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UNDER THE MICROSCOPE

NIGERIAN APPLIED MICROBIOLOGISTS NEWSLETTER

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Researcher In Focus

*Dr Adewale Obadina, Director,
Biotechnology Centre, FUNAAB*

Research Article

*Is Africa full of new microbial
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from the editorial team

JOYCE ODIMBA, OBABIYI AJAO, AMARA ANYOGU

"There is no useful research coming out of Nigerian Higher Education Institutions!"

This comment on Twitter a few months ago served as a wake up call. I (Amara) have been involved in a number of successful collaborative research projects with Nigerian-based scientists. After our results and conclusions are published in scientific articles, I cannot help asking 'What next? What impact will this have on the lives of ordinary Nigerians?'

We know our research matters. It can and does improve our lives. It has the solutions for feeding our growing population with safe, nutritious food; for diagnosing and treating infectious diseases; for decontaminating our polluted waters.

However if we are to achieve these laudable goals, we must improve the quality and quantity of our microbiological research output. We must also do a better job of communicating the 'why, what and how' of our research with the general public.

Welcome to the maiden edition of 'Under The Microscope', the periodic newsletter of the Nigerian Applied Microbiologists Network. Our mission is to showcase both our research and researchers. We know why #MicrobesMatter, we need everyone to know too!

In this edition, our research article discusses Africa's potential as a source for new microbial species. These microbes can make a significant contribution to our bio-economy and health, but we must focus our research efforts on identifying them accurately. We are also privileged to interview Dr Obadina, one of the mentors in our network. He shared his thoughts on his career journey so far as well as the challenges and future prospects of biotechnology research in Nigeria.

It's not all 'serious' science stuff though, check out how well you do in our Food Microbiology trivia! We hope you enjoy reading this edition as much as we enjoyed creating it! Till next time.

Nigerian Applied **MICROBIOLOGISTS**

In July 2017 at the annual Society for Applied Microbiology conference, a group of researchers met to discuss the challenges and opportunities that face Nigerian based researchers. This conversation ended with the creation of the Nigerian Applied Microbiologist network.

We are a dynamic network of scientists with a mission to advance applied microbiology research in Nigeria and beyond. We have set out to achieve this by; 1) fostering collaboration among our members 2) serving as a platform for mentoring early career researchers and 3) communicating science and engaging with the general public to raise awareness of the importance of applied microbiology in our every day lives.

The values that underpin our group are **collaboration** and **contribution**. We collaborate to maximise the impact of the work we do. We also contribute our resources to guarantee the sustainability of our network. To adapt President John F. Kennedy's famous quote, our motto is - 'Do not just ask what the network can do for you but think about what you can give to it'.

For more information about joining us, please contact our Communications Officer, **Nneka Odimba** - nam2utm@gmail.com.

UNDER THE MICROSCOPE

Science is for everyone. However, too often the outcomes of our research remain hidden in peer reviewed journals, inaccessible to our most important stakeholders - the general public. An important part of our mission as a network is to communicate science with non-scientists of all ages and backgrounds.

With this in mind, we have recently launched our blog - Under the Microscope. This can be accessed at www.nigerianappliedmicrobiologists.wordpress.com. We aim to write clearly using as little jargon as possible. We aim to write accurately and provide evidence based information. We aim to advertise the research coming out of our Universities and Research Institutes. We aim to create a platform for mentoring and developing the writing skills of our early career researchers. We aim to highlight the challenges faced by our researchers and collectively seek solutions.

Our blog is a community project. We would love to read from you. For more information on how you can contribute, please contact our Publications Officer, **Obabiyi Ajao** - nam2utm@gmail.com.

Amara Anyogu & Yinka Somorin
Convenors, NAM

RESEARCHER IN FOCUS

Dr Adewale Obadina

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BY NNEKA ODIMBA



Under The Microscope (UTM): *Please can you share your education and professional background?*

Adewale Obadina (AO): I obtained my BSc in 1998, Masters and Ph.D degrees in 2002 and 2006 respectively from the Federal University of Agriculture, Abeokuta, Nigeria (FUNAAB). I began my lecturing career at Bells University of Technology, Ota, Nigeria in 2005 in the Department of Food Biotechnology and later became the coordinator for the Department of Food Science and Technology. In September 2009, I returned to FUNAAB, where I continued my career as a Food Science and Technology lecturer and researcher.

UTM: *Where did the love/passion for microbiology come from? Was it a case of 'no medicine, then something close to it?*

AO: The passion for Food Microbiology was developed during the period of my undergraduate project. I worked on "Studies into the Microbiological Safety of fermenting cassava mash 'Lafun' under the supervision of my mentor, Professor O.B Oyewole. I decided to choose Food Microbiology & Biotechnology for my Masters program. I was also exposed to the world of Food Microbiology and research grants during this period by my mentor.

UTM: *What is the benefit of your research to the 'everyday' Nigerian?*

AO: During my PhD research, I was able to identify the problem of food safety with cassava fermented 'fufu'. As a result, I developed a HACCP plan for the production of hazards free 'fufu' among which some recommendations were made that many people in the business are using now:

UTM: **What are your current projects? How do they contribute to our country's development?**

AO: Currently, I am working on two projects. (1) Bacterial and mycotoxin contamination of Nigerian fermented foods and (2) development of sourdough fermentation using cheap and readily available cereals. This research is important because the microbiological safety of spontaneously fermented foods is not always guaranteed due to the undefined fermenting microbial consortium and processing materials. Therefore, there is need to educate the processors/vendors of these fermented foods on good hygienic and manufacturing practices (GHP/GMP). Production of (sourdough) bread with lactic acid bacteria producing beneficial compounds. Interestingly, we have shown that these compounds were able to survive heating, making the sourdough bread to have 'probiotic' potential by stimulating immune responses in the gut.

UTM: *What is your opinion on the state of biotechnology research in Nigeria? What do you think is the way forward?*

“ I HAVE BEEN ABLE TO IMPACT POSITIVELY ON THE LIVES OF MANY YOUNG FOOD MICROBIOLOGISTS AND I STILL LOOK FORWARD TO ACHIEVING MORE IN THIS ASPECT. ”

AO:The Nigerian government in 2001 set up the National Biotechnology Development Agency, NABDA, under the Federal Ministry of Science and Technology, with the mandate to catalyse biotechnological methods and applications in the country. The goal was that simple, cheap and unsophisticated scientific methods of plant breeding and disease prevention would be introduced in agriculture to improve our annual yields, supply better stocks for planting and make available large quantities of seedlings for farmers.

Since its inception, NABDA, in collaboration with related institutions like IITA, has energetically pursued methods of making the average farmer in Nigeria feel the impact of biotechnology. An example was the audacious plan to establish tissue culture plant breeding laboratories in different zones of the Federation through which much needed seedlings and cassava stems would be biotechnologically manufactured and made available to the suffering farmers of Nigeria.

I believe we can also harness this technology more in microbial and animal biotechnology to impact our bio-economy. But it is saddening to note that science students in final year (SSS III) do not know anything about biotechnology. It is also disturbing to note that many scientists/researchers in the pure and applied sciences cannot conduct simple basic biotechnology exercises. The way forward is for there to be genuine willingness and commitment from the government to support this technology and make all the prerequisites needed for learning, training and operation available.

UTM: What is your greatest accomplishment?

AO: The ability to impact positively on the lives of many young food microbiologists and I still look forward to achieving more in this aspect.

UTM: *What advice/encouragement do you have for our Early Career Researchers?*

AO: 1. **Have a mentor or somebody to guide you** in your field of research. As early career researchers, we need to see how the job is done by someone who has experience and enjoys doing it. This way we can lay the foundations so we are ready when we do it by ourselves. It is like “and are a bottega” – an Italian expression used to describe the apprenticeship in a “maestro’s” workshop.

2. **Don’t underestimate the value of what you are doing.** If you are practicing microbiology research, then you are doing something worthwhile. Enthusiasm is an important catalyst, just as cynicism can be contagious. Passion and enthusiasm are key catalysts in research and in communicating your science.

3. **The real challenge in science is asking appropriate questions.** Our main focus is on getting answers – answers that can be defended against external criticism. But how much time do we spend formulating our questions? Is this not the most important part of the scientific process? I would argue that getting answers is often much easier than asking novel, relevant, or appropriate questions, and that we should spend much more time in making sure we ask the critical questions and in designing our projects to help answer these questions.

“RE-EVALUATE YOUR PRIORITIES AND GOALS OFTEN; THEY WILL CHANGE OVER TIME. MAKE TIME TO REFLECT.”

4. Time is our most important commodity. It is critical to learn to use it wisely. Scientists have many diverse demands and the most successful researchers have learned to use a system of triage to prioritize their tasks and to recognize that each task must have an associated timeline. Use your day wisely to meet your obligations and your goals. Moreover, as your career progresses, it is easy for most of your day to disappear with many other obligations that, although often supportive to the overall scientific process (e.g., administrative tasks), divert your attention from your core priorities.

A system that protects time for basic research and reading and other related activities is critical. Re-evaluate your priorities and goals often; they will change over time. And leave time to reflect.

5. If you are going to cite or criticize a paper, at least have the courtesy to read it! With my experience as a reviewer and as a scientist, I have this sense that our community has a growing problem of researchers citing and sometimes criticizing papers that they simply could not have ever read or thought deeply about.

An increasingly worrying trend is how authors are re-citing other peoples' published interpretations of studies, without reading the original papers. This has always reminded me of the “telephone game” that young children sometimes play at parties: a story is whispered into the ear of one child, who then whispers the story into the ear of the next child in line, and so forth. By the time you get to the last child in the line, the story has changed so much that the original story is no longer recognizable!

UTM: What are your expectations for NAM as a group and how do you hope to contribute to its progressive growth?



AO: My expectations are in consonance with NAM's objectives. To advocate and work towards the advancement of applied microbiology research and foster collaboration among members. To serve as a platform for guiding and mentoring younger scientists.

UTM: How do you hope to contribute to the growth of NAM?

AO: I hope to use the opportunity of the NAM platform to reach out to more early scientists in sharing my experience with those that are willing.

UTM: Do you have any current research projects under way that is open for collaboration with members of the group? If yes, please can you provide some brief information on it to generate interest for possible collaborators. If no, are you open for collaboration with others?

AO: Yes, I am open to interested collaborators among the NAM members on projects that relate to the study of metagenomics and metabolomics of our fermented foods. I am also interested in the effect of climate change on the pathogenicity of foodborne pathogens and toxinogenic fungi.

Dr Adewale Obadina serves as a mentor for early career researchers in the Nigerian Applied Microbiologists Network. He can be reached via email - obadinaw@gmail.com and on Linked and ResearchGate.

IS AFRICA FULL OF NEW MICROBIAL SPECIES?

The case of *Hanseniaspora
jakobsenii* sp. nov. and *Listeria
monocytogenes*

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The advent of molecular biology has enabled the reclassification of several bacteria and discovery of new archaea.

Following the discovery of polymerase chain reaction (PCR), the amplification of certain regions of bacterial genes such as 16S and 26S rRNA became a popular tool for species identification for bacteria and fungi. Generally, DNA is extracted from candidate isolates and then amplified with the necessary primers before sequencing.

Sequences generated can be used to conduct a search of genetic databases such as Genbank by using the basic local alignment search tool (BLAST) to determine close relatives. Based on the identity percentage from aligned sequences, the new isolates are identified. If the identity percentage is lower than the acceptable threshold, the isolates are investigated further as potential new species.

Confirmation is obtained by submitting the sequences for curation after which new accession numbers are given.

Ogueri Nwaiwu is a food safety consultant. He is a graduate of FUTO Owerri (B.Tech 1994), University of Port Harcourt (MSc 1997) and The University of Nottingham (PhD, 2011). Dr Nwaiwu has food manufacturing experience and also worked as a Research Fellow at the Division of Food Sciences, University of Nottingham, UK (2011-2013) where he managed several European improvement projects.

“MANY INVESTIGATORS FROM SEVERAL COUNTRIES IN AFRICA STILL CARRY OUT ONLY BIOCHEMICAL TESTS FOR IDENTIFICATION OR CHARACTERIZATION”

In the last 5 years there has been an increase in the use of whole genome sequencing (WGS) due to cost reduction of sequencing. Whole genome sequencing may soon become the gold standard for identification of new species.

While molecular identification is common in the developed world, many investigators from several countries in Africa still carry out only biochemical tests for identification or characterization due to costs & limited infrastructure. This has resulted in the availability of little information on the molecular characteristics of microorganisms in the traditional local food and environment in Africa. It is likely that many new species have not been identified or properly characterized.

This article focuses on recent publications on new yeast species *Hanseniaspora jakobsenii* sp. nov. obtained from palm wine in Burkina Faso and *Listeria monocytogenes* isolated from leafy vegetables in Nigeria which possess new core genome multilocus sequence profiles.

***Hanseniaspora jakobsenii* sp. nov – Burkina Faso**

Increased molecular studies of yeasts from palm wine and other alcoholic beverages in the last decade has led to more information on the diversity of *Saccharomyces cerevisiae* strains prevalent in the drink.

Molecular characterization of palm wine yeasts has been carried out with palm wine sourced from Nigeria, Cameroun, Burkina Faso and Cote d'Ivoire [1]. This has led to the discovery of new yeast strains from Bandji, a traditional palm wine from Burkina Faso [2].

The new strains were discovered when the investigators found that two yeast isolates had unusual phenotypic and genotypic characteristics. They also found that the isolates divide by bipolar budding with no production of ascospores.

Following phylogenetic analysis of concatenated sequences of the D1/D2 region of the 26S rRNA gene and internal transcribed spacer (ITS) regions, the scientists concluded that the new isolates represent a novel species and proposed the name *Hanseniaspora jakobsenii* sp. nov.

Palm wine from many communities in Africa can taste differently and it is now necessary to carry out a holistic characterization to establish microbial diversity and check if there are any more new species. In the process of establishing diversity, the role of the different yeasts in aroma and flavour may be determined and lead to improvement of the drink's quality by selecting and developing starter cultures.

Listeria monocytogenes

More studies are needed on *L. monocytogenes* because the organism has continued to cause listeriosis in the developed world but is rarely reported in the developing world. Since 2009, nine new species have been found [3] and the economic costs associated with outbreaks has continued to increase.

The molecular serotypes and evolutionary lineages of three strains of *L. monocytogenes* from Nigerian leafy vegetables have been reported [4] and it appears that leafy vegetables might be a source of *L. monocytogenes* contamination.

“THE PREVALENCE OF *L. MONOCYTOGENES* AND OTHER *LISTERIA* IN NIGERIA AND AFRICA AS A WHOLE IS STILL UNKNOWN”

After enrichment of leafy vegetable samples, one strain was obtained from each vegetable namely Onugbu (*Vernonia amygdalina*), Utazi (*Gongronema latifolium*) and Ukazi (*Gnetum africanum*). The draft genome sequences of these strains has recently been announced [5].

Most reports of occurrence in Nigeria are based on black coloration of culture media which can be misleading [6]. The prevalence of *L. monocytogenes* and other *Listeria* spp. in Nigeria and Africa as a whole is still unknown. Genomic studies show that there is international circulation of *L. monocytogenes* and there is now an urgent need for more global studies to have a better understanding of the organism [7].

Recent data suggest that there may be special or new strains in Nigeria. The strains from the vegetables study above were evaluated further and after analysis, the core genome multilocus sequence typing profiles were defined as new cgMLST types CT2050 and CT2051 [5]. In another Nigerian milk study [8], a phylogenetic tree was constructed after analysis and 2 clusters of *Listeria monocytogenes* were shown. One cluster had a high bootstrap value whereas the other cluster had a low value. The authors did not make much of the bootstrap values. Apart from statistics, could this low value in one of the cluster groups be because the strains are genetically or evolutionary distinct from the *L. monocytogenes* sequences in the GenBank®?

Conclusion

More molecular studies are needed to characterise the microorganisms isolated from Africa. In the absence of proper surveillance in many African countries, data generated by investigators may throw more light on species prevalence and diversity.

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WHAT'S NEW UNDER THE MICROSCOPE?

Recent publications from our network

Adedeji, S.A., Ezeokoli, T.O., Ezekiel, C.N., Obadina, A.O., Somorin, Y.M. et al., 2017. Bacterial species and mycotoxin contamination associated with locust bean, melon and their fermented products in South-Western Nigeria. *Int. J. Food Microbiol.* 258, 73 - 80.

Adekoya, I., Obadina, A.O. et al., 2017. Contamination of fermented foods in Nigeria with fungi. *LWT Food Sci. Tech.* 86, 76-84.

Ahaotu, N., Anyogu, A., Obioha, P., et al. 2017. Influence of soy fortification on microbial diversity during cassava fermentation and subsequent physicochemical characteristics of garri. *Food Microbiol.* 66, 165-172.

Onwosi, C., Igbokwe, V., Odimba, J. et al. 2017. Composting technology in waste stabilisation: On the methods, challenges and future prospects. *J. Environ. Management*, 190, 140-157.

Owoseni, M. & Okoh, A. 2017. Evidence of emerging challenge of chlorine tolerance of *Enterococcus* spp. recovered from wastewater treatment plants. *Int. Biodeterioration & Biodegradation.* 120, 216 -223.

FOOD MICROBIOLOGY

Test your knowledge of Microbiology by answering these trivia questions. Answers are available on the blog.

1. In order of shelf life, which has the shortest to longest shelf life? White wine, red wine, beer?
2. What is PCR and what is its purpose?
3. What is the name of the bacterium that produces xanthan gum?
4. List three benefits of fermentation.
5. A microbial population has been decreased by what percentage when it undergoes a one-log reduction?
6. What is the lowest water activity that can support microbial growth?
7. What is the toxic substance removed from cotton seed?
8. What do O and H represent in the O157:H7 antigen on *Escherichia coli*?
9. What two microorganisms are used to ferment milk to produce yoghurt?
10. A positive catalase test shows the production of what when hydrogen peroxide is added?



Obabiyi Ajao - Food Microbiology Group Coordinator

GRANTS INFORMATION

Looking to attend an international meeting? Kickstart or expand your research? Grants are an important source of funding for undertaking or publicising your research. Please check eligibility criteria before applying.

Society for Applied Microbiology International Capacity Building & Developing Economies -

<http://www.sfam.org.uk/en/grants--awards/international-capacity-building/index.cfm>

Royal Society International Exchanges Programme - <https://royalsociety.org/grants-schemes-awards/grants/international-exchanges>

Commonwealth Scholarships for Masters and PhD Programmes - <http://cscuk.dfid.gov.uk/apply/scholarships-developing-cw>

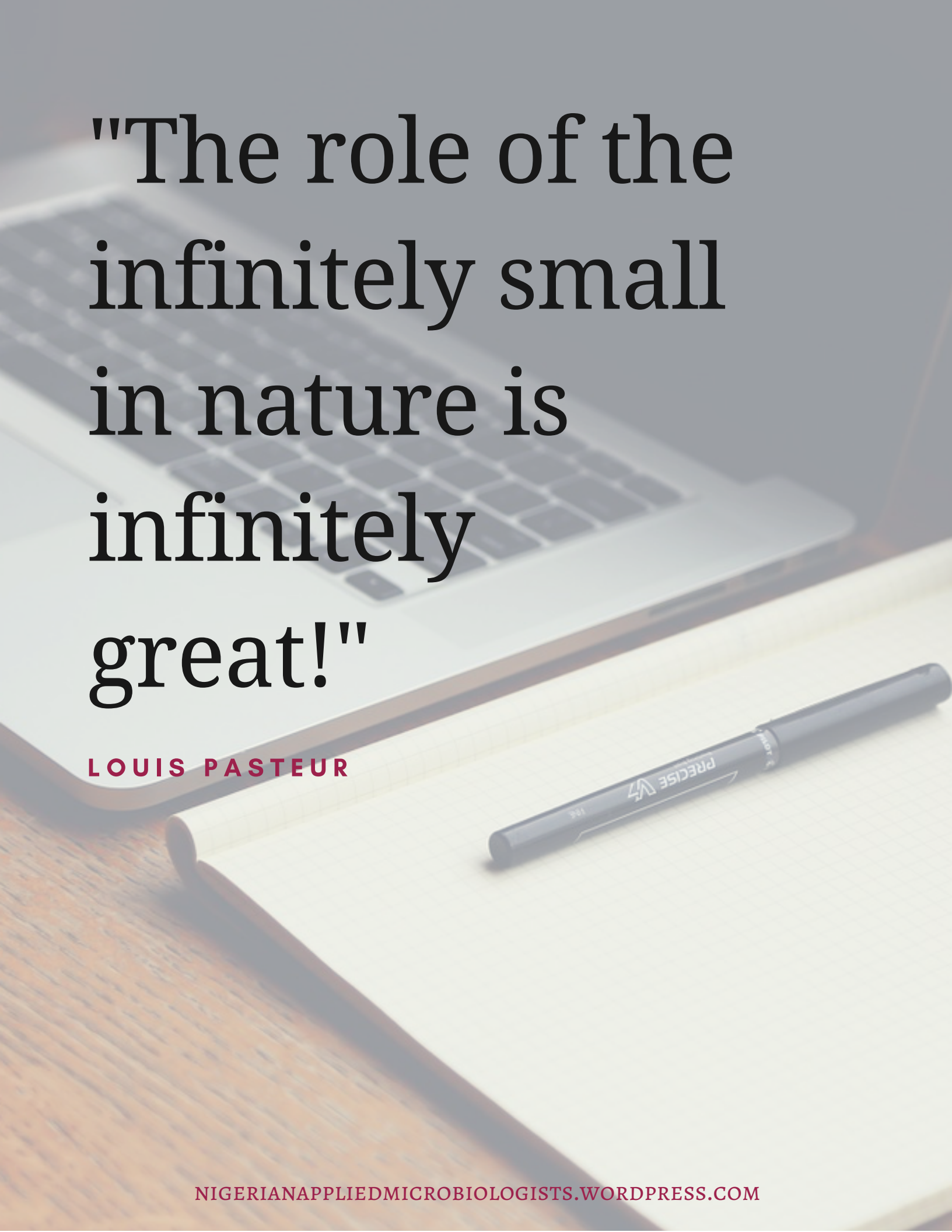
Africa Oxford Travel Grant - <http://www.afox.ox.ac.uk/grants>

AAUW International Fellowships - <http://www.aauw.org/what-we-do/educational-funding-and-awards/international-fellowships>

Netherland fellowship program - <https://www.studyinholland.nl/scholarships/highlighted-scholarships/netherlands-fellowship-programmes>

Fulbright Scholarships for students and researchers - <https://eca.state.gov/fulbright/fulbright-programs/program-summaries>

Ifeoluwa Adekoya - Grants Officer



"The role of the
infinitely small
in nature is
infinitely
great!"

LOUIS PASTEUR