# Supplemental Appendix

# Clinical Chemistry for Developing Countries: Mass Spectrometry

Suji Lee, Kavyasree Chintalapudi and Abraham K. Badu-Tawiah*

Department of Chemistry and Biochemistry, The Ohio State University, Columbus, OH 43210

***Correspondence to Dr. Abraham Badu-Tawiah**

100 W. 18th Avenue, Columbus OH, 43210

Email: badu-tawiah.1@osu.edu

Tel.: 614-292-4276

Fax: (614) 292-1685

**BOX 1: Interview with Dr. Giles Edwards, Technical Director and Founder of Recycling Organization for Research Opportunities (RORO)**

**Q1. What is the main purpose of your company?**

**A.** RORO is a registered charity, so we all work as volunteers. We do not get paid for our work.

The main purpose of this charity is to provide sophisticated analytical instrumentation and training to academics who cannot afford the price of new equipment. As a secondary function, we also provide donors a service whereby we collect their redundant equipment for reuse in academia which assists them with fulfilling their obligations to society and assisting the wider scientific community.

**Q2. How many countries/Universities have you worked with so far?**

**A.** Oman, Pakistan, Nepal, Mongolia, Egypt, Uganda, Kenya, Ghana, Ethiopia, South Sudan, Namibia, and Cameroon

**Q3. Where do you get instruments from, to install in these areas?**

**A.** The main donor to date has been the Waters Corporation. We have also received donations from numbers of pharmaceutical companies, contract analysis labs and universities.

**Q4. Do you know what these instruments are being used for?**

**A.** Mainly in chemistry departments used for teaching and in research for running samples.

**Q5. After installation, how do the local people maintain these instruments to keep them functional?**

**A.** The RORO charity supports the instrumentation as far as possible with spare parts and preventative maintenance kits wherever possible, however, financial resources and time is not in abundance. For example, we had installed Waters Acquity TQD LC-MS/MS systems in Ghana and Nepal and when they developed faults this has resulted in the need for instrument swap out, replacement instruments are now ready to be shipped. Much easier solution than organizing a site visit with lots of spare parts. The TQD instruments that are not working will be shipped back for repair in the UK where time is not so critical.

**Q6. Any challenges common to the different places you have visited?**

**A.** Site requirements must be satisfied prior to installation. This would usually include decent air conditioning and a decent electrical supply. The quality of the electricity is often questionable with the need of additional uninterrupted power supply units being critical to smooth brown and black outs. A fluctuating electrical supply, dusty environment and insufficient air conditioning will significantly impact on the lifetime of the instrument. Over-priced gases also have a serious impact on research outcomes.

**BOX 2: Interview with Emeritus Professor Warren Dick, School of Environmental and Natural Resources, The Ohio State University and Director of the Non-Profit Organization Bethel Agricultural Association, Inc**

**Q1. What kind of work are you involved with?**

**A.** We mostly analyze agricultural and environmental samples. That includes analyzing soil, water, plants, and various types of waste materials.

**Q2. Why did you decide to establish this laboratory?**

**A.** In my experiences of working in Africa while I was still an active faculty member at The Ohio State University, I found that it was very difficult to get samples analyzed in Africa and to trust the data obtained. So, in our project's efforts to start an agricultural and environmental university in Ethiopia, we decided to also establish an analytical laboratory. I was also informed by people in Ethiopia that a functional analytical laboratory was a critical need. Finally, one of our project board members owns an agricultural consulting company and analytical laboratory and he has become a key person in helping us establish our laboratory in Ethiopia.

**Q3. What instruments do you use for your work?**

**A.** pH meters, atomic absorption spectrophotometers, UV/VIS spectrophotometers, and equipment to measure salt content and feed quality. I am sure we will also include an NIR spectrometer.

**Q4. How are the instruments maintained by the local people?**

**A.** That is yet to be determined. I do not know how many laboratory instrument technicians are in Ethiopia. Maybe this will be a place of opportunity for our new university, i.e. training these types of people.

**Q5. How has your lab contributed to the life of people in Ethiopia, compared with traditional methods they used to use?**

**A.** During a trip in 2019 to Ethiopia, I was told that the two main areas where we could provide support was to help farmers with soil fertility analyses and recommendations and in providing environmental impact assessments. Both areas require an analytical laboratory and so that is another reason we are moving this way forward.

**BOX 3: Interview with Professor Nathaniel Boadi, Chemistry Department, Kwame Nkrumah University of Science and Technology (KNUST)**

**Q1. What instruments are currently available at KNUST?**

A. The KNUST currently has six colleges and each college has a set of specific instruments they use. As of now, there is no single database of all the instruments available at KNUST, However, the University's Central laboratory has instruments that include but, not limited to the following: Bruker 500 NMR; Bruker Platinum ATR FT-IR; Perkin Elmer FT-IR; Flame AAS; Perkin Elmer GC-MS; Perkin Elmer GC-FID; HPLC; LC-MS-MS (TOF)

**Q2. What do the Chemistry Department use mass spectrometry for?**

A. The Department of Chemistry currently uses the GC-MS for chemical analysis such as determination of pesticide residues in environmental matrices. The Department of Chemistry and the Central Laboratory do not have a standalone mass spectrometer.

**Q3. What other instruments are popular in your department, and what are they being used for?**

A. The other popular instruments in our Department are the GC-FID/FPD/ECD and the ICP-OES

**Q4. How do outside people, not affiliated with the University, benefit from these core facilities?**

A. The KNUST Central Laboratory is a commercial laboratory that is open to the public for analyses at a fee. Academic and business clients from other places are able to get their samples analyzed at the Central Laboratory.

**Q5. How are the instruments maintained or serviced?**

A. Periodic maintenance is done on all the instruments at the University's Central Laboratory. This occurs about twice each year and whenever an instrument is down.

**Q6. What are the main challenges for such facilities?**

A. The cost of maintenance and consumables are the main challenges faced since the technicians are flown from abroad for maintenance and servicing of the equipment and the consumables are all imported.