Inaugural Lecture Series 108

UNDERSTANDING THE CHEMICAL NATURE OF PLANTS FOR BETTER HEALTH

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An Inaugural Lecture Delivered at Oduduwa Hall, Obafemi Awolowo University, Ile-Ife
on Tuesday, 15th August, 1995.

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OBAFEMI AWOLOWO UNIVERSITY PRESS LIMITED
ILE-IFE, NIGERIA.

ISSN 0189 – 7845

Printed by
Obafemi Awolowo University Press Limited Ile-Ife, Nigeria

Mr. Vice-Chancellor, Sir, Ladies and Gentlemen, it is with great humility that I stand before you on this memorable day and please share the joy with me as I dedicate this presentation, my Inaugural Lecture to the Glory of God, who has made ALL THINGS possible, even for today

My lecture on "*Understanding the Chemical Nature of Plants for Better Health*" sets out to focus on the chemical nature of natural products, with particular emphasis on plants and plant products. It is a testimony to many fascinating years of gathering knowledge and information, of searching and researching, of enquiring and listening-inspired and motivated by the values of our green cultural heritage, our flora, for which we are all very proud.

It is generally accepted that civilisation is routed in nature and this has helped to shapen human culture and influence all forms of achievements. Mankind, as we may appreciate, is a part of nature and our lives depend on the uninterrupted functioning of natural systems, like the growth and development of plants, which ensure the supply of nutrients and energy.

The human body may be compared with a perfect working chemical factory which, as of necessity, utilizes plant-derived foods and drinks as fuel. It is generally constructed to render poisonous substances innocuous. The major pipeline fluid is blood, and the waste water is of course, urine. The understanding of the chemical nature of plants and of biological fluids in living systems sets out to show these systems-be it in man, animal or plants, as composed of complex mixtures of chemical compounds in different concentrations and this will help us ALL to appreciate the values of the food we eat, and the plant-derived medicines that we use to sustain ourselves.

Mr. Vice-Chancellor, this is another inaugural lecture from the Faculty of Pharmacy and indeed a first one from the Drug Research and Production Unit. I should within the next few minutes be able to (1). highlight some of the contributions of chemistry to herbal medicine and to health care generally, (2), discuss in some reasonable depths, some of the challenges of my career spanning about 23 years, (3), create an awareness regarding medicinal plant research and (4), give my recommendations to governments and the general public, the main users of our plants and their products.

Some Relevant Historical Perspectives

The Observations [1,2] of the celebrated English Chemist and Clergyman, Joseph Priestley, after a candle-burning experiment in an enclosed container in 1771, led to his conclusions that combustion somehow "injured" the air and such an "injured" air would not support the life of an animal. Further experiments, however, made him to realize that he could restore the injured air, and that the restorative was "vegetation". He noted that the restored air was not "at all inconvenient to a mouse" placed in it. Priestley concluded that plants are what keep the lower atmosphere pure enough to support life, even as the air is consumed and contaminated by burning fires and breathing animals.

The growing of living plants inside rooms and houses is now a part of the culture in some parts of the world, and, apart form their ornamental values, these plants serve to purify the air.

The results of Joseph Priestley's experiments were confirmed in 1779 by the Dutch physician and plant physiologist, Ian Ingenhoue, who observed also the great power of vegetables in purifying the common air in the sunshine, or of injuring it in the shade or at night. Ian Ingenhouse proved that plants purify the air only in sunlight and these results were to form the basis for photosynthesis. It has since been demonstrated that equal amounts of carbon dioxide and oxygen are indeed exchanged during photosynthesis, and that the plant does retain the carbon as nourishment. It is now also known that from equal parts of water and carbon dioxide, plus the energy of light, the reaction yields the oxygen, which we breathe in, and the carbohydrate, which is the source of our food and energy.

Nature is itself chemistry and the various developments in chemistry are, therefore, not far removed from nature. By the 18th and 19th centuries, chemistry, which had belonged largely to the natural history tradition, took a whole new direction as it was reformed as a physical science, indeed, a model experimental science. In their search for scientific truth, talented individuals played key roles in laying the foundations of modern science. Chemistry developed as a subject through the efforts of such renowned chemist as Frenchman Laivosier, the German Organic Chemists, Liebig and his student Pro. Hoffman, the Swede, Berzelius, the Russian Mendeleev, and a host of others-Gay Lussac, Dumans, Michael Faraday, Avogadro, etc. With the developments in Chemistry, the Englishman Beddoes saw in Chemistry and Medicine, ways of improving human life. Similarly the Frenchman, Boussingault, was able to relate agriculture and chemistry, and whereas many of Liebig's early students were pharmacists, Liebig himself demonstrated the utility of Chemistry in agriculture and industry, thus showing the versatility of chemistry as a subject.

Phytochemistry as a Discipline, Aims and Scope

The subject, "Phytochemistry", has evolved as a discipline, which covers all aspects of pure and applied plant biochemistry. It leads to a deep understanding of such factors underlying the growth, development and metabolism of plants and the chemistry of plant constituents. Phytochemistry, otherwise known as natural product chemistry, has been described[3] by Leslie Fowden as largely a study of *living* carbon compounds different from organic chemistry, which does not require the incursion of a *living force.*

It is a common knowledge that at the subcellular level, plants and animals display some similarities, considering the processes of replication of information, genetic recombination, the development of subcellular structures and respiration, etc. This is why plant products are more readily useful to man as food and as medicine. All drugs are, in fact, chemicals that ultimately act by modulating endogenous cellular chemistry and these results in healthy living and better health.

Reasons for the accumulation of Chemical Compounds

Chemical compounds used by man are thought to be the by-products of metabolic processes in animals and plants. Some of these compounds function as growth regulators, or participate in maintaining the ionic balance in plants. Because of their biological activities and bitter taste, they may function as animal and insect repellents. While some *coloured compounds* and other phenolics may act as pollinator attractants, some other compounds provide the plants with a defence against viral and fungal infections. The concentrations of such compounds tend to increase at the site of the plant wound or infection.

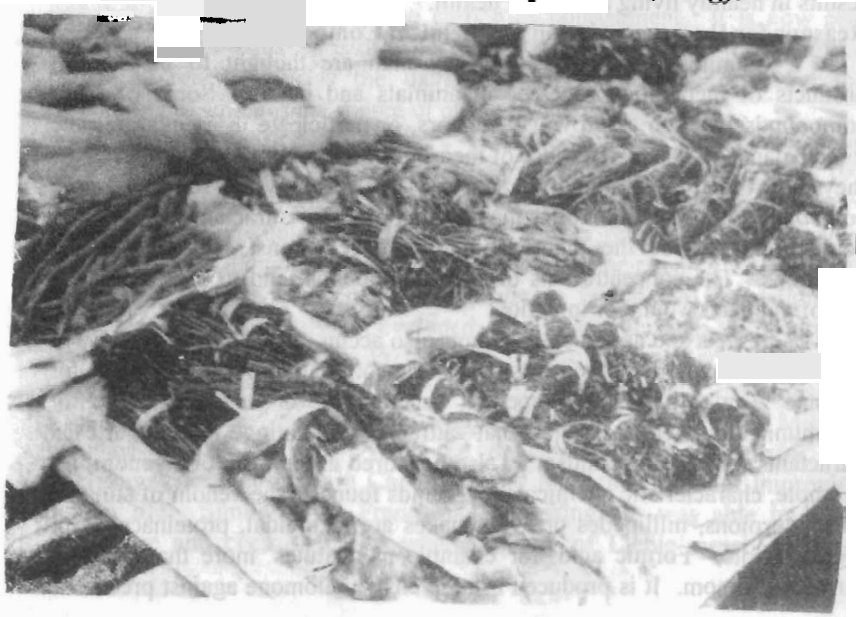
Insects and animals, like plants also accumulate a curious variety of chemical compounds in their organs. These compounds are used mainly for defence (defensive and repellent secretions or odours), or for communication (flora scents that attracts pollinating insects or sex attractants). The compounds may also be stored in the form of a venom, for example, characteristic chemical compounds found in the venom of stinging ants, scorpions, millipedes or even snakes are alkaloidal, proteinaceous or highly acidic. Formic acid, for example, constitutes[4] more than 99% of formicine venom. It is produced as a defensive allomone against predators.

Many bufotoxins have been isolated[5] from the skin of the toad, *Bufo melanostictus* (Schneider), benzoquinone and hydrocarbons have been described[6] from the hot defensive secretion of the beetle, *Mystroponus regularis* (Carabidae), while cardenolides and pyrrolizidine alkaloids exist[9] as N-oxides in another species of the beetle, *Oreina speciosissima* (Chrysomelidae).

Mr. Vice-Chancellor, it is interesting to note that these chemical compounds are used for defence by animals and plants; human beings also use them for defence against all sorts of diseases.

SOME CONTRIBUTIONS OF CHEMISTRY TO HEALTH

Perhaps at this stage, one can make a quick survey of how chemical research has helped some aspects of food science, phytomedicine and public health. The positive successes of chemistry in contributing to the prolongation of life and to the reduction of morbidity and the general maintenance of health cannot be over-emphasized. No branch of science has done more or promises more in improving matters than chemistry. Chemistry has provided, in the worlds of Lord Porter (at the RSC's 150th anniversary congress at Imperial College, London) "a cornucopia, both of necessities and luxuries-Health, food, clothing, materials, energy."



The use of plants by man dates back to prehistoric times and herbal medicine is cherished worldwide.

For a very long time, most cultures of the world have used plants for medicinal purposes, in various forms - as ground powder, tisane, boiled concoction, in native soap and pomades, through sacrification, etc, and plant products were thought to contain substances that "worked more by superstition or magic". Though there was the belief in the presence of active constituents in some cultures, chemical compounds were first identified as the active constituents of plants around the 18th century. Medicinal plant research (es) have made remarkable contributions particularly in areas relating to (a), fertility regulation – consider natural contraceptives and the production of sex hormones (b), sourcing of natural sweeteners and bitters (c), chemical and biological appraisal of some of our chewing sticks (d), the identification of proteolytic ferments/enzymes of plant origin (e), the sourcing of natural laxatives and purgatives (f), the sourcing of quality foods, also industrial and pharmaceutical raw materials and (g), the identification of plant constituents and marine natural products with various medicinal values.

Plants have fed the world since creation, and food in the form of carbohydrates, proteins, fats, oils, etc. are also derived from plants. For example, the pepper soup for which we, as a people are very proud, usually contains extracts of plants and animals including:

(a) The West African Black Pepper, (*Piper guineense*, Yoruba, *Iyere*) or
(b) The African Guinea Pepper, (*Xylopia aethiopica*, Yoruba, *Eeru*),
(c) The Onion (*Allium cepa*, Yoruba, *Alubosa onisu*)
(d) Pepper, (*Capsicum frutescens*, Yoruba, *Ata*) and
(e) Some bitter leaf, (*Vernonia amygdalina*, Yoruba, *Ewuro*).

Some animal parts like the head of a goat, oil, tomatoes, salt and water are usually added on to these ingredients to make the soup.

Apart from an essential oil which constitutes about 2% of West African black pepper berries, some other 15 or more compounds including piperine, sesamin, refractomides, piperlonguminine etc. have been described from the berries[7,8]. The constituents, mainly amides and lignnas, have shown many medicinal values-killing bacteria, lowering blood pressure, managing convulsion and showing sedative, carminative and diuretic properties.

The dried fruits of the African Guinea Pepper (*Xylopia aethiopica*) produce an agreeable spice and a fragrant essential oil. The fruit yields fatty acids as well as cuminal, eugenol, cineole and many oxygenated diterpenes including xylopic acid, kauran-16$^{\cdot}$ –01 and their derivatives[9,11].

Pepper (C.*frutescens*) contains related compounds, pungent amides and lignans such as capsaicin (8-Methyl-N-vanillyl-6-nonenamide) and its dihydro derivative (8-Methyl-N-vanillyl-nonenamide). The Onion (*Allium cepa*) also contains[12] flavonoids, allyl-propyl-disulphide and higher sulphides, propenylsulphenic acid, the lachrymatory factor and other aldehydes. Onion extract is bactericidal, antifungal, antiseptic and antiviral.

The bitter leaf (*Vernonia amygdalina*) has furnished[13] is two anti-cancer agents identified as vernodalin and vernomygdalin. Vernodalin and three other sesquiterpene lactones-vernolide 2^{1}-hydroxy vernolide, vernodalol and all the five steroid glucosides isolated from this plant showed strong anti-schistosomal activity. [81,82]. Leafy vegetables contain chlorophyll which is a powerful insecticide that can destroy the germs of the mouth cavity and the intestines. It also contains high quality protein and such constituents like the bitter vernonioside A4 and its aglycone that may improve food intake and digestion. Vegetables contain nutrients useful in reducing the acidity of the stomach (e.g in peptic ulcer) and the body, useful also for anaemia and body weakness.

We now know from these information that the substances which make one sneeze violently or cough disturbingly and even sweat in the fore-head when one consumes the pepper soup are the many pungent amides and spicy oxygenated constituents present in the berries (and fruits) and used as spice or condiment, stimulant and flavourer. This shows that even plant materials we use as food also have medicinal values. No wonder then that herbalists usually incorporate these plant parts in their remedies for coughs, intestinal disorders, common colds, bronchitis, venereal diseases and rheumatism.

The pursuit of happiness is a peculiarly human characteristic and there has been the search for drugs or other substances to facilitate this pursuit.

Nearly every society in the world appears to have discovered substances which mildly or powerfully influence the mind, lightening fatigue and the burden or care, promoting fellow-feeling and at least a temporary sense or well-being. These include mood-elevating substances, such as tea, coffee, cocoa, opium, tobacco, etc. In our immediate environment, the traditional euphoritants have always been the tobacco and

our various brews from local cereals and drinks tapped from the palm tree (*Elais guineensis*. Yoruba, *Ope*) or the date palm. Today the beer from barley or oats etc, stout (from sorghum or millet), wine (from grapes, date-palm or the palm tree),also cider (from apples), and spirits are common. With these brews used in moderation, we offer hospitality and display our sociability. Over a glass or a fraction of it, we enjoy old friends and make new ones, we proclaim our loyalties, discuss affairs, negotiate and seal bargains. Also at solemn ceremonies, social drinking has an honoured and accustomed place.

It is interesting to note that the Holy Scripture (Deut. 14:26) does not require, or even indicate total abstinence from wine or alcoholic beverages for all persons. Instead, God has provided (Psalm 104:15) "wine that gladdens the heart of man". We have the records of the events at the wedding in Cana-in Galilee (John 2:1-11) where by turning water into the best wine, our Lord Jesus Christ revealed his glory and led his disciples to believe in him. Also in his first letter to Timothy, (I Timothy 5:23), the apostle, Paul enjoined young Timothy, and I quote, "Stop drinking only water, and use a little wine because of your stomach, and your frequent illnesses". This recommendation harmonizes well with modern day recognition of wine's dietary and medicinal use. It is now known that wine, the most important medicinal agent in continuous use throughout the history of man, when drunk in moderate amounts is not accompanied by any serious ill-effects but instead has social and health benefits. It is effective as a mild tranquiliser, an appetite stimulant, an aid to digestion and an aid to the absorption of minerals in food eaten.

Our traditional brews contain ethyl alcohol (ethanol) and this usually comes from the fermentation by yeast of sugars that occur naturally in plants. Beer contains about 3 to 5% by volume of alcohol, and about 8% alcohol for strong beer. Most wines contain between 10 and 12% of alcohol, and palm-wine left over-night to ferment (Yoruba, *Isa*), probably contains higher quantities of alcohol. Spirits contain between 30 and 40% by volume. The difference between having a drink and becoming drunk depends, to a large extent, on the quantity of the alcohol taken and the individual concerned. There is the great need to learn from the word of truth (Proverbs 20:1) that "wine is a mocker and beer a brawler; whoever is led astray by them is not wise". Those who indulge in alcohol expose themselves to serious physical deterioration, grave spiritual damage, intoxication and terrible social and mental consequences.

Scientific studies of many other natural products used in medicine have confirmed their reputed values and identified their various active components.

Malaria is probably as old as mankind and it appears wiser. Intermittent fevers associated with a rise in body temperature and an enlargement of the spleen have been described in media writings from many civilisations since earliest times. Even today, malaria remains the single greatest disease threat to the health of the world. Malaria endemic regions of the world show this. Plants used in indigenous medicine to treat malaria have furnished potent [14-16] antimalarial drugs such as quinine –type alkaloids from the South American *Cinchona* species, artemisinin from the Chinese plant, *Artemisia annua*, gedunin, nimbolide and other limonoids contributing to the antimalarial, antipyretic and anti-inflammatory agents of the Neem tree (***Azadirachta indica*, Yoruba-*Dogonyaro*).**

The stem bark and leaves of *Alstonia boonei* (Yor. *Ahun, Awogbaarun*) is used in the treatment of rheumatic pain; malaria, febrile jaundice and insomnia. The plant has furnished many alkaloids chief among which is echitamine. This compound has shown antimalarial and antileukemic properties. Some of these isolated compounds have shown the lead to some synthetic antimalarial drugs such as chloroquine, mefloquine, halofantrin etc. now in common use.

Man also wages constant war on a whole range of diseases caused by viruses, bacteria, protozoa and fungi and has relied [17-20] on plants for the cure of infections, removal of worms, and the treatment of urinary tract disorders. Such plants include the lemon grass (*Cymbopogon citratus*, Yoruba *Kooko Oba*) which furnished the antibacterial compound, citral and many other terpenoids, and the African *Borreria* (*Borreria verticillata* Yor. *Irawo ile*) which furnished the antibacterial and amoebicidal compound borreverine. The common ginger (*Zingiber officinale*) has furnished an oil containing gingerols, shogaols and related compounds with anti-microbial, antifungal, anti-viral, anti-inflammatory, anthelmintic and anti-arrhythmic properties.

Medicinal plant research has also confirmed that some chemical compounds isolated [19-20] from plants exhibit anti-tumour properties, some of these have, in fact, received clinical attention. The common flower, Rose Periwinkle (*Catharanthus roseus*), has yielded the clinically useful anti-cancer agents vincristine and vinblastine and the Ceylon lead-wort (*Plumbago zeylanica* Yoruba, *Inabiri*) gave plumbagin which showed anti-cancer, antibiotic and antibacterial properties.

Plants have been used [20-21] to manage many forms of convulsions and such disorders as hypertension, psychiatric and psychosomatic diseases from time immemorial. The African *Rauwofia (Rauwolfia vomitoria,* Yor. *Oora Igbo)* contains reserpine which shows hypotensive properties and is used clinically as a major tranquilizer and as an antihypertensive agent either alone or in combination with other drugs as in 'brinerdine'(R), Raudixin, Serpasil or Terbolan. Ajmaline, another isolate from *Rauwolfia* species, has also been used clinically in the treatment of cardiac arrhythmia.

The beneficial effects of some other natural products are worthy of mention. Natural honey, derived from the bee is a unique medicine and is always preferred to the common table sugar. A statement on the bee and I quote: "The bee builds its cells in hills, on trees and in men's habitations. It eats all the produce of the earth. There issues from within their bodies a drink of varying colours, wherein there is healing for men". Honey contains 76.4% carbohydrate with levulose (D-fructose 40%), medicinal glucose, (dextrose, 34%), cane sugar (2%), dextrin (1.5%), ash (0.2%) and vitamins. Honey helps the functioning of the eyes, the liver, the heart and preserves youthfulness. It is an ideal food full of powerful antibacterial properties against pneumonia, typhoid and diarrhoea (bacterial gastroenteritis) and has powerful ulcer, burns and would-healing properties. The antibacterial properties of this product are usually attributed to the production of locally high osmolality due to the water activity of honey, the enzymically liberated hydrogen peroxide and some antibacterial substances on which bees feed. Honey is considered a remedy for rheumatism, arthritis, sore throat, indigestion and various diseases of the stomach and intestines. Many of the world's oldest medical literature contain various prescriptions based on the curative properties of honey, Scientific and clinical evidence(s) of the benefits of honey are many. It is now known as a "sweet healer" with fantastic antiseptic properties. To link religion and science, perhaps the advice of the Holy Scriptures that "whoever licks honey three mornings a month is saved from serious illnesses" should be taken very seriously.

It is very clear that natural products are really the source of raw materials for our medicines. Individuals who despise medicines for some reasons may want to re-consider their decisions. Joshua Ben Sira had written (at about 180 B.C. in Ecclesiasticus, XXXVIII 4,7)on this subject as follows:

> "The Lord has created medicines form the earth, And a sensible man will not disparage them, By using them thedoctor relieves pain and from them the pharmacist makes up his mixture"

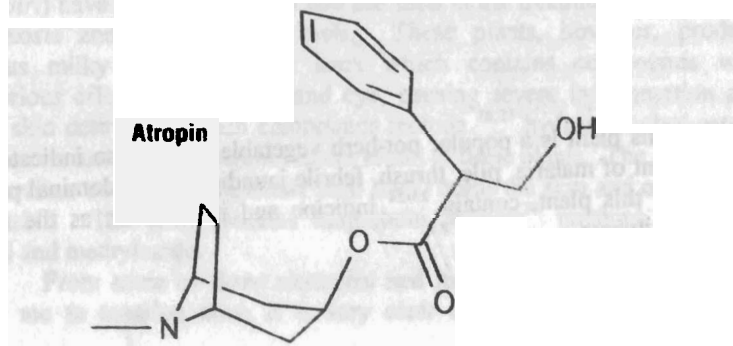
Locally-manufactured soft soaps, otherwise known as black soap or "*Ose dudu*" are produced from plant products- from kolanut or cocoa pods, aridan fruits, coconut oil, castor oil, palm kernel oil, cotton seed oil etc. Soaps are prepared traditionally from the reaction of fatty acids from the various fats and oils with the alkaline materials, the lye from leached wood and fruit ashes, that is, through fatty acid saponification.

The black soap is used more by the herbal practitioner and, of course, the rural woman. Many people erroneously believe that the black soap is the exclusive preserve of the herbalists, it should be noted that the black or brown colour of the soap comes on as a result of the heat treatment and charring of plant products which soaps undergo during local production. Whereas the well-known basic property of the soft soap is to cleanse, as toilet soap, for example, or used as an ointment base for other components, soft soaps are now known to be able to reduce the population of micro-organisms that are known to be either normal skin microflora or are transient organisms on the skin. Used as an African traditional herbal medicament for topical use, alone, or in admixture with *Carica papaya* (*Pawpaw*) juice, for example, there is the general claim that soft soaps help in reducing the incidence of facial carbuncles or wrinkles, pimples, etc. and brings lustre to the body. *Carica papaya* itself is a very useful plant medicinally. Its medicinal and economic values are usually attributed to the presence of proteolytic enzyme, papain, present in the latex (juice).

Soft soaps are now known to have germicidal, disinfectant, and antiseptic properties depending on the fatty acid radicals constituting the soap, the state of unsaturation of the fatty acids, the concentration of the soap and the amount of foreign matter(s) present. The therapeutic values of the soap have been linked with the detergency of soaps and their ability to induce changes in the optical density of cell suspensions.

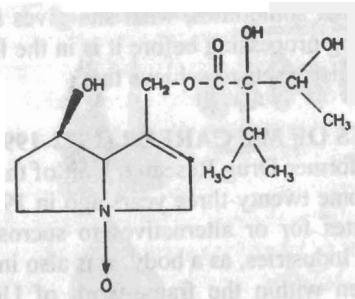
Phyotochemical research has also identified poisonous principles from plants. In the mid 1700's, traditional healers calmed the violent sezures of epileptic patients with a tea made by steeping the crushed spiny fruits of the jimson weed, *Datura strasmonium*

For some patients this potent plant produced a trnquilizing effect. For the unlucky others, however, the tea was poisonous and often fatal. The secret to its effectiveness was proper dosage for the patient- a critical guessing game of life and death. *Datura* species contains the alkaloid, atropine, large doses of which have been found toxic. Effective therapeutic use demanded accurate dosage and effective drug monitoring, an area in which herbalists may not be able to show enough expertise.



Senecio plants accumulate pyrrolizidine alkaloids. Acute liver poisoning, liver cirrhosis and accompanied damage to kidneys, lungs, coronary vessels in humans and cattle have been linked[22] to the large consumption of *Senecio* alkaloids. In Nigeria here, a very popular anticonvulsant drug has *Heliotropium indicum,* vulture's beak, or Cock's comb (Yor. Ogbe ori akuko, Agogo Igun, Ori-Igun) as a major components.

This plant is a popular pot-herb vegetable and is also indicated in the treatment of malaria, pile, thrush, febrile jaundice and abdominal pains. Extracts of this plant, contain [23-24] indicine and its N-oxide as the main active constituents.



Indicine N-oxide

Indicine N-oxide showed strong anti-tumour properties and so encouraged clinical evaluation. It showed 91% tumour inhibition and a high degree of life extension (120%) but like other *Senecio* alkaloids was found to be hepatotoxic. Severe hepatotoxicity was noted[25] in 7 of the 55 courses of therapy, thus delimiting the free use of this compound in medicine. This represents an example of a herbal drug that is known to present problems in terms of its quality and safety at high doses. This is a plant that will take care of malaria, jaundice, tumours, convulsions but will also damage the liver when taken in large doses.

We are also very familiar with the toxicity of some varieties of cassava. The toxicity is attributed to the presence of cyanogenetic compounds, especially linamarin, which is the source of the thicyanate found in most cassava meal. Antithyroid effects of cassava and thiocyanate have also been reported [26-27]. It is the proper preparation of these cassava varieties that can make them safe for human consumption.

Some *Euphorbiaceae* Plants species such as Jatropha species, ***Euphorbia kamerunic*** **(Yor. *Oro Agogo*)** and ***Euphobia lateriflora*** (Yor. *Enuopiri*) have purgative actions and are used in the treatment of numerous dermatosis and intestinal parsitosis. These plants, however, produce copious milky irritant sap or latex which contains compounds with deleterious effects on the skin and eye, causing severe inflammation and acute skin detmatitis. Such compounds include [28,29] hydroxyphobol esters, ingol esters and hydroxyingenol esters found in these plants. The juice from *Anacardium occidentale* (Cashew seed shell) burns the skin and causes skin dermatitis. The seed contains long-chain phenols[30] unishiol, cardanol, cardol and methylcardo.

From some of these examples and many more that time will not allow me to mention now, it is very clear that mother nature gives us

everything we need, but sometimes, what she gives is a little unrefined or contaminated, requiring processing before it is in the form we can use or the form we prefer. Chemistry sets to achieve this.

THE CHALLENGES OF MY CAREER (1972-1995)

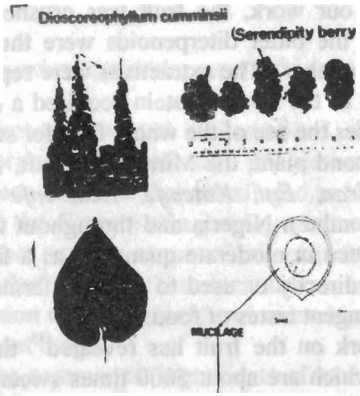
I joined the former Drug Research Unit of this great institution as a Research Assistant some twenty-three years ago in 1972 when the Unit was interested in substitutes for or alternatives to sucrose, the common table sugar. Tate and Lyle Industries, as a body, was also interested in the project which was undertaken within the frame-work of University/Industry co-operation. It was to be one of the "sweetest challenges" of all times, and a source of alternative sweetener for mankind.

From the point of view of a Research Unit in Pharmacy, natural product research that could lead to the identification and sourcing of *alternative sweeteners or flavouring agents* was most welcome, for its many benefits. Most of the 200 or so known sweeteners, -plant products and synthetic non-nutritive sweeteners, have shown highly undesirable taste qualities and have been discountenanced on toxicological grounds. Such reasons led to the ban in 1974 of sodium cyclamate which was discovered in 1937 and marketed in 1950. Apart from the toxic levels of many synthetic sweeteners, such as saccharin, sodium cyclamate and aspartame, most of the plant-derived sweetening agents known for example, glycyrrhizin, osladin, perillartine also occurred in small amounts, not of commercial interest!

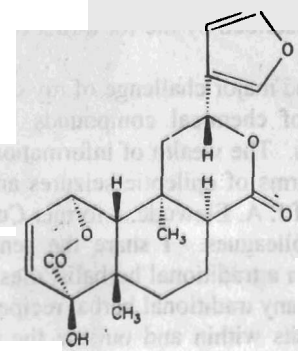
Hence, there was the desire for low-calorie intensity sweeteners which were thought would be less toxic and which could be better tolerated by the diabetic or such other persons who must take carbohdrate-restricted diets or medicines.

Our field survey led to the identification of some Nigerian plants containing sweet substances in their fruits. Further work led to the identification of sucrose and its hydrolytic products as the major sweeteners of the fruits, except two plants which proved more interesting and, therefore received greater attention in subsequent years.

One of the plants, *Dioscoreophyllum cumminsii,* (Yoruba-*Omu Aja*) is a twinning climber and presents an interesting chemistry. The fresh, fully-ripened berries are red and contain an intensely sweet polypeptide.



The sweet compound is about 3,000 times sweeter than sucrose on a weight basis. It was reputed to be the sweetest natural product known at the time, and was also the first known protein to exhibit remarkable property of potent sweetness. While the fleshy pericarp of the berry has a persistent. very sweet taste due to the content of its taste-active polypeptide, the seeds taste extremely bitter. This is, therefore, an interesting situation where one finds an extremely bitter substance with a very sweet substance in the same fruit. The "sweet challenge" was to identify the chemical nature of the two substances and be able to process them for human use. We have isolated[35] two compounds, *columbin* and *isocolumbin*, which taste very bitter.



1. Columbin
2. Isocolumbin
   8-C epimer

During our work, the fruit was crushed in water and the sweet polypeptide and the bitter diterpenoids were thus extracted in water, one contaminating the other. The extractives were separated by dialysis, but this was only partial as the sweet protein acquired a lingering bitter after-taste. This fact precludes the use of the whole fruit for sweetening purposes.

The second plant, the Miraculous fruit, *Thaumatococcus daniellii*, Yoruba *Ewe Eran, Eni, Katemfe, Kekerenfe* or *Adunduntan* grows abundantly in Southern Nigeria and throughout the West Coast of Africa. The *fruits* are eaten in moderate quantities as a free sweet by children and farmers, sucked directly or used to sweeten fermented wine or to suppress the bitter or astringent tastes of foods.

Our work on the fruit has revealed[36] the presence of two major sweet proteins which are about 5000 times sweeter than sucrose. *Katemfe* fruits are now known to contain the sweetest substances in the world and can be used as sweetener,flavour enhancer and food additive. In fact, the sweet proteins have been incorporated in animal feeds, tooth-paste, soft dirnks, flavours, chewing gum, cigarette tips and some pharmaceuticals in which they serve to mask the bitter taste of drugs or sweeten the products.

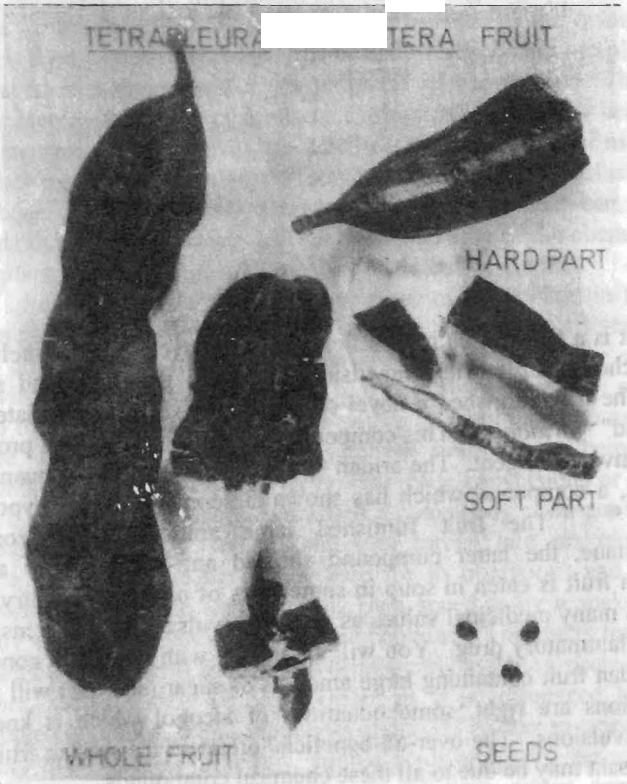
Each *Katemfe* seed is covered by a thin transparent gel, which swells naturally in water to about 6 times its original size of seed and form the core of a carbohydrate polysaccharide. This we identified [37,38] as an arabinoglucuronoxylan. For commercial exploitation of the sweeteners, the polysaccharide and sweeteners are usually extracted together. This requires careful ion-exchange chromatography for the separation of the polysaccharide from the proteins. This contribution to the development of a natural protein sweetener led to the complete identification of three NEW natural products described by me for a first time. It is indeed an addition to chemical literature.

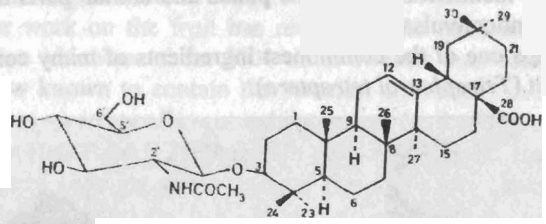
The second major challenge of my career is the identification from medicinal plants of chemical compounds with anticonvulsant and anti-infective properties. The wealth of information on medicinal plants used to manage various forms of epileptic seizures and convulsions came through the Late Chief J. A. Elewude, a former Consultant Herbalist to the Unit or some of his colleagues. I share the sentiment once expressed by a colleague that when a traditional herbalist dies, it is as if a library has burnt down. From the many traditional herbal recipes collected through organised home to home visits within and outside the state, more than 150 natural products that are used in the management of one form of convulsion or the other are now known [20,39]. I use this opportunity to pay tribute to a man who

worked so hard for the growth and development of traditional medicine in this environment.

Most of the ethnobotanical and ethnomedical information came through written or oral literature (incantations). We have not bothered with incantations or investigations of plants that are alleged to have a power that can stop the rain or reduce the distance of a journey as these are beyond the present mandate of the Unit and the scope of our chemistry and biology. We have, however, noted that some of these incantations are very useful as they help in the identification of some plants and animal parts useful in the preparation of anticonvulsant drugs.

Perhaps one of the commonest ingredients of many concoctions is the Aridan fruit (*Tetrapleural tetraptera*).





It is a fruit which herb-sellers have displayed on their shelves as a drug of choice for febrile convulsions, infantile flatulence and stomach gripes. The fruit furnished a novel compound which I have isolated[40] and "christened" "*aridanin*". This compound has shown [41,42] a great promise as an anti-convulsant agent. The aridan fruit also contains[43] large quantities of scopoletin, a compound which has shown anticonvulsant and hypotensive effects[44, 46]. The fruit furnished large amounts of sucrose and hentriacontane, the latter compound showed anti-inflammatory activity. The aridan fruit is eaten in soup in some parts of our great country, and it has shown many medicinal values as an anticonvulsant, an hypotensive and an anti-inflammatory drug. You will also agree with me that a concoction of the Aridan fruit containing large amounts of sugar (sucrose) will give, if the conditions are right, some quantities of alcohol which is known to inhibit convulsions. The over-all beneficial effect of the Aridan fruit as an anticonvulsant may be due to all these chemical compounds.

Chief Lambo in 1979, and late Chief Elewude in 1980, claimed that the tobacco leaf is an excellent remedy for convulsions, giddiness, depression, lassitude, aches and certain nervous diseases and noted that the leaf could be used alone but NOT in very large amounts. The caution, "not in very large amounts" was found to be very valuable.

Nicotiana tabacum, the tobacco plant, is an interesting plant from which I isolated[47] high quantities of scopoletin and scoparone, from the leaf. These compounds have shown anti-convulsant effects. As I mentioned earlier, the leaf also contains alkaloids chief among which is nicotine, a known convulsant drug. Two interesting phamacological properties of nicotine need be high-lighted: the action of nicotine has been found to be biphasic-the first phase of short or transient stimulation and a second phase of long depression. An increase in the quantity of tobacco leaf means an increase in the quantity of nicotine and an increase in the quantity of the anticonvulsant phenylpropanoids. Biologically, this implies more pronounced stimulation and a longer phase of depression. The over-all effect is increased toxicity of the extract, which is not good for health. With a little material used however, the CNS depressant effects of nicotine and the sedative and anticonvulsant effects of the simple coumarins can be of mush benefit for the management of convulsions. One can, therefore, conclude that to benefit from our little understanding of the chemical nature of this plant, there is the need to use a little material at a time.

Research has shown that treatment of convulsion in the middle ages emphasized some substances of occult power, frog's liver and even human urine, preferably collected from the first witness to the seizure. In our environment too, the use of local gin, corn steep, human or cow's urine used to be very popular. Substances with a pungent or sharp taste-sodium chloride, urine, or dilute copper sulphate solution are being used in traditional medicine to temporarily arrest febrile convulsions or used as an antidote. I have, for instance, witnessed a convulsing child get some relief with the common salt (sodium chloride) forced into his mouth! The question is, could urine have been used for its obnoxious and unpleasant sharp taste? I have also seen a young man spued at by a snake get some relief by washing off with urine. Urine contains[49,50] products formed in the putrefaction of all forms of food and drinks-carbohydrates, proteins, etc. and therefore, varies widely in composition, as it is influenced by diet and pathologic conditions. Urea represents about 3% of human urine, and there is a very high level of ammonia, simple acids and salts, essential amino-acids, aromatic acids, sulphides, phenols, vitamins, odour, enzymes, fatty

acids, purine bases, pigments, ethereal sulphates etc. present. Many of these compounds and other urine metabolites such as the isoflavones: equol, and 4-0-methyl equol are physiologically –active and they possess hypnotic, sedative and anaesthetic effects. It is note-worthy that the barbiturates, and many other related potent drugs for the epileptic, are commercially prepared by the condensation of urea, a major component or urine, respectively with malonic and glycolic esters of guanidine, hydroxyl acids and acid chlorides, also well known constituents of urine.

Perhaps for the fear of the unknown constituent which may be a poison, for the composition of urine which may be difficult to standardize, and to discourage the re-introduction of a waste effluent into the system, the use of urine as a vehicle should be discouraged. It is, however pertinent to reason that the herbalist may be right.

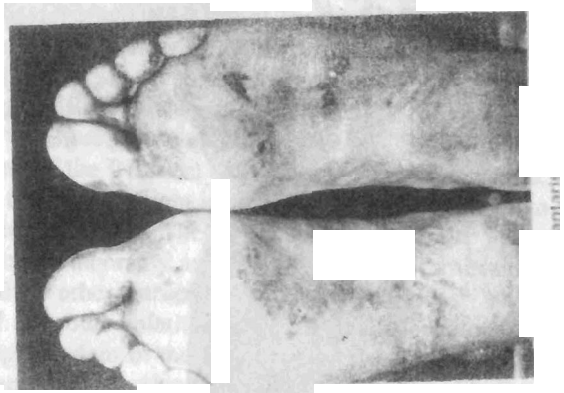
A study of the chemistry and anticonvulsant actions of the giant sulphur-smelling insect *Paltothyreus tarsatus* (Yor., *Ikandu, Ikamodu*) and the external secretory gland of the Civet cat (*Viverra civetta,* Yoruba, *Iseta, Ibon eta*) was undertaken to gain an insight into why herbalists include them in their anticonvulsant preparations. The alcoholic extract of the insect showed anti-leptazol effects in laboratoy animals. The extract furnished [51] dimethylsulphide and five other structurally-related sulphides which represent about 8.5% of the total volatile component and constitute the source of the peculiar sulphur odour of the insect. Three ketones-camphor, benzophenone, 9-heptadecanone are also present with formic acid, fatty acids and cholesterol forming the bulk of the compounds identified. The presence of formic acid and simple organic acids, is useful as pyruvic acid and acetic acid derivatives are known to show anti-convulsant effect in animals.

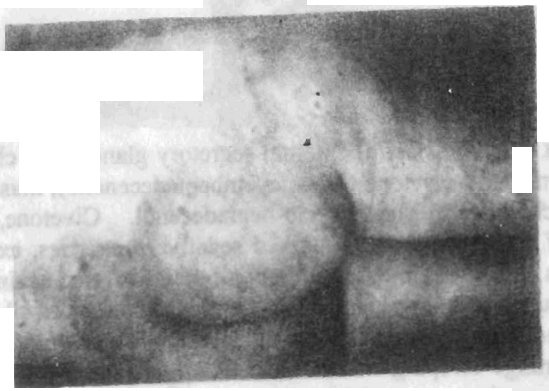
The result of our investigation of the civet cat gland is more interesting.

The civet cat (*Viverra civetta*) external secretory gland has a characteristic smell and furnished[52] civetone (9-cis, cycloheptadecenone), muscone, many fatty acids, cholestrerol and 9-cyclo-heptadecenol. Civetone, the major compound of the gland showed marked sedative properties, extending for over 50 hours and it was found to protect all the mice used against leptazol-induced convulsions at low doses. No fatality was noticed as all the animals used recovered fully afterwards. Here again, there is a chemical evidence to justify the strange sleeping habit of the Civet cat and the actions of the herbalist in using the extract of this gland as an anticonvulsant.

Studies on the Antifungal Agents of Medicinal Plants

My research team is also deeply involved in the development of herbal drugs from our abundant natural products. The leaves of Red acalypha (*Acalypha wilkesiana*), an ornamental plant, introduced here but now naturalised, have folk-loric use in the treatment of various fungal infections (dermatomycoses), and bacterial infections of the skin.

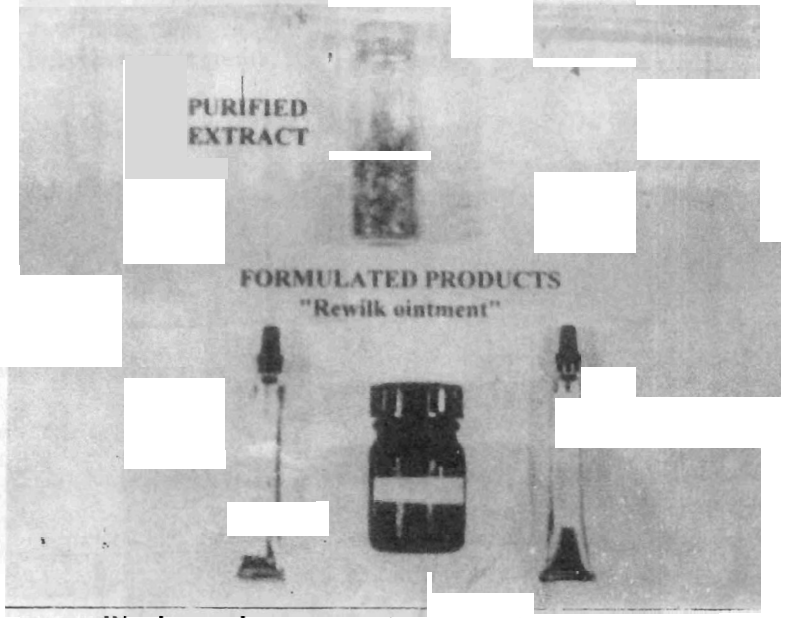




Pityriasis versicolor

Pityriasis versicolor

Chemical work has revealed flavonoid compounds and tannins which showed[55] antibacterial and antifungal effects. The purified fractions were formulated into an ointment in a further study. Our results showed [56] a very stable product which when given to volunteers with various fungal skin infections gave very promising results, with over 98% therapeutic success. This result has encouraged a more detailed chemical study of the plant and related species. Today the Unit is proud of a suitable plant product that is receiving further chemical and clinical trials.



We have also attempted the development of topical herbal medicaments (I.e. therapeutically-effective non-toxic standard drug) from ***Ageratum conyzoides*** **(Yor. *Imi esu*).** *Ageratum* conyzoides, otherwise known as the craw-craw plant, is a weed which has medicinal values as a remedy for eczematous skin, craw-craw chronic ulcers, sores and wounds. In traditional medicine, its tender leaves are used in wound or sore dressing. Such wounds/sores have healed within the shortest time possible. Twelve isolated chemical compounds mainly polyoxygenated flavones and 51 other components of the essential oil fraction are now known [76-79]. The wound-healing and antifungal properties of this plant are ascribed to many of these compounds and have been established to be superior to those of Vaseline gauze[80]. Our formulated product is stable, therapeutically viable and is undergoing further scientific tests.

Perhaps an area where I have the greatest satisfaction or personal joy is in my contribution to the chemistry of the Nigerian Rutaceae. It is a

third challenge of my career. The Rutaceae is a very large plant family that has been the source of many compounds with interesting biological properties.

Rutaceae are trees, shrubs or woody climbers, often spiny or thorny with the bark, and especially inner bark, yellowish. In West Africa, the Rutaceae contains members of economic importance including about 10-12 different Citrus species and 11 *Zanthoxylum* (Fagara) species [besides *Aegle marmelos, Aeglopsis chevalieri, Afraegle paniculata, Clausena anisata, Feronia limonia etc*]. It is note-worthy that all the eleven *Zanthoxylum* species are known as *ATA* in Yoruba language. Rutaceae plants are now better reputed for their medicinal values and are known to be capable of curing a dozen or more illnesses including the common cold, bronchitis, indigestion, toothache, sore gum, cancer, rheumatism, psychosomatic diseases, sickle-cell disease, lumbago; syphilis, genito-urinary problems etc

Plant metabolites such as alkaloids, amides, phenylpropanoids etc are known to exhibit various biological properties. Six classes of alkaloids have been isolated from the 7 species of *Zanthoxylum* investigated to date. The representative alkaloids, nitidine and chelerythrine, were isolated[57-58] from all *Zanthoxylum* species investigated. The furoquinolines and to a lesser extent, the aporphines have a widespread occurrence and have been isolated from all the 7 *Zanthoxylum* species I have investigated. The acridone alkaloids seem restricted [59,60] to one species (*Z. leprieurii*) only. Carbazoles which have defied identification in any *Zanthoxylum* till now have been isolated by us from four species along with 3-methyl carbazole identified from one species. This contribution represents a first report of the carbazoles from the *Zanthoxylum.*

With some of the results obtained, it is now possible to relate some therapeutic values of the plants with some of the chemical constitutents. Nitidine and fagaronine have shown anticancer activity[61,62]. Apart form its medicinal value as an inhibitor of tumours, nitidine has also shown[63,64] antihypertensive effects. The pure alkaloid was found to lower both the systolic and diastolic blood pressures remarkably.

The distribution of aromatic amides in the West African *Zanthoxylum* is also of interest. Apart from one report each of the occurrence of cyclopropane-carboxamide from *Z. rubescens* and *zanthamamide* from *Z. thomese* and three reports of fagaramide from three other *Zanthoxylum* species, we have reported the presence of all the other 21 aromatic amides now known in the genus. In fact 14 of these amides are new natural products to which we have given different names, such as

dioxamin, dioxamide, rubemamin, rubemamide and rubescenamin etc from *Zanthoxylum rubescens, eimarie*-all of which are now accepted in the chemical literature[65-68].

Fagaramide showed[69] anti-inflammatory effect in laboratory animals and we have recently (in 1988), showed that two aromatic amides, rubemamin and dioxamin, which we isolated[66-67] from *Z. rubescens* had[70] anticonvulsant propeties. The detailesd biological values of these aromatic amides are just being understood.

Rutaceae (*Zanthoxylum*) roots are used, particularly by the elderly, as chewing sticks and as tooth-ache remedy.

These roots have been found to give a warm, rather pungent and benumbing effect on the pallate, this is usually accompanied by profuse salivation. The names "tooth ache tree" and "Ata" in Yoruba language seem to describe the properties of these plants. The alkamide, (N-isobutyldeca-2,4-dienamide)-pellitorine, was isolated[71] as the local anaesthetic from *Zanthoxylum zanthoxyloides* in 1963. We have isolated[58-72] this compound also from two other *Zanthoxylum* species. The distribution of aliphatic amides is also of interest. Apart from a recent report of N-isobutylocta-2, 4-dienamide in *Z.gilletti* and the three reports of pellitorine, my group has reported[57-60] the presence of all remaining 5 aliphatic amides[72]. All these amides charcterize the genus *Zanthoxylum* and have been isolated from all the species investigated. They are all collectively responsible for the pungency, the warm taste and antitussive properties of *Zanthoxylum* roots. Apart from the physiological property, the alkamide, N-isobutyldecadienamide also shows[73] high insecticidal and larvicidal properties.

We have also studied[58] the presence and distribution of other constituents-sterols, coumarins, lignans, etc, and have noted that the seven *Zanthoxylum* species studied accumulate related chemical-type constituents in varying quantities. Differences have, however, been noticed in the ability of the plant species to accumulate a particular group of compounds. The results of our work[74-75] on other Rutaceae plant species have been very useful in chemotaxonomic studies and in the development of our phytomedicines.

Mr. Vice-Chancellor, my modest contributions to my various projects have resulted in the publication of many technical reports and 54 scientific manuscripts distributed in 16 learned journals.

THE CHALLENGES OF OUR TIMES

We live in an era when the general contributions of chemistry take the pride of place and as I have tried to demonstrate, the contributions of phytochemistry to health, regarded as part of the total effort towards sound health-care is still largely unexplored. Only a small percentage of Nigeria's plant species has been investigated chemically and only very little percentage of this has been submitted to biological screening.

All through my career, I have concerned myself with natural product chemistry which relates to unravelling the chemical nature of some natural products. Medicinal plant research has developed over the last 35 years from routine chemical compound isolation and identification to a more purposeful search for biologically-active chemical constituents. I have had

to seek collaboration with biologists (including pharmacologists) to examine the various bio-activities of plant constituents. The link with traditional healers has helped the documentation of the knowledge held by these herbal practitioners.

The collaboration with botanists guarantees accurate plant identification which is a pre-requisite to making use of relevant information on plants. The scientific process that leads from the flowering plant to the isolation and identification of the biologically-active chemical constituent is

very long, tedious, very expensive and requires a multidisciplinary approach involving many well trained and devoted scientists.

One feels worried about the future of phytochemistry in our environment and what we, as a people do to our environment and plants, and most importantly, how we use the plant. It is on these premises that I would like to create an awareness and later on base my recommendations to our governments and the general public who are the main users of these products.

In its early history, mankind treated nature with reverence and harming nature was considerred a deadly sin. Nature, in all forms, was considered superior and unfathomable. Today, man has accumulated knowledge and practical skills and now sees himself as superior to nature, setting himself the goal of conquering it more and more and subordinating it to his own interests. This feat has been linked with economic growth, rapid development and modern civilization.

It is however, becoming apparent that the arrogance of technical knowledge scares nature with wounds that may take time to heal. We have been told that the balance in the relationship between man and the rest of nature to which he is inextricably linked has been upset and that the survival of man is in jeopardy. We have been told, that man now stands at the threshold of irreversible climate change, that there is the depletion of ozone layer and the warming of the earth, that the deserts are expanding and that much land and water are drying out, the rivers, the seas and the oceans are being polluted, that only a half of the world's urban population breathes clean air. We note that it is the plant that suffers and suffers. Man is now faced with the formidable task of re-orienting itself towards building a more humane economy in which safety and sustainability save both nature and the individual human being from the destructive consequences of economic growth or civilisation. Man is being advised to save his face, and base his activities on the "Laws of nature", and in the words of Mikhail Gorbachev "man must foster greener ways".

Nigeria is one of the many countries of the world where the resources to provide adequate modern health care (orthodox or conventional medicine) is extremely very limited and so borne out of real need and necessities, many Nigerians rely on the time-old skill (i.e alternative or complementary medicine) and natural resources especially plants to alleviate their health problems. In practical terms, Mr. Vice Chancellor, plants more than any other natural product, have cured the illnesses of the world and so **IF WE KILL THE PLANT THE WORLD WOULD**

SUFFER GRAVE CONSEQUENCES. Nigerians threaten the environment in many ways-through the over-use of our resources, through an uncontrolled use of chemicals that can pollute the soil and through neglect and waste. For instance, the Nation loses many species of plants annually to bush burning and the indiscriminate clearing of useful plants even in regions designated forest reserves. I give another example-between 1978 and 1984 seven beautiful stands of *Khaya senegalensis* (Yoruba, *Oganwo*) adorned a part of the Road 1 and could be seen immediately one drives past the sports area of the University. These beautiful trees were soon recognised by members of the University community as potent antimalarial drug. Each day witnessed the uncontrolled peeling of their stem barks. The trees have not been able to cope with the incessant mutilation of their bodies and today all these trees have been destroyed. This community has utilised the plants in excess of their natural capacity for regeneration.

The present trends in plant research in our country calls for a re-appraisal of our goals. Personnel is short and financing is grossly inadequate, indeed very poor, encouraging loss of incentive and motivation a direct effect of political and economic instability. As technical progress now makes chemistry more sensitive and specific, and as our institutions of higher learning can no longer provide all the required support, the high expectations of innovation may not be readily fulfilled. It should be noted that without sophisticated basic research, there will be no new and better pharmaceutical and agricultural chemicals for our use. The intelligent public must also realise that a family or a nation relying only on buying and selling and without a definite ideology for growth will remain perpetually dependent on other families or nations with nothing new to offer its future generations.

"Diet is health, diet is medicine", so said Socrates several hundred years back. Hippocrates, the Greek physician, widely regarded as the Father of Medicine also gave the advice "Let thy food be thy medicine". The maintenance of our health is a life-long and sacred duty, and we should realise that nothing is impossible for the omnipotent nature if we understand him. A diet of raw food and juice can help us remain healthy. In fact, juice-diet has been found to be able to prevent as well as cure chronic diseases and keep our minds and bodies healthy. It has, for example been noted, from the point of view of natural therapies that our medicinal plants and foods-the seaweeds, the leafy vegetables, the medicinal mushrooms, the edible root and stems of our plants, when incorporated into our diet, can be

seen as a way of strengthening and building the vitality needed to deal with weakened or aging body; polysaccharide-containing plants, for example, contain immune potentiators which offer the best prospects for maintaining the immune function, the diaphoretics and the resins from many plants act directly against micro-organisms, flavonoid- as alteratives, decrease hyper-sensitivity reactions and generally modify a large number of immunological actions, saponins from plants behave as adaptogens as they effect a non-specific increase in the resistance of an organism to noxious influences. Chemical constituents from our natural foods generally support life in a way that science and what we call rational reasoning alone cannot fully explain. Perhaps another Biblical allusion will remind us as God said to man (in Genesis 1:29) on quote "I give you every seed-bearing plant on the face of the whole earth and every tree that has fruit with seed in it. They will be yours for food". There may be little or no need for us to expose ourselves to the harsh effects of synthetic foods.

RECOMMENDATIONS

1. **The Preservation of the Eco-system**

To preserve the eco-system should be our major concern. And if are to be inspired by the World Charter for Nature, regarding the protection of our green cultural heritage, our flora, we should avoid utilizing the plants in excess of their natural capacity for regeneration. We should also avoid the indiscriminate discharge of pollutants, particularly those that damage the land, atmospheric resources, plants and plant products. We should guide against the indiscriminate use of pesticides and fumigation agents, organic phosphate, herbicides, fungicides, and the unguarded disposal of engine oil, battery acids etc on our soil. A dump of undesirable chemicals on our soil may enrich the soil of some chemical elements (or salts) such as soluble oxalates or selenium which may be stored by the growing plants. Such have been found to be injurious to cattle or even man who feed on such plants. All such chemicals have also served to pollute our environment and our water.

We should also discourage burning our bushes annually, as this disturbs the growth and development of plants and animals on which man feeds; it is like setting the Lord's Pharmacy shop on fire annually.

Government and especially State and Local Governments should evolve a better surveillance strategy of our flora and encourage all concepts and programmes that will make our environment "greener" for the survival

of our future generations. We should, in the expression, of our ecologists, reforest the earth so that the planet can breathe clean air again.

2. **Support to Medicinal Plant Research**

Botanists are trained personnel involved in plant identification collection, germ-plasm surveys, in natural regeneration and propagation of indigenous plants. Phytochemists are involved in studies in plant biochemistry, chemistry of plant constituents and chemical modifications The training of phytochemists and taxonomists, the development of tropical herbaria and the maintenance of suitable medicinal gardens for the propagation of endangered plant species need be encouraged particularly with the current global interest in medicinal and spice plants.

It is being recommended to our governments at various levels that greater emphasis should be given to funding medicinal plant research in our higher institutions. Adequate investment in chemical and pharmaceutical research will ensure the availability of better pharmaceutical and agricultural chemicals for the use of the teeming masses of this country.

Many Nigerian academics who have travelled abroad at one time or the other to study or to spend a leave have been sponsored using a fellowship. specialised government or agency funds. These qualified Nigerians have, most of the time, worked for those agencies or governments that financed them. Our various governments should think along these lines to be able to attract qualified foreigners to come and work for short periods for our great country

3. **Quality Assurance of Herbal Remedies**

The use of plants in the struggle for survival against diseases particularly in curing and healing can be traced back to the early civilizations in the Near East, India and China, and it is a persistent aspect of present-day health care. In fact, the growth and consumption patterns of Nigeria's population pose ever increasing demands on the supply of natural food products and medicine

A judicious use of our natural products therefore will continue to be of immense value to mankind.

(i) Herbal remedies should be obtained from reliable and trusted sources from the trusted herb dealer or collector or trained personnel who can handle such products properly. Herbs and herbal products should be handled in a way to reduce or totally eliminate microbiological contaminations.

(ii) The directions for use and dosage should be noted for all remedies so collected or purchased. If side effects are known, these should also be properly indicated. Care should be taken of toxic botanicals, including adulterants. Such remedies with side effects should not be used for long periods.

(iii) Herbal remedies should be handled and stored with care, and should not be exposed to long spells of light to check photodecomposition or transformation of chemical constituents or kept indefinitely for years unattended when it will grow mould and loose its value.

(iv) Mildly-acting herbal remedies should not be used for very serious illnesses requiring urgent medical attention, for example, surgery; an overdose is not the answer.

(v) Breast-feeding mothers and our pregnant women should take greater care in taking herbal remedies. A herbal remedy may not be taken simultaneously with other medicines.

(vi) It should be noted that there may be variations in the chemical constituents of some plants, even when there are no morphological or floral differences, and this will affect the quality of some herbal products.

(vii) Scientific result, whether documented in learned scientific journals or announced over the media, including pages of the newspapers, should be interpreted with the greatest caution to check abuse and mis-use. An excited parent who once read in the newspapers on the efficacy of a plant extract in curing a particular disease prepared a concentrated boiled extract of what was sold to her in the market, and ingested this into her son. Every glass of such an extract probably contains over 8gm of a mixture of over 50 chemical compounds at intolerable dosage levels. The result, as one may guess, is no more to cure the disease but to do more damage to the child. In essence, self medication should be avoided.

Training and Re-training of Traditional Healers (including ditional birth attendants)

Traditional medicine is an heritage of every culture of the world, its ctice varies form one culture to another, and is influenced by modern

technologies and civilization. Traditional healers erstwhile custodian of traditional medicine, in the face of modern-day usage of herbal products, need exposure, organised training and refresher courses just like other professionals. The Drug Research and Production Unit moved along this line some four years ago and the survival of the training programme remains very much on the administration of the Faculty.

It is being suggested to our governments and institutions to organise some training schemes for those healers who can benefit from them for an improved and enhanced productivity. It will also provide the opportunity to check quacks and charlatans who parade themselves as traditional healers.

5. **Prevention of Diseases in Traditional Medical Practice**

Prevention of diseases takes a prominent position in traditional medical practice. For example, the fruits of *Lagenaria brevilflora (*Yor. *Tagiri)* are usually harvested and dropped inside homes with the belief that they will ward off small pox, measles and related viral diseases; or sliced in water for ducks or chicks to drink, with the belief that the sliced fruit contains anti-viral agents, general disinfectants or water clarifiers to combat insect- and water-born diseases. The leaves of *Launaea taraxacifolia,* the antiasthmatic plant, otherwise known as wild lettuce or "Yanrin" in Yoruba language are eaten as vegetable freely. The plant has folk-loric uses in the treatment of measles and asthma. It is indeed the first drug of choice for asthma and is known to greatly reduce the incidence of asthmatic attacks.

As there are some scientific justifications for the use of these plants, it is being recommeended that more attention should be given to the prevention of diseases in all forms.

6. **Our Feeding Habits**

Life is nature's gifts to us and we can make the most of this cherished gift only by reverting to mother nature. It should be noted that hot and spicy foods from modern books of cookery more often cater for our tastes rather than natural foods which cater for our dietary needs. The secret in the values of natural foods and juice diets is the abundance of vitamins minerals and enzymes present in them.

It is being recommended that greater encouragement should be given to the effective exploitation and utilization of plants for their nutritional values. Since we agree to the popular saying that "ALL FLESH IS GRASS", we should continue to strengthen and rejuvenate the flesh with FRESH plant material daily for a chemical balance and nourishment of the body's driving force.

ACKNOWLEDGEMENT

Mr. vice-chancellor, every statement I make draws me closer to the inauguration of the chair of phytochemistry at the Drug Research and Production Unit of this great institution. I thank the University, for making it possible for me to develop my English and German connections. I have enjoyed many financial and technical supports provided by many agencies and institutions around the world particularly the Tate and Lyle Industries and the University of Reading both in England, the Henrich-Hertz Stiftung, the German Academic Exchange Service (DAAD) and Westfalischen-Wilhems University all in Germany, and also the United Nations University based in Tokyo. I am proud to be associated with Great Ife and to have been able to contribute, through God's Grace, to its greatness in a modest way.

And finally, I sincerely thank my audience for sparing the time to come and grace this occasion with your presence, God bless you All.

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