NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH

Past, Present And Future
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PROF. CORNELIUS O. QUARCOOPOME
01/07/1979 – 30/09/1984

DR. FRANCIS C. GRANT
01/08/1984 – 30/11/1986

PROF. SAMUEL N'TOW AFOAKWA
01/12/1986 – 31/07/1989

PROF. FRANCIS K. NKRUMAH
01/04/1990 – 31/08/1998

PROF. DAVID OFORI-ADJEI

PROF. ALEXANDER K. NYARKO
01/10/2006 – 31/07/2012
Preface

This publication aims to provide a brief historical narrative of the Noguchi Memorial Institute for Medical Research (NMIMR). It also seeks to document the Institute’s beginnings and subsequent growth into a full-fledged world class institution conducting cutting-edge medical research. It captures the wide range of significant contributions made by NMIMR to different sectors of human development worldwide - including medical research, teaching at both graduate and undergraduate levels, providing opportunities for internships to both local and foreign students and providing formal and informal training towards producing a diverse calibre of skills for health and biomedical research.

Additionally, the publication throws a searchlight on the broad range of extension services NMIMR has provided and continues to provide to bilateral and multilateral organisations as well as ministries, departments and agencies in Ghana and in the West African sub region.

Finally, through the perspectives of past directors and some significant personalities associated with the Institute over the years, the publication takes a peek into the future of NMIMR – its relevance and potential to harness existing rich and diverse intellectual resources for medical research advancement and application in Ghana and beyond.
Acknowledgements

This publication would not have been possible without the tireless efforts of a hardworking and outstanding team comprising the following NMIMR staff: Nana Oye Akuffo, Gloria Obeng-Benefo, Kwabena Owusu-Boateng, Frederick Atiemo Ofori Addo and John Gainsford. The team’s genuine display of group work proved to be a formidable endorsement of the unquestionable adage that there is wisdom in multiple counsels. Led by communications specialist, Jeannette Quarcoo, the team held several consultative sessions to edit and finalise the manuscript and also select appropriate photographs.

Recognition is given to Professor Alexander Nyarko for conceiving this initiative. To Professor David Ofori –Adjei, a ‘big thank you’ for sparing valuable time to be interviewed. Immense gratitude is extended to Professor Francis Nkrumah for contributing immensely to this compilation by making himself available for a rigorous interview and to Professor Samuel Afoakwa for sharing his memories to enrich this publication.

Special mention needs to be made of NMIMR’s present Director, Professor Kwadwo Koram and Professor Michael Wilson, Professor of Parasitology who provided useful feedback on earlier drafts. Appreciation also goes to all heads of departments whose contributions enriched the departmental profiles.

A debt of gratitude is owed to Hudson Odoi for his excellent photographic skills that produced the gallery of photographs that has enhanced the graphic presentation of this publication.
In 1979, after more than a decade of medical cooperation between Ghana and Japan, the Noguchi Memorial Institute for Medical Research (NMIMR) was established with a grant aid from the Government of Japan as a gift to the Government and People of Ghana and in memory of Dr Hideyo Noguchi, to conduct research into infectious diseases. In its early years, research at the Institute was hampered by the lack of permanent staff and resources. As a result of good leadership, enthusiasm and commitment exhibited by the early directors, and a firm institutional base, NMIMR has grown from its modest beginnings to an enviable status today, playing a critical role and making significant contributions towards the advancement of biomedical research in Ghana.

Over the course of time many people and factors have shaped the life of NMIMR and its evolution through the years has been defined in large part by a string of farsighted and strategic decisions.

Admittedly, the processes of institutional building are never easy, especially in times of economic and financial constraints, but several donor and funding institutions have consistently made tremendous contributions to ensure that NMIMR’s mandate to deliver is sustained.

Not enough has been documented to reflect the volume of promising results emerging from the research work that the institute’s scientists have conducted throughout the years of its existence and in that regard this publication is long overdue. However, from the perspective of its intention and the purpose that it seeks to serve, we can say better late than never.

It is the intention that through this publication we will portray succinctly, the wide range of research conducted by NMIMR to address health problems and impact on the disease burden in Ghana, sub-Saharan Africa and indeed low- and middle-income countries as a whole. The future presents us with exciting opportunities but not without challenges. As the University looks forward to becoming a research university, a lot more will be expected of the Institute in the areas of training and mentoring of students, and we should expand our nascent postdoctoral training programme to form the backbone of postgraduate training in health research in the College of Health Sciences. We should also position ourselves to exploit the opportunities presented by the relocation of the Teaching Hospital to the Legon campus in the coming years. To be able to fully exploit these and other opportunities will require the continued support of all stakeholders to guarantee NMIMR’s progression so as to further advance the cause of health research and expand upon the achievements gained so far. This is the opportune time to demonstrate the impact of research and the linkage to practical health care delivery. In this regard, I dare say the future looks exciting.

*Kwadwo A. Koram*
In today’s world, universities have no option but to go beyond teaching and producing graduates and rather become more and more relevant to their environment and the society that supports them.

Therefore if a university is going to be relevant to the society it should do more relevant research and provide answers to the questions of society. This is why I have a vision of the University of Ghana progressively transforming itself into a research intensive university. This will be done by increasing the number of graduate students especially at the PhD level because that is where the research is done.

I expect institutions like NMIMR to become very active in PhD work. I see young people around who are anxious and motivated. What we have not done well in the past is to incentivize them and make them aware of the opportunities for their own personal transformation. NMIMR has taken this up and a good number of young, intelligent people are being promoted to the status of professors and that is a huge incentive.

Gone are the days when one comes close to retirement before one can become a professor. This is changing and I see the young people responding to that. I am confident that with the right motivation we will have young people who are prepared to do significant research work. It is a nurturing process.

NMIMR will remain a major asset to the University of Ghana.

It has done a lot and will continue to do a lot in the years to come because there are many more societal problems to be addressed. So long as there is a society that has challenges such as ours, there will always be problems that need to be tackled by researchers. It is for the Institute to address the critical question: “What are the diseases that are killing Ghanaians?” Neglected tropical diseases for example offer opportunities for young scientists to do research and PhD studies. The Institute therefore can make a strong case for research grants to tackle these lesser known diseases, while still focusing on malaria, HIV AIDS and other more common diseases.

NMIMR will need to work with many Departments in the university (Biochemistry, Nutrition & Food Science, Biomedical Engineering, Medical School etc.) to offer more graduate studies.

I think the Institute should also reflect on how it can change the scope of its work basing its fresh directions on available new information and the new realities of our society. There are things we may have thought were unnecessary a few years ago or that there were no funds available for, but now as a result of new opportunities they can be re-looked at.

NMIMR Researchers should be seriously considering how to patent their work so as to derive some income for themselves and for the Institute. I am aware that there are a few patents that are registered in the name of NMIMR but more can be done in this area.
The Noguchi Memorial Institute for Medical Research is a good example of the success story of the collaboration between Japan and Ghana. The fact that Dr. Noguchi lived and died here is one of the reasons for the good relations and the good feelings that the peoples of the two countries have towards each other. In Japan, the story of Dr. Noguchi is read and shared by all Japanese people from childhood.

The Institute was established at a financially difficult time for Japan. There was an energy crisis and the country was experiencing harsh economic conditions, but the medical teams of the two countries worked diligently and with determination they succeeded in persuading the government of Japan to provide funding to set up the Institute.

Today the Institute has developed so well and with Japanese assistance it is making greater improvements. With the continuous exchanges of medical teams involving many capable Ghanaian scientists, there is every indication that the direction for future collaboration is one of equal partnership.

We expect greater collaboration for joint research between NMIMR and the Japanese National Institute for Medical Sciences. Hopefully this will result in further exploring new medicines using traditional and herbal products.

At the governmental level the bilateral cooperation between the two countries started very early when soon after Ghana’s independence in 1957, diplomatic relations were established and embassies were opened, followed by projects in many sectors including medical, road construction and agriculture.

Since the 1970’s both countries have benefitted immensely from the important grassroots component of the relations under which over 1,000 Japanese youth served as volunteers in a variety of areas throughout the 10 regions of Ghana.

Today, about 80% of the cocoa that is processed in Japan comes from Ghana and we value very much chocolate made from Ghana’s cocoa. Indeed there is a popular brand of chocolate in Japan called “Ghana”.

H.E. Naoto Nikai
Japanese Ambassador to Ghana
2010 – 2014
NMIMR’s growth and development has been quite enviable judging by the significant impact of its research activities in a number of critical disease areas.

In the area of schistosomiasis studies, NMIMR used a new approach (Dip Stick) to detect antigens of the parasite in urine. The accuracy of this approach coupled with additional work on infant schistosomiasis exposed the real extent of the disease burden resulting in the Ghana Health Service paying greater attention to it as a public health danger. This work also underscored the WHO’s policy change regarding the disease.

Secondly, NMIMR helped to advance research in trypanosomiasis thus bringing to the fore new diagnostic methods for the disease which is found in some regions of Ghana with a relatively high rate of infection. The Institute’s training programmes for middle level laboratory technicians of the Ghana Health Service led to more efficient management of trypanosomiasis.

The expertise of NMIMR researchers also ensured strengthening of the country’s health systems for surveillance of this disease, with the Institute being instrumental in the creation of a Ghana Trypanosomiasis Research Group comprising NMIMR, Ministry of Health, Veterinary Services Department, Centre for Scientific Research into Plant Medicine (Akuapem – Mampong) and School of Allied and Health Sciences.

Following a G8 summit in Birmingham, NMIMR took a lead role in the development of measures to advance parasitic disease control worldwide. The objective of this initiative was to foster strong collaboration between education and health as an effective approach for disease control. Implementation of this initiative resulted in advocacy and policy change in ten (10) countries including Ghana. Another important outcome was the creation of the West African Centre for International Parasite Control (WACIPAC) which has to date retained its status as a hub for regional harmonization and collaboration in parasitic disease control.
Mr. Koji described the Institute as one of the first physical symbols of Japan’s cooperation with Ghana which began in 1966. According to him NMIMR soon became one of the most important programmes of JICA through which experiences were shared between medical researchers from the two countries.

He said today the institutional capability at NMIMR is quite well advanced, infrastructure is well maintained and the overall development is impressive.

“We consider NMIMR as a centre of excellence for West Africa. One area in which we would like to share our experience further is in the use of the ‘Hashimoto Initiative’, where a school based approach is employed to carry health education to homes through school children. Japan also looks forward to sharing its experience in using medical research to formulate health policy”.

According to him, the current relationship is more academic oriented. “Going forward we want to encourage a relationship of equal partners to undertake joint research into various infectious diseases, publish the results and invite pharmaceutical companies to consider the commercialization of the results and the data”.

“We are willing to support Ghana with our knowledge in the use of a multi-sectoral approach to parasitic disease control which involves provision of clean water, improved sanitation and waste disposal.”

“All in all JICA is very proud of NMIMR’s achievements. We will do all we can to help sustain the Institute’s successes. For Japan, Ghana is the most important country in the sub-region and our office here is the biggest in West Africa”.

Mr. Makino Koji
JICA Chief Representative
Our governance and administrative structure is quite a unique one. The administration exists to provide administrative support to drive the mandate of the Institute. We are therefore expected to be the repository of all documents including protocols, proposals, contracts and agreements.

At the highest governance level NMIMR reports to the University of Ghana structure. However we prepare our own institutional budget which is submitted to and defended at the National Council for Tertiary Education (NCTE).

For the purposes of decision making there are a number of statutory committees: STC, Institutional Review Board (the first to be established in Ghana), Advisory Board and the Research fellow meetings among others. Ad-hoc committees are also established as and when needed.

The administrative developments at the Institute have brought new challenges and greater visibility thereby attracting more young scientists with very diverse research interests. A new image has emerged necessitating the creation of structures such as the Office of Research Support (ORS) to oversee issues dealing with grant applications and reporting mechanisms and deadlines.

The growth is also exposing some of the short falls that need to be addressed in the future such as the need for more specialisation and integration. There is also the need for constant orientation for researchers (as potential leaders) and more especially for Departmental heads to enable them work across the different departments.

I think going forward NMIMR will need to evolve a very dynamic administrative system under which all institutional documentation can be harnessed into a common pool with centralised storage and retrieval mechanisms. This will enable the Institute to better respond to its increasing role and societal expectations for more advanced medical research.

Mr. Okyere Boateng
Institute Administrator, NMIMR
I became associated with the NMIMR in the late 1960s through Professors Easmon and Kenji Honda at the time that the Ghana-Japan Medical Cooperation (GJMC) was initiated. When the idea of setting up the Institute first came up it was proposed that it should be sited at Korle-Bu. This proposal was later dropped and the present location was selected.

The Virology Department of the Ghana Medical School was the first manifestation of the collaboration and later additional units - Bacteriology, Electron Microscopy etc. were added on. Some of the early studies were in the area of viral diseases such as Salmonella and Typhoid among others.

I think one of the most critical and impactful decisions was to have NMIMR serve as a post graduate training institute for medical students and also as a centre for disease research in general in Ghana. It was as a result of this decision that with the advent of HIV, the Institute emerged naturally as a referral centre for confirming AIDS and AIDS related diseases.

The Institute has continued to be instrumental in developing the human resource required for medical research. It has also opened up new directions and broader dimensions in the area of animal health and science.

It has successfully maintained its facilities very well and is now well positioned to undertake more extensive research into other infectious diseases.

I am confident that the Institute will encourage more researchers to enter into specialisation particularly in the area of Immunology.

I would like to see the Institute deepening its collaboration with the School of Public Health and other related research institutes.

Prof. Samuel N. Afoakwa

Reflections of Past Directors
I recall the period around 1990 when the Institute was confronted with a number of institutional challenges in terms of research capacity and research leadership. Today, I highly commend NMIMR for making substantial progress in the three specialised areas that it was mandated to work in:

- Biomedical research into diseases of public health importance to Ghana
- Human resource training to expand the human resource base for biomedical research
- Sophisticated laboratory services to support Ministry of Health’s programmes.

In all these areas, NMIMR has displayed high quality research through a progressively improved research capacity and focus. This has resulted in high research standards in HIV/AIDS, malaria, tuberculosis, vaccine preventable diseases and other prevalent endemic diseases. Much of the research activities go to support Ministry of Health programmes. This support is commendable but it needs to be deepened to maximize the impact on national nutrition and disease control programmes.

I am quite satisfied that research capacity has improved tremendously over the past years, bringing with it international recognition and reputation. All Directors must be credited with the steady and progressive increase in training programmes; internships, hosting of graduate and post-graduate students and recently, Postdoctoral fellows.

Without a doubt, the vision of the Institute is being progressively fulfilled. NMIMR has made its mark in the area of communicable and infectious diseases. The Institute may now also wish to look into the direction of research development in non-communicable diseases which are presently gaining relevance. However, it should not lose sight of the original vision of research into communicable diseases which still constitute a major disease burden on our African populations. In this context, one would advocate greater research collaboration with other African health and medical research institutions to address common health problems.

Low financial resource continues to be one of the greatest challenges facing the Institute today. Presently, almost all research at the Institute is grant driven and as such there is a high external grant dependency thereby creating a problem of sustainability. The Institute needs more governmental support for actual research work because research is necessary for formulating and guiding national developmental policies.

One critical issue that the Institute might do well to discuss and have broad consultation on is the current governance/institutional structure and status of NMIMR within the governance system of the University of Ghana.

The high point of my tenure as Director was persuading the Japanese Government to fund a complex of additional infrastructure comprising the P-3 Laboratory, the Animal Experimentation Department and the Noguchi Conference Centre.
As Director of the Institute from December 1998 to September 2006, I would say that Noguchi Memorial Institute for Medical Research has delivered on its operative mandate and met significant targets. It has evolved from a period when research programmes were determined strictly within the framework of Japan’s grant and aid.

Today I can vouch that NMIMR has come of age after successfully weaning itself from exclusive Japanese support, although to some extent research is still quite dependent on external funding.

In the beginning the research units were not considered as fully fledged Departments therefore an important step in institutional growth was the development of the Units into Departments. This came alongside an increase in the number and quality of staff. Research programmes were expanded and a number of post graduate programmes also evolved as an endorsement of the Institute’s commitment to growing the next generation of scientists. This expansion in research led to the institution of a project management team and a dedicated Office of Research Support in 2004/2005.

From my perspective there is the need to take another look at the reason for the establishment of NMIMR in light of the realization of the critical importance of the social sciences as an integral part of hard core science in order to put a human face to science.

Expansion in infrastructure has included state of the art facilities such as a liquid nitrogen plant and facilities for conducting delicate research to position NMIMR as one of the leading laboratories in Africa.

NMIMR’s contribution to national development has been quite phenomenal. This includes, among others: support towards the management of rotavirus diarrhoea disease, contribution to change in WHO childhood immunization policy, work in the area of mapping out the sensitivity of malaria parasites and emergence of resistance etc.

Translating research findings into policy formulation remains a challenge. This can be addressed by paying greater attention to production of journals/publications, increasing the Institute’s involvement in national disease control programmes, hosting annual medical research meetings and public lectures to discuss and promote priority issues in health sciences and contribute to advanced research in tropical, communicable and non-communicable diseases and neglected tropical diseases.

Reflections of Past Directors
As Director, my aim was to position the Institute to work with other stakeholders to deliver on the Institute’s mandate of contributing to a sustained reduction in the burden of preventable diseases through research and training activities.

Building on efforts of past Directors and through collective work NMIMR assisted the University of Ghana to review the policy on post-retirement appointments so as to enable professors in research institutes to also be considered for post-retirement appointments as a way of sustaining the University’s research agenda.

Recognising that the greatest asset of every organisation is its human resource, I increased the academic staff strength through recruitment and promotions and successfully restructured and equipped the following sections for effective research administration:

i. (Office of Research Support (ORS) to handle grant acquisition and administration;
ii. Institutional Review Board (IRB) for ethical review to ensure safety of human participants in research;
iii. Animal Care and Use Committee (NIACUC) to ensure proper care and use of animals in research.

Compared to 2004/5 baseline values, the quantum of externally funded research increased between 2006 and 2012, translating into more than a two-fold increase in research funding, including for the first time a Bill and Melinda Gates funding to institute a postdoctoral training programme.

Other significant developments were:

- Upgrading of internet bandwidth
- Increasing the number of servers to allow separate servers for multiple use
- Improving the IT environment to support research
- Rehabilitating the Biosafety level three (BSL3) facility, four cold rooms and laboratories.
- Installing a biometric access control and a Photo Voltaic (PV) system to generate 715kVA of power,
- Deploying CCTV cameras at strategic entry points to control unauthorized visitors
- Providing an insectary to increase the breeding of mosquitoes from 200 to 1,500 daily and a world-class laboratory for testing of insecticides etc.

As one of the few biomedical research institutes in the country and sub-region, the Institute has to confront local issues that are also of global importance. In this regard it must build capacity for tackling non-communicable diseases such as diabetes mellitus, hypertension and other cardiovascular diseases, as well as various cancers, which are on the increase. The Institute must endeavour to strengthen its postdoctoral training program and work towards creating PhD programmes to advance biomedical research.

My appreciation goes to all past Directors who laid the foundations for these achievements, especially Professor M. D. Wilson and Professor Kwadwo Koram, the two Deputy Directors I worked with and all other members of the administrative team.
NMIMR is famous in Japan because of Dr. Hideyo Noguchi. It is also popular continentally and worldwide for its extensive and impressive medical research that has contributed towards improving the life of people.

I first visited the institute in 1984 as a graduate student under a collaboration between Tokyo University’s Institute of Medical Science and the Virology Department of NMIMR. The partnership was for a joint research into HIV and it resulted in the first identification of the HIV virus by me and the staff of the Virology Department. In 1985, further research was done to characterize the virus in order to develop a vaccine and drugs.

Today the collaboration is thriving once again with a team currently researching into other infections of HIV patients as well as analyzing diagnostic kits to find their sensitivity and specificity to HIV virus in Africa. Studies are also being done to characterize prevailing HIV recombinant strains in patients while data is being generated to further guide policies on anti-retroviral therapy in Ghana.

Additionally, NMIMR, the Koforidua Regional Hospital, National AIDS Control Programme of Ghana and Japanese counterparts are working hard to develop a safe and efficient HIV vaccine for Africa and it is expected that clinical trials will begin in Ghana.

While congratulating the Institute for excellent research work done so far and for offering opportunities to young scientists to deepen their knowledge and research skills, it is my wish to see more research data being provided to help formulate policies for improving the health status of the people.

NMIMR must also strive to increase its involvement in national disease control programmes and foster closer collaboration with other universities and institutions including the upcoming medical complex next to the Institute.

Reflections of other Personalities

Dr. Koichi Ishikawa
Japanese Researcher
My first arrival at the Institute was in 1984 as a JICA expert at which time we undertook field cohort studies at Gomoa Fetteh (an area chosen for the limited movement by the people therefore making it a perfect site for epidemiological study). Research work at that time was concentrated on measles, malaria and poor nutrition.

I worked with the Virology Department and trained young researchers on how to measure antibody titre. After one and a half years, I left to pursue further studies in the USA in HIV and then proceeded to work at the Tokyo University.

In 2010, I returned in response to an invitation to work on HIV Anti Retroviral Therapy Evaluation, under the sponsorship of the Japan Initiative for Global Research Network of Infectious Disease (j-GRID).

Research work at the institute has been mutually beneficial since Japanese scientists have access to first hand information and knowledge about diseases through direct contact with the patients being worked on (e.g. HIV patients), unlike in Japan where researchers rarely have contact with AIDS patients. Ghanaian researchers on the other hand benefit from the technological knowledge of their Japanese counterparts. Through the collaboration also more than 20 Ghanaian researchers from the Institute have completed their PhD studies in Japan, therefore further enhancing the strong bonds between the two countries.

Recalling the beginnings of the Institute, Prof. Ido said soon after Ghana’s independence many of its institutions were experiencing difficulties due to general economic hardship. It was at this time that the Government of Ghana invited other countries to assist in reviving institutions. Prof. Kenji Honda, who was newly appointed as a professor at the Fukushima Medical School, approached the Japanese foreign minister to consider extending help. His request resulted in a team of about 20-30 members of staff from the Fukushima Medical School visiting Ghana. These visits culminated in a proposal for the construction of a research institute initially for the purpose of assembling equipments and training researchers.

“I would want the Institute to research into viral hemorrhage fevers including Ebola. Again currently Ghana is burdened with contemporary diseases such as cancers, cardiovascular diseases, etc. I therefore think the Institute should be looking to research in such areas as well.

NMIMR also needs to associate with more hospitals to help make science more impactful.”

Reflections of other Personalities

Prof. Eiji Ido
Senior Researcher
In 1926 Dr Hideyo Noguchi, a world renowned Japanese scientist of the Rockefeller Institute for Medical Research arrived in Accra on the shores of the Gold Coast as a member of the Rockefeller Foundation's Yellow Fever Commission in West Africa. He was met by Dr W. A. Young, Director of the British Medical Research Institute in Accra, who welcomed him to this institution and cooperated with him. Dr Noguchi died on May 21, 1928 from yellow fever a disease he was researching into.

Historically, the beginning of Noguchi Memorial Institute for Medical Research dates back to 1968 (40 years after the death of Dr. Noguchi), when the late Professor Charles. O. Easmon, then Dean of the University of Ghana Medical School (UGMS), approached the Embassy of Japan in Accra, to seek Japanese government assistance to develop capacity for medical research in Ghana. The request was transmitted to Japan and a delegation, led by the late Dr Kenji Honda, Professor of Surgery at the Fukushima Medical College, (incidentally, Fukushima also happened to be the prefecture/district of Dr Noguchi’s home town) was sent to Accra to discuss the form and details of the envisaged cooperation. Subsequently, a Japanese implementation survey team again led by Professor Honda was dispatched by the Japan International Cooperation Agency (JICA) to finalise all previous arrangements. These latter discussions which were held with UGMS, officials of the Ministry of Health and representatives of other agencies of the Government of Ghana, culminated in the signing of the “Record of Discussions” which established the Ghana-Japan Medical Cooperation Programme under the auspices of JICA.
The cooperation programme created a five-year scheme of collaborative research projects between the Fukushima Medical College and the UGMS. Under the scheme, the projects were centred in designated departments of the UGMS, with heads of those departments serving as counterparts of the Japanese experts, while staff and other departmental resources provided technical and administrative support.

The expectation was that by the end of the five year period, the selected participating departments would be well-equipped and staffed with experienced researchers.

The first three projects were:

1. Virology and Electron Microscopy project based at the Department of Microbiology;
2. Viral and other Parasitic Diseases of the Eye project based in the Department of Surgery, Ophthalmology Unit;
3. Pathophysiology and Immunology of Tropical Diseases in Ghana to provide technical support to the Department of Physiology, Pathology and Medicine.

It was during the third phase of implementation that the decision was made by the Government of Japan to construct a physical facility. Construction commenced in 1977 and was completed and commissioned in November 1979 by the former President of Ghana Dr Hilla Limann, and dedicated to the memory of Dr Hideyo Noguchi.

NMIMR was envisaged to become the leading biomedical research facility in Ghana operating as a semi-autonomous institute of the University of Ghana. Later, with the inception of the College of Health Sciences, the Institute became one of its six founding constituent institutions.

The overall mandate of the Institute is to conduct research into diseases of public health importance, train postgraduate students in biomedical sciences and support the public health programmes of the Ministry of Health and Ghana Health Service. Specifically this involved:

- Conducting research into communicable and non-communicable diseases;
- Providing training opportunities in biomedical research for undergraduate and postgraduate students;
- Providing high end laboratory diagnostic and monitoring and surveillance services in support of national public health programmes.
**Vision Statement**

To be a world class Institute, conducting high quality cutting edge research and training in the biomedical sciences.

**Mission Statement**

Improving the health and well being of Ghanaians and mankind through focused and relevant quality biomedical research, human resource development and support of national public health activities.

**Values**

In order to generate quality data to guide evidence based policies, the Institute is committed to:

- Conducting quality research
- Ensuring integrity of research data
- Upholding high ethical standards in research

**Executing the Mandate**

The Institute is headed by a Director appointed by the University Council to exercise overall responsibility for both the scientific and administrative functions of the Institute. A deputy Director is available to assist in the performance of this function. The Institute has well qualified scientists with expertise in diverse areas of health research who head various programmes and an array of technicians, pharmacists etc. in supporting roles.
The physical facility of NMIMR consists of a square two-story building of approximately 85m x 85m located on the southern edge of the main campus of the University of Ghana, which is about 10 kilometers north of Accra, the capital of Ghana.

The ground floor of the building houses the general administration and finance offices, the Epidemiology, Nutrition, Histopathology and Electron Microscopy Departments, the main computer centre, a laboratory for Acute Febrile Illness and a library. On the first floor are the Parasitology, Immunology, Chemical Pathology, Virology and Bacteriology Departments and a smaller meeting room. Besides the main laboratory building, there are adjoining buildings housing a Biosafety Level 3 facility for work with infectious pathogens such as HIV and TB, and another one for laboratory animals.

Laboratories at NMIMR routinely carry out molecular biological experiments including PCR, plasmid cloning and DNA sequencing, and immunological experiments including lymphocyte culture, immunofluorescence, EIA, ELISPOT, generation of monoclonal antibodies, and flow cytometry.

The Department of Immunology has a Multiplex System that allows for the determination of antibodies to several antigens simultaneously in very small samples of sera while the Parasitology Department maintains an insectary on site at the Institute.

There is a biological samples platform that is responsible for receiving and processing all biological samples, including tissue culture cells, blood samples (both filter paper or frozen), buccal samples, and genomic DNA samples from both local and international sources. The platform ensures that all samples are coded and tracked with sample information and are stored and processed by relevant sample pipelines.

The facilities of the genetic analysis platform support genotyping and single-nucleotide polymorphism (SNP) discovery activities that are used in numerous disease and population genetics studies. This platform has over 11,000 square feet of dedicated laboratory space.
Institutional Support Mechanisms

Office for Research Support (ORS)

Research administration has become a vital constituent of research institutes due to the increasing demands on researchers to meet specific requirements from funders. The Office of Research Support (ORS), established in 2005 was a move to help streamline Grants Applications, Awards management and Implementation process. The ORS provides pre and post – award administrative services for sponsored projects and helps to ensure the overall effective coordination of the research administration service, system, policies and processes. The Office, therefore, serves as an instrumental link between the funders and the Principal Investigator at the Institute. The main functions of the ORS include Identifying funding opportunities and sources, and assist researchers to develop proposals, helping to negotiate and execute contracts and acceptance of grant awards that are consistent with the Institute’s policy and that they contain terms and conditions acceptable to NMIMR, Helping in preparing and submitting reports of expenditures to funding agencies and assists with the closing out of contracts and grants, and Ensure compliance with government and other research regulations in matters such as human subjects, animal welfare, and biohazards.

The ORS comprises the Finance Unit, Documentation/Compliance Unit, Publications, Database Management and Research Links Unit (such as NIACUC, IRB and STC). These units work together to provide administrative services for projects.
Information and Communication Technology (ICT)

NMIMR considers ICT as very critical and believes that a strong ICT service is the backbone of its internal and external communication system. With the support of a vibrant ICT policy, the Institute maintains a reliable and dependable system that facilitates internal and external communication via e-mail and web surfing. Bandwidth upgrading, a fibre optic link and acquisition of additional servers are some of the measures being vigorously pursued to ensure uninhibited access by all scientists at the Institute. The principal computing resource is an IBM Bladecenter server farm comprising over 400 Linux nodes with more than 1100 processor cores (Intel and AMD). File storage is provided by network-attached storage products, including Network Appliance, Sun Microsystems and Isilon, which collectively provide access to over 750TB of usable file space through NFS and CIFS/SMB protocols. Dedicated computer server rooms are located in approximately 4,000 square feet of space.
Library

The Institute has a modern library with up-to-date facilities including internet connectivity for accessing electronic versions of health and health related journals through the HINARI, AGORA, OARE and other electronic databases. The Institute's library is an active participant in the UGcat; the University of Ghana's version of Online Public Access Catalogue (OPAC) and coordinated by the Balme Library. The library has seen significant modernisation since the inception of the Institute and this has improved access to scientific and other vital information as well as research activities. The library registers an average of 515 users per month including staff, graduate and undergraduate students from various universities and polytechnics attached to laboratories at the Institute.
Institutional Animal Care and Use Committee (NIACUC)

The Institutional Animal Care and Use Committee (NIACUC) was established in 2012 with authorisation from the Faculty Board of NMIMR, in accordance with University of Ghana policy. Its jurisdiction includes all research involving live vertebrate animals performed at or in conjunction with NMIMR and its employees.

NIACUC operates as a competent body with oversight responsibility for the proper care and humane use of animals within NMIMR research, testing and teaching programmes. In this regard, all research projects and educational or extension activities using animals under the jurisdiction or control of NMIMR are reviewed and approved by the NIACUC.

NIACUC’s work is guided by a comprehensive Animal Care and Use policy document that enables it to comply with international animal care and use guidelines and regulations, while maintaining flexibility to best meet the unique biomedical needs of the institute and the research community at large.

Significantly, the Office of Laboratory Animal Welfare (OLAW, USA) reviewed the NMIMR’s Animal Welfare Assurance submitted by NIACUC and in March 2012, gave it full approval and accreditation as being compliant with the Public Health Service (PHS) Policy on Human Care and use of Laboratory Animal Policy. In addition, NIACUC projects receive authorisation under an agreement with Yale University (USA).

The Scientific and Technical Committee (STC)

The STC is charged with the scientific evaluation of all research protocols and amendments proposed at NMIMR prior to IRB approval and study initiation. Its reviews encompass an assessment of the scientific rationale and merit of a proposed study in addition to the protocol design, safety considerations and bio statistical analysis to determine if high quality and appropriate designs are being used to address the study question(s). It also reviews informed consent documents to assess their scientific accuracy and ensure that participants are clearly informed of risks, side effects and any alternative treatments.

The STC is chaired by the Director of the Institute and has membership comprising the Deputy Director, all professors, four departmental Heads and a representative from University of Ghana Institute for Statistical Social and Economic Research and the University of Ghana Medical School. The Institute’s Executive Secretary, Assistant Registrar and a representative from the Institutional Review Board (IRB) provide administrative support.

Institutional Review Board (IRB)

The Institutional Review Board (IRB) was established in 2000 as part of improving the ethical conduct of research at the Institute. It operates as a competent, independent mechanism for reviewing, evaluating and determining the ethical merits of research protocols thereby ensuring and guaranteeing the rights, dignity, safety and protection of all individuals and communities who participate in research activities of the Institute. Through its well defined processes and with careful scrutiny the IRB works to ensure adequate protection of all research subjects. The IRB reviews both internal and external research protocols from NMIMR, School of Nursing, School of Public Health, School of Allied Health, UGMS, private organizations among others.
NMIMR drives its research programmes through nine (9) well established research departments. These departments facilitate the conduct of excellent, diligent and efficient research and ensure an expedited delivery of Noguchi’s objectives and mandate. Research activities conducted by the departments are in a variety of scientific and medical areas - basic biomedical science, health systems, diagnosis and intervention studies including social science, Clinical trials, surveillance/monitoring and evaluation of disease control programmes are among the major core activities. The nine departments are: Animal Experimentation, Bacteriology, Clinical Pathology, Electron Microscopy and Histopathology, Epidemiology, Immunology, Nutrition, Parasitology and Virology.
At the time of its establishment in 1981, the Department of Animal Experimentation was known as the Special Experimental Laboratory. It was initially envisaged as an extension of the research laboratories of the Institute and tasked to be responsible for the production and maintenance of animals for biomedical research and testing thereby making it a service-oriented unit.

During the first six (6) years of its existence, it became the Animal Unit. In line with its mandate, it produced and maintained genetically undesignated mice, rats, rabbits and guinea pigs for use by the Immunology Unit, the Anatomy Department of UGMS and later the Biochemistry Department of the University of Ghana. In 1987 the facility was expanded to include an in-house diagnostic laboratory for the scientific appraisal of animal production and maintenance. In 2000 the Government of Japan constructed a one-storey centralized facility detached from the rest of the Institute to promote and ensure public health safety and proper operation of the animal facility.

It was during this time also that there was a major transformation of the Unit’s mandate to include the use of animals in elucidating human diseases aetiology. These strategic developments steered the Department into exciting directions with the emergence of new ideas and improved staff training in reproductive biology, microbiology, animal genetics and pathology among others.

Today animals produced at the Department are made available to institutions within and outside the country. Additional funds are generated through the sale of animal products and the provision of services to private and public organizations.

One significant milestone in the Department’s existence was its ability to establish an animal model for Buruli ulcer disease, paving the way for similar work to be undertaken for other human diseases.
Work at the Department revolves around four thematic areas

i. Production of Laboratory Animals – This involves production and maintenance of specific pathogen-free animals (mice, rats and hamsters) and conventional laboratory animals (rabbits, guinea pigs, Thryonomys swinderianus, sheep and goats) for research and teaching.

ii. Animal modelling – This involves the development of animals as models of various human disease conditions. The animal models stand-in for humans and facilitate better understanding of the transmission, pathogenesis and treatment of human disease conditions.

iii. Buruli ulcer – This involves studies into the transmission, pathology and therapy of the disease. Some aspects of the research are undertaken in collaboration with other departments of the Institute and the University of Ghana.

iv. Phytomedicine – This involves, on one hand, the in-vitro and in-vivo evaluations and upgrading of the quality, safety and efficacy of phytomedicines already in use or being developed, and on another hand, the search for novel medicinal plants for the treatment of human diseases.

Although the production, care and maintenance of research animals remain its core activities, the Department also conducts its own research and studies. Some studies that have been successfully completed are:

- Establishment and Characterisation (microbiologic & genetic) of Specific Pathogen Free Animal Colonies for Research, Testing and Disease Diagnosis;
- Establishment and Characterisation of Laboratory Animal Housing and Experimentation Facilities;
- Domestication of the *Thryonomys swinderianus* as Micro Livestock with Emphasis on Husbandry and Reproductive Biology. (The Department was the first to establish the ovulatory mechanism of the thryonomys swinderianus);
- Introduction and Establishment of the *Thryonomys swinderianus* as Micro Livestock in Tanzania;
- Establishment of the *Thryonomys swinderianus* as a Laboratory Animal. (The Department is the first to maintain and breed the *Thryonomys swinderianus* under laboratory conditions).
Department of Bacteriology

The Bacteriology Department’s overall goal is to improve the quality of life of Ghanaians and the world at large by conducting research into bacterial diseases of public health importance. In addition to researching into enteric pathogens and sexually transmitted diseases, the Department’s current main focus is on the two most important mycobacterial diseases of public health importance, Buruli ulcer (BU) and tuberculosis (TB). The Department in collaboration with its partners is contributing to the global fight against TB and BU through studies that aim to contribute to their control by improving the understanding of disease epidemiology, genetic diversity within the causative agent, host pathogen interactions and laboratory diagnosis. To ensure that research findings contribute to disease control, staff of the Department work closely with endemic communities, the respective national control programmes and district health management teams of the Ghana Health Service.

Within its TB research, the Department has established active DNA fingerprinting methods including spoli-genotyping mycobacterial interspersed repetitive unit/variable number of tandem repeat (MIRU/VNTR), region of difference (RD) and single nucleotide polymorphism (SNP) analysis as well as mutational analysis of drug target genes. Thus the Department serves as reference laboratories for both TB and Buruli ulcer and also has the capacity to be involved in the evaluation of effectiveness of interventions such as diagnostics and vaccines.
The Department in its role as the National TB Reference Laboratory is involved in the organisation and hosting of the National TB Laboratory Network, development of training manuals for laboratory training and implementation of nation-wide TB laboratory quality assurance, and anti-TB drug resistance surveillance. The Department has conducted extensive food safety studies specifically safety of street foods. Research activities of the Department include:

**Tuberculosis**

- Genotypic and Phenotypic Characterization of *Mycobacterium africanum*
- Research focus: to investigate the genetic diversity between the two causative agents of human tuberculosis—*Mycobacterium tuberculosis* and *Mycobacterium africanum*. Africanum is found uniquely in West-Africa and has a strong bearing on the efficacy of vaccines being developed as well as other control tools like diagnostics and drug. The study also aims to analyze the evolutionary forces that drive this diversity by comparative genomics; and the phenotypic consequences of this diversity by analyzing phenotypic features of host-pathogen interaction like innate and acquired immune response.
- Drug Resistant Tuberculosis in Ghana: Molecular Epidemiology and Relations with Species in *Mycobacterium tuberculosis* complex
  - Focus: To understand the MDR/XDR-TB situation in Ghana and provide a reference for assessing its current status in West Africa with specific objective of determining the incidence/prevalence of MDR and XDR among Ghanaian TB patients and monitor the emergence of XDR among relapsed TB patients.
- Determination of TB disease prevalence in Ghana through a population-based survey to assess the true burden of disease in the country. Also to serve as baseline data to assess trends of TB disease prevalence overtime with an added advantage of it being used to generate data to evaluate the quality of TB disease surveillance in the country.

**Buruli ulcer**

- “Stop Buruli Project”: to improve wound care, develop a field-compatible method for early diagnosis, and identify major transmission pathways and environmental reservoirs of *M. ulcerans*.
- Scaling up Early Detection and Treatment to Reduce Buruli ulcer Morbidity in the Asante Akim North District of Ghana.

Overall, the Department has contributed to deepening public understanding of bacterial infections.

*A researcher picking colonies from culture medium for drug sensitivity test (DST)*
The Department came into being in 1979 as the Chemical Pathology Unit. With time, it had to be re-designated as the Clinical Pathology Department to enable it maintain a clear focus on its mandate to among other things investigate the injurious effects of chemicals in foods, medicinal herbs, selected trace elements on body organs, hematological conditions and the relation to non-communicable diseases in the country. Some of its early work was to demonstrate the effect of heavy metal contamination and phytomedicines. It has carried out major research into plant medicine and its lead role is well recognised in the development and improvement of local traditional herbal medicines. Most especially, the Department made significant contribution towards helping to establish the toxicology, efficacy and mode of action of herbal preparations, so as to boost their expected role in Ghana’s health delivery system. An example of work in this area is the successful investigation of *Indigofera arrecta* and *Adenia* – two herbal medicines respectively used to manage diabetes mellitus and hypertension by the Centre for Scientific Research into Plant Medicine (CSRPM), Akuapem, Mampong. Other studies into herbal preparations are:

- Chemical and Biological Fingerprinting of Ghanaian Medicinal Plants;
- Prevalence of Co-use of Plant and Orthodox Medicines in the Adult Population of Ga East District of Ghana;
- Evaluation of the Efficacy and Safety of Ghanaian Herbal Medicines for Erectile Dysfunction;
• Studies of Anti-viral and Anti-Parasitic Compounds from Selected Ghanaian Medicinal Plants; Toxicity of Ghanaian Medicinal Plants.

Currently, there are investigations into the drug-drug and herb-drug interactions potentials of drugs and plant medicines used to treat malaria, tuberculosis and manage HIV/AIDS in Ghana. The outcomes of these studies on plant medicines and drugs will guide national policy on drug and plant medicines use.

In 1986, the Department began research into naturally occurring toxic chemicals in foods, with particular emphasis on levels of aflatoxins in commercially prepared Ghanaian foods. One specific study was on Enterosorbet (Novasil) intervention therapies for populations at risk of aflatoxins-related diseases. Cultural acceptability, safety in children and the effectiveness of Novasil was assessed. Other studies in this area are still on-going.

The Department also conducts studies on environmental contamination of toxic heavy metals; lead, (mercury and arsenic) contamination. Lead levels in school children and people occupationally exposed in the Ga urban areas have been studied. The findings of these studies have helped provide direction for interventions to prevent poisoning from environmental toxicants so as to reduce health threats.
The Electron Microscopy and Histopathology Department's main research focus is in the area of enteric diarrhoea with particular emphasis on rotaviruses. The Department is a key member of the African Rotavirus Surveillance Network which was set up to determine accurately the burden of rotavirus diarrhoea disease across Africa and to provide evidence-based data for the introduction of rotavirus vaccines in Africa and developing countries. Notably, through its diarrhoea surveillance studies, the Department helped to firmly establish rotavirus as a major cause of diarrhoea in children less than five years of age.

The Department is an accredited WHO supported reference centre for the identification of rotavirus using electron microscopy, enzyme-linked immunoassay and molecular biology methods.

It is also involved in estimating the burden and characterisation of Noroviruses as demonstrated by a project it undertook to isolate and characterise Norovirus from senior high school students in Sekondi, Ghana, during a gastroenteritis outbreak.

There has been major research on Rotavirus and also in areas such as:

- Estimating the Economic Burden of Gastroenteritis in Ghanaian Children;
- Assessment of Faecal Exposure Pathways in Low Income Settings in Accra, Ghana.
Department of Epidemiology

The Department contributes to NMIMR’s mission through the pursuance of basic and applied epidemiological research on diseases and public health problems including but not limited to malaria, Buruli ulcer, HIV/AIDS and tuberculosis. It also conducts research on policy and health systems in the areas of maternal and child health and general health services. The Department’s current research activities range from malaria infection, disease and drug resistance monitoring, social determinants of health to real time monitoring of child mortality, adolescent sexual and reproductive resilience, access to medicines and enhancing health insurance enrolment in Ghana.

The Department is home to the Social Science Unit of the Institute, including the Health Support Centre for HIV/AIDS counselling and testing, and other communicable and non-communicable health problems. The Department also has oversight responsibility for the Institute’s Clinical Trials, Data Management and the Computer and Information Technology Units.

It has been involved in several important studies that have informed disease control policies in the country.

The Department’s current research includes the following:

- Malaria Infection, Disease and Drug Resistance Monitoring at Sentinel Sites in the 10 Regions of Ghana;
- Intervention Research Aimed at Enhancing and Sustaining Health Insurance Participation in Ghana through Improved Client-Oriented Quality of Care in Western and Greater Accra Regions;
- Real Time Monitoring of Child Mortality in the Context of Increased Support for Achievement of MDG-4 in three pilot Districts in the Northern Region of Ghana;
- Adolescent Sexual Reproductive Resilience in Accra Metropolitan Area, Ghana;
- Social Determinants of Health Seeking for Buruli Ulcer in the Eastern and Greater Accra Regions of Ghana.

Through its research, the Department has brought improvement in the health of pregnant women and pre-school children in many rural communities.
The Immunology Department was set up to develop and apply immunological methods for the improved diagnosis, treatment, control and prevention of the major infectious diseases in a bid to promote overall well-being and health status of human population. As part of its work, the Department focuses on the exploitation of existing and novel techniques for the evaluation of immune responses (humoral and cellular) of healthy and sick individuals in various disease states. The Department has built capacity to utilize up-to-date techniques such as Flow Cytometry, Enzyme-linked Immunosorbent Assay (ELISA), Multiplex, ELISPOT, B Cell transformation, continuous cultivation of malaria parasites, Fluorescent microscopy and molecular immunology techniques.

Research Fellows of the Department teach at both undergraduate and postgraduate levels and supervise undergraduate/postgraduate research projects of students from the University of Ghana.

The Department supports the Foods and Drugs Authority in assessing the potency of newly introduced rapid malaria diagnostic tests in Ghana. One key area of study is the collaborative research with a team of scientists from Osaka University, Japan and the Pasteur Institute, France into the molecular basis of malaria parasite surface protein as an antigen and determination of the three-dimensional structure of the antigen-antibody complex. The study has the potential of contributing significantly to the development of a malaria vaccine.

Other equally important studies carried out by the Department in the recent past include:

- The sensitivity status of *Plasmodium falciparum* to chloroquine and other anti-malarial drugs.
- Antibody levels following immunization with Diphtheria, Pertussis and Tetanus, undertaken in collaboration with the Department of Epidemiology - the study examined the levels of antibodies against tetanus in pregnant women and their children at different times following immunisation and further sought to determine the effect of maternal antibodies on the response of their children following immunisation.
- Investigations into the immunoglobulins and complement levels of sickle-cell disease patients.
- The pathogenesis of major infectious and non-infectious diseases, especially malaria in children and pregnant women by studying immunological and molecular mechanisms that affect the human host and pathogen relationships.
- Identification and evaluation of potential malaria vaccine candidates.
Operationally, the Department started under the then Chemical Pathology Department. In 1986 it was designated a separate Department (Department of Nutrition) to carry out research directed towards improvement of the nutritional status of Ghanaians. Specifically, it was tasked to identify and contribute to solving the nutritional problems of the country by collecting basic information regarding the nutritional status of vulnerable groups in the society and examining the contributory factors to malnutrition.

The Department’s main research areas relate to maternal, infant and children nutrition, food consumption and food security, micronutrient deficiency and interventions, these being the priority food and nutrition problems in Ghana. It has also acquired extensive experience in the broad area of applied nutrition research and interventions. Some of its recent intervention projects include:

- Tailoring Food Sciences to Endogenous Patterns of Local Food Supply for Future Nutrition (TELFUN). Focus: To assess the efficacy of iron-fortified cowpea-based diet to improve diet quality and iron and nutritional status of school children fed through the school feeding program.

- Effect of fish meal and vitamin C on the iron status of Ghanaian children consuming cowpea-based food, to assess the combined effect of consumption of fish meal, vitamin C and cowpea-based food on non-haeme iron bioavailability and iron status of school children fed through the school feeding program.
Development of a focused ethnography study manual to assess the behavioural and local market environment for a commercial complementary food.

In fulfilling its mandate the Department has conducted studies in some core areas such as:

A) Nutritional requirements of Ghanaians

Under this area the Department concentrated its efforts on investigating the protein requirement of Ghanaians through a number of studies including:

- Nitrogen balance study in Ghanaian male adults
- Nitrogen balance in Ghanaian adolescents
- Obligatory nitrogen excretions of Ghanaian male adults
- Assessment of nutritional status – Work in this area was carried out through the following studies:
  - Nutritional parameters during recovery process from malnutrition
  - Food consumption survey in different communities of southern Ghana (1983 – 1984)
  - Nutritional survey in a rural community in the Upper East region of Ghana

B) Assessment of Vitamin A Nutrition

In this area, the Department conducted the following research to establish that poor health, duration of breastfeeding and acceptance of weaning foods are possible factors associated with malnutrition in children:

- Primary causes of protein energy malnutrition (PEM) and diarrhoea in children
- Assessment of duration of breastfeeding
- Age of commencement and rejection of weaning food
- Nutrients content of local foodstuffs – This entailed a detailed analysis of the energy, moisture, nitrogen, fiber, ash, lipid, vitamins (retinol, thiamine, riboflavin and ascorbic acid) and minerals (sodium, potassium, calcium, phosphorous, zinc and iron) content of selected local foodstuffs. This study has potential of helping to update the food composition table of Ghana.
- Suitability of fluids for rehydration therapy – The Department carried out analysis for the chloride, sodium, potassium and sugar contents of some fluids to evaluate their use as oral rehydration solutions (ORS). The fluids analysed were kenkey water, coconut juice and rice water. Biological assessments were also carried out.

These and many more of the studies done by the Department have proved useful in providing information for education on the proper weaning age for children, the need to provide more protein and energy to adolescents and generally the importance of good food for growing children as well as for children recovering from illness. They also underscored the need for increased fruits and vegetables in the diets of Ghanaian of all ages.

A senior technician using the HPLC equipment in the nutrition department.
Department of Parasitology

This Department was established in 1979 purposely to carry out research on the aetiology of the major parasitic diseases in Ghana to facilitate the implementation of effective control. Its mandate is also to conduct basic and applied research in communicable diseases such as malaria, neglected tropical diseases including (but not limited to) lymphatic filariasis, onchocerciasis, schistosomiasis (Bilharzia), leishmaniasis, Soil-transmitted helminthiasis (STH), human African trypanosomiasis (HAT), Buruli ulcer and toxoplasmosis.

In 1980, the Department benefited from a JICA sponsorship that brought in Japanese scientists to work in collaboration with other Departments on a diarrhoeal diseases project.

The Department in carrying out its research mandate interacts with Ghanaian communities by communicating results from studies and offering health education through durbars with citizens in the Institute’s field research sites.

It also offers mentorship, undergraduate, graduate and postgraduate research training and capacity building for students and researchers from local and international academic and research institutions. Over the years, the Department has supported the training of several MPhil and PhD students most of who occupy positions within and without the Institute, locally and internationally.

As regards schistosomiasis, the Department has been at the forefront of investigations into host-parasite relationship using snail cross-infection and electrophoretic methods as a basis for recommending effective control measures. It has consistently provided information on the life-cycle of the parasite to the schistosomiasis unit of the Ministry of Health and the Institute of Aquatic Biology (CSIR) to facilitate their research.
The Department is also leading toxoplasmosis research aimed at contributing evidence that will influence policy and effective control and prevention of the disease, especially, among women of child-bearing age to improve maternal and child health. The Department is involved in the challenge of unravelling the mode of transmission of *Mycobacterium ulcerans*, the causative agent for Buruli ulcer and doing similarly for leishmaniasis. The Department also collaborates with local and external academic and research institutions in vaccine development and drug discovery studies for parasitic diseases, including schistosomiasis, STH and HAT, exploring medicinal plants in Ghana.

Recently, the Department engaged in a major research project on asthma and allergies (non-communicable diseases) because of the linkages with helminths infections.

It contributes immensely to comprehensive school health and nutrition by working in collaboration with the health and education sectors in Ghana and sub-Saharan Africa through human resource capacity building. This is with support and in collaboration with JICA.

The Department has contributed to parasitic diseases database and scientific knowledge through its numerous publications, reports, seminars and results presentations at local and international scientific meetings, and conferences.

The Parasitology Department also builds capacity of programme managers for parasitic diseases control in Africa, and provides specialised technical services to local and international industries and agencies.

Three specialised centres with facilities at NMIMR are affiliated to the Department. These are:

1. Lymphatic Filariasis Support Centre for Africa (LFSCA)
2. West African Centre for International Parasite Control (WACIPAC)
3. Vestergaard-NMIMR Vector Laboratory
Department of Virology

The Department of Virology started as one of the first three collaborative projects instituted in 1968 under the Ghana-Japan Medical Cooperation Programme (GJMCP) between the Fukushima Medical College and the University of Ghana Medical School (UGMS).

The specific project which the Department was an integral part of was the Virology and Electron Microscopy project, based at the Department of Microbiology, UGMS. The objectives outlined for it in the initial constitutive documents of the cooperation were to provide diagnostic services for viral infections; specifically:

- HIV by immunofluorescent antibody test (IFAT) and Western Blot test.
- Yellow fever by IFAT and neutralization tests
- Measles by neutralisation and Haemoglobin Inhibition Test (HIT)
- Poliomyelitis by neutralization test
- Rubella by HIT

Its early work included among others the following:

- Assessment of the seroconversion rate of measles vaccination at three communities in southern Ghana, to determine the optimal age for measles vaccination;
- Assessment of the role of rotavirus in infantile diarrhoea in two communities - Gomoa Onyadze and Gomoa Fetteh.
- The first diagnosed CA 24v-related epidemic of Acute Hemorrhagic Conjunctivitis (AHC) in an African country south of the Sahara.

With the emergence of viruses such as the Human Immunodeficiency Virus (HIV), the Department rapidly gained prominence and increasingly became active in the development and evaluation of rapid diagnosis tools and sero-epidemiological surveillance for viral diseases.

The Virology Department collaborates with other Departments of NMIMR to carry out critical research on viral infections such as:
In collaboration with the Department of Parasitology it established a Bioinformatics Centre under the auspices of H3AfricaBioNet Consortium - a consortium of universities and research institutes, coordinated from the University of Cape Town (South Africa). The aim is to utilize bioinformatics and computational biology for health benefits in Africa through the effective support and implementation of cutting-edge, cross-discipline, integrated high-impact genomic and epidemiological research programmes.

Under the WHO Global Polio Eradication Programme, the Department is responsible for a laboratory for surveillance of poliomyelitis viruses from Acute Flaccid Paralysis (AFP) cases in Ghana. It has consistently maintained its status as a WHO Accredited Poliovirus Laboratory in support of the Global Eradication Programme and continues to receive samples, isolate and characterize poliovirus and other enteroviruses from AFP children and promptly reports the results to the Ministry of Health/ Ghana Health Service and WHO.

Resource persons from the Department have provided technical support for the Ghana – Sudan partnership to strengthen the capacity of public health laboratories project - a project that resulted in significant improvement in public health laboratory services in Khartoum, through the development of standard operating procedures to cover laboratory procedures, quality assurance, biosafety and molecular tools in microbiology.

The Department’s recent major areas of research are HIV, influenza, poliovirus/other enteroviruses and viral haemorrhagic fever viruses. The Department also provides diagnostic support for emerging and re-emerging infections such as Lassa fever and Simian herpes virus.

One of its significant activities in HIV work is the pilot project for the Prevention of Mother to Child Transmission (PMTCT) of HIV in Ghana with the anti-retroviral drug Nevirapine. The Department was instrumental in a NMIMR/Ghana Statistical Service collaboration to implement the 2003 Ghana Demographic and Health Survey which was the first to incorporate HIV testing. The data obtained is still used in population estimates and national models for HIV prevalence in Ghana.

The Department conducted the first ever phase III clinical trial to investigate an agent; SAVVY for the ability to prevent HIV transmission in Ghana. Additionally, it is credited with providing laboratory expertise for patient management and research needs of a pilot comprehensive treatment and management of antiretroviral therapy programme for HIV in Ghana.

In an interesting study, the Department did an assessment of serological responses to Hepatitis B and Haemophilus influenza B vaccines in infants receiving vitamin A supplementation to examine the effect of vitamin A supplementation during the early months of life on the immune responses of infants to the Hepatitis B and Haemophilus influenza type B components of a pentavalent vaccine.

Through the Department’s reputable work in surveillance for influenza virus in acute respiratory illness in Ghana, the NMIMR has been designated as the national influenza centre for Ghana as part of the WHO global influenza surveillance and response system.

The Department is actively working with the Tokyo Medical and Dental University, Japan, and the Koforidua Government hospital to characterize prevailing HIV recombinant strains in patients under the project “Characterisation of Prevailing HIV Recombinant Strains in Ghanaian Patients on Anti-Retroviral Therapy in Koforidua, Ghana”. This study will provide data to guide national policies on anti-retroviral therapy.

The Department’s “Integrated Human-Animal-Vector Surveillance (IHAVS)” initiative is targeted at selected high-risk populations characterized by a dense co-mingling of humans, animals and vectors of disease agents. The study is:

1. A comprehensive risk assessment and outbreak evaluation tool for quick diagnosis of endemic and emerging infections
2. A tool to fill the gap in current surveillance capacities for diseases of interest belonging largely to neglected tropical diseases (NTDs).
NMIMR prides itself as the host for a number of recognised national and international centres and laboratories of enviable stature and excellent standards. These are:

- Prince Alwaleed Clinical Research Facility
- WHO Regional Reference Laboratory for Poliomyelitis, Africa
- Laboratory for Surveillance and Diagnosis of Rotavirus Diarrheal Diseases
- Biosafety Level 3 Laboratory
- National Influenza Centre
- Lymphatic Filariasis Support Centre for Africa (LFSCA)
- West African Centre for International Parasite Control (WACIPAC)
- African Rotavirus Surveillance Network (ARSN)
- NMIMR-Vestergaard Research Facility
Health Support Centre

NMIMR – Vestergaard Research Facility

West African Centre for International Parasite Control (WACIPAC)

Lymphatic Filariasis Support Centre for Africa
Significant Collaborations

**NMIMR – Yale University Research Partnership for Capacity Building**

The Ghana-Yale Partnership for Global Health was established in 2006 to build sustainable biomedical research capacity through an ongoing collaboration between Yale University and the Noguchi Memorial Institute for Medical Research (NMIMR) and the University of Ghana Medical School (UGMS). The Ghana-Yale Partnership fosters collaborative research, sponsors bi-directional faculty and student exchanges, and training young scientists for productive careers focused on infectious diseases of great public health importance. The mission of the Ghana-Yale Partnership is the training of young scientists in the latest laboratory and field-based methodologies, with a goal of inspiring the next generation of investigators committed to global infectious diseases research. This innovative program effectively leverages the expertise of faculty at the University of Ghana and Yale, creating a partnership that catalyses discovery while building research capacity at NMIMR.

The Ghana Research Scholars Program is an intensive 8 week summer program held at Yale for a select group of trainees from NMIMR and UGMS. These students and postdoctoral fellows, selected from among the most accomplished trainees at NMIMR/UGMS, receive a mentored research experience with Yale faculty experts in infectious diseases. The Ghana Research Scholars attend research seminars, take courses at Yale’s Investigative Medicine Program, and present data at a formal research symposium. While at Yale, Ghana Research Scholars join other international trainees, as well as Yale students, in a program of activities specifically designed to nurture a global community of young scientists who are committed to collaborative research.

In addition, each year Yale students and postdoctoral fellows conduct laboratory and field-based research in Ghana under the mentorship of faculty at NMIMR/UGMS. These trainees accelerate the progress of existing projects, and also develop important relationships with future collaborators. Upon return to New Haven, Yale trainees present their work at symposia on campus, further highlighting the important accomplishments of the Ghana-Yale Partnership and value of conducting research in an endemic setting. More than 20 young NMIMR scientists and faculty from NMIMR have visited Yale University since 2007.

In 2007, the Programme also launched a Visiting Professorship programme to highlight collaborative research at Yale University and NMIMR/UGMS. In 2007, Yale Professor Dieter Söll PhD delivered the inaugural lecture at the Noguchi Institute. In 2008, Noguchi Professor Michael Wilson PhD spoke at Yale on his work to eradicate insect vectors of onchocerciasis in Equatorial Guinea. In 2008, Yale Professor Yung-Chi Cheng delivered the 2nd annual Yale Visiting lecture on the pharmacology of traditional medicines, and in 2010 Yale Professor Gerald Friedland spoke in Accra on drug resistant tuberculosis and HIV. In addition, numerous Yale faculty members have delivered research seminars during visits to NMIMR, including Linda Koch Lorimer (Vice President and Secretary of Yale University), Dr Elijah Paintsil (Yale School of Medicine) and Dr Michael Cappello (Yale School of Medicine) and Dr Debbie Humphries (Yale School of Public Health).

Other areas of capacity development at NMIMR include the setting up of the Institute’s Office of Research Support and the Noguchi Institutional Animal Care and Use Committee which the Yale Office of Sponsored Research and Yale Institutional Animal Use and Care Committee
respectively assisted by providing on-site training of Nana Oye Akuffo and Dr Phyllis Addo at Yale University.

The activities of collaborative research is supported by institutional resources and individual faculty grants, with data generated through these projects used to write new grants and patents to fund future work. Our young scientists are supported by the Institute, while Yale provides intensive faculty mentoring, opportunities for ongoing collaborative engagement, and access to its vast research and training infrastructure. Yale students who travel to participate in research at NMIMR apply for fellowships offered through the Yale College Dean’s Office, the Office of Student Research at Yale School of Medicine, the Wilbur Downs International Research Fellowship Program at the Yale School of Public Health, and the Doris Duke International Medical Fellowship.
NMIMR and DANIDA Relations

The Danish government through DANIDA (Danish International Development Agency) has supported the Noguchi Memorial Institute for Medical Research for a long time. It initiated the Accra Copenhagen Research Link under the Enereca Programme which started in the early 1990’s through collaboration between Centre for Medical Parasitology, University of Copenhagen and two departments with the Institute (Epidemiology & Immunology) together with department of child health at korle-Bu under a research programme in Malaria Pathogenesis which lasted for about Ten years.

Through this support, DANIDA in collaboration with the Institute helped in training staff at the Mampong Center for Scientific Research into Plant Medicine to PhD levels. The support has also trained a number of NMIMR staff to masters and PhD levels both locally and internationally at University of Copenhagen over the years.

Again most of the research conducted on Pregnancy-Associated Malaria received funding from DANIDA.

Recently, scientist from the Institute in collaboration with their Danish partners won a five years grant in Malaria Vaccine Research and Capacity building in Ghana (MAVERECA) with the overall objective of building capacity that can accelerate Malaria vaccines. The project is training four Ghanaian PhD students through a sandwich programme in collaboration with the Centre for Medical Parasitology, University of Copenhagen. This capacity building is aimed at establishing a well-equipped Laboratory, well trained staff to diagnose malaria and to identify the potential malaria vaccine candidates against severe malaria. (Another group of scientist from the institute have won five years grant to look at the area of capacity building at the Hohoe Municipal Hospital for the Study and Management of severe malaria.)

With the vision of the Vice Chancellor of University of Ghana to establish malaria centre of excellence, which aimed at eliminating the disease in the very near future, it is the hope that by building this capacity in the area of Vaccine development, the effort of eliminating malaria is bright.

Over the years, the Danish government through DANIDA has played a very pivotal role in the area of malaria research in the Institute which has been demonstrated in the support that has been received both academically and technically as well as the provision of equipment for Malaria research.
Community Relations (Gomoa Onyadzi, Central Region, Ghana)

The Noguchi Memorial Institute for Medical Research considers it both a duty and a privilege to make the impact of its research available for improving the health status of communities and for the general benefit of citizens. To this end NMIMR has continued to explore opportunities for meaningful engagement with communities in various parts of the country.

In 1986 for example, the then Director, Dr. F.C. Grant requested a team from the Institute to visit Gomoa Onyadzi in the Central region of Ghana and to specifically undertake activities to ensure drastic reduction of malaria cases in the area. In the process of time, a collaboration developed between the Institute and the people of the community leading to the establishment of a Noguchi health facility there. Professors Francis Nkrumah, Fred Binka and Edwin Afari all staff of NMIMR personally devoted time and resources towards the establishment of the health facility. In the year 2000 it was upgraded to a health centre and a nurses' quarters was constructed with Japanese assistance.

Since its inception, the facility has helped to reduce death through motor accidents, malaria, diarrhoea, etc. In addition it has developed a strong focus on school health education and immunization and is also very successful in the provision of ante natal care. According to Ghana Health Service statistics, between 2,000 and 4,500 patients are attended to at the health centre annually.

To date it continues to be of immense benefit to the community and its immediate surroundings since it is the only health centre located between Kasoa and Mankessim.

In future it is expected that the collaboration between the Institute and the health centre will be further deepened through the training of personnel and the provision of other appropriate support.
Achievements and Policy Impact of NMIMR

Teaching and Training

NMIMR, with its high calibre scientists and facilities, provides unique opportunities for more economical training of biomedical scientists at the B.Sc., M.Sc. and PhD levels locally. Recently, a new chapter in the training of biomedical scientists was opened with the inauguration of Post-Doctoral Training Fellowships at the Institute, with sponsorship from the Bill and Melinda Gates Foundation (BMGF). This is a regional initiative that aims at training young African scientists in biomedical research for the control of infectious diseases. The Institute’s senior members are constantly involved in teaching at some of the constituent faculties of the College of Health Sciences as well as some departments of the University of Ghana, while Research Fellows and faculty members provide supervision of MPhil and PhD students. These all go to support the development of manpower in the biomedical sciences for the country.

It is worth noting that students from sister universities in Ghana and in Africa have conducted and continue to conduct postgraduate research at the Institute’s facilities. The Institute also organises local and international training programs to:

• Upgrade the skills of programme managers and policy makers in the health and health-related sectors;
• Train middle level technicians from both public and private health facilities in Ghana in routine diagnostic skills for major endemic diseases such as malaria, TB, HIV/AIDS;
• Train postdoctoral scientists in control of infectious diseases;
• Build capacity of various technical and professional staff through workshops and in-service programmes.
HIV/AIDS
- NMIMR Scientists were the first to diagnose HIV in Ghana in 1982 and the Institute has since served as a reference and confirmatory HIV laboratory in the country.
- NMIMR continues to conduct genomic and antigenic analysis and characterization of HIV1 and HIV2 towards future vaccine development.
- NMIMR is the national HIV drugs resistance centre that supports the monitoring of anti-retroviral therapy for HIV/AIDS.

Avian Influenza
- NMIMR with it’s state of the art diagnostic system confirmed the outbreak of avian influenza in domestic poultry in Ghana.
- The Institute’s diagnostic capability complements national health surveillance systems and protects the Ghanaian public from Avian Flu.
- The Institute serves as the National Influenza Centre, coordinating Influenza surveillance in the country and also providing data to the WHO influenza monitoring programme.

Malaria
Provision of evidence to guide Malaria treatment control policies in the following ways:
- Results of the NMIMR research into malaria contributed to the drafting of the country’s first national malaria control policy in the 1990s.
- Work on anti-malarial drug sensitivity helped reveal the emerging ineffectiveness of chloroquine in the late 90’s. The studies provided evidence for the change in drug treatment policy from chloroquine to Artemisinin + Amodiaquine.

Polio Eradication
- Studies conducted by NMIMR formed the basis for the WHO global adoption of the current polio immunisation schedule (with an additional dose at delivery).
- The Institute has trained several scientists to oversee national polio laboratories in Africa.
- Currently, the Institute is a regional WHO accredited laboratory for surveillance and diagnosis of poliomyelitis in the sub region.

Rotavirus infection
- Researchers of the Institute have received global recognition for conducting cutting-edge research to demonstrate the role of rotavirus in severe cases of diarrhoea in Africa.
- The Institute hosts a Rotavirus Reference Laboratory (RVRF) that serves West and Central Africa. Through it several doctors and researchers around the continent have received training in the detection of rotavirus.
- The RVRF has facilitated surveillance and provided data on the burden of disease in the sub-region thereby creating a vibrant African database for tracking rotavirus infection.

Measles control
- Results of research conducted at the Institute justified the development of new multiple measles immunizations in children.
**Buruli ulcer**
- Scientists at the Institute have purified the Buruli ulcer toxin and replicated the disease in animals in order to advance further understanding of the disease and the development of drugs to cure it.

**Schistosomiasis (bilharzias)/Intestinal worms**
- Diagnosis of schistosomiasis
- Operating the global parasite control initiative in West Africa; West African Centre for International Parasite Control (WACIPAC)
- Training of programme managers from selected West African countries in the management of bilharzias and other intestinal worms.

**Onchocerciasis**
- Successful work done to control and eliminate blackflies from the island of Bioko in Equatorial Guinea. The blackfly control commenced in 2004 and ended in 2005. Bioko has since been certified as free from blackflies.
- NMIMR research has produced results to support policies for freeing onchocerciasis-ridden tracts of arable land for settlement and cultivation. Research work in the area of vector control helped to alleviate the biting nuisance of the black fly hence improving the living environment in endemic areas. In this regard scientists from the Institute assisted the Bui Power Authority to control blackflies biting nuisance at the Bui Dam site and its environs.

**Leishmaniasis**
NMIMR has remained in the forefront of critical entomological and parasitological studies to produce critical understanding of the disease parasite and vector species following an outbreak in the Hohoe District of the Volta region. The studies also informed policy and the development of a comprehensive disease prevention and management plan.
Lymphatic filariasis

As part of ascertaining the reasons for persistent on-going transmission in certain endemic areas despite several years of treatment, NMIMR conducted significant studies towards the following:

- Development of the evidence base and tools for Mass Drug Administration (MDA)
- Establishment of the evidence base for implementing and scaling up disability prevention programmes
- Improvement of implementation of MDA in urban settings and where opportunities exist for integration

Additional work:

- Studies
  - Human exposure to aflatoxins and heavy metals (Lead and Mercury)
  - Dengue fever
  - Leprosy
  - African Trypanosomiasis
  - Chagas
- General contributions to improvement in the health of Ghanaians through the establishment of clinics in rural areas and the introduction of services such as childhood immunisation, antenatal care, treatment of parasitic diseases and minor illnesses as well as health education and basic sanitation programmes to reduce infant and child morbidity and mortality.

- Students from the country’s tertiary institutions and foreign universities are regularly attached to NMIMR for laboratory experience and conducting research projects for university degrees. Additionally, NMIMR’s Research Studentship Programme which provides opportunities for graduate students to undertake their project work with full sponsorship from the Institute is well known and highly rated.
- Through specialised training of middle level manpower and programme managers, the Institute has enhanced the preparedness of health systems for disease diagnosis and control and currently acts as the first point of call in providing research capacity to manage emerging and re-emerging epidemics such as Avian Influenza.
- NMIMR provides scientific evidence to inform Malaria treatment and control policy, and has made available laboratory diagnostic support towards Polio eradication, control of Measles, management of Buruli ulcer, as well as epidemiological and diagnostic support for the control of schistosomiasis (bilharzias)/intestinal worms. Additionally it provides support for the development of plant medicines.
Future

Through research and other outreach programmes, the Institute has made strides in responding to the need to find solutions to the various health problems in Ghana. NMIMR has therefore contributed significantly to medical research for the improvement of the health of Ghanaians.

From the establishment of clinics in rural areas, the testing of the effects of basic primary health care services such as childhood immunisation, antenatal care and the treatment of parasitic diseases and minor illnesses, NMIMR has made significant contributions to the improvement of health care in the country.

Guided by long term strategic thinking and planning, NMIMR has worked assiduously to execute its mandate by implementing an excellent biomedical research agenda. Through the collective resources of its research departments the Institute has actively supported, strengthened and accelerated medical research in Africa and globally. Clearly the Institute's current infrastructure has positioned it to be a backbone to manpower development in health research.

Going forward, the success in the future for NMIMR will depend on its ability to harness all talents therein to conduct innovative research, build upon the gains made thus far to be of relevance to Ghana and global health. In particular we aim at:

1. Improving funding to support further development and to expand research activities, especially those of local importance such as development of local traditional medicines by:
   • Increasing internally generated funds
   • Expanding the base for externally generated funding for research
   • Augmenting the Institute's financial base through establishment of an endowment fund
   • Collaborating with industry to develop products from research. To this end the establishment of the Institute of Applied Science and Technology (IAST) by the University of Ghana is a welcome development and the Institute will seek greater collaboration with IAST
   • Improving measures for prudent resource management

2. Developing existing capacity and potential human resource for expanded research activities. To this end the Institute will:
   • Attract qualified and highly trained research staff from local and international sources
   • Increase number of staff with higher qualifications (PhDs)
   • Increase number of students (M.Phil. and PhD) to support research activities
   • Create project funded Post-Doctoral positions

3. Acquiring additional infrastructure and new technology to address current and emerging health threats beyond Ebola
   • Major expansion of working space by building specialized laboratories. To this end, discussions are far advanced for the construction of Advanced Research Laboratories for Infectious Disease under the auspices of JICA.
   • Improving facilities for genomics, proteomics and bioinformatics. The Institute will use these methodologies to build upon its work in Ebola testing to establish a platform for the detection of other emerging viruses of epidemic
potential besides Ebola virus.

- Equipping laboratories for cutting edge research into chronic diseases and drug discovery research. The Institute will progressively and in the medium term expand its research into Diabetes Mellitus, Hypertension, Cancers, Chronic Kidney Diseases etc.
- Pursuing climate change associated health and mapping of diseases
- Upgrading the Institute’s Internet system for more effective support for research and training activities

Additionally the Institute plans to:

- Increase capacity for conducting of clinical trials
- Establish research into molecular characterization of laboratory animal strains, including exploring the biomedical resourcefulness of indigenous small mammals in research into such diseases as Diabetes and hypertension.

- Increase the number of Journal articles and conference reports

While translating research into policy remains a challenge for many research institutions around the world, NMIMR’s will continue to work in close collaboration with the Ghana Health Service / Ministry of Health (GHS/MOH) to ensure that research findings are put to immediate use. To this end, the Institute will strengthen its discussions with the GHS /MOH and establish common platforms for policy engagement.

These initiatives emphasise the need for national research resources and greater support from Noguchi’s key funders, strategic partners and collaborators.
## Collaborators, Stakeholders and Funders of NMIMR

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<th>Collaborator/Stakeholder</th>
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<td>British Council - UK</td>
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<td>Canadian International Development Agency (Canada)</td>
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<td>Center for Diseases Control (USA)</td>
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<td>Centre for Neglected Tropical Diseases (UK)</td>
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<td>Danish International Development Agency (Denmark)</td>
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<td>European Foundation Initiative for Neglected Tropical Diseases</td>
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<td>European Union – African, Caribbean and Pacific Group of States (EU-ACP)</td>
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<td>European-Developing Countries Training Partnership</td>
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<td>Family Health International</td>
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<td>Global Fund</td>
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<td>International Association of National Public Health Institutes</td>
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<td>International Development and Research Center (Canada)</td>
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<td>Japan International Cooperation Agency (JICA)</td>
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<td>Ministry of Health- Ghana</td>
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<td>National AIDS Control Program</td>
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<td>National Centre for Competence in Research, North-South (Switzerland)</td>
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<td>Netherlands Organization for Scientific Research – Science for Global Development</td>
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Collaborators, Stakeholders and Funders of NMIMR

- Pasteur Stopenterics Services
- Prince Alwaleed Foundation
- Programme for Appropriate Technology in Health
- Research Triangle International (USA)
- Royal Society of UK
- St. Jude Center of Excellence for Influenza Research and Surveillance (USA)
- Swiss Development Co-operation (Switzerland)
- Swiss Tropical and Public Health Institute (Switzerland)
- Third World Academy of Science
- United States Agency For International Development
- University Development Cooperation (Belgium)
- University of California (USA)
- University of Liverpool (UK)
- University of Wageningen, The Netherlands
- US Naval Medical Research Centre

- US National Institutes of Health
- National Institute of Allergy and Infectious Diseases
- Vestergaard
- Wellcome Trust (UK)
- World Health Organization (Geneva)
- WHO Health Metrics Network (Geneva)
- World Health Organization Multi-lateral Initiative on Malaria
- World Health Organization Training and Development in Tropical Diseases (WHO/TDR)
- World Health Organisation Pesticide Evaluation Scheme (WHOPES)
- Zenith Bank, Ghana
- Unit
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