



# **RESEARCH REPORT**

## **2020/2021**

**ORID**

OFFICE OF RESEARCH,  
INNOVATION & DEVELOPMENT

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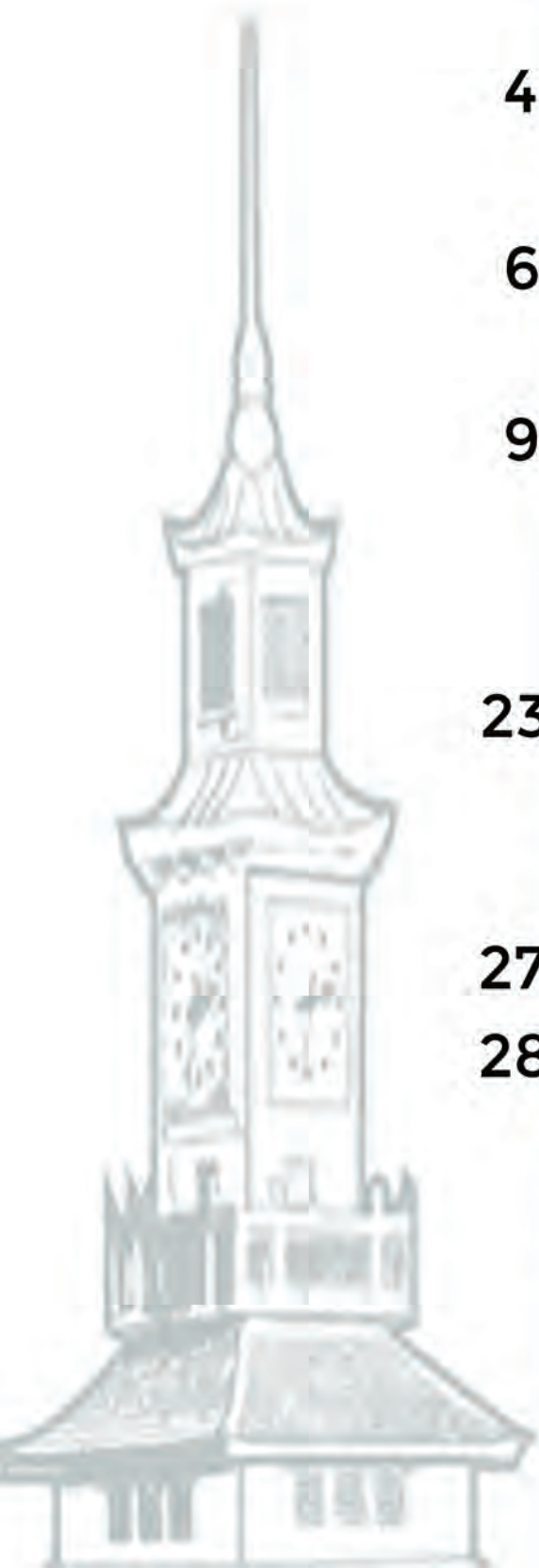
## RESEARCH SUPPORT

### SERVICES

- Office of Research, Innovation and Development (ORID)
- University of Ghana Computing Systems (UGCS)

### RESOURCES

- Electronic Resources for Research





# FOREWORD



*Professor Nana Aba Appiah Amfo*  
*Vice-Chancellor*

We welcome our stakeholders to explore the range of research endeavours underway at the University of Ghana (UG).

Research intensified over the past year across all Colleges, with a renewed mandate to researchers to address global challenges and be better prepared for the next pandemic.

Prompted by the dynamics of the global response to the COVID 19 pandemic, the direction and intensity of research collaboration in Africa remains a priority for researchers at UG. Determined to make a difference in addressing the daily challenges of our populace we continued proactive engagement with stakeholders in government, and within communities where our research outcomes impact positively.

Our agenda for massive transformation of the student experience at the University of Ghana, bodes well for nurturing young scholars to drive our research agenda.

The University is committed to the task of education and producing impactful research outcomes.

We are grateful to our numerous stakeholders who make our work feasible and worthwhile.



# RESEARCH @ UG

*Professor Felix Ankomah Asante*

*Pro Vice-Chancellor*

*Research, Innovation and Development*

The UG research agenda persevered through local and global challenges during the year (2020-2021). While medical science and public health interventions prevailed largely with vaccine inventions, researchers must now contend with ending one pandemic and preparing the world for future pandemics.



At the Office of Research, Innovation and Development (ORID) we recognize the onus on researchers to address emerging critical matters which are inter linked and require cross cutting solutions. To this end, policies on Safeguarding; Equality, Diversity and Inclusion; Modern Slavery and Innovation are being developed to ensure that UG meets international best practice.

Research studies at UG are underway to decipher the immunological impact of SARS COV 2 variants in pandemic control and a review of the ethical dimensions of COVID 19 research in Africa may provide a blueprint for research review authorities.

As widely acknowledged, preparation for the next pandemic is foreshadowed by point in time rather than probability. Being better prepared remains a priority for applied research at the University of Ghana.

During the year under review, UG partnered with industry to enhance research and training through technology. This created platforms to enhance entrepreneurship, support novel discoveries, promote inventions and harness solutions, fit for purpose. The University's research performance in relation to the UN/SDGs ranked in the top tier of the Times Higher Education (THE) rankings for 2020 -2021. Our strongest contributions relate to SDG1; on Poverty, SDG3; Good Health and Well-Being, SDG9; Industry, Innovation and Infrastructure and SDG16; Peace, Justice and Strong Institutions.

The University of Ghana Research Fund (UGRF) continues to support multi-disciplinary research projects and provide travel grants for faculty to engage with international research networks.

In recognition of shared objectives, donor funding and collaborative research have remained at the forefront of scientific agenda, and the University of Ghana is deeply indebted to our donor partners for their benevolence.

We applaud the work of UG's researchers, and research partners at home and abroad.



# RESEARCH BY COLLEGES

Access list of research via; <https://orid.ug.edu.gh/research-colleges>

College of Basic and Applied Sciences; <http://tiny.cc/db5yuz>

College of Health Sciences; <http://tiny.cc/fb5yuz>

College of Humanities; <http://tiny.cc/kb5yuz>

College of Education; <http://tiny.cc/lb5yuz>



# RESEARCH PERFORMANCE

## UNIVERSITY OF GHANA WORLD UNIVERSITY RANKINGS

### 2021 TIMES HIGHER EDUCATION IMPACT RANKINGS ON THE SDG's

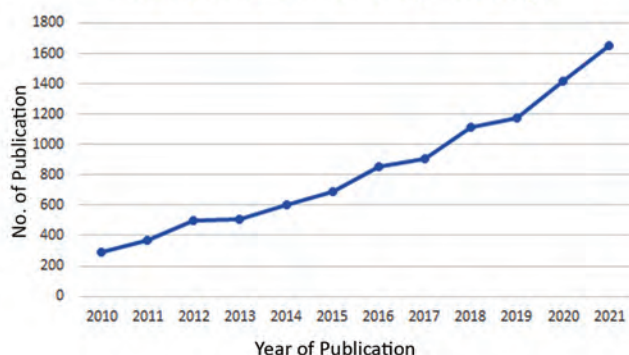




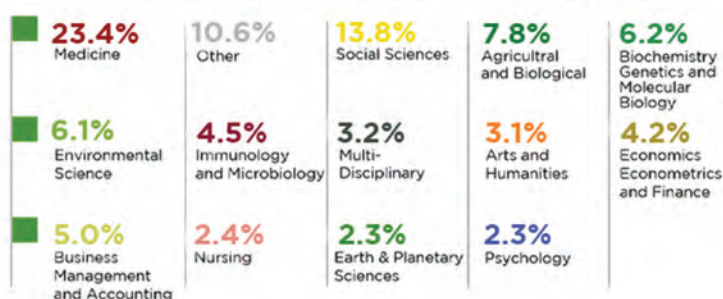
# PUBLICATIONS

## PUBLICATIONS IN SCOPUS

Publications Trend by Faculty



Contribution to Publication Output by Discipline



Selected performance indicators of Publications (2016 - 2021)

**6,769**  
Scholarly Output

**3,807**  
Authors

**1.10**  
Field Weighted Citation Impact

**46,957**  
Citation Count

**6.9**  
Citation Per Publication

**51**  
h5-Index

**21.8%**

Publication in top 10% journals by CiteScore

**9.4**

Number of publications in the top 10% most cited publications worldwide is 637

**1.10%**

Field Weighted Citation Impact (FWCI) of publications (above the World's average by 14%)

**58.5%**

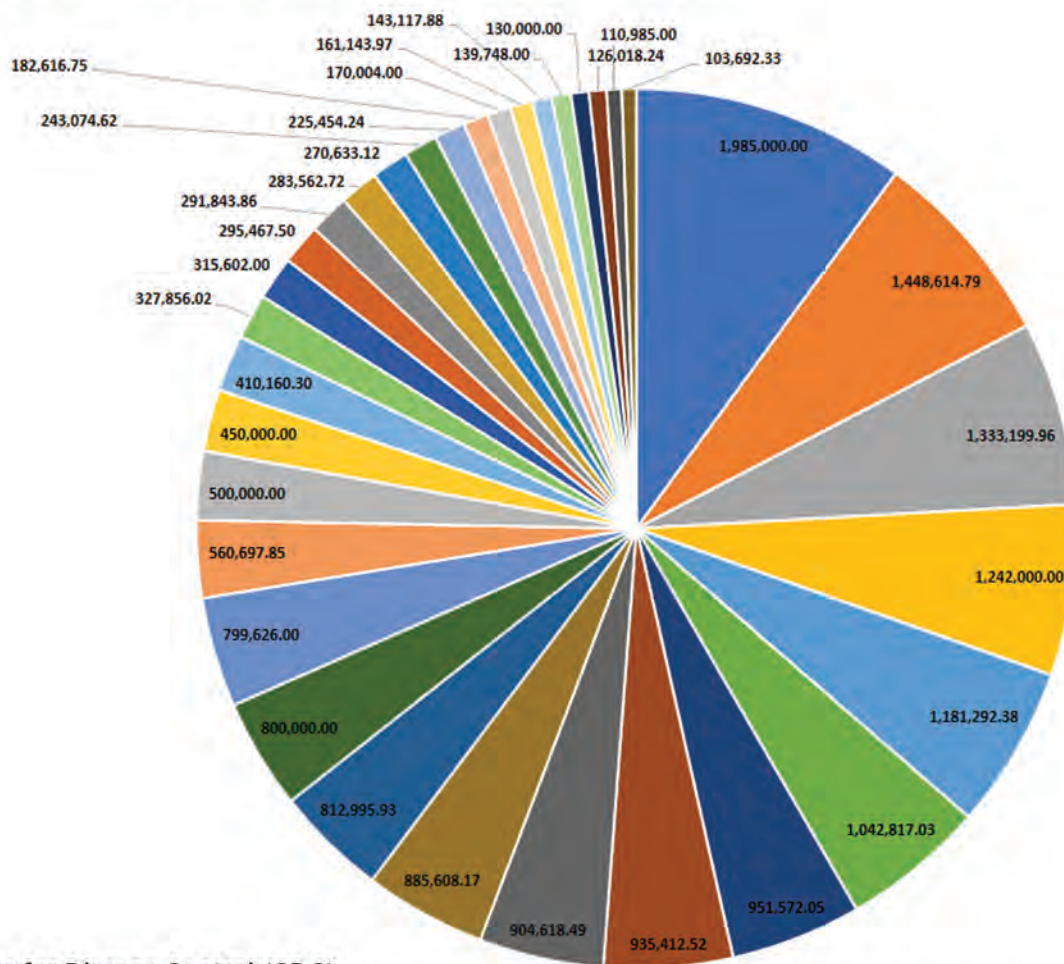
Publications co-authored with Institutions internationally



# FUNDING

## EXTERNAL RESEARCH FUNDS

### DISTRIBUTION OF MAJOR GRANTS



- Centre for Disease Control (CDC)
- DANIDA Fellowship Centre (DFC)
- Bill and Melinda Gates Foundation
- National Institute for Health Research (NIHR)
- EDCTP/Africa CDC
- U.S. Agency for International Development (USAID)
- Rockefeller Foundation
- Open Society Institute
- National Research Foundation COVID-19 Africa Rapid Grant Fund
- PATH
- Engineering and Physical Sciences Research Council (EPSRC)
- Arts and Humanities Research Council
- British Academy
- World Health Organisation (WHO)
- Chemonics International Inc.
- Australia Awards-African Grants
- International Development Research Centre (IDRC)
- National Institute of Health (NIH)
- Department of Health and Human Services, US
- European Union/Commision
- Department for International Development (Dfid), UK
- Options Consultancy Services Limited
- Andrew Mellon Foundation
- UKRI
- Ford Foundation
- Mohammed VI Polytechnic University, Morocco
- AXA Research Fund
- German and Aerospace Centre
- Global Challenges Research Fund (GCRF)
- WASCAL and German Government
- Deutsche Gesellschaft fur Internationale Zusammenarbeiten (GiZ)
- PASET Executive Board
- Scottish Funding Council (SFC)
- European Research Council Executive Agency (ERCEA)



## OTHER DONORS

- European and Developing Countries Clinical Trials Partnership (EDCTP)
- Wageningen Centre for Development Innovation (WCDI)
- Research England
- Mastercard Foundation
- Leverhulme Trust and The Royal Society
- Community Foundations of Canada (CFC)
- Defense Advanced Research Projects Agency (DARPA)
- Social Sciences and Humanities Research Council (SSHRC)
- Institute of Development Studies
- Nagel Institute for the Study of World Religions
- Tides Foundation
- President and Fellows of Harvard College
- Norwegian Agency for Development Cooperation (Norad)
- Ares Trading, SA
- British Council
- SouthSouthNorth Projects (Africa)
- Health Information Systems Programme (HISP)
- ISSACHAR Fund
- Medicines for Malaria Venture (MMV)
- World Resources Institute (WRI)
- UNDP
- International Centre for Insect Physiology and Ecology
- Leona M. and Harry B. Helmsley Charitable Trust
- International Food Policy Research Institute (IFPRI)
- Federal Ministry of Education and Research (BMBF)
- National Geographic Society
- National Institute of Genetics
- Cambridge-Africa ALBORADA Research Fund
- UN Women
- Nippon Paint Co. Ltd
- Royal Academy of Engineering
- Medical Research Council
- Star Ghana Foundation
- SumOfUs
- Academy of Medical Sciences
- Prudential Insurance Ghana Limited
- University of Manchester
- Paris Dauphine Foundation
- French Agricultural Research Centre for International Development (CIRAD)
- Operation Smile Ghana
- National Foundation for the Centers for Disease Control and Prevention, Inc.
- World Universities Network (WUN)



# INTERNAL GRANT PORTFOLIO

## UNIVERSITY OF GHANA RESEARCH FUND (UGRF)

The UGRF provides seed funding for early to mid-career academics and multidisciplinary research groups

Total Value  
(USD)

1,108,000

## FACULTY DEVELOPMENT FUND

The development fund provides doctoral scholarships

Total Value  
(USD)

300,000

## CONFERENCE GRANTS

Funds colloquia organized locally and facilitates international travel to promote visibility of UG's research

Total Value  
(USD)

749,872

reporting interval: 2010 - 2022





## *Special Feature*

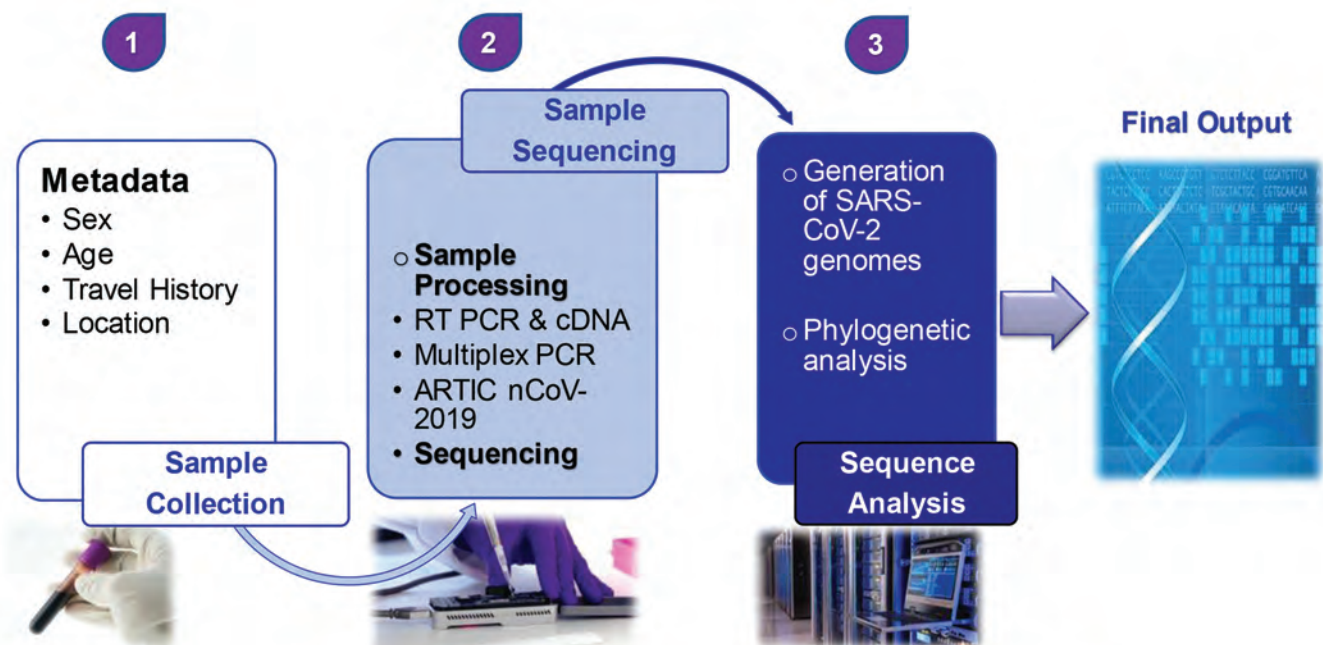
### **Combating the COVID-19 Pandemic A Diagnostic, Preventive and Management Analysis**

The University of Ghana, in collaboration with the Ministry of Health, played an active role in the national response and case management of the COVID-19 pandemic.

The Noguchi Memorial Institute for Medical Research (NMIMR), the West African Centre for Cell Biology of Infectious Pathogens (WACCBIP) and the School of Public Health (SPG), as well as the Department of Psychology and Careers and Counselling Centre, among other units at UG, made significant contributions to combat the pandemic.

A summary of the pandemic related research is presented in this report.





Workflow of SARS-CoV-2 Sequencing and Analysis



COVID-19 Testing Labs





## **CONTRIBUTION OF THE NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH (NMIMR) IN THE NATIONAL AND SUB-REGIONAL PUBLIC HEALTH RESPONSE AGAINST COVID-19**

The Noguchi Memorial Institute for Medical Research (NMIMR) of the University of Ghana, has been a major front-liner in the COVID-19 pandemic response, providing leadership and innovation in Ghana, the West African sub-region and globally.

In February 2020, the NMIMR began COVID-19 testing in returning international travellers and patients with suspected symptoms and confirmed the first two cases of COVID-19 in Ghana in March 2020. This led to an important policy decision of the Government of Ghana (GOG) through the Ghana Health Service (GHS) to establish targeted contact tracing in areas with high transmission as more cases were confirmed.

With increasing daily new cases, the NMIMR introduced 'the pooling and testing' innovation and became the first Institution globally to use the technique in testing COVID-19. To help decentralize and expand COVID-19 testing, the institute trained several public and private laboratories across the country to carry out testing.

As of May 2022, a total of 513,628 samples had been tested at the NMIMR, with 59,780 (11.64%) being positive. As yet, no other single institution has tested as many COVID-19 samples in Ghana. The Institute has also been at the forefront of generating SARS-CoV-2 genomic surveillance data to inform the GHS of variants being imported and those driving community spread in Ghana.

The NMIMR has been designated a Regional SARS-CoV-2 Genomic Sequencing Hub by the Africa Centre of Disease Control and Prevention (Africa CDC) and the World Health Organisation (WHO) to provide sequencing support to Ghana, Togo, Benin, Liberia and Sierra Leone.

As of May 2022, about 4,000 SARS-CoV-2 samples had been sequenced from the different countries and data shared with their respective public health authorities to inform their COVID-19 policy decisions. In addition, the Institute has also trained several local and international (Togo, Benin, Guinea, Liberia, Sierra Leone, Cape Verde, Mauritania and Cote d'Ivoire) laboratory personnel in SARS-CoV-2 genomic sequencing and data analysis and supported the establishment of SARS-CoV-2 sequencing laboratories within both the public and private sector.

Further, the NMIMR played a pivotal role in supporting the Ghana Food and Drugs Authority by evaluating several PCR test kits, ribonucleic acid (RNA) extraction kits, antigen/antibody rapid test kits as well as oropharyngeal and nasopharyngeal swabs.

Finally, the Institute is conducting several studies aimed at drug discovery, understanding the transmission dynamics and immunological responses to natural COVID-19 infections and vaccines in the Ghanaian population.



## **A. SPECIALIZED DIAGNOSTICS IN SUPPORT OF NATIONAL PUBLIC HEALTH EFFORTS**

### **COVID-19 Testing**

Prior to the arrival of COVID-19 to the shores of Ghana, the NMIMR made a proactive decision and began the optimization of real-time polymerase chain reaction (RT-PCR) methods for the detection of the novel coronavirus (SARS-CoV-2), reported to be causing severe acute respiratory illness, (later termed coronavirus disease 19 or COVID-19) in Wuhan, China.

In collaboration with the Ghana Health Service (GHS), NMIMR began screening for COVID-19 in suspected hospital samples in early February 2020. This led to the confirmation of the first 2 cases in Ghana in March 2020. From then on, the NMIMR became the first and only testing laboratory for COVID-19 in the country throughout the lock-down period, with samples being transported from across the country, by vehicles, aircraft and drones, for testing. Later, the Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR) began testing for COVID-19 as well, but since nearly 50% of cases in the country were coming from the Greater-Accra region alone, the number of samples being tested at the NMIMR was still enormous. At the peak of the first and second waves of transmission in Ghana, the Institute was receiving more than 5,000 samples daily through the GOG contact tracing programme.

The NMIMR operated a 24 hour, 7 days a week testing service with three teams each comprising over 100 personnel working a 12-hour rotation shift system, in order to meet the increased COVID-19 testing demand. As the outbreak subsided and more laboratories became capable of testing - mostly through NMIMR training - the shift system was abolished, and the teams were adjusted in accordance with the needed workload. As of May 2022, the NMIMR had tested a total of 513,628 samples with 59,780 (11.64%) being positive making it the single institution that has tested most of the COVID-19 samples in the country.

### **SARS-CoV-2 Genomic Sequencing: Community and Traveller Samples**

In addition to COVID-19 testing, the NMIMR has also been at the forefront of generating SARS-CoV-2 genomic sequencing data to understand the evolution and transmission dynamics of new variants in imported infections in the local Ghanaian population. The first SARS-CoV-2 genomic sequencing to identify imported and circulating variants in the country was carried out at the NMIMR in collaboration with the West African Center for Cell Biology of Infectious Pathogens.

The NMIMR continues to play a leading role in the identification of existing and emerging variants in the population. For example, the prompt genomic sequencing and identification of important variants of concern (VOCs) such as Omicron by the NMIMR, and efficient communication to the GHS and key stakeholders, led to a more effective public health response and sensitization of the public. As of May 2022, 465 SARS-CoV-2 genomic sequences from imported cases had been sequenced at the NMIMR. By leveraging the existing integrated Influenza and SARS-CoV-2 Surveillance Network, contact tracing, hospital and walk-in testing samples, the NMIMR has contributed over 2000 genomic sequencing data to provide insights into SARS-CoV-2 transmission dynamics in the country.



## **B. NOGUCHI WHO-AFRICA CDC REGIONAL SARS-COV-2 GENOMIC SEQUENCING HUB**

In recognition of the Institute's leadership and excellence in the sub-region, the NMIMR has been designated as one of the nine Regional SARS-CoV-2 Genomic Sequencing Hubs in the continent by the Africa Centre for Disease Control and Prevention (Africa CDC) and the World Health Organisation. This comes under the Africa Pathogen Genomics Initiative (Africa-PGI), in which the NMIMR has been assigned to provide SARS-CoV-2 genomic sequencing support to five countries - Ghana, Togo, Benin, Liberia and Sierra Leone - with support from the Africa CDC and the WHO. Samples from the supported countries are shipped to the NMIMR for sequencing, after which data is sent back to the respective country's public health authorities and ministries to inform their policy decisions. Through this initiative, the NMIMR has sequenced about 4,000 SARS-CoV-2 samples for the five countries, since February 2021.

## **C. TRAINING TO BUILD CAPACITY OF LABORATORY AND PUBLIC HEALTH PERSONNEL**

As the COVID-19 transmission intensified globally and in Ghana, the NMIMR quickly saw the need to assist in building the capacity of laboratory personnel in order to decentralise testing, increase output and ensure sustainability. This led to the roll out of several training activities to support both private and public health laboratories in carrying out COVID-19 testing.

### **Sample Collection, Biosafety and Biosecurity Training**

Having recognised the essential role of biosafety and biosecurity in effective public health response to outbreaks, the NMIMR provided training and capacity building in proper sample collection, transportation, biosafety and biosecurity for several public and private laboratory personnel from the National Public Health Laboratory (NPHRL), Accra. The trainings were conducted both at the NMIMR and some at the site of the respective laboratories. The laboratories trained include NPHRL-Accra, Tamale Public Health laboratory, Centre for Scientific and Industrial Research (CSIR), Nyaho Medical Centre, and MDS Lancet, among others.

### **COVID-19 Testing Capacity Building**

The NMIMR conducted training and capacity building in molecular diagnosis of COVID-19 for several public and private laboratories to support the decentralisation of COVID-19 testing in the country. Some of the laboratories trained include NPHRL-Accra, CSIR, Nyaho Medical Centre, MDS Lancet, Affia Nkwanta Hospital, Sekondi Public Laboratory, Veterinary Services Directorate Pong, Tamale, Trust Hospital, Veterinary Services Department laboratory, Accra, 24/7 Doctor online, East Wing Clinic, UGMC, Alabaster Laboratory, Essence Medical Laboratory, Airport Clinic, Ashanti-Gold and Anglogold Ashanti. Altogether, the NMIMR has so far supported the establishment of 45 other testing centres across the country.

### **Local Capacity Building in Genomic SARS-CoV-2 Sequencing and Bioinformatics**

In recognition of the crucial role of genomic surveillance in monitoring the spread of SARS-CoV2 and to guiding effective public health decisions, the NMIMR has played a key role in building sequencing capacities in different laboratories both in Ghana and the sub-region. The Institute provided genomic sequencing and bioinformatics training to laboratory personnel of the NPHRL Accra and the Kwame Nkrumah University of Science and Technology Infectious Disease and Genomics Laboratory (KNUST-IDGL), Kumasi.



This initial training at the NMIMR was then followed up with on-site sequencing platform installation and further training at both the NPHRL and KNUST-IDGL to get the two laboratories started with SARS-CoV-2 genomic sequencing. Currently, these laboratories are both generating data and contributing to Ghana's SARS-CoV-2 genomics data output.

### **International Capacity Building in Genomic SARS-CoV-2 Sequencing and Bioinformatics**

The NMIMR has also played a pivotal role in building genomic sequencing capacity across the West African sub-region. The Institute has provided training to build regional and national capacity in SARS-CoV-2 genomic sequencing to 10 participants from eight (8) different countries namely Togo, Benin, Guinea, Liberia, Sierra Leone, Cape Verde, Mauritania, and Cote d'Ivoire. In addition, the Institute has also supported the on-site installation of the Minlon sequencing platform and training of personnel at the National Public Health Laboratory in Liberia. This training led to the first ever SARS-CoV-2 genomic data generated in-country in Liberia.

### **COVID-19 Test Kits and Equipment Evaluation for FDA Approval Purposes**

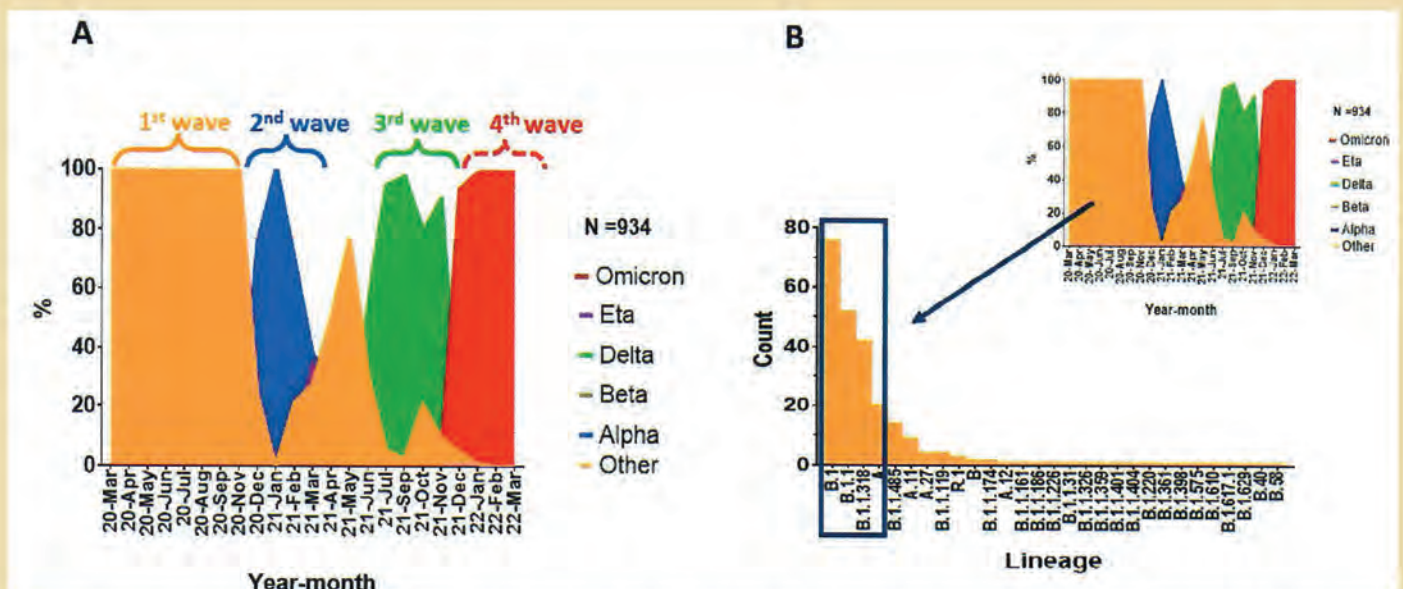
The NMIMR played a key role in the evaluation of several COVID-19 test kits, reagents, and equipment, mainly on behalf of the Food and Drugs Authority (FDA) as part of their approval processes prior to permitting their importation or use in the country. Those evaluated by the NMIMR since the COVID-19 outbreak in Ghana include 26 PCR kits for SARS-CoV-2 detection, 39 antibody test kits, 30 antigen test, 10 RNA extraction kits, and 12 naso and oropharyngeal swabs. All these were evaluated according to the manufacturers' instructions. Other equipment such as centrifuges, glove box, PCR workstations, microcentrifuges and RNA extractors were also sent to the Institute by the FDA and were evaluated for their suitability to process samples as indicated by the manufacturers. Evaluation reports on each of these were sent to FDA and respective suppliers to inform their further actions and decisions on the product. Altogether, through these evaluation exercises, the NMIMR supported the FDA in protecting the Ghanaian health sector against inferior or sub-optimal COVID-19 testing related reagents and equipment.

## **D. RESEARCH**

### **Genomic Surveillance of SARS-CoV-2 in Ghana**

The Institute has conducted different studies in different parts of the country aimed at understanding the emergence and transmission dynamics of SARS-CoV-2. These studies used samples from the existing influenza sentinel sites, hospital collection and contact tracing. The patterns of lineages seen in these samples were quite similar, depicting the global trends where the initial spread of the virus was by multiple variants until the emergence of variants of concern (VOC). The genomic data strongly supports the epidemiological data of surges in cases in the country each time the VOCs got introduced into the population with Alpha, Delta and Omicron driving the second, third and fourth waves of transmission respectively. We find some imported VOCs such as Beta and Gamma rapidly going extinct in the Ghanaian population, and the reasons for this do not seem clear at the moment. It could be due to effective public health interventions that may have stopped their spread, or some peculiar host genetic factors. These warrant further investigations. Our other genomic epidemiological studies have also highlighted the co-circulation of SARS-CoV-2 and Influenza in some populations, with seasonal changes in their distributions.

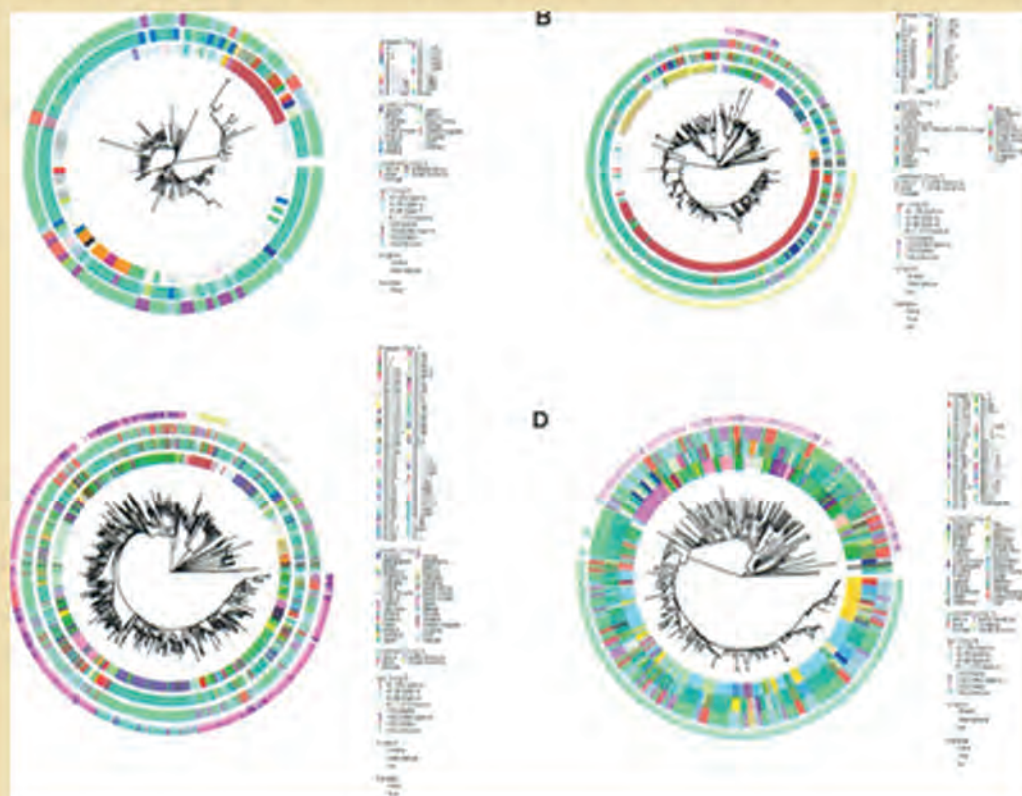




**Figure 1. SARS-CoV-2 lineages driving community outbreaks in Greater Accra region from March 2020 to March 2021. A total of 935 sequences from samples collected from March 2020 to March 2022. (A) Four major outbreaks (waves) are indicated with the initial wave driven by multiple SARS-CoV-2 lineages described here as 'Other'. The second, third and fourth waves were mainly driven by the Alpha, Delta and Omicron variants, respectively. (B) SARS-CoV-2 lineages comprising the 'Other' group (mainly: B. 1, B. 1.1, B. 1.1.318 and A lineages indicated by a dark blue box)**

## Tracking the Importation of SARS-CoV-2 Variants into Ghana

The NMIMR are conducting studies that seek to understand the dynamics of variant importation into the country, particularly through the neighbouring countries but also globally. We found a clear importation of VOCs preceding their community spread in Ghana, suggesting the need for stricter adherence to quarantine should new VOCs emerge in other parts of the world since their importation into the country is highly likely.



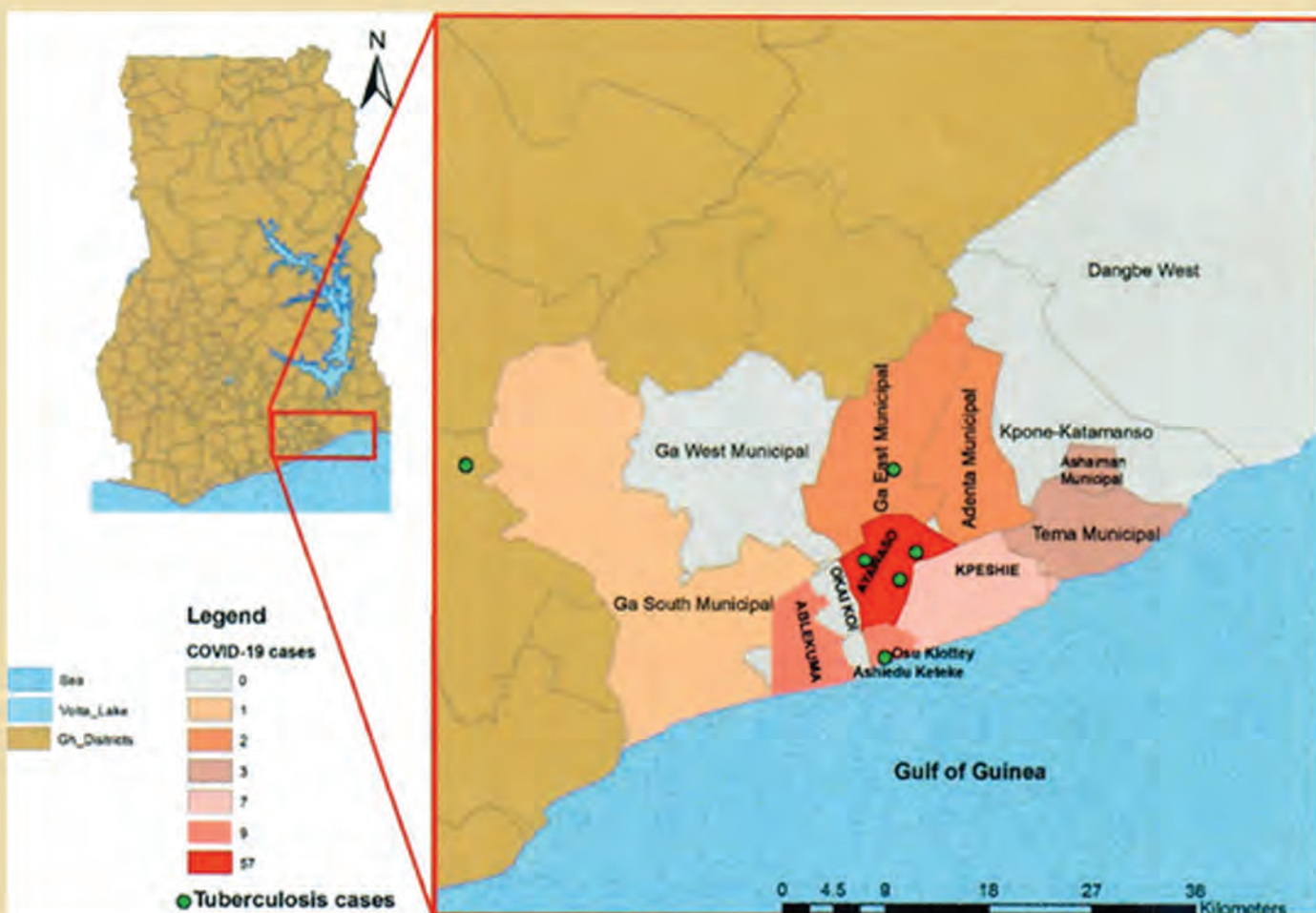
**Figure 2: Phylogeny of Ghana SARS-CoV-2 sequences and closely related genomes from international samples. Maximum likelihood phylogenetic tree of (A) wave 1 (B) wave 2 (C) wave 3 and (D) wave 4 Ghana sequences and their closest global samples. Samples' lineages and origin are indicated in the rings. Tip shape indicates whether the sample was collected from travellers. Type A lineages are lineages that were first detected in travellers and possibly precede community waves.**



## SARS-CoV-2 Tuberculosis Co-infection Studies

COVID-19 shares similar symptoms such as fever, cough, and shortness of breath, with other viral and bacterial infections. This means that co-infections may be missed. We therefore leveraged samples collected during the early stages of the pandemic in Ghana to perform differential diagnosis (i.e. performing different tests) to ascertain the true etiology of symptoms being reported by patients. Of the 774 suspected samples tested, 1 tested positive for COVID-19 with positive cases, while 6 (0.8%) were positive for pulmonary tuberculosis, one of which was resistant to a commonly used potent anti-TB drug, rifampicin.

The TB positive results were immediately communicated to the National Tuberculosis control Programme (NTP) for follow-up and the commencement of antiTB drug therapy. There were two TB and COVID-19 coinfection. This study highlighted the untold stories of undiagnosed TB in our communities. The detection of TB among COVID-19 suspected cases further establishes the need for differential diagnosis. Further, the study informed the NTP to provide onsite capacity building for bidirectional testing for TB and COVID-19 across the country.



**Figure 3: Geographical density of COVID-19 and distribution of TB cases within the sampling period. We used ArcMap employed in ArcGIS v10.1 to construct a visual plot of the distribution of COVID-19 and TB cases in the Greater Accra region. The Greater Accra region was divided into districts with the Accra Metropolitan area being sub-divided into 6 geographical subdistricts (Ayawaso, Ablekuma, Okalkol, Osu Klotey, Ashiedu Keteke and Kpeshie).**



## **SARS-CoV-2 Antibody Seroprevalence and its Determinants in Ghana: A Nationwide Cross-Sectional Survey**

Initial surveillance and estimates during the COVID-19 pandemic focused on those with symptoms or severe disease; surveillance estimates did not include asymptomatic infections. Estimates of SARS-CoV-2 transmission rates have significant public health policy implications since they shed light on the severity of illness in various groups and aid in the strategic deployment of diagnostics, treatments, and vaccination. However, no population-based investigation has been conducted in Ghana to identify the true prevalence of SARS-CoV-2 total antibodies (IgG and IgM). We conducted a population-based study to evaluate the seroprevalence of SARS-CoV-2 antibodies and to identify risk factors in Ghana. We detected IgG antibodies against SAR-COV-2 in 3,476 of the 5,348 participants, indicating a weighted seroprevalence of 67.10%. Almost two thirds of study participants aged five years and older were exposed to the SARS-CoV-2 virus. In comparison to those aged 5-59, the seroprevalence is lower in the elderly (60 years and older). Virus transmission is more likely in urban than rural areas, hence strict adherence to CO VID-19 prevention measures needs to be maintained.

## **Screening African Herbal Extracts for Anti-SARS-CoV-2 Activity**

Currently, there is no drug that is widely available in Ghana targeting the replication of SARSCoV-2, the virus that cause COVID-19. Drugs developed in the US like Paxlovid are expensive and not readily accessible in Ghana. The Institute established the first culture system for SARS-CoV-2 in the country that enables us to grow the virus in the laboratory, perform drug screens and test the efficacy of various neutralizing antibodies. With this system, we have grown and archived all the SARS-CoV-2 variants that have been detected in Ghana. In collaboration with the Centre for Plant Medicine Research (CPMR) at Mampong, we are currently screening a set of 100 herbal extracts and compounds for their ability to inhibit the replication of the virus. This process involves cultivation of the virus in cell lines and growing the live virus with and without the extracts or compounds. It is our hope that this project will yield a few homegrown compounds that could prove useful for treating COVID-19.

## **E. FUNDING SOURCES AND PARTNERS**

- Government of Ghana
- Ghana Health Service (GHS)
- Ministry of Health (MoH)
- Bill and Melinda Gates Foundation
- World Health Organization (WHO)
- African Academy of Sciences
- Africa Centre for Disease Control and Prevention
- African Society for Laboratory Medicine
- European and Developing Countries Clinical Trials Partnership
- The Pan-African Network for Rapid Research, Response, Relief and Preparedness for Infectious Diseases Epidemics (PANDORA-ID-NET funded by EDCTP)
- Fleming Fund through the SEQAfrica project.



# COVID-19 RESEARCH AND IMPACT AT THE WEST AFRICAN CENTRE FOR CELL BIOLOGY OF INFECTIOUS PATHOGENS (WACCBIP)

The West African Centre for Cell Biology of Infectious Pathogens (WACCBIP) undertook COVID-19 research in several areas. In tracking the variation of the virus in circulation, they performed a whole genome sequencing from patient samples and studied the population exposure to the virus by performing seropositivity/seroprevalence studies to detect the presence of antibodies against the virus in people. This provided information on how many people have been infected with the virus (within 1-3 months due to declining responses).

In collaboration with the African Centre of Excellence for Genomics of Infectious Diseases (ACEGID), Groupe de Recherche Action Santé (GRAS), the African Centre of Excellence for Biotechnical Innovations for the Elimination of Vector-borne Diseases (CEA/ITECH-MTV), and the African Centre of Excellence for Population Health and Policy (ACEPHAP), WACCBIP has led and undertaken extensive research on seroprevalence and genomic surveillance for SARS-CoV-2 in Ghana, Burkina Faso, and Nigeria.

The study, funded by the Rockefeller Foundation, the Foreign Commonwealth and Development Office of the United Kingdom (FCDO), Agence Française de Développement (AFD) and the Institut de Recherche pour le Développement (IRD), is one of the first and largest population studies of the Covid-19 pandemic in Africa since its outbreak, and it represents the most comprehensive analysis of seroprevalence and genetic diversity of SARS-CoV-2 in West Africa to date.

The epidemic waves were stratified based on the WHO COVID-19 Dashboard for Africa (<https://covid19.who.int/>) using months of test screening and diagnosis to identify short-term trends in seropositivity. Population data were divided into 4 waves as follows:

- Wave I: Apr 2020 - Oct 2020
- Wave II: Nov 2020 - May 2021
- Wave III: Jun 2021 - Nov 2021
- Wave IV: Dec 2021- March 2022
- Wave V: May 2022- Present

Activities conducted over the period include:

## Seroprevalence Testing

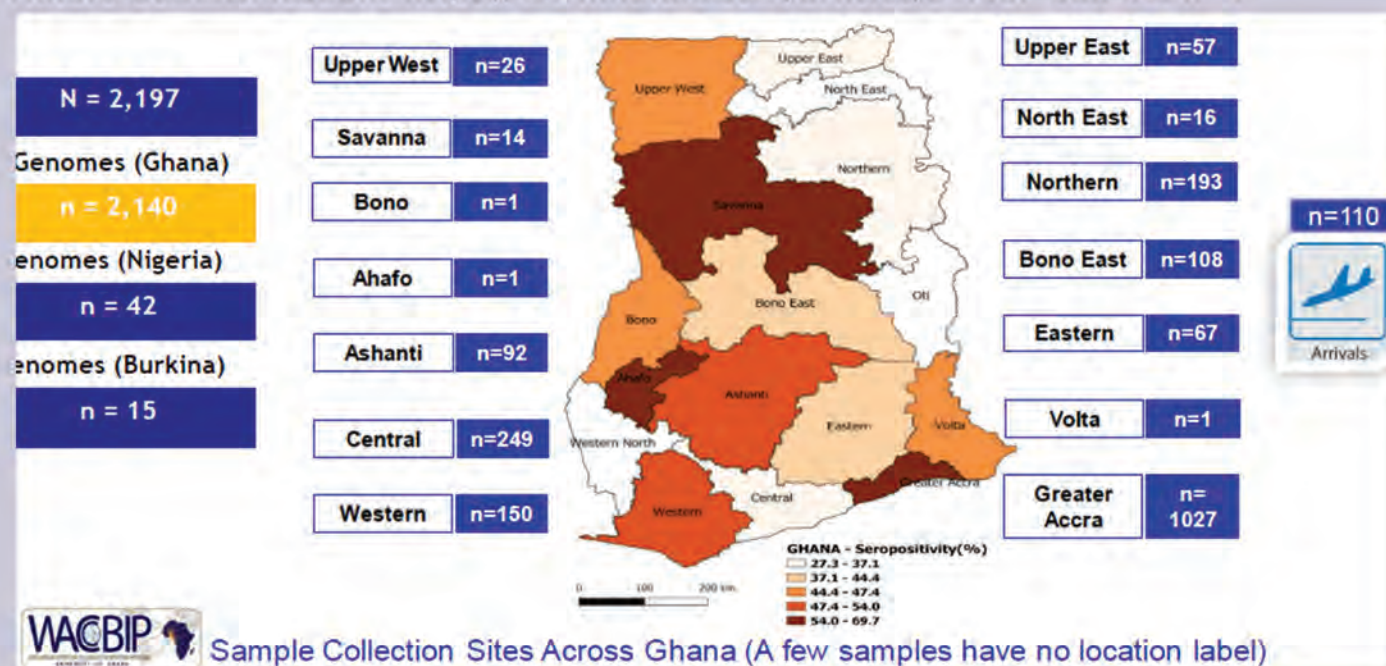
Over the last two years, WACCBIP, in collaboration with its partners, has undertaken the most comprehensive analysis of seroprevalence and genetic diversity of SARS-CoV-2 in West Africa. During the period, more than 20, 000 individuals across 3 countries (15K in Ghana, 7K in Nigeria and 1.5K in Burkina Faso) showed high levels of SARS-CoV-2 exposure; 19-80% (2020-2022), an indication that seropositivity rose sharply with each infection wave. The results of this study have been published in the first seroprevalence manuscript in the Wellcome Open Research journal, (<https://wellcomeopenresearch.org/articles/6-173>). A second multi-country manuscript will be submitted soon to the Lancet infectious disease journal and a third manuscript, with colleagues at the Noguchi Memorial Institute for Medical Research (NMIMR), is being prepared for submission.



## Tracking of Viral Variants and Waves

WACCBIP led one of the most intensive SARS-CoV-2 variant tracking efforts in Ghana and by extension West Africa – with over 1,700 sequences in GISAID (over 50% of all sequences) becoming the only centre with a wide coverage in sequences (all 16 regions) nationwide. This resulted in the identification of the first cases of circulating Alpha, Eta, Omicron, BA2, BA4 and other variants. The results of the sequencing process have been published in the following journals:

- First African manuscript of detailed genetic analysis of SARS-CoV-2 variations <https://journals.sagepub.com/doi/full/10.1177/1535370220975351>.
- Co-authors of published Africa-wide sequencing manuscript in Science <https://www.science.org/doi/10.1126/science.abj4336>.
- Second WACCBIP sequence manuscript published in Nature Communications <https://www.nature.com/articles/s41467-022-30219-5>.
- Co-authors in one of the first evidence of SARS-CoV-2 superinfection, published in Nature Communications <https://www.nature.com/articles/s41467-022-31247-x>



## Increased International Exposure for National and Regional Impact

WACCBIP was the first to identify key variants of concern such as Alpha and Omicron in local circulation in addition to the recently identified ongoing surge being driven by BA-4 omicron subvariant.

Therefore, to increase its visibility and international exposure on its novel research on the SARS-CoV-2, WACCBIP has organised several webinars and capacity building workshops to discuss and disseminate its research outcome

These include:

- Webinar series to encourage vaccination uptake [https://www.youtube.com/watch?v=\\_VNtZrAIDvA](https://www.youtube.com/watch?v=_VNtZrAIDvA)
- Webinar to Disseminate Study Results of SARS-CoV-2 Infections in West Africa: Project funded by the Rockefeller foundation (8th June 2022)
- SARS-CoV-2 Sequencing Training Workshop for Partner Laboratories in West and Central Africa (May 2022)
- Workshop on Genome Sequencing and Regulatory Affairs for biomedical and medical laboratory scientists of CHAG (April 2022) <https://www.waccbip.org/news-events/news/waccbip-chag-fcdo-organise-workshop-on-genome-sequencing-and-regulatory-affairs>



- WACCBIP-CHAG-FCDO Online Workshop for Laboratorians (February/March 2022)
- Webinar with TIBA partners on Genomic Analysis of SARS-CoV-2 (28th April 2021)
- Webinar on the status of COVID-19 in Ghana (28th October 2020) <https://t.co/tMQjODRQrE> Tracking SARS-CoV-2 in Ghana (26 August 2020)

### **Studying Host-Virus Interactions (Immunology)**

The Centre performed immunology studies to understand the cellular composition and kinetics over the course of infection; and compared the cellular composition and activation profiles between symptomatic and asymptomatic individuals. The research also focused on the kinetics of seroconversion and the identification of neutralising antibodies. This is done by Investigating cytokine responses and profile cytokines associated with symptomatic and asymptomatic individuals. A First manuscript under review has been submitted to a high impact journal, and a second manuscript is being prepared for submission. The success of the immunology studies has led to the setting up of a Ghana site for the Bill and Melinda Gates Foundation funded ***“Global Immunology and Immune Sequencing for Epidemic Response” (GIISER)*** programme. The programme will focus on Identifying pools of plasma (with known SARS-CoV-2 lineage) with strong broadly neutralization activity and the development of an antibody production pipeline that will aid in the response to COVID-19 and future pandemics.

### **Antiviral Drug Discovery**

There are ongoing efforts aimed at developing a scalable assay set-up which can perform medium to high throughput screening of purported antiviral compounds/preparations. So far, 37 herbal preparations have been screened showing that 50% of the herbal preparations have some ability to prevent SARS-CoV-2 infection in cell culture. Further screening and testing are ongoing to determine the efficacy of these herbal preparation in the fight against the pandemic.

### **Diagnostics Development**

WACCBIP has collaborated with colleagues at the University of Southampton to develop a cheap antigen, ELISA. The results have been published in the Journal of Infection [https://www.journalofinfection.com/article/S0163-4453\(21\)00492-8/fulltext](https://www.journalofinfection.com/article/S0163-4453(21)00492-8/fulltext). Efforts will be put in place to seek regulatory approval for the use of these point-of-care diagnostics that have been developed.

### **Institutional Impact: Grants Accrued for Research Activities**

WACCBIP has leveraged its work on COVID-19 to obtain several grants to support research in Ghana and beyond.

- Bill and Melinda Gates Foundation (GIISER Ghana): Using Antibody Technology to Decipher and Exploit the Immunological Impact of SARS-CoV-2 Variants (2021-2023)
- IRD/WANIDA: Molecular Epidemiology of SARS-CoV-2 in West African Countries (2021-2023)
- UK FCDO Ghana Partnerships Beyond Aid Programme: Comprehensive national surveillance for COVID-19 and building laboratory capacity for sustainable disease control in Ghana (2021-2023)
- Rockefeller Foundation: Tracking COVID-19 infection in West Africa to guide public health interventions (2021-2022)
- Cambridge Alborada Research Grant: Development of Serological Assays to study antibody responses in Ghanaian COVID-19 Patients (2020-2021)
- WELLCOME/FCDO Grant: Expansion and support of SARS-CoV-2 sequencing in West and Central Africa



# SCHOOL OF PUBLIC HEALTH

## COVID-19 FIELD EPIDEMIOLOGY AND LABORATORY TRAINING PROGRAMME

The School of Public Health's Department of Epidemiology and Disease Control in collaboration with the Ghana Health Service (GHS), Veterinary Service Directorate, United States Centers for Disease Control and Prevention (US-CDC), and the African Field Epidemiology Network (AFENET) has been training field epidemiologists for the past 15 years. The training programme, named the "The Ghana Field Epidemiology and Laboratory Training Programme" (GFELTP), at the advanced level, leads to the award of MPhil in Applied Epidemiology and Disease Control and a competency certification in Field Epidemiology and Laboratory Practice. The Ghana FELTP launched the frontline and the intermediate levels of the training in 2014 and 2019 respectively to complement the advanced level training.

The Ghana FELTP serves as the hub for competency-based training of field epidemiologists in English-speaking West Africa (except for Nigeria, which has its own advanced FELTP). The field epidemiology competencies gained by residents and graduates are critical national and subregional assets and were brought to the fore in response to the COVID-19 pandemic. Prior to Ghana recording its first two cases of COVID-19 in March 2020, the Ghana FELTP organized refresher training for its residents and alumni to enhance their capacity in the handling of epidemics, and as a preparatory measure for tackling COVID-19 in Ghana. The capacity of residents and alumni was enhanced in the application of Geographic Information System for effective contact tracing as well as Infection Prevention and Control - including donning and doffing of personal protective equipment (PPEs).

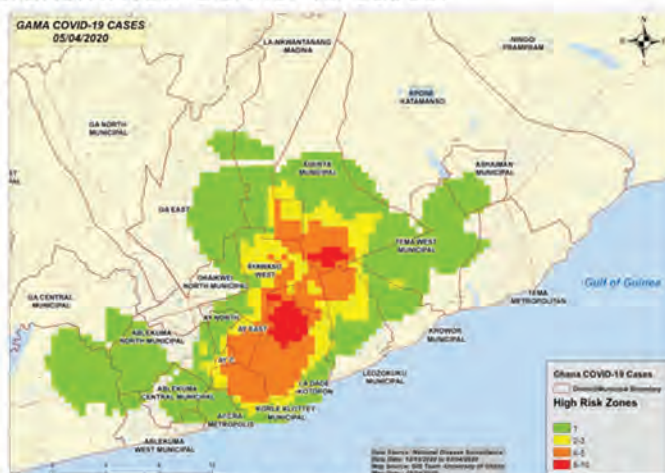
Following Ghana's declaration of the COVID-19 outbreak, residents, and alumni of the GFELTP programme, have been involved in responding to the pandemic under the various pillars of epidemic response. Ghana FELTP residents and alumni played key roles in response to Ghana's first set of cases leading to the outbreak. Their field epidemiology skills and competences became an asset and were brought to bear in response to the COVID-19 pandemic. They worked with the Disease Surveillance Division (DSD) of the GHS to put in place and begin contact tracing and contact monitoring via phone calls using a symptoms diary; and managed the COVID-19 data at the national level. These residents and alumni actively acted as District Supervisors for contact tracing for the COVID-19 response in the various districts in the country. A total of 77 residents and alumni - comprising 5 Cohort XII residents, 7 Cohort XIII residents and 65 alumni - participated in the response to the COVID-19 outbreak among some students and faculty of the university community. They were responsible for providing the following;

- Supporting the development of the COVID-19 response plan
- Training of contact tracers
- Supporting the districts to respond to the outbreak
- Collecting GPS coordinates and mapping of community transmission of the disease
- Visiting and interviewing households of confirmed COVID-19 community transmitted cases using electronic tablets
- Collecting sputum/throat/nasal swab samples of all local contacts
- Providing daily situational updates
- Keeping a daily log file of all activities

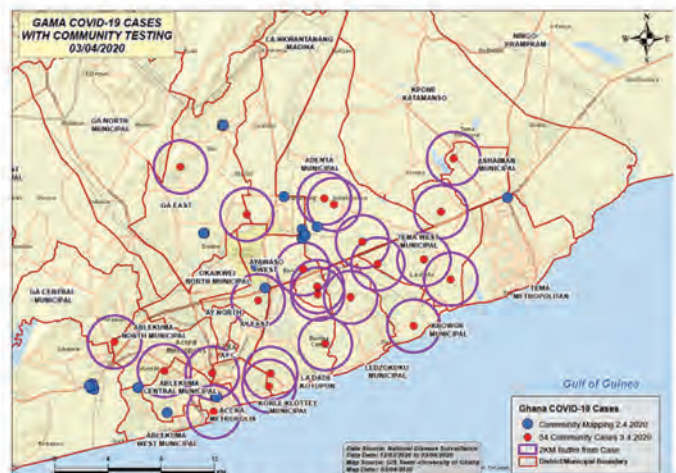


These residents and alumni also helped in training frontline health care workers on the use of the Active Response Geographic Information System (ARGIS) and survey 123. Both these GIS tools were adopted as a stop gap home solution by GFELTP and Geography Department of University of Ghana in the initial phase of the pandemic for effectively conducting contact tracing and active case search. This was later replaced with the current data collection software - Surveillance Outbreak Response Management and Analysis System (SORMAS) - for data collection including contact tracing.

Teams of residents and alumni of the programme, including medical doctors, nurses, laboratory scientists, physician assistants and disease control officers, were recruited from various district health facilities to assist the districts in creating case management teams. These teams included medical doctors, pharmacists, nurses, and laboratory technicians. They also created a smaller group, made up of epidemiologists, District Disease Control Officers, and a laboratory technician, to identify all community transmitted COVID-19 cases.



**Application of ARGIS for risk prediction, April 2020**



**Use of survey 123 to map cases and contacts, April 2020**

As the pandemic spread and became protracted, the GFELTP, together with Noguchi Memorial Institute for Medical Research (NMIMR), National Influenza Centre (NIC), World Health Organization (WHO) and DSD through the support of US-CDC, evaluated the existing influenza-like-illnesses and Severe Acute Respiratory Syndrome (ILI/SARI) surveillance system and supported the integration of COVID-19 into the existing ILI/SARI surveillance system. This is currently being used for routine surveillance for ILI and COVID-19.

In addition, the programme, in collaboration with the GHS, Ghana Immigration Service and the Port Health, conducted COVID-19 seroprevalence surveys across all major land points of entry (POE). This enabled data to be generated which later supported the evidence to inform Ghana's opening of the land borders. The survey provided information on the positivity rate among long distance drivers, their mates and border residents using our land borders, as well as the circulating variants of the COVID-19 virus.

### **Establishment Of Regional Public Health Emergency Operation (PHEOC) Centres In Ghana**

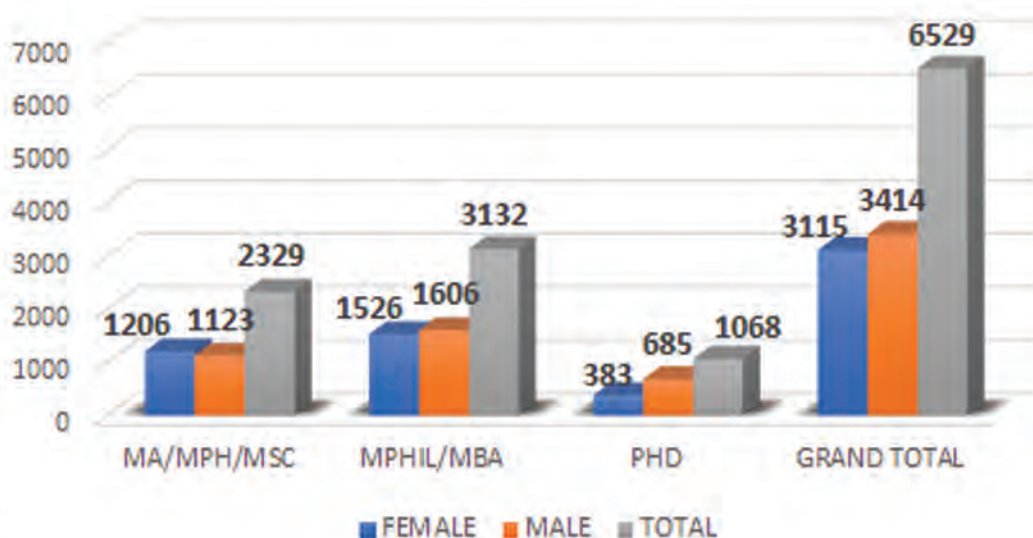
As part of measures to control the pandemic in Ghana, the US CDC awarded NMIMR funding to improve and support response in the public health infrastructure in Ghana. This came under the project titled "Enhanced Strategies to Protect and Improve Health Security in Ghana". Through this support, three Regional Public Health Emergency Operation Centre (PHEOCs) were established and commissioned on August 24, August 26, and September 16, 2021, in the Western, Northern and Ashanti regions respectively.



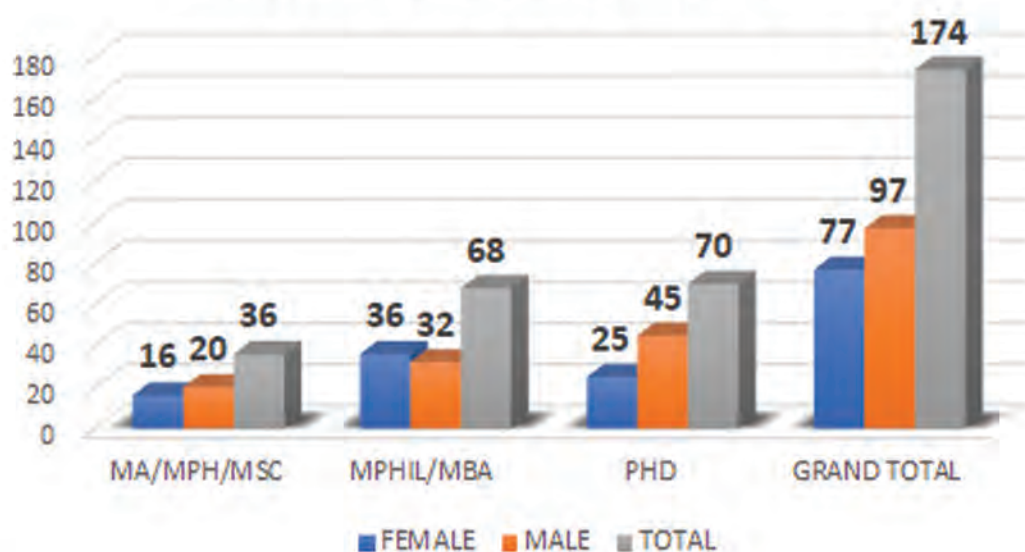
# POSTGRADUATE STUDENT ENROLLMENT

**2020/2021 ACADEMIC YEAR**

## Ghanaian Students



## International Students





# Vice-Chancellor's ACADEMIC AWARDS

Outstanding Doctoral Dissertations

(2019/2020)



## Humanities

### DR. JOSEPH BUDU

Department of Operations and Management Information Systems

#### *Thesis Title*

Digital Platforms and Value Creation: Evidence from a Developing Country



## Sciences

### DR. PRINCE ASARE

West African Centre for Cell Biology of Infectious Pathogens,  
Department of Biochemistry, Cell and Molecular Biology

#### *Thesis Title*

Molecular Epidemiology of Mycobacterium Tuberculosis Complex in Ghana: Understanding Transmission Dynamics

(2020/2021)



## Humanities

### DR. JOSHUA KWAKU OFOEDA

Department of Operations and Management Information Systems

#### *Thesis Title*

Achieving Organizational Agility through Application Programming Interfaces: A Dynamic Capability and Institutional Theory Analysis



## Sciences

### DR. SAMUEL MAWULI ADADEY

Department of Biochemistry, Cell and Molecular Biology

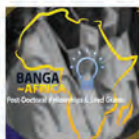
#### *Thesis Title*

The Genetics of Congenital Non-Syndromic Hearing Impairment in Ghana

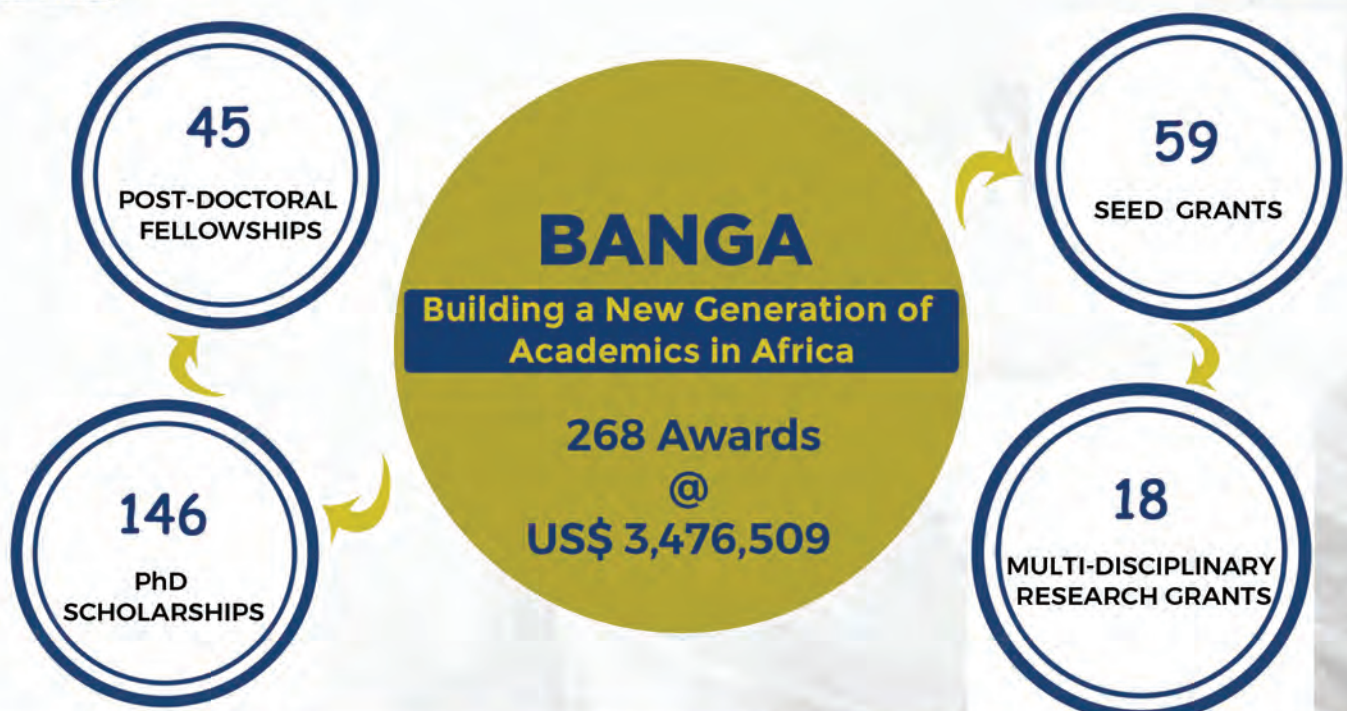


# SCHOLARSHIPS / FELLOWSHIP PROGRAMMES

## Sponsors and Beneficiaries



## THE BANGA AFRICA PROJECT



A MODEL OF EXCELLENCE

reporting interval = 2017 - 2022




Research Report 2020/2021








# POST GRADUATE TRAINING AT WORLD BANK CENTRES OF EXCELLENCE



	PhD	MPhil
 →	62	20
 →	33	10
 →	95	30



	PhD	Post Doctoral	Masters
 →	24	17	72
 →	15	7	40
 →	39	24	112

reporting interval = 2016 - 2021



	PhD	Masters
 →	13	52

reporting interval = 2019 - 2021



# SOME INDUSTRY PARTNERS

## Food Processing



Cosmo Seafoods Ltd



Parlays Biscuits



Nestle Ghana Ltd



CSIR-Food Research Institute



HoneyWorld

Honey World



Jegs Company Ltd

## Manufacturing/Transport/Assembly



Azar Chemicals Ltd



L'oreal Ghana



Scania West Africa



Heavy Machinery Dealership



Toyota Ghana Limited



Sun Electronics Ltd (Hisense)

## Healthcare



Arcoa Ltd



Roche Pharmaceuticals Ltd



Centre for Plant medicine and Medical Research



Ghana Federation of Traditional Medicine Practitioners



Hanisa Ghana Ltd



Clinix Healthcare Ghana Ltd

## GOG/Reulatory Agencies



SDG Secretariat of the Office of the President



Ghana Education Service: Regional Science Unit



Bulk Oil Storage and Transportation Ltd



Nuclear Regulatory Authority



Radiation Protection Institute



Ghana Chamber of Mines



Ghana Airforce

## CSO/NGO/Advocacy/Fund raising/Energy



Plastic Punch



EDC Ghana Ltd



CDC Consult



SNV Netherlands, Ghana



Kosmos Energy



Enubia



Global Reset



Space Generation Advisory Council



# RESEARCH SUPPORT

## SERVICES

### OFFICE OF RESEARCH, INNOVATION AND DEVELOPMENT (ORID)

The Office of Research, Innovation and Development (ORID) provides a range of research management services to faculty, students and staff. As the University's central research administration unit, ORID facilitates increasing volumes of funded research and provides other research related services in the following areas;







## PUBLICATION, DISSEMINATION AND TRANSLATION TEAM (PDT)

### EXTEND RESEARCH OUTCOME BEYOND UG

- Extend UG Research Through Publications
- Extend Learning Outcomes to Stakeholders
- Disseminate Research Findings for Impact
- Alternative Approaches to Highlight Research Outcomes



## HUMAN AND ANIMAL RESEARCH ETHICS TEAM (HARES)

### PROMOTE ETHICAL STANDARDS IN RESEARCH



Visit us @ <https://orid.ug.edu.gh/research-ethics-team> for more information



## CAPACITY DEVELOPMENT TEAM (CAD)

### DEVELOP A FORMIDABLE RESEARCH ETHOS AT UG

- Optimizing Training Opportunities with Innovative Tools
- Facilitating Grantsmanship Training for Faculty
- Building Capacity in Research Management Trends
- Support for Elsevier Editors Training



## ACCOUNTS

### PROVIDING FINANCIAL ADMINISTRATION





# UNIVERSITY OF GHANA COMPUTING SYSTEM (UGCS)

**The University of Ghana Computing Systems (UGCS) provides a range of IT services required to fulfil the University's research objectives. Our core IT infrastructure systems, tools, and services provide researchers with stable connectivity, administrative and academic computing end-user support services. We deliver these innovative services through:**

- The establishment and support for a High Performance Computing (HPC) platform infrastructure. This provides credible and suitable Computing Power for conducting complex computing simulations and analysis by WACCBIP, WACCI, Physics, and other units, for quick turnaround research output on a world class code.
- The establishment and management of fibre backbone connectivity: providing reliable and high-speed internet access to all units in the University through the Ghanaian Academic and Research Network and Vodafone Ghana.
- The establishment, development, and support for Institutional Repository (IR) and availability of digitised research material for referencing by the research community as well as storage and publication of research reports.
- The provision of relevant and targeted capacity building training in the use of statistical and research software tools for faculty, staff and students, to support research activities. The deployment of anti-plagiarism checker solutions to promote originality of research output.
- The provision of cyber security tools, solutions, and other collaborative applications to promote, protect, and facilitate communication among UG researchers and their counterparts globally.
- Publication and maintenance of relevant information on UG's websites to enhance the visibility of UG Research output.





# ELECTRONIC RESOURCES FOR RESEARCH

## @ BALME LIBRARY

The Balme Library holds the repository of information resources for research with links to satellite libraries in Schools, Institutes, Centres, Departments and Halls of Residence.



### UG CAT

Lists the books and theses in the libraries . Can be assessed at <http://library.ug.edu.gh>



### ELECTRONIC BOOKS

Compilation of thousands of e-books by subject areas. Can be accessed at <http://balme.ug.edu.gh/index.php/research-tools/ebooks>



### RESEARCH GUIDES

Comprises of teaching, learning, and research resources compiled by subject librarians. Available at: <http://libguides.ug.edu.gh/?b=g&d=a>



### PAST EXAM QUESTIONS

Downloadable PDFs of past examination questions in all subject areas. Available at: <http://balme.ug.edu.gh/past.exampapers/>



### UG SPACE

Open access electronic achieve for the collection, preservation and distribution of digital materials. Available at: <http://ugspace.ug.edu.gh/>



### OFF-CAMPUS ACCESS

Provides off- campus access to the library's e-books and e-journal databases. Available at: <https://ezproxy.ug.edu.gh/>



### ARTICLE REQUEST

Request for an article not available in the Library's subscribed or free databases. Available at: <http://balme.ug.edu.gh/index.php/services/article-request-service>



### DATABASES QUICK A-Z

An alphabetical list of academic databases offering full-text articles, books, images and videos. Available at: <http://balme.ug.edu.gh/index.php/research-tools/databases-quick-a-z>



### ENDNOTE INSTALLATION

Software for managing your references. Available at: <http://balme.ug.edu.gh/index.php/research-tools/software-installation-request>



### RESEARCH COMMONS ROOM RESERVATION

Reserve a discussion room in the Research Commons (RC). Available at: <http://libcal.ug.edu.gh/booking/rcrooms>



### ASK A LIBRARIAN

Chat with a librarian online to help answer your questions. Available at: <http://balme.ug.edu.gh/chat/index.php/chat?locale=en&url=http%3A%2F%2Fbalme.ug.edu.gh%2F&referrer=>



### SEARCH ALL DATABASES

Search the UGCat and all academic databases simultaneously



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