

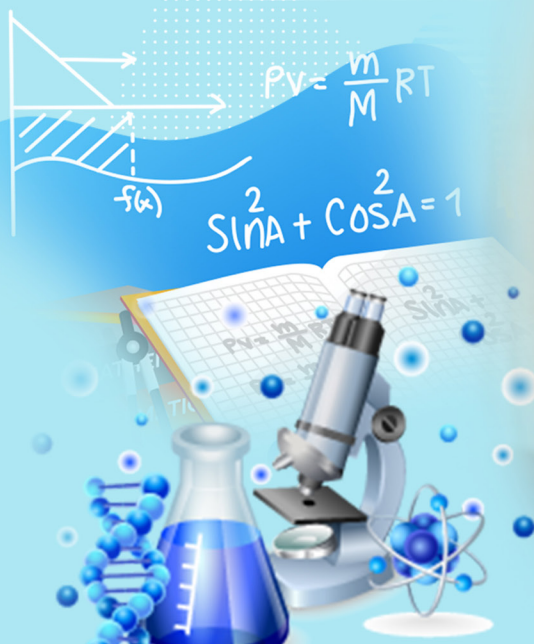


# Everyday SCIENCE For Schools

Volume 9, Number 1, 2021

*"There is a time for everything. Sustainable success does not happen overnight. It takes consistent diligence. Please consider your education as an investment in your future; work hard now and you will reap the benefits. Always think of ways of using your education and knowledge to make life better for yourself, family, community, nation and the world. Your generation must do better than mine!"*

- Prof. Elsie A. B. Effah Kaufmann -



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“There is a time for everything. Sustainable success does not happen overnight. It takes consistent diligence. Please consider your education as an investment in your future; work hard now and you will reap the benefits. Always think of ways of using your education and knowledge to make life better for yourself, family, community, nation and the world. Your generation must do better than mine!”

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# Editorial Board



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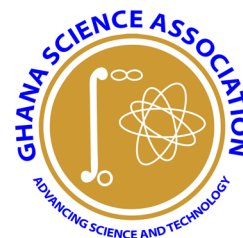
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## **Editorial Disclaimer:**

Articles and imagery in this Magazine apart from those referenced, are the sole responsibility/views of their respective authors.

# Ghana Science Association



## Introduction

The Ghana Science Association (GSA), a voluntary, non-profit making and multidisciplinary organisation of scientists, technologists and mathematicians was formed in 1959. The Association traces its origin to the West African Science Association (WASA) which was formed in 1953 at the University College of the Gold Coast. WASA was formed to provide West African scientists the forum to advocate the importance of Science and Technology as a necessity and bedrock for national development. The formation of GSA broadened the scope of activities from reading of scientific papers to involvement in national and international affairs. The Association was placed on government subvention under the Ministry of Education as far back as 1961 by a Presidential Fiat. Hence the Association is supported through a budgetary allocation from the Ghana Government. Other sources of income include membership dues and proceeds from workshops and conferences. The GSA was mandated to promote, popularize and demystify science and create a scientific culture in the country. The Association has made tremendous contributions to National Development, Health and Economic Growth through scientific interventions. The Secretariat is a point where scientific and technological information and research findings are

obtained by individuals and corporate bodies.

Membership of the Association is drawn from the Universities, Research Institutes, Industry, Government and Persons interested in the promotion of Science and Technology.

## Vision and Mission

### Vision

To become a dominant voice in Science and Technology advocacy by promoting and popularizing Science and Technology to meet national developmental needs.

### Mission

Advancing Science, Technology, Engineering and Mathematics (STEM) through interaction and cross-fertilization of ideas of all interested people to:-

1. Popularize, promote and disseminate scientific information and technology transfer for national development.
2. Contribute to the development of National Science and Technology policy.
3. Collaborate with industry to set national research agenda.
4. Establish linkages with industry to promote the transfer and application of Science.
5. Seek affiliation and foster

cooperative links with other national and international organizations.

## Activities

1. Organization and participation in scientific conferences, workshops, seminars, symposia, public lectures, quizzes and science fairs.
2. Promotion of career development of scientists in Universities and Research Institutes in Ghana and elsewhere.
3. Publication of the scientific journal, magazines and books (e.g. Journal of the Ghana Science Association and Everyday Science for Schools magazine).
4. Training programmes for mathematics and science teachers to improve the teaching and learning of these subjects in schools and colleges of Education

## Contribution to National Development

Issues of national importance have been regularly and consistently highlighted at biennial workshops, conferences etc. Communiqués had been submitted to Government and other stakeholders on very topical themes to help shape national policies.



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# ESS Articles

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# Become A Geoscience Professional!

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**Fig. 1:** A) UG Earth Science students on a field trip, seen taking descriptions and measurements of rocks. B) A geoscientist in the laboratory studying rock samples using an electron microscope. C) Geologists studying rock drill core samples at a mineral exploration company.

## What is Geoscience?

We live on the planet Earth that resides in a Solar System made up of other planets and stars. The Earth provides for all our needs and sustains life. As we live our daily lives, develop, evolve, innovate, manufacture and construct, our activities impact the Earth. Humans and other living organisms depend on Earth's natural environment and resources to thrive. This makes our knowledge and understanding of the Earth and how it works extremely important for us to be able to sustain it well for our survival and the survival of generations after us. This calls for the need for people to study the Earth and develop ways by which it can be managed, protected and sustained. A discipline of science

that deals with the study of the Earth is known as Geoscience and the professionals who study Geoscience are called Geoscientists.

The word Geo is from the Greek word *gē* meaning Earth. So, simply, Geoscience is the science of the Earth. The word Geoscience is used interchangeably with the word Earth science. It involves the study of the materials of which the Earth is made up (i.e., minerals, rocks, soil, and water), the structure of these materials, the processes that form and shape them, and the organisms that have inhabited the Earth and how these organisms have changed over time. The field of Geoscience incorporates several scientific disciplines related by their applications to the study of

the Earth. In this regard, Geology, which is the study of the solid Earth, is the leading discipline. Other sub-disciplines include but not limited to Geophysics, Geochemistry, Hydrology, Atmospheric Science, Environmental Science, and Planetary Science.

## What Do Geoscientists Do?

Geoscientists can apply their knowledge and skill in most careers that involve the study and understanding of the Earth. Geoscientist work in universities and research institutes where they study the Earth to understand how Earth's natural systems work today, how they operated in the recent and ancient past and how we expect they may behave in the future. Geoscientists

work in the extractive industry where they conduct studies that locate rocks that contain natural resources (minerals, water, oil and gas), plan the mines that produce them and the methods used to extract them from the rocks. Geoscientists work in the building and construction industry to understand Earth processes well enough to avoid building important structures such as bridges, dams and high-rise buildings, where they might be damaged or become a hazard. Geoscientists also carry out studies that contribute directly to public health issues. Some natural substances such as fluorite, asbestos and radon gas occurring in rocks can be hazardous and a threat to public health. Geoscientists prepare geochemical maps that can be used to understand and mitigate public health risks.

Geoscientists also play an important role in interdisciplinary studies that seek to understand the interactions between the solid Earth, oceans, the atmosphere and the biosphere. These interdisciplinary studies address contemporary problems such as long and short-term climatic change, pollution monitoring, resource evaluation, ecological issues and land use.

## How Do I Become a Geoscience Professional?

Geoscience is the science that pursues an understanding of planet Earth—how it was born, how it has evolved, how it works, and how we can help preserve its habitats. And to explain an entity like Earth, Geoscientists combine an array of other domains of science such as physics, chemistry, mathematics, biology, computation and even subjects like geography and cartography. So, Geoscience is the combination of different fields aimed at explaining the Earth and its related processes. Geoscientists, therefore, apply principles of the physical sciences, mathematics and computing not only to solve natural problems

but also to explore oil, natural gas, groundwater and mineral deposits. Therefore, to become a Geoscientist you need to study General Science at the Senior High School and take science subjects: Physics, Chemistry, Biology and Elective Mathematics. You may replace Biology with Geography if you so wish.

Several Universities in Ghana run Geoscience or Geoscience related programmes at the undergraduate level. The University of Ghana runs Earth Science and Geophysics programmes; Kwame Nkrumah University of Science and Technology (KNUST) run Geological Engineering and Geophysics programmes; University of Mines and Technology (UMaT) runs a Geological Engineering degree programme; University for Development Studies (Navrongo Campus) runs an Earth and Environmental Science degree programme; Radford University College, a private university in Accra, runs a Geoscience degree programme. Other Universities, such as the University of Energy Natural Resources, intend to run a Geoscience degree programme soon. A typical undergraduate Geoscience programme includes core geology courses (mineralogy, petrology, sedimentology, and structural geology), which are important for all Geoscientists. In addition to courses in core geology, most programmes require students to take courses in applied geology (Geochemistry, Geophysics, hydrogeology, engineering geology etc.) and other courses in physics, chemistry, mathematics, engineering, and computer science. Some programmes include training on specific software packages and other specialized courses that will be useful to those seeking a career as a Geoscientist.

Students are required to participate in faculty-student research projects or conduct independent research of their

own. Field exercises and excursions form an important component of an undergraduate Geoscience programme (Fig. 1A). The excursions together with laboratory exercises and periods of industrial training enhance student's knowledge and practical understanding of Geoscience. Through the combination of classroom, laboratory, fieldwork and project modules, a typical Geoscience programme facilitates the transfer of skills such as communication skills, critical-thinking skills, outdoor skills, physical stamina, problem-solving skills, teamwork abilities and personal organisation and development. After obtaining a bachelors' degree, one can specialize in a specific geoscience field through higher education degrees such as a Master of Science degree or a PhD.

## What are the Career Opportunities in Geoscience?

The field of Geoscience has opportunities for a variety of careers. Geoscientists with different specialties study different aspects of the Earth. Here are just a few of the many types of Geoscientists, with a brief description of what they study:

- Hydrogeologists study the distribution, circulation, and physical properties of subsurface water.
- Mine geologists study the relationship between geology and ore formation and locate mineral resources such as gold, diamond, uranium, and iron ore.
- Geophysicists study the earth using gravity, magnetic, electrical, and seismic methods.
- Petroleum geoscientists are involved in the exploration and production of oil and natural gas.
- Engineering geoscientists use their knowledge of geology and geophysics in the construction of roads, dams, and buildings.

Geoscientists typically need at least a bachelors' degree in any of the Geoscience fields for most entry-level positions. However, some Geoscientists begin their careers with degrees in environmental science or geological engineering. Nowadays, some geoscience jobs, such as in the minerals and oil/gas industry, require a masters' degree.

The career opportunities are very diverse. Some Geoscientists spend most of their time outdoors, others spend their entire time in the laboratory, and many spend a mixture of time outside, in the laboratory, and at their desk. Most Geoscience jobs require written and/or oral reports on the completed project as well as some computer work. Geoscientists can work in private industry, governmental agencies or educational institutions.

Many Geoscience graduates enter professions directly related to

their degree. In Ghana, the mineral industry hires nearly one-third of all Geoscientists. Water companies and related agencies employ/contract geoscientists for groundwater exploration and development. With the discoveries of oil and gas in commercial quantities since 2008, the oil and gas industry has become a major employer of Geoscientists. Other areas include environmental engineering, civil engineering and construction, geological surveying, environmental planning, geoscience policy, resources regulation, and pollution control. Other potential employers include the geo-tourism industry, local authorities, museums and government organizations. Those interested in working in academia or relevant research institutions require a PhD.

In their roles, Geoscientists typically do the following: plan and carry out field studies, in which they visit

locations to collect samples and conduct surveys to collect data, conduct laboratory tests on samples collected in the field, analyse data (e.g., aerial photographs, well logs, rock samples, seismic data, geochemical data, etc.) (Fig. 1 B, C), make geological maps and charts, prepare written scientific reports and present their findings to clients, colleagues, peers, and other interested parties.

Geoscientists can apply their knowledge and skills to the study of other planets and planetary bodies. There can be no space exploration without Geoscientists. Opportunities are available to Geoscientists in space exploration as Astrogeologists, Geochemists, Engineers, Atmospheric scientists, Astronauts and Researchers. All space missions require the expertise of Geoscientists. In conclusion, a career in Geoscience provides many choices, many challenges and much fulfilling work.

# Food Science And Technology: Future Prospects And Misconceptions

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*Microbiological Analysis*



*Product Development Team*



*Sensory Evaluation*



*Sample Analysis in the Laboratory*

## Background

Food Science and Technology is a multidisciplinary science that prepares one with a comprehensive knowledge of biological, physical and engineering sciences to develop new

food products, design innovative processing technologies, and improve food quality. The basis of the discipline lies in an understanding of the chemistry of food components, such as proteins, carbohydrates, fats and

water and the reactions they undergo during processing and storage. A complete understanding of processing and preservation methods such as drying, freezing, pasteurization,

canning, irradiation, and extrusion, is required. The ability to carry out analysis of food constituents is developed along with statistical quality control methods in the study of Food Science and Technology. Some courses studied include Food Chemistry, Food Microbiology, Food additives, Food Engineering, Product Development, Sensory Evaluation, Nutrition, Postharvest Management/Technology, Food Law and Legislation, and Packaging.

The Food Scientists/Technologist can be considered to be a 'Food Doctor' whose work is in the field of preventive medicine. Preventive medicine aims at ensuring the nonexistence of diseases by either preventing the occurrence or by halting disease and averting its complications. The choice of food for preventive medicine can be best formulated or produced by the Food Scientist/Technologist. Though most farm products are seasonal, we enjoy food products from these seasonal crops all year round because of the Food Scientists/Technologist. Ultimately, the Food Scientist/Technologist ensures nutritious, safe and abundant food supply. Food Scientist/Technologist may not be popular by name but very popular in the numerous brands displayed at supermarkets, from baby products through dairy products like canned, powdered and liquid milk and yoghurt, canned meat,

fish and vegetables like corned beef, sardine, baked beans, confectionaries ranging from sugar-based candies to chocolates, chewing gum and ice creams, dry and convenient products like corn flakes, milo, fufu flour, biscuits and many more shelf-stable food products known.

Since the coming of COVID-19, its management has been more of foods that boost the immune systems than drugs. Can there be a world without Food Scientists/Technologists?

## Prospects Of Food Science and Technology

An undergraduate Food Science Degree prepares students for successful careers with the food industry, research, or manufacturing companies in the public, corporate, or government sector. However, the need for trained Food Scientists has grown steadily at pace with consumer demands for convenient, safe, and nutritious food and beverage products. Also, the food industry was the only industry in the world that continued to experience positive growth during the global financial crisis of 2007/2008 contributing massively to youth employment in most food industries around the globe. Currently, studies have proposed several functional foods as prevention or treatment of COVID-19. The Food Scientist/Technologist is

even more important in this era as available evidence shows a direct link between diet, immunity and disease susceptibility. By considering a career in Food Science and Technology, one has varying opportunities in the areas listed below aside being self employed by starting a food business.

## Job Opportunities

- Cereal Scientist
- Dairy Products Scientist
- Director of Quality Assurance
- Food Biotechnologist
- Food Chemist
- Research and Development Scientist
- Food Ingredient Scientist
- Plant Manager
- Plant Supervisor
- Food Microbiologist
- Food Product Consultant
- Food Product Developer
- Food Safety Inspector
- Food Toxicologist
- Nutritional therapist
- Quality control manager
- Technical brewer
- Scientific Secretary, Research
- Laboratory Director
- Food Sensory Analyst
- Manager, Meat Applications
- Meat Scientist
- Natural Products Researcher
- Packaging Specialist
- Lecturer
- Project/Product Manager
- Public Health Official
- Food policy Analyst



*Plant Supervisor*



*Project Development Manager*



*Food Technologist*



*Food Engineer*



*Food Safety Inspector*



*Technical Brewer*

## Misconceptions about Food Science and Technology

Though the Food Science program is widely known by most people, they do not have in-depth knowledge on what the course is all about and the science behind it. Food Science and

Technology is heckled with lots of misconceptions that keep shrouding the exact scope of the program and its prospects. Such misconceptions include but not limited to:

- Equating Food Science to home economics i.e cooking
- Food Science is regarded as a female program
- Food Science is for academically poor students
- You will gain no respect in society when you study Food Science
- Food Science is the only nutrition

## What Food Science is **NOT**





# Bachelor of Science in Medical Imaging Technology (BSc MIT) Offered By The University For Development Studies

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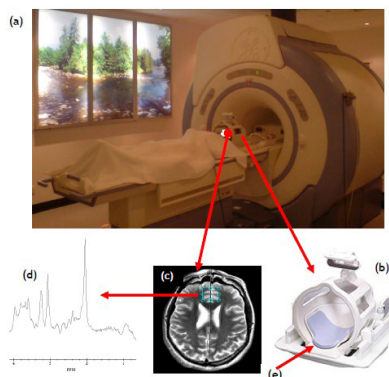
## Introduction

Medical Imaging Technology (MIT) describes a group of techniques and processes of creating visual representations of the interior of the human body for purposes of clinical analysis, diagnosis, medical intervention, and evaluation of organ or tissue structure and function. Compared to Medical Pathology, MIT is mostly non-invasive but requires a basic understanding of the theory, science and technologies involved, as well as anatomy and physiology of the human body. MIT incorporates the following imaging modalities: X-ray radiography, Magnetic Resonance Imaging (MRI), Medical Ultrasonography, Computed Tomography (CT), Fluoroscopy, Positron Emission Tomography (PET), and Single-Photon Emission Computed Tomography (SPECT).

The BSc Medical Imaging Technology programme focuses on providing practical, clinical skill-set to students to be proficient at both the applications of imaging technologies and patient care, in a professional manner. Other names of the programme as used in other institutions include Diagnostic Imaging, Diagnostic Radiography, Radiography, Radiologic Technology and Medical Imaging. The content of the BSc MIT programme at the University for Development Studies (UDS) highlights the training of students in the efficient use of imaging technology for clinical evaluation of patients toward accurate and timely medical diagnosis.

The clinical skill training offered by the programme introduces students

to new and emerging medical imaging techniques; enforces the principles of safety in the application of diagnostic imaging methods; ensures structured clinical internship experience at accredited district and regional health facilities; ensures research capacity building; and provides absolute quality managerial skills to students. These goals are achieved by the Department of Medical Imaging through collaborations with both academic and professional bodies in the training of students.



**Figure 1.1:** A clinical whole-body MRI scanner (a) equipped with a phased-array head coil (b) used to acquire MRI of the brain (c) and to localise spectra to the frontal region of the brain (d). The patient rests their head on the padding in the head coil (e)

The BSc Medical Imaging Technology programme is of 4-year duration and is currently run by the Department of Medical Imaging in the School of Allied Health Sciences on the Dungu-Tamale campus of the University for Development Studies.

## Objectives Of The Programme

The programme is designed to provide diagnostic imaging training over in a 4-year period, so that graduates will:

- be equipped with the *professional skills* to independently undertake radiological procedures, effectively communicate with patients, and effectively manage resources in diverse healthcare settings under minimum supervision
- be *knowledgeable* about technical issues regarding imaging systems and technologies, to evaluate imaging data collected from them with a high level of consistent reliability
- have the *technical competence* to supervise and adhere to quality control systems for patients' benefit
- gain *research skills* adequate for a successful pursuit of scholarly activities such as contributions to advances in the profession and postgraduate level research to improve healthcare systems

## Intended Outcomes Of The Programme

In the order of the above objectives, the following are the respective outcomes envisaged in graduates of the programme. It is expected that at the end of the training, graduates would:

- demonstrate professionalism through consistent ethical behaviour, managerial skills, and

effective communication skills with patients, the general public, and other healthcare providers.

- be familiar with current advances in the various diagnostic imaging modalities in the specialty of Medical Imaging Technology, and therefore be in a position to coordinate Diagnostic Imaging services in healthcare facilities they may be allocated to.
- demonstrate a level of competence in medical imaging and information technology adequate for the handling of medical imaging data and records in diverse clinical settings.
- have acquired qualifications suitable for entry-level radiography profession and progression to postgraduate studies in related fields, and should be able to independently conduct high quality and innovative MIT research towards optimisation and improvement of current imaging protocols.

## Targets For Admission Into The Programme

Applicants to the 4-year BSc Medical Imaging Technology programme include the following categories:

### *Wassce candidates*

Applicants must have credit passes (A1-C6) in three core subjects: English Language, Mathematics, and Integrated Science plus three elective subjects: Biology, Physics and Chemistry (or Mathematics).

### *Top-up candidates*

Applicants must have a Diploma/HND (GPA not less than 2.5) in Radiography, Radiologic Technology, Diagnostic Imaging, Sonography, or

any related Medical Imaging specialty, with at least 3 years of radiography work experience.

### *Mature candidates*

#### *Allied Health Professionals*

Applicants must have a Diploma or Degree (GPA not less than 2.5; i.e., Second Class Lower or better) in Physician Assistant, Nursing, Nurse Practitioner, Midwifery, Nutrition, or any related Allied Health programme, and must have credit passes in Science-based WASSCE elective subjects.

Allied Health Professionals from a non-science background (at WASSCE level) DO NOT qualify to apply for admission into the programme.

#### *Graduate Entry and Transfers*

Applicants must have BSc (GPA not less than 2.5; i.e., Second Class Lower or better) in the Basic Sciences such as Physics, Biology, Chemistry, Mathematics, Computer Science, etc.

### *Foreign Candidates*

Applicants may hold any of the following qualifications: International Baccalaureate (IB), GCE (Cambridge) – ‘O’ and ‘A’ Levels, IGSC (Cambridge) – ‘O’ and ‘A’ Levels, American High School Grade – Grades 12 and 13 examinations. Evidence of English Language proficiency will be required from non-English speaking applicants.

Applicants whose results are not WASSCE must seek interpretations of the results with the National Accreditation Board before admission would be processed.

Purchase undergraduate e-voucher from GCB, ADB, ECOBANK and ZENITH BANK for GHc180 (currently for the 2020/2021 academic year) and apply at <https://admissions.uds.edu.gh/>

Employment Opportunities For Graduates of The Programme Graduates of BSc Medical Imaging Technology could:

- be self-employed via the establishment of private Diagnostic Imaging centres, and sale of imaging equipment and accessories
- be employed as general and specialist radiographers in government hospitals such as teaching, regional and district hospitals, and non-governmental hospitals
- work in research and development institutions such as universities, colleges, polytechnics / technical universities, and medical imaging equipment vendor companies
- work with the health units of international agencies such as WHO, UN, UNESCO, etc.
- proceed to study for higher degree certificates (at Masters and Ph.D. levels) in other specialized areas of Diagnostic Imaging and Medical Physics

## Conclusion

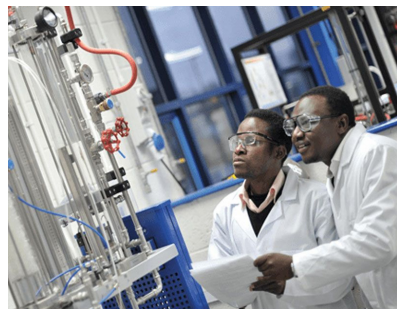
The BSc Medical Imaging Technology programme embodies current knowledge and skill training in all aspects of diagnostic imaging to produce graduates who are capable of offering services and clinical practice that conform to the rapidly changing trends in disease and technology. The long-term goal of the programme is to contribute towards Ghana’s achievement of the set targets outlined in sustainable development goal number 3, which seeks to ensure healthy lives and promote well-being for all at all ages.

# The Role of a Chemical Engineer in Improving Human Life

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## What is Chemical or Process Engineering?

Chemical or Process Engineering is a branch of engineering which applies the knowledge of chemistry, mathematics, physics, biology and other scopes of science to develop economical technologies and industrial process that can transform raw materials into useful products and energy to enhance the quality of human life (CollegeGrad, 2021; Stanford University, 2021). Chemical engineers also referred to as “universal engineers” are well proficient in designing process technologies (developing new production processes or improving existing processes to create useful products) and operation of chemical plants for managing resources. Chemical engineers are the main brains behind the manufacturing of a wide range of products, such as plastics, paper, dyes, medicines, cosmetics, glass, metals, ceramic, polymers, fertilizers, petrochemicals, foods and beverages and many more products we use in our everyday lives (CareerExplorer, 2021; Stanford University, 2021).



**Figure 1:** Chemical engineers in the laboratory.

Source: <https://www.pinterest.com.au/pin/837810336909735892/>

## The Birth of Chemical Engineering

The father of Chemical Engineering is considered to be George Davis (1850 – 1906) who studied at the Slough Mechanics Institute and the Royal School of Mines now Imperial College in London. He worked as a consultant for many chemical industries around Manchester with a job profile of visiting the various chemical plants to inspect their operations.



**Figure 2:** The father of Chemical Engineering, George Davis (1850 – 1906).

Source: <https://www.thechemicalengineer.com/features/cewctw-george-e-davis-meet-the-daddy/>

Whilst undertaking his job duties, he found several similarities in the operation processes in the various units of the different plants and so he conducted a comprehensive study of all the various processes in the plants and highlighted the fundamental principles on which these processes were based on which formed the basis of the Handbook of Chemical Engineering. Davis's contribution is seen in how he organized the basic operations common to the different industries – solid, liquid and gas transportation, distillation, crystallization, evaporation and

other engineering processes and the observation of the fundamental similarities led to the introduction of the concept of unit operations; reactors, separators, etc., which provided the framework for understanding and describing processes operating on similar principles in industries (Pushpavanam, 2012).

## What You Will Study for Chemical Engineering as a Degree

A degree in chemical engineering is directly linked with all of the other engineering disciplines, to various extents and the program usually takes 4 years to complete and includes classroom, laboratory, and field studies. Ultimately, the curriculum of the Chemical Engineering Department, includes the study of applied mathematics, physics, chemistry, material and energy balances, thermodynamics, fluid mechanics, energy and mass transfer, separations technologies, chemical reaction kinetics, reactor design and process design. These are the essential and core elements of chemical or process engineering degrees. Undertaking chemical engineering as a study program, one will learn how to design the reactors for raw material transformation into useful products, fluid transport phenomenon through pipes and pumps that get materials to and from the reactors, the separation and purification of materials based on equilibrium processes or mass transfer and other techniques to ensure safe waste material treatment and disposal. Also, one will get to study heat

transfer equipment and technologies to maintain the desired temperatures for reactors, the application of the knowledge of thermodynamics and reaction engineering to determine if chemical reactions will occur and the design of control systems for the smooth operation of plants (University of Michigan, 2021; Mendeley Careers, 2020; CollegeGrad, 2021; Stanford University, 2021).



**Figure 3:** Students' Practical Sessions

The principles of chemical engineering have a broad application in the biological and medical fields by applying the understanding of how diffusion occurs through a system in tissue engineering, such as determining how far apart blood vessels need to be to make sure that oxygen can diffuse to all parts of a tissue. In the same way the understanding of fluid dynamics and flow through pipes can help a chemical engineer explain how blood moves through a blood vessel. This overlap application of chemical engineering in biology and medicine allows chemical engineers to make unique contributions to these fields (University of Michigan, 2021).

In Ghana, Chemical Engineering as a programme is offered in two tertiary institutions: Kwame Nkrumah University of Science and Technology (KNUST) and Kumasi Technical University (KsTU). In KNUST, the Department of Chemical Engineering runs three Chemical Engineering programmes which are BSc (Bachelor of Science), MPhil (Master of Philosophy) and Ph.D. (Doctor of Philosophy). In KsTU,

the programmes offered are HND (Higher National Diploma), BTech (Bachelor of Technology) and MTech (Master of Technology). To be enrolled in Chemical Engineering in these universities, a student must take General Science at the Senior High School level and must obtain credit (A1 – C6) in Physics, Chemistry and Elective Mathematics as well as in three core subjects: English, Mathematics, and Integrated Science with a total aggregate of 24 or better. Admissions are competitive based on the performance of qualifying applicants and the number of students the universities can accommodate.

## Chemical Engineering in Everyday Life

Chemical Engineers understand techniques to synthesize substances, design devices and manufacture items we use as part of our daily life. When starting your day, the mattress you wake up from made from blends of different latexes, the cement used for the building you slept in, the toothpaste and toothbrush (bristles and the handle) for brushing your teeth, the cosmetic products you use, the fuel (petrol or diesel) in your vehicles, the paper you write on, the ink in your pen, the canned food and beverages you consume, the liquified petroleum gas (LPG) used for domestic cooking in households which is a mixture of propane and butane, the fabrics, glass, plastics and metal materials and other numerous products you use in your home are processed and made by the chemical engineers. Usually, we use these products without thinking about the process by which they are made or how the composition of products is determined. Similarly, different electronic devices and chips used in computers and other electronic gadgets are all manufactured using chemical engineering principles and the chemical engineer is not only concerned about the

manufacture of these products but also improving their quality to ensure they do not have any negative impact on public health and the environment (Pushpavanam, 2012).



**Figure 4:** Some everyday products made by chemical engineers.

Source: <https://www.pinterest.com/pin/852024823223087704/>

## Chemical Engineering Career Opportunities

Chemical engineering career and employment opportunities often overlap with many other engineering fields and chemical engineering graduates work in industries such as pharmaceuticals and cosmetics, energy sector, oil and gas refineries, nuclear, atomic and nanotechnology industries, health and safety sectors, agriculture processing, food and beverages, chemical processing, academia, mining and mineral processing, water treatment, consulting and research, law, medicine, finance, and other fields. They are also employed by environmental engineering firms where they develop processes to prevent pollution, safely dispose of toxic waste, or manage a sewage treatment plant, etc. (Stanford University, 2021; CareerExplorer, 2021).

In Ghana, chemical engineers can be found in industries and companies such as Unilever, Nestle Ghana Ltd, Kasapreko Company Ltd, Fanmilk Ghana Ltd, Coca-Cola Company, Tullow Oil, Schlumberger Ghana, Ghana National Gas Company, Nutrifoods Ghana Ltd, Wilmar Africa Ltd, Volta Aluminum Company

Limited (VALCO), Tema Oil Refinery (TOR), GHACEM Ltd, Newmont Ghana Ltd, Kosmos Energy, Genser Energy, Cargill, Olam Ghana Ltd, Takoradi Thermal Power Station, Ernest Chemist Limited, Accra Compost and Recycling Plant (ACARP), Sewage Systems Ghana Limited, ZOIL, Vester Oil Mill, Ghana Nuts, Ghana Standard Authority (GSA), Ghana National Petroleum Corporation (GNPC) Food and Drugs Authority (FDA), Council for Scientific and Industrial Research (CSIR), Environmental Protection Agency (EPA), National Petroleum Agency (NPA) and many other organizations and economic fields. Ghanaian chemical engineers are significantly impacting the socio-economic lives of people in Ghana and it is always proud to know that the Gas Processing Plant of the Ghana National Gas Company, the producer of purified methane gas and Liquefied Petroleum Gas (LPG), used for cooking in our homes was designed and constructed from scratch by Ghanaian chemical engineers. The plant is also fully operated by Ghanaian chemical engineers with Dr. Ben K. Asante as the

Chief Executive Officer who happens to be a well-celebrated alumnus of the Department of Chemical Engineering, KNUST.



**Figure 5:** Chemical engineers in the industry.

Source: <https://yen.com.gh/106645-top-10-pharmaceutical-companies-ghana/>

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## Interview: Dr. Amma Aboagyewa Larbi

*Department of Biochemistry and Biotechnology, KNUST-Kumasi.*

*Email: ammalarbi@gmail.com*



*1. Please tell us a little about yourself (biodata/background, education and profession)*

I am Amma Aboagyewa Larbi Andam-Akorful (PhD. Mrs), I had my secondary education at St. Roses Secondary school. I hold a PhD, MSc and BSc. I am a Lecturer at the Department of Biochemistry and Biotechnology at KNUST.

*2. What influenced your choice of courses or programmed you studied during your youthful days (secondary school up to university)?*

I am naturally curious and I loved mathematics and general science. This made me select Science during my Secondary school education.

*3. How did that influence your career to date? What/who influenced you most?*

At the secondary school I developed an interest in medical research. This lead me to pursue Biochemistry during my undergraduate studies. I met a professor Prof Ben Gyan during my BSc who encouraged me to pursue biomedical research.

*What motivated you or motivates you?*

In the course of my studies I encountered very seasoned scientists. I noticed one common thing among all of them and that is discipline. I have come to understand that this is Key. But

you cannot let go of Integrity and hard work. As a Christian, I draw my inspiration from Jesus and His word .

*5. You are seen as an outstanding scientist/professor/leader. How did you achieve this? What are your success habits?*

God, Discipline, Integrity and hard work.

*6. How long have you been in the teaching field and how was the experience?*

Four years. It been exciting and a learning platform for me as well.

*7. What is your teaching philosophy?*

Present the idea in a simple manner to impact the student and challenge them to learn more.

*8. How did you manage to supervise your students, motivating them to get the best out of them?*

I relate to them very well and hence they open up about their challenges in the course of their project. This makes it easier to correct mistakes.

*9. What has been the impact of your research works?*

Better Understanding of Cerebral Malaria and thus helping to eliminate malaria as well as Improved maternal health.

*10. Outside your profession, are you involved in any other businesses/activities?*

I am active in Church and Youth ministry. I am also a Patron of a group called Youth Alive focused

on enhancing the youth to make better choices especially sexually.

*11. Do you consider yourself successful? Have you attained fully your desired goals?*

I consider myself on a journey. I have not reached yet but I am definitely on the right path.

*12. When you began your career many years ago, did you ever imagine that you would be a professor or leader?*

Yes. I have always seen myself as a leader

*13. Did you face any challenges in your career/life?*

I am now early career but I have faced some challenges.

*14. How do you compare the past to the present (in terms of opportunities to help develop the country?)*

What do you think about the

youth of the present generation? I see that the youth of the present Generation have a great opportunity to make the best of their lives.

*15. Finally, what advice would you give to the young people, students, researchers/scientists and technologists?*

Be focused and Trust God. Work Hard and know that everything will work out for their good.

## Interview: Dr. Mrs. Marina Harvey-Ewusi

*Department of Biochemistry and Biotechnology, PMB, KNUST, Kumasi, Ghana*

*Email: mtandoh@yahoo.com*

*Tel: +233 248989545*

*1. Please tell us a little about yourself (biodata/background, education and profession)*

My name is Dr. Mrs. Marina Harvey-Ewusi. I hail from Elmina in the Central region of Ghana. I am a Lecturer at the Department of Biochemistry (Human Nutrition and Dietetics Unit) at the Kwame Nkrumah University of Science and Technology (KNUST), Ghana. I had my first degree in Biochemistry at KNUST, a master's degree in Dietetics at the University of Ghana, Legon, and a Ph.D. in Foods and Nutrition at the University of Georgia, U.S.A. My research focuses on improving nutritional status and food security across the life cycle, with a primary focus on children and cognition.

Before being employed at KNUST, I worked at Bronston University College in Accra, Ghana as a Lecturer and Director for academic affairs, and before that, I worked as a Laboratory assistant at the Anitox Company Ltd in Earls Barton, United Kingdom.

*2. What influenced your choice of courses or programmed you studied during your youthful days (secondary school up to university)?*

From my early childhood days, I had a passion for reading and asking questions. Coupled with that, I was a brilliant student in school, and I loved to study Science as a subject because my Science teacher taught the course so well. During my Junior High

School education at Achimota Primary School, my teachers advised me to pursue Science at the secondary school level, since I had a natural passion for it. Hence, I ended up choosing Science as my first choice of course, and had the opportunity to attend Wesley Girls' High School to pursue it.

*3. How did that influence your career to date? What/who influenced you most?*

Choosing Science as a course at the secondary school level greatly influenced my career path, since it provided that needed background to pursue a first degree in Biochemistry (Nutrition option).

Moreover, I was also very passionate about nutrition whilst growing up, so Biochemistry gave me the needed background to do further study in a nutrition-related field.

*4. What motivated you or motivates you?*

My first and foremost motivation is God. I always encourage myself in the Lord in all my endeavors. My second motivation in the past was derived from my mentor at the time, who would always encourage me to pursue a higher degree after my first degree in Biochemistry. Currently, my added motivation is derived from the satisfaction I get from giving





back to my community and my students through mentorship, teaching, community work, and seeing them come to the level of excellence and achieve their full potential in life.

*5. You are seen as an outstanding scientist/professor/leader. How did you achieve this? What are your success habits?*

I have attributed my success over the years to my effective use of time and making it a priority to make each day count no matter what. I ensure this by starting my day early, so I can get a lot done during the day. We were also taught in Wesley Girls' High School to make the most use of our daytime, and that has stuck with me to date. Also, believing in myself, being optimistic, determined and having a sense of never giving up has been some of my greatest attributes. Whenever I face a setback, I learn my lessons and pick myself up quickly. If I set a target for myself, it doesn't matter how many times I fail at it, I will keep going back to it until I achieve my aim. Furthermore, I always believe opportunity must meet preparation. Hence, I aim to always prepare myself academically and socially to take up challenges and opportunities that come my way. Finally, no matter how good or prepared one is, you will always need people to help you achieve your goals or even to offer you the needed direction. Thus, one of the best habits I developed was to invest in mentorship by availing myself and putting in the time and accountability it required.

*6. How long have you been in the teaching field and how was the*

*experience?*

I have been in the teaching field for the past seven (7) years, and it has been fulfilling to see the quality of students we churn out on yearly basis. It has certainly come with its challenges, but it is all been worthwhile.

*7. What is your teaching philosophy?*

As a Nutrition Educator, teaching is one of the best ways that provides me with a platform and the opportunity to communicate or relay information, and to transfer knowledge to a group of people (students/patients/colleagues/clients). Teaching is done in a way that can make a profound impact on my students to facilitate understanding of the subject matter and improve lives by empowering my students to make informed choices.

*8. How did you manage to supervise your students, motivating them to get the best out of them?*

Every student is different, so I work with them based on their individual capabilities, while I set reasonable timelines, which I encourage them to achieve reasonable targets over a period of time. Effective communication of my expectation of the student is always clearly stated, whilst encouraging feedback, so basically, it is teamwork with my students that motivates them.

*9. What has been the impact of your research works?*

My research work over the years has primarily focused on the use of nutrition education among vulnerable groups to inform behavioral change. Hence, it has made a tremendous impact by

using research to modify the negative behavior of target groups such as children. Through the use of nutrition education tools, our target populations have improved their sanitary/hygiene habits, as well as reduced the rate of helminth infections in endemic areas. Furthermore, they have become more knowledgeable in food safety issues and improved their nutritional status and cognitive performance. This has the potential to break the cycle of poverty.

*10. Outside your profession, are you involved in any other businesses/activities?*

Apart from being a Lecturer, I am also a Registered Dietician (RD), so I do give dietary consultations once in a while.

*11. Do you consider yourself successful? Have you attained fully your desired goals?*

Academically, yes, I do consider myself successful to some extent by the grace of God. I have attained a doctorate degree to enhance my teaching experience. In terms of my overall goals, I am yet to fully attain them all, as it is number keeps increasing over time.

*12. When you began your career many years ago, did you ever imagine that you would be a professor or leader?*

Not really. When I started my career, it seemed like a daunting task in the beginning, and somehow overwhelming at times. However, through the right guidance and mentorship from my mentors, I developed a love for my job and found it less stressful,

but rather more fulfilling.

*13. Did you face any challenges in your career/life?*

Yes, I did face some challenges, and major setbacks in life and my career. First, I set out to pursue my master's as a single divorcee mother. By virtue of that, my only daughter and I had to live apart on different occasions for me to attend and complete school. Sometimes it was the most heartbreaking and difficult moments of my life, but I had to focus to make a better life for both of us. Financing my education was one other challenge especially at the master's level, so I had to resort to some form of petty trading whilst I was at the University of Ghana, Legon. I would often go to a friend's sister who usually bought things in bulk from Dubai and China, and I would ask for some things to sell in school, where I could keep the profit and pay her back. I would go from one room to the other on campus, knocking on doors of students after lectures to sell these items to make ends meet so I could send some to my mother who

was taking care of my daughter in my hometown. There were even times that I sold phone cards, flash drives, jewelry, etc just to get by. My second major challenge came during my doctoral program in 2015 when I was diagnosed with asthma, but I had to press on regardless of this major health challenge to complete my Ph.D. within the 4 years stipulated time. It was very challenging, dealing with chronic asthma and allergies, being a graduate student and a research assistant at the University of Georgia, U.S.A. There were many times that the temptation to quit was very strong, but I kept putting one foot in front of the other until I completed.

*14. How do you compare the past to the present (in terms of opportunities to help develop the country?)*

The youth of this present generation are intelligent and have many opportunities before them, however, apart from intellectual intelligence; they have to develop a good attitude in terms of their soft skills. Currently, the world is

a global village, and the youth of today have more opportunities than we did during our time. They only have to develop themselves well holistically, to get the full benefits of the opportunities that present themselves. They also need to humble themselves to be mentored.

*15. Finally, what advice would you give to the young people, students, researchers/scientists and technologists?*

My advice would be that nothing good in life comes easy. To young people out there, please avoid looking for shortcuts and easy ways to achieve your goals. Do not avoid or despise the process that is meant to shape you into your next level of greatness. What doesn't break you will always make you stronger, so remain focused, be determined, humble and honest in all your endeavours, and the sky will only be the limit. Remember, a good name is better than riches, therefore build on your integrity by keeping God at the center of your life.

# Interview: Dr. Winifred Ayinpogbila Atiah

*Department of Physics,  
KNUST-Kumasi*

*1. Please tell us a little about yourself (biodata/background, education and profession)*

Winifred Ayinpogbilla Atiah is my name. I am a young female Ghanaian climate scientist who holds a master's degree in Mathematical Sciences and a doctorate in Meteorology and Climate Science.

My key research interests are, Hydro-meteorology, Weather Systems and Forecasting, Tropical Meteorology and Climate extremes. I am a highly motivated young woman whose career aspiration is to in the next 5-10 years become a well-recognized female climate researcher in Africa and eventually, the world at large. I am currently a postdoc under the SWIFT project researching on "Investigating the Impacts of Mesoscale Convective Systems on Rainfall Cases in Ghana, West Africa".

*2. What influenced your choice of courses or programmed you studied during your youthful days (secondary school up to university)?*

I have always been motivated to study the atmosphere since I was a young girl. I was so fascinated by weather forecasts and many others topics that had to do with the atmosphere. In addition, life has always been to me an opportunity God gives us to learn and make ourselves better. I would say, the challenge and the experience that comes along with studying Physics,



Mathematics has inspired me too.

*3. How did that influence your career to date? What/who influenced you most?*

Getting to where I am today has not been an easy ordeal albeit, God has always been my help and fortress. Nonetheless, my mentors (Prof. Leonard K. Amekudzi and Prof. Mrs. Ibok Oduro) have been my motivation. They never stop encouraging me and this I must say has brought me this far and taking me to greater heights.

*4. What motivated you or motivates you?*

Coming from a poor background, I have always been self-motivated to work hard to make my parents proud of me. I did not want to let them suffer to take care of me and not get rewarded one day. So I made a promise to myself I would have to make it in life. Also, my mentors have motivated me a lot.

*5. You are seen as an outstanding scientist/professor/leader. How did you achieve this? What are your success habits?*

I must acknowledge the almighty God for how far I have gone in life. He has been the master planner of it all. In addition, I have to agree

that the mentors and supervisors I have been fortunate to meet in my career walk have helped a lot through the words of encouragement, motivation, connections, couple with my hard work and dedication to whatever I find myself doing.

*6. How long have you been in the teaching field and how was the experience?*

I have been in the teaching field since the day I was appointed a teaching assistant at the Physics department of the Kwame Nkrumah University of Science and Technology (KNUST) in 2013 so I would say I have roughly 7 years' experience. I have to say the initial stages were not easy but I gained experience with time and currently, I enjoy teaching.

*7. What is your teaching philosophy?*

My philosophy for teaching is that all students are unique and must have an enabling environment where they can grow physically, mentally, emotionally, and socially. It has always been my passion to create this type of atmosphere where students can flourish.

*8. How did you manage to supervise your students, motivating them to get the best out of them?*

I do that by not having too high expectations of my students, not comparing their abilities, giving them encouraging words and finally not spoon-feeding them but challenging them with tasks to bring the best out of them.

*9. What has been the impact of your research works?*

I have been impactful in her area of specialization and this

is underscored by the great researches I have published in peer-review journals. Due to the enthusiasm, I demonstrate towards research, I was contracted as a consultant under Africa RISING West Africa program where I analyzed seasonal wet and dry spells over Northern Ghana to aid advise farmers in the region. I have collaborated with CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) on the topic "Seasonal Climate Predictability in Northern Ghana: Application to spatial crop yield forecasting".

*10. Outside your profession, are you involved in any other businesses/activities?*

A day in my life is full of life. I spend my time doing what I love, singing and worshiping my creator and spending time with the family when I am not researching or teaching.

*11. Do you consider yourself successful? Have you attained fully your desired goals?*

Life has always thought me to be grateful for how far I have gone in life and to work hard for what I would become in the future. I am happy with how far the Lord has brought me and I would say I am successful. However, I am not satisfied with where I am. I am working judiciously hard and with the help of God to get to greater heights.

*12. When you began your career many years ago, did you ever imagine that you would be a professor or leader?*

I have always been optimistic about my future and so I have

always believed I would go far in life though starting from a poor background. However, I frankly did not know I would be a professor one day.

*13. Did you face any challenges in your career/life?*

Like any pursuit, life is full of ups and downs and I had and still have my share of them both. A major barrier in my career has been the issue of being looked down upon because of my age, stature, gender and my origin. I can recall instances where people have called me names just because they didn't believe a woman could be smart or be the best. There have also been times where I had to go the extra mile to prove myself and my research competencies, which in my opinion isn't the case for my male counterparts. Sometimes I find myself been looked down upon because of where I come from (Northern Ghana).

*14. How do you compare the past to the present (in terms of opportunities to help develop the country?)*

I honestly agree that the present is better than the past however, we still have great room for improving the present. My candid opinion about the youth of the present generation is that most of the youth want things done and they want it done immediately with no patience to gradually achieve them. This is what destroying the world today in my opinion.

*15. Finally, what advice would you give to the young people, students, researchers/scientists and technologists?*

My advice to the younger

generation is to be patient with whatever dealings they find themselves doing and if you have a dream, go chase it. There will inevitably be challenges and setbacks, but every step forward brings you closer to achieving your goals.

# Interview: Rose-Mary Owusuaa Mensah

*Department of Computer Science, KNUST*

*Email: rmo.mensah@knust.edu.gh*

*Tel: 050 3332854*



## *1. Please tell us a little about yourself (biography/background, education and profession)*

I am Mrs. Rose-Mary Owusuaa Mensah Gyening, a computer scientist and a mum to three wonderful children. I had my primary and junior high school education at Infant Jesus Lumen Christi School at Ayeduase in Kumasi, after which I proceeded to St. Louis Senior High School to read Science. I hold a BSc in Computer Science from Kwame Nkrumah University of Science and Technology, KNUST, MSc Computer Science from the University of Bonn in Germany

and I have recently completed my Ph.D. Computer Science at KNUST. From 2016 to August 2020, I was a lecturer at the Department of Computer Science at Garden City University College. Currently, I am an assistant lecturer at the Department of Computer Science, KNUST.

## *2. What influenced your choice of courses or programmed you studied during your youthful days (secondary school up to university)?*

I have been fascinated by computers since infancy so as I was growing up, I knew I would like to be a computer scientist.

After BECE, I attended a Computer School to learn about computers and how to use some of the Microsoft Office Suite. So even before I went to SHS, I could use a computer very well and also type and edit documents in Microsoft Word, Powerpoint and Excel. I would say, my passion for computers influenced my decision to pursue science and ultimately undergraduate and post-graduate degrees in computer science.

## *3. What motivated you or motivates you?*

I am motivated by meeting set goals on time and also, working with teams.

## *4. You are seen as an outstanding scientist/professor/leader. How did you achieve this? What are your success habits?*

To be successful, you need to have a plan and work towards it. I always have a plan and I set timelines. I try as much as possible to go by the timelines but sometimes things do not go as planned. In such cases, I pause, reflect and re-strategize. Some of my success habits are positive thinking, reading wide, networking, honesty and exercising to be healthy.

## *5. How long have you been in the teaching field and how was the experience?*

I love to teach so after completion of Senior High School, I took up a job as a teacher at a basic school. I taught for a year and had

to leave for the University. At the tertiary level, I have been teaching for over four years. I love to teach because it enables me to impart knowledge to other people and also, I get to learn new things all the time. So I would say teaching is fun.

#### *6. What is your teaching philosophy?*

My teaching philosophy revolves around the fact that every individual has his or her unique abilities. Therefore, to effectively address the needs of each person, a blended learning approach needs to be adopted. Again, there should be reciprocity in the teaching and learning process. As a teacher, I have to provide a conducive learning environment, knowledge and materials that can enable students to acquire new skills and obtain knowledge. I also have to treat all students equally irrespective of their age, gender, ethnicity, religious or political affiliation and also set a good example for my students. I also have a firm belief that students need to contribute towards the learning process by participating actively in classwork, group discussions and dialog with other students.

#### *7. How did you manage to supervise your students, motivating them to get the best out of them?*

I always make sure there is a cordial and respectful relationship among us. I help the students to set targets and their timelines and organize frequent meetings where students make presentations on the work done, outline any challenges and peer critique their fellow students' work. By so doing, the students become engaged and motivated to give off their best.

#### *8. What has been the impact of your research works?*

My research focuses on using artificial intelligence to address challenges facing our society. So I have undertaken projects focusing on smart farming technologies, smart homes and assistive technologies. I would say the most outstanding of all the research I have conducted is "using robots as assistive technologies for children with autism". A lot of children on the autism spectrum in Ghana are being left behind with respect to using technologies to aid in their education. Per the research I have conducted in Ghana using three Schools for children with autism as case studies, I have realized that the children are very responsive towards humanoid robots and are likely to learn from robots! So I am envisioning that very soon, my research team would develop robots to serve as assistive technologies in autism education in Ghana and beyond.

#### *9. Outside your profession, are you involved in any other businesses/activities?*

Yes. Aside the usual lectures and research, I work with a team to organize free internet of things and robotics workshops and training sessions for students. I derive so much joy from these workshops because I am able to contribute to society positively and enable young people to acquire new skills.

#### *10. Do you consider yourself successful? Have you attained fully your desired goals?*

Yes, I consider myself successful. Although I have had some failures, I have achieved a lot of the goals I set for myself although I have not

fully attained all my desired goals.

#### *11. When you began your career many years ago, did you ever imagine that you would be a professor or leader?*

I would say yes. I knew I wanted to be in academia the day we were matriculated as freshers at KNUST. I was mesmerized when I saw the procession of academicians in their gowns and hats! Hahaha. So I said to myself, I want to be like these people. As I have said earlier, I am passionate about teaching so I knew I would fit very well in academia. So I started reading and asking a lot of lecturers on campus how I can develop a career in academia. I was advised to learn hard, stay focused and most importantly, put God first in everything I do. I am most grateful to all the lecturers at the Department of Computer Science and all the people who have mentored me to be who I am today.

#### *12. Did you face any challenges in your career/life?*

Yes, Life has its own challenges. I come from a family of ten! My mum was a petty trader and my dad a driver. So you can imagine the financial difficulties we had growing up. Despite everything, my parents made sure that we also had good food to eat and also tried their possible best to take us through school. Today, out of the family of ten, we have two lecturers, a medical doctor, a nurse, a teacher, Roman Sisters who are also teachers and also businessmen and women! This has been possible because we saw how our parents tried so hard to pay our fees and buy us all that we needed for school and therefore,

we decided to learn hard to make our parents proud and also pursue careers that would enable us to also reach out to the needy in society. I love this quote so much: "Obstacles? Don't be Stopped by them, be Strengthened by them" - Bernard Kelvin Clive. To everyone reading this, I want to encourage you to persevere and be diligent in whatever you are doing. It shall be well.

Currently in Ghana and abroad, computer science is largely a male-dominated field. In my course of work, I interact with few women. There is a general perception that "Computer Science is a difficult course" and that makes a lot of women shy away from it. When I decided to pursue Computer Science, people asked me "Can you do it? It is difficult oo". I always replied that yes I can do it. I have seen women who have been able

to do it and therefore I can also do it. Here I am today. I have been able to do it! I even emerged as the overall best student of the 2012 BSc Computer Science year group. I am also the first female to successfully defend my Ph.D. thesis at the Department of Computer Science, KNUST. I would like to use this opportunity to encourage men and most especially women to pursue computer science since technology is what drives the world today. If I have been able to do it, certainly, you too can do it.

*13. How do you compare the past to the present (in terms of opportunities to help develop the country?). What do you think about the youth of the present generation?*  
I think we have come far with respect to technology. In this 21st century, a lot of processes and activities have been digitized. Digitization presents enormous

opportunities for every aspect of life. We can sit in the comfort of our homes and access educational resources all over the world. I would advise the youth to take this opportunity to upgrade themselves. Take a certification course, learn a new skill and do not stay idle. The more we learn, the more we are better positioned to contribute to developing our nation.

*14. Finally, what advice would you give to the young people, students, researchers/scientists and technologists?*

My advice is simple. In whatever you do, put God first. Have clear goals and work diligently towards them. Challenges may come but do not give up. You shall succeed. And do not forget to treat each person who comes your way with respect, for you do not know where your paths would cross again!



## Profile: Ing. Professor Elsie Effah Kaufmann

Ing. Professor Elsie Effah Kaufmann is a Visiting Scholar and Head of the newly established Department of Orthotics and Prosthetics at the University of Health and Allied Sciences for the 2020/2021 Academic Year. She is an Associate Professor of Biomedical Engineering from the University of Ghana.

Prof. 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. 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.

Prof. Elsie Effah Kaufmann was appointed as the first Head of the Department of Biomedical Engineering in 2006 and served as Head for some 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 also published in *Engineering Education*. Despite her heavy administrative and teaching responsibilities, she has consistently developed and cultivated a reputation for service at the University and at National and International levels as indicated by her service on numerous committees. She was elected to represent non-professorial academic staff on the highest decision-making body of the University of Ghana, the University Council in 2010, a position she held for four years. Nationally, she has served on



the Management Board as well as the Research and Technical Committee of the National Nuclear Research Institute of the Ghana Atomic Energy Commission; the pioneering Technical Advisory Committee on Medical Devices of the Food and Drugs Authority, Ghana; and the Ghana Standards Authority's Technical Committee on Metrology & Measurement (pioneering 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, Prof. Effah Kaufmann has received several prestigious local and international awards. She was the recipient of the 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 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.



Prof. 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, Prof. 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 Ph.D. 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.

### *Advice to Young People*

There is a time for everything. Sustainable success does not happen overnight. It takes consistent diligence. Please consider your education as an investment in your future; work hard now and you will reap the benefits. Always think of ways of using your education and knowledge to make life better for yourself, family, community, nation and the world. Your generation must do better than mine!



## Profile: Professor Mohammed Muniru Iddrisu

### *Education and Teaching Experience*

Professor Mohammed Muniru Iddrisu started basic education at the St. Joseph Primary school in Tamale in 1976 and later moved to Nuriya Arabic and English School, Tamale to study both secular and Islamic education together. After passing his common entrance examination in 1986, he entered the Northern school of Business (Nobisco), Tamale for his secondary education and due to his ambition to pursue science he was released on transfer to Ghana Secondary school (now Ghana Senior High School), Tamale in 1987 where he obtained his general certificate of education ordinary level (GCE O' Level) in 1991. He continued at Fijai Secondary School (now Fijai Senior High School), Sekondi and obtained his Advanced Level (A' Level) Certificate in 1993, after which he did his National Service at the Ziong E/A primary school as a classroom teacher in 1994. A Bachelor of Science (BSc) degree in Mathematics (major) and Physics (minor) in 1998 at UCC further bolstered his passion for mathematics and its power in providing great problem-solving skills and analytical reasoning.

A second one-year national service was mandatory, which he performed at the Business Secondary School (now Business Senior High School), Tamale in 1999 as a Mathematics tutor. During this period, he also doubled as a part-time mathematics teacher at the Tamale Polytechnic



(now Tamale Technical University). Soon afterward, he joined the Tamale Polytechnic full-time and taught Mathematics and Statistics courses for three years before proceeding to the Norwegian University of Science and Technology, Trondheim, to pursue a Master of Science (MSc) degree in Mathematics, and was awarded in 2004.

The experience in Norway was a challenging one; faced with the realities of getting to understand the subject matter of pure mathematics and challenges, at the same time, to establish one's theorems and proofs. But with

strong dedication, discipline and perseverance he was able to complete the programme successfully. He then traveled to London for a short course in Computer Studies at South Chelsea College and returned to Ghana to join the University for Development Studies (UDS) as a Lecturer in 2005. He later traveled to the University of Angers in France for research training (2011-2013) and received a Doctor of Philosophy (Ph.D.) degree from UDS in 2015. He was promoted to a Senior Lecturer in 2015 and also to an Associate Professor of Mathematics in 2019. He has bigger aspirations that include

working on some more proofs and theorems and doing some more administration work. But then family also calls.

Surprisingly, working in academia was never thought of at the early stages of his career. His dream was actually to work in the industry. The decision to remain in academia was conceived when he joined UDS. Teaching for over fifteen (15) years now, his philosophy has been to maintain discipline and commitment to duty by providing students with the right knowledge and skills through the application of innovative teaching methods for best results and quality products.

### *Research and Publications*

Professor Iddrisu is an astute academic and has over 35 publications in refereed journals of which part concentrated on presenting some of the most important inequalities in mathematics (Hardy, Jensen, and Steffensen inequalities) much simpler in their various proofs. The applications of his research work are more within the analytical aspect of mathematics. His research work largely focuses on Mathematical Analysis with a key interest in mathematical inequalities, Special functions, Coding Theory and Cryptography. He has supervised over seventy (70) undergraduate projects, five (5) MPhil Theses, Two (2) Ph.D. Theses and Four (4) postgraduate theses are currently under supervision. He maintains very good and cordial relations with his students and colleagues. He supports his students in various forms by providing them with reading materials and encouragement. The usual key

message to students has been to embrace high values of hard work, commitment, dedication and perseverance. He has attended and made presentations at many local and international conferences. He is also a reviewer to many international journals. He currently serves as a Deputy Editor of the Everyday Science for Schools Magazine of the Ghana Science Association.

### *Community Service*

He has served many Institutions in Ghana professionally. This includes the works with the Tamale Technical University and Bolgatanga Technical University. He has been involved in the training of teachers of some selected Senior High Schools in the Upper East Region of Ghana including OLL Senior High School in Navrongo and Bongo Senior High School, Bongo. He also supports the National Accreditation Board of Ghana as a team/panel member on mathematics programmes accreditations in the country's tertiary institutions. He is the founder and Proprietor of Idrees Smart Academy in Tamale.

### *Leadership*

Professor Iddrisu is the current Dean of the School of Graduate Studies and Research and the Chair of Convocation Leadership of the C.K. Tedam University of Technology and Applied Sciences (CKT-UTAS) in Navrongo, Ghana. He has served in various management positions at the University for Development Studies, Ghana including Vice-Dean of the Faculty of Mathematical Sciences (2017-2020), Head of the Department of Mathematics (2016

– 2017), Faculty Coordinator of the Third Trimester Field Practical Program (TTFPP) (2014 - 2016), Department Quality Assurance Officer (2014 – 2016), Campus/ Faculty Examinations Officer (2008 –2011), Kintampo North District Coordinator of the University TTFPP (2006 – 2008) and Acting Head of the Department of Applied Mathematics and Computer Science (2007 – 2008).

### *Membership of Boards and Committees*

He has served on several boards and committees of UDS and CKT-UTAS including the Academic Board and the Appointments and Promotions Board. He is a member of the committees that drafted; the UDS Ethics Policy and Standard Operating Procedures for Research Involving Humans and other Living Organisms, the Strategic Plan for Workforce Development document, and the CKT-UTAS Statutes. He also chaired the committees that finalized the documents for the introduction of new academic programmes and the establishment of new academic Faculties.

### *Awards, Scholarships and Professional Associations*

He is a recipient of many awards and citations including the French Government Scholarship that sponsored the first two years of his Ph.D. studies at the University of Angers in France, the Norwegian Government Scholarship (Quota program) that sponsored his master's studies, and citations from Staff and students for distinguished leadership and dedication to service. He is a

member of many professional bodies including the Ghana Mathematics Society, Ghana Science Association, Nigerian Association of Mathematical Physics, and the National Institute for Mathematical Sciences, Ghana.

### *Present and Past Opportunities*

He has a somewhat different kind of experience from the current generation. They pass through a system in their secondary school days that did

mathematical computations using the Mathematical Tables Book (Four-Figure Tables) without using calculators. They had little technology at the time. Due to technology (An application of science and engineering to accomplish specific tasks or solve problems) like smartphones, the internet, screens etc., there has been great improvement in life activities. Online classes, conferences and workshops are organized using Zoom, Google

meet, Google classroom, etc. to support education and research. Social media like Instagram, Facebook, WhatsApp and many more connects people and provides fast communication. The youth is advised to take advantage of these opportunities to better their education to become responsible citizens.

Professor Iddrisu is married with five children.

# Profile: Dr. Abdul Nashirudeen Mumuni (PhD)

## 1. About Myself

Dr. Abdul Nashirudeen Mumuni is a Medical Physicist specialized in Diagnostic Imaging, with a focus on Neuroimaging using Magnetic Resonance Imaging (MRI). He has extensive research experience in studies of human brain biochemical profiling using Magnetic Resonance Spectroscopy, an advanced MRI technique.

Dr. Mumuni holds a Ph.D. in Clinical Physics from the University of Glasgow UK (2013), an MSc in Medical Physics Computing from the University of Aberdeen, UK (2009) and a BSc in Applied Physics with Environmental Science from the University for Development Studies, Tamale-Ghana (2007).

Dr. Mumuni was appointed Lecturer in the University for Development Studies (UDS) in 2014. He has since then been teaching and supervising both undergraduate and postgraduate students as a core staff of the School of Allied Health Sciences (SAHS) and a cognate staff of the School of Medicine, School of Nursing and Midwifery, and School of Public Health, all on the Tamale-Dungu Campus of the UDS. He has served in various administrative positions in the UDS and is currently a Senior Lecturer and Founding Head, Department of Medical Imaging in the SAHS.

## 2. Motivation For Choosing Courses I Studied In School

During my Junior High School days, I had so much interest in Physics and Mathematics, and indeed, these were subjects I found easy to read and understand without difficulty. I, therefore, chose to study Science at Senior High School. At Senior High School, we did not have good tuition in Physics in particular but my interest in the subject propelled me to improvise Physics laboratory practical



methods at home and this gave me so much confidence that I could pursue the subject at the tertiary level even if I had no one to guide me through. I subsequently chose to study Physics at University where I finally chose to specialize in Clinical Physics later at the postgraduate level.

## 3. How My Motivation Influenced My Career To Date

My motivation to study Physics kept me challenged to search for career paths I could go into after school, which would still be in the area of Physics. I was therefore during university constantly in search of specialisations in Physics while pursuing BSc in Physics. In my third year, I discovered Medical Physics

and took it as an elective course. While studying the course, I sought advice about career opportunities in that area from the then lecturer of the course, Mr. Eric Addison (now Senior Lecturer, KNUST). Talking to him about specialisations in Medical Physics itself was an eye-opener which later guided me to look for postgraduate opportunities in that area, and I was lucky to find one in the University of Aberdeen, UK where I pursued an MSc in Medical Physics Computing and proceeded to Ph.D. in that same area at the University of Glasgow, UK.

## 4. What Keeps Me Motivated

My desire to make a difference, no matter how small, at every

opportunity I get keeps me motivated to work towards my growth. I know that I cannot give what I do not have and to give out my best, I need to prepare myself to make that little difference and to create an impact in society. I believe Science can serve our society better if the younger generation is guided to develop an interest in the rare areas of Science such as Physics. Having this on my mind, over the years, has given me the urge to keep working towards achieving that dream.

### 5. My Success Habits

My most reliable success habit is keeping a focus on achieving one thing at a time and while at this, I constantly work according to a plan to get to that goal. I always look out for people I can rely on to provide guidance on aspects of my plans and to identify the resources I will need to get things done. Timelines are always in my plan, and these serve as signposts to me about my progress. Actions and activities that do not add to my goal at one point or another are often not given so much attention.

### 6. My Teaching Experience

I have been teaching at the university for 6 years now, and the experience has been great so far. The fact that I teach all Health Science Departments in the university has allowed me to interact with students in all the Health Science programmes, and to understand the challenges faced by students in these disciplines. This has offered me the opportunity to learn many techniques of teaching rather complex and abstract concepts in a manner that is comprehensive to the caliber of students who do not have a background at all in some of the courses I teach, and it is refreshing to see them cope and do well in the end.

### 7. My Teaching Philosophy

There is no concept that is too complex to learn and understand, and to teach it to others if you put your mind to it.

Minimise the theory and practicalise everything; that's the only way Science can become useful to society.

### 8. How I Supervise And Motivate My Students To Get Things Done

To start a research project with students, I let them understand that it is an academic exercise but they should focus on generating at least some knowledge that they can take away with them after school; if they should forget everything they learned in school, their project work should never be forgotten. I will then give them an overview of what the expectations of the topic would be, including the possibility of publishing. Over the years, I have observed that students I supervise with this kind of mindset have worked with enthusiasm to very good endings and indeed, publications.

### 9. Impact Of My Research

Some of the impacts of my research works include the following:

- Even though high-field MRI may offer sensitivity advantages over low-field MRI, for safety considerations and clinical use, low-field MRI is recommendable.
- Proposed, developed and implemented brain tissue water quantification techniques for in vivo magnetic resonance spectroscopy studies
- Proposed and implemented method for correction of the partial volume effect in spectroscopic voxels

### 10. Other Engagements Outside Of My Profession

Away from the lecture room, I am into commercial maize farming, and this year (2021), I have started poultry and livestock rearing too.

### 11. The success I Have Chalked So Far In My Career

I think so far, I have chalked some considerable success in my career, but I am still many levels below my desired goal in my career. I am therefore working purposively hard towards achieving my desired goal.

### 12. My Imagination About Becoming A Professor/Leader One Day

I started my career with a vision of becoming a professor one day. I do not think that this is so different from the thinking of any other academic who wishes to stay in that job throughout their life. I envisaged becoming a Head of Department while I started working on the BSc Medical Imaging Technology programme and helping establish the Department of Medical Imaging. Therefore, my appointment into that administrative position when the Department was established was a dream come true.

### 13. Challenges I Faced In My Career/ Life

- Being constantly sacked from school due to defaulting in payment of fees was quite a traumatizing experience for me from primary school until my first year in university. I never had the opportunity to write mock examinations at Senior High School because I was asked to go home due to non-payment of fees. I put an end to this by my second year in university by applying for the Students' Loan to take care of my education throughout university.
- Currently, as an MRI Physicist in UDS, Tamale, there are no research facilities in the whole region to support my area of research. The only MRI machine in the Tamale Teaching Hospital I can rely on for research is not operational. My research output has been dramatically affected and slowed down, as I have to rely on external collaborators to

get things done.

#### *14. My Views About The Youth And Opportunities To Develop Ghana*

In my opinion, there are so many opportunities for the development of Ghana and Ghanaian youth. What is lacking is a national agenda and political will to execute an ambitious national agenda that will involve the youth. It appears that social interventions are not properly targeted and if at all targeted at the youth, they are not sustainable.

The youth, on the other hand, seem to be focused on immediate results and achievements rather than patiently

pursuing long-term goals. The internet, social media, and technology have not so well been exploited positively by the Ghanaian youth as their counterparts in Asia and Europe, and this is worrying.

#### *15. My Advice To Key Stakeholders In Society*

- Finally, my advice to the youth of Ghana is that identifying a realistic dream and pursuing it all your life the right way will make you successful. Do not forget to ask for help and direction from God and those who are already ahead of you in the same pursuit.
- To students, do not just study

hard for the sake of it, pursue programmes you have passion and interest for and not programmes people say fetch money or those that are being pursued by your peers. If you make an independent choice of a programme, you will succeed and you will enjoy your career life.

- Researchers, scientists and technologists should place scholarship and innovations for humanity over any other interest. If what we do as researchers has national relevance, Ghana will be a better place for all.



## Interview: Dr. Stephen Moore

*University of Cape Coast,*

*Email: [stephen.moore@ucc.edu.gh](mailto:stephen.moore@ucc.edu.gh)*

*1. Please tell us a little about yourself (biodata/background, education and profession)*

I am Stephen Moore from Saltpond, Ghana. I am a trained computational scientist with strong mathematical background. A computational scientist is someone who applies high-performance computing to several disciplines including physics, biology, chemistry, medicine, social science, etc. with mathematical tools. I did my primary and junior high school education in a boarding school in Accra. I am the patron of APSU-HOPSA on the UCC campus and an alumnus of the Department of mathematics, KNUST, Ghana. After my bachelor studies, I pursued graduate studies in Industrial Mathematics in Germany and Austria with European Union funding. Thereafter, I worked as a research engineer in The Netherlands and Switzerland. I moved to pursue doctoral studies in Austria upon the invitation of my graduate thesis supervisor. My doctoral studies lie in the field of computational science and engineering (CSE). During my doctoral studies, I worked at the Austrian Academy of Science, founded by Gottfried Leibniz (renowned mathematician), some known people have worked in the academy include Boltzmann, Eiselsberg, Doppler, Lorenz and Schrödinger and several other Nobel Prize winners. I also worked as a consultant to some engineering firms during this period.

After my doctoral studies, I decided to gain more industrial experience with my training. So I worked as a consultant to Austria's oldest Exploration and Production (Oil and Gas) company. After a successful project implementation for the company, I moved into the automotive industry to gain further experience



in engineering. Here, I worked on designing of cars and testing for their efficiency. Some of our clients were Volvo, Daimler, Toyota, Jaguar, etc.

I am currently a lecturer at the Department of Mathematics, Ghana after a piece of advice from Prof. Francis Allotey of blessed memory during my visit to Ghana in February 2017.

*2. What influenced your choice of courses or programmes you studied during your youthful days (secondary school up to university)?*

I loved puzzles and abstract things

whiles growing up like playing scrabble or learning to play chess on my own by reading rules. Everything that follows logic and had a manual, I did love to engage with it. I knew I wanted to pursue science at the senior high school level. My father and guided me to choose St. Augustine's College, Ghana.

I was also lucky to have a very intelligent friend (who's now my in-law), who was pursuing engineering in KNUST advise me to choose mathematics because it offered more options than the rest. Through my parents, I got to meet Prof. Allotey during that time. *Fun fact;* I wrote

a scientific article during my doctoral studies by reading an original Russian text from my supervisor. That is how catholic mathematics is.

### *3. How did that influence your career to date? What/who influenced you most?*

By pursuing undergraduate and graduate studies in mathematics, I have managed to work in several companies from oil and gas to automotive industries and also worked as a member of one of the world's most prestigious academies of sciences. My undergraduate studies in KNUST was the springboard that propelled me to higher studies. In mathematics and many areas, it is always good to be associated with the best, it makes life easier. Prof. Allotey was a huge influence as well. He offered me very good advice when I need it most; including moving to UCC. He paid for me to go to Europe to pursue my graduate studies as well. Finally, Jesus Christ is my main influence in life.

### *4. What motivated you or motivates you?*

During my undergraduate studies, I was impressed with computer science and engineering students; their ability to write codes that did several tasks, etc. was very interesting. I always wondered how Media Player got those visualizations to respond to the music I played. This made me consider studying a combination of computer science and mathematics. I did my bachelor thesis then using Neural Network to solve the malaria problem at KATH.

A good mathematical background coupled with strong computer skills is what the future world looks like. I want many Ghanaians to know that mathematics is real and alive.

### *5. You are seen as an outstanding scientist/professor/leader. How did*

### *you achieve this? What are your success habits?*

I read a lot of material on daily basis including fiction, novels, history, etc. and also like to work on new and immersing areas in science. I spend most of my night-time working and solving problems. Sometimes, I'm screaming at the computer, other times I'm throwing papers around when I'm lost. I fight till the results are achieved. Don't be idle-minded. More information is good for the brain.



### *6. How long have you been in the teaching field and how was the experience?*

I was a teaching assistant in KNUST, Kumasi from 2007-2008. Since then, I have taught in several capacities in many countries. I joined UCC, Ghana in 2018 as a full-time lecturer. It has been fulfilling. I love to teach and share my knowledge willingly. I want to see more people understand mathematics better than I do.

### *7. What is your teaching philosophy?*

I believe my role as a university teacher is to nurture and encourage the lifelong learning of my students. Through classroom discussions and even the use of humor, I hope to prompt students to think creatively and explore their natural curiosity.

### *8. How did you manage to supervise your students, motivating them to get the best out of them?*

I usually work with my students consistently and conscientiously. For all my students, I always ensure they can present their results line-by-line

on a board and can explain the very basic techniques they have employed. I want my students to have confidence in their work. I see supervision as training and even a Ph.D. is nothing but training. I make students aware that, results are not given; they are hard work that is possible to achieve. I demonstrate it by always giving them examples that elucidate their current problem.

### *9. What has been the impact of your research works?*

I have worked in several areas as a numerical analyst including but not limited to mathematical biology and artificial intelligence. Understanding the spread of diseases is now very critical to controlling the current pandemic. I developed software (G+Smo) which is currently being used by researchers all over the world and some automotive companies in Europe and the USA.

### *10. Outside your profession, are you involved in any other businesses/activities?*

I am the co-founder of Ghana Natural Language Processing (Ghana NLP); we aim to develop language translators for all the eleven (11) government accepted languages in Ghana. You can already test it on Google Play for the initial version. I also founded the Ghana Numerical Analysis to share knowledge and to train more people in the area of computational mathematics.

### *11. Do you consider yourself successful? Have you attained fully your desired goals?*

I do not consider myself successful neither do I consider myself a failure. I think my success will be measured by my peers after a few more years. I have not attained my full goals and vision. My desired vision is to train several graduate students in the area of computational mathematics till

I several areas of mathematics are fully covered in Ghana. I wish to see Ghana become mathematically sustainable.

*12. When you began your career many years ago, did you ever imagine that you would be a professor or leader?*

During my undergraduate studies, I always wanted to teach at the university. To share knowledge at the highest level. I never thought of being a leader but I knew I wanted to be in the university or research environment. I am glad to be doing this back in Ghana.

*13. Did you face any challenges in your career/life?*

In Germany and Austria, the mode of examination is oral. So you can imagine a 30-40minutes examination with your professor and with either a pen and paper or chalk and a

blackboard. He's asking you several mathematical questions and you need to write the answers on the board. My first two to three examinations in Europe were a complete failure. I had lost it and was confused if I was ever going to pass exams again. It took efforts from some friends and colleagues for me to comprehend and appreciate oral exams and how to pass it successfully. I have had to stay at a police station for three hours while traveling to a conference. But, Perseverance conquers all and in Latin, Omnia Vincit Labour.

*14. How do you compare the past to the present (in terms of opportunities to help develop the country?). What do you think about the youth of the present generation?*

The internet has made it easier for many students to learn varied topics and courses; that's a great opportunity to acquire knowledge from the best

teachers in the world. I think the opportunities to reach the highest have no boundaries. It is a generation of knowledge especially for the African generation because of the internet. Several years ago, it was not so. This allows several others to gain skills and compete at the highest level.

*15. Finally, what advice would you give to the young people, students, researchers/scientists and technologists?*

To the students, use the internet well. Use your minds well. As you grow, you build on what you've acquired. Read more, read other fields, be curious about your studies, be curious about your environment. To other researchers, scientists and technologists, I'll say do not stay in your corner. The world is moving towards unity in diversity. All fields are finding a common interest. Collaborate and innovate!

## Interview: Prof. (Mrs.) Faustina Dufie Wireko-Manu

*Department of Food Science and Technology, KNUST-Kumasi*

*Email: fdbaah@yahoo.com*

*Tel: +233-207010712*



### *1. Please tell us a little about yourself (biodata/background, education and profession)*

I am Faustina Dufie Wireko-Manu, affectionately called Nana Adwoa by family members and close friends. I hail from Asonomaso in the Kwabre District of Ashanti region of Ghana and happen to be the 9th and last born of my parents, Opanin Edward Kwame Baah and Obaapanin Comfort Akua Tiwaah, both of blessed memory.

I started my primary education at the L/A Primary School in New Asonomaso Nkwanta and proceeded proudly as one of the first batch of students

of the then newly introduced Junior Secondary School (JSS) at Asonomaso Presby JSS in 1987 to 1989. Having passed with excellent results, I got admission to offer Science at St. Louis Secondary School in 1990 to 1993. I am now a Food Scientist/Technologist with nutrition background, and Associate Professor at the Department of Food Science and Technology, KNUST, Kumasi.

### *2. What influenced your choice of courses or programmed you studied during your youthful days (secondary school up to university)?*

I think it was more of an influence

from my teachers and older siblings who thought I was brilliant and so had to do science. They wanted me to do either medicine or nursing at the tertiary level, but fortunately for me, I was declined medicine at Legon after I qualified for an interview. I then had to look within myself for my interest and knowing that I loved trying new food recipes with local ingredients, I decided to go in for Nutrition and Food Science. This was after careful reflections, consultations and prayers. I was later offered Nursing, but I declined because my mind was made up, and I thank God for helping me make that right decision. I have never looked back nor regretted it.

### *3. What motivated you or motivates you?*

Well, I majored in Food Science with Nutrition as a minor at Legon and I guess that helped me to grow my interest in Food Science. Even though I loved Nutrition too, I wanted to continue my education where I could support my aged parents in the Ashanti Region as well, so I had both masters and terminal degrees in Food Science and Technology at KNUST.

### *4. What motivated you or motivates you?*

My motivation all this while has been my passion to learn, have experience in my way and share. I just love seeing my students do well in diverse ways after school. I am more inspired by the positive impact I am making through research, teaching and mentoring to

the current and future generations, towards food/nutrition security and wealth creation in Ghana and beyond.

*5. You are seen as an outstanding scientist/professor/leader. How did you achieve this? What are your success habits?*

I am a Christian and believe in working hard at whatever I lay my hands on, doing it to the glory of God for positive impacts on others, and also for my good, Ecclesiastes 9:10a. Again Prov 10:4 says 'Lazy hands make a man poor, but diligent hands bring wealth'. I try my very best in any given task. The Lord has been my strength, promoter and sustainer, moving me from one rank to the other. Looking back, I am humbled by how far the Lord has brought me and will continually give Him all the praise and honor. I thank all my mentors, colleagues, students, friends and family for their contributions to my life.

*6. How long have you been in the teaching field and how was the experience?*

I have been lecturing at KNUST since December 1, 2009, a month after my Ph.D. graduation. It was not an easy task initially, but with the help of good mentors and short training, and of course the willingness to learn and share, it has become easier and more interesting. I love to interact with students and currently do more facilitation, where students own part of the knowledge shared through reading and research before lectures, discussing in groups, participating in journal clubs and brainstorming for possible solutions to community real-life food challenges.

*7. What is your teaching philosophy?*

My philosophy is that every student has the potential to contribute positively to life if given or supported with the right information, motivation and nurturing. My job is to do that, lighting up their minds to do exploits.

Many teachers/lecturers, professors and mentors did the same to me, lighted my mind and showed me how to build my career, and I count it all joy to follow their steps. I also believe in instilling the spirit of humanity and good virtues in students so they can become agents of positive change.

*8. How did you manage to supervise your students, motivating them to get the best out of them?*

Hmmm, it's not easy but I guess just being myself, motivating them with my story, planning and doing it together with them, setting timelines and putting positive pressures have yielded good results. I meet my students bi-weekly or monthly to plan, discuss and share ideas on projects. I also do team supervision with my colleagues and collaborators from different disciplines, thus learning and sharing best practices.

*9. What has been the impact of your research works?*

I have had the privilege of working on some good international and local projects, which have raised funds for students' training, teaching and research, and enhanced the visibility of KNUST.

I have published thirty-seven (37) peer-reviewed research articles, co-authored books and book chapters, manuals and poster presentations at workshops. My articles are cited globally and index in good databases such as Scopus, Springer, ResearchGate, Google Scholar, among others. So far, seventy-one (71) students have been supervised by me including Ph.Ds. My students are found across the globe either continuing their studies or working in the food and research sectors while others are doing their food businesses.

Communities have been directly engaged through organized training, exhibitions, festivals and media discussions to create awareness,

transfer skills and empower relevant stakeholders along the food value chain. I have contributed to debates and discussions on food fraud, healthy eating lifestyle, value addition and inclusion of sweet potato (high in vitamin A) in meals to reduce the burden of vitamin A deficiency

Currently, I am working with industry players to provide healthy and convenient traditional products for commercialization. In addition, I have been an Assessor for some academic programs accreditation, a member of the Technical Advisory Committee on Nutrition for Food and Drugs Authority (FDA), a reviewer of journal articles and a member of some statutory and non-statutory committees at KNUST.

*10. Outside your profession, are you involved in any other businesses/activities?*

Yes, church and home management businesses.

*11. Do you consider yourself successful? Have you attained fully your desired goals?*

I consider myself very successful, judging from where I am coming from and the positive contributions made to my students, some communities through training and the many activities I have been involved in both at local and international levels. I am an inspiration to my own family, many students, church members, former schoolmates, just to mention a few. I know the Lord is not done with me yet, provided I continue working hard under His direction and remain connected to Him.

*12. When you began your career many years ago, did you ever imagine that you would be a professor or leader?*

No! I talked myself out of that until my Professors, specifically Prof William Otoo Ellis, Prof Ibok Oduro and Prof.

Robert Abaidoo among many others saw the potential in me, and motivated me to work at Crops Research, later at the International Institute of Tropical Agriculture (IITA) and virtually pushed me to do my Ph.D. Luckily for me during my Ph.D. time, I had an opportunity to be a Fellow of African Women in Agricultural Research and Development (AWARD) where my science, professional and leadership skills were enhanced through mentoring and tailor-made training programs. As part of the fellowship activities, I had to draft a Life Purpose Road Map (LPRM), and the highest position I indicated on the LPRM was to be a Full Professor like my AWARD official Mentor, Professor Ibok Nsa Oduro. That was when it dawned on me to work towards it and I thank God I am just one step more to a Full Professor.

*13. Did you face any challenges in your career/life?*

Plenty! It has not been easy; financially, emotionally and spiritually. I had to make lots of sacrifices, and stay connected to my source of hope, Jesus, to come this far. Financial support was an initial challenge because my parents were old throughout my prime training period, and I had to forfeit a lot of fun times to support my

mother's baking business and petty trading. At a point, I had to send my parents some of my SSNIT loan to support their living and during my master's at KNUST, God, through my brothers granted me the opportunity to go and work abroad to support myself and family. I really appreciate the support of my siblings.

Challenges have not ended, currently, there is always the challenge of balancing time for family, work, church and other equally important and demanding tasks. I have to over-work sometimes, even at odd hours, to meet deadlines, accomplish tasks and make progress. I see challenges as a way of life and if well managed, promotion is always assured.

*14. How do you compare the past to the present (in terms of opportunities to help develop the country)? What do you think about the youth of the present generation?*

As a nation, we don't need to reinvent the wheel. What has worked elsewhere should guide us to prioritize and focus, reduce talking and be more action-oriented. Improvement in the agricultural sector alone can have significant impacts on the economy, job creation, food and nutrition

security.

For students, there are more opportunities now for young ones to be educated due to more scholarships, technologies and diverse means of getting knowledge to advance. The only thing is that competition is high and the youth of today are not as proactive as they should in taking advantage of good opportunities.

*15. Finally, what advice would you give to the young people, students, researchers/scientists and technologists?*

For students and youth, they should look within themselves for the many God-given potentials, search for new things, focus, work hard, have mentors, and not be afraid of taking steps. They should believe in themselves and know that they are more than able, just like any youth making it at the global front, and finally, they should allow the Lord to order their steps.

For researchers, I say ayekoo to all of them. Learning is thriving and without research, the development will be slow, so I pray that God will grant them more discoveries to inform developmental actions and mentor generations to generations irrespective of the challenges.

## Interview: Dr. (Mrs) Sandra Abankwa Kwarteng

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*Tel: +233244136467*

*1. Please tell us a little about yourself (biodata/background, education and profession)*

My name is Dr (Mrs) Sandra Abankwa Kwarteng. I am 36 years old and hail from the Ashanti Region. I fellowship with the Presbyterian Church of Ghana. I am a versatile, assiduous and determined scientist with MPhil and Ph.D. in Medical Entomology. Currently, I am a lecturer at the Kwame Nkrumah University of Science and Technology (KNUST). It is through this position and previous positions that I have had a unique vantage point from which to undertake teaching, research and consultancy.

*2. What influenced your choice of courses or programmed you studied during your youthful days (secondary school up to university)?*

Well for secondary school, I was not too sure what exactly I wanted, I guess my case was not so different from that of the average Ghanaian where your path is predetermined by your parents and teachers. During those days a 'brilliant' student was brainwashed so to speak to read a STEM course at the senior secondary school level after your junior secondary school.

The story was a little different with regard to the university. My aim was to read a marketable science course. I asked around then decided to apply for Engineering or Medical Laboratory Science. I however got my third choice course that was Biological Science.



I remember I was so disappointed back then. But oh my! How completely wrong I was!

*3. (a) What motivated you or motivates you?*

It is not abstract it is expressed in everything in and around us. Hence knowing more and understanding how it works being more curious and then digging deeper and using this knowledge to solve societal problems is simply wonderful. I just cannot envision myself doing anything else in terms of a career.

*(b) What/who influenced you most?*

The culture of excellence was at the

Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR) where I did my National Service, and MPhil and Ph.D.

*4. What motivated you or motivates you?*

Observing the women researchers at KCCR motivated me greatly. Even though they were mothers, wives, or engaged in one thing and another they were extremely conscientious. Apart from being smart and hardworking, they were team players and ready to walk any novice through and teach you their research techniques. Also, another motivating factor is the noticeable career progression I saw in the research scientists at KCCR over time by the dint of hard work.

5. *You are seen as an outstanding scientist/professor/leader. How did you achieve this? What are your success habits?*

Thank you.

Hard work never kills! Work hard!  
Work smart! Be a team player!

6. *How long have you been in the teaching field and how was the experience?*

I have been in the teaching field for the past 3 years. In the research close to ten years now. The experience has been simply fulfilling.

7. *What is your teaching philosophy?*

To nurture and encourage a lifelong learning habit in my students through hands-on activities such as presentations and community interaction, classroom discussion, and even the use of humor. I aspire to always prompt students to be creative in their thinking and juggle their research curiosity to investigate things happening in and around them.

8. *How did you manage to supervise your students, motivating them to get the best out of them?*

At the beginning of every semester, each student brings a comprehensive Gantt chart as their timelines and how their studies and research will be carried out throughout the entire period as well as the times for the student to meet up with me. I set reminders on my phone based on their timeline and as much as possible we work at following these timelines.

9. *What has been the impact of your research works?*

My research interest involves interaction between entomology and infectious diseases, considering insects as vectors and potential zoonotic sources for infectious diseases. One

of my research focuses on using larvicides as part of an integrated vector management tool to reduce the malaria burden by controlling the mosquito population. A study that has seen considerable success as a proof of concept in community-controlled trials. In addition to this, several studies have been done using genotypic and phenotypic techniques to determine how resistant the malaria vector is to WHO-approved insecticides with results relayed to the scientific community through publications, workshops and seminars and to the layperson via community interactions. The study revealed how extremely resistant the Anopheles mosquito is to the pyrethroid insecticide that is mostly used in the insecticide-treated bed nets and local mosquito sprays on the market. In fact information such as this is and the reasons why these resistances are in the ascendancy in the first place is timely as we record increasing numbers of malaria cases in the OPDs of our various health facilities. Another study that has contributed to knowledge in the body of science is the TRANSMIT multinational study which looked at the attractiveness of the Anopheles mosquitoes to individuals with schistosomiasis among others. All these studies have impacted the local and international populace through publications, conference abstract presentations and community outreaches. Recently I conducted a bovine tuberculosis study in Kumasi which helped veterinary officers to mitigate a potential public health crisis.

10. *Outside your profession, are you involved in any other businesses/activities?*

I am an entrepreneur, together with my husband we breed livestock including pigs, foreign dogs and fish.

11. *Do you consider yourself successful? Have you attained fully your desired goals?*

Not yet. And like Paul said in Philippians 3:14, I press on toward the goal to win the victorious crown.

12. *When you began your career many years ago, did you ever imagine that you would be a professor or leader?*

I did and still do. I have always had big dreams and aspirations fueled by my passion to attain excellence and do exploits in all my endeavors.

13. *Did you face any challenges in your career/life?*

I did and still do. But in the face of challenges and adversities, I seek wise counsel from my predecessors and then pray into the challenge for it to solve.

14. *How do you compare the past to the present (in terms of opportunities to help develop the country)? What do you think about the youth of the present generation?*

Knowledge abounds more now than in previous years. The youth of this present generation present with very knowledgeable and smart people however a lot more are only interested in obtaining things on a silver platter as it translates at the examination halls when a sizeable number of students are only interested in cheating and funnily some feel they are entitled to do so.

15. *Finally, what advice would you give to the young people, students, researchers/scientists and technologists?*

Be focused, be hardworking, be thorough, be a team player and work smart. There are no shortcuts in life.



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# ESS Quiz & Puzzles

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# Integrate Science Puzzle

*Kwaku Appiah-Kubi, PhD*

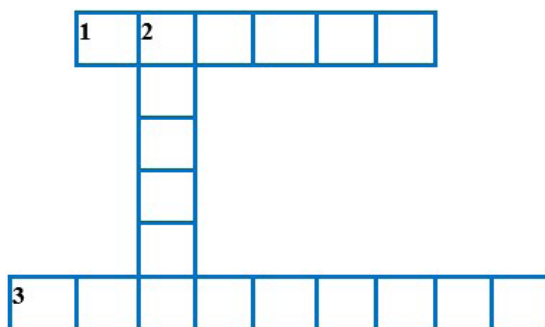
*Department of Applied Biology, C. K. Tedam University of Technology and Applied Sciences,*

*Navrongo, UK-0215-5321, Ghana*

## Worked example

### Matter

Use the diagram below and descriptions Across and Down to guide you to identify a suitable scientific term for **1**, **2**, and **5**.



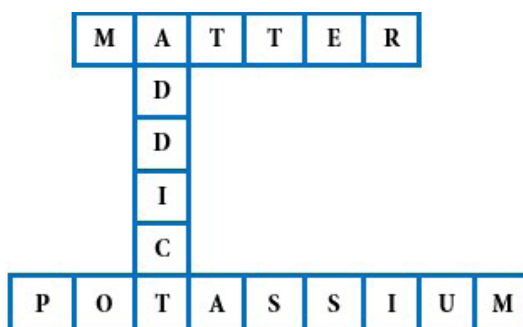
#### Across

1. Anything that has mass and can occupy space.
3. Has atomic number 19.

#### Down

2. One exhibiting a compulsive, chronic, physiological or psychological need for a habit-forming substance, behaviour, or activity.

Answer



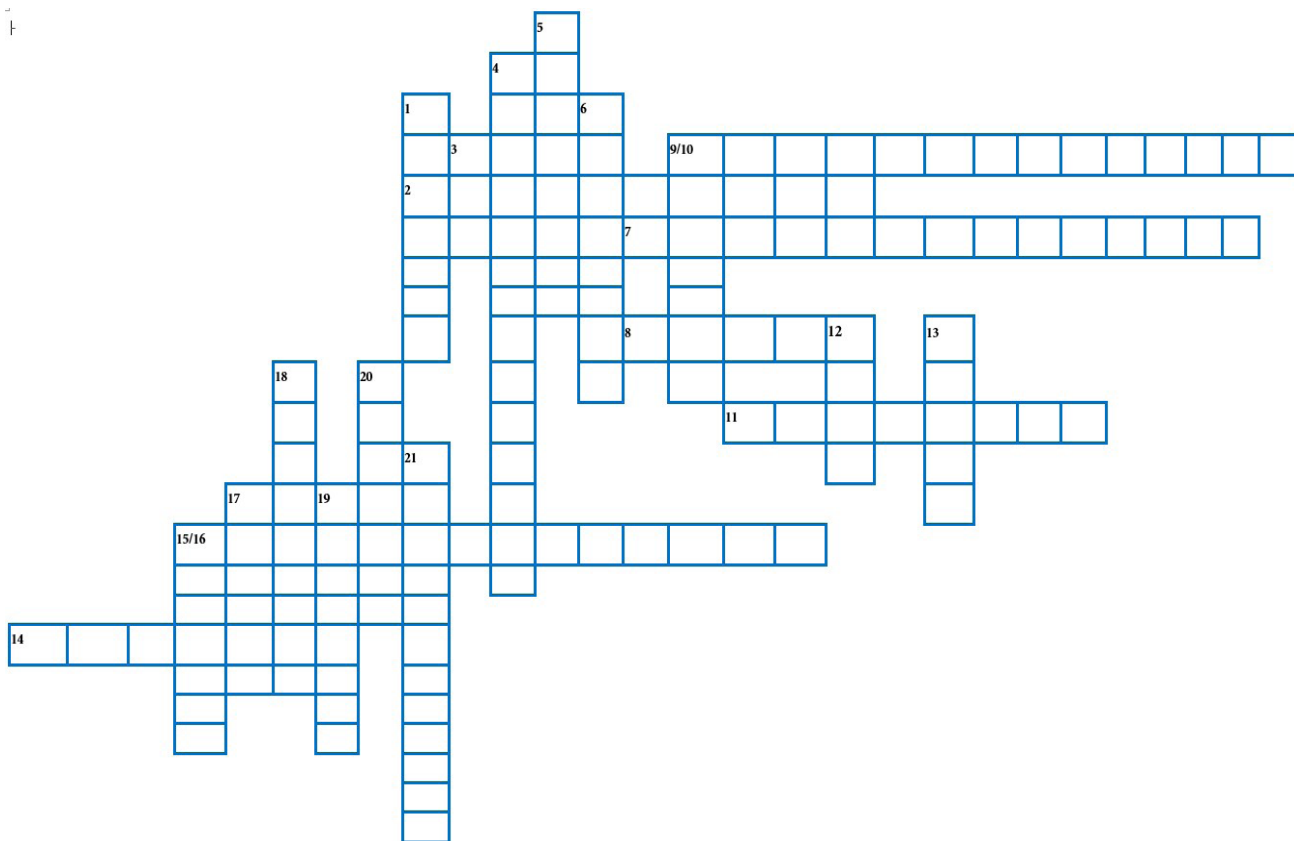
Summary

#### Across

1. Matter
3. Potassium

#### Down

2. Addict



### Assignment on Nutrition

Use the diagram below and descriptions Across and Down to guide you to identify a suitable scientific term for 1-21.

#### Across

2. An organic compound that contains the elements carbon, hydrogen and oxygen, which the ratio of oxygen to hydrogen is 1:1 and the general formular is  $C_x(H_2O)_y$ , where x and y are whole numbers.
7. A simplest form of sugar and the most basic units of carbohydrates.
8. A group of substances comprising fatty, greasy, oily, and waxy compounds that are not soluble in water and soluble in nonpolar solvents, such as hexane, ether, and chloroform.
9. A long chain polymeric carbohydrates composed of monosaccharide units bound together by glycosidic linkages.
11. The application of the science of nutrition to the human being in health and disease.
14. Medical specialist who can remove plaque build ups on your teeth.
15. They are nutrients that required in minute quantities by the human body. Examples are vitamins and minerals.

#### Down

1. A disaccharide, a molecule composed of two monosaccharides: glucose and fructose.
3. A lipid that is normally in a solid state at room temperature.
4. They are nutrients that are required in large quantities and include carbohydrates, proteins, and lipids; all of which provide energy.
5. An indigestible material that passes through the alimentary canal almost unchanged.
6. A multibranched polysaccharide of glucose that serves as a form of energy storage in animals, fungi, and bacteria.
10. An organic compound that contains carbon, hydrogen, oxygen, and nitrogen. Some contain phosphorus and sulphur.
12. The sum of food consumed by a person or other organism.
13. An adult who has a Body Mass Index over 30.
16. A sugar made of two glucose molecules bound together.
17. An organic compound and a form of vitamin B<sub>3</sub>, an essential human nutrient.
18. A monosaccharide sugar that has the same chemical formular as glucose, as sweet as glucose, and about 65% as sweet as sucrose.
19. A simple ketonic monosaccharide found in many plants, where it is often bonded to glucose to form the disaccharide sucrose. Fructose
20. A monosaccharide and is the primary metabolite for energy production in the body.
21. A process of modifying the molecular structure of a protein or nucleic acid.

**Submit your answers to  
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