



The Bioinnovation Center

Academic City University College
location of the Bioinnovation Center

To address issues with the delivery of health care in rural West Africa, a partnership of

***Northeastern University,
Academic City University College
and the non-profit
4GBI (For Ghana Biomedical Innovation)***

have established a **Bioinnovation Center** on the campus of Academic City in Accra

Activities are being initiated to train entrepreneurial teams of engineers, healthcare workers and businessmen in the design, production and commercialization of medical devices and supplies designed specifically for use in the healthcare clinics of West Africa.

The rationale for the activities of the Center are based on a detailed analysis of the current challenges to health care delivery in rural Ghana.



Dr. Fred McBagonluri, President of Academic City, demonstrating the Smallwood Respiratory Assist Device

Current Ecosystem:

Most people of Ghana receive healthcare at rural healthcare clinics that are staffed by non-physician healthcare workers, have limited infrastructure, lack control of air quality, humidity or temperature and are subject to interruptions or fluctuations in electrical supply.



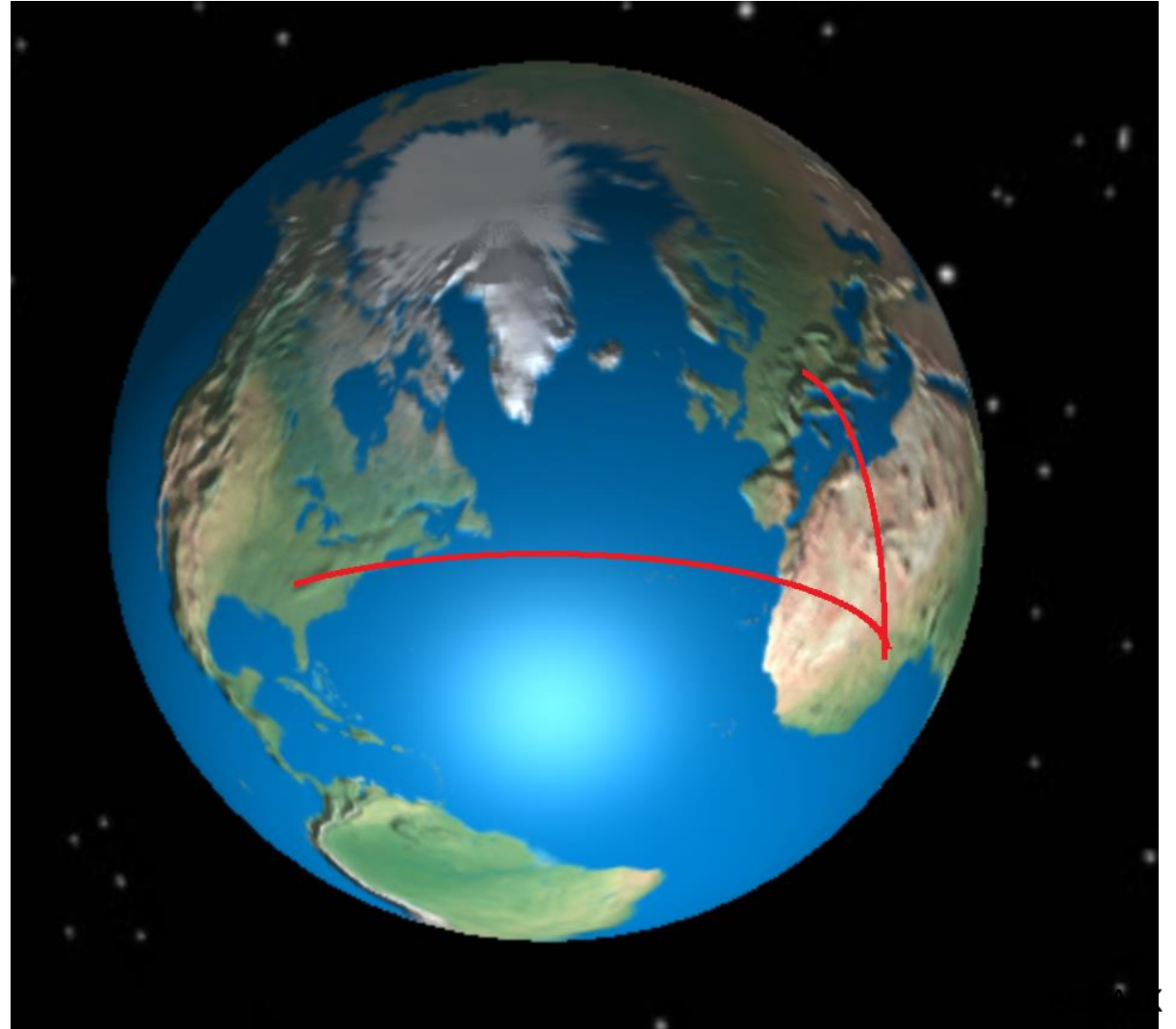


Deficiencies in infrastructure present formidable barriers to rural healthcare. It slows transportation of patients to better equipped District and Regional Hospitals and amplifies the importance of rural Clinics in healthcare delivery.

Supply Chains:

Over 95% of biomedical supplies and instruments used in Ghana are imported. The supply chain is long and vulnerable to disruption. Distance from manufacturer to end user makes maintenance contracts prohibitively expensive or impossible to obtain. Spare parts are expensive and their delivery indefinite.

Maintenance becomes nearly impossible and the working life-span of even the simplest instruments is shortened, and it is common for them to be used well after their accuracy or reliability is compromised.



Inappropriate designs:

Most currently available medical devices are not well designed for use in West Africa. The vast majority of biomedical supplies and instruments currently available worldwide are designed for use in clinics with stable temperature, air quality and humidity, and electrical supply. Rural clinics in Ghana do not have the infrastructure to maintain the standard of operational conditions required for these instruments. Instruments used in poorly controlled environments are prone to premature failure. Operational efficacy and quality suffer dramatically under these conditions - leading to error-prone functioning long before instruments are taken out of service.



University of Ghana
Medical Centre



Dwenase Health Center

Inadequate engineering support:

Every hospital in Africa has one or more 'equipment graveyards' - rooms filled with donated or purchased equipment that has failed and for which there are no resources for repair. The Ghana Health Service employs 200 biomedical engineers to provide service to their 7000+ facilities. This is patently inadequate.



photos courtesy of Robert Djagblety, MD

Shortage of Healthcare Professionals

Ghana has one physician for every 10,000 people. By comparison, the US has one physician for every 200 people. Consequently, the vast majority of healthcare in Ghana is provided by non-physician workers. Non-physician healthcare workers are also in short supply. Ghana has 35 nurses per 10,000 population, whereas the US has 125.

That said, in many cases, these workers are well trained to treat the most common diseases and injuries. But they lack the training needed to operate, calibrate, maintain or repair biomedical instruments and devices.



The reason the problem has not yet been solved:

The market for biomedical supplies and instruments in West Africa is small (financially if not by patient count) and manufacturing to design specifications appropriate for reliable operation in rural African infrastructure has never been a priority for vendors. As a market it remains unlikely to attract attention from existing device manufacturers in Europe or the Americas.

need designs that can be used here...



not here...



Scale of Need:

There are over 5000 community health planning and service centers (CHPS) and village health clinics in Ghana. Ghana represents somewhat less than 8% of the population of West Africa (roughly 33 million out of 430 million). Therefore, we can anticipate that there may be as many as 50,000 rural health care clinics in West Africa that suffer at least sporadic - if not chronic - shortages of biomedical materials and supplies while having to evaluate and treat patients with poorly functioning, poorly calibrated instruments that are prone to failure under the conditions in which they are used.

Locally sourced supplies and instruments supported by commercial teams capable of training, maintenance and repair are needed to address these shortcomings.

If Ghana can produce these:



Why not these:



courtesy of Robert Djangblety, MD

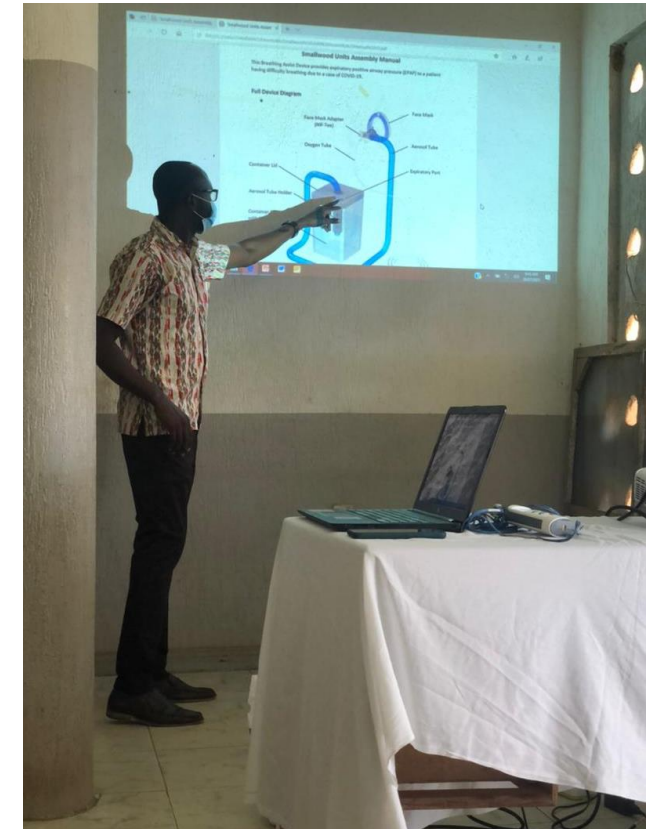
Our Strategy:

We posit that the endemic shortcomings in supply of biomedical materials, supplies and functional instruments can best be addressed by the local design, production and distribution of biomedical supplies and instruments specifically designed for conditions encountered in rural health care clinics in West Africa.

A partnership of Northeastern University, Academic City University College and 4GBI have established a **Bioinnovation Center** in Accra that is in the process of developing programs designed to train entrepreneurial teams in the design, production and commercialization of healthcare products that will improve healthcare delivery and to promote economic growth in West Africa.

Real impact will require commercialization - that is the only way to scale the manufacture and distribution of appropriately designed supplies and instruments to a level that will make an impact.

Our strategy is to use the **Bioinnovation Center** to drive the formation of companies that can accomplish this.



Demonstration of Smallwood Respiratory Assist Device at Asamankese Regional Hospital

Vision:

We foresee the Center as

A hub of an ecosystem of interdisciplinary interactions between healthcare professionals, engineers, academics and entrepreneurs.

A facility that will carry out training in rapid prototyping, entrepreneurship, fund raising, regulatory affairs, biomedical engineering.

A focal point of a Business/ Government/HealthCare/ Academia partnership formed with the mission of supporting the growth of a biomedical device industry that can serve local hospitals and health clinics while contributing to economic growth in Ghana.



Professor Fuller at a Rapid Prototyping Workshop at the Biomedical Engineering Department of the University of Ghana (2019)

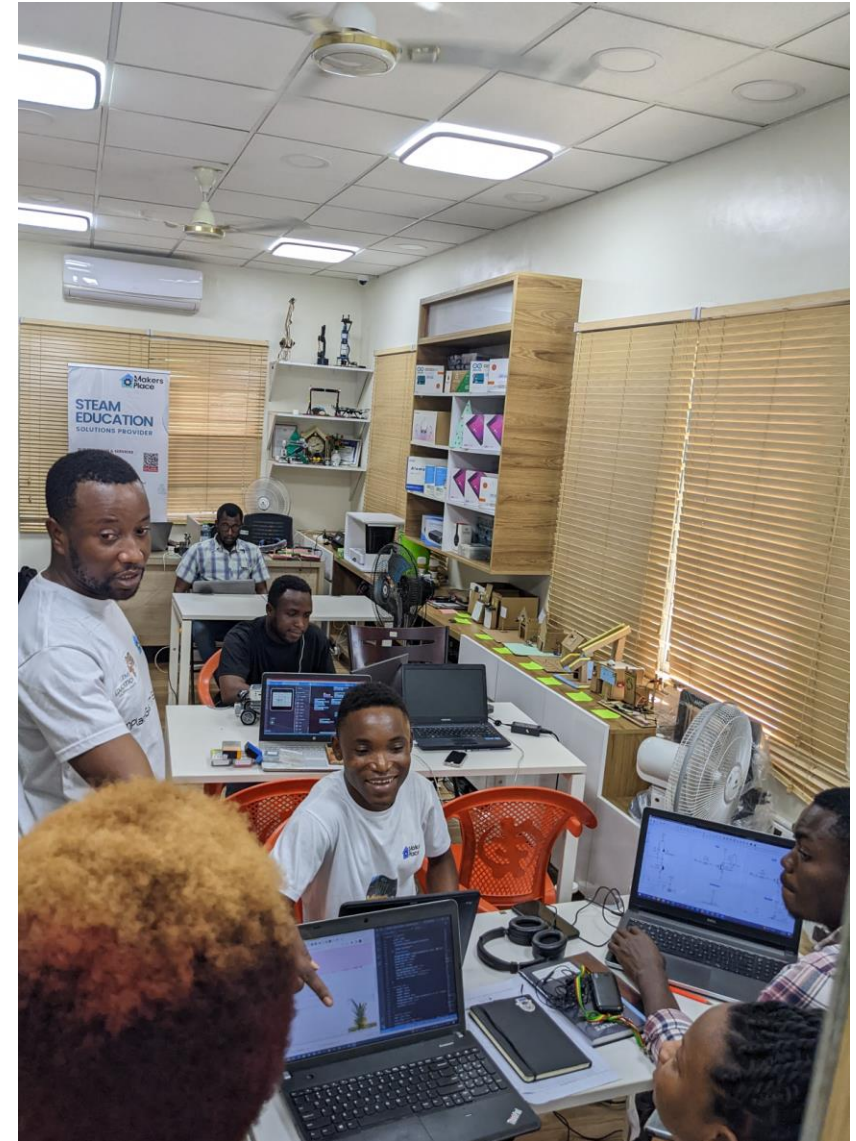
Infrastructure:

The Center will have resources for prototype fabrication including 3D printers, laser cutters, machine tools and computers.

It will have training space to stage workshops that bring together healthcare workers with engineers, entrepreneurs, government representatives.

It will act as a hub for visiting scientists and students from Northeastern and other Universities to work collaboratively with academics, physicians and health care workers in Ghana.

It will be a venue for efforts to form teams that will design biomedical devices tuned to the conditions encountered in rural West Africa and work together to build commercial enterprises that produce these devices.



Douglas Ayitey Tetteh, Founder
Makers Place, Ghana

Understanding the ecosystem:

A Bioinnovation Workshop held on December 6, 2022 was designed specifically to obtain feedback for our ideas. Over 200 healthcare workers from rural Ghana attended. The Okyehene, His Majesty Osagyefo Amoatia Ofori Panin II, the chairperson for the event, applauded all health workers for their dedication to ensuring that the country had access to good health, despite the difficulties they go through due to the unavailability of key logistics.

'We understand that sometimes the resources needed to provide the best possible healthcare remain unavailable. We would like to understand better what resources healthcare workers have to work with and what resources they still need to better fulfill their mission. These are physicians, engineers and lawyers who have travelled all the way to hear our stories. It is your job to help them understand the workings of our healthcare system. It is only when they better understand the current state of our healthcare that they will be able to provide resources to make us better. They need to know the resources we have and what resources we can benefit from having'.

- The Okyehene
in 'Modern Ghana'
December 10, 2022



The Okyehene at the
Bioinnovation Workshop

Networking:

Two days after the Workshop, a Symposium of sector leaders was held in Accra. This served to publicize our efforts and obtain feedback on our strategies and goals.



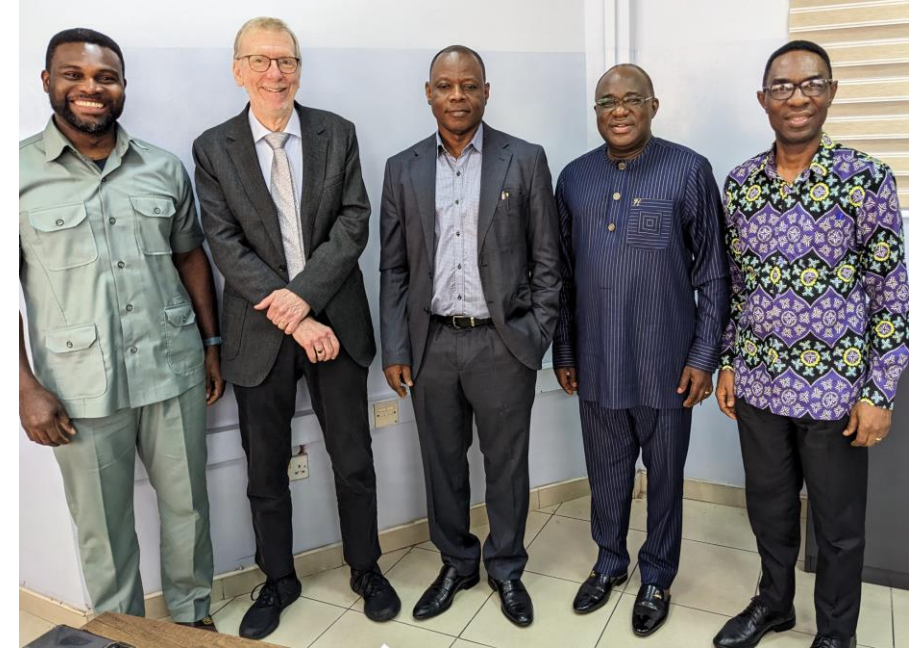
Some of the speakers at the Bioinnovation Symposium, Accra, December 8, 2022

Left to Right: Ben Honeynuga, Vice Chancellor, Ho Technical University; Barima Oppong Kyekyeku II, Chief Akyem Batabi, John Kutor, Professor of Bioengineering, UGhana (did sabbatical at Northeastern, spring 2022); Sam Burd, Member Northeastern BioE IAB; Tina Naa Mensah, Deputy Minister of Health; Robert Dzagblatey, Head, Anaesthesiology, Korle Bu Teaching Hospital; Kwabena Kyei-Aboage, Chief, Akyem Dwenase; Francis Agyare, Immigration Lawyer; Dr. Phillip Bannor, Registrar, Health Facilities Regulatory Agency, Ghana; Anthony Basing, CEO, Inca Therapeutics; Thelma Asare, OBGYN; Lee Makowski, Chair, Bioengineering, Northeastern University; Elsie Kaufmann, Dean, School of Engineering Sciences, U. Ghana (PhD, U. Penn)

Interfacing with Key Sector Leaders

Our initial efforts to obtain buy-in from all parts of the Healthcare sector have engaged a wide range of sector leaders. In May 2024, Lee Makowski and Francis Danso Agyare (4GBI) travelled to Ghana to meet with key actors in the sector, including

- Dr. Patrick Kuma-Aboagye, Director General of the Ghana Health Service
- Dr. Ebo Hammond, Director of Health Administration and Support Services Division of the GHS.
- Dr. Philip Bannor, Registrar of the Ghana Health Facilities Regulatory Agency (HeFRA) and
- Emmanuel Nkrumah, Director, Medical Devices, Cosmetics and Household Chemicals Directorate, Ghana FDA
- Dr. Fred McBagonluri, President, Academic City
- Patience Cofie, Country Manager of PATH
- Dr. Robert Djagbletey, Head of Anaesthesiology at Korle Bu Hospital
- Prof. Boatend Onwona-Agyeman, Professor and Provost in Materials Science, U . Ghana



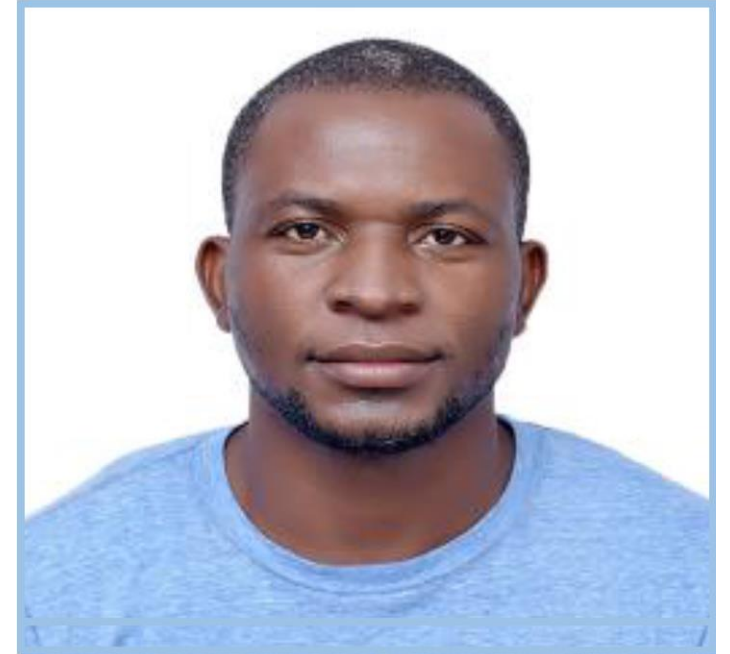
left to right: Francis Danso Agyare, Lee Makowski, Patrick Kuma-Aboagye, Ebo Hammond, Philip Bannor

First steps:

Funding: Initial funding for the Center came from a generous gift from an anonymous donor. Work continues to find additional support for the Program.

Director: Dr. Danyuo Yiporo (Senior Lecturer, Academic City) was recruited to be the Director of the Innovation Center. A faculty member at Academic City, Dr. Yiporo is committed to pushing forward the agenda of the Center

Location: Working with Dr. Fred McBagonluri, President of Academic City (AC), the AC campus was chosen to be the venue for the Center. AC will provide office and workshop space for the activities of the Center. Northeastern University will provide resources in the form of instrumentation, materials and supplies as well as arranging the engagement of faculty and students in engineering and entrepreneurship to work with Dr. Yiporo to construct an agenda for the Center.



Dr. Danyuo Yiporo

Next steps:

Initial steps will include:

- Establish a monthly Forum focused on Bioinnovation with on-line presentations from leaders in Bioinnovation from medicine, business and engineering.
- Create an Executive Committee of academics, entrepreneurs, physicians and engineers to develop a detailed agenda for the activities of the Center
- Devise a strategy for building and training entrepreneurial teams to commercialize medical device production