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THE Spark

Official Magazine of The College Of Basic And Applied Sciences

2020

UNIVERSITY OF GHANA

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PRINCIPAL OFFICERS
OF THE COLLEGE

Prof. Daniel Asiedu
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Mr. Emmanuel Baidoo
COLLEGE SECRETARY

Mr. Benjamin Addo
COLLEGE FINANCE OFFICER

Prof. Rose Mamaa Entsua-Mensah
CHAIR OF ADVISORY BOARD

MESSAGES

PROF. DANIEL ASIEDU
Provost, College of Basic and Applied Sciences

The College of Basic and Applied Sciences warmly welcomes you to the launch of its maiden magazine called ***"The SPARK"***. ***"The SPARK"*** serves as a channel to bring to the fore groundbreaking research, honors and achievements of faculty and staff of the college with each edition focusing on a particular school. This maiden edition put the spotlight on the School of Engineering Sciences highlighting how it all began to its present age. Also, some achievements and initiatives undertaken by some units within the College that contribute to the enhancement of the image of this great Premier University will be mentioned. The College of Basic and Applied Sciences (CBAS) is one of the four Colleges adopted by the University in 2014. CBAS constituents' units include the School of Agriculture, School of Biological Sciences, School of Engineering Sciences, School of Nuclear and Allied Sciences, School of Physical and Mathematical Sciences, School of Veterinary Medicine, Institute of Environment and Sanitation Studies, Institute of Applied Science and Technology, Centre for Climate Change and Sustainability Studies, Biotechnology Centre and the West African Centre for Crop Improvement. The mandate of the College is to foster collaboration among its diverse vibrant community dedicated to translational innovative research to impact society. Together with our impressive faculty and staff, we are committed to engaging with the expanded world of scholars to make a global impact. Thank you for taking time to peruse through the magazine.

PROF. ELVIS TIBURU, CHAIRMAN of CBAS Research Board

The Research Board of the College of Basic and Applied Sciences is privileged to bring to the University Community the SPARK magazine. The SPARK magazine which is the brain work of the CBAS Research Board showcases activities from the College of Basic and Applied Sciences. The name "SPARK" was carefully chosen to reflect the realization of the vision and mission of the College and its research activities that cause positive effect in its immediate environs, communities, the country and the World at large. Thus, our hope is to showcase to the World through stories and news the creative genius of our students and faculty. This is the maiden edition and is expected to come out quarterly to provide information on activities emanating from the various Schools of the College for the purpose of education. This maiden edition is focusing on the School of Engineering Sciences, highlighting students' life and faculty research activities. We are very grateful for patronizing this magazine. I would also like to mention the hard-working research board members of the college through whose efforts and dedication have helped to bring this maiden magazine to bear.

1. Prof. George Obeng Adjei	Office of Research, Innovation and Development
2. Prof. G. Oduro Nkansah	Institute of Applied Science and Technology
3. Prof. Samuel B. Dampare	School of Nuclear and Allied Sciences
4. Prof. S. Adjei-Nsiah	School of Agriculture
5. Dr. Samuel Addo	School of Biological Sciences
6. Dr. Ferdinand Katsriku	School of Physical and Mathematical Sciences
7. Dr. Hope Richard Otsyina	School of Veterinary Medicine
8. Dr. Kwabena Kan-Dapaah	School of Engineering Sciences
9. Dr. Jesse Sey Ayivor	Institute for Environment and Sanitation Studies
10. Dr. John Saviour Yaw Eleblu	Biotechnology Centre
11. Mr. Addey Owusu Prince	GRASAG Representative
12. Mr. Mawusi Kofi Glozah	CBAS/Secretary

SCHOOL OF ENGINEERING SCIENCES

MESSAGE

FROM THE DEAN

Prof. Boateng Onwona-Agyemang

On behalf of the School of Engineering Sciences, I extend our appreciation to the College Research Board for providing our esteem faculty and students the platform to showcase their research works and other achievements. The School has five departments; Agricultural Engineering, Biomedical Engineering, Computer Engineering, Food Process Engineering and Materials Science and Engineering. We strive to use innovative approaches to address local problems through innovative research approaches in new materials for healthcare delivery and energy supply as well as designing, fabricating of improved technologies for food security. The School is uniquely positioned to collaborate with industrial partners and our esteem students are actively involved in internship programmes to help explore possible solutions to problems affecting communities. I am very excited that this Maiden Magazine will share with the wider University Community and the World our commitment to engage stakeholders to bring to bear the long-term vision of the School which is to impact our Communities through innovative research. Meanwhile I bring to you the genesis of the School of Engineering Sciences put together by the foundation Dean, Professor Samuel Sefa-Dedeh, followed by a summary of his profile and the profile of the first lady pioneering faculty of the school.

THE MAKING

OF THE SCHOOL OF ENGINEERING SCIENCES AT THE UNIVERSITY OF GHANA.

PART 1 2000-2005 |
BY PROFESSOR SAMUEL SEFA-DEDEH, PH.D FOUNDATION DEAN

The Planning Committee

It was under the leadership of Prof. Ivan Addae-Mensah, Vice Chancellor, that the University of Ghana initiated steps to establish a Faculty of Engineering Sciences. This followed the decision of the Academic Board at its meeting of June 3, 2000 to recognize current trends towards the accelerated scientific and technological development world-wide and agreed for the university to diversify its curricula to fulfill its engineering mandate. In the realization of this, and to start with, the Academic Board decided to set up a Committee to examine the possibility of establishing the following non-conventional engineering sciences. a. Aeronautics and Space Science Technology b. Agricultural Engineering c. Biotechnology and Bioengineering d. Computer Engineering and Information Communication Technology e. Food Technology and Process Engineering f. Materials Science g. Medical Engineering

The Vice Chancellor therefore on June 20, 2000 set up a Committee to make proposals for the establishment of a Faculty of Engineering Sciences. He intimated that whilst the University of Ghana had remained a liberal arts and basic sciences institution since its inception in 1948, the proposals that mandated its establishment also envisaged an Engineering Faculty.

Membership of the Committee was as follows:

Professor F. K. A. Allotey
GAEC | **Chairman**
Dr. N. Quaynor
NCS | **Member**
Professor K. Andam
Representative of the Ghana Institution of Engineers | **Member**
Professor W.A. Asomaning
Dean, Faculty of Science | **Member**
Professor B.K. Ahunu
Dean, Faculty of Agriculture | **Member**
Professor E. Ofori-Sarpong
Dean Faculty of Social Studies | **Member**
Professor M. Dakubu
Coordinator, African Virtual University | **Member**
Professor S. Sefa-Dedeh
Department of Nutrition & Food Science | **Member**
Mr. J.A. Aryeetey
Department of Computer Science | **Member**
Dr. R. Kwadjo
Department of Physics | **Member**
Dr. S. Abenney-Mickson
Department of Agricultural Engineering | **Member**
Dr. K.K. Atsina
College of Health Sciences | **Member**
Mr. E.A. Amartey
Academic Affairs | **Secretary**

Co-opted Members: The following were co-opted for their expertise.
Professor E. Jackson, Vice Dean School of Engineering, KNUST, (Computer Engineering)

Dr. Elsie E. Kaufmann, Department of Physics, University of Ghana (Biomedical and Materials Science & Engineering)

During the Committee's work, Dr. S. Abenney-Mickson, Dr. R. Kwadjo and Dr. K.K. Atsina were replaced by Dr. R.J. Bani, Dr. V.C.K. Kakane and Dr. G. Toworfe respectively.

Proposals from the Committee

The Committee gave the justification1 for the establishment of the Faculty as:

- To provide manpower in the selected disciplines and other emerging areas of the economy for research and industrial applications.
- To fully fulfil the University's original mandate of establishing a Faculty of Engineering.
- To help expand and diversify the University's curricula.
- To create more opportunities for the increasing number of science students from the Senior Secondary School level.

» To expand the engineering capacity of the public universities taken together. Currently there is only one Faculty of Engineering in the public university system as opposed to four (4) Faculties of Agriculture and three (3) Medical Schools.

The Committee made detailed proposals for the establishment of the Faculty of Engineering Sciences at the University of Ghana. Major amongst these were:

1. The implementation of the establishment of a Faculty of Engineering Sciences by the University of Ghana should be done in phases considering the needs of the country, existing academic programmes, staffing, physical infrastructure, equipment and funds.
2. Phase one was proposed to have programmes in,
   a. Food Process Engineering
   b. Computer Engineering
   c. Agricultural Engineering
   d. Materials Science (Ceramics Option)
   e. Biomedical Engineering
3. Phase Two was proposed to have programmes in,
   a. Materials Science (Metallurgy and Polymers Options)
   b. Aeronautics and Space Science Technology
4. Committee adopted a model in which all engineering students were exposed to common courses in basic sciences, mathematics, basic engineering as well as social sciences for a period of two years before branching into specializations.
5. The adoption of a two-year common courses and also the realization that most of the courses to be taught at Level 100 and Level 200 were already being offered in some existing Departments in the Faculties of Science, Agriculture, Social Science, Law and Administration, led the Committee to indicate that Phase one programmes could take off at the beginning of the 2002-2003 academic year.
6. Important to the work of the Committee was the appointment of Coordinators for the programmes for phase one. They were to deal with the development of the academic programmes, resources in relation to staff, infrastructure and equipment needs for Levels 300 and 400.

PROGRAMME & COORDINATOR

Agricultural Engineering
Dr S. Abbeney-Mickson/Dr. R. J. Bani

Computer Engineering
Prof Mumuni Dakubu

Food Process Engineering
Prof. Samuel K. Sefa-Dedeh

Materials Science (Ceramics)
Dr Robert Kwadjo/Dr V.C.K. Kakane

Biomedical Engineering
Dr. Elsie Effah Kaufman

Implementation Committee

Following the approval of the report of the Planning Committee by the Academic Board and the University Council the Vice Chancellor set up an Implementation Committee (IC) made up of Prof. Samuel K. Sefa-Dedeh (Chairman), Dr. Elsie Effah Kaufmann, and Dr. Benjamin A. Ntim. The Implementation Committee among others worked to establish the Dean's office, identified needs of the Faculty, developed guidelines for admission of students into the faculty, initiated the process of hiring staff for the Departments.

A series of actions were initiated to absorb the Department of Agricultural Engineering, located at the Faculty of Agriculture, into the new Faculty of Engineering Sciences. This was triggered by a decision of the Senior Members at a meeting held on June 6, 2003 unanimously agreeing to be part of the new Faculty of Engineering Sciences. This information provided under the signature of the Head of Department Dr. R. J. Bani to the Dean of the Faculty of Agriculture paved the way for the Board of the Faculty of Agriculture to initiate steps for the approval of the transfer. On the recommendation of Academic Board, Council at its meeting of 20th May 2004 approved the transfer of the Department of Agricultural Engineering from the Faculty of Agriculture to the Faculty of Engineering Sciences.

The three member Implementation Committee was later expanded to an eight-member Committee. The Committee worked successfully for the effective start of the new Faculty. Membership of the eight-member Committee for the Implementation of the Establishment of the Faculty of Engineering Sciences was as follows:

Prof. S. Sefa-Dedeh	Chairman
Prof. R.D. Baeta Departmental	Rep., Materials Sc. & Eng. Program.
Prof. W.A Asomaning	Departmental Rep., Materials Sc. & Eng. Program.
Dr. Elsie E. Kaufmann	Departmental Rep., Biomedical Eng. Program.
Prof. E.K. Wiredu	Departmental Rep., Biomedical Eng. Program.
Dr. B. A. Ntim	Departmental Rep., Computer Eng. Program.
Dr. Esther Sakyi-Dawson	Departmental Rep., Food Process Eng. Program
Dr. R. J. Bani Head,	Dept. of Agricultural Engineering.
Mr. B.O. Asare-Bediako	Secretary.

The strategy for implementation was to identify and put in place the resources (human and infrastructure) needed to implement the programmes of the Faculty on a year to year basis. The Dean's office was set up at the Torto's Chemistry building, classroom space was allocated in the new Social Science building Forson's Building) and the first students admitted during the 20042005 academic year.

The First Board of the Faculty of Engineering Sciences

Having successfully seen to the effective take start of the new Faculty of Engineering Sciences, the Implementation Committee was converted into the Board of the Faculty of Engineering Sciences with representatives from other Faculty Boards as required by the University of Ghana Statutes. Prof. Samuel Sefa-Dedeh was appointed as the Acting Dean and additional administrative staff added to the office of the Dean.

The membership of the first Board of Faculty of Engineering Sciences for 2004/2005 academic year were

Prof. S. Sefa-Dedeh	Ag. Dean, Chairman.
Prof. W.A. Asomaning	Departmental Rep., Materials Sc. & Eng. Program.
Prof. R.D. Baeta	Departmental Rep., Materials Sc. & Eng. Program.
Dr. B. A. Ntim	Departmental Rep., Computer Eng. Program.
Dr. Elsie E. Kaufmann	Departmental Rep., Biomedical Eng. Program
Dr. R.J. Bani	Dept. of Agricultural Engineering.
Dr. Emmanuel Sinayobye	Lecturer, Dept. of Food Process Eng.
Dr. John Kutor	Lecturer, Dept. of Biomedical Eng.
Dr. M.N. Josiah	Lecturer, Dept. of Agric. Eng.
Dr. D.K. Banoeng-Yakubo	Representing Faculty of Science
Ms. Eme U. Fiawoyife	Representing UGBS.
Prof. E.K. Wiredu	Representing College of Health Sciences
Dr. E.K. Nartey	Representing College of Agric & Consumer Sc.

Admission of First Students

The Faculty of Engineering Sciences admitted thirty one (31) pioneering students into 5 (five undergraduate degree programmes (Agricultural Engineering, Biomedical Engineering, Computer Engineering, Food Process Engineering and Materials Science and Engineering). One was a foreign

PROGRAMME	2004/2005	
	Male	Female
Agricultural Engineering	1	1
Biomedical Engineering	7	1
Computer Engineering	11	0
Food Process Engineering	5	3
Material Science and Engineering	2	0
Total	**26**	**5**

Staffing Dean's Office

S. Sefa-Dedeh, BSc (Ghana) MSc, PhD (Guelph)	Ag. Dean
B.O. Asare-Bediako BA, MA (Pop,Ghana)	Faculty Officer
R. Hope-Ankrah, BA (Ghana)	Snr. Admn. Assistant
Mary Mavis Osae (Mrs.) BA (Ghana)	Snr. Admn. Assistant
Sarah Aba Essilfie	Snr. Clerk/Secretary
Ahmed Appiah	Headman/Office Assist

Staffing-Pioneering Teachers

For the first two years of the establishment of the Faculty it was agreed to use staff in already existing Departments to teach some of the foundation courses whilst permanent staff were recruited. This strategy worked very well and all the approved courses for the first year were taught effectively by full time and part time lecturers. The Faculty established a strong relationship with the Ghana Institution of Engineers. Some Professional Engineers from the Ghana Institution of Engineers thus supported and participated in teaching some courses.

Agricultural Engineering Department

R. J. Bani, BSc. (K'si) MSc., PhD (Cranfield), MASAE, MGSAE	Senior Lecturer, Head of Department
A.A. Mahama, MSc (Eng) PhD (Tech Sc) Tash-kent , MGHIE	Senior Lecturer.
M.N. Josiah, BSc MSc, MPhil (Newcastle) PhD (Calif), MGHIE, MASAE, MGSAE, MLAE,	Lecturer.
Eric Y. Kra, BSc MSc (Brit Col) PhD (Utah State)	Lecturer.
S. Abenney-Mickson, BSc (Agric) (Ghana) MSc PhD (Okayama)	Lecturer.
E.B. Sabi BSc (Agric Eng) (K'si) MSc, PhD (Gifu), MASAE, MCSAE,	Lecturer.

Computer Engineering Department

B.A. Ntim BSc (Eng) PhD (Lond), MGhIE, MRAeS	Consultant/Senior Lecturer.

Food Process Engineering Department

Dr. E. Sinayobye BSc, MSc (Abidjan), MSc, PhD (Toulouse)	Lecturer.

Biomedical Engineering Department

J. Kutor BSc. (UCC), MSc. (UCC), PhD (Zhejiang, China),	Lecturer

Part-Time Lecturers

Elsie Effah Kaufmann	BSc. MSc PhD (Pennsylvania),	Physics
J.Y. Amoah,	BSc (Eng) (Pakistan) MSc (Wageningen),	Agric. Eng.
A.K. Ussher	BSc MSc (Melbourne), Dip (Agro Meteo, Reading),	Agric. Eng.
E. Kuatsinu	BSc (Eng) (K'si) MSc (Wageningen),	Agric. Eng.
F.A. Hughes	BSc MSc. (Ghana)	Physics
E. B.B. Gyebi	BSc (K'si) MSc MCP (Lond)	Computer Science.
G.S.K. Adika,	BA, MPhil (Cantab), PhD (Ghana)	Language Centre
D. A. Edoh,	BSc, MSc (KNUST), PhD (Basel),	Zoology.
Matilda Wilson	BSc, MPhil	Computer Science
L. Enu-Kwesi,	MSc (Cape Coast), PhD (Waterloo),	Botany
G.K. Ameka,	Mphil (Ghana) PhD (Ghana),	Botany
R. Akuamoah-Boateng,	BA (Ghana) MA (NY) PhD(Cantab),	Psychology.
S.A. Dogbe,	BSc, Mphil (Ghana)	Chemistry.
E. Kwatsinu,	BSc (Eng, Ksi) MSc (Wageningen),	Agric. Engineering.

Part Time/Guest Lecturers from Ghana Institution of Engineers and KNUST

Mrs. Bou-Chedid,	Member, Ghana Institution of Engineers, Accra.
Togbi Kporku III,	Fellow, Ghana Institution of Engineers, Accra.
Dr. J.K.D. Annan,	Fellow, Ghana Institution of Engineers, Tema.
Mr. M. Seidu,	Fellow, Ghana Institution of Engineers, University of Cape Coast.
Prof. R.K. Appiah,	Member, Ghana Institution of Engineers
Prof. E.A. Jackson,	Fellow, Ghana Institution of Engineers, School of Engineering, KNUST.
Prof. S.K. Agodzo,	Fellow, Ghana Institution of Engineers, School of Engineering, KNUST.
Dr. J. Anthonio,	Member, Ghana Institution of Engineers, School of Engineering, KNUST.

Administrative Staff (Department of Agricultural Engineering)

Ms. Stella Kwami	Prin. Administrative Assistant
Mr. Emmanuel Obeng	Senior Departmental Assistant
Ms. Faustina Maud Agordah	Clerk Grade I
Mr. Dzifa Quarshie	Messenger/Cleaner

After the 2004/2005 academic year activities in the faculty picked up. The major milestones were:

1. Finalization of the academic programmes for levels 300 and 400
2. Hiring of additional Teaching Staff and other staff for all Departments.
3. Acquisition of Laboratory Equipment.
4. Establishment of a program dubbed “Institutional-Partner Initiative”
5. Seeking funds and the construction of the permanent buildings of the Faculty
6. Design of academic gowns for Engineering graduates
7. Establishment of special prizes
8. Graduation of the first batch of Engineers in 2008
9. The Engineering graduation ball at the Great Hall of the University.

Many people have contributed to the success of the Faculty of Engineering Sciences, especially in the establishment of Departments. The first appointed Head of Department and Coordinators in 2006 were:

Dr. Elsie Effah Kaufman	Head Biomedical Engineering
Dr. Nii Darko Asante	Coordinator, Food Process Engineering
Dr. Godfrey Mills	Coordinator, Computer Engineering
Dr. R. J. Bani	Head, Agricultural Engineering
Prof. W. A. Asomaning	Coordinator/Acting Head, Materials Science and Engineering

Profile

SUMMARY PROFILE OF PROFESSOR SAMUEL SEFA-DEDEH

BSC (UG) MSC, PH.D. (GUELPH), FGA, FIAFST, DSC (H.C.), OV

After playing an instrumental role towards the establishment of the School of Engineering Sciences, Professor Samuel Sefa Dedeh, was appointed to serve as the Acting Dean of the School from October 2004 to July 2006. He then became the substantive Dean of the School from August 2006 to July 31, 2011 and reappointed Acting Dean again from August 1, 2015 to July 31, 2016. He has since been contributing to the growth of the School till date.

Prior to that he served as a Lecturer, Senior Lecturer, Head of Department of the Department of Nutrition and Food Science from 1980 to 2000 and the Dean of International Programmes of the University of Ghana in 2000.

He continues to serve as a scientist, technologist, researcher and a food industry consultant and holds several positions including being a fellow and Vice President of the Ghana Academy of Arts and Sciences, fellow of the International Academy of Food Science and Technology and the Kellogg Foundation Leadership Programme positions.

Aside serving on several University of Ghana boards and committees, he also served on boards outside the University including being the Chairman of the Presidential Task Force Committee for the establishment of University of Health and Allied Sciences, University of Energy and Natural Resources, National Screening Committee of DANIDA Fellowship Centre, Chairman of the Board of Directors of the Millennium Development Authority for Ghana's Millennium Challenge Compact 1 and Compact 2, Ghana Food Distribution Corporation, Director of Carnegie Project, Vice Chairperson of FAO/WHO Codex Alimentarius Commission, Rome/Geneva, Country Director of the Hunger Project-Ghana and the team lead of the Development of Ghana's Second Compact for the Millennium Challenge Corporation, Washington, D.C.

Profile

ING. DR. ELSIE EFFAH KAUFMANN

Dr. Elsie Effah Kaufmann began her teaching career with the University of Ghana in 2001. She initially joined the Department of Physics where she taught undergraduate courses and also supported teaching in the Dental School and the then newly formed Department of Physiotherapy. Incidentally she was the first female to be appointed full-time to the Department of Physics. During the period between 2001 and 2006 she was a member of the committees that prepared proposals for the establishment of the Departments of Physiotherapy, Radiography, Audiology and Medical Physics. In 2001 she was nominated to serve on the planning committee set up by the Academic Board of the University to make proposals for establishing the then Faculty of Engineering Sciences, now the School of Engineering Sciences. On this committee her major responsibility was to develop the academic programme and curriculum for Biomedical Engineering and coordinate the development of the Materials Science and Engineering programme and curriculum (in consultation with Dr. Kakane and Prof. Baeta). She was later nominated as a member of the three-person Implementation Committee set up by the Vice Chancellor following the submission and adoption of the Planning Committee's report.

Dr. Elsie Effah Kaufmann was appointed as the first Head of the Department of Biomedical Engineering in 2006 and served as Head for a number of years (2006-2012, 2014-2016). As faculty and Head of Department, she was dedicated to student welfare, high quality academic work as well as the growth and visibility of the Department. Her teaching and research are focused on tissue engineering, biomaterials, design of scaffolds for tissue engineering applications, characterization of natural materials and the application of biomedical engineering concepts to the solution of problems in the Ghanaian context. She has Drugs Authority, Ghana; and the Ghana Standards Authority's Technical Committee on Metrology & Measurement Subcommittee on

Medical Devices). She is currently a member of the University of Ghana Centre for Ageing Studies. She has also been an invited speaker at numerous high profile fora both nationally and internationally.

As a reflection of her hard work and achievement, Dr. Effah Kaufmann has received a number of prestigious local and international awards. She was the recipient of University of Ghana's Best Teacher Award for the Sciences in 2009 and a winner of the prestigious International Women's Forum Leadership Foundation Fellowship in 2011. This Fellowship enabled her to acquire certificates in Leadership Development from the Executive Education Programs of INSEAD, Singapore and Harvard Business School, USA. In 2017, she became the Impact Africa Summit Laureate for Education in Ghana, an award that recognizes her "exceptional and continuous contribution to science education in Ghana and for being a role model and inspiration to many young girls, activities which are vital to achieving Sustainable Development Goals 4 and 5". In 2018 Dr. Effah Kaufmann received the Leading Women Achievers Award from the Global Women Economic & Social Empowerment Summit (GWESES).She is also the recipient of the National Society of Black Engineers' 2018 Golden Torch Award for International Academic Leadership in recognition of her excellence in support of academics on an international level and exhibition of commitment to the Science, Technology, Engineering, and Math (STEM) fields. In March 2019 she received the Ghana Women of Excellence Award for Tertiary Education (Science and Mathematics), conferred under the auspices of the Ministry of Gender, Children and Social Protection in recognition of her contribution to the social and economic development of Ghana. She is also Glitz Africa's Honouree for Excellence in Education, 2019. Dr. Effah Kaufmann has been featured in Who's Who in Ghana Publication, 2019 and as an Inspirational Person in the Those Who Inspire Ghana Book, 2020.

Dr. Effah Kaufmann has contributed immensely towards the development of Science education at all levels in Ghana and beyond and has been the Host and Quiz Mistress of the Ghana National Science & Mathematics Quiz TV Programme since 2006. She is a member of the Scientific Programmes Committee of the Next Einstein Forum and a member of the Ghana National Committee of the United World Colleges. She sits on the Boards/ Advisory Councils of the West Africa STEM hub, African Gifted Foundation Ghana (African Science Academy), the British International School-Ghana and Chairs the Board of the Practical Education Network. She is also a Member of the Ghana Institution of Engineering, a Fellow of Biomaterials Science and Engineering (an accolade awarded by the International Union of Societies for Biomaterials Science and Engineering) and is the current President of the Ghana Society of Biomedical Engineers.

On her educational front, Dr. Elsie Effah Kaufmann began her education at ATTC Demonstration School, Winneba and Nana Kwaku Boateng Experimental School, Koforidua. She then proceeded to Aburi Girls' Secondary School. Having passed with distinction she proceeded on scholarship to the United World College of the Atlantic in Wales in 1988 where she obtained an International Baccalaureate Diploma. By dint of hard work she obtained her Bachelor of Science in Engineering (BSE, Cum Laude), Master of Science in Engineering (MSE) and PhD in Bioengineering from the University of Pennsylvania. After her graduate studies she received her postdoctoral training at Rutgers University, serving also as founding director of the Cell Biology Laboratory at the New Jersey Center for Biomaterials, and thereafter joined the University of Ghana in 2001.

Research Activities

Fighting Against **COVID 19**

Vibrant research activities have been on the ascendency within the College of Basic and Applied Sciences. In response to the threat of the novel coronavirus, scientists at the College of Basic and Applied Sciences (West African Centre for Cell Biology of Infectious Pathogens - WACCBIP) and College of Health Sciences (Noguchi Memorial Institute for Medical Research- NMIMR) of the University of Ghana have successfully sequenced genomes of SARS-CoV-2, the virus responsible for the global COVID-19 pandemic, obtaining important information about the genetic composition of viral strains in 15 of the confirmed cases in Ghana.

The scientists analyzed samples from selected cases to gain a comprehensive understanding of the variations of the virus that are present in the country. Samples analyzed were taken from two travelers who arrived in Ghana from the UK, one from Norway, one from Hungary, one from India, and one traveler who arrived from the United States through the United Arab Emirates. Nine samples were taken from individuals who had no travel history, who are believed to have acquired the infection locally.

According to Prof. Abraham Anang, Director of NMIMR, the successful establishment of this sequencing capability at University of Ghana is a significant milestone in Ghana's response to the pandemic, as it will strengthen surveillance for tracking mutations of the virus and aid in the tracing of the sources of community infections in people with no known contact with confirmed cases.

Prof. Gordon Awandare, Director of WACCBIP also confirmed that the data generated gives information indicating that, while there were some differences between the strains from the various countries, all the 15 genomes generally resembled (with >92% similarity) the reference strain that was isolated in the Wuhan Province of China, where the outbreak began. It also confirms that we are dealing with the same pathogen, and that it has not yet changed its genetic make-up significantly.

The team is monitoring the spread of the virus to keep track with these changes and determine how they impact on the efficacy of potential drugs or vaccines that are being developed.

Scientist analyzing samples for covid 19 test

Shaping the Regulatory Framework for Frequency Spectrum Deployment in Ghana

DR. GODFREY MILLS

With sponsorship from the Engineering and Physical Sciences Research Council (EPSRC), the department of Computer Engineering with Dr. Godfrey Mills as the lead Principal Investigator, is currently collaborating with the University of Strathclyde, Glasgow and three other partner institutions in Africa working on a Television White Space (TVWS) project that seeks to provide affordable internet access with dynamic spectrum management and software defined radio in Ghana.

This project follows a successful pilot TVWS project that was carried out in 2015 by the Department in collaboration with the University of Ghana Computing System (UGCS) with equipment support (one base station and 6 customer equipment) from the NRCS and free spectrum allocation from the National Communication Authority (NCA) of Ghana. The focus of the UG TVWS project on campus successfully explored the possibility of using the technology to extend data services to constrained service areas in the university for students and the staff residential areas.

Building upon the pilot project, the current TVWS project investigates how the use of dynamic spectrum access (DSA) management and geo-location database technology, combined with the software defined radio (SDR) implementations could be used to enable effective and efficient wireless networks to be built in Ghana to support affordable Internet access using the shared spectrum resource of the TV broadcasting spectrum. The project makes use of the availability of the TV broadcasts in the UHF frequency band of 470 MHz to 790 MHz and the free unused frequency spectrum within the analogue TV broadcasting spectrum (referred to as the Television white space) expected to come from the TV broadcasting shifts from the analogue to digital broadcasting.

The successful completion of the project will help meet the continuous demand in the growth for

wireless data and transmission. Ultimately, it will provide useful technical information to the National Communication Authority (NCA) in shaping their regulatory framework for TVWS deployment in Ghana. Currently, licenses in Ghana are statically applied for and released by the NCA but as more networks come online, there will be the need for methods that will enable sharing of spectrum resources, including RF sensing and software-defined radios and accessible cloud services to manage the data. It will also provide the NCA benefits that can be derived from dynamic spectrum access and dynamic spectrum management using the geo-location spectrum database method. Further, it will facilitate the extension of data services to Ghanaians in service constrained areas of the country with difficult terrain using the TV broadcasting spectrum. Through the project, a geo-location spectrum database for the country will be developed in collaboration with the NCA to enhance and regulate TVWS operations.

Hardware Module Design and Software Implementation of Multi-Sensor Fire Detection and Notification System using Fuzzy Logic and Convolutional Neural Networks (CNN)

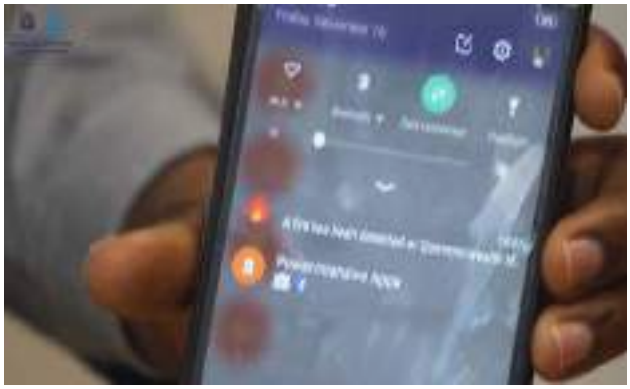
Dr. Robert Sowah

This research project proposed the design and development of a fuzzy logic-based multi-sensor fire detection and a web-based notification system with trained Convolutional Neural Networks for both proximity and wide-area fire detection. Until recently, most consumer-grade fire detection systems relied solely on smoke detectors. These offer limited protection due to the type of fire present and the detection technology at use. To solve this problem, we present a multi-sensor data fusion with Convolutional Neural Networks (CNN) fire detection and notification technology. Convolutional Neural Networks are mainstream methods of deep learning due to their ability to perform feature extraction and classification in the same architecture. The system is designed to enable early detection of fire in residential, commercial, and industrial environments by using multiple fire signatures such as flames, smoke, and heat.

The incorporation of the Convolutional Neural Networks enables broader coverage of the area of interest, using visuals from surveillance cameras. With access granted to the web-based system, the Fire and Rescue Crew get notified in real-time with location information.

The efficiency of the fire detection and notification system employed by standard fire detectors and the multi-sensor remote-based notification approach showed significant improvements with timely fire detection, alerting, and response time for firefighting. The final experimental and performance evaluation results showed that the accuracy rate of CNN was 94%, and that of the fuzzy logic unit is 90%.

A student demonstrating how the system works



Sample notification of fire on the mobile phone

Decision Support System

(DSS) for Fraud Detection in Health Insurance Claims Using Genetic Support Vector Machines (GSVMs)

Dr. Robert Sowah explaining how the system works

Fraud in health insurance claims has become a significant problem whose rampant growth has deeply affected the global delivery of health services. In addition to financial losses incurred, patients who genuinely need medical care suffer because service providers are not paid on time as a result of delays in the manual vetting of their claims and are therefore unwilling to continue offering their services. Health insurance claims fraud is committed through service providers, insurance subscribers, and insurance companies. The need for the development of a decision support system (DSS) for accurate, automated claim processing to offset the attendant challenges faced by the National Health Insurance Scheme cannot be overstated. This paper utilized the National Health Insurance Scheme claims dataset obtained from hospitals in Ghana for detecting health insurance fraud and other anomalies. Genetic support vector machines (GSVMs), a novel hybridized data mining and statistical machine learning tool, which provides a set of sophisticated algorithms for the automatic detection of fraudulent claims in these health insurance databases, are used.

The experimental results have proven that the GSVM possessed better detection and classification performance when applied using SVM kernel classifiers. Three GSVM classifiers were evaluated, and their results compared. Experimental results show a significant reduction in computational time on claims processing while increasing classification accuracy via the various SVM classifiers (linear (80.67%), polynomial (81.22%), and radial basis function (RBF) kernel (87.91%).

A Computational Approach to Stacking Interactions in Carbon Nanosystems

The above study jointly conducted by Professor. Abu Yaya and Professor Onwona-Agyeman looked at mimicking what happens in the body system when one takes in drugs, for instance, how drugs and DNA of the body system binds together?

This was carried out by looking at π-π and π -H bonding interactions. These interactions play a major role in all branches of organic chemistry, biochemistry and materials science, from the stabilization of host-guess complexes and the interactions of certain drugs to DNA to the recognition of molecular species (self-assembly). In particular, they are a driving force in determining crystal stacking, from solids of small organic molecules such as benzene, through polymers containing aromatic rings, to large conjugated systems such as graphene stacking in graphite. Such systems often exhibit a subtle competition between π - π and π -H bonding.

In hybrid composite systems, conjugated polymer composites with graphene and single-walled carbon nanotubes (SWCNTs) are believed to exhibit strong binding through non-covalent π-stacking and are promising for mechanical and optoelectronic applications. Several theoretical and experimental polymer-SWCNTs studies have demonstrated polymer wrapping of SWCNT. Even though these studies do not always represent bulk nanocomposite properties, they give useful information on the nature of the polymer-nanotube interface. The enormous structural variety of monomeric and polymeric aromatic compounds coupled with the lack of a thorough understanding of π-π and π-H bonding, makes it difficult to investigate their interactions. These difficulties come from the treatment of the electron correlation, dispersion, polarization and solvation, in a manner that is appropriate to the context of the applications and within the confines of available computer resource. Experimental methods such as NMR have been used to study the nature of π-π interactions, giving partial information about their

Professor. Abu Yaya

energetic and substituent effects. However, the interpretation of these experimental results is complex as solvation effects and secondary interactions complicate the situation.

In the light of this, quantum mechanical studies have become key in the study of interactions involving π-π bonding. Higher order wave function methods such a couple-cluster theory through the use of perturbative triples, CCSD(T), with large basis sets can reach a good level of accuracy, but the computational cost is too demanding for all except small systems: computational time scales as ~O(N 7), where N is the number of atoms in the system. Less expensive methods such as Møller-Plesset perturbation (MP2) can also become prohibitive when a large basis set is taken into consideration. Also, they lead to overestimation of the electron correlation effects that are inherent in pure π-π interactions. These then also leave problems for the theoretical understanding of larger systems containing π-π stacking interactions. Other high levels

of electronic structure theory have been applied by Sinnokrot et al and Tsuzuki et al to give an accurate model of π-stacking interaction. However the computational cost means none of these methods can be applied to the large systems we are considering here, such as PPV-nanotube interactions. Therefore a simpler and computationally less demanding approach is needed.

To address these large π-π systems we apply here density functional techniques (DFT) using the local density approximation (LDA), which scale much less critically with basis set size than the advanced wave functional methods discussed above. We initially benchmark this approach against these more complex techniques using smaller molecules. Our approach is pragmatic, more akin to numerical experimentation: The question we are posing is, to what extent can simpler exchange-correlation description such as LDA successfully reproduce π-π interaction for extremely large systems? Having benchmarked the approach we then explore the energy surface as PPV moves over the surface of PPV, graphene and carbon nanotubes. These computationally demanding mappings allow us to develop a comprehensive model of π-π stacking interaction in 0, 1 and 2D conjugated carbon materials mimicking what happens in our system when we take in drugs.

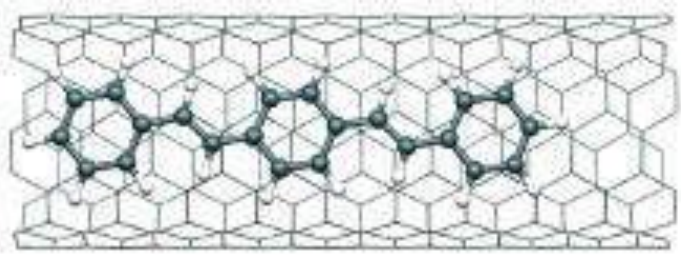


Figure 1. DFT model of PPV interacting with a (6,6) metallic nanotube in the most favorable orientation

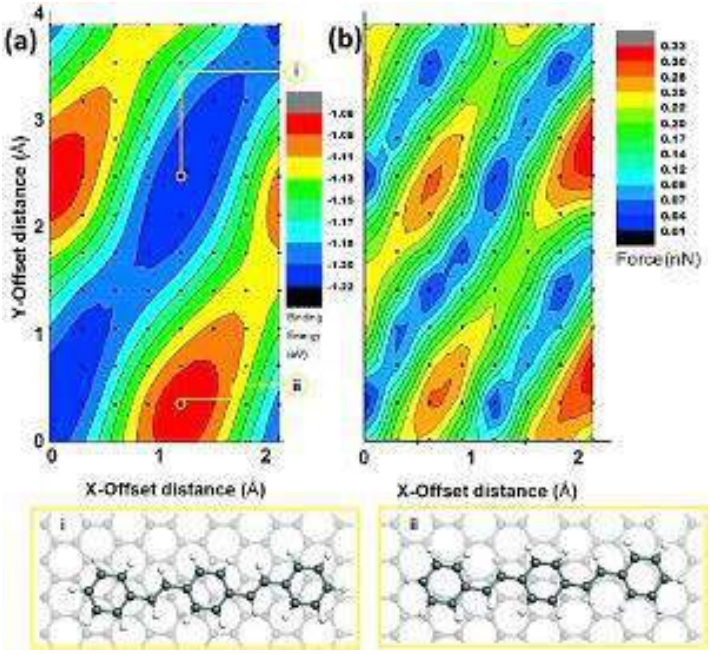


Figure 2. Contour plot showing binding energies (eV) interactions between Graphene-PPV in the parallel-stacked (PS) (a) conformation as a function of their centre-centre offset in a grid of xy plane (Å). The geometries for the highest binding energy state, favourable state (colour blue) and that of the lowest unfavourable (colour red) are also indicated. Black dots indicate structures optimised in order to generate the contour plot. (b) Energy gradient (force) plot of (a).

Garbage-in, Energy-out:
making use of plastic waste for liquid fuel and gas production in Ghana

Prof. David Dodoo-Arhin

Prof. Dodoo-Arhin of the Department of Materials Science and Engineering and his colleagues are exploring the conversion of plastic waste into liquid fuel and gas, as well as their potential utilization in light-duty engines. The project which is already yielding very promising results is building on an earlier pilot project which was supported by the University of Ghana BANGA-Africa seed grant fellowship, in collaboration with CNRS Centré RAPSODEE of Ecole de Mines d'Albi-Carmaux, France.

The project, "Garbage-in, Energy-out", seeks to remediate the menace of plastic debris in the country by reprocessing them into high value fuels and chemicals for households or small running engines like mowers and generators and off-grid hybrid solar-thermal plant systems. As indicated in Figure 1, the reprocessing involves the use of circular catalytic pyrolysis leading to the production of liquid and gaseous fuels from waste plastic samples in a semi-laboratory batch reactor system. The project is also expected to meet the exponential growth in industrial demand for energy which is mostly petroleum fuel-based and again diversify the energy resource leading to the mitigation of the usual experience of increasing trends in world price of crude oil.

On the minor benefits, the project will help achieve zero leakage of plastic waste into our oceans, waterways and the environment in general as it (the project) also seeks to develop and deploy a semi-commercial scale plastics pyrolysis plant in a coastal community. The project work is also in line with the developmental approaches of the Ghana Government's National Plastic Action Partnership agenda and the Ghana multi-stakeholder "Waste Recovery Platform" involving circularity indicators in line with the UN SDGs.

Figure 1. The batch reactor system

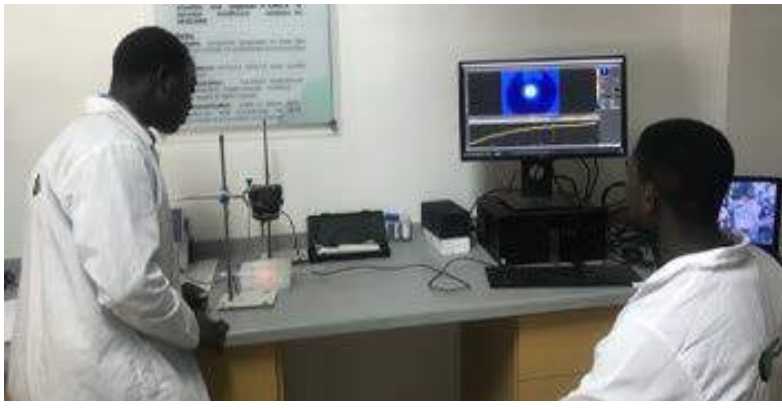
Thermal Self-regulating Nanocomposites Implants for Interstitial Cancer Treatment

Dr. Kwabena Kan-Dapaah

With support from the University of Ghana Research Fund, the departments of Biomedical Engineering (Dr. Kwabena Kan-Dapaah) and Materials Science and Engineering (Prof. Abu Yaya and Dr. Benjamin Agyei-Tuffour) at the University of Ghana as well as the Biomedical Engineering Department (Prof. Winston Soboyejo) at Worcester Polytechnic Institute in Worcester MA, USA are currently exploiting current advances in nanotechnology and multifunctional material science to develop an implantable polymer-nanoparticle composite implant that can potentially overcome issues related to conventional metallic alloy implants and enhance the efficacy during the thermotherapy of deep-seated tumours. This will be achieved through synthesizing and characterizing of self-regulating nanoparticles, preparation and characterization of polymer-based nanocomposite material and the fabrication and evaluation of the implants.

It is expected to produce an optimized strategy for thermotherapy that possesses an efficacy equal to or greater than metallic alloy implants. It is also expected to end up in a design specification for a nanocomposite thermoseed that self-regulates heat generation to achieve precisely hyperthermic or ablative temperature levels in biological media. Also, a finite element model that can be used to predict the temperature distribution in a tissue subjected to hyperthermia or ablative temperature levels by our thermoseed.

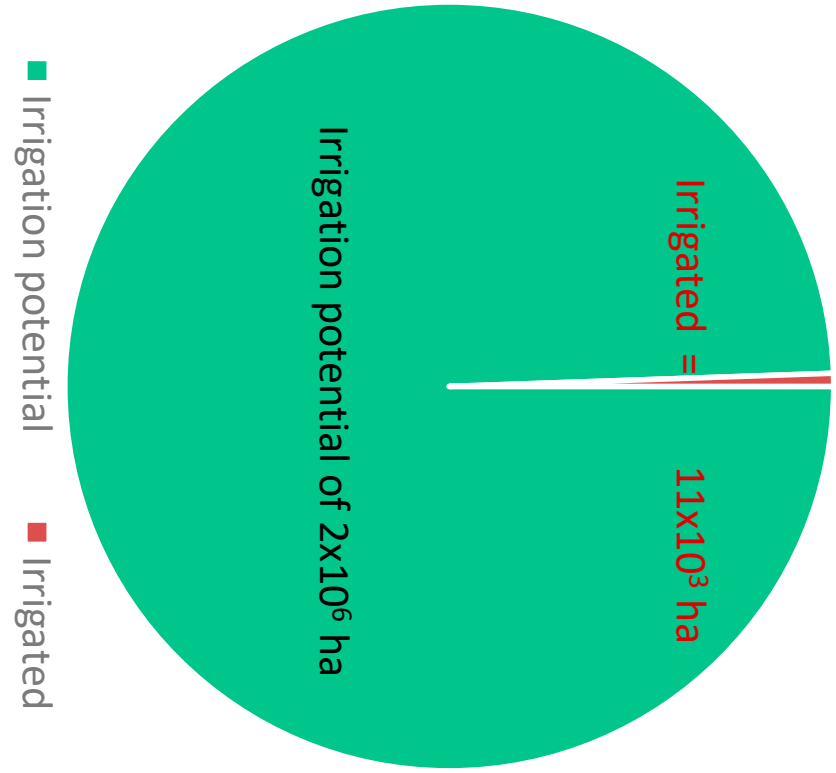
This research work fulfills the UN SDG 3 includes target 3.4, which seeks to reduce premature mortality from non-communicable diseases such as cancer by one third by 2030 through prevention and treatment. Although incidence rates of some cancers is reducing in some developed countries (e.g. North America) due to effective preventive methods, most countries in the global south are still faced with increasing numbers of new cases due to issues related to late diagnosis and inadequate treatment options. Therefore, this work, which will seek to extend the preliminary findings from previous published work and provide sufficient proof-of-concept and fundamental new knowledge to support the development of a cancer treatment strategy based on polymer-based nanocomposites thermoseed, is a contribution toward the realization of the UN SDG, target 3.4.



Student researcher conducting Photothermal Heating Experiments at the Nanotheranostix Lab at the School of Engineering Sciences.

A NEW SIMPLE TECHNIQUE OF WATERING CROPS FOR SMALLHOLDER FARMERS – THE SOLAR POWERED DRIP IRRIGATION SYSTEM.

By The Department of Agriculture Engineering



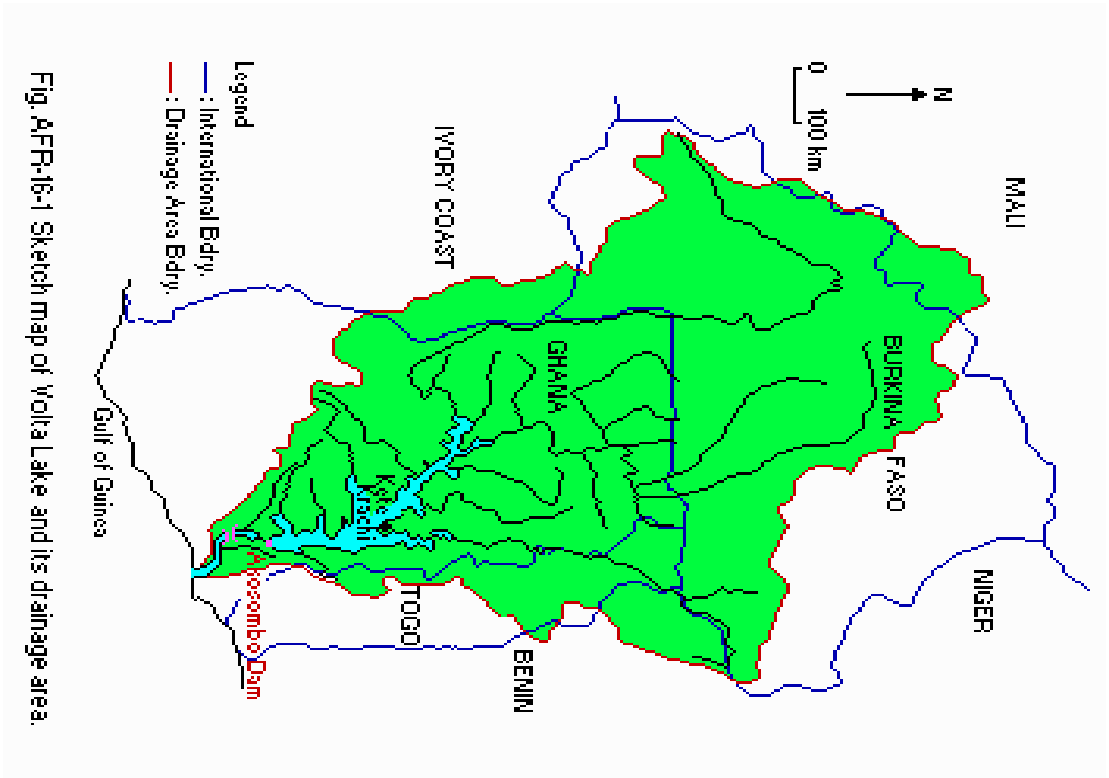


Fig. AFR-16-1 Sketch map of Volta Lake and its drainage area.

Thus farmers in Ghana rely on rain for their farming

CLIMATE CHANGE - A THREAT TO FOOD SECURITY

Most of the farmers are losing their crops because climate change has made rainfall patterns unreliable

Poor farmers are adapting by manually fetching water to irrigate their farms

Labour intensive, requires 5 hours of hard work a day to irrigate 500 m2 area.

- Still laborious and time consuming
- Fuel is major cost component

Resourceful farmers use petrol/diesel pumps to irrigate their farms

SOLAR POWERED AUTOMATED SYSTEM

Introduction of Efficient Irrigation Method

Drip Irrigation Delivers Water Directly to the Roots Unaffected by lack of Electricity or Fuel

Energy from Sun to Power Pump

We have developed a new solar powered automated technique to help farmers water their crops

The device for the automation was fabricated from locally available PVC pipes and fittings

The device can be fabricated and operated by farmers themselves

This work was completed and tested at the Forest and Horticultural Crop Research Centre at Kade. The test results were very encouraging and farmers have adopted the thechnology.

The team from the department who developed this technology are:

Dr. Stephen Abenney-Mickson

Dr. Eric Oppong Danso

Dr. Edward Benjamin Sabi

Acknowledgement

We are very grateful to DANIDA Fellowship Centre for providing funding for the project.

INTERNATIONAL APPOINTMENTS

In recent times, some faculty of the College of Basic and Applied Sciences have been handed prestigious internal appointments. The College is proud of its faculty and extends a hearty congratulations to the following appointees and encourages all to continue to uphold the good image of the College

Prof. Daniel Bruce Sarpong- nominated to Steering Committee of UN-FAO High Level Panel of Experts on Food Security and Nutrition

Prof. Daniel Bruce Sarpong, Dean of the School of Agriculture, College of Basic and Applied Sciences, has been nominated to the membership of the Steering Committee of the High Level Panel of Experts on Food Security and Nutrition (HLPE) of the UN-FAO for 2019-2021.

The High Level Panel of Experts (HLPE) on food security and nutrition was created as part of the reform of the international governance of food security to advise the Committee on the World Food Security (CFS) which is the foremost intergovernmental and international platform dealing with food security and nutrition. An important part of this reform was the creation of the HLPE to keep CFS updated with worldwide knowledge and abreast of emerging trends in the food security that leads to more informed policy debates and improves the quality, effectiveness and coherence of food security and nutrition policies from local to international levels.

Key functions of the HLPE are to assess and analyze the current state of food security and nutrition and its underlying cause; provide scientific and knowledge-based analysis and advice on specific policy-relevant issues, utilizing existing high quality research, data and technical studies as well as identify emerging issues, and help members prioritize future and attentions on key focal area.

Nomination into the Steering Committee which is composed of 15 international recognized experts in a variety of food security and nutrition related fields is done by governments, institutions or organizations of the nominees. Prof. Sarpong was nominated officially by the Ministry of Food and Agriculture, Ghana. Even though members of the Steering Committee are nominated by governments, institutions or organizations, the members serve in their individual capacities and not as representatives of the nominating institutions.

Source: https://www.ug.edu.gh/news/prof-daniel-bruce-sarpong-nominated-steering-committee-un-fao-high-level-panel-experts-food

PROF. KWASI APPEANING ADDO- APPOINTED AS MEMBER OF THE EXPERT GROUP OF HIGH LEVEL PANEL

Prof. Kwasi Appeaning Addo, Director of the Institute for Environment and Sanitation Studies (IESS) at the University of Ghana has been appointed a member of the Expert Group of the High Level Panel (HLP). The HLP is made up of 14 Heads of Government with support from the UN Secretary General's Special Envoy for the Ocean.

The Heads of Government consist of Australia, Canada, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Namibia, Norway, Mexico, Palau and Portugal.

Prof. Kwasi Appeaning Addo, an Associate Professor in Coastal Processes and Delta Studies, has also been appointed a Co-Lead Author for one of the 15-chapter Blue Papers. The Blue Papers will play a central role in the production of the HLP's Summary of Recommendations on the Blue Economy, which will make the case for change and calls for international action for the short, medium and long term.

Source: https://www.ug.edu.gh/news/prof-kwasi-appeaning-addo-appointed-member-expert-group-high-level-panel

PROF. ERIC DANQUAH- TO SERVE ON SAGNA, IAEA

Prof. Eric Danquah, Director of the West Africa Centre for Crop Improvement (WACCI), University of Ghana has been invited to serve as a member of the International Atomic Energy Agency (IAEA) Standing Advisory Group for Nuclear Applications (SAGNA). This was communicated to Prof. Danquah by the Director General of the IAEA, Yukiya Amano.

The Standing Advisory Group on Nuclear Applications provides advice to the Director General on the Agency's activities in the application of nuclear techniques carried out within the programmes of the Department of Nuclear Science and Applications.

SAGNA is composed of about 25 members, appointed by the Director General and members are senior experts in the area of nuclear sciences and applications, drawn from research and technological centres, academic institutions and nuclear industry.

Source: https://www.ug.edu.gh/news/prof-eric-danquah-serve-sagna-iaea

PROF. GORDON AWANDARE-
NAMED FIRST EBM JOURNAL GLOBAL EDITOR FOR AFRICA

Prof. Awandare pictured with EBM Editor-in-Chief, Prof. Steven Goodman, and Global Editor for Europe, Prof. Farzin Farzaneh, after the announcement at the University of Ghana.

Director of the West African Centre for Cell Biology of Infectious Pathogens (WACCBIP), Professor Gordon Awandare, has been named the first Africa Global Editor of the Experimental Biology and Medicine (EBM) journal. The journal, founded in 1903 as the flagship journal for the Society for Experimental Biology and Medicine (SEBM), publishes both research and review articles, as well as meeting symposia and brief communications. Articles published in the journal represent cutting-edge research at the overlapping junctions of the biological, physical and engineering sciences that impact on the health and welfare of the world's population. The 2019 Thomson Reuters Journal Citation Reports gives EBM an impact factor of 3.005 and the journal is indexed in all the major databases including Scopus and PubMed.

"When I was interviewed to become the Editor-in-Chief of EBM in 2006, I told the SEBM Council of my plans to globalise Experimental Biology and Medicine, and by virtue of doing so, would globalise the Society of Experimental Biology and Medicine," said Prof. Steven Goodman, Editor-in-Chief of the journal. "Thankfully the SEBM Council was supportive of this plan, and we began our expansion beyond the borders of the United States. Thirteen years from accepting the role as Editor-in-Chief of EBM, with the opening of our EBM/SEBM African Office at the University of Ghana, we now are a Journal and Society with EBM/SEBM Offices on five continents."

Membership in SEBM is open to all researchers in the biological sciences, with a free membership offer for students in the biomedical sciences. SEBM members receive free page charges, which allows them to publish in the journal for free.

The Africa Global Office, led by Prof. Awandare, is mandated to expand the SEBM's membership in Africa and to extend EBM's reach to include world-class research conducted on the African continent.

"Once I had the opportunity to speak with Steve about his vision for EBM/SEBM, it became immediately clear that the journal shared our values and I was honoured to represent it on the African continent," Prof. Gordon Awandare said. "WACCBIP represents the future of basic biomedical science in Africa, and I am glad we have a partner in EBM/SEBM, which offers a great opportunity for African scientists to publish their research to a global audience and establish collaborations through these platforms."

University of Ghana researchers are invited to join the society and submit their work for publication in the EBM journal.

Source: https://www.ug.edu.gh/news/waccbip-director-named-first-ebm-journal-global-editor-africa

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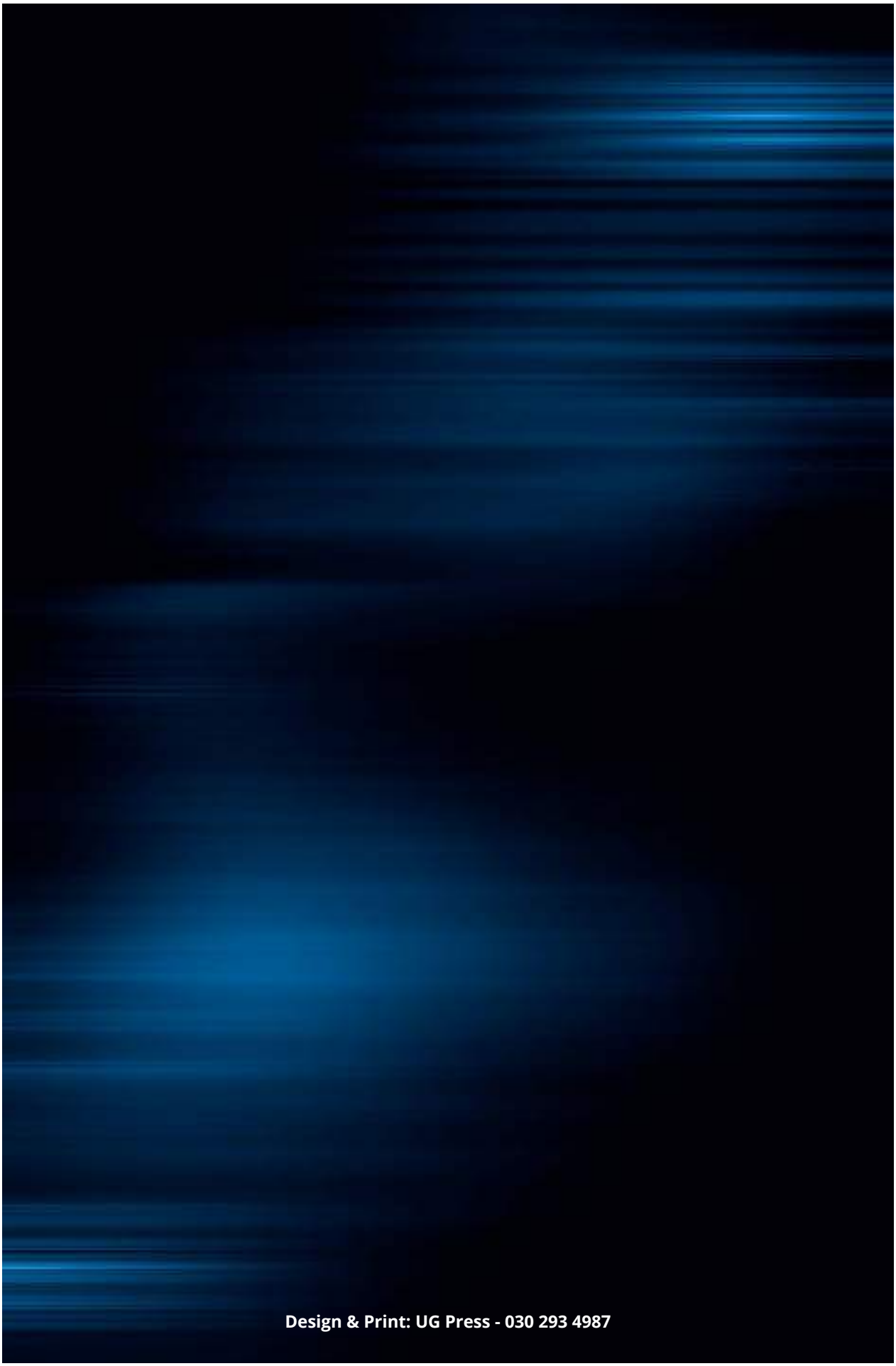
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