THE SENSE AND THE NONSENSE OF TRADITIONAL MEDICINE IN AFRICA: THE ODYSSEY OF A HERBALIST'S GRANDSON IN NATURE'S LABORATORY

An inaugural lecture delivered at the University of Ibadan

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By

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The Vice-Chancellor, Deputy Vice-Chancellor (Administration), Deputy Vice-Chancellor (Academic), Registrar, Librarian, Provost of the College of Medicine, Dean of Faculty of Pharmacy, Dean of the Postgraduate School, Deans of other Faculties and of students, Directors of Institutes, Distinguished ladies and Gentlemen.

Introduction

The title of this discourse is not a tribute to some esoteric field or magic discipline, but an introduction to an inaugural lecture from the discipline of Pharmacognosy, a core area in the pharmaceutical sciences concerned with the study of the physical, chemical, biochemical and biological properties of drugs, drug substances, or potential drugs of natural origin. It is a field that is concerned with the search for, development and evaluation of drugs from natural sources. The term pharmacognosy, first used between 1811 and 1815 by Alexander Saydler, was derived from two Greek words, "pharmakon" (a drug) and "gignosco" (to acquire the knowledge of). Originally referred to as "De Materia Medica" by the Greek scholar, Pedanius Dioscorides as early as AD 78, the discipline has transformed from the mainly descriptive and microscopical applications to a multifaceted applied science concerned with the biologic, biochemical and economic features of natural drugs and their constituents. These natural sources include medicinal plants, animals, mineral substances, fungi, and bacteria.

Since most of these natural sources constitute ingredients of herbal remedies and traditional medicines in all cultures, to talk about pharmacognosy is to follow the evolution of man's knowledge during the various civilizations across the world from the dawn of time to the present. Pharmacognosy is the oldest yet most modern of all pharmaceutical and medical sciences. Research problems in pharmacognosy today include studies in the area of phytochemistry, microbial chemistry, biosynthesis, biotechnology and biotransformation, chemotaxonomy, ethnobotany, genetics, proteomics and genomics, cultivation of medicinal plants, standardization of traditional

medicines, tissue culture, zoopharmacognosy and other chemical and biological sciences (Ageta et al. 1998).

Shakespeare alluded to the use of natural sources as medicines in his days when he wrote the following famous lines in *Romeo and Juliet II*:

> O mickle is the powerful grace that lies
> In herbs, plants, stones and their true qualities:
> For nought so vile that on earth doth live
> But to the earth some special good doth give,
> Within the infant rind of this weak flower
> Poison has residence and medicine power. (p iii)

Even long before Shakespeare, the biblical story of the contest and rivalry between Rachel and Leah for the love of their husband Jacob using mandrake roots which was probably assumed to arouse sexual desire is well known (Genesis 30:14-16). So also was Isaiah's preparation of a poultice of figs which on application to King Hezekiah's boil led to his recovery. The earliest systematic study of herbal medicine was made by Emperor Shen Nung who probably lived around 2700 BC and generally regarded as the father of Chinese medicine. Over 365 herbs listed in his days include ephedra, castor oil (*Ricinus cummunis*) and opium poppy (*Papaver somniferum L*) which are today sources of clinically useful drugs (Foley 2006).

Major contributors to the growth and development of the discipline of pharmacognosy include Hippocrates (460-370 BC), Theophrastus (371-286 BC), Galen (130-201 AD) and Claude Bernard (1813-1888). Alexander Tshirch (1856-1939), a Professor of Pharmacognosy in Berne and who is arguably referred to as the father of modern Pharmacognosy, extended the concept of the discipline with his monumental work *Handbuch der Pharmacognosie*, and established the various branches of the science to include Pharmacoergasia, Pharmacoemporia, Pharmaco-botanics, Pharmaco-chemistry, among others (Pasquale 1984).

The transformation of the discipline from a mainly descriptive botanical feature to one having more of a chemical focus in the last century was subsequently spear-headed by notable American, British and German pioneers including Arthur E. Schwarting (USA), Egil Ramstard (USA) (who incidentally was the Dean of Pharmacy at Ife in my first year), Norman Farnsworth (USA) of the NAPRALERT fame and Varro E Tyler (USA). Others are Jack Beal (USA), James Fairbain (UK), Edward J Shellard (UK), Francis Fish (UK) and Egon Stahl (Germany). The major pioneer contributors in Nigerian Pharmacognosy departments include Professor Osisiogu (UNN), Professor Abayomi Sofowora (Ife), Mr Phillip Ishaku (ABU), Professor Maurice Iwu (UNN), Professor J D Kulkarni (Ife) and Professor Musa Shok (ABU), as well as other natural product chemists in non-pharmacy departments. The WHO defines traditional medicine as the sum total of all knowledge and practice, whether explicable or not, used in diagnosing, preventing, or eliminating a physical, mental or social disease and which may rely exclusively on past experience and observation handed down from generation to generation, either verbally or in writing (Sofowora 2008).

From the brief sketch of the evolution of the subject matter of Pharmacognosy, it is quite obvious that there has been and continues to be a very strong linkage between the discipline and traditional medicine or traditional medical practices around the world. It is also very obvious that in every culture, traditional medicine has always combined the good and the ugly, the rational and the irrational, the useful and the seemingly useless, the helpful and the not so helpful, the righteous and the unrighteous, the sensible and the not-so-sensible, the straightforward and the occult. The burden on the shoulders of pharmacognosists in the arduous task of drug discovery and development is to make sense out of what may appear on face value to be nonsense in the indigenous knowledge that traditional medicine around the world sometimes represents.

Mr. Vice-Chancellor, by what I can only attribute to divine arrangement and providence, I have been paid salaries, offered national and international scholarships, fellowships and research grants throughout my academic career or odyssey as I would love to put it, to enable me make some scientific sense out of the concoctions, powders and several recipes I saw my grandfather and his fellow herbalists use with great success in the treatment of diseases and ailments in their different communities. It is therefore with great pleasure and with deep gratitude to Almighty God, the maker of heaven and earth that I stand here today to deliver this year's inaugural lecture on behalf of the Faculty of Pharmacy. This is the sixth inaugural lecture coming from the Faculty since its inception nearly 30 years ago but significantly the first from the Department of Pharmacognosy. Past inaugural lectures from the Faculty were incidentally also delivered by the past five Deans of Pharmacy (table 1).

Table 1: Past Inaugural Lectures of the Faculty of Pharmacy

S/N	Name	Year	Title	Department
1	Olaniyi AA	1984	Pharmacy and drugs in the conquest of disease	Pharmaceutical Chemistry
2	Okpako DT	1987	Do drugs grow on trees?	Pharmacology and Therapeutics
3	Jaiyeoba KT	1991	Drugs are either magic or technology	Pharmaceutics and Industrial Pharmacy
4	Odelola HA	1995	Who is afraid of microbes?	Pharmaceutical Microbiology
5	Itiola OA	2009	Drug formulation: Between art, science and technology	Pharmaceutics and Industrial Pharmacy

The healing power of plants has always fascinated me. My earliest recollections and observations as a child was that of my grandfather dealing with his array of clients including missionaries from the SIM Hospital, Egbe in present day Kogi State, bringing some cases they felt he could treat with his herbal remedies. I heard desperate mothers knocking on the door of our family house in the dead of the night with

convulsing children at the point of death. Yes, I watched granddad dexterously bringing out the right herbal remedies and solving many of the health problems in the community. I watched granddad attend to the low and the high in society, coming from far and near either to find solutions to their health problems or to seek first-hand indigenous information and knowledge about the medicinal uses of local plants. One of such visitors I remember as a young lad is the now retired Professor Kayode Adesogan, who used to visit grandpa for information on his many herbal formulas in the early 70's. By a twist of fate, Professor Adesogan was to become instrumental in my transfer of service as a Lecturer II from University of Ife (now Obafemi Awolowo University) to the new School of Pharmacy in the premier University of Ibadan in 1983!

Grandfather was easily accessible to the community. He charged no fees. Patients appreciated him by bringing gifts at special occasions or on their own volition when healed. He was recognized by the community for the invaluable services although there were no advertisements on radio or television as is common practice today. His practice was culturally acceptable to the people. Despite the often quoted obvious demerits, these attributes are some of the merits of traditional medicine.

Nature's Laboratories

> *The works of the Lord are great, sought out by all those who have delight in them*
>
> ——Psalm 111.2

Humankind and the entire animal kingdom depend on the plant kingdom for their existence. The plant kingdom is like a giant industry or a huge and sophisticated chemical laboratory where arrays of chemical moieties are continuously been biosynthesized. The raw materials used by plants include carbon dioxide and oxygen from the atmosphere, water, inorganic salts, and nitrogenous compounds from the soil. These raw materials are utilized by plants, in the presence of

sunlight, to make major biomolecules of nature—carbohydrates, lipids and proteins, which are collectively known as ***primary metabolites*** as they are invariably found in all plants. Glucose, a simple sugar is, for example, synthesized by green plants (which contain chlorophyll), from carbon dioxide and water in the presence of sunlight—a process familiarly referred to as ***photosynthesis.*** From primary metabolites emerge ***secondary metabolites***, which tend to be species-specific: they are formed through various biosynthetic pathways, catalysed and controlled by different enzymes and co-enzymes which are specific for each plant as defined by its genetic constitution and environmental dispositions. The products are different compounds like, flavonoids, coumarins, naphthoquinones, anthraquinones, alkaloids, steroids, lignins, lignans, and many others.

These compounds (secondary metabolites), made by plants most often to protect themselves from predators or serve as attractants, have the power to kill man and animals as poisons or heal diseases depending on the dosages administered. From these secondary metabolites come many of our modern drugs, drug templates or precursors. It is estimated that 63% of all our conventional small molecule drugs in the market between 1981 and 2006 are based on natural products models as depicted in table 2.

Table 2: Origin (%) of 974 drugs in the Market Over the Period 1981- 2006

Origin of Drug	Percentage (%)
Natural molecule	6
Natural derivative molecule (semi-synthetic)	28
Natural mimics (synthetic)	12
Synthetic using natural pharmacophore	5
Synthetic using natural mimics pharmacophore	12
Non-biologically originated synthesis	37
Total	100

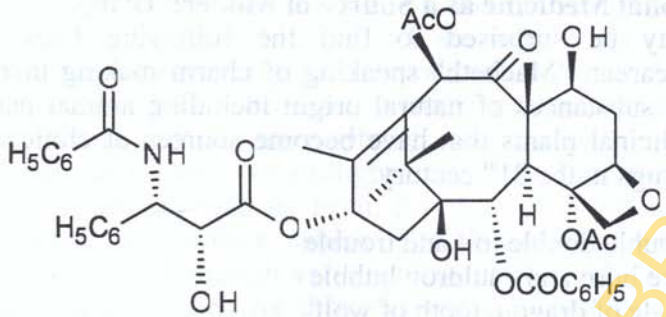
Source: (Newman and Cragg 2007)

Traditional Medicine as a Source of Modern Drugs

One may be surprised to find the following lines in Shakespearean "Macbeth" speaking of charm making involving the substances of natural origin including animal parts and medicinal plants that have become sources of clinically useful drugs in the 21st century.

Double double toil and trouble
Fire burn and cauldron bubble
Scale of dragon, tooth of wolf
Witches mummy mow and gulf
Of the ravin'd salt-sea shark
Root of hemlock digg'd in the dark
Liver of blaspheming Jew
Gall of goat and **slips of yew**
Slivere'd in the moon's eclipse
Nose of Turk and Tartar's lips
Finger of birth –strangled babe
Ditch delivered by a drab
Make the gruel thick and slab
Add thereto a tiger's chaudron
For the ingredients of our Cauldron
Double double toil and trouble
Fire burn and cauldron bubble
Cool it with a baboon's blood
Then the charm is firm and good. (Macbeth IV, iii)

The bark of the **yew tree** (*Taxus brevifolia* Nutt: Taxaceae) mentioned in the above lines became the source of taxol (paclitaxel), one of the most exciting new and clinically useful drugs in recent history. This chemically unmodified plant constituent which exhibits its action by blocking the depolarization of microtubules was approved for the treatment of ovarian and breast cancer by the Food and Drug Administration (FDA) in the 1990's and became the biggest selling anticancer agent in the US with sales over $1 billion per year (Kingston 2000).



Paclitaxel

Plants have offered and continue to offer the pharmacognosist and other research scientists involved in the search for novel bioactive compounds the added advantage of ethnobotanical observations since many species are used in systems of traditional medicine especially in developing economies around the world (fig. 1). It has been estimated that nearly 75% of about 120 biologically active plant-derived drug substances used in the world are discovered by following up on leads from their use in traditional medicine (Soejarto and Farnsworth 1989). Great concern however continues to be expressed about the prospects of indigenous knowledge of ethnomedicine and traditional medicine lasting far into this millennium. The Nigerian scene has for example in the last thirty years or so been bombarded with charlatans both from within and without who sell anything and everything to make money and encouraging our usual Nigerian "money answereth all things" syndrome. Apart from the fact that the forests are disappearing, thousands of years of accumulated human wisdom pertaining to the knowledge of the usage of the forest to benefit mankind and heal diseases, is also disappearing. As Plotkin (1993) puts it;

> Throughout the tropics, the plant species is disappearing and the knowledge to use these species is also disappearing at an even faster rate. Each time one of these medicine men (or women)

dies, it is as if a whole library (like Kenneth Dike library) has gone up in smoke.

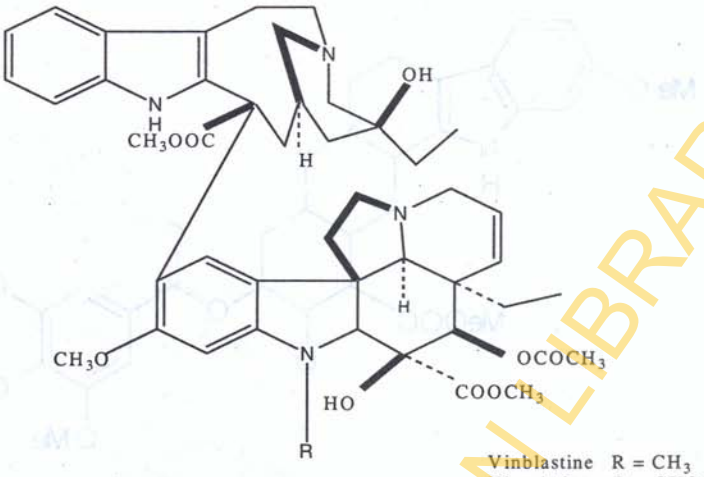
Fig. 1: Picture showing some postgraduate students and the lecturer on an ethnobotanical trip to an old woman "library" of indigenous knowledge on Okun medicinal plants in Isanlu, Yagba East LGA, Kogi State (August, 2008)

The doctrine of signature appeared to be a concept on what some ancient cultures based the use and applications of plants in the therapy of human ailments. Times without number, these cultural myths and beliefs may have turned out to be utter nonsense as rigorous and systematic scientific inquiries revealed. In the course of examining the "nonsense" however, landmark discoveries leading to enduring drugs had often emerged. These chanced findings known as SERENDIPITY in science as well as those validating the folkloric usages of plants continue to provide the impetus for us in the discipline of pharmacognosy and drug discovery programmes, to start from indigenous knowledge however weird and senseless the information might appear to be on the surface.

Two quick examples may be cited here to illustrate this point of serendipity.

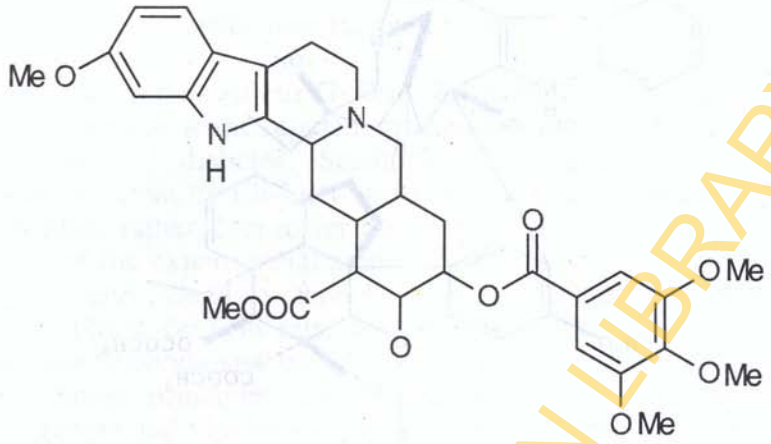
Catharanthus roseus G. Don (Rose periwinkle) (fig. 2) is a Madagascar plant reputed in traditional medicine for the treatment of diabetes. Scientific investigations into this folkloric claim by Eli-Lilly scientists showed that extracts of this plant rather than lower blood sugar, in fact led to the death of the experimental animals. The extracts and fractions were found indeed to cause leucopenia or destruction of the white blood cells in rats, an observation that was to lead Gordon Svoboda and his co-workers to the discovery of two anti-cancer principles from the plant. These were named vincristine and vinblastine, depicting their abilities to destroy abnormal disease-causing white blood cells. These two complex, dimeric indole-indoline alkaloids are important therapies for the treatment of acute childhood leukaemia (vincristine), Hodgkin's disease (vinblastine) and metastatic testicular tumours (vinblastine), and continue to be manufactured today by mass cultivation and processing of the natural source (Clark 1996).

Fig. 2: *Catharanthus roseus* (Rose Periwinkle) growing luxuriously in Abadina Quarters, University of Ibadan.



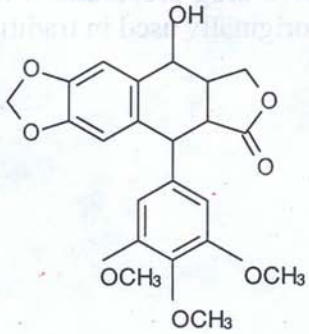
Vinblastine R = CH_3
Vincristine R = CHO

The second example is the use of the snake-like root of *Rauwolfia serpentina* (Apocynaceae) in the treatment of snake bites by Indian tribesmen. Rauwolfia and its constituents such as reserpine (with its Nigerian equivalent *R. vomitoria* Afz. or *Asofeyeje* in Yoruba), have since found their way into modern medicine as ingredients in anti-hypertensive drug preparations but not for snake bites as the root was originally used in traditional medicine.

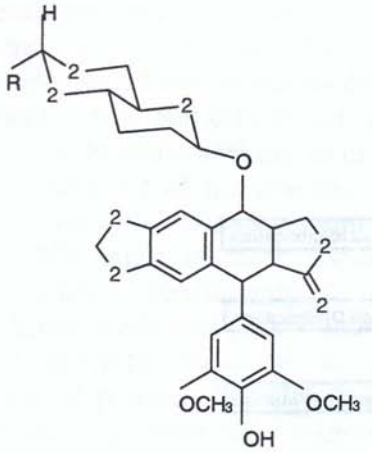


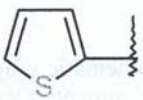
Reserpine

Other examples of drugs emanating from traditional medicine include physostigmine and related drugs from *Physostigma venenosum,* cardioactive digoxin from *Digitalis purpurea L,* anti-cancer agent podophyllotoxin from *Podophyllum peltatum* and its semi-synthetic derivatives etoposide and teniposide among others (Evans 2009).



Podophyllotoxin



Etoposide, R = CH_3 Teniposide, R = 

Despite the evident success of drug discovery from medicinal plants, future endeavours face many challenges. The process of bringing a drug to the market has been estimated to take an average of ten to fifteen years and costs more than 800 million US dollars. Much of the time, money is spent on the numerous leads that become discarded during the discovery process which include identification and characterization of the lead compounds from plants, lead optimization, lead development, selection of drug candidates and clinical trials (Balunas and Kinghorn 2005) (fig. 3).

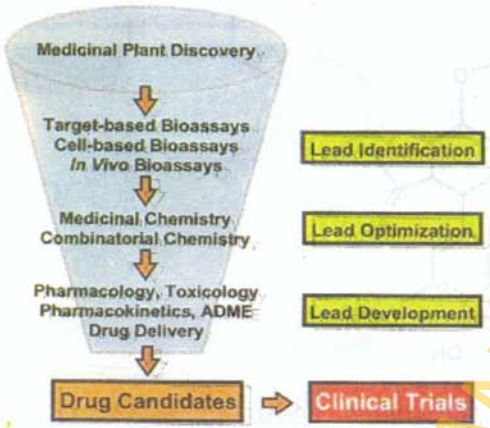


Fig. 3: Schematic diagram of typical medicinal plant drug discovery and development (Courtesy R W Brueggemeter, College of Pharmacy, The Ohio State University)

Plant derived chemicals of course serve several important uses other than as drugs, for example, as sources of such economic materials as industrial oils, gums, suspending agents, colourants, flavouring agents, binders, lubricants and disintegrants in dosage formulations (Olaniyi 1984).

My Contributions

The lame in the path outstrip the swift who wander from it
—Francis Bacon

An American President once said, "I do not care what my grandfather achieved, I am more concerned with what his grandson will turn out to be!" For the rest of the lecture, I intend to show by some examples, how in collaboration with other researchers within and outside Nigeria, I have tried to make sense out of the apparent "nonsense" that traditional

medicine and traditional medical practice in Africa sometimes seem to present. Our goal has been to contribute to the upgrading of traditional medicine, particularly in the development of safe and efficacious medicines that meet international standards while seeking to crystallize something positive and enduring out of the nonsense usually surrounding the otherwise very precious assets embedded in the practice.

My major research focus has been concerned with the systematic phytochemical and biological evaluation of African medicinal plants with a view to not only establishing the scientific rationale for the reported usages in ethnomedical practice, but also to isolating and characterizing in a bioactivity-monitored fashion, the bioactive constituents of the plant extracts and herbal remedies. Over the years therefore, I have been able to show in collaborative studies, both locally and internationally, that the inclusion of quite a number of plants in herbal recipes in traditional communities for the treatment of parasitic and microbial infectious diseases (e.g. malaria, candidiasis, polio), inflammation-based diseases (arthritis, sickle-cell anaemia etc), and diabetes, have scientific merit and constitute a great national asset for further development into clinically useful chemotherapeutic agents. Many of the extracts (e.g. *Sphenocentrum jollyanum)* also showed potential applications in crop protection and food preservation as they demonstrated activities against disease-causing microorganisms (Moody, Roberts & Adeniji 2002; Adegoke et al. 2002).

Sickle-Cell Disease and Anti-sickling Agents

Sickle-cell disease, a genetically transmitted blood disorder, continues to be a great burden on the black race largely represented by the African population, south of the Sahara. Over 40 million Nigerians are carriers of the gene for this disease. The basic problem in sickle-cell haemoglobinopathy is the point mutation in the beta–globin gene that leads to the replacement of glutamic acid residue by valine at the 6th position of the beta chain of haemoglobin. This leads to the production of an abnormal, less soluble haemoglobin type

(HbS) which consequently permits the crystallization and distortion of the red blood cells under oxygen desaturation (fig. 4).

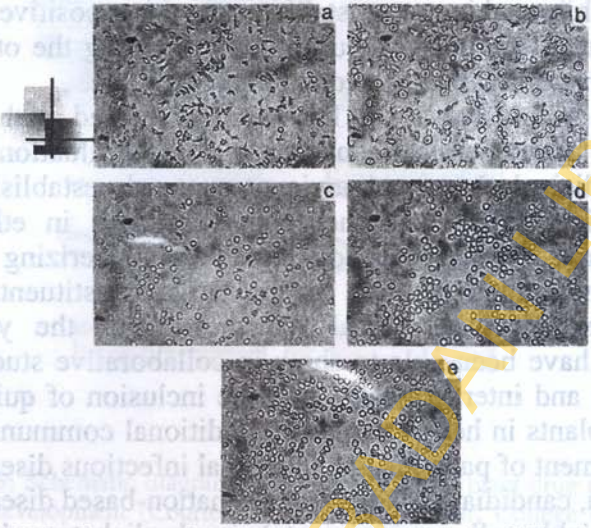


Fig. 4: Blood smears showing normal and sickled red blood cells (a, b and c = blood smear with different degrees of sickling; d and e = normal red blood cells)

The sickle-shaped red cells increase the viscosity of the blood, aggregate into clumps and are subsequently destroyed in the reticulo-endothelial system. The starvation of the end organs of necessary blood and oxygen leads to the various manifestations of pain, anaemia, and other effects in the body. The lifespan of the sickle haemoglobin is reduced significantly and in an effort to increase the production of red cells, the marrow overworks and enlarges thus producing the abnormal physique associated with the disease. The search for cost effective chemotherapeutic agents for the management of this disease from the Nigerian flora has engaged our attention.

My introduction into research in the discipline of Pharmacognosy actually started in 1976 during the long vacation preceding my final year as an undergraduate pharmacy

student in the University of Ife (now Obafemi Awolowo University). A notice appeared on the notice board seeking applications from interested students to work as research assistants in the Pharmacognosy Department/Drug Research Unit with a foreign scientist who was visiting Professor Abayomi Sofowora's laboratory during the long vacation. By divine arrangement, I was one of the two successful applicants out of so many that applied. Our assignment was to evaluate the relative *in-vitro* anti-sickling potencies of benzoic acid derivatives including some recently isolated compounds from Fagara (now *Zanthoxylum*) (*Orin ata* in Yoruba) while Professor Sofowora was away abroad on vacation. This singular opportunity paved the way for my final year B.Pharm and M.Phil projects to be supervised by Professor Sofowora, the doyen of Nigerian Pharmacognosy, who indeed has remained my academic mentor since then. Together with two of my senior colleagues, Professor Tony Elujoba, Dr Soji Adeoye and others under the supervision of Professor Sofowora, we were labelled "Fagara disciples" in those formative years at Ife.

My very first published work emanating from the Fagara work was published "offshore" in one of the leading journals in the discipline - *Planta Medica*- where we described the occurrence of a leaf furoquinoline alkaloid (8-methoxy dictamine) that was absent in the root of *Zanthoxylum rubescens* Planch ex Hook, from where other bioactive benzophenanthridine alkaloids such as nitidine and chelerythrine were also isolated and characterized by us (Moody & Sofowora 1984). These findings were of significant biosynthetic and chemotaxonomic importance especially because there was such a major taxonomic confusion confronting the *Zanthoxylum*/Fagara complex at that period.

Two ethnomedically important plants (*Terminalia catappa* L and *Cissus polpulnea* L), among others, have been shown for the first time by our work in collaboration with University College Hospital, Ibadan to possess highly potent anti-sickling activities depending on the time of harvest and

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method of processing of the relevant plant parts. Our work on *Terminalia catappa* (Indian almond) indeed presents another example of how not to discard in one stroke the "nonsense" associated with traditional medical practice. Mrs Folashade Segun, a professional colleague, who was later to become one of my postgraduate students noticed in her community pharmacy practice some years ago that a number of her sickle-cell disease patients who were using the fallen leaves of this plant in form of decoction as prescribed by traditional healers were experiencing very much reduced monthly pain episodes. The condition for efficacy was that the leaves selected for the decoction must be ripe and fallen from the tree. We examined and compared the anti-sickling activities of the ripe fallen, ripe but not fallen, and the unripe and not fallen leaves. Results revealed that the ethanol extract of the reddish brown ripe freshly fallen leaves exhibited the highest anti-sickling activity (78% inhibition after 180 min incubation). Extracts of the other leaves harvested when still on the tree were in fact found to cause lysis of the red blood cells thus providing justification for the choice of the fallen leaves in traditional medicine.

The diurnal, seasonal and ontogenetic accumulation of secondary metabolites and biological activities in plants is of course well documented and exemplified by *Tamarindus indica, Mentha piperita and Ocimum gratissimum* (Evans 2009).

Adesogan (1979) reported that oruwacin, an iridoid ferulate from the leaves of *Morinda lucida* was only extractible just at the beginning of the dry season. The anthraquinone level of this same plant was also found by us to be dramatically dependent on the month of collection (Moody & Adeyemi 1998) as shown in figure 5.

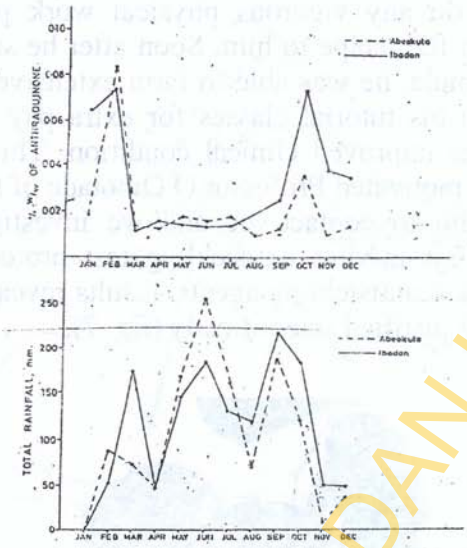


Fig. 5: Seasonal variation in rainfall and anthraquinone contents of leaves of *Morinda lucida* growing in Abeokuta/Ibadan areas.

Apart from the anti-sickling activity exhibited by leaf extracts of the almond tree, it will be of interest to note that it was also under an almond tree as a postgraduate student at the University of Ife that something else that was to change the course of my life happened in 1979. I shall return to this later in the course of the lecture.

Among the several other plants and recipes that we have evaluated for the phytotherapy of sickle-cell disease, *Cissus polpulnea* Linn (Yoruba: *Ogbolo*) (fig. 6), which is a major component of a herbal formula (HF) used in ethnomedicine, stands out as having a great potential in the management of the disease (Egunyomi, Moody & Eletu 2009, Moody et al. 2003). The recipe containing this plant was submitted by a middle-aged teacher who had previously been treated with conventional medications in the University College Hospital, Ibadan, as a sickle-cell anaemia patient. The recipe was brought so that it would be introduced to the patients on

account of his experience with it. He claimed not to have been able to do any vigorous physical work prior to the introduction of the recipe to him. Soon after he started using the herbal formula, he was able to farm extensively and also able to extend his tutorial classes for extra pay as a manifestation of his improved clinical condition. This evidence-based account motivated Professor O Omotade of the Institute of Child Health to contact me and we investigated these claims using our in-vitro antisickling test protocols. Compared to standard antisickling agents, results revealed that the claims are well justified scientifically (fig. 7).

Fig. 6: Herbarium specimen of *Cissus polpulnea* Linn

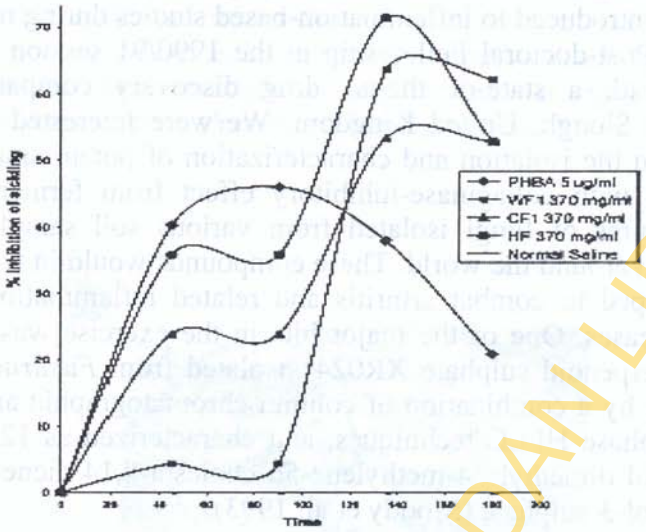


Fig. 7: In-vitro antisickling effect of *Cissus populnea* Linn root extracts and partially purified fractions

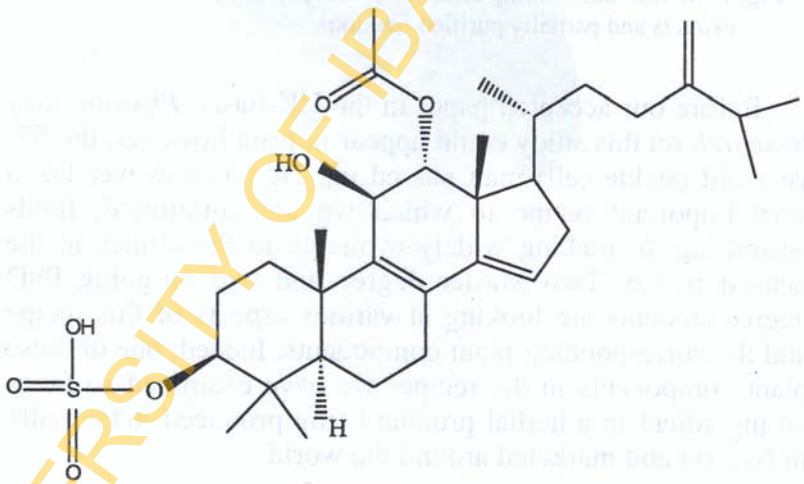
Before our accepted paper in the UK-based *Phytotherapy Research* on this study could appear in print however, the 57-year old (sickle-cell) man passed on. He has however left a very important recipe to which we are committed, funds permitting, to making widely available to the clinics in the nearest future. Two Master degree and two on-going PhD degree students are looking at various aspects of this recipe and the corresponding plant components. Indeed, one of these plant components in the recipes we have examined so far is an ingredient in a herbal product being produced industrially in Nigeria and marketed around the world.

Inflammation-based Diseases and Anti-inflammatory Agents from Nature

Many disease conditions such as malaria, sickle-cell disease, and various cancers are now known to have the inflammation

process as part of their components, hence the great demand for safe and effective anti-inflammatory agents.

I was introduced to inflammation-based studies during my one-year Post-doctoral Fellowship in the 1990/91 session at Xenova Ltd, a state-of the-art drug discovery company located in Slough, United Kingdom. We were interested at the time in the isolation and characterization of potent small molecules with collaginase-inhibitory effect from fermentation cultures of fungi isolated from various soil samples taken from around the world. These compounds would in turn be developed to combat arthritis and related inflammation-based diseases. One of the major hits in the exercise was a novel triterpenoid sulphate XR0241 isolated from *Fusarium colmorum* by a combination of column chromatographic and reversed phase HPLC techniques, and characterized as 12α-acetoxy-4,4-dimethyl-24-methylene-5α-cholesta-8,14-diene-3β,11β-diol-3-sulphate (Moody et al. 1993).



XR0241

Though a subject of patent application in the UK, further developments over this compound became rather difficult for me to track since my return to Nigeria! The experience however propelled me on return to Nigeria to introduce my

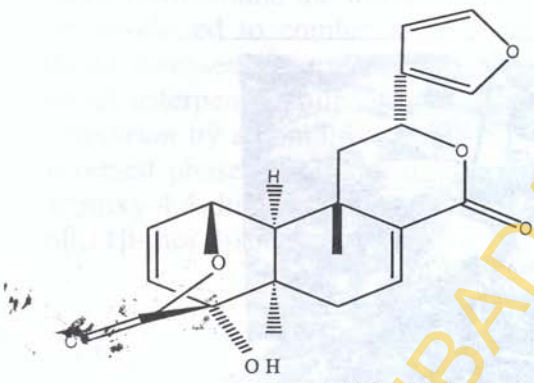
very first postgraduate student and subsequently several others to a systematic bio-activity monitored evaluation and isolation of anti-inflammatory agents from plants reputed in Nigerian ethnomedicine, using simple bench-top animal models. One example of such plants is *Sphenocentrum jollyanum* Pierre (Yoruba: *Akerejupon*) (fig. 8).

Fig. 8: *Sphenocentrum jollyanum* showing characteristic orange fruits

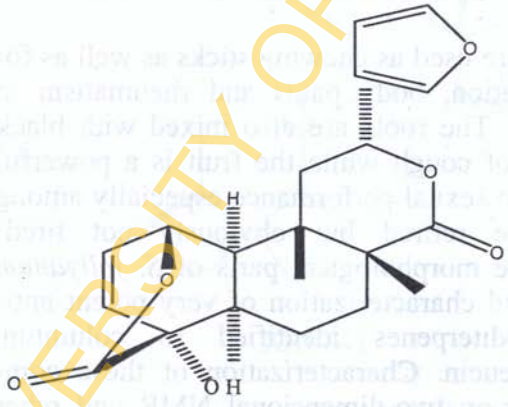
The yellow roots are used as chewing sticks as well as for the relief of constipation, body pains and rheumatism in Southwestern Nigeria. The roots are also mixed with black pepper for treatment of cough while the fruit is a powerful aphrodisiac to improve sexual performance especially among the elderly who are retired but obviously not tired! Examination of all the morphological parts of *S. jollyanum* led to the isolation and characterization of very potent anti-inflammatory furanoditerpenes identified as columbin, isocolumbin and fibleucin. Characterization of these compounds relied heavily on two-dimensional NMR and other spectroscopic techniques (Moody et al. 2006).

Columbin gave a significant ($p<0.05$) sustained and dose-dependent anti-inflammatory activity with highest percentage

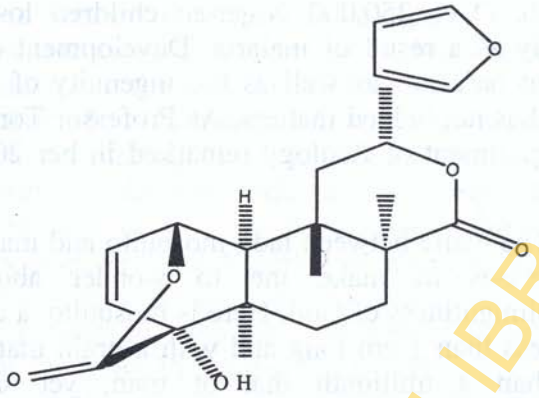
inhibition of 67.08% at 20 mg kg^{-1} dose level which was found to be in comparable range with the reference acetylsalicylic acid (72.50% inhibition at 100 mg kg^{-1}). The results thus provide some justification for the use of this plant extract in the phytotherapy of inflammation-based diseases in traditional medical practice (fig. 9). Of some interest too is that this work provided evidence from a 2-D NMR study for an unambiguous assignment of the ^{13}CNMR signals of the three furanoditerpene lactones isolated from this plant.



Fibleucin



Columbin



Isocolumbin

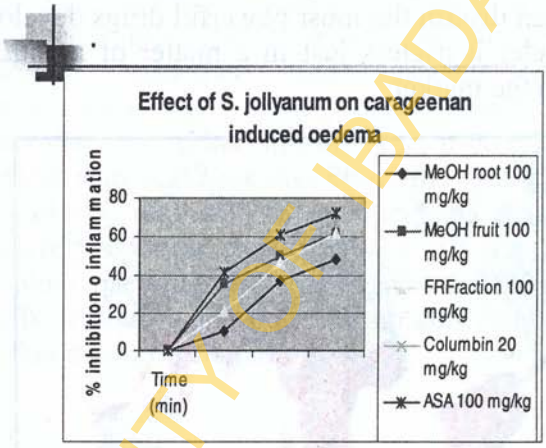


Fig. 9: Anti-inflammatory activity of *S. jollyanum* fruit extractives

Anti-malarial and Anti-infective Agents from Plants

Parasitic and other infectious communicable diseases such as malaria, trypanosomiasis, tuberculosis, HIV, among others, continue to constitute major health burdens on the African population. The number of reported cases of clinical malaria annually is in excess of 500 million worldwide out of which over 2 million deaths are recorded in sub-Saharan Africa (see

fig. 10). Over 250,000 Nigerian children lose their lives annually as a result of malaria. Development of multi-drug resistant parasites as well as the ingenuity of the mosquito vector has not helped matters. As Professor Tonye Okorie of the Department of Zoology remarked in her 2006 inaugural lecture:

> The battle between lady mosquito and man never ceases to make me to wonder about the almightiness of God. Here is mosquito, a creature less than 1 cm long and with a brain matter less than a millionth that of man, yet she can stand up to man, and beat him at his own game.

Probably more significant is the dexterity with which the deadly *Plasmodium falciparum* parasite that the mosquito carries around can disarm the most powerful drugs developed by man and render it useless just in a matter of months of introduction into the market.

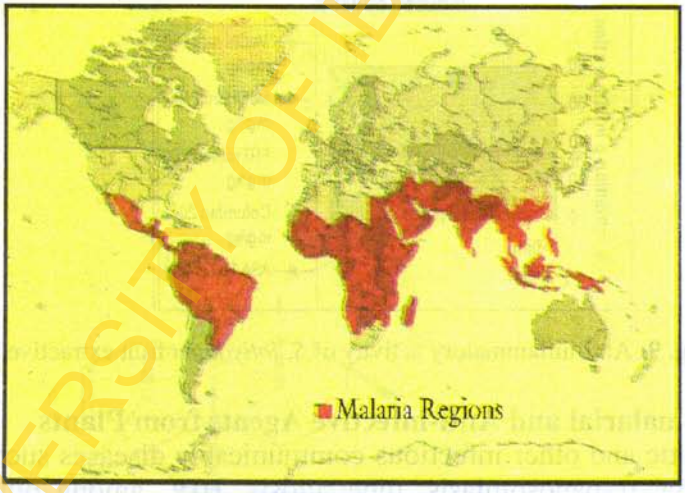


Fig. 10: Map of the World showing malaria endemic regions

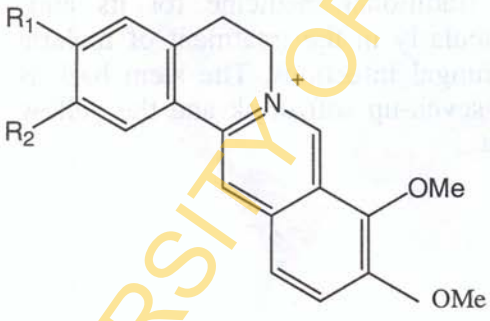
This explains the need for combination therapy in malaria treatment today, a concept which of course has always been

recognized and utilized in traditional medical practice. The success of quinine from *Cinchona succirubra* Pavon bark, and artemisinine from the Chinese medicinal plant *Artemisia annua* L nearly 350 years later, continue to provide the rationale to attempt making sense out of the several medicinal plants employed in traditional medicine to treat malaria.

Armed with a three-year Commonwealth scholarship, I took two very popular local Nigerian plants with me to the pharmacognosy laboratories of the King's College, University of London in 1986 for a Ph.D research under the supervision of Dr (now Professor) Peter J Hylands whom I had met earlier in Vienna, Austria, during my first outing for an international conference with Professor Sofowora in 1981. Collaborating with the London School of Tropical Medicine and Hygiene, our task was to unravel any scientific sense from the folkloric usages of *Morinda lucida* Benth (Rubiaceae) plant parts (which was suggested to me by Professor Adesogan) and *Enantia chlorantha* Oliv (Annonaceae), by isolating and characterizing the anti-plasmodial and other anti-infective principles (if any) from the plant samples. *Enantia chlorantha* Oliv (Yoruba: *Awopa*) (fig. 11) is reputed in traditional medicine for its anti-infective properties, particularly in the treatment of malaria and other bacterial and fungal infections. The stem bark is usually soaked in gin or seven-up soft drink and the yellow infusion drunk for malaria.

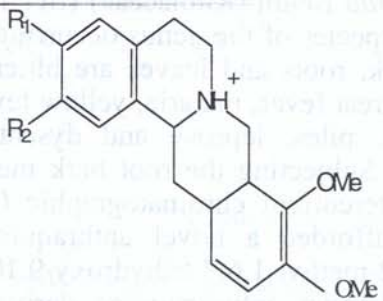
Fig. 11: Open display of *Enantia chlorantha* bark in a Nigerian herbal market

This work resulted in the isolation of two active protoberberine alkaloids, palmatine and jatrorrhizine.



$R_1 = R_2 = OMe$ Palmatine $R_1 = OH, R_2 = OMe$ Jatrorrhizine

$R_1 = OCOMe, R_2 = OMe$ Jatrorrhizine monoacetate



$R_1 = R_2 = OMe$ Tetrahydro Palmatine

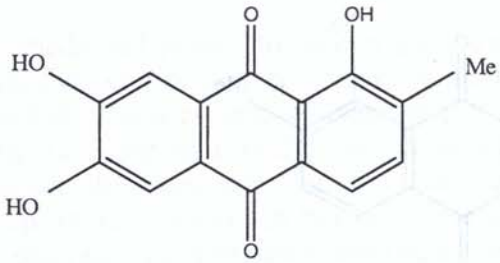
Derivatization of the isolated compounds was found to affect antiplasmodial activities. Tetrahydropalmatine for example exhibited a lower activity while acetylation of jatrorrhizine resulted in an enhanced activity. The bioactivities of fractions and isolates were monitored by in-vitro [^{1}H]-hypoxanthine incorporation assay method (Desjardins et al. 1979; Moody, Bloomfield & Hylands 1995). The compounds also show strong antifungal activities to warrant our current effort in collaboration with a colleague (Dr Kunle George) in the Department of Medicine, University College Hospital, Ibadan to formulate and evaluate the alkaloidal fraction of *Enantia chlorantha* into an acceptable ointment for the treatment of vulvo-candidal infections in women (Moody et al. 1992; Nyong 2010). The toxicological profile of this alkaloidal fraction has also been evaluated in rats by us (Moody et al. 2007).

These studies resulting in the isolation and characterization of bioactive molecules relied heavily on relevant bioassays, state-of- the-art chromatographic separations, 1-D and 2-D NMR and other spectroscopic techniques for the structural elucidation of isolated compounds. Some of these bioactive compounds generated sufficient interest in many multinational pharmaceutical/agro-chemical companies

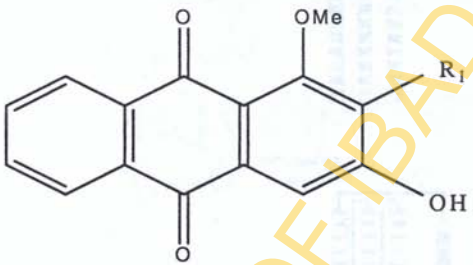
around the world such as USA-based Dow-Elanco and Eli-Lilly, to warrant a request for a 5-year contract for the supply of the compounds.

Morinda lucida Benth (Rubiaceae) (fig. 12) is one of the eighty or more species of the genus occurring throughout the tropics. The bark, roots and leaves are bitter and astringent and are used to treat fever, malaria, yellow fever, gonorrhoea, jaundice, ulcers, piles, leprosy and dysentery in African ethno-medicine. Subjecting the root bark methanolic extract to droplet countercurrent chromatographic (DCCC) separation (fig. 13) afforded a novel anthraquinone compound identified as 2-methyl-1,6,7-trihydroxy-9,10-anthraquinone and six other known anthraquinone deriva-tives (Moody, Hylands & Bray 1994). At the time this work was carried out, DCCC was about the most elegant piece of equipment available to the phytochemist for separating very polar compounds and it gave me one of the most satisfactory isolation experiences in my career.

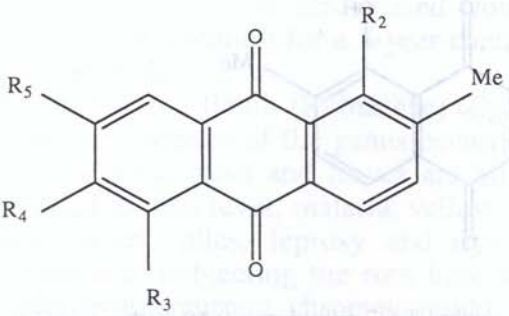
Fig. 12: *Morinda lucida leaves* (*Oruwo* in Yoruba)



2-methyl-1,6,7-trihydroxy-9,10-anthraquinone
m/z - 270, $C_{15}H_{10}O_5$
NMR : chelated OH at 13.30 ppm., 2H singlet at 7.76



Damnacanthal : $R_1 = CHO$
Damnacanthol : $R_1 = CH_2OH$
Damnacanthol-methyl-ether: $R_1 = CH_2O\ Me$
Rubiadin -1-methyl-ether: $R_1 = CH_3$



Morindone : $R_2 = R_3 = R_4 = OH$, $R_5 = H$

Morindone triacetate: $R_2 = R_3 = R_4$ OCOMe, $R_5 = H$

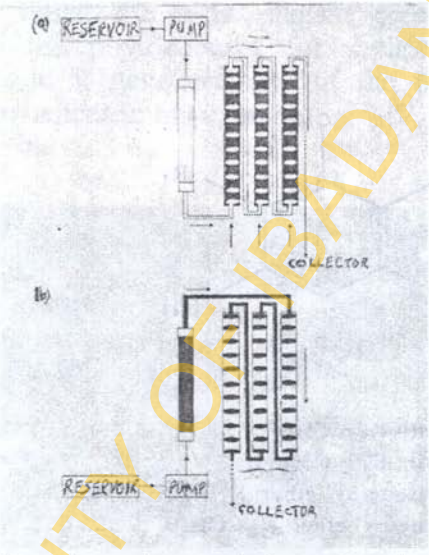


Fig. 13: Droplet countercurrent chromatograph set-up showing (a) ascending mode and (b) descending mode

The down side of the work however was that none of the isolated compounds showed any meaningful anti-plasmodial or anti-microbial activity in the bioassays used to monitor the fractionation! This illustrates the frustration at times that accompanies scientific enquiry in this field and the need also for some paradigm shifts in drug discovery and development

from medicinal plants, to take cognizance of the synergistic effects that compounds have when administered as a mixture in herbal remedies and phytomedicines. This is the new global thinking and reality as exemplified even in conventional therapies such as the anti-malarial ACTs. The concept of this synergism has of course always been known and practised in traditional medicine even though it may appear unusual to the pharmaceutical scientist that is more used to single "bullet" therapeutic agents (Phillipson 1999). It could also be a metabolite of these compounds that has anti-plasmodial activity.

Quantification of some of these constituents using analytical pharmacognosy techniques provided information as to the best time of the year for harvest of plant material in order to maximize output of active ingredients. Thus for example, total anthraquinone content of *Morinda lucida* Benth was found to peak at specific months during the year as earlier mentioned. The potential economic and therapeutic benefits of such information in the industrial utilization of medicinal plants cannot be over-emphasized.

In the continued search for anti-infective agents of plant origin, we were attracted by the observation that leaves of *Alchornea laxiflora* (Benth) Pax ex Hoffman known in Yoruba as *Pepe* or *Ijan* find use traditionally in preserving kola nuts. *A. laxiflora* is a shrub or forest understorey of about 6 m high and is widespread in Nigeria, Cameroon and in most parts of tropical Africa. The plant enters into a Yoruba incantation to make "bad medicine" rebound to sender (Burkill 1994). What sense is there to use the leaves of this plant to wrap kola nuts instead of more presentable packaging materials? My very first Ph.D student and indeed the first to be produced by our Department of Pharmacognosy in this University, Dr Oluwayemisi Oludipe (nee Ajayi-Obe), took up the challenge. In collaboration with the late Professor H A Odelola of the Department of Pharmaceutical Microbiology and colleagues at King's College, London, we were able to isolate and characterize six bioactive constituents from the ethyl acetate-soluble fraction of the methanolic

extract of the leaves using Sephadex LH-20 column and other chromatographic techniques (fig. 14).

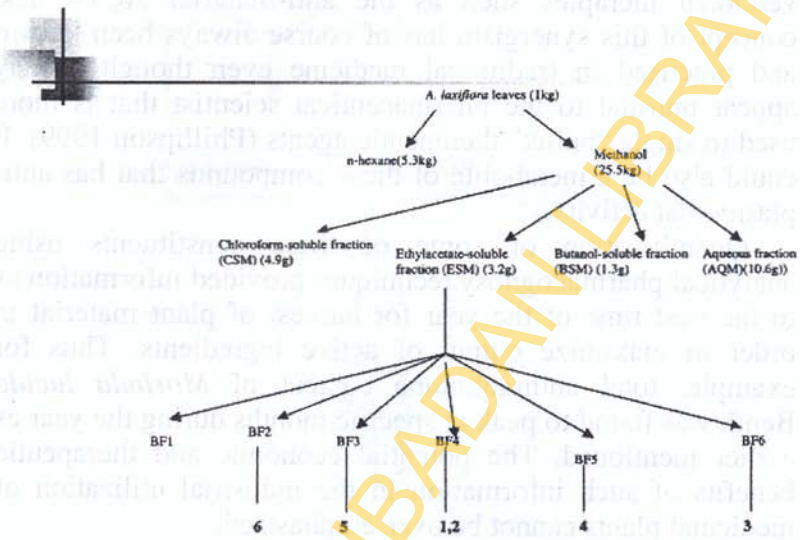
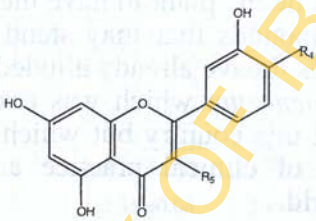


Fig. 14: Fractionation and isolation procedure for *A. laxiflora* bioactive metabolites

Compd 1 $R_1 = OSO_2OH$, $R_2 = OH$ Quercetin -7,4'-disulphate
Compd 3 $R_1 = OH$, $R_2 = OSO_2OH$ Quercetin-3',4'-disulphate



Compd 4 $R_4 = OCOCH_3$, $R_5 = OCOCH_3$ Quercetin -3,4'-diacetate
Compd 5 $R_4 = OH$, R_5 =O-rutinose Rutin

Compd 2 $R_4 = OH$, $R_5 = OH$ Quecetin

The compounds showed broad spectrum activity against pathogenic organisms. One of these compounds, quercetin-7, 4'-disulphate, was a novel flavonol sulphate described for the first time in chemical literature (Ogundipe et al. 2001a; Ogundipe et al. 2001b). Several of the compounds as well as extracts, chromatographic fractions and isolated compounds demonstrated antimicrobial, anti-oxidant and anti-inflammatory activities, and thus justifying the local use of this plant in food preservation and management of conditions such as gingivitis by traditional health practitioners (Ogundipe, Moody & Odelola 1999; Farombi et al. 2003). The sulphated flavonoid derivatives had preferred activity over the non-sulphated ones while also showing comparable activity with existing antimicrobials such as ampicillin and tioconazole. Occurrence of flavonol sulphates in the leaves of *A. laxiflora* was also of chemotaxonomic significance as there was no previous report of such compounds in the genus or other related genera in the family Euphorbiaceae.

Mr. Vice-Chancellor, this particular example is one among many of our "mysterious plants" which when looked at more closely may just be the plant to have the apparatus to synthesize unusual compounds that may stand it out in the chemotherapy of diseases. I have already alluded to the ordeal plant *Physostigmine venenosum* which was once a terror in the Southeastern part of this country but which today is part of the armamentarium of clinical practice and healthcare delivery all over the world.

Antidiabetic Agents from Plant Food Sources

Diabetes mellitus currently affects more than 15.1 million people in North America, 6.6 million in the former USSR, 18.5 million in Europe, 12.6 million in Latin America, and 5.3 in Africa. Non-Insulin Dependent Diabetes Mellitus (NIDDM) was responsible for 85-90% of all cases annually and 18-20 million people are diagnosed with this disease. Modern therapies for NIDDM involve a graduated treatment beginning with diet before progressing to oral hypoglycemic agents and then insulin. The use of existing therapies such as suphonylureas and biguanides is restricted by their pharmaco-kinetic properties, secondary failure rates and accompanying

side effects. Dietary and lifestyle modification remain a mainstay therapy of diabetes mellitus. Based on ethno-botanical data, examination of a number of local plant foods for hypoglycaemic activities led to findings that the methanolic extracts of the following plants significantly reduced the blood glucose level of alloxanized diabetic mice, though at different rates (table 3). The ranking of anti-diabetic activity was *Hibiscus sabdariffa* L (Yoruba: *Sobo*) >*Anarcadium occidentalis* L. (Yoruba: *Kaju*) > *Solanum americanum* L (Yoruba: *Igba*) > *Vernonia amygdalina* Del (Yoruba: *Ewuro*) > *Gongronema latifolium* Engl suggesting the beneficial effect of inclusion of these plant foods in the diet regimens of diabetics (Ogundipe et al. 2003).

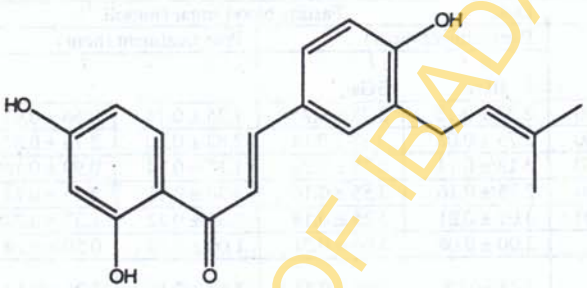
Table 3: The Effect of the Methanolic Plant Extracts of Selected Plant Foods on Blood Glucose Level in Diabetic Mice

Extracts/standards (mg kg^{-1})		Dose Fasting blood sugar (mmolL^{-1})			
		Pretreatment (hour)		Post-treatment (hour)	
		0 BG0	1 BGa	2	3
H.sabdariffa	100	2.23 ± 0.12	2.75 ± 0.25	1.25 ± 0.14	0.66 ± 0.05*
V. amygdalina	100	2.75 ± 0.08	3.55 ± 0.14	2.83 ± 0.20	2.75 ± 0.27
A. occidentalis	100	3.13 ± 0.14	3.75 ± 0.24	1.17 ± 0.14	0.99 ± 0.16*
G. latifolium	100	2.75 ± 0.16	3.55 ± 0.16	3.36 ± 0.21	2.75 ± 0.14
S. americanum	100	3.02 ± 0.21	3.25 ± 0.14	2.35 ± 0.12	1.37 ± 0.27*
Chlorpropamide	5	2.00 ± 0.06	3.00 ± 0.21	1.00 ± 0.14	0.50 ± 0.14
Control 40% Tween 80 in normal saline		2.35 ±0.08	2.98 ± 0.13	3.12 ± 0.16	3.25 ± 0.14

Key
BG0 = Initial Fasting Blood Glucose level
BGa = Fasting Blood glucose level of alloxinized mice
** = significantly different from control samples*

Oyelola et al. (2007) also investigated the hypoglycaemic potential of *Treculia africana* Decne (Moraceae) which is popularly known as African breadfruit. This is a plant food that is native to tropical West and parts of East Africa. Ethno-medically, it is used as a vermifuge, febrifuge, galactogogue and laxative (Irvine 1961). This plant was introduced to me by an old herbalist for the treatment of rheumatism and sickle-cell disease while on an ethnobotanical survey to parts

of Osun State some years ago. The plant is also an important component of some ancient anti-diabetic recipes used in the Western and Middle Belt of Nigeria as our survey among herbalists and a number of patients attending Diabetic Clinics in the University College Hospital, Ibadan, revealed. Our evaluation of the extracts and solvent-partitioned fractions on both normal and alloxan-induced diabetic rats gave the first scientific basis for the folkloric use of this plant in the management of diabetes. In collaboration with some Japanese colleagues during my 10-month sojourn in the beautiful and frontline Hokkaido University in Sapporo as JSPS fellow, one of the compounds we isolated from the anti-diabetic fraction of this plant was a chalcone characterized as 3-prenyl-2',4,4'-trihydroxychalcone (Moody, Oyelola et al. 2006).



3-prenyl-2', 4, 4' - trihydroxychalcone

The traditional medicinal soft soaps (known in Yoruba as abuwe or osedudu) occupy a prominent position in ethno-medicine especially among the Yorubas of the Southwestern Nigeria. The soft soaps are employed as formulation bases for many herbal recipes intended mainly for topical applications on lesions, ulcers and other skin infections. The soaps are prepared exclusively by rural women at work sites known as *Ebu* by a saponification process involving locally extracted vegetable oils (palm oil and palm kernel oil) from *Elaies guineensis* and alkaline lye leached from agro-waste wood

ashes (such as cocoa pods ash and palm kernel shafts ash). We asked ourselves the question, "Do Aloe vera and *Ageratum conyzoides* enhance the anti-microbial activity of traditional medicinal soft soaps?" Laboratory-based evidence revealed that the source of the wood ashes had an effect on the antibacterial and antifungal activities of the soft soaps prepared. Incorporation of Aloe vera gel did not however appear to enhance the anti-infective activity of the soaps (Moody, Adebiyi & Adeniyi 2004).

Another major area of research focus is the application of phytochemistry to the chemosystematics of medicinal plants. Thus, specific and rare chemical markers relevant to the delineation of problematic taxa such as *Cymbopogon, Artemisia, Stoebe* and *Leucas* species, using their essential oil constituents and other secondary metabolites, have also engaged our attention over the years. (Moody et al. 1994, Moody, Hylands & Bray 1995, Moody, et al., 1997, Moody, Gundidza & Wyllie 2006).

Future Prospects of Traditional Medicine in Africa?

The World Health Assembly in 1977 first drew attention to the potential of traditional medicine, especially its manpower reserve in national healthcare systems, and urged member countries to utilize traditional medicines. This was followed by the World Health Organization's Alma Atta declaration of 1978 which recommended that all nations of the world should look inwards towards using the ideals of their various traditional medicines for the benefits of mankind. For more than three decades now, WHO has encouraged the use of traditional medicine especially in the developing countries by promoting the incorporation of its useful elements into national healthcare systems.

The Economic Commission of West African States (ECOWAS) through its health agency, West African Health Organization (WAHO) where I have been privileged to serve on the Expert Committee on the development of traditional medicine in the sub-region, is also taking the bull by the horn as far as the development and regulation of traditional medicine is concerned. The 11th Ordinary Meeting of the

West African Health Ministers recently held in Sierra Leone rose with a strong resolution to push it to the front burner, and institutionalize traditional medicine in the sub-region. In the recent speech of The Chairman of WAHO and Minister of State for Health in Sierra Leone on the occasion he declared inter alia:

> .....For many people in the region, traditional medicine was the only means to access health care as it was readily accessible, affordable and culturally acceptable. It is therefore imperative that the traditional medicine sector is supported to leave no room for charlatanism. Traditional medicine practitioners must be trained and regulated to enable them acquire the necessary skills and competencies to perform this ancient and culturally respected art of compassionate care and healing alongside the orthodox medical practice.

These declarations no doubt took cognizance of the important role that traditional medicine in different cultures has played and still is able to play as a source of modern drugs and, when appropriately harnessed, as an important segment of healthcare for the people.

According to the Development Centre for Biotechnology, the global market value for herbal medicines is expected to surpass US $60 billion by the year 2011 compared to a total of US $19 billion in 2006. The world demand for natural products has in recent times been growing at the rate of 10-15% per annum. The WHO projects that the global market of herbal products would be worth US $5 trillion by the year 2050. The sad aspect of it all however is that despite the global upsurge, Africa's contribution is so low compared to Europe and America which accounts for 63% of the world market. China continues to be a major exporter of traditional medicinal products to the world market. On the African scene, while traditional medicine cannot be embraced uncritically, it is quite clear that the claims should receive more rigorous sympathetic investigation by groups of collaborating

scientists and clinicians who most often have been most sceptical because of the lack of evidence of safety and efficacy. The country and indeed Africa neglects this important healthcare heritage to her own peril.

There are of course many questions that will still remain unanswered as far as African traditional medicine is concerned and this inaugural lecture does not pretend to have all the answers either! How for example does one explain or set about research on the phenomenon of *magun*, in Yorubaland which is still commonplace and which also claim to involve the use of aspects of traditional medicine? How does a ring worn by a sexually active African woman prevent conception? Obviously, these are challenging areas that affect society and which will at one time or the other require more rigorous empirical investigations by African scientists.

Recommendations

Mr. Vice-Chancellor, some recommendations are in order as I wind up this inaugural lecture:

1. There is an urgent need and challenge for the government to stop playing lip service to the issue of research and development necessary for the standardization and utilization of traditional medicine with a view to integrating same into the national healthcare system. The Pharmaceutical and allied industries should be made to contribute by way of a special R and D tax to a Research and Development fund. Government should also provide platforms for the training of traditional healers in the use of modern methods to improve their practice.
2. In view of the world-wide upsurge in the interest and utilization of herbal medicines, courses on aspects of Pharmacognosy and traditional medicine should be made compulsory for students and conventional health practitioners for proper awareness of the issues at stake. The continued neglect of the effect of inappropriate use of traditional medicine on the health status of the society can only be to the peril of the nation.

3. The University should set up and fund a Centre for Drug Discovery and Production with a view to conducting translational drug research and development as well as providing outlets for a number of research findings and products from local sources that could improve the healthcare delivery in the nation.
4. After 30 years of entrance of the Faculty of Pharmacy into the University of Ibadan and with its contribution to the pharmaceutical sector manpower both nationally and internationally, the Faculty deserves a suitable and conducive learning environment befitting its status. The overall effect of the grossly inadequate and scattered facilities on the psyche of staff and students and consequently on the future quality of healthcare delivery to society at large is probably unquantifiable.

Conclusion

In the course of my career and odyssey in nature's laboratory, there has accrued sufficient evidence to provide some rationale for the use of a number of African medicinal plants to buttress the link that has always existed between modern drugs and traditional medicine. Historical development of drugs has demonstrated how a number of the substances used for poisons in murder cases, magic and folk medicine or herbal remedies, have been successfully transformed into clinically acceptable drugs. With over 80% of the population in Africa depending on healthcare provided by traditional medicine, it is quite clear that a more effective utilization of the wisdom and knowledge in this system is critical and necessary if healthcare in the region is to improve.

I have tried to paint a picture of the pivotal role which pharmacognosy as the oldest and yet the most modern science has played and will continue to play in the development and quality assurance of both conventional drugs and the emerging phytomedicines from nature. Even with all the challenges facing drug discovery and development from

medicinal plants, natural products obtained as leads from ethnomedicine can be predicted to remain an essential component in the search for new medicines in the future. We as Africans certainly cannot afford to throw away the baby with the bath water. The good aspects of traditional medicine deserve to be salvaged through the provision of all necessary facilities for research and development right here on our soil. The proposed University Central Laboratory and the expected ETF zonal laboratory is heartwarming and a good step in the right direction which needs to be done quickly but should not be seen as a substitute for adequately funding the different science-based units if we must remain competitive in the global knowledge-driven economy. The limitations of scientific research in the third world is aptly summed up in a reference letter once written on my behalf some years ago by one of my teachers and co-supervisor at King's College, University of London—Emeritus Professor Peter Houghton, which reads as follows:

> I have kept in touch with Dr Moody ever since he was a Ph.D student in our department. We correspond regularly and I was a guest speaker at a conference which he organized in Ibadan in 1998.....I have great admiration for Lanre who has persisted in keeping research going and publishing papers in spite of very difficult circumstances in his own institution and country. Many like him have taken the easy option and emigrate to more lucrative and scientifically rewarding positions in the First World but he has taught and trained a steady stream of young scientists, some of whom have worked in my lab for a time. I believe that his portfolio of papers and other scientific output would be much greater if he had not made the sacrifice to stay in Nigeria. The necessary constraints of not being familiar with modern techniques and instrumentation because of the economics and geographical distance of Nigeria

mean that he has had to be fairly self-reliant and independent but finding it difficult to keep up with literature –even the recent improvements of access to research made possible by the Internet are not so easy to apprehend in developing countries as many think! Dr Moody works very hard. I consider that he is an ideal candidate who would benefit immensely from the chance to receive a Fellowship.

Prof. D T Okpako asked philosophically in his inaugural lecture in 1987, "Do drugs grow on trees?" The science, art, technology and economics involved in the discovery, formulation, production and analysis of drugs is enormous and cannot be otherwise if the important parameters of safety, efficacy and quality are to be ascertained and sustained at all times for the benefit of all and sundry.

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First, I give all glory and honour to Almighty God, the strength of my life and by whose grace and special favour I am what I am today. I thank my late grandfather Pa Moody Olayemi, who unknowingly played a part in preparing me for my career as he took every opportunity, and deliberate field and plant collection trips, to show us his grandchildren the diverse medicinal plants available in the locality with their Yagba/Okun names and usefulness. I thank my octogenarian father, Elder (Chief) Solomon Kayode Moody, the Afedetaiyese of Yorubaland, who also doubled as my Yoruba and Fine Art teacher in secondary school for his exemplary life and all the training he gave me. I thank my mother Mrs Grace Olufunke Moody for her sacrifice over the years.

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the Adekoyas, Ashafas and the Ajayis of Ijebuland. I appreciate my late uncle, Rev Dr D S Moody who while far away in the USA in 1968, desired that I would one day be addressed as Dr Jones Moody. His dreams were in fact surpassed when my 2005 professorship was announced about two years ago.

I thank my primary and secondary school teachers who were most instrumental in moulding my life as they selflessly laboured in those formative years of mine.

I thank all my teachers from primary and secondary school to pharmacy school at Ife, especially Professor Abayomi Sofowora who ensured my return to Ife for postgraduate studies with the immediate offer of a Demonstrator/Internee position in the Department of Pharmacognosy on completion of the B.Pharm degree programme. I also acknowledge his mentorship over the years and appreciate his invaluable input into the preparation of this lecture. I also thank my teachers at King's College, University of London: Professors PJ Hylands and Bob Hider, late Professor Norman Bisset and Emeritus Professor Peter Houghton for not just being teachers but life-long friends.

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It is often said that teachers make the pupil. In my own case it is both the teachers and the pupils that have made me. I am indebted in more ways than one to all my past and present graduate students for their immense contributions to all that have been presented in this lecture. I appreciate all members of staff and students of the Faculty of Pharmacy in general and the Department of Pharmacognosy in particular for providing an enabling environment to operate over the past 27 years of my sojourn in Ibadan. I particularly thank members of the Inaugural Lecture Committee headed by Dr Dele Odeniyi for all the technical support and assistance in making this lecture a reality.

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Words are certainly inadequate on a day like this to publicly acknowledge and appreciate the prayerful support, the care, and the sacrificial love that Dr Ikeoluwapo Ore-Ofe Moody has given me as my soul mate over the past 29 years of marriage. (It was under a *Terminalia* tree late in 1979 that she said "Yes" to an earlier proposal to be my wife).I also thank our four wonderful children—Timi, Tobi, Tola and Tolu—who have indeed been and continue to be God's special blessings to us and to their generation!

It has been a long journey since I walked barefooted to primary school as a little boy with a wooden box on my head on those sandy and dusty roads of Kogi State in the early 1960's. I give all the glory, honour, and majesty to the King of Kings and Lord of Lords, the Lord Jesus Christ for the unsearchable riches of His grace and faithfulness over the years.

Mr. Vice-Chancellor, distinguished ladies and gentlemen, I hope I have made some sense of this inaugural lecture! Thank you all for your attention.

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BIODATA OF
PROFESSOR JONES OLANREWAJU MOODY

Jones Olanrewaju Moody was born to the family of Elder (Chief) and Mrs S. K. Moody in Egbe, Yagba West Local Government of Kogi State on September 3, 1953. He started his Primary Education at the ECWA Primary School, Ejiba in 1959 before transferring to ECWA Primary School, Egbe in 1960 where he obtained his First School Leaving Certificate in 1965. He obtained his West African School Certificate in Grade One Division in 1970 at Titcombe College Egbe where he also obtained his Higher School Certificate in 1972. He was the Class Captain, Food Prefect and Kwara State Basketball Team Captain in his A' levels class at school. He taught briefly at Queen Elizabeth School, Ilorin before proceeding to the University of Ife (on sponsorship by the old Kwara State Government) where he obtained the Bachelor of Pharmacy (Honours) degree in June, 1977. After a brief period as intern pharmacist in Lokoja General Hospital, he returned to the Department of Pharmacognosy, University of Ife (now Obafemi Awolowo University) in September 1977 as Demonstrator/Internee and with an opportunity to commence his postgraduate studies under the supervision of Professor Abayomi Sofowora. He completed the M.Phil degree programme in March 1981 after a year's break to serve the nation under the NYSC scheme at the General Hospital, Gboko, Benue State in the 1978/79 session. He was appointed Assistant Lecturer in Pharmacognosy in March 1981 at Ife and re-designated Lecturer II in October 1981. He joined the University of Ibadan in August 1983 as Lecturer II, as one of the pioneer staff of the newly established Faculty of Pharmacy. Between 1986 and 1990, Lanre Moody was at the King's College, University of London for his Ph.D degree programme on an Association of Commonwealth Universities Staff Scholarship under the supervision of Dr (now Professor) P J Hylands and Dr (now Emeritus Professor) P J Houghton where he worked on the isolation and characterization of

bioactive principles from Nigerian medicinal plants used in the treatment of fevers.

After a one-year postdoctoral research fellowship at the Department of Natural Product Chemistry, Xenova Ltd, a state-of-the-art drug discovery company located in Slough, UK, Dr Moody returned to the University of Ibadan in 1991 at the inception of the postgraduate programme in the Faculty. He was re-designated Lecturer I in the Department of Pharmacognosy in 1991. He rose to become the first Professor of Pharmacognosy in the University of Ibadan on October 1, 2005. He has benefited greatly and broadened his academic and professional competence and expertise through highly competitive awards and fellowships such as British Council Higher Education Award (1994) in the UK and Regensburg, Germany, MacArthur Foundation Award (2003) and the Japanese Society for the Promotion of Science Award (2005/2006) at Hokkaido University, Sapporo, Japan.

He has been a member, Expert Committee of the West African Health Organization (WAHO) for the development of Traditional Medicine and West African Herbal Pharmacopoaeia in the sub-region since 2009; Member, National Accreditation Board of Ghana Panel of Assessors for the Accreditation of Pharmacy Programmes in Public Universities in Ghana (2006), Chairman, Nigerian Association of Pharmacists in Academia, Oyo State, a technical group of the Pharmaceutical Society of Nigeria (1995-2008); External Examiner in Pharmacognosy to seven Nigerian and Ghanaian Universities at both Undergraduate and Postgraduate levels (1997 – date); Member, National Expert Committee on Regulation and Registration Guidelines on Herbal Medicinal Products and Related Substances (1999); Consultant to UNICEF on the Evaluation of Primary Health Care (Bamako Initiative) in Nigeria (1996). He was Chairman, Local Organizing Committee of the 1st and 2nd International Workshops on Herbal Medicinal Products (1998 and 2008) organized by the Department of Pharmacognosy as well as Programme Coordinator, Pharmacists Council of Nigeria

Orientation Course for Foreign Trained Pharmacists (1986 and 2002). He is a past National Vice-President (2003-2006) and Ag President (2006-2007), Nigerian Society of Pharmacognosy as well as a member of the Society for Medicinal Plant Research (GA) and American Society of Pharmacognosy.

Professor Moody has held many administrative positions in the University. He has been a member of Senate since 1997 and a former Sub-Dean (Undergraduate) in the Faculty of Pharmacy (1992-1996). He has served as Acting Head, Department of Pharmacognosy (1997-1999, 2001-2003) as well as the first substantive Head of Department (2007-2009). He is the current Dean, Faculty of Pharmacy since August 1, 2009. He has over 40 publications comprising journal articles, conference proceedings, and commissioned technical reports.

A keen sportsman, Olanrewaju Moody was named Basketballer of the year at the University of Ife in 1976 when he was also a member of the Nigerian Universities All Stars team. He has been the Honorary Coach of the University of Ibadan Basketball Team since 2005 till date. An alumnus of the Haggai Institute Christian Leadership Seminar in Singapore, Professor Moody has been an Elder in the Evangelical Church Winning All (ECWA) since 1979. He is happily married to Dr (Mrs) IkeOluwapo Moody (nee Adekoya) and they are blessed with four children.