UNIVERSITY OF ILORIN

THE TWO HUNDRED AND THIRTEENTH
(213TH) INAUGURAL LECTURE

HUMAN ANATOMY: BEYOND FLESH AND BONES

BY

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My Lords Spiritual and Temporal,
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Members of My Family, Nuclear and Extended,
Esteemed Invited Guests, Friends and Relations,
Gentlemen of the Print and Electronic Media,
Great Students of the University of Ilorin,
Distinguished Ladies and Gentlemen.

Preamble

It is with a deep sense of humility and gratitude to the Almighty God that I present before this distinguished audience the 213th in the series of Inaugural Lectures of the University of Ilorin – the most-subscribed Nigerian University (https://punchng.com/unilorin-unilag-top-10-first-choice-varsities/).

Mr. Vice-Chancellor Sir, another history is made today in the annals of the University of Ilorin as this is the first inaugural lecture to be delivered by a Professor of Anatomy since the establishment of the Faculty/College of Health Sciences and the University of Ilorin more than 45 years ago. This reminds us of the paucity of Professors of Anatomy in the Nigerian University System for several decades.

My journey to the world of basic medical sciences, and specifically the anatomical sciences, started shortly after my secondary school education at Government Secondary School Afon, Kwara State. Being a brilliant science student, my father (Chief David Adebayo Akinola) desired that I read Medicine in order to become a medical doctor. I do recall, with gratitude, how my father and I (accompanied by his late friend, Hon. Suberu Bakase), visited the then Acting Head of the Department of Anatomy, Dr. Abayomi Odekunle in 1991, in order to get me admitted into the medical (MB;BS) programme. As fate would have it, it was that same (1991/1992) academic session that the B.Sc. Anatomy degree programme commenced in this University. Therefore, owing to the over-subscribed nature of the MB; BS degree programme, Dr. Odekunle did not hesitate to sell the idea of having me join the new B.Sc. Anatomy degree programme to my father. My father accepted the suggestion, on the condition that I would return to read Medicine after my graduation. As God would have it, though, that was never to be. This marked the beginning of my career in Anatomy, even though at that time I did not understand the meaning of the term.
It has been more than two decades since I joined the services of the University of Ilorin (in 1999) as a graduate assistant in Anatomy, rising consistently through several academic cadres over the years to become a full **Professor of Anatomy** in 2017. I am therefore highly privileged, honoured, and elated to present the 213th Inaugural Lecture of the University of Ilorin titled: **'Human Anatomy: Beyond Flesh and Bones'**. This lecture, which ought to have held in May 2020 but for the nation-wide lockdown, is coming less than four years after the announcement of my promotion to the rank of Professor of Anatomy by this better-by-far University.

Introduction

Mr. Vice-Chancellor Sir, without prejudice to the scientific theory of evolution, Human Anatomy came into being as described by the Holy Bible in Genesis chapter 2 verse7 (NLT): "And the LORD God formed a man's body from the dust of the ground and breathed into it the breath of life. And the man became a living person"; and in the Holy Quran chapter 23 verses 12-14: "We created man out of the extract of clay, then We made him into a drop of life-germ, then We placed it in a safe depository, then We made this drop into a clot, then We made the clot into an embryonic lump, then We made the lump into bones, then We clothed the bones with flesh, and then We caused it to grow into another creation. Thus, Most Blessed is Allah, the Best of all those that create". Therefore, human, as molded by God, existed at creation first in a physical, structural form, *i.e.*, Human Anatomy.

By definition, Anatomy is the field of science that studies the physical structure of organisms. The term was derived from the Greek word "*Anatomien*", meaning 'to cut open'. Human Anatomy therefore studies the structural make-up or organization of the human body. This explains why the Department of Anatomy houses the Gross Laboratory for dissecting cadavers (embalmed dead bodies), in order to understand the structures that lay perfectly and intricately interwoven underneath our skin (Figure 1). Classically, the teaching and learning of human anatomy are approached in four basic subdivisions: G**ross Anatomy** (the study of the macroscopic details of body structure: i.e., "**Flesh and bones**"), **Microscopic Anatomy** or **Histology** (using microscopes to study body structures that cannot be seen with the unaided eyes), **Developmental Anatomy** or **Embryology** (the study of prenatal [and postnatal] human development), and **Neuroanatomy** (the study of nervous system structure).

Figure 1: Early human body dissection. (Source: Rembrandt, 1632)

In most instances, however, many use the term 'Anatomy' to simply refer to its **Gross Anatomy** division, which involves **dissecting flesh and profiling bones**. It is for this reason that the general public erroneously take Anatomy to mean dead bodies or mere dissection of dead bodies. This also informs the title of this inaugural lecture, captioned: **'Human Anatomy: Beyond Flesh and Bones'**. The phrase '**Beyond Flesh and Bones**' implies that human Anatomy is much more than cutting up dead bodies and studying bones. An anatomist's job is beyond dissecting more than 300 pairs of skeletal muscles (*i.e.*, flesh), characterising more than 200 pieces of bones; and identifying countless blood vessels, nerves, ligaments, fasciae, and viscera (internal organs) that make up the human body.

Therefore, being sandwiched between Biology and Medicine, contemporary Human Anatomy is truly **'Beyond flesh and bones'**. Modern anatomists actively contribute to emerging disciplines such as bioinformatics, computational biology, genomics, and proteomics. Anatomical sciences include such fields as physical anthropology, forensic science, evolution and comparative anatomy, surface and living anatomy, clinical and applied anatomy, radiological anatomy, archeology and paleontology, and genetics. These divergent faces of Anatomy are the reason many structural scientists prefer the term Anatomical Sciences to describe the discipline of Anatomy. Most 21st century Anatomists do have expertise in molecular biology, and are actively involved in the study of the genetic basis of diseases. It is now possible to experimentally edit our hereditary materials (genes), and by so doing offer medical solutions to several hereditary diseases resulting from gene mutation, for example. In the not-too-distant future, it is possible to have clinically-approved gene therapies for several hereditary diseases and congenital anomalies such as cystic fibrosis, sickle cell anaemia, Duchenne muscular dystrophy, achondroplasia (a type of dwarfism), Marfans syndrome, haemophilia, Huntington disease, and fragile X syndrome, among others. I have no doubt that at the end of this lecture, you would agree with me that Human Anatomy is much more than mere cadaveric dissection, and is therefore “**Beyond Flesh and Bones’**.

Mr. Vice-Chancellor Sir, Anatomy remains a foundation subject and the backbone of Medicine and Surgery. It is one of the first key subjects that medical students learn during their undergraduate training. It is therefore no wonder that the teaching of the anatomical sciences (gross anatomy, histology, embryology, and neuroanatomy) is given top priority in the training of all medical professionals. In hospitals, anatomical knowledge is applied when a medical doctor physically examines a patient; in the surgical theatre when a patient is operated upon; in the labour room when a baby is being delivered; in the pathology laboratory where tissues are examined; and in the injection room when a patient receives a jab, *etc.*

Historical Consideration

Being the first professorial inaugural lecture in Anatomy in this great University, kindly permit me to give a short narrative of the history of the subject. As early as around 400 BC, Greek scientists such as Hippocrates (460-370 BC), Aristotle (384-322 BC), Herophilus (325-255 BC) and Aelius Galen (129-210 AD) had taken interest in Anatomy and were regarded as the Fathers of Anatomy. Aelius Galen had the appellation of the 'Prince of Physicians', and his contributions to Anatomy were conserved for centuries. The great cerebral vein of Galen was named in his honour. Moreover, the Romans also made useful contributions to the development of the anatomical sciences. In the 14^{th} century, Mondino de Liuzzi (1270-1326 AD) wrote an anatomy text titled '*Anthomia'*, which was one of the most authoritative anatomy texts at that time. De Liuzzi taught anatomy to his students by dissection. The 15^{th} century also witnessed notable advances in the field of gross anatomy, owing to the robust contributions of Leonardo da Vinci (1452-1519), an Italian scientist. Da Vinci was not only a great anatomist but also an excellent artist. Structures of parts of the human body were illustrated in elegant drawings made by da Vinci. Da Vinci was succeeded in the 16^{th} century by a notable Flemish anatomist, Andreas Vesalius (1514-1564). Vesalius was born in Brussel and had been regarded as the father of modern Anatomy (Figure 2). He corrected some erroneous teaching of human anatomy that spanned centuries. His famous textbook of anatomy was titled *De Humani Corpori Fabrica* (The Fabrics of the Human Body).

Without any doubts, the Greek and Romans had contributed in no small measures to our understanding of human body structures. It is for this reason that several structures in the human body have Greek or Latin names, e.g., *Flexor carpi radialis* (radial flexor of the wrist), *gluteus maximus* (large muscle of the buttock), *Longus colli* (long muscle of the neck), *Ligamentum teres hepatis* (round ligament of the liver), and many other.

Furthermore, British scientists also made useful contributions to the anatomical sciences. Example was William Harvey, a 17^{th} century anatomist, who shaped our understanding of blood circulation and published a book on embryology. In the 18^{th} and 19^{th} centuries, dissection of bodies became compulsory across European medical schools. The British Parliament passed the Warburton Anatomy Act to legalise acquisition of bodies for dissection. Henry Gray (1827-1861) (Figure 2) was a famous 19th century anatomist that wrote the most authoritative textbook of human anatomy till date, titled '**Gray's Anatomy**'.

Figure 2: Andreas Vesalius (Left), Henry Gray (Middle), and Keith More (Right)

Unfortunately, the development of anatomical education and research in Nigeria was slowed over the years largely owing to the dearth of experts in this field, partly as a result of the non-availability of the undergraduate (and postgraduate) degree programmes in Anatomy. The early Anatomists that taught and researched anatomical sciences in the University of Ilorin Medical School were mostly foreigners, and included Dr. Nithilia Isaac, Dr. Sen Gupta, and Dr. Harold S. Amono-Kofi.

As a 21st century anatomist, this Inaugural Lecture is a brief account of my contributions to the advancement of the Anatomical Sciences, and how I have deployed my understanding of morphological science to teaching, research and community service.

Teaching of Anatomical Sciences in Medical Schools: Past, Present, and Future

Generally, the basic medical sciences disciplines of Anatomy, Physiology and Biochemistry have traditionally been taught in medical schools globally by seasoned scholars with multidisciplinary academic backgrounds: including B.Sc./Ph.D., MBBS/Ph.D., BDS/Ph.D., MD, and MD/Ph.D. This was and remains the practice all over the world (Bergman *et al.*, 2014). In December 2019, the global anatomy community lost one of its leading professors and academic elder, **Professor Emeritus Keith L. Moore** of the University of Toronto, Canada (Figure 2). Prof. Moore was an excellent example of an anatomist. A basic medical scientist, whose academic qualifications included **BA, M.Sc.,** and **Ph.D**. in Anatomy from the University of Western Ontario, Canada. (https://www.schulich.uwo.ca/anatomy/about_us/news/2019/dr_keith_l_moore.html; Moore, 2012). Keith Moore was internationally acknowledged as a leading anatomy authority who received multiple prizes for his outstanding contributions to medical education, including the Henry Gray/Elsevier Distinguished Educator Award from the American Association of Anatomists; the J.C.B. Grant Award from the Canadian Association of Anatomists; Honoured Membership of the American Association of Clinical Anatomists; American Medical Writers Association Awards; British Medical Association Awards; R. Benton Adkins Jr. Distinguished Service Award; and the Queen's Diamond Jubilee Medal.

Prof. Moore authored at least three celebrated anatomy textbooks; including the famous Clinically-Oriented Anatomy, The Developing Human, and Essential Anatomy, which are used in medical schools all over the world. Therefore, any medical students in this auditorium are indirectly students of Prof. Keith Moore for using his books on gross anatomy and embryology.

Mr. Vice-Chancellor, Sir, while we still mourn his passing, may I pray that Nigerian Anatomists that possess similar academic background (B.Sc./M.Sc./Ph.D.) as Professor Emeritus Keith Moore should not be relieved of their role as teachers of tomorrow's medical doctors in our Universities, as being championed by some regulatory body. As an anatomist, I have taught and examined medical students for more than 20 years in this University and elsewhere, and would not hesitate to continue to offer this service as a competent medical educator.

My Contributions to Anatomical and Medical Education

Undergraduate curriculum in several medical schools had undergone repeated reviews from time to time. Such reviews had, among other objectives, attempted to limit the depth of anatomy that students of medicine and allied medical professions must learn in their preclinical years, as well as the amount of time spent in the dissecting room (Morley, 2003). However, this was not without dire consequences. Findings had shown that increasing cases of medical and surgical errors and ligations could be linked partly to diminished attention to anatomical education during the undergraduate, and even postgraduate years (Ellis, 2002; Godwin, 2000; Monkhouse and Farrell, 2002). A recent example of surgical error in Nigeria involved the (supposed) erroneous removal of the kidneys of a patient by a medical doctor in Adamawa state, as published by the Sahara Reporters of September 27, 2019 (http://saharareporters.com/2019/09/27/adamawa-doctor-banned-practicing-again-cutting-patient%E2%80%99s-kidneys). Part of the newspaper report reads "He failed to correctly diagnose the illness of Hamma and advise him. He undertook a surgical operation on the patient and removed an organ he could not identify". Predictably, and sadly, the patient in this case died from this anatomical (surgical) error, while the medical doctor concerned had his licence withdrawn by the Medical and Dental Council of Nigeria. Such is a reminder of the critical role that a sound knowledge of basic medical sciences plays in medical and surgical practice.

My contributions to anatomical education at the University of Ilorin and beyond span more than two decades. I joined the Department of Anatomy at a time of extreme paucity of anatomy lecturers. I was therefore challenged with the enormous task of teaching almost all compartments of Anatomy, in addition to active supervision of gross and histology practical classes. In order to support my students to study, understand and pass anatomy, I published two books: (i) **Human Anatomy: Pre-Exam-Self-Assessment Tests** and (ii) two volumes of the

Highlights of Human Anatomy (co-authored with Dr. Olufunke Dosumu of the University of Lagos) (Akinola and Dosumu, 2005, 2006) (Figure 3).

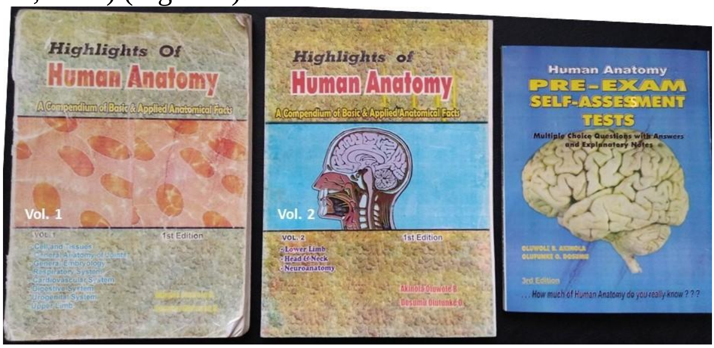

Figure 3. Anatomy books authored by Prof. Akinola: Highlights of Human Anatomy (Volumes 1 and 2) and Human Anatomy: Pre-Exam Self-Assessment Tests. (Akinola and Dosumu, 2005, 2006)

Because of the concise approach to writing the 'Highlights of Human Anatomy', and the fact that it contains basic information that is essential to students' understanding of the subject, copies of the book were readily sold in bookstores in several Universities. I recall with delight, how I received a hand-written letter of commendation from a medical student of the University of Benin who came across the book. He personally offered to be my Sales Representative in his University. I could therefore not be happier as a young anatomy lecturer after that experience!

The Gross Anatomy Laboratory: Where the Dead Teaches the Living

As fascinating as the discipline of gross anatomy is, many seem to avoid it because of the sight and 'smell' of embalmed bodies in the Gross Anatomy Laboratory. The fact remains, however, that practical dissection of cadavers is the gold standard all over the world in the teaching and learning of human body structure at the gross level (McHanwell *et al.*, 2007;

Akinola, 2011; Connolly *et al.*, 2018; Finn et. al., 2018). Unfortunately, what has become a herculean task is the growing difficulty in sourcing cadavers (dead bodies) for teaching and research. In the developed world, Departments of Anatomy of medical schools acquire cadavers through the famous Body Bequest Programme (Body Donation Programme). Indeed, in 2012, the world anatomy umbrella body, the International Federation of Associations of Anatomists (IFAA) recommended the use of donated bodies only for anatomical research and teaching in all medical schools. However, a survey conducted in 2016 and 2017 by Habicht *et al.* (2018) reported that only 22 (32%) of the 68 countries studied used cadavers that were exclusively sourced by voluntary body donation, and most of those countries are in North America, Europe, and Australia-Asia (Figure 4). South Africa is the only African country where most of the bodies used for medical education is sourced by voluntary donation.

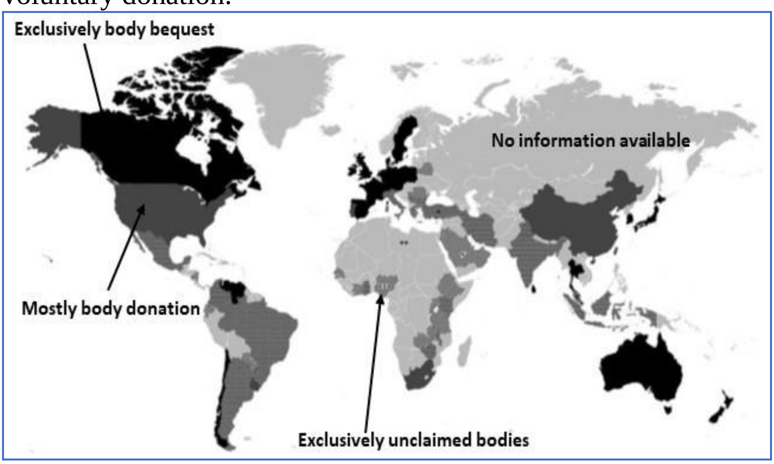

Figure 4. Sources of cadavers used for anatomy teaching in undergraduate medical curricula in 68 sovereign countries of the world. (Source: Habicht et al., 2018).

In Nigeria, the reports of Habicht *et al.* (2018) and Chia and Oyeniran (2019) corroborate a review by Akinola (2011a) that no medical schools in Nigeria source for cadavers by a formal body donation programme (Table 1); rather, through the acquisition of abandoned (unclaimed) bodies or bodies of executed criminals and convicts. This practice is contrary to global best standard, and therefore, unacceptable. The explanation for the absence of the body donation programme in most African medical schools, including Nigeria, may not be far from religious practices, and cultural and traditional beliefs about what could happen to our bodies after death. In those countries where the voluntary body donation programme is in place, citizens support the programme because of the understanding that it is more rewarding to donate the whole body to science at death rather than lose it to cremation or burial. This is therefore a wake-up call to Africans that the human bodies still serve better usage after death if donated to science for teaching and research. Such a practice bears some resemblance to the organ donation programme where (dead) donors offer vital organs such as the heart, liver, cornea, and kidneys to those patients in dire need of organ transplantation.

Mr. Vice-Chancellor Sir, distinguished Ladies and Gentlemen, I am convinced that if an appropriate Act of the National Assembly were to endorse voluntary body donation to medical schools, and aggressive public enlightenment campaigns are promoted, a sizeable number of the population would embrace this global best practice to bequeath their (dead) bodies to the gross anatomy laboratories, in the best interest of medical education and human health.

Table 1. Sources of cadavers for anatomy teaching in undergraduate medical curricula in African countries.

Country	**Sources of Cadavers**	**Information Source**
Ethiopia	Exclusively unclaimed bodies	Gangata *et al.*, 2010
Ghana	Mostly unclaimed bodies	Gangata *et al.*, 2010
Ivory Coast	Exclusively unclaimed bodies	Gangata *et al.*, 2010
Kenya	Mostly unclaimed bodies	Mwachaka *et al.*, 2016
Libya	Import only	Gangata *et al.*, 2010

Malawi	Mostly unclaimed bodies	Gangata *et al.*, 2010
Nigeria	Exclusively unclaimed bodies/ Bodies of executed individuals	Akinola, 2011; Ewonubari *et al.*, 2012; Anyanwu *et al.*, 2014; Biasutto *et al.*, 2014
Rwanda	Exclusively unclaimed bodies	Riederer, 2016
Senegal	Exclusively unclaimed bodies	Manyacka Ma Nyemb *et al.*, 2014
South Africa	Mostly body donation	Satyapal, 2012; Kramer and Hutchinson, 2015
Tanzania	Exclusively unclaimed bodies	Mazyala *et al.*, 2014
Uganda	Exclusively unclaimed bodies	Riederer, 2016; Ihunwo, 2014
Zambia	Exclusively unclaimed bodies	Gangata *et al.*, 2010
Zimbabwe	Mostly unclaimed bodies	Gangata *et al.*, 2010

[Source: Habicht et al., 2018, Modified]

My Contributions to Basic Medical Research as a Morphologist

In the early stage of my career, my research endeavours were largely in the fields of **physical anthropology** and **endocrinology**. However, after my postdoctoral training, I gained competences in neuroscience research, which afforded me the opportunity to contribute my quota to cognitive and developmental **neuroscience**. In these fields of anatomical sciences, I have published more than 85 scientific papers, and according to Google Scholar, those papers have been cited more than 600 times, with an h-index of 13. The following sections are summaries of my research findings so far.

Different Shapes for Different Folks: Understanding Physical Anthropology

Humans exist in different shapes, statures (heights) and sizes. Bones, which are the remains of the dead, also tell lots of stories about their owners, who belong to the past. The field of Anatomy that studies the pattern of biological variations among living human and non-human primates and their fossil remains is biological (or physical) anthropology (Figure 5).

Figure 5. Physical anthropology studies biological variations among humans and in fossil remains (Source: ©Dimitri Vervitsiotis).

This field not only deals with variations in form but also in function and behaviour. Some of my contributions to knowledge as a physical anthropologist have to do with understanding the biological variations that influence the health status of Nigerians.

Anthropometry as a Cardiometabolic Whistleblower

Mr. Vice-Chancellor Sir, the state of health of an individual could be predicted by measuring certain body parts and relating the values to standard data for that age group. Anthropometric parameters such as body weight, body mass index (BMI), waist circumference (WC), and hip circumference (HC), *etc.*, have relevance in the assessment of the health of a population. Some parameters also vary from population to population, and are therefore relevant in criminology, ergonomics, and biometrics. Such variations are decided by genetic factor, lifestyle, and environmental factors. Some of the known anthropometric extremes included Jon Brower Minnoch, who weighed 640 kg, was 185 cm tall, and had a BMI of 185.5 kg/m^2. He died at the age of 41 years from oedema. The least adult body weight was for a Mexican named Lucia Zarate (1863-1890) whose body weight was only 2.1 kg at 17 years and was just 61 cm tall (Figure 6). She died at 27 years from hypothermia.

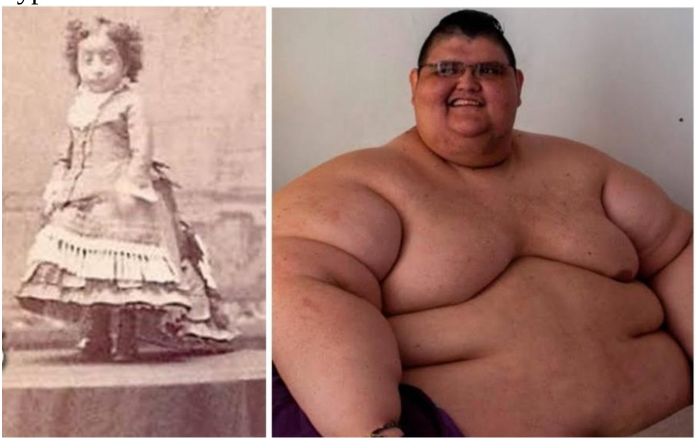

Figure 6. Lucia Zarate (left) and Jon Brower Minnoch (right)

However, aside from these rare anthropometric extremes, childhood obesity is increasingly becoming commonplace worldwide. Considering the higher cardiometabolic risks (heart attack, hypertension, stroke, diabetes mellitus, and atherosclerosis, *etc.*) associated with being obese, efforts must be renewed toward stemming childhood obesity. Available data in Nigerian children showed increasing incidence of obesity in different age groups and geopolitical regions (Akinola *et al.*, 2014a, 2014b). Analyses of data from 400 children (13-17 years) resident in Ilorin revealed gender disparity in the prevalence of obesity (Akinola *et al.*, 2014a). Based on BMI, 6% of adolescent girls were obese, and 8.5% were overweight; while 2% and 2.5% of adolescent boys were obese and overweight, respectively. Although childhood obesity in Nigeria is relatively low compared to global rates, data from this and related studies lend support to the need to promote physical exercise and limit consumption of sweetened drinks among children to check the rising incidence of juvenile obesity and the risk of developing metabolic disease (Figure 7).

Furthermore, though obesity is more prevalent in adolescent females, males are twice as likely to be underweight than their female counterparts (Akinola *et al.*, 2014a). Of the 400 subjects studied, 7% of adolescent females and 15% of adolescent males were underweight. Given that growth retardation and underweight stature in children is not unconnected with hereditary, socio-economic and nutritional factors, the National Home-Grown School Feeding Programme (NHGSFP) of the Federal Government (https://www.vanguardngr.com/2021/05/nhgsfp-were-feeding-10m-pupils-in-schools-says-fg/) is a step in the right direction. This could improve the nutritional status of school-age children, and therefore reduce the incidence of underweight profile in this population.

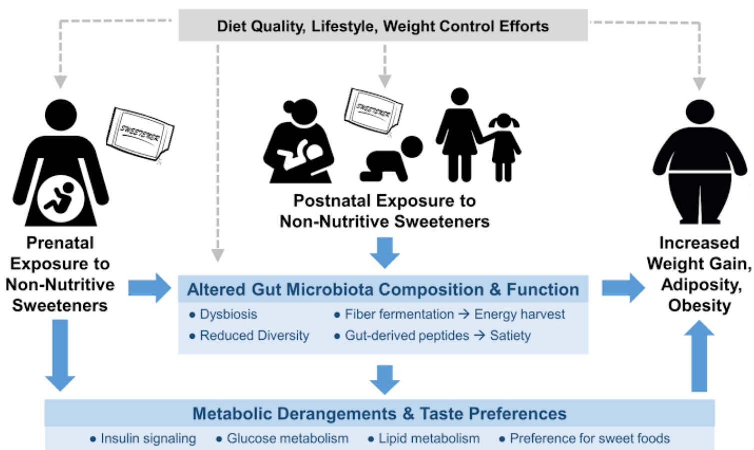

Figure 7. The impact of early-life exposure to non-nutritive sweeteners on obesity-related outcomes later in life. (Source: Archibald et al., 2018)

My Contributions to Reproductive Endocrinology

A celebrated Nigerian Anatomist and my good friend, Prof. Abraham Osinubi of the University of Lagos, captioned his Inaugural Lecture as 'The Anatomist: Jack of All Trade, Master of All'! This supports the view that given their extensive knowledge of basic medical sciences, anatomists are great at contributing to several facets of medical research. Thus, their role is '**Beyond cutting up dead bodies and profiling dry bones**'.

Mr. Vice-Chancellor, Sir, in my two-decade career as an anatomist, most of my contributions to biomedical research have been in the field of endocrinology, specifically reproductive endocrinology and diabetes mellitus. My interest in reproductive science and research was born at the University of Lagos as a master's student in the year 2000, under the tutelage of Prof. A. Okanlawon and Dr. C.C Noronha. As a matter of fact, the pioneer practitioner of Assisted Reproduction Technology ("Test-Tube Baby") in Nigeria, Prof. Oladapo Ashiru, was a Professor of Anatomy at the University of Lagos. His efforts and those of others have offered solution to some types of infertility and brought smiles to homes across Nigeria and beyond; further corroborating the title of my lecture that Anatomy as a science is more than mere cadaveric dissection.

Infertility is a global phenomenon that had been with man for a long time. According to the International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO), "Infertility is a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse" (Zegers-Hochschild *et al.*, 2009). Infertility affects between 50-70 million couples globally (Szamatowicz and Szamatowicz, 2020). Males are solely responsible for 20-30% of infertility cases but also contribute to 50% of overall cases (Mascarenhas *et al.* 2012).

Unfortunately, in West Africa, infertility is frequently blamed on the females, thereby leaving them with huge and often lingering emotional distress. However, as indicated earlier, male factor infertility among couples is real! Causes can range from genetic factor, nutritional factor, lifestyle, infectious diseases, psychological stress, and environmental factors; or a combination of these (Elmussareh *et al.*, 2015; Yao and Mills, 2016; Akinola and Gabriel, 2018; Medubi *et al.*, 2021) (Figure 8). Male partners of infertile couples should therefore not hesitate to seek medical attention where this becomes necessary.

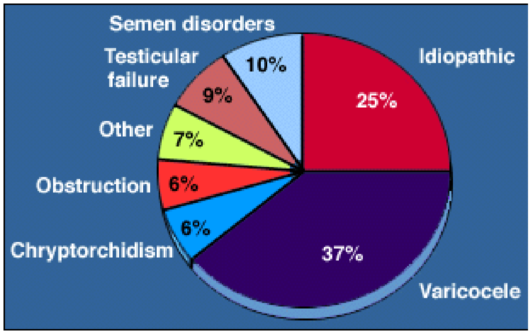

Figure 8. Causes of male infertility (Source: library. med.utah.edu)

Environmental and Metabolic Factors as Causes of Male Infertility

Adequate sperm production is a prerequisite for male fertility. As shown in Table 2, fertile males should have sperm concentration not less than 15 million sperm per milliliter of semen, with a total motility >40% of the sperm cells (Cooper *et al.*, 2010). Unfortunately, several findings have shown that the quantity and quality of sperm have been diminishing gradually over the decades. Mean sperm concentrations had decreased by 12.5% over the past 50 years in India (Sengupta *et al.*, 2018) and by 32.5% over the same 50-year period in Europe (Sengupta *et al.*, 2017). A retrospective study (2010 to 2015) among Nigerians showed that of the 907 adult males studied, 12% were azoospermic (no sperm cells in semen), 38.2% were oligozoospermic (very few sperm cells in semen), while 49.8% were normospermic (normal number of sperm cells in semen). Overweight and obese men were twice as likely to be azoospermic compared to normal weight men. Obese azoospermic men were about 4 times as likely to have high number of pus cells in their semen than normal-weight azoospermic men (Ajayi *et al.*, 2018). These suggest that metabolic perturbation as seen in obesity, metabolic syndrome, and diabetes mellitus could contribute to male infertility.

Table 2. WHO semen analysis criteria and reference values

Parameter	**Lower Reference Limit**
Semen volume (ml)	1.5
Sperm concentration (10^6/ml)	15
Total sperm number (10^6/ ejaculate)	39
Progressive motility (PR, %)	32
Total motility (PR+NP, %)	40
Vitality (live sperms, %)	58
Sperm morphology (NF, %)	4
pH*	≥7.2
Leucocyte* (10^6/ml)	<1
MAR/Immunobead test* (%)	<50

(Source: Cooper *et al.*, 2010)

Such findings in human subjects have been corroborated by biochemical and histological data from our rodent model, where diabetes was induced by intraperitoneal alloxan. Untreated diabetic rats had low sperm concentrations in the caudal epididymides, with histomorphometric evidence of testicular lesion characterized by attenuation of the wall of the seminiferous tubules (Figure 9). However, treatment of diabetic rats with oral doses of pioglitazone (an insulin sensitizer) improved sperm profile and testicular histology. This suggests that medications that promote insulin-receptor signaling could enhance fertility in obese insulin-resistant males (Akinola *et al.*, 2015b).

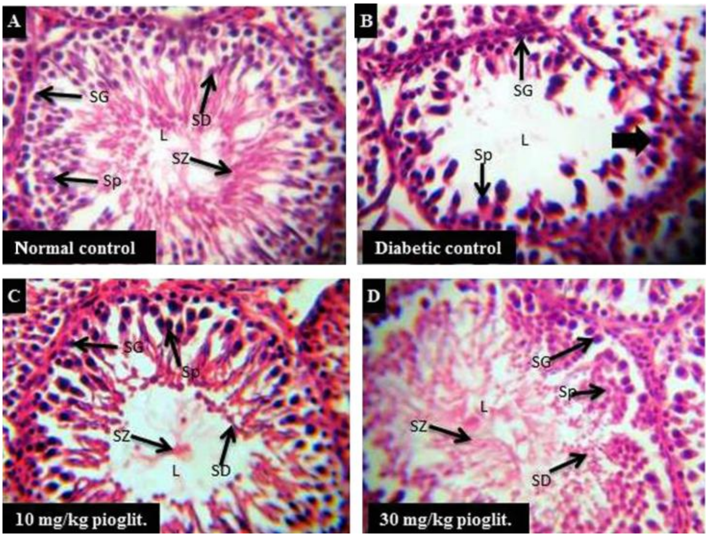

Figure 9. Testicular sections of the treated and untreated diabetic rats. Attenuation of the seminiferous epithelium, characterised by loss of spermatozoa (SZ) in the adluminal compartment (L); and diminished spermatids (SD) and spermatocytes (Sp) is observable in the untreated diabetic group (B), but absent in the non-diabetic controls (A); and in pioglitazone-treated diabetic rats (C, D. (Source: Akinola et al., 2015b).

Furthermore, certain **diets**, **infectious diseases,** and exposure to **heavy metals** do contribute to the rising incidence of infertility and subfertility in males (Akinola *et al.*, 2006, 2007c; Garolla *et al.*, 2013; Akinola *et al.*, 2015c; Odukoya and Akinola, 2017). Such heavy metals include lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As) (Figure 10). Of these metals, the biotoxicity of lead had been in the news owing to the illegal mining activity in some parts of Nigeria, which is reportedly associated with high mortality and morbidity among adults and children (Medecins Sans Frontieres, 2012). In the exposed children, blood lead levels were as high as 45-708 μg/dl (Medecins Sans Frontieres, 2012), much higher than the internationally acceptable level of 10 μg/dl. Lead can enter cells via the calcium ion (Ca^{2+}) channels (Atchison, 2003) and can perturb cellular processes that involve Ca^{2+} signalling, such as intercellular communication. These biological properties of lead could impact negatively on sperm production and quality, as well as alter testicular microanatomy. Our findings in rodents exposed to oral or lactational doses of lead at the juvenile stage of postnatal life showed significant histological lesion in their testicles in early adulthood, as shown in Figure 11 (Akinola *et al.*, 2015c; Odukoya and Akinola, 2017).

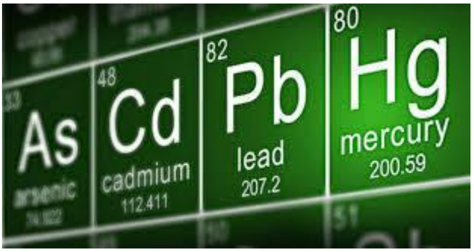

Figure 10. Examples of heavy metals

Furthermore, the adverse impact of heavy metals on male fertility could be exacerbated in the presence of an existing metabolic disease. Akinola *et al.* (2015a) reported low sperm count and poor sperm motility with loss of testicular parenchyma and interstitium after exposure of rodents to aluminum in the presence of chronic fasting hyperglycaemia (high blood sugar). This further shows how environmental and metabolic factors could combine to worsen male fertility, and partly explains why sperm quality and quantity have been on the decline globally.

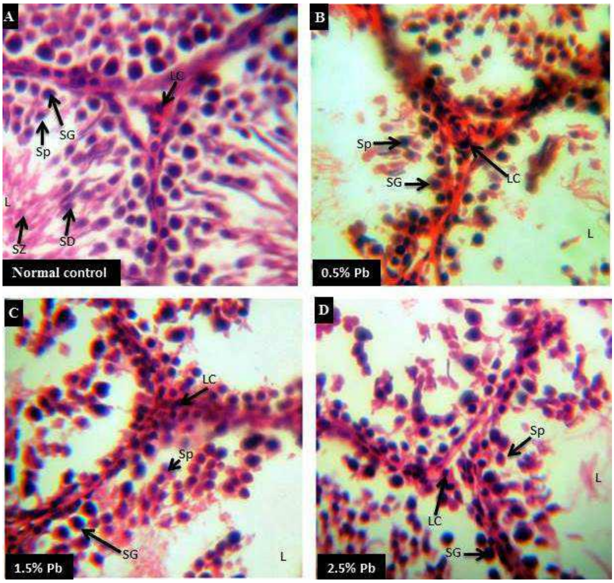

*Figure 11. Testicular microanatomy in the control rats **(A)**, and those on 0.5% **(B)**, 1.5% **(C)**, and 2.5% **(D)** aqueous solutions of Pb acetate. Massive sloughing of germinal epithelium can be seen; but spermatogonial stem cells (SG) and Leydig cells (LC) are preserved. (Source: Akinola et al., 2015c).*

Relationship between Diets and Fertility Failure

The notion that "We are what we eat" is true in many ways. Diets do affect fertility positively, but also negatively. In both sexes, fertility could be enhanced through dietary intake of Mediterranean food (meals rich in fruits and vegetables) and whole grains. Intake of folic acid appears to enhance fertility in females, while the use of antioxidant supplements is reportedly beneficial to male fertility (Chavarro and Schlaff, 2018).

On the contrary, certain food can cause or worsen infertility in males and/or females. Research has shown that the use of cottonseed products, specifically cottonseed oil, could predispose to infertility in male animals and humans, especially if the oil is poorly refined (Akinola *et al.*, 2006, 2007c; Mehta *et* *al.,* 2006). Cottonseed contains gossypol, whose concentrations in cottonseed products is inversely proportional to semen quality, as a result of its gonadotoxic property (Akinola *et al.*, 2006) (Figure 12). In Kurnool (India) where the locals consumed poorly refined oil and other products from cottonseed, Mehta *et al.* (2006) observed a high prevalence of oligozoospermia and azoospermia among males. Our findings from animal studies also showed the ability of gossypol to impair ovulation and fecundity in females (Akinola *et al.*, 2005). It is therefore imperative to ensure adequate refining of cottonseed products in order to limit their gossypol contents, and prevent diet-induced reproductive failure, especially in males.

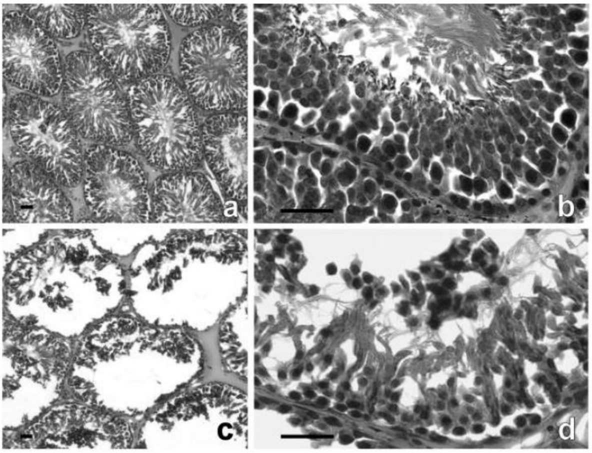

Figure 12. Cross sections of seminiferous tubules of controls (a,b) and gossypol-exposed rats (c,d). The latter group showed loss of germinal epithelial tissue from gossypol toxicity. (Source: Akinola et al., 2006).

Enhancing Male Fertility Via Renewed Basic and Clinical Research

A large population of males with infertility has frequently resorted to self-help with the use of ethnomedicinal substances, mind-body practices, and faith-based healing, which have not been validated scientifically. This is especially true in many African nations, including Nigeria, where for lack of the financial wherewithal and low formal education, affected individuals consider medical consultation as the last rather than the first option.

Fortunately, there is sufficient literature to support improved semen quality upon weight reduction by diet and exercise, alcohol moderation, and smoking cessation (Yao and Mills, 2016). Findings from our laboratory research on botanical substances with strong potentials to improve male fertility are much available. Plants such as *Psidium guajava* (‘*Goroba’*) and *Musa paradisiaca* (‘*Ogede Agbagba’*) contain phytochemicals that are beneficial to male fertility (Akinola *et al.*, 2007a, 2007b; Alabi *et al.*, 2013). In the years ahead, my team will continue to study the effects and mechanisms of the association between obesogenic diets, environmental toxicants, and male reproductive microanatomy and functions.

Stemming the Diabetes Pandemics

Diabetes mellitus is a chronic non-communicable disease characterized by fasting hyperglycaemia arising from deficient insulin production or action. According to the World Health Organisation (2016), the prevalence of diabetes has risen from 108 million in 1980 to 422 million in 2014. This is especially the case in low-income and middle-income countries, including Nigeria (Figure 13).

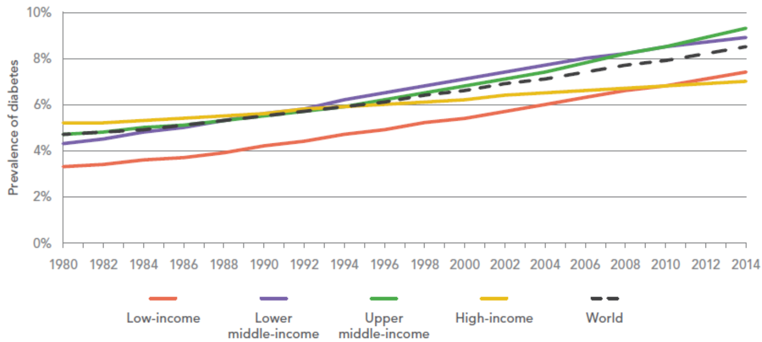

Figure 13. Global Burden of diabetes mellitus, 1980-2014 (WHO, 2014).

Anatomic Complications of Diabetes Mellitus and My Contributions to Diabetes Research

The numerous contributions of anatomists to basic research on diabetes mellitus further underscore the title of my lecture that human anatomy is '**Beyond flesh and bones'**. My journey into diabetes research started, not of my volition, but as directed by my Ph.D. thesis supervisor, Prof. Ademola Caxton-Martins (of blessed memory). I was privileged to conduct my first diabetes research in the laboratory of Prof. Luciana Dini where I did part of my doctoral benchwork at the University of Salento, Italy; with funding from the Italian government through the award of a Pre-doctoral Research Fellowship.

Clinical and laboratory evidence shows that poorly-managed diabetes could lead to numerous and sometimes life-threatening complications, including cardiovascular disease, blindness, limb ulceration and amputation, kidney disease, and impotence (Figure 14). Diabetes could also be the cause of some psychiatric problems.

Despite the success recorded over the years in the management of diabetes, active basic and clinical research continues, in order to deepen our understanding of the pathogenesis of its numerous complications and offer new medical solutions that would improve the quality of life in the affected persons. In this respect, our team and others have been actively involved in laboratory research into botanical materials that could improve pancreatic islet anatomy and functions using such plants as *Azadirachta indica* (*Dongoyaro*), *Vernonia amygdalina* (*Ewúro*), and *Anacardium occidentale* (*Kasú*) (Akinola *et al*., 2010b, 2010c; Olatunji *et al.*, 2012; Ukwenya *et al.*, 2012).

Furthermore, microvascular and macrovascular complications of diabetes do occur. Diabetic nephropathy (DN) is a microvascular complication of diabetes and a leading cause of end-stage renal disease (ESRD). It affects 40-45% of patients with type 1 diabetes and about 30% of those with type 2 diabetes

(Gnudi *et al.*, 2016). Akinola *et al.* (2011a) modeled DN in rodents following induction of diabetes using streptozotocin (STZ). Our model showed characteristic vacuolar degeneration of renal proximal tubules (Armanni-Ebstein lesion) and glomerulosclerosis (Figure 14). Treatment of diabetic rats with oral doses of the leaf extract of *Azadirachta indica* (neem) normalized blood glucose and improved renal histology. These research findings were considered significant by the International Diabetes Federation to have been accepted for oral presentation at the 21st World Diabetes Congress in Dubai in 2011 (Akinola *et al.*, 2011b), for which I received a generous travel grant. Neem leaf could therefore be explored further as a potential source of new drugs for treating diabetes mellitus and its (renal) complications.

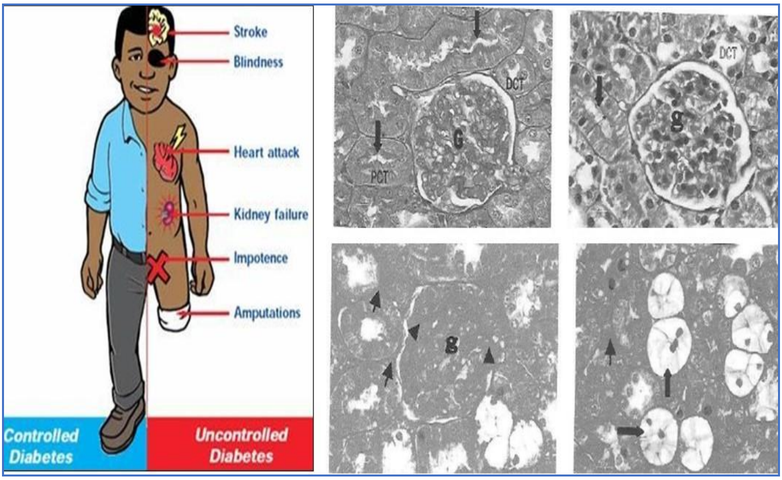

Figure 14. Complications of poorly-managed diabetes mellitus (Left); Renal lesions in untreated diabetes mellitus (Right); g: glomerulus; thick arrows: renal tubules (several of which were vacuolated in diabetic rats [lower Plates]); thin arrows: interstitium; arrowheads: glomerulosclerosis. (Source: diabetesswaziland.wordpress.com; Akinola et al., 2011a)

The kidney, however, is not the only vital organ at risk of being damaged by poorly-managed diabetes. Diabetes may as well damage the liver if not promptly treated with the right medications. While non-alcoholic fatty liver disease (accumulation of fat in the liver) may be seen in patients with type 2 diabetes, hepatic glycogenosis (accumulation of glycogen in the liver) is relatively common in type 1 diabetes patients (Figure 15). Although hepatic glycogenosis is often under-diagnosed, a large percentage of diabetic patients could be affected (Julian *et al*., 2015). In our laboratory, we modelled hepatic glycogenosis in rodents in which diabetes was induced with STZ. Our results suggest that *A. indica* leaf extract ameliorates this diabetic complication (Akinola *et al*., 2010a); Figure 15). This beneficial effect might arise from effective control of blood glucose by the extract, further corroborating related data from our laboratory that the leaf extract of *A. indica* (Figure 16) could be a source of novel chemical entities for treating diabetes.

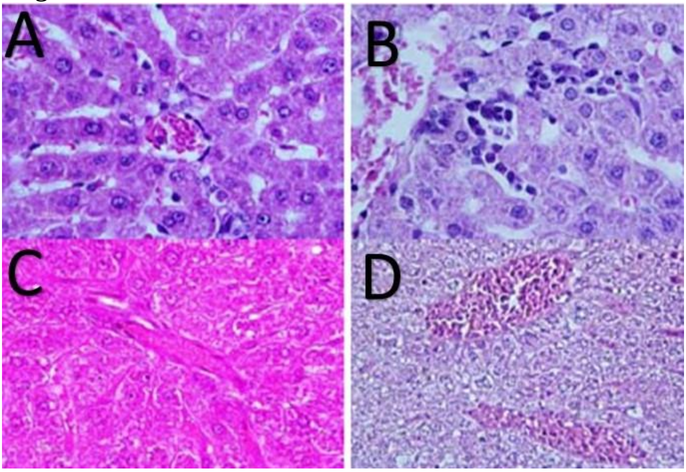

Figure 15. Hepatic glycogenosis in poorly controlled diabetes (C&D) as modelled in rodents. Hepatic histology appears normal in the controls (A&B). PAS stain. (Source: Akinola et al., 2010a).

*Figure 16****.*** *Azadirachta indica, a potential source of antidiabetic drug (Source: Akinola, 2010).*

Mr. Vice-Chancellor, Sir. Does diabetes have any effects on the brain? Of course, it does! The brain is one of the most vital and highly-protected organs in the human body. Many attributes that make us human are traceable to this organ. Unfortunately, the high morbidity and mortality associated with poorly-controlled diabetes mellitus also involve the brain in a number of ways. Diabetes increases the risk of having stroke at least four times. Cardiometabolic risk factors (insulin resistance, hypertension, obesity, and dyslipidaemia) frequently co-exist with diabetes, and do make diabetic patients more susceptible to developing stroke.

Aside from being a risk factor for stroke, much attention has also been drawn to the role of insulin resistance and diabetes in the pathogenesis and progression of neurodegenerative diseases, especially dementia. Diabetes has been known to have deleterious effects on the cognitive and behavioural functions of the brain for more than one hundred years (Miles and Root, 1922). With the growing population of people that live to old age with diabetes, diabetes-associated cerebral dysfunction could have enormous public health implications. According to Alzheimer's Disease International (2015), an estimated 46.8 million individuals are living with dementia world-wide. This figure is expected to nearly double every 20 years, rising to almost 74.7 million by 2030, and 131.5 million by 2050. This suggests that new cases of (Alzheimer's) dementia may emerge, or that existing cases may progress rapidly in parallel with increasing incidence of diabetes mellitus (Figure 17).

Recent evidence indicates the presence of Alzheimer's-like brain pathology in human subjects and laboratory rodents with insulin resistance and/or type 2 diabetes. This further suggests a strong association between the duo (Li *et al.*, 2007; Akinola *et al.*, 2011c,2012,2015,2016, 2017) (Figure 17). In this regard, while working in the laboratory of Prof. S. Sideromenos at the University of Vienna (Austria) as a Pre-doctoral Research Scholar, findings by one of my doctoral students (Michael Gabriel) showed that insulin resistance and obesity have adverse effect on (fear) memory in mice. This effect was ameliorated by oral treatment with 6-shogaol from ginger (Gabriel *et al*., 2020). Thus, our data supports an association between metabolic dysfunction and cognitive impairment; and also provides evidence that ginger contains some chemical substance (6-shogaol) capable of promoting brain health and cognitive function.

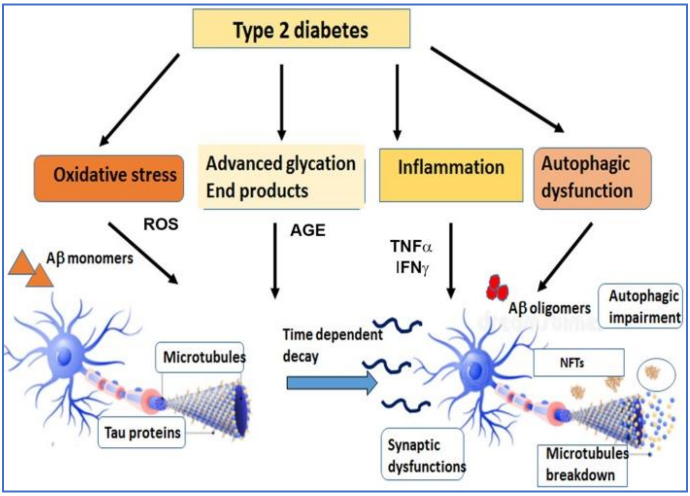

Figure 17. Mechanistic insight into the association between diabetes mellitus and cognitive impairment (Source: Michelson Medical Research Foundation).

In addition, we do have active scientific collaboration with Prof. P. Cardona-Gomez and her team at the University of Antioquia, Colombia, where my doctoral student (Patience Ojo) worked on the association between metabolic perturbation, stroke, and memory dysfunction in 2019. One of the objectives of our collaborative research was to study how insulin resistance impacted behaviour, learning and memory after global cerebral ischaemia. Our data, which was published in Nutritional Neuroscience, showed that pre-existing metabolic dysfunction (especially dyslipidaemia associated with diabetes mellitus and obesity) predisposes to worse prognosis after cerebral ischemia

(Ojo *et al.*, 2020) (Figures 18 and 19). In other words, obese and/or diabetic subjects are likely to have worse neurological and cognitive outcomes following (ischaemic) stroke.

Furthermore, recent morphological evidence from our laboratory suggests that androgen deprivation (induced in some males with prostate cancer) and central insulin resistance do combine to facilitate hippocampal cellular, subcellular, and molecular changes that perturb memory and cognitive function (Yawson and Akinola, 2021). However, detailed molecular underpinnings of the above associations between endocrine/metabolic perturbation and cognitive dysfunction are yet to be fully understood, and are therefore subject to future research. On my part, my research team at Unilorin would continue to explore the mechanisms by which androgen deprivation, insulin resistance and/or diabetes mellitus induce the structural and molecular changes in brain regions that mediate behavioural, cognitive, emotional, and motor functions. We would also continue to take advantage of our international collaborations to achieve this objective. In this regard, one of my doctoral students, Afees Olanrewaju, would be visiting the laboratory of Prof. Russell of the Department of Genetics, University of Cambridge (UK), having won the Cambridge-Africa ALBORADA Research Fund to study the "Modulatory role of curcumin and quercetin on GSK-3 activity in a Drosophila model of Parkinson's disease" in a bid to deepen our understanding of the molecular link between diabetes mellitus and neurodegenerative disease.

Meanwhile, enlightenment campaigns directed at educating the public on the numerous complications of untreated or poorly-treated diabetes mellitus should be intensified. My community service in this regard was the formation of a student-based advocacy group called 'Diabetes Advocacy Initiative'. We had successfully organized visitations to a number of secondary schools within Ilorin metropolis as Diabetes Advocates (Figure 22).

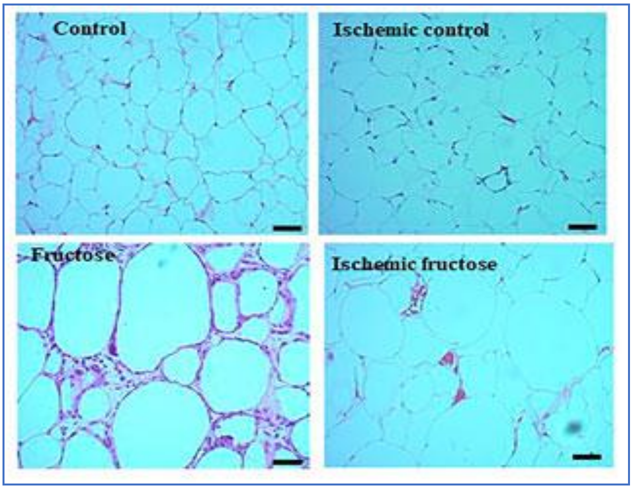

Figure 18. H&E staining of adipose tissue showing high fructose diet-induced increases in adipocyte size. (Source: Ojo et al., 2020).

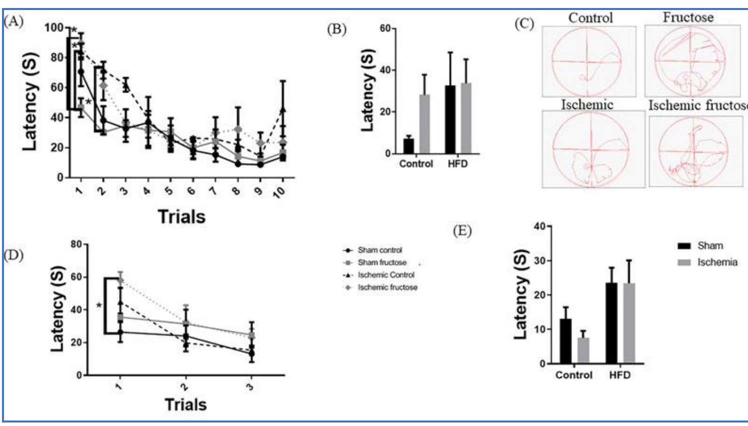

*Figure 19. Ischemia with obesity comorbidity affected the ability to learn new skills. The Morris water maze test involved the following variables: (A) learning, (B) retention, (C) image representing the route of travel during the retention test, (D) the transfer test and (E) the visible test, which was performed to detect cognitive deficits in high fructose and ischemic animals. *P < 0.05, **P < 0.01, ***P < 0.001, ****P < 0.0001 (Source: Ojo et al., 2020).*

My Contributions to Developmental Neuroscience

Mr. Vice-Chancellor Sir, the field of neuroscience (the study of the brain and spinal cord) had aroused my interest since the beginning of my career. Unfortunately, the opportunity to advance Anatomy '**Beyond flesh and bones**' in this field did not come until when I received the prestigious IBRO Research Fellowship from the International Brain Research Organization (IBRO, France) in 2012. This Fellowship funded my 12-month postdoctoral training in the laboratory of Prof. Sharon Juliano of the Uniformed Services University of the Health Sciences (USUHS), Bethesda, USA. In Prof. Juliano's lab, I had the opportunity to study the association between gestational exposure to environmental toxin and cerebral cortical dysplasia.

Environmental Toxins and Brain Developmental Defects

Like other congenital anomalies, congenital brain defects may arise as a result of genetic, chromosomal, environmental, multifactorial, or even unknown causes. In some cases, in the absence of obvious gross anatomical malformations, certain individuals may present with such neurological issues as seizure disorders, autism spectrum disorder, mental retardation, and schizophrenia; suggesting underlying cellular and/or molecular aberrations.

Environmental factors that could contribute to neurodevelopmental defects are many, and include gestational exposure to organophosphorus pesticides and herbicides used in farms and homes, heavy metals from mining sites and factories, cigarrete smoking, alcoholism, certain drugs, and air pollution (Choi, 1988, 1989; Eskenazi *et al.*, 2008; Omotoso *et al*., 2014, 2015; Bolton *et al.*, 2017; Bernal-Meléndez *et al.*, 2019; Sunyer and Dadvand, 2019). Also, Gestational infection with micro-organisms such as the Zika virus, rubella virus, and *toxoplasma gondii, etc*., does have negative implications for brain development and functions (Adibi *et al.,* 2016; Felix *et al.*, 2017).

Furthermore, neurodevelopmental anomalies could arise from dietary sources. For example, the seed and fruit of the tropical palm-like plants in the cycad family (e.g., *Encephalartos barteri* found in Nigeria) are known neurotoxins in human and animals. Cycad fruit and seed contain cycasin, which when ingested, is hydrolysed into glucose and methylazoxylmethanol (MAM). The latter is responsible for the neurotoxicity of cycasin. Our team had shown that gestational exposure to this toxin in the gyrencephalic ferrets produces mild lissencephaly in these animals (*i.e.*, having a brain with smooth, rather than folded surfaces). When compared to the normal ferrets, MAM-exposed ferret pups showed increased, early expression of the neuron-specific potassium chloride co-transporter 2 (KCC2) in inhibitory neurons (Djankpa, Akinola and Juliano, 2018). This molecular perturbation manifests as incorrect cortical circuit formation arising from deficient migration of the neurons to their definitive cortical laminae. Inhibitory (GABAergic) thalamocortical neurons destined for cerebral cortical layer 4 were largely affected, resulting in marked reduction in the thickness of this lamina (Poluch, Akinola, and Juliano, 2012) (Figures 20 and 21). In some schizophrenic subjects, there is empirical evidence to support significant decreases in the cortical population of the parvalbumin-positive GABAergic neurons (Beasley and Reynolds, 1997); indicating that gestational factors play important role in the aetiology of some neuropsychiatric disorders.

Thus, given the fact that humans are repeatedly co-exposed to environmental toxicants and obesogenic (high-fat and high-sugar) diets, it is essential to continue to engage in research that studies the degree to which simultaneous exposure to these factors impact neuronal migration and lamination during corticogenesis (formation of the outer layer of the mammalian brain in foetus). This is one of the future research focuses of my team as a scientist committed to advancing Anatomy '**Beyond flesh and bones'**.

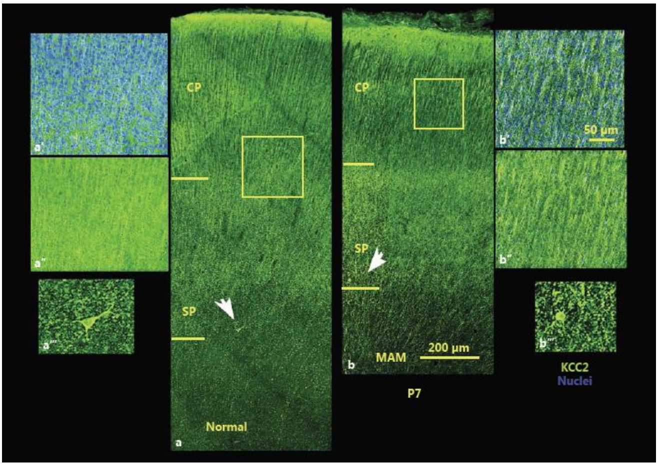

*Figure 20***.** *KCC2 immunoreactivity at postnatal day 7 (P7). Strong immunoreactivity continues in the subplate (SP). We generally see less labeling in, or at the edges of, cell bodies and a stronger reaction in a pattern surrounding the cells (***insets***) revealed by bisbenzimide staining (blue). The cortical thickness remains reduced in the MAM-treated ferrets. (Source: Djankpa, Akinola, and Juliano, 2018).*

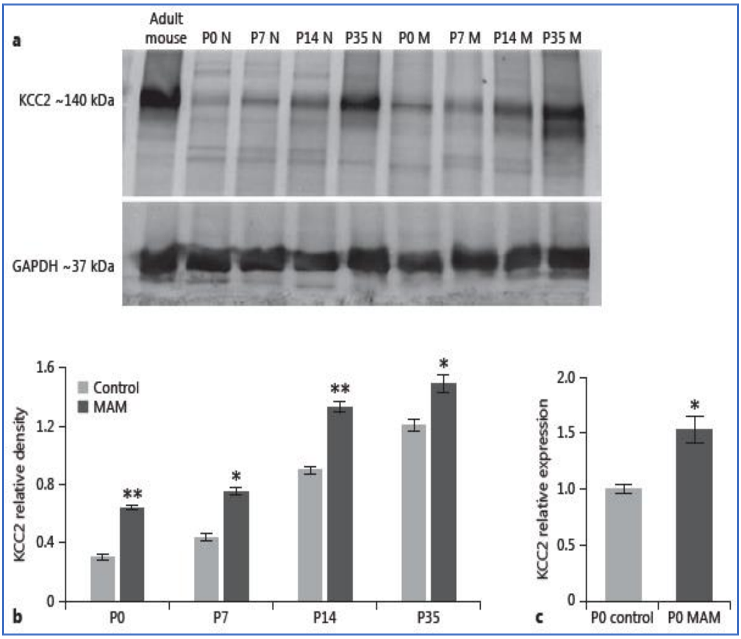

*Figure 21***.** *KCC2 Western blot and qPCR. (**a**) Western blots showing levels of KCC2 at postnatal day 0 (P0), P7, P14, and P35 for normal (N) and MAM-treated (M) parietal cortex. (**b**) The relative density of KCC2 levels compared to the control protein GAPDH is shown. At each age, KCC2 levels are significantly greater than control levels. n = 3 animals from different litters in each group. *p<0.01; **p<0.001. (**c**) qPCR analysis showed that MAM treatment significantly increases KCC2 mRNA levels in P0 samples *p = 0.039, n = 4 animals in each group (Djankpa, Akinola & Juliano, 2018).*

My Contributions to Brain and Mental Health Advocacy

The very fact that maternal ingestion of certain food substances and exposure to environmental toxicants could have profound effects on foetal brain development is a wake-up call to pregnant women to choose their diet with exceptional care. In developing nations where many females are either uneducated or have minimal formal education, there is a need for intensive public enlightenment campaigns to educate our women on the association between gestational exposure to environmental toxins and foetal wellbeing.

Mr. Vice-Chancellor, Sir, in a bid to advance neuroscience research and promote mental health in our immediate communities, Prof. Bamidele Owoyele and I have championed the establishment of the Ilorin Neuroscience Group consisting of students and scientists with interest in neuroscience. The group has been periodically organizing radio talks, and school visitations within and outside Ilorin (Figure 22). The most recent event was held in April 2021 as a Global Neuroscience Engagement and Advocacy Programme; the goal of which was to motivate our students to pursue a career in Neuroscience.

Each year, we also join Brain Advocates all over the world to mark the annual Brain Awareness Week, which holds in the month of March. In this regard, we do have periodic interaction with the public via phone-in radio programme that previously held on Unilorin 89.3 FM, Sobi FM, and Harmony FM. Some of these activities were funded by our personal contributions, with occasional financial support from foreign donors. Distinguished members of the Ilorin Neuroscience Group have been instrumental in achieving the objectives of our Group; they include Prof. Moyosore Ajao, Prof. Musa Yakubu, Dr. Gabriel Omotoso, Dr. Joseph Olajide, Dr. Maryam Ayinla, Dr. Lukman Oyewole, and Dr. Susan Lewu, among several others.

At this point, kindly permit me to thank the Vice-Chancellor of the University of Ilorin, **Prof. Sulyman Age Abdulkareem**, who approved the hosting of the IBRO School on Mood Disorders organised by the Ilorin Neuroscience Group in March 2019 with financial and logistic support from the International Brain Research Organisation (IBRO) and the University of Ilorin. This international event, which featured lectures and laboratory workshops on mood disorders, hosted selected postgraduate students and junior faculties from

Universities in Ghana, Cameroun, and Nigeria. We also had resource persons that included two Professors from Harvard University, USA, and one from USUHS, USA. Our Vice-Chancellor specifically gave approval for the feeding and hotel accommodation of the three American resource persons during the week-long programme. This event and many more, are our own means of checking the rising rates of mood disorders (especially depression and suicidality) in our immediate society.

Figure 22: Brain Awareness Outreach by Ilorin Neuroscience Group held at St. Anthony Secondary School, Ilorin (Left); Diabetes Advocacy at the School for Special Needs, Old Jebba road, Ilorin (Right).

Conclusion

Anatomy continues to take the traditional lead as one of the foundation courses in the undergraduate curricula of medical and allied health professions. Therefore, sufficient provision must be made to ensure adequacy of material and human resources required for teaching and research in anatomical sciences. With continuous training and re-training, and the availability of state-of-the-art equipment, anatomists would always be in the frontier of promoting the health of the public through advanced research in virtually all fields of medical science; and also, through their involvement in undergraduate and postgraduate medical education. So far, as a human anatomist, I have dedicated my time, energy, and intellectual prowess to the advancement of medical education and biomedical research specifically in reproductive endocrinology, diabetes mellitus, and neuroscience. I have also had the privilege of providing administrative and academic leadership previously as Level Adviser, Postgraduate Programmes Coordinator, Acting Head of Anatomy Department, and presently as Dean of the Faculty of Basic Medical Sciences in this great University. As a mentor, I have as well provided academic and research leadership to the next generation of anatomists, having successfully supervised 20 masters and 9 Ph.D. students in Anatomy. In the years ahead, I intend to continue to devote my energy to the noble course of advancing human anatomy **'Beyond flesh and bones'** through active teaching, advanced research, and impactful community service**.**

Recommendations

To the Government

1. The illegal mining activity in some parts of the country is not only fueling insecurity, but is also of public health concern. High morbidity and mortality have been reported in the affected communities, including brain damage and male subfertility arising from lead toxicity, for example. The government should therefore ensure that mining activity is strictly regulated, in the interest of mental and reproductive health of the people;
2. Given the relatively high incidence of underweight male pupils in Nigerian public schools, the National Home-Grown School Feeding Programme (NHGSFP) of the Federal Government should be continued and improved upon, in the best interest of pupils in our public schools;
3. It is high time that government at the federal, state, and local levels considered the establishment of forensic DNA databases and forensic laboratories (crime laboratories) across the country to check the high rates of crimes in the nation. With the aid of forensic DNA profiling (DNA finger-

printing), it is easier to track and prosecute offenders, and by so doing enhance national security. Graduates of the B.Sc. Anatomy degree programme are a source of skilled human resource that can be given short training to operate such forensic laboratories.

To the University

1. The approval to run the B.Sc. degree programme in Anatomy in Nigerian Universities is a commendable step taken several years ago by the National Universities Commission. It is heart-warming that a number of public and private universities are currently running this degree programme, with the objective of producing competent anatomical sciences personnel to serve as lecturers and scientists in our medical schools. This legacy should be sustained, with a proviso that undergraduate admission into the programme is not bloated, for proper training;
2. Renewed research efforts are recommended to check the high mortality and morbidity associated with diabetes mellitus. In this respect, robust intramural and national research grants should be made available to medical scientists to facilitate the discovery of new, highly effective diabetes therapies. Specifically, TETFund, through the National Research Fund, should do more to support numerous excellent proposals submitted by medical researchers each year;
3. Being a structural science, modern research equipment and facilities that promote high-resolution visualisation of tissues, cells and subcellular structures are required in the anatomy research laboratories. A situation where no Nigerian Universities can boast of functional transmission electron and confocal microscopes is worrisome. Universities should therefore pursue the establishment of electron and confocal microscopy suites for teaching and research purposes, to re-position morphologists to deliver '**Beyond flesh and bones**'.

To the Society

1. The age-long belief that blames infertility solely on females is not only incorrect, but is also unfair. Male factor infertility is real. Males should therefore not hesitate to promptly present themselves for medical attention in the event of infertility in the family. The problem could be traceable to them in nearly half of the cases;
2. Diabetic patients should desist from self-medication. Rather, they should seek prompt medical attention. When untreated, diabetes mellitus could result in several complications that, among others, include psychiatric and cognitive problems;
3. Congenital anatomical and/or functional defects of the brain could arise from exposure to environmental toxins and ingestion of certain food substances during pregnancy (for example, food sourced from the cycad plants). Pregnant women should therefore avoid exposure to such substances in the interest of foetal brain and well-being.

Acknowledgements

It is nearly five decades since my birth into the Akinola Family. I am therefore indebted to the LORD for sparing my life till date, and for helping me to attain the peak of my academic and research career.

I would like to appreciate everyone in this auditorium for honouring my invitation. Several individuals, who are too numerous to mention, have been part of my journey so far, and have contributed in different ways to making me who I am today.

Mr. Vice-Chancellor, Sir, may I seek your kind indulgence to publicly acknowledge and appreciate a few of them:

- Firstly, and most importantly, I give all glory, honour, and adoration to the **almighty GOD** and the Father of

my LORD and SAVOIUR Jesus Christ for making this day a reality. The story of my academic journey testifies to the benevolence and goodness of the LORD (Jm 1:17), and underscores the biblical saying that ‘By strength shall no man prevail’ (1Sam. 2:9);

- I am grateful to my academic fathers in Anatomy at Unilorin: **Prof. E.A. Caxton-Martins** (of blessed memory), and **Prof. B.U. Enaibe**. Under his supervision, Prof. Caxton-Martins gave me the privilege of becoming the first graduate of the Ph.D. degree programme in Anatomy at the University of Ilorin in 2011. Unfortunately, he passed on in December 2012. May his soul rest in eternal peace.
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Mr. Vice-Chancellor Sir, Distinguished Ladies and Gentlemen; I wish everyone who had come from far and near to attend this lecture safe journey back to your destinations.

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