18th Annual B. O. Osuntokun Memorial Lecture

PRECISION MEDICINE FOR ALL

Building on the Osuntokun Legacy of Excellence in Clinical Medicine

Yes We Can!

by

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Introduction

I am honoured and grateful to be giving the 18th annual lecture in memory of our late, great Professor Benjamin Oluwakayode Osuntokun, a giant in his field, who left an indelible national and international legacy. A top scholar, a dedicated and compassionate physician, his departure from this earth 21 years ago is still deeply felt among all of us who were fortunate to have known him. I was a house officer in Neurology and fondly remember our brilliant professor. He simply knew every fact in medicine and was an astute physician in the Osler tradition. His memory lives on through his wonderful and highly accomplished family, the Benjamin Oluwakayode Osuntokun Trust, and the phenomenal body of knowledge he created, influencing generations of physician scholars to this day.

Professor Osuntokun accomplished so much during his time on earth and a dozen or more lectures enumerating his work would not be enough to truly do him justice. Throughout his career, his principal and enduring research interest was refining the methodology for neuro-epidemiology and community control of common tropical neurological diseases. He worked closely with residents in communities around Ibadan and throughout Nigeria, who were afflicted with tropical ataxic neuropathy, largely due to their diet of poorly processed cassava.[1] Through dedicated epidemiological research and precise data collection and analysis, Professor Osuntokun successfully discovered the basis of tropical ataxic neuropathy and was immensely lauded by the international medical community for this breakthrough. This is what excellence in clinical medicine demands. You define a disease phenotype, conduct

research to find the cause and then develop the cure to wipe the disease off and thereby relieve human suffering.

Professor Osuntokun was a highly creative and visionary physician scientist. Later in his illustrious life, he embarked on the Indianapolis-Ibadan Dementia Project, an international collaboration on the comparative epidemiology of the dementias between the Yoruba of Ibadan and an African American population in Indianapolis, Indiana. During the early 1990s, the medical and public health community had yet to make the shift from "international health" to "global health" and there was still much to learn regarding how global trends and determinants increasingly influenced public health. Professor Osuntokun understood that Nigeria and much of the African continent as a whole, struggled, and still does, with infectious and tropical diseases and other traditional health issues, like child and maternal mortality. However, he had the foresight to recognize that he lived in a rapidly aging world undergoing demographic changes leading to an epidemi-ological transition. The predominance of infectious diseases was shifting to non-communicable chronic diseases (NCDs) including a wide range of conditions like cancer, diabetes, cardiovascular disease, as well as Alzheimer's and other dementias. Professor Osuntokun knew that gone were the days where the common understanding was that these conditions only afflicted industrialized countries. In fact, beyond HIV/AIDS, tuberculosis, and malaria, chronic non-communicable diseases and injuries contribute to more than half of the deaths in the developing world. While Professor Osuntokun did not come across a large number of Alzheimer's patients in his clinical practice, he was aware that there was an enormous and growing burden associated with dementia, particularly for countries in the developing world. His academic curiosity and thirst for knowledge coupled with his compassionate nature as a physician pushed him to develop a partnership in 1991 between the University of Ibadan, Nigeria and

Indiana University, Indianapolis, Indiana, and establish the Indianapolis-Ibadan Dementia Project.

What is truly unfortunate is that Professor Osuntokun did not live long enough to witness how the descriptive and analytical nature of his epidemiological studies redefined the world's understanding of how genetic and environmental factors and their interactions influence the risk for Alzheimer's disease and dementia. Initial findings from his project reported that the incidence rates for Alzheimer's disease and dementia among the Yoruba are less than half the incidence rates of the African American comparison group, spawning several analytical studies to identify factors that may account for these differential rates.[2]

Inspired by Professor Osuntokun and using data from his prolific study, many of his collaborators and countless other Alzheimer's disease researchers are hoping to develop a risk factor model for Alzheimer's disease that incorporates an evaluation of environmental and genetic risk factors and their interaction in order to better understand population phenotypic differences.[3] This type of research is key to the future of medicine as a discipline. Be it Alzheimer's disease or any other disease, risk factor models and genomics allow us to tailor medical treatment to the individual characteristics of each patient. We are outfitted with knowledge of an individual's susceptibility to a particular illness and we can identify those at highest risk for developing a disease and who could benefit most from prevention measures. Professor Osuntokun would be proud to know that he left an important legacy allowing for precision medicine research in Alzheimer's disease treatment and prevention. It is this legacy, a legacy of precision medicine research in a non-communicable disease that I find his work most inspirational and the spirit in which I present my lecture today.

Chronic Non-Communicable Diseases in Nigeria

Training as a physician in Ibadan in the late 70s was formative for my future career as it provided the foundation for a successful careeer in the US. Our Teachers in the College of Medicine, as well as consultants and senior registrars in UCH were giants in their respective fields who inspired us. Everyone was incredibly bright and knowledgeable about human physiology. Teachers like Osuntokun, Akinkugbe, Falase, Bademosi, Ayoola and Famuyiwa, to mention a few, did their best to impart a culture of inquiry on trainees in Medicine by being productive, publishing seminal articles in reputable international journals.

As the most populous African country with a population of over 170 million,[4] Nigeria contributes significantly to the global burden of non-communicable diseases (NCDs) with an estimated 792,600 NCDs-related deaths in 2008 resulting in adverse social, economic, and health outcomes. The 2014 World Health Organization Global Status report on NCDs in Nigeria showed that the percentage of all NCD deaths in males and females under the age of 70 years was over 70%.[5] In a 1990-1992 NCD survey in Nigeria, the prevalence of diabetes mellitus was 2.7% and that has risen to nearly 5% in a 2014 report from the International Diabetes Federation, which showed that diabetes mellitus currently affects over three million Nigerians.[6] The number of patients with hypertension and end stage chronic kidney diseases is staggering. Nigeria has the largest population of people with sickle cell disease (SCD) with an estimated carrier prevalence of 24%; 20 per 1000 births are estimated to be affected by SCD, resulting in an estimated 150,000 children with SCD born annually.[7] Beyond HIV/AIDS, TB, and malaria, chronic non-communicable diseases (NCDs) and injuries contribute to more than half of deaths in the developing world. The WHO predicts that deaths from cancer will rise by 2030 from

approximately 8 million individuals/year to more than 13 million/year. Most of the increases in new cancer diagnoses will occur in economically disadvantaged low to middle income countries (LMIC) that are least able to detect and treat cancer. The burden of NCD in Nigeria remains poorly characterized and in need of an analysis of the population genetics of contemporary African populations in comparison to African Americans in the U.S. Estimated annual new cases of cancer in Nigeria are 102,100; but who is counting? [8]

Despite the growing burden of NCDs in Nigeria and Africa in general, there has been no response-coordinated strategy to this looming epidemic. Translational research productivity remains quite low. Through several initiatives from donor countries including the Medical Education Planning Initiative, medical schools in Nigeria are now beginning to integrate basic science in the curricula to broaden exposure. In 2016, medical students in Nigeria will graduate without ever having set foot in a research laboratory or participating in research. Advances in genomics research have been transformative in the diagnosis and treatment of the most intractable NCDs and should be part of routine clinical care. Yet, graduates of medical schools on the continent lack a fundamental understanding of how genes regulate human physiology and behaviour in health and disease. It is a fact that genetic and non-genetic risk factors interact in complex ways to cause human diseases. The race is on to use "Big Data Science" to improve clinical outcomes. Risk factors for NCDs such as physical inactivity, unhealthy diets, tobacco and harmful alcohol use are now mechanistically linked to the aetiology of NCDs. Patient reported outcomes can be linked electronically to provide patient-centered care and improving adherence to treatment plans. Drugs used to treat patients in Nigeria were never studied here as all the efficacy studies have been deduced from populations of European ancestry that may not be generalizable to other

populations. Pharmaco-genetics and pharmacodynamics are key elements of experimental therapeutics, that when given proper consideration can reduce errors in prescribing life-saving drugs. There is a dearth of data on the human genetic diversity and the biological mechanisms underlying the development of NCDs among African populations. This underscores the need to accelerate progress in genomics research that benefit patients. Professor Osuntokun would have wanted nothing more than to have competitive teams of investigators translating scientific advances on the root causes of NCDs on our medical wards and outpatient clinic. In fact the entire University Hospital should be a "Human Laboratory" for patient-oriented research. Interdisciplinary teams of basic, clinical and population scientists can develop innovative clinical trials to personalize disease treatment and prevention among African populations. If Professor Osuntokun did it for tropical ataxic neuropathy, we can do it for other diseases that are prevalent in populations of African ancestry in this country and across the globe. Such was our ambition when we began the Nigerian Breast Cancer study in 1998.

Not only is American medicine the best in the world, American ingenuity and investments in biomedical research will ensure its leadership for decades to come. The citizens of the country pay taxes and expect the best science from medical research centres. Researchers continue to discover new disease entities and reclassifying what we previously thought we had mastered. Ask Dr. Williams Balogun who recently returned from six month training in the US how he now approaches diabetes. From having Type I and 2 diabetes, we now have a dozen or more different types of diabetes for which genetic testing is available. Today's medicine is all about precision—no longer "common things occur commonly'. As a hematologist-oncologist, I have become very interested in studying diseases that disproportionately impact people of African ancestry.

I am sure a significant fraction of this audience has heard me talk about my research and I will use this opportunity to highlight the outstanding work that our colleagues in Ibadan are doing to accelerate progress in precision medicine for Nigerians. As the US continues to invest in research in Nigeria through partnership, the Nigerian government must also invest in a robust biomedical research enterprise. If Nigeria doesn't lead the way, the emerging epidemic of NCDs could threaten our economic development.

The Perfect Storm - Current Climate

CGH can foster the development of expertise in genomics research among African scientists and the establishment of a networked community of African investigators to collaborate with U.S. investigators. Most relevant to low resource settings, University of Chicago is poised to lead in the implementation and delivery of novel genomic technologies to improve global health.

Breast and cervical cancers are the leading causes of cancer deaths in Nigerian women. There is no such thing as breast cancer as a disease. Breast cancer is not one disease but a heterogeneous group of cancers that originate in mammary glands. For too long, Africans and African Americans in the USA were not included in discovery research. I was shocked by the degree of segregation that existed in Chicago when I landed there in 1983. There was simply no research going on at Cook County Hospital where 98% of the patients were poor and uninsured African Americans.

You have heard about "Black Lives Matter." If Black lives matter to us, we must help the next generation of scholars build research capacity and focus on diseases that disproportionately impact individuals of African ancestry. I did not want to be a trauma surgeon so I had to work my way to a fellowship in hematology-oncology at the University of Chicago. Having trained in molecular biology and genetics in the Rowley Laboratory, I was determined to

make sure that the translation of scientific advances that benefit vulnerable minority populations was not delayed as they are the ones likely to benefit the most from these discoveries. Black women are more likely to be diagnosed at advanced stages of cancer for reasons that were unknown and were understudied when we started our Chicago-Ibadan collaborative research, which is following in the footsteps of the Indiana-Ibadan research collaboration on Alzheimer's disease. As a result of our breast cancer studies in Nigeria, we now know why. It is all about the perfect storm of health care delivery patterns, tumor biology and genomics that collide to create a racial survival disparity in breast cancer.[9]

In all sub-Saharan Africa, breast cancer is almost uniformly fatal.[10]A diagnosis of breast cancer should not be a death sentence. In our pioneering study in Nigeria, we found that the majority of women presenting with a breast cancer diagnosis are under the age of 50 years, and most present in advanced stages in part because of ignorance of the disease on the part of health care providers.[11,12,13] The Yoruba word for describing breast cancer is jejere — which means ulceration. Breast cancer is neither painful nor ulcerated at the beginning but often when women present health care providers in the community or primary care centres with a breast lump, our study found that these health care providers would often administer antibiotics or use a knife to lance the "boil".

In 2011, Professor Ojengbede and Drs Ogundiran and Adenipekun hosted two medical students from the University of Chicago who recruited patients in the radiotherapy and surgery clinics at UCH. All women who had been diagnosed with breast cancer were eligible, regardless of the stage of diagnosis, as long as they were 18 years of age or older. Patients from all ethnic groups and language groups were eligible as long as they spoke a common language with the translator.

Using semi-structured interviews, 31 women were asked about how they first found their breast cancer, their health care seeking behaviours, any delays they had experienced in care, beliefs about disease causation and experiences with stigma. The take home message from our studies in Ibadan which was consistent with what we had found in the US was that the health care system was in part to blame. We need to change the system in a way to meet the needs of women who were often offered inappropriate care. We found that delays in diagnosis were due to honest ignorance of the disease among women and the utilization of non-physician medical services such as chemists and pharmacists. Delays in treatment were also often due to the fear of surgical procedures and the attendant cost. The majority of women did not know the cause of their breast cancer, but some believed it was caused by a spiritual affliction and spent time and money seeking cures from spiritual healers.[14]

The Perfect Storm—Financial T4oxicity

Because cost was identified as a barrier to treatment, we conducted a pilot study using 37 women to estimate the direct costs associated with breast cancer, the indirect costs associated with lost productivity and morbidity, and coping costs and strategies used by Nigerian households.

First, we found that women spent a lot of money accessing 'bad care." Next, we found that even upon seeking formal medical care for breast cancer, patients faced a mean total cost of $666/month, which included all medical, indirect and coping costs. Patients who delayed seeking medical care for diagnosis (self-reported, >3 months) had significantly higher direct medical costs ($375/month vs. $189/month, p=. 018) compared to patients who did

not delay diagnosis, suggesting that earlier stage diagnosis is critical to lowering breast cancer costs. At the same time, upon diagnosis, patient income dropped an average of 45% ($387/month vs. $185/month, p=.009) and household income dropped an average of 27% ($734/month vs. $535/month, p=.239). Nearly a third of patients quit work, and 86% of patients reported missing formal work. On average, patients had 63% less money saved at the time of interview than before diagnosis, and 59% had no savings at all. We calculated cost burdens (cost/income) using World Bank estimates for average household income ($195/month). Mean out-of-pocket cost burden was 1.77 times greater and mean total cost burden was 3.42 times greater than income. Experiencing financial constraint due to cost burden was correlated with treatment delay (82% vs. 32%, p=. 01), treatment non-adherence (45% vs. 8%, p=. 018), and underutilization of health care (direct medical costs $236/month vs. $437/month, p=.027). Consequently households were forced to utilize coping strategies, including labour substitution (96%), savings (88%), reducing food expenditures (62%), and loans (49%).

The results of our study and others suggest that the economic burden of breast cancer may be catastrophic for households and an impediment to economic development as the disease strikes productive, working-age females. Households incur huge direct, indirect, and coping costs in exchange for immediate access to medical care, but for what gain? Even with surgery, chemotherapy, and radiation, five year survival for patients with breast cancer in Nigeria is only 10% (15). Thus, breast cancer diagnosis often foretells a quick death for the patient, the simultaneous financial devastation of their household, and serves as an impediment to economic development (ref: Anterasian in preparation).

Genomic Landscape of Breast Cancer

With our outstanding collaborators and staff working diligently in Ibadan, we have now published more than 30 papers on the genetic epidemiology of breast cancer among women in communities around Ibadan who had been referred to UCH. We have identified genetic and non-genetic risk factors for breast cancer in Nigerian women. Our colleagues, Professor Obajimi with help from Drs Afolabi and Oluwasola established the Ibadan Multidisciplinary Breast Cancer Group and they have used this group to mentor the next generation of physician scholars in patient-oriented research and expanded breast cancer awareness in the community. We have been most encouraged by our laboratory partners, the indefatigable Professor Adeyinka Falusi and her long term exceptional medical technologist Mr Abayomi Odetunde, who runs a highly functional genetics and immunohistochemistry laboratory in Ibadan.

Key findings from our research led to the conclusion that the significantly higher incidence of early-onset breast cancer in women of African ancestry is likely due to a correspondingly higher prevalence of pertinent genetic risk factors. We tested this hypothesis by obtaining DNA and tissues samples from more than 2000 breast cancer cases and 2000 controls recruited in Ibadan. Population differences in the breast cancer survey in indigenous African women reveals over-representation.[16] The study indicated population differences between white women from the US and Western Europe, African Americans and indigenous Africans. Of course these should have been expected based on the young age of the at-risk population in Nigeria, but everyone had been working on the basic premise that breast cancer is the same in ALL women. It was common practice to prescribe tamoxifen without proper diagnosis of breast cancer and assume every woman would respond. This is not so as breast cancer is not one disease and our study underscored the need for fundamental research among populations in Africa.

Our research has shown that indigenous West Africans have high proportions of “estrogen receptor negative” (ER-), “progesterone

receptor negative" (PR-) and "HER2 negative—"triple negative breast cancer" (TNBC) than African Americans. Specifically, while the reported proportion of TNBC was 21% in European Americans, 32% in African Americans, the statistics in Africans living in Nigeria and Senegal was 55%.[16] This finding was confirmed by another study in Africa.[17]

Results from the Carolina Breast Cancer Study showed that 39 percent of premenopausal African American women diagnosed with breast cancer had the basal-like TNBC disease, compared with 14 percent of postmenopausal African American women and 16 percent of non-African American women of any age.[17] A study from the California Cancer Registry also concluded that African American women have the highest lifetime incidence of TNBC.[18] Regardless of the stage at diagnosis, women with TNBC showed poorer survival rates than those with other breast cancers.

TNBC is by far the most deadly of all breast cancer subtypes because molecular targets for pharmacologic therapy have not yet been identified. Furthermore, risk factors, especially modifiable risk factors, for TNBC are not fully determined. It appears that the association between parity and breast cancer risk differs appreciably for ER+ and triple-negative breast cancers.[19-21] There are no defined strategies for early detection as TNBC which often presents as interval cancers in women undergoing annual screening. These biologic characteristics, along with socioeconomic factors, make TNBC a serious threat to all women in resource-limited settings.

We are taking advantage of our partnership with the exceptional team now engaged with our work in Nigeria, to advance the complex "science" to understand the root causes of TNBC. We are addressing this problem using a systems approach that allows us to interrogate genetic and non-genetic risk factors in breast cancer aetiology and pathogenesis.[22-29]

Our ultimate goal is for Nigerian investigators to "leap frog" by developing novel translational genomic solutions that build local capacity in science and technology and thereby reduce health inequity.

The programme is now in a sustainable growth phase and has expanded to become the West African Breast Cancer Study (WABCS). The WABCS is a public-private partnership between Novartis Institutes for Biomedical Research; University of Chicago, Medicine; University College Hospital (UCH), Ibadan; and Lagos State University Teaching Hospital. It has been designed to gain a better understanding of the genomic landscape of Nigerian breast cancer patients by analyzing the genetic alterations of 200 breast cancer samples from Nigerian women and comparing the type and frequency of these alterations to those in North American Caucasian and African-American breast cancers. Anyone visiting the IMRAT Genetics and Bioethics Unit as well as the Breast Cancer Laboratory will attest to the state-of-the-art equipment and the cutting edge research that the units can support. For a place like Ibadan, the entire place should be humming with research activities. We can do better and I am thrilled that the next generation of young scholars is returning to Ibadan and they will make medicine in Nigeria return to the "glory days".

Genomic studies of African breast tumors are non-existent in the literature. With the deployment of new technologies, improved work flow, and the training of investigators in Nigeria, both the quantity and quality of the samples collected have dramatically improved. Intensive training has enabled our staff in Nigeria to process samples on site. Tissue samples are fixed in either RNAlater or PaxGENE fixatives or formalin fixed paraffin embedded (FFPE). We are now developing new genomic tests including Exome sequencing and Whole Genome Sequencing. Our goal for these studies is to conduct research that will drive policy in Nigeria.

We are now in the active phase of launching a second clinical trial in Nigeria. Members of the Ibadan Multidisci-plinary Breast

Cancer group developed the ARRETA protocol entitled "Assessing the response rate of weekly neo-adjuvant Paclitaxel (Taxol) in Nigerian women with breast cancer". Unlike past studies where funders bring projects and Africans implement tasks on behalf of funders, consultants from UCH are working with scientists from IMRAT and the University of Ibadan. As a team, they will work collaboratively with investigators from LASUTH and Obafemi Awolowo Teaching Hospital to implement a clinical trial in which treatment will be stratified, based on genomic biomarkers.

Precision Medicine for All

Breast cancer (BC) risk prediction models, such as the Gail model, have been developed and widely used to identify women at higher risk of having breast cancer in developed countries. However, no model exists for Black women of sub-Saharan Africa (SSA). Because African women have different risk profiles, it is of public health importance to develop a Black women-specific model. From the nearly 2000 cases and more than 2000 population-based controls from the Nigerian Breast Cancer Study (NBCS, 1998~2015) we have used multivariate logistic regressions to derive the model. Risk factors were selected based on previous NBCS findings and literature review.

The final model includes: age, age at menarche, parity, duration of breast feeding, family history of BC in first-degree relatives, height, body mass index, benign breast diseases, oral contraceptive use, and alcohol drinking. The model performed well in the validation set with an O/E of 1.01 (95% CI: 0.93~1.09) and C-index of 0.694 (95% CI: 0.666~0.722). The odds ratios for developing BC by percentiles of the predicted chance of cases, relative to women in the middle quintile, showed a monotonic increase.

We have developed and validated a risk prediction model for BC that is specific to Black women. It can be used to identify individuals at high risk for BC for personalized risk assessment and

prevention. Using the population incidence rates in Nigeria, an absolute risk prediction model will be further developed.

Table 1. Performance of the risk prediction model in the training set and validation set

Percentile of predicted chance being cases	Training set (n=2699) OR (95%CI)	Validation set (n=1347) OR (95%CI)
<5%	0.18 (0.10-0.30)	0.24 (0.11-0.55)
5%~20%	0.31 (0.23-0.41)	0.53 (0.36-0.78)
20%~40%	0.62 (0.48-0.79)	0.83 (0.60-1.16)
40%~60%	1.00 (referent)	1.00(referent)
60%~80%	1.50 (1.18-1.90)	1.74 (1.25-2.44)
80%~95%	2.76 (2.10-3.62)	3.68 (2.48-5.44)
95%~	8.53 (4.93-14.77)	7.43 (3.76-14.69)

Note: Odds ratios are for different percentiles of the predicted chance being cases relative to the middle quintile (40% to 60%).

: According to the training set's cut points.

..I want to close by thanking all those who have supported this research. They are too many to name individually. There have been many past department chairs, deans, provosts, and vice chancellors in the university who supported this work and provided the necessary environment to galvanize research resources. Within the hospital, past and present CMDs, technologists and nursing staff have contributed to the success of the project. I am proud to say that the breast cancer research group has been incredibly productive. They are leading the field in breast cancer research in Africa and are increasingly gaining an international reputation. The substantial reduction in cancer mortality seen in developed countries has been attributed in part to advances in research that have led to the implementation of treatment modalities such as adjuvant and neo-adjuvant chemotherapy, hormonal therapy, radiation therapy, and immunotherapy. Rigorous research activities in developed countries

have established the evidence basis for management guidelines and standard of care, such that everyone with access to care receives the most effective cancer management, none of which currently exists in most sub-Saharan African countries. As African countries emerge from decades of poor governance and political unrest, they can no longer wait to translate advances in genomics to the benefit of patients. The growing cancer burden could further impede socio-economic growth if we do not act with a sense of urgency. I am truly delighted that Professor I.F. Adewole, is the new Minister of Health. This should be good news for Ibadan and the entire population. Professor Osuntokun is smiling up there and waiting to see whether we can now realize his vision for transformational patient-oriented research that finds cures for disease that plague our people.

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About the Author

Professor Olopade, a physician scientist, is the Walter L. Palmer Distinguished Service Professor of Medicine and Human Genetics, Dean for Global Health and Director, Center for Clinical Cancer Genetics at The University of Chicago. Professor Olopade earned her medical degree from the University of Ibadan College of Medicine in Nigeria. She trained in internal medicine at Cook County Hospital in Chicago and in oncology, hematology and cancer genetics at the Joint Section of Hematology and Oncology at The University of Chicago. A global leader in Medicine, Professor Olopade studies familial forms of cancers, molecular mechanisms of tumor progression as well as genetic and non-genetic factors contributing to tumor progression in diverse populations. Her current laboratory research is focused on using whole genome technologies and bioinformatics to gain a deeper understanding of the genomic landscape of breast cancer. Professor Olopade is an expert in cancer risk assessment and individualized treatment for the most aggressive forms of breast cancer. The translational focus of her research is to develop innovative approaches to democratize access to quality precision health care, increase health equity and thereby improve cancer outcomes. She has been elected to numerous honor societies including Phi Beta Kappa, the Nigerian Academy of Science, the Nigerian Leadership Initiative, the American Society for Clinical Investigation, the Association of American Physicians, the National Academy of Medicine, the American Academy of Arts and Sciences and the American Philosophical Society. Professor Olopade has received numerous honors and awards, including honorary degrees from Bowdoin University, Princeton University, North Central College and Dominican University; Doris Duke Distinguished Clinical Scientist and Exceptional Mentor Award; American Cancer Society Clinical Research Professorship; MacArthur Foundation Fellowship, Officer of the Order of the Niger Award, and the Franklin D. Roosevelt Freedom from Want Award. Professor Olopade serves on the Board of Directors for the National Cancer Advisory Board, Susan G. Komen for the Cure and the Lyric Opera of Chicago.