

WHO/RPS/ACHR-34/1997
Distr.: LIMITED
English Only

ADVISORY COMMITTEE ON HEALTH RESEARCH

BENJAMIN OSUNTOKUN MEMORIAL LECTURE

“HEALTH RESEARCH FOR HUMANKIND”

Delivered by Adetokunbo O. Lucas



World Health Organization

BENJAMIN OLUWAKAYODE OSUNTOKUN MEMORIAL LECTURE
"HEALTH RESEARCH FOR HUMANKIND"

DELIVERED BY ADETOKUNBO O. LUCAS



**Professor Benjamin Oluwakayode Osuntokun O.F.R., N.N.M.A.,
D.Sc. Hon. (Unimaid.) Ph.D., M.D., D.Sc. (Lond.), F.M.C.C.P. (Nig.)
F.R.C.P. (Lond.), F.W.A.C.P. (West Africa), F.A.S. (Nig.)**

**Under the Auspices of
WORLD HEALTH ORGANIZATION ADVISORY COMMITTEE ON HEALTH RESEARCH**

16 OCTOBER 1996

OSUNTOKUN MEMORIAL LECTURE

In Memory of

Professor Benjamin Oluwakayode Osuntokun

O.F.R., N.N.M.A., D.Sc. Hon. (Unimaid.)

Ph.D., (Iba.), M.D., D.Sc. (Lond.), F.M.C.C.P. (Nig.).

F.R.C.P. (Lond.), F.W.A.C.P. (West Africa), F.A.S. (Nig.)



HEALTH RESEARCH FOR HUMANKIND

ADETOKUNBO O. LUCAS

**ADVISORY COMMITTEE FOR HEALTH RESEARCH
WORLD HEALTH ORGANISATION
GENEVA, SWITZERLAND**

16 OCTOBER 1996

BENJAMIN OSUNTOKUN MEMORIAL LECTURE

"HEALTH RESEARCH FOR HUMANKIND"

Adetokunbo O. Lucas, M.D.

It is a great honour and a privilege for me to deliver the 1996 Benjamin Osuntokun Memorial Lecture. The untimely death of Benjamin Oluwakayode Osuntokun was a sad blow to his family, his friends, his nation and to the scientific world at large. All of us are slowly adjusting to the post-Osuntokun era, realising that we no longer have direct access to his knowledge and wisdom, to his caring concern, to his humour and to everything that made him a very special person to all of us who had the good fortune to know him. But like all great men and women, he has bequeathed to us his heirs and to generations to come, a large heritage of knowledge, wisdom, example and guidance.

In preparing my presentation, I was tempted to devote all my attention to the celebration of this great life; to recount the exploits and achievements of this outstanding man and to leave you to draw all the lessons from his fine example. Noting that I am addressing an audience with a common interest in health research, I decided to broaden my presentation to include a critical examination of the lessons that can be drawn directly from the examination of the life of this most enthusiastic health researcher. My main thesis is that the life and example of Professor Osuntokun illustrate many important issues in health research. I will examine some of these issues under the general title:

"HEALTH RESEARCH FOR HUMANKIND"

I first became acquainted with Osuntokun in 1960 when I returned home to Nigeria after training abroad to work at the new medical school in Ibadan. I was most impressed with this bright shiny new teaching hospital with its modern equipment and dedicated faculty, but I was even more impressed by the highly motivated medical students. I became aware of Osuntokun's brilliance from remarks made by one of the examiners from the University of London; he told us about Osuntokun's dazzling performance in the oral examination in obstetrics. After Osuntokun had satisfactorily answered routine questions on pregnancy and delivery, the examiner challenged him on a topic which was then at the growing point of recent scientific advances. He asked Osuntokun what he knew about oral contraceptives. He was amazed when the candidate filled the foolscap sheet with the structural chemical formulae of the oral contraceptives that were then available! Osuntokun was about to launch into a discussion of the relationship between the structures and functions of the hormones when the examiner concluded the test! Saying "Enough, enough, I am satisfied!", he awarded him honours in obstetrics. From then until his death last year, I had the privilege of watching the growth, development and manifestation of his brilliant genius.

Born on the 6th of January, 1935, in Ekiti, in south-western Nigeria, he received his basic education in local schools. A major obstacle confronted his ambition to study medicine at the University of Ibadan; the university admission requirement included a pass in physics, but this subject had not been included in the curriculum at his school. The university insisted -- "No physics, No medicine". Osuntokun tackled this obstacle in a way that typified his subsequent approach to constraints and obstacles. He bought a standard textbook of physics, read it from cover to cover and passed the physics examination with an A grade -- the highest grade! This was an early manifestation of his dogged determination to achieve excellence in all his endeavours. No half measures for this brilliant student. As shown in Table 1, his brilliant academic record at the medical school won him numerous prizes:

TABLE 1

**Undergraduate Academic Distinctions, Prizes And Honours
Awarded To Professor Osuntokun**

COLLEGE SCHOLARSHIP

University College, Ibadan 1956-61

DISTINCTIONS

1960 Pathology

1961 Obstetrics and Gynaecology

PRIZES

1958 Physiology

1961 Preventive & Social Medicine

1961 Obstetrics And Gynaecology

1961 Sir Kofu Abayomi Prize for obtaining the highest marks in Medicine and Pathology in the Final M.B., B.S. (London) examination.

FINAL EXAMINATION

1961 M.B., B.S. (London) Honours Class

From my first acquaintance with him as a final year medical student until his death last year, I had the privilege of admiring at close quarters as one academic achievement followed the other.

- I was there when in 1964, six months after he arrived in England, he passed the examination for the Membership of the Royal College of Physicians, (MRCP), London, the qualification for specialists in internal medicine. The examiners were so impressed with his performance that they did not ask him any questions in the final oral examination;

- I was there in 1969, as the chief internal examiner, when he was defending his Doctor of Philosophy (Ph.D.) thesis at the University of Ibadan. The external examiner, a distinguished international authority in neurology, engaged Osuntokun in a stimulating discourse on neuropathies, and in his formal report, he couched his praise of the thesis in superlative terms;
- I was there when in 1971, he obtained the research degree of Doctor of Medicine from London University for his research on the neurological complications of diabetes;
- I was there when in 1977 the Faculty of Science of the University of London awarded him the Doctor of Science degree for his scientific contributions to basic biomedical sciences -- a rare honour for a clinical scientist; and
- I was there when national and foreign institutions poured honours on him.

TABLE 2

Illustrative List Of Postgraduate Academic Honours Awarded To Professor Osuntokun

- 1971 **Sir Langley Memorial Prize** awarded by the London School of Hygiene & Tropical Medicine for the best paper published in the Transactions of the Royal Society of tropical Medicine and Hygiene, 1968-1971.
- 1977 **Frederick Murgatoyd Prize** of the Royal College of Physicians, London for "important contributions to the Science and Practice of Medicine in the Tropics."
- 1978 **Officer of the Federal Republic of Nigeria (O.F.R.)**
- 1984 **Nigerian National Merit Award, (N.N.M.A.)** the highest national honour for "distinguished contribution to national and international level in the Sciences, Medicine, Literature, Arts and Culture"
- 1984 **Doctor of Science**, Honorary degree from University of Maiduguri, Nigeria
- 1988 **Adesuyi Gold Medal Prize**, of the West African Postgraduate Medical College
- 1989 **Dr. Charles R. Drew World Medical Prize** at Howard University, Washington, DC, USA

He was truly a genius, a rare being whose phenomenal photographic memory gave him the uncanny ability to quote scientific literature from memory with detailed recall of minute details. He never seemed to forget anything that he ever read. His remarkable achievements were the result of his outstanding intellect and dedicated hard work. Not only was he so highly gifted, he worked extremely hard with uncompromising commitment to thoroughness. It was a great privilege for me to have been appointed the supervisor in the later stage of his Ph.D. programme. He carried out most of his field work in two towns in the endemic area, Epe and Ososa, which lie about 70 miles from Ibadan. He would leave home as early as 6 am to carry out clinical and epidemiological work at Epe and Ososa. Typically, he would arrive back at about 10 pm and spend the next four hours in the biochemistry laboratory processing the various specimens that he collected in the field. He would then crawl into bed after 2am to reappear at work in the morning to resume normal work! I was alarmed at this punishing work habit and repeatedly urged him to slow down the pace of work. I urged him to live long enough to complete his Ph.D. thesis. What a thesis!!

I will give a lot of details about Osuntokun's Ph.D. thesis on "Chronic Cyanide Intoxication And A Degenerative Neuropathy In Nigeria"; it illustrates many important features of his life. It was an outstanding piece of work. He tackled a disease which constituted a major public health problem in the affected communities. In the Epe and Ososa districts, where he carried out his field work, this neurological problem affected a large proportion of the community such that in some age groups, up to 8 to 10% of the adults walked with a staggering gait. More severely affected persons were crippled and bed-ridden. Before Osuntokun tackled this problem, Professor Lobe Monekosso, the former regional director of the W.H.O. African region, had carried out epidemiological work for his doctoral thesis on what was then defined as tropical nutritional neuropathy. Because of evidence of vitamin B deficiency in the affected communities, previous workers had attributed the neurological problem to malnutrition, specifically to vitamin deficiency. Osuntokun's Ph.D. thesis proved conclusively that the disease was due to chronic cyanide intoxication of dietary origin.

FIVE THESES IN ONE!

Professor Osuntokun's comprehensive study consisted of five major sections, each one of which would have been acceptable as a doctoral thesis on its own:

1. **CLINICAL STUDIES** The thesis was based on careful documentation of several hundred patients with tropical ataxic neuropathy (Osuntokun, 1968a). This large series of cases enabled Osuntokun to describe the full spectrum of the clinical manifestations of this disease. He also identified unusual manifestations of the disease and he drew attention to the effects of the disease on hearing (Osuntokun, Singh and Martinson, 1970; Hinchliffe, Osuntokun and Adejaja, 1971, Osuntokun, 1975). He also described the natural history of the disease and tested the response to various treatments (Osuntokun, Wilson, Langman and Aladetoyinbo, 1970; Osuntokun, Langman, Wilson, Adejaja and Aladetoyinbo, 1974). In collaboration with a Nigerian pathologist, he examined the pathological changes in the peripheral nerves under light and electron microscopy (Williams and Osuntokun, 1969).

2. **NEUROPHYSIOLOGY** Neurotransmission studies provided objective evidence of the neurological lesions. He used this tool to provide objective assessment of the site and severity of damage, the natural course of the disease and the response to therapy (Osuntokun, 1968; Osuntokun, 1970a)
3. **BIOCHEMISTRY** Osuntokun adduced biochemical evidence that eliminated other theories as to the aetiology of the disease. He clearly demonstrated the role of chronic cyanide intoxication in a systematic and conclusive manner. Cassava the staple food has a high content of cyanogens (Osuntokun, 1971a). Dietary surveys showed a heavy use of cassava often with little variation and without supplementing with protein sources rich in essential amino acids. Stomach acid releases free cyanide. Patients and relatives show very high levels of thiocyanate in their blood and urine and they also showed disruption of Vitamin B¹² metabolism (Osuntokun, Durowoju, MacFarlane and Wilson, 1968; Osuntokun, Adejaja and Aladetoyinbo, 1970; Osuntokun and Aladetoyinbo, 1970; Aladetoyinbo, Osuntokun and Adejaja, 1971; Osuntokun and Aladetoyinbo, 1972; Osuntokun, Aladetoyinbo and Bademosi, 1985).
4. **EPIDEMIOLOGY** In the endemic area, Osuntokun identified the risk factors, mainly the close association with processing cassava as a family occupation and heavy use of cassava in the diet (Osuntokun, Monekoso and Wilson, 1969a, 1969b; Osuntokun, 1970b; Osuntokun, 1971b). He carried out epidemiological studies in another part of Western Nigeria where the disease was virtually unknown. He selected a community 30 miles north of Ibadan as a control group. The people of Akinmorin are Yorubas -- the same ethnic group as in the endemic area but their diet is largely based on yams rather than cassava. Osuntokun showed a low frequency of peripheral neuropathy, low consumption of cassava and low level of thiocyanate in the population in the control area.
5. **EXPERIMENTAL NEUROPATHY** In collaboration with a Nigerian pathologist, Osuntokun reproduced the syndrome of neuropathy experimentally in Wistar rats. He and his colleagues documented biochemical changes and the evolution of the demyelination on rats fed on cassava. (Osuntokun, 1969a, 1970c).

This five part thesis, in two large volumes was an outstanding scholarly work. It was original in its concepts; brilliant in its execution; erudite in its analyses; and most rewarding in its impact on the problem not only in the local endemic area but in similarly affected communities in other parts of the world.

It is universally accepted that Osuntokun's work provided the definitive answer to the problem. It is an eternal tribute to his memory that the disease has virtually disappeared from the endemic area. His findings have guided studies in other parts of the world where ataxic neuropathy occurs in endemic or epidemic form. Not only did Osuntokun's work lead directly to the elimination of the scourge from the affected area in Nigeria but the lessons learnt have been applied in communities in other parts of Africa. His findings and writings have been widely disseminated and are cited by scientists throughout the world. A search on "cassava" on the Internet reveals the citation of several papers published by Osuntokun. This was indeed "HEALTH RESEARCH FOR HUMANKIND"

Time will not permit me to review in detail Osuntokun's remarkable achievements. Let me summarise his contributions under five main headings:

1. Medical practice
2. Medical Education
3. Institution Capacity Building
4. Health Research
5. International Health

1. Medical Practice

Many things can be said about this great man but one must not forget he laid the foundation of his professional life on being a very good doctor. A specialist neurologist, he was an outstanding clinician who combined great healing skills, with warm compassion for the sick and disabled.

2. Medical Education

Professor Osuntokun had a most distinguished academic career. He was appointed a full professor in medicine in 1970 at the University of Ibadan and this remained his academic base for the remaining 25 years of his life. An outstanding teacher, he attracted postgraduate students who regarded him as a credible role model. He trained and nurtured his protégés who now represent the new generation of Nigerian neurologists. His contributions to medical education went beyond teaching within his own department. As the sub-dean for postgraduate medical studies, he helped to shape advanced training for doctors in Ibadan. In his capacity as the Dean of the medical school from 1974 to 1978, he promoted teaching and research by creating and enlarging the opportunities for other members of the faculty.

But his influence on medical education was not confined to this one medical school. His writings include discussions on the objectives of and strategies for medical education (Osuntokun and Osunkoya, 1974). He was in great demand as a visiting professor, external examiner, and guest lecturer at many academic institutions both in Africa and elsewhere:

- On sabbatical leave from Ibadan, he was a visiting professor for extended periods up to one year in each case, to prestigious academic institutions all over the world including the Royal Postgraduate Medical School in London, the National Institutes of Health, Bethesda, USA, the University of Indianapolis, and the University of Cambridge, England
- He gave special guest lectures at various institutions: University of Newcastle upon Tyne, Institute of Neurological Sciences, Glasgow; Danish Neurological Association, Copenhagen; Mayo Clinic, Rochester; Sloan Kettering Memorial Hospital for Cancer, New York; Albert Einstein College, New York; University of California; Mauritius Medical Association; University of Addis Ababa, etc.
- He served as external examiner to institutions in Nigeria, Ghana, Kenya, Tanzania, and the West Indies; he was a member of the examining panel of the Royal College of Physicians, London;

He was a member of many distinguished learned societies -- Nigerian Academy of Science, International Epidemiological Association, New York Academy of Sciences, American Academy of Neurology, Medical Society of London, American Neurological Association, Pan-African Association of Neurological Sciences, Council of Delegates of the World Federation of Neurology; etc. To each of these organisations, he provided wisdom, guidance and leadership.

3. Institutional Capacity Building

Professor Osuntokun made important contributions to the building and strengthening of institutional capacity. He has left an indelible mark on his Alma Mater the University of Ibadan, its medical school and the teaching hospital. In 1985, he was appointed the Chief Medical Director of the University College Hospital at a time when the infrastructure of the institution had deteriorated and its fabric had faded. His skill and energy as a manager helped to restore the institution to its old glory. In a similar way, from 1983 to 1985, he had served as the medical director of the Aro Neuropsychiatric Hospital, the famous institution that Professor T. Adeoye Lambo, the former deputy director general of WHO, founded and where he did his classical studies on community care of psychiatric patients.

Professor Osuntokun also contributed to the strengthening of medical education and health research in foreign institutions. He helped device new academic and research programmes in foreign institutions -- such as the Royal Post-Graduate Medical School, London, the National Institutes of Health, Bethesda, USA, University of Cambridge, England. He paid back with interest what he had received from the post-graduate training that he had received abroad.

Through his work with the global Advisory Committee on Health Research (ACHR) over many years, he made significant contributions to the strengthening of research capability in developing countries. (Osuntokun and Hashmi, 1992). On behalf of ACHR he travelled all over the world stimulating, advising and supporting developing countries in their effort to strengthen research capability.

4. Research

Osuntokun's contributions to health research were phenomenal. He produced a massive volume of work that was highly relevant and of unassailable excellence. He made significant contributions in the following areas:

- **Nutritional And Toxic Diseases Of The Nervous System:** (Osuntokun, 1972; 1973; 1975, 1976; See also numerous references in relation to toxic ataxic neuropathy);
- **Cerebro-Vascular Diseases:** (Osuntokun, Odeku and Adeyoye, 1969a, 1969b; Adeyoye, Osuntokun and Odeku, 1970; Osuntokun, 1977; Adejaja and Osuntokun, 1987);
- **The Epilepsies:** (Dada, Osuntokun and Odeku, 1969; Osuntokun and Odeku, 1970a, 1970b; Osuntokun, 1971b; Osuntokun, Bademosi, Familusi and Oke, 1974; Osuntokun, Adejaja, Nottidge, Bademosi, et al., 1987; Oggunyi, Oggunyi, Bademosi, Osuntokun and Adejaja, 1992)
- **The Neurology Of Diabetes** (Osuntokun, 1969b; Osuntokun, 1969c; Osuntokun, 1970d; Osuntokun, Akinkugbe, Francis, Reddy, Osuntokun and Taylor, 1971);

- ✧ **The Neurology Of Diabetes** (Osuntokun, 1969b; Osuntokun, 1969c; Osuntokun, 1970d; Osuntokun, Akinkugbe, Francis, Reddy, Osuntokun and Taylor, 1971);
- ✧ **The Neurology Of Infectious Diseases** Typhoid (Osuntokun, Bademosi, Ogunremi and Wright, 1972); Torulosis (Adeloye, Agbadiuno and Osuntokun, 1979); Meningitis (Bademosi and Osuntokun, 1972); Malaria (Osuntokun, 1983a; Osuntokun, 1983b; Osuntokun, 1985a); Vaccination (Osuntokun, 1968b)
- ✧ **Analytical Epidemiology Of Neurological Diseases:** Ogunniyi, Bademosi and Osuntokun, 1989; Falope, Osuntokun and Ogunniyi, 1992; Ogunniyi, Osuntokun, Bademosi, Adeuja, Schoenberg, 1987)
- ✧ **Community Neurology:** (Osuntokun, Bademosi, Oyediran, Akinkugbe, and Carlisle, 1979; Atto, Osuntokun, et al., 1980; Osuntokun, Schoenberg, Nottidge, Adeuja, Kale, Adeyefa and Bademosi, 1982; Adeuja & Osuntokun, 1987; Osuntokun, 1985b; Osuntokun, Adeuja, Schoenberg, Bademosi, Olumide, Ige, Yaria and Bolis, 1987; Longe and Osuntokun, 1988, 1989; Osuntokun, Adeuja, Nottidge, Olumide, Ige, Yaria, Schoenberg, and Bolis, 1992)
- ✧ **The Dementias Of The Elderly** (Osuntokun, Ogunniyi, Lekwuawu and Oyediran, 1991; Osuntokun, Ogunniyi and Lekwuawu, 1991; Ogunniyi and Osuntokun, 1991; Ogunniyi, Osuntokun, Lekwuawu and Falope, 1992; Osuntokun, Ogunniyi and Lekwuawu, 1992; Ogunniyi, Lekwuawu, Falope and Osuntokun, 1993; Osuntokun, Ogunniyi, Akang, Aghadiuno, Ilori, Umoh, Masters and Beyreuth, 1994)
- ✧ **Cross-cultural Studies:**
STROKE (Hatano, Osuntokun and others, 1976);
PARKINSON'S DISEASE (Schoenberg, Osuntokun, Adeuja, Bademosi, Nottidge, Anderson, and Haerer, 1987, 1988);
ALZHEIMER'S DISEASE (Osuntokun, Hendrie, Hall, Ogunniyi, Lekwuawu, Brittain, Norton, Oyediran, Pillay, and Roders, 1992; Hendrie, Hall, Pillay, Rodgers, Prince, Norton, Brittain, Nath, Blue, Kaufort, Shelton, Postle and Osuntokun, 1993; Baldereschi, Amato, Nencini, Pracucci, Lippi, Amaducci, Gauthier, Beatty, Quiroga, Klassen, Galea, Muscat, Osuntokun, Ogunniyi, Portera-Sanchez, Bermejo, Hendrie, Burdine, Brashear, Farlow, Maggi and Kartzman, 1994; Hall, Hendrie, Rodgers, Prince, Pillay, Blue, Brittain, Norton, Kaufort, Nath, , Shelton, Osuntokun, 1993; Hendrie, Osuntokun, Hall, Ogunniyi, Hui, Unverzagt, Gureje, Rodenberg, Baiyewu, Musick, Adeyinka, Farlow, Oluwole, Class, Komolafe, Brashear and Burdine (1995); Hendrie, Hall, Hui, Yu, Lahiri, Osuntokun, Ogunniyi, Gureje, Baiyewu and Schellenberg, (1995).

He was a prolific author. He published his findings and ideas in over three hundred scientific publications with major contributions on tropical neuropathy, neurological complications of diabetes, dementias of the elderly, general neurology, medical education, health care policy and health research policy including ethical issues. His publications include classical papers on important issues. He continued working right through to the end; publications that he completed on his sick bed have since appeared post-humously.

TABLE 4
Professor Osuntokun's Publications

| SUBJECT | No. |
|--------------------------|------------|
| NEUROLOGY | 243 |
| Tropical Neuropathy | 51 |
| Dementias | 22 |
| Diabetes | 13 |
| Other Neurological | 157 |
| RESEARCH POLICY | 26 |
| HEALTH POLICY | 12 |
| MEDICAL EDUCATION | 8 |
| TOTAL | 319 |

5. International Health

Osuntokun was fiercely nationalistic. As a distinguished member of the global international health community, he became a citizen of the world but he remained very loyal to Nigeria, the country of his birth. He refused to take up numerous opportunities to exploit the marketability of his skills abroad. At the stage when the resources of the hospitals in Nigeria contracted, the teaching hospital could no longer carry out some basic laboratory and radiological investigations, the frustrating situation could have finally persuaded him to leave home and accept employment where he could more effectively use his skills. He confronted the situation positively. "As a neurologist, I can still achieve a lot by using my five senses." It was at this stage that he intensified his work in community neurology. He conducted door to door community surveys on the prevalence of various neurological disorders -- stroke, epilepsy, Parkinsonism. He developed diagnostic and treatment protocols for use at the primary health care level.

Although Nigeria had the first call on time and energy, Osuntokun made his knowledge, skill and expertise available to the global community. Foreign countries sought his advice and expertise in tackling a variety of neurological problems (Roman, Schoenberg, Spencer, Osuntokun, et al., 1986; Roman, Spencer, Schoenberg, Hugon, Ludolph, Rodgers-Johnson and Osuntokun, 1986). He provided expert advice to various international organisations -- UNESCO, ILO, CIOMS and most notably, WHO.

One specific area in which he made outstanding contributions was in designing and conducting international collaborative studies. These international cross-cultural studies are providing valuable insights into the distribution and determinants of chronic neurological diseases. His most ambitious project was on the comparative epidemiology of Alzheimer's disease. His earlier studies had shown that the disease is extremely rare in Nigeria. The cross-cultural study of *senile dementias*, funded by the National Institutes of Health, Bethesda, USA linked Osuntokun and his colleagues in Ibadan, Nigeria to

partners in Indianapolis, USA. The preliminary findings showed a very low prevalence of Alzheimer's disease in Ibadan as compared with its relatively high occurrence among black Americans in Indianapolis, USA. Their findings provide powerful evidence indicating the probable role of environmental and behavioural factors as determinants of the relatively high frequency of Alzheimer's disease in developed countries. Even though a genetic predisposition may be a factor, this study suggests that lifestyle and environmental factors may be important determinants for the expression of any predisposing genetic factor. The findings of the first phase of the study have been published in some 20 scientific papers

POLICY IMPLICATIONS

What lessons can we learn from the life of the late Professor Kayode Osuntokun? It is tempting to conclude that he was such an outstandingly gifted person that lessons learnt from his life cannot be applied to ordinary people who lack his genius. He was no doubt a genius. he came to the world with exceptionally good genes but these genes flourished because he made good use of them in an environment that permitted their expression:

- He was most fortunate in his family life. I met his late mother on the occasion when she was receiving honours for her contributions to the community. Obviously, our late colleague was nurtured in his family of origin by outstanding parents who, as credible role models, gave him good values.
- He was most fortunate in his own nuclear family, married to his classmate, an outstanding scholar who shared academic honours with him in the medical school and who rose to become the Professor of Ophthalmology at the University of Ibadan. Their loving relationship included professional and academic collaboration in the interface between ophthalmology and neurology (Osuntokun, O., Osuntokun, B.O., and Olurin, 1970, Osuntokun, B.O. and Osuntokun, O. 1971, Osuntokun, Akinkugbe, Francis, Reddy, Osuntokun and Taylor, 1971; Osuntokun, O. and Osuntokun, B.O., 1972;
- He was most fortunate in his children who are following the examples of their illustrious parents and in their chosen fields, are achieving professional distinction and academic honours i in their own right .

Professor Osuntokun's life and example raise many issues that have important policy implications. For the sake of emphasis, I will confine myself to the analysis of two questions:

- A. International collaboration in health research
- B. National Health Research

A. International Collaboration in Health Research

From his personal example, Professor Osuntokun has demonstrated the feasibility and the value of international collaborative research studies.

WHO has had considerable experience in promoting and supporting international collaborative research studies. The success of the special research programmes -- Special Programme for Research and training in Human Reproduction (HRP) and the Special Programme for research and training in Tropical Diseases (TDR) -- testify to WHO as a credible sponsor of this approach. I am aware of the fact that the global ACHR is currently undertaking new major initiatives to intensify international collaboration in health research; that you are mobilising the powerful tools of modern communications and information technology to support this effort. WHO should intensify and expand its research programme to deal with selected issues that can profitably be approached through international collaboration.

At this stage, one can make a strong case in favour of WHO giving high priority to promoting international collaborative research on chronic diseases. I am aware of important contributions that WHO has made in promoting research on chronic diseases. For example, the WHO sponsored project aimed at defining the global epidemic of Type II diabetes and its MONICA programme on cardio-vascular diseases illustrate what this organisation can achieve. But there are many missed opportunities.

Why chronic diseases deserve urgent attention

One can easily list many good reasons why chronic diseases deserve urgent attention and why it is important to promote cross-cultural studies that link developing and developed countries: I will highlight three important reasons:

1. Heavy burden of chronic diseases
2. Increasing prevalence
3. High cost of care

1. Heavy burden of chronic disease

The increasingly heavy burden of chronic diseases is undermining health gains from the control of communicable diseases. For example, diabetes is now the commonest cause of new blindness in the world; the complications of this disease necessitate the amputation of thousands of limbs every year. WHO should draw up a priority list of chronic diseases that deserve intensified international research effort.

2. Increasing prevalence

Developing countries are undergoing epidemiological transition with relative as well as absolute increase in the occurrence of chronic diseases. In some places, these changes are occurring at a fast rate. For example, in 16 years of clinical practice in Nigeria, from 1960-76, I did not encounter one case of acute myocardial infarction in a Nigerian even though we were diagnosing cases among the European and Asians living in Ibadan. This low frequency was confirmed in autopsy studies which showed minimal atherosclerosis of coronary arteries of Nigerians including elderly subjects in their sixties and seventies. In those days, I used to boast that "We, Nigerians have many faults, but our coronaries are clean!". The picture has changed; cases of ischaemic heart disease are now being seen with increasing frequency especially among the educated elite (Falase, Basile and Osuntokun, 1973) Generally, communities that maintain traditional lifestyles have low

rates of the chronic diseases that are increasing in the cosmopolitan urban centres. (Osuntokun, 1988) For example, a national survey of chronic diseases in Nigeria showed a wide range in the prevalence of diabetes which ranged from 0.7% in a rural community to 7% in the city of Lagos. Similar rural/urban, and traditional/cosmopolitan differences have been noted in studies in other parts of Africa, in Australia, China and elsewhere.

There is a limited window of opportunity for identifying risk factors in the emergent phase of chronic diseases. This opportunity is time limited as the chronic diseases seem to be advancing at a fast pace thereby eliminating the areas of low prevalence.

3. High cost of coping with chronic diseases

The availability of vaccines and simple environmental interventions facilitated the control of communicable diseases even in the poorest countries. No such simple, cost-effective control measures are available for dealing with chronic diseases. Rather, complicated, expensive high technology is required to manage chronic diseases and their complications. For example, even though the prevalence of diabetes is still relatively low in Tanzania, a study showed that the health services cannot afford to provide the essential drugs for the treatment of current cases. If the present trend of increasing prevalence of diabetes continues, the economic burden on the national health services could become unbearable if not catastrophic. Ideally, developing countries should prolong this period characterised by low prevalence of chronic diseases. Strategies to prevent the emergence of these chronic diseases would be more cost effective than interventions for controlling the diseases once they become well established.

WHO can play a unique role in promoting cross-cultural international collaborative studies on key chronic diseases. The objectives of the intensified programme would be:

1. **Identifying risk factors**
2. **Testing hypotheses** generated in one locality at other sites; and
3. **Developing and testing appropriate, cost-effective technologies** for prevention, diagnosis and the management of chronic diseases.

1. Identifying risk factors It is well recognised that the epidemiology of each chronic disease is determined by a complex web of aetiological factors. Cross-cultural analytic studies could provide additional clues for unravelling this complex web. International comparisons provide the opportunity of examining these variables in high prevalence and in low prevalence groups; and also in situations where the disease is newly emerging.

2. Testing hypotheses that are generated in one locality at other sites. Cross-cultural studies provide the opportunity to examine hypotheses that seem valid in one country or geographical area, by testing them at other sites.

3. Developing appropriate cost-effective technologies This is a well trodden path. Effective technologies that are used in developed countries tend to be expensive and often require sophisticated infrastructure and equipment. Studies in developing countries have helped to adapt some expensive, complicated technologies into cost-effective methods. Not only do such modified techniques benefit developing countries but they have been adopted by developed countries. Classical examples include ambulatory care of

tuberculosis and out-patient surgery. The management of chronic diseases should be approached with the same objective of achieving effective interventions at low cost.

WHO's role in cross-cultural research

WHO can play an important role in stimulating and supporting cross-cultural studies. Its specific input would include:

1. **Convening function** Bringing together experts from different parts of the world to identify priority needs, developing strategies and specific projects;
2. **Defining procedures and designing protocols** It is often difficult to compare the results obtained by scientists working independently in their own countries, using different protocols and adopting different diagnostic criteria and laboratory methods. Cross-cultural studies that are designed using standard protocols and standardised quality controls provide a more powerful tool than such independent studies.
3. **Regulatory function** WHO can ensure that in cross-cultural studies, the rights of all the participants, especially the weaker partners, are adequately protected. WHO can also ensure that appropriate ethical standards are observed in international, cross-cultural studies. (Osuntokun, 1993a, 1993b).
4. **Dissemination of findings** WHO would ensure that the results of the studies are widely disseminated so that the findings can be used in making policies and developing strategies for disease control.

International cross-cultural studies are difficult to organise especially when the design involves prospective longitudinal observations. Professor Osuntokun and his colleagues, from the wealth of their experience in designing and participating in cross-cultural studies, identified four key factors that influence success in such endeavours (Baker, Ogunniyi and Osuntokun, 1995):

1. Administrative concerns;
2. Resources
3. Understanding of research design; and
4. Problem solving.

B. Organisation and management of health research

The second issue concerns the role of national governments in organising, managing and co-ordinating research at the country level. Again, we can learn a lot by examining the life of Professor Benjamin Osuntokun.

It would be fair to recognise the contributions that Nigeria made to Osuntokun's success. He obtained his basic schooling, his professional education in medicine and some of his postgraduate training in Nigeria. His most outstanding research work was carried out in Nigeria, partly supported by local resources but also from substantial grants from foreign foundations and other international agencies. But for the greater part of his professional life, national mechanism for promoting and supporting research was weak or non-existent. Osuntokun's research successes occurred in spite of this weakness. It was credit to his initiative that he was able to overcome the problems created by the lack of effective policy and plan for research in Nigeria.

The WHO special programmes, the global and regional ACHR's have done a lot to promote research. WHO programmes have supported the training of many scientists; New research institutes have been established and existing ones have been strengthened. WHO has sponsored numerous seminars, workshops and conferences. As judged by the publication of research papers, these activities have had a measure of success. Many scientists and institutions in developing countries are now carrying out high quality research. We must admit however, that the health services in many developing countries do not make effective use of research results. It seems that many public health practitioners, especially high level decision makers are still somewhat sceptical about the value of research. The research establishment still tends to operate as a separate entity with its own objectives and its own agenda.

Why has this problem persisted? Why do decision makers in the health sector fail to make effective use of research? Let me suggest two probable reasons that account for this problem:

1. Scepticism about the value of research Some public health practitioners, especially high level decision makers, are still somewhat sceptical about the value of research. This is not a new problem. Not too long ago, the dominant voices in public health policy often spoke strongly against research. Two decades ago, when TDR was being established, strong voices among policy makers strongly opposed investment in research. They strongly opposed investment in research on the grounds that "we do not need more research; what is required is for us to apply what we already know." This misguided approach had a damaging effect on some important global initiatives. This is perhaps a good time to examine the consequences of the policies adopted in relation to research on various tropical diseases classified into two main groups:

Group A Major disease control programmes that were based on the use of existing technologies with suspension of significant innovative research: **Malaria and Tuberculosis.**

Group B Major disease control programmes closely associated with ongoing innovative research: **Smallpox, Onchocerciasis, and Leprosy.**

This might at first sight appear to be an over simplification but the lesson is clear. If we had relied solely on applying what we know, smallpox would still be with us. The contrasting trends in the prevalence of leprosy and tuberculosis may also be telling the same story. If we had relied solely on applying what we know, the world would not have seen the dramatic fall in the prevalence of leprosy -- a disease that is now receding with the application of multiple drug therapy, a product of research effort co-ordinated by WHO's Tropical Diseases Research Programme. If we had relied solely on applying only what we know, we would have had to continue the fight against onchocerciasis using dangerous and inappropriate drugs like diethyl carbamazine and suramin; fortunately, research led to the discovery of ivermectin, a safe, effective drug that is simple to apply for mass drug treatment.

2. Rivalry and competition This problem is related to the first one. Some health authorities regard research as being in competition with the health care for the limited resources available in the health sector. Rather than recognising health research as an essential ingredient of health development, they view it as a drain on limited health resources.

The problems can be summarised under three main headings -- the THREE FAILURES:

- **POLICY MAKING:** Failure to use of research findings in policy making.
- **HEALTH CARE DELIVERY:** Failure to apply research findings in planning, monitoring and evaluation of health services
- **RESEARCH PRIORITIES:** Failure to address the research priorities.

POLICY MAKING It is somewhat surprising that some governments, usually on the advice of international organisations, introduce major policies without good scientific backing. I have often told the allegorical story of the new drug that was introduced into a number of developing countries under pressure from a major international organisation. The drug had not been tested for safety nor had the appropriate dosage and other therapeutic features been optimised. After its introduction UNICEF and other groups raised the alarm that in some of the countries that had adopted this remedy, children were dying in increasing numbers. The drug was called "STRUCTURAL ADJUSTMENT PROGRAMME". Poor countries that were pressured to adopt this macro-economic markedly reduced public investment in health and other social sectors. UNICEF and other agencies drew attention to the need to protect vulnerable groups -- Structural adjustment with a human face.

The world has learnt that:

- It is wrong to introduce new drugs without careful pre-clinical testing and phased clinical trials.
- It is dangerous to construct dams, irrigation schemes and other large agro-engineering projects without careful analysis of the health and environmental impact;
- It is no longer acceptable to introduce major health policies -- user fees, decentralisation, fund holding by general practitioners, etc. -- without careful scientific information and analysis.

Decision makers in the health sector should adapt the family planning slogan "Choice And Not By Chance" to read "Not Solely By Instinct Or Intuition, But By Science And Information."

HEALTH CARE DELIVERY Those who are responsible for planning and implementing services often fail to apply research findings. In 1975, the Nigerian Medical Research Council collated evidence of a high prevalence of iodine deficiency in Nigeria. In my capacity as the Chairman of the Council, I mobilised a group of national scientists who had worked on various aspects of goitre and iodine deficiency in Nigeria. We provided the Federal Ministry of Health with a review of the evidence showing high prevalence of goitre in some parts of the country and drawing attention to the damage to

the health of the population from iodine deficiency. UNICEF offered to provide funds to enable government to iodise salt. For almost 20 years, the Ministry failed to implement the iodination programme! On the bookshelves of libraries lie the reports of research studies that have similarly been ignored by decision makers. Professor Osuntokun developed and published simple, practical protocols for assessing and managing stroke, epilepsy and other neurological problems at the primary health care level. As far as I know, none of the health authorities in Nigeria have tested and formally adopted these protocols.

Nigeria is not unique in this problem. Instead of basing strategies and programmes on verifiable scientific information, decision makers often import and apply uncritically pre-packaged programmes that have been devised by international experts. Even though many of such packages contain some valuable ideas, they need to be adapted in the light of local needs and opportunities. GOBI-FFF from UNICEF, clinical and public health packages as advocated by the World Bank are examples of the stereotyped solutions that are offered to developing countries. In the absence of local scientific information, decision makers are unable to fit these imported packages properly into the national health system.

RESEARCH PRIORITIES It is often stated that researchers, especially those in academia, do not usually address problems that are of high priority to health authorities; that researchers often aim at prestige rather than searching for things that are of practical value.

As shown from the report of the Commission on Health Research, a few years ago, many developing countries lack the mechanism for identifying research priorities, for building and strengthening research capacity, for providing resources to support priority areas, for absorbing and using the findings for research results. The Commission recommended that every country should adopt a new mechanism for managing research -- *Essential National Health Research* (ENHR).

The three defining features of ENHR flow naturally from the Alma Ata declaration which stipulated that primary health care should be "**scientifically sound**":

- > Its **goal** is to achieve equity in health development;
- > Its **content** includes all the various tools of biomedical and social and behavioural research; and
- > Its **mode of operation** is characterised by inclusiveness involving the partnership of all stake holders -- researchers, health care givers and the population as a whole.

This approach is being actively developed through an independent non-governmental organisation, the Council for Health Research for Development (COHRED). I appreciate the contributions that WHO has made to the development of national research programmes and to the development of the concepts underlying ENHR. All these initiatives represent significant progress but more needs to be done. One hopes and expects WHO to continue to play a leadership role in stimulating and supporting national health research and capacity. WHO must continue to use its considerable influence in advocating more effective use of health research in support of health development.

In addition to all other initiatives on health research, WHO should mount a strong campaign of advocacy in favour of health research. Health research should no longer be compartmentalised as a separate indulgence of academics. The goal should be that every health authority throughout the world would aim at achieving "science based, knowledge based decision making at levels of the health services".

THE WAY FORWARD

Where do we go from here? Do we need new schemes? Must WHO establish a new special programmes to address this need? What is required is a fundamental change in the attitudes of health care providers to research. What is required is to promote knowledge-based and science-based decision making at every level of the health services -- from the most peripheral Primary Health Care unit, district hospital to specialist referral hospital, through to policy making division at the Ministry of Health.

WHO must use its influence to persuade member states that the type of situation that Professor Osuntokun faced is no longer acceptable. Professor Monekosso and others had identified tropical neuropathy as a major health problem in the endemic area of southern Nigeria. Later, Professor Osuntokun addressed the problem as part of his Ph.D. thesis. Fortunately for the affected population, Professor Osuntokun's approach was thorough, erudite, scholarly, of high academic standard but also aimed at solving the problem. Ideally, such a serious problem should not rely solely on the accidental interest of university academics. The studies should not have been so dependent on research grants from foreign institutions. The health care providers in Epe and Ososa should have approached the university 70 miles away and provided resources for defining and solving the problem.

WHO must work hard to bridge the gap between policy makers and health care givers on the one hand and researchers on the other hand. The organisation has done a lot to promote research in developing countries. The residual problem is to create within national institutions this goal of health research for humankind -- adopting a policy of science based, information based decision making at all levels of the health services. We all realise that WHO is not a supra-national organisation. It cannot compel sovereign nations to adopt specific health policies or programmes. But the organisation has the duty and the right to challenge individual countries to demonstrate their compliance with agreed policies. If member states at the World Health Assembly and at regional committees resolve to use science as the basis of decision making, WHO can legitimately challenge health officials to show the scientific basis for their decisions. It would be appropriate for WHO to remind decision makers of the value of using science and valid information as the basis of their policies and strategies.

TABLE 5
INSTITUTIONAL RESEARCH CAPACITY
THE COMPLEMENTARY ROLES OF VARIOUS TYPES OF INSTITUTIONS

| TYPE OF INSTITUTION | ROLES | | |
|---------------------|----------|----------|---------|
| | RESEARCH | TRAINING | SERVICE |
| RESEARCH INSTITUTES | +++ | ++ | + |
| UNIVERSITIES | ++ | +++ | + |
| HEALTH CARE | ++ | ++ | +++ |

| | |
|-----|-----------------|
| +++ | PRIMARY MANDATE |
| ++ | MAJOR ROLE |
| + | MINOR ROLE |

All available resources should be mobilised -- research institutes, academia and the health services. In most developing countries, much can be gained by utilising more efficiently existing research capacity in their various institutions. Table 5 shows the various types of institutions that can and should carry out health research.

TABLE 6
HEALTH RELATED RESEARCH AT THE UNIVERSITY OF IBADAN, NIGERIA

| FACULTY | DEPARTMENTS | RESEARCH SUBJECTS |
|------------------------------|---|--|
| MEDICINE | Pre-Clinical, Clinical & Laboratory Departments | Wide Range Of Biomedical And Community-Based Research- |
| SCIENCE | Chemistry | Chemistry of Haemoglobins |
| | Zoology | Parasitology Malacology Molecular biology of parasites |
| SOCIAL SCIENCES | Economics | Health Policy |
| | Geography | Medical Geography |
| | Sociology | Human behaviour on relation to environmental sanitation |
| EDUCATION | Psychology | Child Development |
| INSTITUTE OF AFRICAN STUDIES | | Traditional Medicine |

As illustrated in Table 6, apart from the obvious interest of the faculty of medicine and health sciences, relevant health research capacity can be found in many faculties and departments of a university. Often, however, such capacity is overlooked by the health sector and is sometimes discouraged by a jealous possessiveness by medical scientists who feel threatened by the involvement of other disciplines in health issues.

The strategy for developing health research for humankind should involve strengthening national institutions and providing appropriate incentives for research. Such incentives would include improving the infrastructure of institutions and providing adequate resources for research; providing appropriate career structures that will attract and retain the interest of the best brains in the country; and most important of all, giving researchers the most valuable reward in seeing their findings applied effectively in improving the health of humankind.

The ultimate goal of health research should be practical application of its findings to relieve human suffering and improve human health. This does not mean that every research project must lead to immediate application in the field; Rather it means that the research that is required to support the planning and delivery of health care must be given high priority and that it should be developed in collaboration between researchers and those who are responsible for delivering health care. National mechanisms must be developed that would help to identify health research needs and provide resources for supporting the activities.

In this way, we can continue to foster the goal of making health research serve the needs of humankind -- the goal to which Professor Osuntokun devoted his professional life.

CONCLUSIONS AND SUMMARY

Our friend and colleague, Professor Benjamin Oluwakayode Osuntokun, was clearly and outstanding person who dedicated his life to the service of humankind. Although he is no longer physically with us, his life and example will continue to inspire us. We will continue to derive knowledge and guidance from his voluminous writings. This lecture has highlighted two important lessons that we can apply immediately. Professor Osuntokun demonstrated the value of cross-cultural international research. This approach rhymes with the fundamental philosophy of the World Health Organisation as a voluntary association of member states working together and mutually supporting each other in the pursuit of the common goal of "HEALTH FOR ALL". The second lesson is the way in which Professor Osuntokun's work illustrated the value of research in national health development. He mobilised a wide variety of research tools, from the most sophisticated laboratory based biomedical technologies to community based epidemiological and sociological methods for identifying and solving health problems. In all his work, he cleverly combined excellence with relevance and thereby he provided contemporary scientists and generations to come, with a credible role model. His life has thrown a double challenge to other scientists and to health care providers: for the former to emulate his dazzling performance and for the latter to make good use of the fruits of research.

We must continue to strive to achieve "science-based, knowledge-based decision making at levels of the health services". As we say farewell to this renowned scientist, erudite scholar and compassionate physician, let us renew our determination to apply the lessons that we have learnt from him in promoting

"HEALTH RESEARCH FOR HUMANKIND"

ACKNOWLEDGEMENTS

I wish to thank the World Health Organisation and specifically, the Global Advisory Committee on Health Research (ACHR), for giving me the opportunity of delivering the Benjamin, Oluwakayode Osuntokun Memorial Lecture for 1996. As a close friend, colleague and compatriot, I am very proud of Professor Osuntokun's achievements and I held him in the highest esteem. It is most gratifying to know that others share my view of this great man as shown by the establishment of this Memorial Lecture. I wish to thank the Director General of WHO, Dr. Hiroshi Nakajima, for this unique tribute to a great African. I also wish to thank Dr. B. Mansourian, Secretary of ACHR, and his staff in the Office of Research Policy and Strategy Co-ordination, who worked most closely with Professor Osuntokun, for their help and support in making arrangements for this lecture. I thank Professor Dr. med. Dr.h.c mult. T.M. Fliedner, Chairman of ACHR and all the members of the committee for their comradeship with Professor Osuntokun over the years and for receiving me most hospitably on this occasion. Professor A.B.O.O. Oyediran, a close colleague of Professor Osuntokun, made useful reprints and other information available. I am indebted to Professor (Mrs.) O. Osuntokun for all her help in the preparation of the lecture and for her support.

REFERENCES

(A selected list of references to illustrate Professor B.O. Osuntokun's contributions to scientific literature. Each paper has been cited in the relevant section of the text of the lecture)

- ADELOYE, A., AGBADIUNO, P. and **OSUNTOKUN, B.O.** (1979) Toruloma of the central nervous system in a patient with schistosomiasis. *Medicine d'Afrique noire* 28: 73-76.
- ADELOYE, A., **OSUNTOKUN, B.O.** and ODEKU, E.L. (1970) Subarachnoid haemorrhage in Nigerians. *Trop. geog. Med.* 22: 20-29.
- ADEUJA, A.O.G. and **OSUNTOKUN, B.O.** (1987) The epidemiology of cerebro-vascular accidents in Nigerian Africans: a review. *Afr. J. Neurol. Sci.* 6: 18-22
- ALADETOYINBO, A., **OSUNTOKUN, B.O.** and ADEUJA, A.O.G. (1971) Serum riboflavin in Nigerian nutritional ataxic neuropathy. *W. Afr. Biol. Appl. Chem.* 14: 3-5
- ATTO, K., **OSUNTOKUN, B.O.** et al. (1980) Cerebro-vascular disease in the community: results of WHO Collaborative study. *Bull. WHO* 58: 113-130
- BADEMOSI, O. and **OSUNTOKUN, B.O.** (1979) Prednisolone in the treatment of pneumococcal meningitis: a clinical trial in Ibadan. *Trop. geog. Med.* 31: 53-6.
- BAKER, F.M., OGUNNIYI, A. and **OSUNTOKUN, B.O.** (1995) A pilot study of dementia in Ibadan, Nigeria. *J. Geriatr. Psychiatry Neurol.* 8: 65-70
- BALDERESCHI, M., AMATO, M.P., NENCINI, P., PRACUCCI, G., LIPPI, A., AMADUCCI, L., GAUTHIER, S., BEATTY, L., QUIROGA, P., KLASSEN, G., GALEA, A., MUSCAT, P., **OSUNTOKUN, B.**, OGUNNIYI, A., PORTERA-SANCHEZ, A., BERMEJO, F., HENDRIE, H., BURDINE, V., BRASHEAR, A., FARLOW, M., MAGGI, S., & KARTZMAN, R. (1994) Cross-national inter-rater agreement on the clinical diagnostic criteria for dementia: WHO-PRA Age-Associated Dementia Working Group, WHO Program for Research on Aging, Health of Elderly Program. *Neurology* 44: 239-242.
- DADA, T.O., **OSUNTOKUN, B.O.** and ODEKU, E.L. (1969) Epilepsy in Nigerians. *Dis. Nerv. Sys.* 30, 807-812.
- FALASE, A.O., BASILE, O. **OSUNTOKUN, B.O.** (1973) Myocardial infarction in Nigerians. *Trop. geogr. Med.* 25: 147-150
- FALOPE, Z.F., **OSUNTOKUN, B.O.** and OGUNNIYI, A.O. (1992) Risk factors for Parkinson's disease in Nigerians: a case-control study. *J. Trop. Geogr. Neurology* 2: 177-180.
- HALL, K.S., HENDRIE, H.C., RODGERS, D.D., PRINCE, C.S., PILLAY, N., BLUE, A.W., BRITAIN, H.M., NORTON, J.A., KAUFERT, J.N., NATH, A., SHELTON, P., and **OSUNTOKUN, B.O.** (1993) The development of a dementia screening interview in two distinct languages. *Int. J. Methods Psychiatr. Res.* 3: 1-28.

- HATANO, S., OSUNTOKUN, B.O. et al. (1977) Observer variation in the diagnosis of stroke: WHO collaborative study on the control of stroke in the community. *Japanese Heart Journal* **18**: 171-177.
- HENDRIE, H.C., HALL, K.S., HUI, S.L., UNVERZAGT, F.W., YU, C.E., LAHIRI, D.K., OSUNTOKUN, B.O., OGUNNIYI, A.O., GUREJE, O., BAIYEWU, O., and SCHELLENBERG, G.D. (1995) Apolipoprotein E genotypes and Alzheimer disease in a community study of elderly African-Americans. *Ann. Neurol.* **37**: 118-120
- HENDRIE, H.C., HALL, K.S., PILLAY, N., RODGERS, D., PRINCE, C., NORTON, J., BRITAIN, H., NATH, A., BLUE, A., KAUFERT, J., SHELTON, P., POSTLE, B. and OSUNTOKUN, B.O. (1993) Alzheimer's rare in Cree? A preliminary report. *International Psychogeriatrics* **5**: 5-14.
- HENDRIE, H.C., OSUNTOKUN, B.O., HALL, K.S., OGUNNIYI, A.O., HUI, S.L., UNVERZAGT, F.W., GUREJE, O., RODENBERG, C.A., BAIYEWU, O. MUSICK, B.S., ADEYINKA, A., FARLOW, M.R., OLUWOLE, S.O., CLASS, C.A. KOMOLAFE, O., BRASHEAR, A., and BURDINE, V., (1995) Prevalence of Alzheimer's disease and dementia in two communities: Nigerian Africans and African Americans. *Am. J.Psychiat.* **152**: 1485-1492
- HINCHCLIFFE, R., OSUNTOKUN, B.O., ADEUJA, A.O.G. (1971) Hearing levels in Nigerian ataxic neuropathy. *Audiology* **11**: 216-230
- LONGE, A.C. and OSUNTOKUN, B.O. (1988) Prevalence of migraine in Udo, a rural community in Bendel State, Nigeria. *E. Afr. Med. J.* **65**: 621-625.
- LONGE, A.C. and OSUNTOKUN, B.O. (1989) Prevalence of neurological disorders in Udo, a rural community in Bendel State, Nigeria. *Trop. geogr. Med.* **41**: 36-40.
- OGUNNIYI, A., LEKWAWA, U.G., FALOPE, Z.F. and OSUNTOKUN, B.O. (1992) Clinically diagnosed dementing illness in Ibadan. **22**: 61-64
- OGUNNIYI, A.O., OGUNNIYI, J.O., LEKWAWA, U.G., BADEMOSI, B.O. OSUNTOKUN, B.O. and ADEUJA, A.O.G. (1992) Aetiology of status epilepticus in Ibadan: a neuropathological study. *W. Afr. Med. J.* **10**: 263-7
- OGUNNIYI, A.O. and OSUNTOKUN, B.O. (1991) Relatively low prevalence of Alzheimer's disease in developing countries and the racial factors in dementia research. *Ethnicity and Disease* **1**: 394-5
- OGUNNIYI, A., OSUNTOKUN, B.O., BADEMOSI, O., ADEUJA, A.O.G., & SCHOENBERG, B.S. (1987) Risk factors in epilepsy: a case-control study. **28**: 280-5
- OGUNNIYI, A., OSUNTOKUN, B.O., LEKWAWA, U.G. and FALOPE, Z.F. (1992) Rarity of dementia (by DSM-III-R) in an urban community in Nigeria. *E. Afr. Med. J.* **69**: 10-14.
- OGUNNIYI, O., BADEMOSI and OSUNTOKUN, B.O. (1989) Evaluation of febrile convulsion as risk factor for epilepsies in Ibadan: a case control study. *Afr. J. Neurological Science* **6**: 20-23.
- OSUNTOKUN, B.O. (1968a) An ataxic neuropathy in Nigeria: a clinical & electrophysiological study. *Brain* **91**: 215-48.

- OSUNTOKUN, B.O.** (1968b) The neurological complications of small-pox and measles vaccination. *W. Afr. Med. J.* **17**: 115-121
- OSUNTOKUN, B.O.** (1969a) Tropical neuropathy, cassava diet and induction of neuropathy by cassava diet in Wistar rats. *Brit. Med. J.* **3**: 178-179
- OSUNTOKUN, B.O.** (1969b) The neurology of pancreatic diabetic mellitus Ghana *Med. J.* **3**: 156
- OSUNTOKUN, B.O.** (1969c) Diabetic retinopathy in Nigerians: a study of 758 patients. *Brit. J. Ophthal.* **53**: 625-663.
- OSUNTOKUN, B.O.** (1970a) Electrophysiological study of neuromuscular function in tropical ataxic neuropathy. *W. Afr. Med. J.* **19**: 126-129
- OSUNTOKUN, B.O.** (1970b) Epidemiology of a nutritional neuropathy in Nigeria. *International Epidemiological Association Bull.* **20**: 138-139
- OSUNTOKUN, B.O.** (1970c) Cassava diet and cyanide metabolism in Wistar rats. *Brit. J. Nutr.* **377-380**
- OSUNTOKUN, B.O.** (1970d) The neurology of calcific non-alcoholic pancreatic diabetes mellitus. *J. Neurol. Sci.* **11**: 17-43
- OSUNTOKUN, B.O.** (1971a) Chronic cyanide neurotoxicity in Nigerians. *Plant Food for Human Nutrition* **2**: 215-266
- OSUNTOKUN, B.O.** (1971b) Epidemiology of tropical neuropathy in Nigeria *Trans. roy. Soc. trop. Med. Hyg.* **65**: 454-479¹
- OSUNTOKUN, B.O.** (1971c) Epilepsy in developing countries: the Nigerian profile. *Epilepsia* **12**: 107-111.
- OSUNTOKUN, B.O.** (1972) The effects of malnutrition on the development of cognitive functions of the nervous system in childhood. *Trop. geog. Med.* **24**:295-310.
- OSUNTOKUN, B.O.** (1973) Protein-Calorie malnutrition and intellect in childhood: a review. *Afr. J. Med. Sci.* **4**: 327-342
- OSUNTOKUN, B.O.** (1975) Deafness in nutritional disorders of the nervous system in Nigerian Africans. *Nigerian Med. J.* **5**: 88-90
- OSUNTOKUN, B.O.** (1976) Nutritional problems in the African region. *Bull. Swiss Academy of Medicine.* **31**: 252-276
- OSUNTOKUN, B.O.** (1977) Stroke in the African *Afr. J. Med. Sci.* **6**: 64-76
- OSUNTOKUN, B.O.** (1983a) The Neurology of Malaria. *Postgraduate Doctor* **5**: 420-6.
- OSUNTOKUN, B.O.** (1983b) Malaria and the nervous system. *Afr. J. Med. Sci.* **12**: 165-172
- OSUNTOKUN, B.O.** (1985a) The nervous system in malaria. *Trop. geog. Med.* **37**: 209-216.
- OSUNTOKUN, B.O.** (1985b) Research in Community Neurology: some of the Nigerian experience. *W. Afr. J. Med.* **4**: 111-124.
- OSUNTOKUN, B.O.** (1988) Lifestyles and changes in patterns of non-communicable diseases in developing countries. *Nigerian Journal of Basic and Applied Psychology* **1**: 165-181.

¹ Langley Prize awarded by the London School of Hygiene and Tropical Medicine for the best paper for the years 1968-1971

- OSUNTOKUN, B.O.** (1993a) A perspective of developing countries. In "Ethics and Human Research: International Guidelines. Proceedings of the XXVth CIOMS Conference, Geneva, Switzerland, 5-7 February, 1992; pages 25-35 Geneva, CIOMS. Bankowski, Z. and Levine, R.J.
- OSUNTOKUN, B.O.** (1993b) Cultural perspectives on ethics and research on human subjects: the African perspective. *ibid* pages 173-6.
- OSUNTOKUN, B.O.,** and **ADEUJA, A.O.G.** (1983) Some epidemiological aspects of peripheral neuropathy in the African. *J. Neurol. Sci.* **2:** 40-53
- OSUNTOKUN, B.O.,** **ADEUJA, A.O.G.,** and **ALADETOYINBO, A.** (1970) Free cyanide levels in tropical ataxic neuropathy. *Lancet* **2:** 372-373
- OSUNTOKUN, B.O.,** **ADEUJA, A.O.G.,** **NOTTIDGE, V.A.,** **BADEMOSI, O.** et al. (1987) Prevalence of Epilepsies in Nigerian Africans: A community-based study. *Epilepsia* **28:** 272-9
- OSUNTOKUN, B.O.,** **ADEUJA, A.O.G.,** **NOTTIDGE, V.A.,** **OLUMIDE, A.O.,** **IGE, O.,** **YARIA, F.,** **SCHOENBERG, B.S.,** & **BOLIS, C.I.** (1992) Prevalence of headache and migrainous headache in Nigerian Africans: a community based study. *E. Afr. Med. J.* **69:** 196-199.
- OSUNTOKUN, B.O.** **ADEUJA, A.O.G.,** **SCHOENBERG, B.S.,** **BADEMOSI, O.,** **OLUMIDE, A.O.,** **IGE, O.,** **YARIA, F.** and **BOLIS, C.I.** (1987) Neurological disorders in Nigerians: A community based study. *Acta Neurological Scand.* **75:** 13-21
- OSUNTOKUN, B.O.,** **AKINKUGBE, O.O.,** **FRANCIS, T.I.,** **REDDY, S.,** **OSUNTOKUN, O.** and **TAYLOR, G.O.L.** (1971) Diabetes mellitus in Nigerians: a study of 832 patients. *W. Afr. Med. J.* **20:** 295-312.
- OSUNTOKUN, B.O.** and **ALADETOYINBO, A.** (1970) Plasma cyanide and hepatic thiosulphate cyanide sulphur transferase activity in the tropical ataxic neuropathy. *Nig. J. Sci.* **4:** 209-230
- OSUNTOKUN, B.O.** and **ALADETOYINBO, A.** (1972) Urinary methylmalonic acid in the tropical ataxic neuropathy. *Lancet* **2:** 1376-77
- OSUNTOKUN, B.O.,** **ALADETOYINBO, A.** and **BADEMOSI, O.** (1985) Vitamin B nutrition in the Nigerian nutritional ataxic neuropathy. *J. Neurol. Neurosurg. Psychiat.* **48:** 154-156
- OSUNTOKUN, B.O.,** **BADEMOSI, O.,** **FAMILUSI, J.B.** and **OKE, F.A.** (1974) EEG correlates of epilepsy in Nigerian children. *Develop. Med. Child Neurol.* **16:** 659-663.
- OSUNTOKUN, B.O.,** **BADEMOSI, O.,** **OGUNREMI, K.** and **WRIGHT, S.A.G.** (1972) The neuropsychiatric manifestations of typhoid fever in 959 Nigerians. *Arch. Neurol.* **27:** 9-13
- OSUNTOKUN, B.O.,** **BADEMOSI, O.,** **OYEDIRAN, A.B.O.O.,** **AKINKUGBE, O.O.** and **CARLISLE, R.C.** (1979) Incidence of stroke in African city. *Stroke* **10:** 205-208
- OSUNTOKUN, B.O.,** **DUROWOJU, J.E.O.,** **MACFARLANE, H.** and **WILSON, J.** (1968) Plasma amino-acids in the Nigerian nutritional ataxic neuropathy. *Brit. Med. J.* **3:** 647-9.

- OSUNTOKUN, B.O. and HASHMI, J. (1992) Issues for research capability strengthening. In "Health Research Strategies" Edited by Davies, A.M. and Mansourian, B. pages 85-98. Horgrefe and Hubers.
- OSUNTOKUN, B.O., HENDRIE, H.C., HALL, K., OGUNNIYI, A.O., LEKWAWUA, U.G., BRITAIN, H., NORTON, J.A., OYEDIRAN, A.B.O.O., PILLAY, N., and RODGERS, E. (1992) Cross-cultural studies in Alzheimer's disease. *Ethnicity and Disease* 2: 352-357.
- OSUNTOKUN, B.O., LANGMAN, M.J.S., WILSON, J., ADEUJA, A.O.G. ALADETOYINBO, A. (1974) Controlled trial of combination of riboflavin-hydroxocobalamincystine in Nigeria ataxic neuropathy. *J. Neurol. Neurosurg. Psychiat.* 37: 102-107
- OSUNTOKUN, B.O., MONEKOSSO, G.L. and WILSON, J. (1969a) Relationship of a degenerative tropical neuropathy to diet: Report of a field survey *Brit. Med. J.* 1: 547-550.
- OSUNTOKUN, B.O., MONEKOSSO, G.L. and WILSON, J. (1969b) Cassava diet and a chronic degenerative neuropathy: an epidemiological study. *Nig. J. Sci.* 3: 3-15
- OSUNTOKUN, B.O. and ODEKU, E.L. (1970a) Epilepsy in Ibadan. *Afr. J. Med. Sci.* 1: 185-200
- OSUNTOKUN, B.O. and ODEKU, E.L. (1970b) Some aspects of epilepsy in Nigerians. *Trop. geog. Med.* 22: 3-19
- OSUNTOKUN, B.O., ODEKU, E.L. and ADELOYE, R.B.A. (1969a) Non-embolic cerebrovascular disease in Nigerians. *J. neurol. Sci.* 9: 361-388
- OSUNTOKUN, B.O., ODEKU, E.L. and ADELOYE, R.B.A. (1969b) Cerebro-vascular disease in Nigerians. *W. Afr. Med. J.* 18: 160-173.
- OSUNTOKUN, B.O., OGUNNIYI, A.O., AKANG, E.E.U., AGHADIUNO, P.U., ILORI, A. UMOH, P. MASTERS, C.L. and BEYREUTH, K. (1994) Beta amyloid in brains of undemented Nigerians. *Lancet* 343: 56.
- OSUNTOKUN, B.O., OGUNNIYI, A.O., LEKWAWUA, U.G., (1992) Alzheimer's disease in Nigerians *Afr. J. Med. Sci.* 21: 71-77.
- OSUNTOKUN, B.O., OGUNNIYI, A.O., LEKWAWUA, U.G., and OYEDIRAN, A.B.O.O. (1991) Epidemiology of age-related dementias in the Third World and aetiological clues of Alzheimer's disease. *Trop. geogr. Med.* 43: 345-351.
- OSUNTOKUN, B.O. and OSUNKOYA, B.O. (1974) Postgraduate medical education in developing countries. *Brit. J. med. Educ.* 3: 69-73.
- OSUNTOKUN, B.O. and OSUNTOKUN, O. (1971) Tropical amblyopia in Nigerians *Amer. J. Ophthal.* 72: 708-716
- OSUNTOKUN, B.O. and OSUNTOKUN, O. Ophthalmoplegic migraine and haemoglobinopathy in Nigerians. *Amer. J. Ophthal.* 74: 451-455.
- OSUNTOKUN, B.O., SCHOENBERG, B.S., NOTTIDGE, V. ADEUJA, A.O.G. KALE, O.A. ADEYEFA, A., & BADEMOSI, O. (1982) Headache in a rural community in Nigeria: results of a pilot study *Neuro-epidemiology* 11: 31-39

- OSUNTOKUN, B.O., SINGH, E.P., and MARTINSON, F.D.** (1970) Deafness in the tropical ataxic neuropathy. *Trop. geog. Med.* **22**: 281-288.
- OSUNTOKUN, B.O., WILSON, J., LANGMAN, M.J.S., and ALADETOYINBO, A.** (1970) Report of a controlled trial of hydroxocobalamin and riboflavin in the Nigerian ataxic neuropathy *J. Neurol. Neurosurg. Psychiat.* **33**: 633-636
- OSUNTOKUN, O., OSUNTOKUN, B.O.** and **OLURIN, O.** (1970) Optic atrophy as a primary presentation in Nigerians as evaluation of 95 patients. *W.Afr. Med. J.* **21**: 69-72
- ROMAN, G.C., SCHOENBERG, B.S., SPENCER, P.S., OSUNTOKUN, B.O., et al.,** (1986) Tropical Spastic Paraplegia (TSP) in the Seychelles Islands of the Indian ocean: Clinical, neurophysiologic and pathologic features. *Neurology* **36**: (Suppl.) *1*: 106
- ROMAN, G.C., SPENCER, P.S., SCHOENBERG, B.S., HUGON, J., LUDOLPH, A., RODGERS-JOHNSON, P. and OSUNTOKUN, B.O.,** (1987) Tropical Spastic Paraplegia (TSP) in the Seychelles Islands: A clinical and case-control epidemiologic study. *Neurology* **37**: 1323-8
- SCHOENBERG, B.S., OSUNTOKUN, B.O., ADEUJA, A.O.G., BADEMOSI, O., NOTTIDGE, V., ANDERSON, D.W., and HAERER, A.E.** (1987) Comparison of the prevalence of Parkinson's disease in Black populations in rural US and in rural Nigeria: Door-to-Door community studies. *Neurology* **37**: (Suppl. 1) page 104.
- SCHOENBERG, B.S., OSUNTOKUN, B.O., ADEUJA, A.O.G., BADEMOSI, O., NOTTIDGE, V., ANDERSON, D.W., and HAERER, A.E.** (1988) Comparison of the prevalence of Parkinson's disease in Black populations in rural US and in rural Nigeria: Door-to-Door community studies. *Neurology* **38**: 645-646.
- WILLIAMS, A.O. and OSUNTOKUN, B.O.** (1969) Light and electron microscopy of peripheral nerves in tropical ataxic neuropathy. *Brit. med. J.* **2**: 43-46