix (mixed aflata and uncooked dough). Moreover, the product can at best be kept for a week for Ga kenkey and two weeks for Fante kenkey. A dried aflata-mix has also been developed. This can be cooked into either a Ga or Fante ex kenkey in a short time – about 15 minutes. It produces a product that compares very well with a conventionally cooked kenkey, as regards the taste and texture. It can be kept for at least two years because of the very low moisture content. This saves time in terms of labour and time needed for the preparation of the traditional product, and delivers a safe and healthy product. This innovation was developed by Dr. Enoch T. Quayson.

2019 | DESIGN OF SINGLE-STAGE SOLAR-SUPPORTED HYPER-THERMOPHILIC BIOGAS DIGESTER

Most biogas digesters that have been designed operate on mesophilic conditions which are often heated using electrical energy. Dr. Isaac Mbir Bryant designed and developed a biogas digester that operates in hyper-thermophilic mode using solar-powered energy.

2019 | RAPID ONSITE DETECTION OF RICE QUALITY AND SAFETY

Dr. Ernest Teye and his colleagues developed a rapid onsite detector of Rice Quality and Safety. They applied a portable spectrometer coupled with a smart phone to measure rice integrity in Ghana (imported and locally produced rice).

2019 | FAST AND NON-DESTRUCTIVE IDENTIFICATION OF CONTAMINATED PALM OIL.

Dr. Ernest Teye and his colleagues developed a fast and non-destructive simultaneous identification of unadulterated palm oil from Sudan dyes' (I, II, III, & IV) adulterated ones. That work was the first to apply portable spectroscopy and chemometrics to classify and quantify Sudan I, II, III, and IV dyes in palm oil.

2019 | DISCOVERY OF NOVEL PLASMODIUM FALCIPARUM I453V KELCH 13 PROPELLER GENE ALLELE

Prof. Desmond Omane Acheamong, Enoch Aninagyei, Dr. Alexander Egyir-Yawson & Prof. Dominic Kwiatkowski discovered a novel

Plasmodium falciparum I453V Kelch 13 propeller gene allele and for the first time, identified Plasmodium falciparum A676S and S466N Kelch 13 propeller gene alleles.

2019 | COST EFFECT IMAGING TOOLS FOR POLYURETHANE FOAM (PUF) CHARACTERIZATION

The morphological properties of porous substrates determine their applicability in membrane filtration for effective water treatment. This challenge led to the proof-of-principle studies by S. Yunus, Dr. B. Sefantiri, Prof. B. Anderson, Dr. F. Kumi, Mr. P. Mensah-Amoah and Dr. S. S. Sackey, on the morphological characterization of Polyurethane Foam (PUF) substrates using cost-effective digital imaging systems/devices.

2019 | AUTHENTICATION AND QUANTIFICATION OF QUALITY PARAMETERS IN INTACT PINEAPPLE FRUITS

Dr. C. L. Y. Amuah, Dr. E. Teye, Mr. F. P. Lamptey, Mr. K. Nyandey, Dr. J. Opoku-Ansah and Dr. P. Osei-Wusu Adueming used total soluble solids (TSS) to predict the maturity of intact pineapple and identified organic from inorganic pineapple fruits based on near-infrared (NIR) spectra fingerprints, and they as well detected pineapple fraud due to mislabeling of conventionally produced fruits as organic ones.

2019 | DESIGN OF MANUALLY-STIRRED DISCONTINUOUS BIOGAS DIGESTER

Most biogas digesters that have existed operated on continuous mode and the stirring mechanism is often powered by electrical energy. Dr. Isaac Mbir Bryant designed and developed a biogas digester that could

operate on a discontinuous mode and could be operated manually. This implies that those who are not connected to the grid can own and operate this digester in their homes.

2019 | NEW NON-EDIBLE ALLANBLACKIA PARVIFLORA FEED STOCK FOR BIODIESEL

Dr. Mohammed Takase discovered a new non-edible *Allanblackia parviflora* seed oil as an alternative feedstock for biodiesel production.

2019 | DESIGN OF SHEA NUT ROTARY ROASTING MACHINE FOR THE PRODUCTION OF SHEA BUTTER

Roasting of Shea nut is quite laborious and time consuming. This led Prof. Ing. Samuel Kofi Tulashie, Godfred Appiah, Ephraim Edem Amoah Akpari and Samuel Muobom Saabome to design and develop a machine for the production of shea butter. The Shea nut Rotary Roaster machine is more convenient to the local community since it is user friendly. Consequently, the machine will serve as a right-hand partner and appropriate device for oil extractors. It can, thus, be utilized as part of the manufacturing process for the extraction of oil.

2019 | PRODUCTION OF FUEL FROM PLASTIC WASTE

Pyrolysis reactors are designed for converting plastic waste to fuel. Subsequently, Prof. Ing. Samuel Kofi Tulashie, Mr. Enoch Kofi Boadu and Samuel Dapaah developed the nature and design specifications for the reactors. Thus, the accumulation of plastic waste in Ghana, with its harmful environmental impact, can be solved by maximizing this timely intervention.

2020 | UCC SCHOLARLY RESEARCH OUTPUT MONITOR AND TRACKER (UCCSCHOLAR)

As the Director of the Directorate of Research, Innovation and Consultancy, Professor Frederick Ato Armah led the development of UCCSCHOLAR. This is a web-based application and bibliometric system that tracks scholarly research output of UCC faculty members at the institutional and sub-institutional levels (Department, Directorate, School, Faculty, and College). This innovative system, which is among the first of its kind on the continent, is a diagnostic tool for management decision-making. Metrics covered include total number of publications, total citations, total number of faculty members, year of publication, journal, H-index, i-10 index, three-year performance tracker, and graphical outputs that can be filtered by Department, Directorate, School, Faculty, and College.

2020 | DEVELOPMENT OF ABRUS PRECATORIUS-BASED DIABETIC DIET

Dr. Alex Boye, Prof. V.Y.A Barku and Prof. D.O. Acheampong developed a diabetic diet from rice, cassava, maize, and yam by incorporating extracts from the leaves of *Abrus precatorius*. This developed diabetic diet has low glycemic index and low glycemic load and is, therefore, recommended for use by diabetics.

2020 | PAVEMENT BLOCK FROM PLASTIC WASTE

Prof. Ing. Samuel Kofi Tulashie and Mr. Enoch Kofi Boadu successfully used plastic waste to produce pavement blocks. This work is aimed at drastically reducing the rapid accumulation of plastic wastes in Ghana.

2020 | BIO-LUBRICANT PRODUCTION FROM CASTOR, PALM KERNEL, AND COCONUT OILS

Prof. Ing. Samuel Kofi Tulashie and Mr. Francis Kotoka successfully formulated bio-based lubricants from castor, palm kernel, and coconut oils via transesterification and special additives addition.

2020 | EGG FRESHNESS INTEGRITY TESTING

Dr. Ernest Teye and Prof. Julius Hagan jointly developed a rapid and non-destructive approach to determining egg freshness category and marked date of lay using spectral fingerprint.

2020 | COCOA BEANS INTEGRITY TESTING

Dr. Ernest Teye and Robert Agbemafle jointly developed a rapid method for identifying authentic cocoa beans. The innovation uses non-destructive authentication of regional and geographical origin of cocoa beans with the aid of a handheld NIR spectroscopy and multivariate algorithms.

2020 | LASER-INDUCED AUTOFLUORESCENCE SAFELY DIAGNOSES CATARACT

Using UV light sources in Laser-induced autofluorescence (LIAF) has its associated cataract formation. Dr. P. Osei-Wusu Adueming, Prof. M. J. Eghan, Prof. B. Anderson, Dr. S. Kyei, Dr. J. Opoku-Ansah, Dr. C. L. Y. Amuah, Dr. C. D. Takyi and Prof. P. K. Buah-Bassuah, with the aid of visible light sources, had been able to detect and discriminate cataractous lenses from healthy lenses as a safer technique for diagnosing cataracts.

2020 | IDENTIFICATION OF GEOGRAPHICAL ORIGIN OF ANTIMALARIAL HERBAL PLANTS

Dr. C. L. Y Amuah, Prof. M. J. Eghan, Prof. B. Anderson, Dr. P. Osei-Wusu Adueming and Prof. P. K. Buah-Bassuah collected some antimalarial herbal plants from four geographical origins in the Cape Coast metropolis, Ghana. Utilizing laser-induced fluorescence and multivariate techniques, they were able to successfully identify the s3 geographical origins of the selected antimalarial herbal plants with a success rate of above 99 %.

2020 | COMPUTATIONAL FLUID DYNAMICS OF A CHIMNEY SOLAR DRYER

Postharvest losses tend to be very high in Africa. However, there is an abundance of solar energy which could be utilized for drying crops for the purposes of preservation. To help tackle this challenge, Dr Francis Kumi adapted a chimney solar dryer built by the University of California Davis in the USA by incorporating sea pebbles into its heating compartment. The improved dryer which was built and tested using local materials, was found to have enhanced the drying rate of pepper compared to the original design. A computational fluid dynamics of the dryer which showed the temperature, relative humidity and air flow under different times of the day was successfully conducted on it. This innovation could be promoted for use by smallholder farmers and food processors in the country.

2020 | DEVELOPMENT OF A SEMI-AUTOMATIC VEGETABLE SEEDLING TRANSPLANTER

The manual transplanting of vegetable seedlings tends to be very tedious and has serious health implication for the individuals involved in such activity due to the continuous bending or squatting. To lessen the burden, and reduce the health implications to the bare minimum, Dr Francis Kumi and Prof. Robert Sarpong Amoah guided Mr Karimu Abdullai, an MPhil student, to develop a semi-automatic vegetable seedling transplanter for use by smallholder farmers in the country. The initial evaluation of the performance of the machine was conducted at

the A.G Carson Technology Centre using pepper as a test crop. The results showed that by using the equipment, the farmer was able to save up to 67% of the time he/she would have ordinarily used in the manual operation. This innovation, if promoted, could help save labour and improve the efficiency of the transplanting of vegetable seedlings in the country.

2020 | ESTABLISHMENT OF RELATIONSHIPS AMONG FACILITATING CONDITIONS, VOLUNTARINESS OF USE AND USE BEHAVIOUR

The important variables such as facilitating conditions, voluntariness of use and use behaviour have existed in information system research for a long time. However, there had been no attempts by anyone to agglomerate those three variables together to unravel their relationships. To that end, Dr. Brandford Bervell and Dr. Valentina Arkorful became the first to bring these three variables together to determine important relationships that existed among facilitating conditions, voluntariness of use and use behaviour in LMS-enabled blended learning uptake in distance higher education. That was done through advanced partial least squares structural equation modelling technique.

2020 | MODEL OF ONLINE LEARNING SATISFACTION (MOLS)

Dr. Brandford Bervell, Prof. Naufal Umar, Irfan and Mr. Hafiz Kamilin, Muhamad modelled how personal innovativeness and modes of interaction (student-material interaction, student-student interaction and student-teacher interaction) intricately related to each other in order to understand the effect of their non-linear interactions towards satisfaction in online learning. Even though modes of interaction and personal innovativeness have existed in information systems research for a long time, modelling them together towards their predictive abilities on online learning satisfaction was missing. That was the first attempt to prove that relationships existed among those variables prior to their final prediction of satisfaction in online learning.

2020 | TECHNOLOGY-RELATED STIMULUS-RESPONSE THEORETICAL FRAMEWORK (TR-SR-TF)

LMS-related anxiety has been cited as one of the behavioural challenges hindering LMS usage in Africa. Dr. Brandford Bervell and Prof. Irfan Naufal Umar focused on unravelling the antecedents of tutors' anxiety towards actual LMS usage, hinged on a Technology-Related Stimulus-Response Theoretical Framework (TR-SR-TF) which they formulated based on the Stimulus-Response Association that existed in psychology. By modifying the theory to suit technology research, the authors successfully grouped technological use factors as Stimulus; Anxiety (Low/High) as Emotional Reaction or Response and; use behaviour (Acceptance/Avoidance/Low Use/High Use) as Behaviour. The framework was validated through advanced partial least squares structural equation modelling technique. That became known as the TR-SR-TF to determine what propelled technology anxiety and its final effect on uptake intentions. That framework became the novel framework and firstly used term in information systems research to address the issue of technology anxiety. Later in 2020, Dr. Brandford Bervell used his brainchild framework (TR-SR-TF) and successfully led his team members: Dr. Paul Nyagorme and Dr. Valentina Arkorful to determine and prove the mediation effect of technology attitude on other exogenous factors such as performance expectancy, effort expectancy and facilitating conditions based on an advanced partial least squares structural equation modelling approach.

2021 | FORMULATION OF AN ORAL CLEANSING FORMULA FROM PLANTAIN FRUIT STALK

Dr. Alex Boye, Mr. Ernest Owusu-Boadi, and Mr. Mainprice Akuoko Essuman developed an herb-derived oral cleansing agent from the fruit stalk of *Musa parasidiaca* (Plantain). In view of the cheap and availability of fruit stalk of plantain, it has been recommended for product development by the Center for Research into Plant Medicine (CRPM), Mampong-Akuapem.

2021 | FORMULATION OF A WOUND HEALING FORMULA FROM PARKIA CLAPPERTONIANA FRUIT HUSK

Dr. Alex Boye, Mr. Dominic Nkwantabisa Kuma, Prof. VYA Barku and Prof. DO Acheampong have developed a wound healing formula from the fruit husk of *Parkia clappertoniana*. The formula is under product development stage at the Center for Research into Plant Medicine (CRPM), Mampong-Akuapem.

2021 | FORMULATION AND EFFICACY ASSESSMENT OF A POLYHERBAL WOUND HEALING FORMULA FROM HELIOTROPIUM INDICUM AND NEPHROLEPIS BISERRATA

Prof. V. Y. A Barku, Dr. Alex Boye and Prof. D. O. Acheampong have developed a polyherbal wound-healing formulation from the leaves of *H. indicum* and *N. biserrata* and further assessed their wound-healing effects by using both in vivo and in vitro wound healing models.

2021 | DEVELOPMENT OF A NEW METHOD FOR IDENTIFICATION AND QUANTIFICATION OF ANTI-PARASITIC AGENTS IN ENVIRONMENTAL SAMPLES

Prof. D.K. Essumang, Mrs. Roberta Antwi-Adjei, Prof. Maria Paz and Dr. C.K. Adokoh have developed a new method for the determination and quantification of anti-parasitic agents using Ultra-High Performance Liquid Chromatography (UHPLC). This method could be used simultaneously to monitor different pharmaceutical contaminants.

2021 | A DEVELOPED BASELINE CORRECTION ALGORITHM

A novel algorithm for the pre-treatment and recovery of Raman signals from fluorescence contaminated spectra was developed by Mr. A. A. Huzortey, Prof. B. Anderson, and Dr. A. Owusu.

2021 | A MODIFIED SODIUM MOLYBDATE CATALYST FOR GREEN ENERGY

Dr Mohammed Takase designed and prepared modified Sodium molybdate as an efficient high yielding heterogeneous catalyst for biodiesel from Ghanaian indigenous *Camelina sativa* as a non-edible resource.

2021 | A NOVEL SCREENING ALGORITHM FOR BLOOD DONORS WITH SUBCLINICAL MALARIA

Prof. Desmond Omane Acheampong and Enoch Aninagyei have developed a novel screening algorithm for blood donors with subclinical malaria.

2021 | NEEM EXTRACTS AS A NATURAL INSECTICIDE AGAINST FALL ARMYWORM (SPODOPTERA FRUGIPERDA (SMITH) (LEPIDOPTERA: NOCTUIDAE))

A new natural insecticide from neem to combat fall armyworm (FAW) infestation on maize was extracted by Prof. Ing. Samuel Kofi Tulashie, Mr. Francis Adjei, Dr. John Abraham and Enoch Addo. They utilized neem seed oil extract and methanolic neem leaf extract as a natural insecticide to fight FAW infestation on maize. Since neem insecticides are relatively non-toxic, environmentally friendly, and highly effective in causing FAW

larval mortality, they can be applied in agriculture as a suitable substitute for synthetic insecticides.

2021 | CONVERSION OF SAWDUST WASTE TO BIOETHANOL

A large amount of sawdust is generated as Municipal waste in Ghana. This led Prof. Ing. Samuel Kofi Tulashie, Mr. Ephraim Edem Amoah Akpari and Mr. Ebenezer Kelvin to convert sawdust to bioethanol through acid hydrolysis. This innovation seeks to provide an alternative to hydrocarbon-based fuels by promoting the production and utilization of bioethanol in Ghana and beyond. This new method provides theoretical projections of this work in the wake of an upscale in industrialization for sustainable future energy source.

2021 | PRODUCTION OF PORTLAND POZZOLANA CEMENT FROM RICE HUSK ASH

The cement industries would save energy and reduce the cost of production if the waste from agriculture that have the potential of improving cement properties are partially/fully incorporated into the production of cement. This has necessitated the production of the Portland Pozzolana cement by Prof. Ing. Samuel Kofi Tulashie, Prince Ebo, Jonathan Kweku Ansah and David Mensah. This intervention will go a long way to reduce the accumulation of agriculture waste such as rice husk, which is usually burnt generating GHGs.

2021 | BLENDED LEARNING ACCEPTANCE SCALE (BLAS) IN DISTANCE HIGHER EDUCATION

Dr. Brandford Bervell, Prof. Irfan Naufal Umar, Dr. Jeya Amantha Kumar, Dr. Beatrice Asante Somuah and Dr. Valentina Arkorful made a novel stride by developing and validating the first Blended Learning Acceptance Scale (BLAS) in Distance Higher Education that combined both face-to-face

and online learning modes in the scale items, and made it apt to measure blended learning acceptance instead of the usual technology-biased scales often used. The BLAS was, thus, developed and validated based on 45 items across 11 constructs or factors to measure acceptance of blended learning by tutors in distance higher education. It is refreshing to indicate that this scale was the first to also incorporate both personality factors and technological factors in a single scale, verified through advanced linear partial least squares structural equation modelling technique to measure blended learning acceptance in information systems research.

2021 | ACOUSTOELECTRIC CURRENT IN GRAPHENE NANORIBBON DUE TO LANDAU DAMPING

Prof. S. Y Mensah together with others performed self-consistent analysis of the Boltzmann transport equation for momentum and energy in the hypersound regime. They investigated the Landau damping of acoustic phonons in graphene nanoribbons, which leads to acoustoelectric current generation. Under a non-quantized field with drift velocity, they observed an acoustic phonon energy quantization that depends on the energy gap, the width, and the sub-index of the material.

2021 | GHANA BEE MAP

The Ghana Bee Map, the first in Ghana, was developed with data from the Department of Conservative Biology and Entomology and the International Stingless Bee Center. It is an interactive map that shows all the locations of the different species and genres of bees collected for over two (2) decades in Ghana. The map will also serve as a guide to climate change by learning the migration patterns of the bees over the period. Dr. Stephen Moore, Prof. P.K Kwapong, and Dr. Rofela Combey were part of the team that developed the interactive map.

2021 | UCC SELF-GUIDED MAPS

Dr. Stephen Moore and his team developed the first ever UCC self-guided map. The self-guided maps give a virtual tour of the university campus and enable visitors and freshmen and women as well as newly employed staff members to locate facilities on campus. The map will reduce the cost of printing campus maps for students and visitors.



UNIVERSITY OF CAPE COAST
CAPE VARS · UNIVERSITY OF COMPETITIVE CHOICE

INAUGURAL ENTRY OF UCC IN THE TIMES HIGHER EDUCATION EMERGING ECONOMIES UNIVERSITY RANKINGS

#1

in Ghana in the 2022 Times Higher Education Emerging Economies University Rankings

#1

in West Africa in the 2022 Times Higher Education Emerging Economies University Rankings

#4

in Africa in the 2022 Times Higher Education Emerging Economies University Rankings

#52

out of 698 Universities from 50 countries in the 2022 Times Higher Education Emerging Economies Rankings

2nd

highest Ranked Debutant out of 104 universities from 32 countries in the 2022 Times Higher Education Emerging Economies Rankings

**TOP
100**

UCC is the only university in West Africa in the top 100 in the 2022 Times Higher Education Emerging Economies University Ranking

RESEARCH AND INNOVATION EXCELLENCE: PERSPECTIVES FROM SOME SUPERANNUATED FACULTY

This section is a collection of views from renowned faculty whose careers span 26 and 51 years. From their rich experiences, both historical and contemporary, we draw lessons to further accelerate innovation at UCC.

Emeritus Professor Divine Edem Korbla Amenumey
(1967 – 2008) - 41 years

If society has invested in you, you should repay society and make sure to leave it better than you found it.

The more we know, the more we know that we do not know everything. There is no end to knowledge. This brings to the fore the issue of lifelong learning.

Inbreeding is ruining our universities in Africa. There is need for infusion of external faculty to catalyse innovation and churn out new ideas at UCC. Inbreeding only reflects ourselves and does not bring about change and this is detrimental to the second and third generations after us. So we need to invest in staff and student exchanges. Sabbatical leave is important and the University's management must devote money for that purpose.

We need to invest in research, research, research. This is the only way we can move the frontiers of our achievements.

Professor Atta Gyamfi Britwum
(1970 – 2021) - 51 years

There have been marked changes in the nature and scope of our mandate over time. The exponential increases in student numbers is a by-product of these changes. A logical consequence is the change in the curriculum and assessment mechanisms. The use of multiple choice questions does not prepare students for graduate school but it is evident that graduate students are important drivers of innovation.

Professor Samuel Yeboah Mensah
(Since 1990 – Date) - 32 years

“What is good innovation always comes in simple, beautiful form.”
Innovators need to be celebrated and motivated a bit more. This serves as an incentive for further innovation. Institutional innovation and nation innovation award schemes or initiatives are useful starting points in this regard.

UCC ought to maintain scholarly excellence and academic rigour. Professors of old were emphatic on these ideals.

We need to forge research and innovation partnerships that will limit our dependence on government and even our research collaborators. It is only then that we can be headed in the direction of academic, financial and institutional autonomy.

Professor Paul Kingsley Buah Bassuah
(1983 – Date) - 39 years

Part of my success and even the recognition of my innovative works have stemmed from my membership of important optical associations. Joining professional bodies is key. That is where you meet your contemporaries. So such affiliations are important for innovation.

Another key driver of innovation is funding. Most of my innovations are not owned by us (UCC). The University gets to own it if they pay for the work and this is the way to go. Innovations from externally funded research takes away ownership

Innovation should link up with entrepreneurship for it is the ultimate way to translate innovation into money (financial and ancillary benefits)

Other drivers of innovation include: building critical skills and core competencies of graduate students, a sacrificing disposition and investments in equipment and infrastructure (physical and digital).

Dr. Gladys Naa Tsitse Buxton
(1972—2016) - 44 years

In those days, the best came to the university, even the labourers. The technical staff, some were very good and supported us ... we should bring the best. Let's bring the best, bring the best.

I wish we could use some professors to teach at the lower levels to build the confidence of the students in the subjects. They need to love the subject. I also wish to see more mentoring of the students to ensure they are firmly grounded in theoretical concepts and practical applications of their disciplines.

Professor Victor Patrick Yao Gadzekpo
(1987—2021) - 34 years

Innovation comes from the desire to solve problems and make life simpler. That, for me, is the drive.

To innovate, we must collaborate with industry because they have the problems to be solved.

Graduate supervision and graduate scholarship need a bit more commitment because the innovations come from there. If we are able to do that, UCC can achieve more in terms of innovations

Innovation does not have to be complicated. You just have to solve a problem, which is relevant for society.

You cannot be a researcher and at the same time a businessman. There is the need to focus as time is limited. You do the research; somebody has to commercialise it. The University can take up patenting and commercialisation and then reward the researchers from the proceeds. We need to concentrate on specific aspects of the innovation value chain.

Professor Akua Opokua Britwum
(since 1996 – Date) - 26 years

The establishment of a dedicated gender centre is an important turning point within the University because gender is a useful lens for assessing the relevance of research and innovation for society.

While leadership at all levels is very important for innovation, leadership at the apex is most critical. If the subjective element of appointing people to occupy positions is replaced with a merit-based system, it becomes possible for people who are given leadership positions at the various levels to stand out and give off their best, knowing they owe it to themselves to leave a legacy that is sustainable.

How we strengthen meritocracy within the University is important. It is within this context that innovation can thrive.

Professor Harold Steward Amonoo-Kuofie
(2004 — 2017) - 40 years in academia, 12 years at UCC

Individual faculties must demonstrate curiosity and imagination. This helps to move away from the status quo and generate new ways of doing things...lateral thinking is important ...target setting is important... monitoring progress and setting new targets are all key ingredients for innovation.

Inventiveness is another characteristic of innovation. This is possible when problem-solving skills are encouraged...everybody has the ability to innovate. The natural intuition however can be unearthed only when the system is flexible. The system needs to be flexible... Of course statutes are important but flexibility is, too.

Leadership must make their vision clear to the people they are leading and build them to own it. ...people will ridicule you when your ideas are new to them but you have to be mentally resilient. You don't allow lack of money to be a constraint.

UCC must truly decentralize to ensure that the colleges are semi-autonomous. This will help in financial administration since colleges can have the latitude to prioritise their needs.

UCC needs to equip students with core competencies and skills that resonate with 21st century education demands. We set the pace on problem-based learning (PBL), objective structured clinical examination (OSCE), white coat ceremony and community based experience and service (COBES) at the UCC Medical School. Other medical schools across the country are now emulating these innovations.

Continuous professional development is also important for every discipline of the university. Because there are new and improved ways of doing things on daily basis. This helps to assess how knowledge is progressing and the University must encourage it, even among administrators and every aspect the university. In this way, the entire university will grow.

**Professor Mansah Prah
(1985 - 2015) - 30 years**

In the past, gender was not prominent in our policy documents. I hope that the establishment of the gender centre has brought some changes. The need for equitable grant opportunities, devoid of nepotism, favouritism and gender biases cannot be overemphasized. This encourages female scholars.

One area that require special attention is faculty welfare. A congenial atmosphere is a requirement for effective research and innovation

There must be incentives for publications in high impact journals

While internationalization is important, we should ensure that our collaborations is not centered on only western countries but other African countries as well...In fact, we need to Africanise our curriculum for local relevance

Professor Kofi Awusabo-Asare
(1980 – 2020) - 40 years

Quality is a key ingredient for innovation... quality in the people we employ, the students we admit, the services we provide and the facilities we maintain

Innovation thrives where there is effective collaboration. The sharing of ideas is important since we cannot have all knowledge in one person.

While funds are essential for research and innovation, we cannot continue to wait for funds before generating ideas. "Money chases good ideas". Once the idea is good funders will emerge.

Leadership that is positive, encouraging or supportive is needed to accelerate innovation and nurture talent.

Professor Albert Machistey Abane
(1984 – Date) - 38 years

Resource constraints and challenges are inevitable in a practical world; leaders should be able to flip challenges into opportunities. For instance, training of PhDs is a prerequisite for generating a critical mass of researchers and innovators. However, the cost of PhD training is sometimes inhibitive. To surmount this challenge, we partnered with an international institution. The partnership ensured that all 12 local research assistants obtained PhDs as part of the project. This is one of the ways by which institutions can accomplish targets and milestones.

Partnerships are critical to institutional sustainability. Two underserved areas are our partnerships with banks and the district assemblies. There is the need to address these areas to ensure that UCC is relevant to sub-national governance systems and the communities within our environs.

Our partners are constantly evaluating us in terms of the quality of our graduates, facilities and research. Therefore, we need to set for ourselves ambitious benchmarks that resonate with international standards. This is important for visibility beyond the boundaries of Ghana.

University management and DRIC should ensure a culture of quality becomes a defining characteristic of UCC. Teaching and research

quality are essential ingredients for maintaining our status as the number one university in the country and sub-region. Poor internet connectivity detracts from our credentials and impinges negatively on our teaching and research quality.

The Directorate of Research, Innovation and Consultancy (DRIC) and the Office of International Relations (OIR) need to work closely together so that internationalization of research and innovation can be achieved in a seamless manner

DRIC was not initially embraced by faculty owing to the sensitive issues that are part of its mandate. A decade on, its relevance is now clear for all to see.

Dr Samuel Yaw Boadi-Siaw
(1969—2011) - 42 years

UCC has been innovative over the years in terms of the nature and scope of the academic disciplines we offer, curriculum content, design, instruction, and evaluation. When I started lecturing, the student population was less than 500. The number of students these days is overwhelming and compromises effective teaching and learning.

Acquiring knowledge and putting same to use is eroding for some students in this generation and in its place we have students whose overarching interest is in just getting a degree. If unchecked, this unfortunate situation could potentially inhibit them from being relevant to society in terms of application of theory to practice and contribution to problem-solving in society.

Mr. Albert Kobina Koomson
(1990-2013) - 23 years

The transition from academia to entrepreneurship requires dedication, commitment and unflinching resolve to succeed in the face of opposition and adversity. When you have a vision, it is important to be convinced about its feasibility and the nature and scope of resources you require to achieve it. This is necessary because there will be obstacles along the way and your conviction will help you to stem the tide.

High level management and leadership is an important driver of innovation, institutional buy-in and critical decision-making. For instance, when I was the Director for the Centre for Continuing Education, the Vice-Chancellor Professor Emmanuel Adow Obeng, understood and embraced the vision of the centre. This high-level support helped in consolidating the gains and expanding the frontiers of the programme on offer at the centre.

Innovation requires uncommon sacrifice because there are immense competing demands on your time, energy and resources. Indeed, sometimes you may have to sacrifice your career progression (personal aspiration) for the collective good (institutional vision and agenda).

Self-motivation (intrinsic attribute) is a key ingredient for innovation because in most instances a critical mass of people may not necessarily support your vision immediately. It takes time for your innovation to resonate with people. You need to do self-introspection to unearth mechanisms through which you can draw faculty and industry to accept your innovation.

Besides hard work, patience, focus, determination, grit and the ability to build teams, the role of divine intervention in making the innovation succeed is important. Your innovative ideas may not necessarily resonate with a broad constituency of stakeholders so you must be prepared to go solo, sometimes. Eventually, time will vindicate your vision and innovation.

Sustainability of innovation is an enduring issue that every innovation ecosystem must account for and consider as part of a medium to long-term vision. This makes it imperative to formulate the innovation with systems in place that can function devoid of human interference.

INAUGURAL ENTRY OF UCC IN THE TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS

-- UNIQUE ACHIEVEMENTS AND HIGHLIGHTS --

- 1** UCC is the topmost ranked university in Ghana in the 2022 THE rankings
- 2** UCC is among the top 5 universities in Africa in the 2022 THE rankings
- 3** UCC is ranked number one globally in terms of field weighted citation impact (research influence) - **No university in Ghana has ever achieved this position since the Times Higher Education (THE) annual rankings commenced nearly two decades ago.**
- 4** Overall, UCC is ranked 301-350 globally
- 5** UCC is the highest ranked new entrant out of the 138 universities that made their debut on the 2022 global universities ranking league.

REFLECTIONS

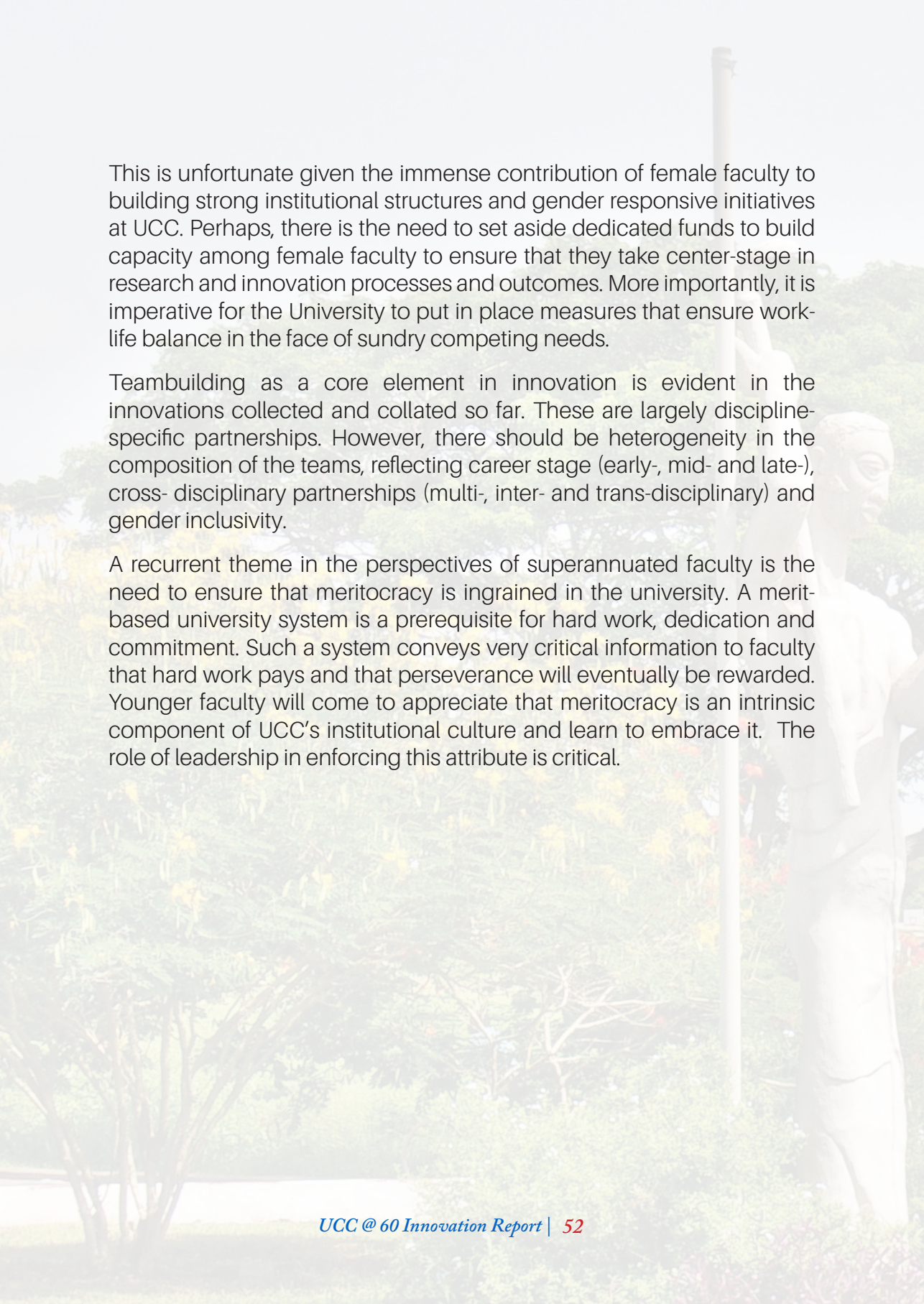
The exponential rise in student numbers during the first half century of the university's existence has been identified as a factor that is likely to compromise the quality of teaching and learning and by extension, research and innovation at UCC. If unattended by commensurate expansion of infrastructure, as well as teaching and learning facilities, quality will likely be undermined and UCC's quest to remain a national and regional leader in higher education will remain a pipe dream.

In research intensive universities and in environments where innovation thrives, the training of a critical mass of PhD graduates is closely linked to the number and quality of innovation. The ratio of undergraduate students to PhD students is lopsided in favour of the former. PhD students constitute less than 10 percent of all graduate students at UCC. It is evident that UCC needs to improve in this area in order to stimulate innovation.

Funding underpins all research and innovations. Innovative universities explore a myriad of funding streams and forge partnerships that deepen collaboration among government, academia, business and industry, civil society and communities. The ownership of output from research and innovation depends on the level of financial investment in the endeavour. It is in the interest of UCC to commit financial resources to research and innovation, in order to ensure that we own the ensuing output.

An area that requires immediate attention by university management is the research and innovation value chain and the transition from lower nodes to higher nodes in the chain. This transition requires emphasis on scale-up, patenting, entrepreneurship and commercialization of research and innovation output. Closely related to this is the need to integrate industrial needs in curriculum development and instruction.

The contribution of female faculty to this innovation report is limited.



This is unfortunate given the immense contribution of female faculty to building strong institutional structures and gender responsive initiatives at UCC. Perhaps, there is the need to set aside dedicated funds to build capacity among female faculty to ensure that they take center-stage in research and innovation processes and outcomes. More importantly, it is imperative for the University to put in place measures that ensure work-life balance in the face of sundry competing needs.

Teambuilding as a core element in innovation is evident in the innovations collected and collated so far. These are largely discipline-specific partnerships. However, there should be heterogeneity in the composition of the teams, reflecting career stage (early-, mid- and late-), cross- disciplinary partnerships (multi-, inter- and trans-disciplinary) and gender inclusivity.

A recurrent theme in the perspectives of superannuated faculty is the need to ensure that meritocracy is ingrained in the university. A merit-based university system is a prerequisite for hard work, dedication and commitment. Such a system conveys very critical information to faculty that hard work pays and that perseverance will eventually be rewarded. Younger faculty will come to appreciate that meritocracy is an intrinsic component of UCC's institutional culture and learn to embrace it. The role of leadership in enforcing this attribute is critical.

**DIRECTORATE OF RESEARCH, INNOVATION AND
CONSULTANCY MANAGEMENT COMMITTEE
UNIVERSITY OF CAPE COAST**

Prof. (Mrs.) Rosemond Boohene	Pro-Vice-Chancellor	Chairperson
Prof. Eric Francis Amuquandoh	Provost, CHLS	Co-Chair
Prof. Moses Jojo Eghan	Provost, CANS	Member
Prof. Isaac Galyuon	Provost, CoDE	Member
Prof. Ernest Kofi Davis	Provost, CES	Member
Prof. Martins Ekor	Provost, CoHAS	Member
Prof. Emmanuel K. Essel	Dean, SPS	Member
Prof. George K. T. Oduro	Dean, SEDO	Member
Prof. John Gartchie Gatsi	Dean, SoB	Member
Prof. Justice K. Sarfo	Dean, SBS	Member
Prof. Kwame Osei Kwarteng	Dean, FoA	Member
Prof. Cosmas Cobbold	Dean, FHSSE	Member
Prof. Douglas D. Agyei	Dean, FSTE	Member
Prof. Akwasi Kumi-Kyereme	Dean, FSS	Member
Prof. Sebastian Eliason	Dean, SMS	Member
Prof. (Mrs.) Sarah Darkwa	Dean, SGS	Member
Prof. Frederick Ato Armah	Director, DRIC	Member
Prof. David Teye Doku	Deputy Director, DRIC	Member
Prof. Dorcas Obiri-Yeboah	Deputy Director, DRIC	Member
Prof. Godwin Awabil	Dean, FEF	Member
Prof. Elvis Ameyaw	Dean, SPPS	Member
Prof. Henry De-Graft Acquah	Dean, SoA	Member
Prof. Omame Acheampong	Dean, SAHS	Member
Prof. Emmanuel Ekow Asmah	Dean, SoE	Member

Dr. Emmanuel Yamoah Tenkorang	Dean, SDS	Member
Dr. Nancy Innocentia E. Enyan	Dean, SoNM	Member
Dr. Mac-Anthony Cobblah	The University Librarian	Member
Dr. Peter A. Atupare	Dean, FoL	Member
Mrs Elizabeth Obese	Director of Finance	Member
Mr. Benjamin Otsen	Assistant Registrar	Secretary
Dr Samuel Owusu	Senior Research Fellow	In Attendance
Dr Francis Annor	Senior Research Fellow	In Attendance
Dr Millicent Abigail Aning-Agyei	Research Fellow	In Attendance
Dr Alex Boadi-Dankyi	Research Fellow	In Attendance
Mr Isaac Nketsiah	Assistant Research Fellow	In Attendance

ACKNOWLEDGEMENTS

The Chancellor

Dr. Sir Sam Essuon Jonah

The Chairman of the University Council

Professor Obeng Mireku

The Vice-Chancellor

Professor Johnson Nyarko
Boampong

The Pro Vice-Chancellor

Professor Rosemond Boohene

The Registrar

Mr. Jeff Teye Emmanuel Onyame

Interviewees

Emeritus Professor Divine Edem
Korbla Amenumey

Emeritus Professor Kodwo Nzeba
Eyeson

Professor Atta Gyamfi Britwum

Professor Samuel Yeboah Mensah

Professor Paul Kingsley Buah
Bassuah

Dr. Gladys Naa Tsitse Buxton

Professor Victor Patrick Yao
Gadzekpo

Professor Akua Opokua Britwum

Professor Harold Steward
Amonoo-Kuofie

Professor Mansah Prah

Professor Kofi Awusabo-Asare

Professor Albert Machistey Abane

Dr. Samuel Yaw Boadi-Siaw

Mr. Albert Kobina Koomson

Chairperson and members of the
DRIC Management Committee

All contributors to the Innovation
Report

Interviewers and Transcribers

Prof. Angela Dziedzom Akorsu

Prof. Frederick Ato Armah

All DRIC Staff

Graphic Designers

Mr. Alfred Ghartey

Mr. Ebenezer Fiifi Wiabo Wie-Addo

Publishers/Printers

Name



UNIVERSITY OF COMPETITIVE CHOICE