UNIVERSITY OF JOS

OF NATURE, KNOWLEDGE AND HEALTH: THE MOLECULAR BASIS OF NATURAL PRODUCTS DEVELOPMENT

INAUGURAL LECTURE

BY

AGUIYI, JOHN CHINYERE,

Pharm.D (Italy), Ph.D in Pharmacology (Jos).
Professor of Pharmacology
Department of Pharmacology
Faculty of Pharmaceutical Sciences
University of Jos, Jos, Nigeria.

==UNIJOS INAUGURAL LECTURE SERIES 49==

Friday March 25, 2011

AGUIYI, JOHN CHINYERE,

UNIVERSITY OF JOS

OF NATURE, KNOWLEDGE AND HEALTH: THE MOLECULAR BASIS OF NATURAL PRODUCTS DEVELOPMENT

INAUGURAL LECTURE
Delivered at the University of Jos
On the 25th MARCH 2011

BY

AGUIYI, JOHN CHINYERE,

Pharm.D (Italy), Ph.D in Pharmacology (Jos).
Professor of Pharmacology
Department of Pharmacology
Faculty of Pharmaceutical Sciences
University of Jos, Jos, Nigeria.

==UNIJOS INAUGURAL LECTURE SERIES 49==

Introduction

The beauty and complexity of nature tells us something about God. However, there is much more to be discovered about God than His creative power and design. To grow in the knowledge of God and of Jesus Christ is to draw closer and closer to what they desire. Do you long for that today?

In the beginning God created the heavens and the earth. And God said, 'let the earth bring forth grass, the herb yielding seeds and the fruit, tree yielding fruit after its kind' and God saw that it was good (Genesis 1:11). And God said, 'behold, I have given you every herb bearing seed, which is upon the face of the earth and every tree, in which is the fruit of a tree yielding seed, to you it shall be for meat (Genesis 1:29, Psalm 104:14) and the leaf for medicine' (Ezekiel 47:12, Revelation 22:2).

Ancient civilization greatly depended on local flora and fauna for survival. Experiments were carried out with various berries, roots, leaves, mineral and animal parts to find out what effects they had and as a result, many crude drugs were observed by the Traditional Medicine Practitioner (TMP) to have some medicinal use. At present, twenty five percent of the modern medicines are developed from plants that were first used traditionally, and many synthetic drugs have also been obtained from natural precursors. In recent times, the spotlight on medicinal plant research has increased all over the world and a great deal of evidence shows the immense potential of medicinal plants used in various traditional systems. More than 13,000 plants have been studied worldwide for their medicinal values (Lewis and Elum-Lewis, 1977). An inventory of medicinal plants compiled by the World Health Organization in 1978 that covered only ninety member countries, contained 20,000 species of which only about 250 were of widespread use and some have been studied to identify their main active chemical compounds (Simon, 1984).

Natural products provide unlimited structural diversity derived from biologically diverse sources. While biodiversity produces vast chemical diversity, gaining access to the sources that can provide medicinally useful chemically diverse structures remains a challenge.

Chemists now possess an enormous technical potential to obtain from a single basic molecular structure, a very large number of derivatives, each with a different side chain. These provide scope and hope of an unlimited proliferation of potential drugs. The fundamental aim now, though often difficult to realise, is to develop, from a naturally occurring molecule in therapeutic use, new basic molecular structures with appropriate therapeutic properties and minimal side effects or toxicity. Drug discovery begins with basic ideas, ideas relevant to therapeutic targets and sources of compounds. Therapeutic targets can arise from genomics, molecular cloning, and detailed understanding of biochemistry, pharmacology and knowledge of the traditional uses of natural products.

Biodiversity

The 1992 Earth summit in Rio de Janeiro defined biodiversity as: The variability among living organisms from all sources, *inter alia*, terrestrial, marine and other aquatic ecosystem. These ecological complexes include diversity between and within species, genes and ecosystem.

Biodiversity is important because each species can give scientists some clue as to how life evolved. In addition it helps to understand how life functions and the role of each species in sustaining ecosystems. However, it is not distributed evenly on the earth. It is consistently richer in the tropics than in the temperate region. As one approaches Polar Regions, one finds less populations of these species. Flora and fauna vary depending on climate, altitude, soils and the presence of other species.

Biodiversity is a reservoir of resources to be drawn from, for the manufacture of food, pharmaceuticals and cosmetic products. Wild plant species have been used for medicinal purposes before the beginning of recorded history. For example quinine for treating malaria comes from the *Cinchona* tree, digitalis from the foxglove plant *Digitalis purpurea* for treating chronic heart disease and morphine from the poppy plant *Papaver somniferum* is used for pain relief. According to the National Cancer Institute (USA), over 70% of the promising anticancer drugs come from plants in tropical rainforests. It is estimated that of the 250,000 known plant species, only about 5,000 have

been researched into for possible medical application (Grabley and Sattler, 2003).

To fully capitalize on the extensive biodiversity available to us in natural products, high-throughput screening processes need to be improved upon so that they can provide a more adequate description of whether or not any given compound may be considered to be potentially active. Admittedly, there are no sound estimates for the actual total number of species of plants, shrubs, trees and fungi that exists worldwide (Cordell, 1998). However, abuse of our natural resources will certainly limit our ability to learn from nature (Cordell, 1995). Lack of proper conservation and the wanton destruction of forests, especially the rain forests, will obviously diminish the opportunity to gain valuable knowledge from a staggering amount of indigenous biodiversity and obviate the possibility to generate a valuable therapeutic agent. In fact, research into natural products can lead to the depletion of sources of natural products and the eventual extinction of species (Concannon *et al.*, 1997). The problem of depletion led to the formation of the International Cooperative Biodiversity Group (ICBG) programme. This programme is to facilitate research and drug discovery from natural sources. It also promotes the identification and establishment of an inventory, conservation of natural resources and economic development of the communities where these products are collected (Cordell, 1995).

Although there are different areas of vegetation in Nigeria, there is no proper methodology regarding dissemination of existing knowledge on the state of natural occurrence of medicinal plants.

The scope of cultivation of medicinal plants has not been clearly defined to the farmers. Therefore they lack awareness of the economic benefits. The conservation of biodiversity has become a global concern. Although not everybody agrees on the extent and significance of current extinction of flora and fauna most studies consider biodiversity essential (Cordell, 1998).

Traditional Medicine

Traditional medicine (indigenous or folk medicine), a rich source of treatment with herbs, is the first point of health care for many people in Africa

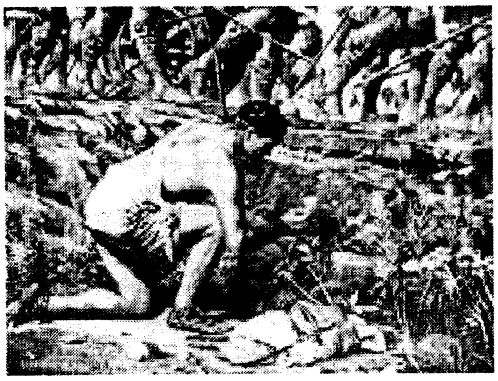
and the third world countries. It is also a part of African culture and comprises of medical knowledge systems that developed over generations within various societies before the era of modern medicine. Early recognised Greek compilers of existing and current herbal knowledge include Hippocrates, Aristotle, Theophrastus Dioscorides and Galen (Heinrich *et al.*, 2005)

a). Trational medicine in ancient Babylon www.pharmacy .wsu.edu

b). Arab apothecaries http:// journals.prous.com

An eighth century Baghdad apothecary shop

c). Dioscorides and ancient Pharmacy



d). African Traditional Medicine www.news.bbc.co.uk

Definition of Traditional Medicine

The World Health Organization (WHO) defines traditional medicine as the health practices, approaches, knowledge and benefits incorporating plant, animal and mineral techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintaining the wellbeing of humans (WHO, 2008).

In Africa, traditional medicine is a holistic discipline involving indigenous herbal and African spirituality, typically involving diviners and midwives. Generally, diagnosis is reached through spiritual means (incantations, divination) and a treatment is prescribed, usually consisting of an herbal remedy that has not only healing abilities, but also symbolic and spiritual significance.

Despite its claim to be able to cure various and diverse conditions such as cancer, HIV/AIDS, high blood pressure and others, modern science still consider methods of traditional medicine practices as primitive. This is so because the traditional diviner-healers are considered by many as practitioners of witchcraft and magic (mystical and cosmic connections, in contact with spirits and sacrifice). However, little has been done to investigate the legitimacy of these practises, as many still believe that the native medical practices are superstitious. These setbacks notwithstanding, researchers are beginning to appreciate traditional and herbal medicine because of its healing power and possible source of lead compounds for new drug development.

Traditional/alternative medicine is becoming more popular worldwide. In developed countries, reliance on alternative medicine for preventive care

has increased tremendously. In France, 75% of the population has used herbal therapy at least once, in Germany, 77% pain clinics provide acupuncture: and in the United Kingdom, expenditure on alternative medicine stands at US $ 2,300 million per year (WHO, 2002). In developing countries, where more than 80% of the population lacks access to essential medicines, traditional therapies are used for preventive or palliative care. The situation has given rise to concerns among health practitioners on the issue of safety, policy, regulation, biodiversity and protection of traditional knowledge.

The global market for traditional therapies stands at US $ 60 billion a year and is steadily growing (WHO, 2002). For these reason policies on the protection of biodiversity and traditional knowledge are necessary.

In the light of these facts, it is therefore, pertinent to encourage the use of herbal remedies as an integral part of our healthcare system because they are cheap, accessible and acceptable to millions worldwide. In addition, the herbal medicine practitioners should learn how to cultivate and preserve the herbs, and to have a written documentation of their herbs and practices.

Biotechnology and Drug development

Biotechnology is simply the use of biological processes to make things for humans e.g. wine, bread etc. It is also the application of the newer techniques such as recombinant DNA technology to produce products not available using traditional techniques (Genetically Modified Organisms, GMO).

Science is a body of knowledge. But this is not just any knowledge. It is knowledge obtained through a study and practice that is referred to as scientific method. This method relies on observations and experimentation to describe a natural phenomenon. Technology is the application of the scientific knowledge.

Most scholars widely agree on the important contribution of science and technology research in accelerating development in most advanced and emerging economies. Such contribution can only come about when the outcomes of research are successfully deployed to serve developmental needs.

Genetically modified organisms (GMO) and drug development

The discovery of DNA:

DNA was first discovered in 1869 by Friedrich Miescher. However, its role in the transmission of genetic material was not confirmed until a series of experiments by Alfred Hershey and Martha Chase in 1952. Finally in 1953, the 3- D structure of DNA was solved by Rosalind Franklin, James Watson and Francis Crick.

In 1944, Oswald Avery, Colin Macleod and Maclyn McCarty, demonstrated that DNA was the material of heredity. They then stated that it is a molecule consisting of only four lives. Some stretches of DNA are organized into genes, each of which contains the information for making one or more proteins. Humans utilize hundreds of thousands of proteins to carry out nearly endless numbers of functions in the body. The human genome contains approximately 3.2 billion base pairs of DNA, of which as little as 1-2% codes for over 20,000- 25,000 genes (Alvi, 2000).

The advent of recombinant DNA technology has given scientists the ability to study and manipulate genetic materials in countless number of ways. Our understanding of genetics has fundamentally changed the way we study, diagnose and even treat some diseases.

Genetically modified organisms (GMOs) are described as organisms whose DNA has been altered to include an additional gene(s) from another organism to give that altered organism a desired characteristic (Transgenic organism).

The first GMO was created in 1973 by Stanley Cohen and Herbert Boyer. Since then, numerous GMOs have been created including genetically altered corn, soya bean, tomato, rice, potato, carrot and wheat GFP (Green Fluorescent Protein) to name but a few. GMOs today are present in many products available on supermarket shelves. Many people do not realize they are eating GMOs every day. This is partially because in the United State of America, products which contain GMOs do not need to be labelled. (www.learner.org/chemical/courses/biology/units/gmo/mages/html).

Generating GMOs

GMOs are usually generated by recombinant DNA technology, which allows scientists to artificially combine genetic material from one or more organisms. In the laboratory, scientists create a plasmid or circular piece of DNA which contains gene(s) of interest. Once the plasmid is created, it is ready to be inserted into the plant. A common way to genetically engineer a plant is to use *Agrobacterium tumefaciens*. Others include using a gene gun and electroporation. The individual plant will be screened to determine whether they have been genetically modified. While the process may sound not too difficult, it often takes about seven to fifteen years to create a new market ready GMO.

Detection of GMOs

GMOs are easy to detect given recent advances in science. Basically, there are two main assays that could be used to detect a GMO, an enzyme-linked immunosorbent assay (ELISA), which detects foreign proteins. The other is the polymerase chain reaction (PCR) which is efficient and sensitive and detects foreign DNA.

The first recombinant bacterium was created in 1973 by Herbert Boyer, founder of Genetech, the first company to use Recombinant DNA technology. In 1978, the company announced the creation of an *E.coli* strain for producing the human protein insulin.

GMOs have been created for many reasons;

I) to improve nutrition,

II) to help crops flourish in poor farming conditions such as drought or high salt content,

III) to make plants resistant, improve flavour, increase shelf- life, increase hardiness and

IV) to make allergy free products.

They also offer many benefits to the environment and the consumer. GMOs help to fight world hunger and nutrition deficiencies, prevent erosion and reduce the need for harmful pesticides and herbicides (www.pbs.org/wgbh/harvest). However, despite these advantages, some

people entertain the fear that these plants might alter the natural evolutionary process, creating super weeds and super bugs, able to attack the GMOs and naturally occurring plants.

In response, scientists have been working to reduce genetic pollution through the creation of terminator gene technology. This involves the production of plants with sterile seeds, such that if cross pollinated, the seeds will not produce any second generation product.

GMOs and drug production

The GM medicines are similarly as controversial as the GM foods. However, this will be a lifeline for providing better treatments and care for patients.

A company GTC-Biotherapeutics based in Massachusetts is already manufacturing protein based medicines for the treatment of exotic diseases e.g. rare genetic disorders that cause dangerous blood clotting. This medication is produced in animals rather than in humans.

Obviously, in medicine, GMOs have widespread applications. They are used in biological and medical research, production of pharmaceutical drugs, experimental medicine (gene therapy). Transgenic microbes and animals have been used to prepare drugs for haemophilia, dwarfism, diabetes etc.

The new anti snake vaccine from *Mucuna pruriens* protein is to be prepared through the new recombinant DNA technology, thus as a GMO medicine.

Molecular Approach

Molecular biology is the study of the molecular basis of life. The discovery of the structure of DNA, the elucidation of the flow of information from gene to protein and the development of recombinant DNA technology are some of the outstanding achievements of molecular biology. Recombinant DNA technology is being used to produce valuable proteins like insulin and to tackle some of the most challenging and fundamental problems in medicine. Plants have provided man with an impressive number of synthetic drugs (Adewole, 1993). These active compounds derived from the plants are

multifunctional and possess more than one biochemical and pharmacological properties (Baker, 1995). Investigation of plant composition and traditional claims often provides a rapid and affordable opportunity to gain a comprehensive insight into the biochemical and pharmacological complexities underlying many biological processes. In order to prepare a clone for the large scale production of a novel glycoprotein from a plant seed (MUC 101 UJ) extract that has been shown to have snake venom neutralising effect (Aguiyi,1996), molecular biology approach is essential to isolate the gene(s) or cDNA(s) encoding this protein. This cannot be achieved without knowledge of the complete amino acid sequence. Detailed genetic knowledge raised the possibility of designing drugs, based upon the expression of given genes in a disease process.

The molecular approach to drug discovery and development from medicinal herbs is based on a combination of genomics (through sequencing of cDNA from the plant), proteomics (through systemic identification and characterization of the plant components) and bio- computing (through the development of a unique biochemical and pharmacological database on plant constituents). The biggest handicap to the development of human and animal vaccines against snakebite is the lack of available data and models for its production.

Venomics

Venomics is the detailed characterization of the toxin content of venoms (venome).It is relevant for a deep understanding of the evolution and the biological effects of the venom. Venom is a poison that one animal injects into another animal.

Venomous organisms are widely spread throughout the animal kingdom, comprising more than 100,000 species distributed among all major phyla such as chordate (reptile, fishes, amphibians and mammals). In any habitat there is competition for resources and every ecosystem on earth supporting life contains poisonous or venomous organisms.

The evolution of the advanced snakes and their venoms

The suborder of snakes (Serpentes) of the reptilian order Squamata, named for their scaly skin, includes about 3000 extant species placed within approximately 400 genera and 18 families. The timing of major events in snake evolution is not well understood, however, owing in part to a relatively patchy and incomplete fossil record (Chan, 1995; Chung *et al.*, 1995). Nevertheless, after more than 100 years of research, the most generalised phylogenetic view is that the group evolved from a family of terrestrial lizards during the time of the dinosaurs in the Jurassic period about 200 million years ago. After the end of the non- avian dinosaurs reign around the cretaceous- Tertiary boundary 65 million years ago (Clark, 1996), the boids (the ancestors of boas, python and anacondas) were the dominant snake family on earth. Within the Cenozoic era that followed, advanced snakes (colubrids) arose as long ago as in the Oligocene epoch (25 - 35 million years). Colubrids, the family which we regard today as typical snakes, remained a small taxon until the tectonic plates drifted apart from the equator and the cool climate pushed boids to disappear from many ecological niches. Colubrids quickly colonized these empty habitats and this family today comprises over two- thirds of all the living snake species (Compostella *et al.*, 2001). Colubroidea encompasses viperidae (30 genera, 272 species of corals, mambas, cobras and their relatives), atractaspididae (14 genera, 65 species of stiletto snakes and molevipors), and colubridae (290 genera, almost 1700 species of rear-fanged and are harmless colubrids). It is noteworthy that the front-fanged venom delivery system appeared three times independently in Viperidae, Elapidae and Atractaspididae (Concannon *et al.*, 1997).

The presence of a venom- secreting oral gland is a shared derived character of the advanced (Caenophidia) snakes. All venomous squamates, snakes and venomous lizards such as gila monster beaded lizards, komodo

dragon, etc, share a common venomous ancestor (Abel *et al.*, 2002) Given the central role that diet has played in the adaptive radiation of snakes (Connolly, 1997) venom thus represent a key adaptation that has played an important role in the diversification of these animals. Venoms represent the critical innovation in ophidian evolution that allowed advanced snakes to transit from a mechanical (constriction) to a chemical (venom) means of subduing and digesting prey larger than themselves, and such venom proteins have multiple functions including immobilizing, paralysing, killing and digesting prey.

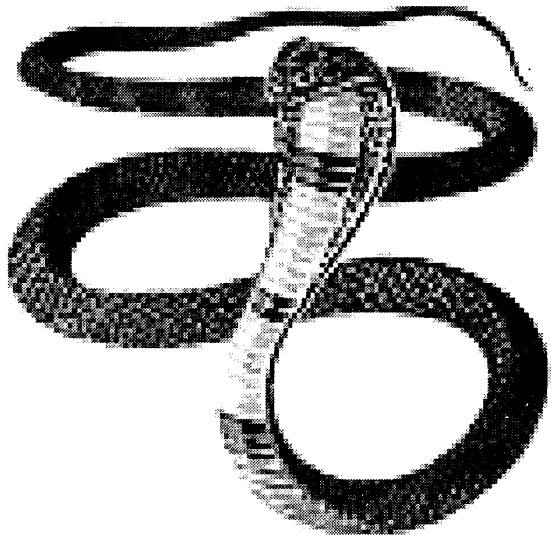
These snake venoms contain complex mixture of hundreds of important pharmacologically active molecules, including low molecular mass organic and inorganic compounds (histamine and other allergens, polyamines alkaloids), small peptides and proteins (Bindeil *et al.*, 2001; Cordell, 2002; Cragg *et al.*, 1993). The biological effects of venoms are complex because different components have distinct actions and may, in addition, act in concert with other venom molecules. The synergistic action of venom proteins may enhance their activity or contribute to the spreading of toxins.

The existence in the same venom of a diversity of proteins of the same family but differing from each other in their pharmacological effects reflects an accelerated positive Darwinian evolution. Thus, to deal with uncertainty, snakes are required to have a variety of proteins "available" in their venom at all times to deal with different preys. Also understanding how toxin genes are regulated and how toxins mutate in an accelerated fashion may reveal not only the molecular basis for adaptative variations in snake phenotypes (Davignon *et al.*, 1987) but also to learn how to use deadly toxins as therapeutics agents.

Venom represents an adaptive trait and an example of convergent evolution (Artuso, 1997). Venoms comprise mixtures of peptides and proteins tailored by natural selection to act on vital systems of the prey or victim. Knowledge of the inter- and intra-species and genetics, individual and geographic venom variability has applied importance for the design of immunization protocols arrived at producing more effective polyspecific anti-venom. The high degree of target specificity makes toxins valuable scaffolds for drug development.

The medicinal value of venoms has been known from ancient times. The snake is a symbol of medicine (Genesis) due to its association with Asclepius, the Greek god of medicine.

Venoms represent a huge and essentially unexplored reservoir of bioactive component that may cure disease conditions which do not respond to currently available therapies e.g. Bradykinin – potentiality peptide isolated from Brazilian viper *Bathrops jaraca* converted into Angiotensin converting enzyme (ACE)-inhibitor drug, captopril (Baucer, 1997).



Cobra snake

Venomous snakes

Venomous snakes belong to the colubriod super family. Among members of this super family, three consist of venomous snakes: colubridae, viperidae and Elapidae. The overall toxicity of their venoms is due to enzymes as well as non enzymatic proteins (Tu, 1997). The complexity and composition of snake venoms and their great variability explain the huge diversity of their biological effects.

In addition to understanding how venoms evolved, a major aim of venomic projects is to gain a deeper insight into the spectrum of medicinally important toxins in venoms to uncover clues in order to solve the riddle of the medical effectiveness of venoms and to learn how to convert deadly toxins into life saving drugs (Bindseil *et al.*, 2001). A long term research goal of

venomics of applied importance for improving current antivenom therapy is to understand the molecular mechanisms and evolutionary forces that underlie venom variation. Thus, a robust knowledge of venom composition and of the onset of genetic and geographic venom variability may have an impact in the treatment of bite victims and the selection of specimens for the generation of improved antidotes (Cannell, 1998).

Venom composition

The two major snake venoms of medical importance include those of vipers (Viperidae) and cobras (Elapidae).

The cobra venom contains three acidic lethal phospholipase A_2 enzymes, three cardio-toxins and two major neurotoxins, whereas the viper venom contains thrombin-like enzymes, platelet-aggregation inducers and inhibitors as well as hemorrhagenic proteases (Tan, 1991).

Mechanism of venom actions:

Vipers: The venom disrupts haemostasis causing bleeding disorder and haemorrhage.

Secondary effects include neurotoxic symptoms, respiratory distress, hind paralysis and convulsions.

Cobra: Cobra venom works presynaptically at neuromuscular junctions to inhibit Ach or transmitters from nerve ending, thus causing paralysis. All these actions are based on PLA_2 enzyme.

Phospholipase A_2 (seven isoenzymes, L-amino acid oxidase, endonuclease, phosphodiesterase, 5-nucleotidase, proteinases and endopeptidase), exhibit a wide range of activity which may contribute to the clinical manifestations of envenoming. These include haemolysis, neurotoxicity, platelet damage, oedema formation, vasodilation and release of autocoids, cardiotoxity, myotoxicity, hypotensive and oedema-inducing effects (Tan, 1991).

Snake Venom as Medicine

Snake venoms can be deadly, but also contain components of medical and biotechnological value. The proteomic characterization of snake venome proteomes, snake venomics has a number of potential benefits for basic research, clinical diagnosis and development of new research tools and drugs of potential clinical use (Calvete et *al.*, 2007). Venom components are currently being investigated for their potential as antibacterial, antiviral (hepatitis, botulism) and anticarcinogenic agents (Zug *et al.*, 1999).

What is the problem?

Snake-bites remain a major public health and agricultural problem throughout the world, in particular Africa. Snake bite affects both man and his domestic animals causing specific problems (Cardiotoxic, neurotoxic) and ultimately death in both.

Table 2: Global Snakebite Profile

COUNTRY	NUMBER OF BITES (per year)	NUMBER OF DEATHS (per year)
America	7000	12-15*
Brazil	20170	122#
Australia	2000	2#
India	100000	20000
Sri-Lanka	1000	6
Nepal	20000	1000*
Nigeria	100000	500+

Key:

*WHO, 1987

#Warrel, 1996

+Theakson, 1998

Venomous snake-bite is a serious health emergency hazard and socio-economic problem facing the local farming communities in Nigeria for which there are acute supply of anti-venoms and no vaccine. There is no snake- bite

National or state data to assess the current burden of snake- bite in Nigeria. However, estimates based on hospital returns from the North central zone (Plateau, Gombe and Taraba states) showed that the incidence is about 500 per 100,000 people per year. These data greatly underestimates the real impact of this health emergency problem since most people affected do not seek hospital treatment but traditional remedies. Worldwide, about 5 million snakebites are recorded each year with about 2.5 million envenoming and about 125,000 deaths (WHO, 2005).

Antivenom

Naja nigracollis (Nigerian cobra) and *Echis occellatus* (Nigerian carpet viper) are two important snakes indigenous to Nigeria. It is estimated that about 10 million vials of antivenoms are needed annually worldwide for treating snake bites (WHO, 2005). Unfortunately, the present worldwide production is below these needs. The production of antiserum for snake-bite management has declined due to economic constraint and lack of global interest. For many years now, the use of antiserum produced for injecting a horse with specific snake venoms has been the preferred method for snake-bite treatment in Nigeria and worldwide. However, this antiserum has the disadvantage of causing serious medical problems such as serum reaction to some individuals. Also implicated is the non availability of the product, high cost (N5000/vial) that can hardly be afforded by the local farmers due to poverty.

Novel Antisnake Venom Research

In response to this emergency health hazards of envenomation that is evident and as part of our responsibility to the community, in line with the University of Jos strategic plan and the national development goals, we have employed our expertise, through collaboration with Universities and research centres abroad and within, to build antivenom research and production capability. Our ultimate goal is to partner with government and the industry to build a national/ global centre of excellence for antivenom research and development (R & D) that will facilitate sustained training, growth,

development and production in Nigeria. In almost any part of the world, where venomous snakes occur, numerous plant species are used as folk medicine to treat snake bites (Houghton and Osibogun, 1993). In the light of these facts, we have conducted research to determine the efficacy of *Mucuna pruriens* plant seed that is being used by the Rukuba people in Bassa Local Government Area of Plateau state, as oral prophylactic drug against venomous snake- bites.

The results obtained so far, from our studies show that the active component(s), a glycoprotein of this plant seed like that of medically important snake venoms (cobra and viper) are multifunctional and possess more than one biochemical and pharmacological property. Further studies have demonstrated that protection of test animals is based on immunological and enzymatic mechanisms (Guerranti *et al.*, 2002) Appendix V.

Since the extract appears to share common epitopes with the venoms, the structural characterization of the seed proteins demonstrated that the bioactive protein designated gpMuc, is a multiform glycoprotein containing N-glycans. The matrix-assisted laser desorption ionization time of flight (MALDI-TOF) MS of the pools of N-glycan isolated from Mucuna pruriens seed glycoproteins by PNGase A treatment shows a mixture of ions that were assigned to (M+Na) adducts of high mannose –type N-glycans ranging from Man5-Man9 as well as x(1,3)-fucose and b(1,2)-xylose containing N-glycan from the truncated paucimannosidic structure. Assignments were done on the basis of N-glycans by homology with previous data on plant N-glycosylation (Lerouge *et al.*, 1998a). These glycans have been demonstrated to elicit antibodies (plantibodies) against snake venoms without any adverse immunological response (Aguiyi, 1999). The immunization of Sheep and Rabbits with Mucuna glycoprotein (gpMuc) without adjuvants elicits the production of core Fucose and core Xylose specific antibodies (Abs) IgG and IgM (Appendix VII).They are equally able to elicit immune responses in humans(personal communication). The immune- reactivity of the glycoprotein is ascribed to the presence of core (β1-2) linked xylose and core (α1-3) linked fucose modified N- glycans chains (Lisa *et al.*, 2006). To further identify and characterize the protein, it became necessary to apply systematic and multi-parallel approaches to study the association of snake venoms with the seed

protein on a global scale. As a consequence, high throughput technologies such as proteomics to profile genome wide expression of the protein levels have been used in this study (Appendix VII). In- depth analysis of the protein by use of two dimension gel electrophoresis coupled with matrix- assisted laser desorption ionization time of flight mass spectrometry and liquid chromatography tandem mass spectrometry, with the objective to characterize the protein and its antivenom network was carried out (Appendix VIII). One of the surprising findings of this proteomics study is the preponderance of proteins related to serine protease inhibitors and with anti-snake activity indicating that immune protective antigens are present in this seed. Also the internal and N- terminal sequence obtained after 2D-E and in gel digestion showed sequence homology with soya bean kunitz and Bowman Birk-type protease inhibitors (Appendix IX). This is interesting considering the fact that serine protease, metalloproteinase and PLA2 cause the disruption of haemostasis as principal mechanisms of action of some snake venoms. This sequence will be used in designing degenerate PCR primers for the amplification of the gene of interest and for the construction of a cDNA library. The amplified gene fragments encoding these proteins will be cloned. So far no laboratory evidence of toxicity has been observed in this study with the crude extracts and proteins (Aguiyi *et al.*, 2001).

We have shown that gp-Muc immunisation is an efficient means of generating antibodies with potent snake venom neutralising activity and that these antibodies neutralised venoms from a wide range of snake species. Given inter and intra-specific variation in snake venom composition of the vipers and Elapids, it is possible that based on the inter-generic effect of gp-Muc, this same product may be used in other African countries, Asia and South America. From these results, we can conclude that this plant seed component(s) has potential as a therapeutic agent for the immunization of humans and animals in the rural farming areas, obviating reliance on the conventional anti-venom and improving social and economic effects on farmers and food shortage. The Federal Government and interested organizations should contribute financially to make the large scale production of this thermo-stable, effective. affordable and injectable vaccine without any

serious side effect possible, and available to the communities ravaged by snake bites and are in need of anti-snake venoms.

Natural Products

The word "natural" is an adjective referring to something that is present in or produced by nature (Schoental, 1965). The term natural products today is commonly understood to refer to herbs, dietary supplements, traditional Chinese medicine (Holt *et al.*, 2002). Natural products generally originate from microbes, plants and animal sources (Nakanishi, 1999). Despite all that nature has provided mankind, it needs to be fully appreciated that the use of herbs as natural product therapy is different from the use of herbs as a platform for drug discovery and development. Natural products today are the most valuable sources of new drug leads, because the degree of chemical diversity found in natural products is broader than from any other sources (Harvey, 2001). A number of natural products currently exist which demonstrate potency against cancer, hypoglycaemia, hemoglobinopathies, leukemia, hypertension and a variety of other diseases (Mehta *et al.*, 2002; Sausville *et al.*, 2000). It is important, therefore, to know the history, folklore, origin of use, source, chemical structure, availability and method of preparation of natural products.

History of Natural Products

Some natural products have been discovered by chance and others as a result of extensive research. The discovery of penicillin by Alexander Fleming in 1929 led to the discovery of streptomycin and other antibiotics. In 1806, a German apothecary purified morphine from opium. In 1817, the French researcher Pierre Joseph Pelletier and Joseph Bienaime Caventou isolated quinine (a plant alkaloid) from the bark of the Latin American *Cinchona* (Quechua in Inca) tree. The bark of this tree has been used by the indigenous Quechua communities of Peru to treat cold and fever. The search for a new drug from plants is thus part of a long research continuum, with scientists observing the work of traditional healers as a starting point to finding new drug candidates (E.g. *Mucuna* Research) Once a single ingredient has been

isolated, its molecular and chemical structure must be determined (*Mucuna* components). Understanding a compound's structure can offer further insights into how the compound functions against the pathologies (e.g. *Mucuna* against snake venom).

Table 1: Selected drugs from Natural products

Drug/ Antibiotics	Use	Source of Drug
Opiates	Analgesic compounds	Poppies
Statins	Reduce cholesterol	Fungal metabolites
Vinca Alkaloid	Anticancer	Rose periwinkle (Family; *Catharanthus roseus*)
Artemether	Antimalaria	Quinghao (Family; *Cinchona*)
Penicillins	Chemotherapy	Fungal and Bacterial metabolites
Digoxin	Cardiac failure	*Digitalis purpurea*

The gradual depletion of the ecosystem containing plants with potential medicinal value is becoming an issue to traditional healers as well as scientists concerned with biodiversity and natural products (WHO, 2005). Globally, development, (urban and rural), deforestation and overexploitation are threatening the survival of these plants even in the wild.

A screen is a chemical biological assay that provides a tool that can be used to test for the presence and level of the target activity in a specific sample. In this approach, a crude product mixture is subjected to fractionation and the individual fractions are then assayed for specific biological activity.

It may not be out of place to update ourselves with latest advances made in natural product drug discovery, highlighting new methodologies such as high-throughput screening (HTS), enabling technologies, genomics, proteomics, templates for diversity oriented synthesis that are responsible for

dramatically driving this area. Today's programme demonstrates their application in driving these exciting products forward. Of note is the fact that only 5 - 15% of the world's approximately 250,000 flowering plants have been analysed for their possible medicinal use (Henkel, 2005). The chemical structures of natural product compounds are firstly identified by modern technology such as Mass spectrometry (MS), Gas chromatography/ Mass spectrometry (GC/MS), Infra-red (IR), Fourier Transform Infrared Spectroscopy (FTIR), Nuclear Magnetic Resonance (NMR), Fourier Transform Nuclear Magnetic Resonance Spectroscopy (FTNMR) and others. Several computer programmes have become available to scientists for the elucidation of the structure of a natural product. Advancements in chromatography, spectrometry and spectroscopy together with breakthroughs in the coupling of these technologies are important steps in the production of a fully automated and integrated natural products structure determination instrument, which will provide significant advantage to rapid identification of new natural product.

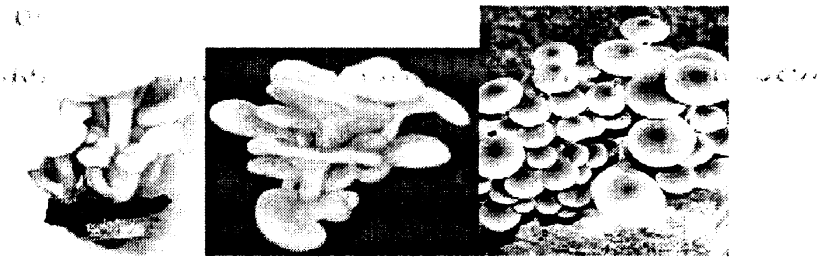
Natural products in drug discovery and development

Natural products have been a central source of drug discovery with the dwindling targets in the pharmaceutical drug pipeline and the disappointing outcome of the combinatorial chemistry route. To begin looking for a way out for Nigeria, we will revisit the potential of some existing chemically and biologically bio-diverse source of future prescribed drug leads e.g. Mushroom. Despite the impressive history of natural products as a source of many of our conventional modern drugs, the importance of this proven source of molecular diversity has been overshadowed in favour of plant products. Today mushroom (fungi) products belong to a well balanced portfolio in drug discovery, but presently underused by pharmaceutical companies. Pharmacologists need to explore the role of mushroom products as viable therapeutic leads in treating diseases for the future.

What are Mushrooms?

Mushrooms are not plants despite their former nomenclature, kingdom, phylum, class, order, family, genus, and species. Mushroom is a fruit body of a fungus bearing seeds (spore).

Mushrooms are fungi and contain no chlorophyll and are considered saprophytes (they breakdown and eat dead plants). There are 14,000 species reportedly recognized.



Mushrooms are nutritious:

- They are a good source of vitamins
- High protein content
- Low in fat and calories
- Complex carbohydrates- polysaccharide.
- They are also sources of phosphates, selenium, potassium, copper etc.

Mushrooms as medicines

They possess hypoglycemic activities, anticancer activity, antipathogenic activities, and immune system enhancing activity.

Drugs derived from Mushrooms:

The following drugs have been derived from fungi; Ergometrine, penicillin, lovastatin, ciclosporin, griseofulvin, cephalosporin.

Chemical composition of Mushrooms:

Proteins, glycoproteins (lectins), triterpenoids vitamins.

Vitamins: vitamin B, vitamin B_3, vitamin B_5 (panthothenic acid), vitamin B_9, vitamin B_{12}, vitamin D_3, vitamin K and selenium.

Amino acids; cystine, methionine; threonine, valine, isoleucine, leucine, tryptophan and phenylalanine.

Fatty acids; unsaturated and saturated fats.

Other benefits of mushrooms include; low energy, low purine, low glucose, low sodium.

A mushroom is a good source of a fiber. It also contains: sugar- mannitol, carbohydrates- polysaccharides, beta glucans, alpha glucans and glycoproteins, stimulants; macrophages, NK cells, T-lymphocyte cells, cytokines. Beta glucans are known as biological response modifiers.

Mode of action of Mushrooms

Beta glucans activate immune system by interacting with the macrophages- 1, antigen CD_{18} receptor on immune cells. Others include toll-like receptor 2; Dectin-1, lactosylceramide, scavenger receptors.

Mushroom direct antihormone activity: *Agaricus bisporus* inhibits the activity of aromastase, enzyme responsible for producing estrogen.

Some inhibit the activity of 5-alpha reductase, responsible for producing dihydrotesterone.

Direct antiviral and anti-microbial properties: *Pleurotus ostreatus* (oyster mushroom) – HIV; *Ganoderma lucidium* (Reishi) - HSV-1, HSV-2; *Cordyceps sinensis* - Hepatitis B. Anticholinesterase (ACH)-like activity – Muscarine, etc.

Recommendations

1. There should be a National policy for cultivation, conservation and propagation of medicinal plants for sustainable use in each ecological zone.
2. There should be the development of workable regulatory and administrative framework on issues of indigenous knowledge and the conservation of traditional medical knowledge and medicinal plant resource.
3. Government should develop a network of genetic resources for the identification of endangered plants for regeneration and protection.
4. There is a need for a National and State snakebite data.

5. Government and the industry should partner with the University to build a National Centre of Excellence for Antivenom Research and Development and Production.

Conclusion

Africa holds 13.4% of the global population but hosts only 1.1% of the world's scientific researchers. Harvesting of research potential deployment of knowledge from many disciplinary sectors into industrialization projects can enhance the capacity to attain the millennium developmental goals/social economic development targets.

Nigeria like Africa is seen as a raw material source and knowledge consumer. This notion must be changed, it must be considered as a contributor of knowledge and a producer of goods and services for its internal consumption and also supporting both internal and external economies. The time for change is now.

Nigeria needs internal intellectual solution that recognises its heritage in many areas including science and technology.

The university should see itself as the engine house in capacity building for the attainment of MDGs and development of new vision.

The African traditional knowledge and herbal plant knowledge is a source for the development of natural products.

The global market for medicinal plants is expanding and the indigenous providers can generate income from the use of their rich biological resources.

There is a threat of exhaustion of these plants from its natural habitat as a result of uncontrolled collection.

We should always explore the multiple linkages between indigenous knowledge and mainstream science for sustainable development, capacity building and intellectual development and discovery.

The Mucuna pruriens purified protein gp-Muc has potential as a therapeutic agent for the immunization of humans and animals against snake envenomation. These data obtained from the *Mucuna pruriens* project provides valuable structure/functional information on *Mucuna pruriens*

proteins but more importantly, a new opportunity to design toxin specific antivenoms.

Good news; eat mushrooms and live longer!

Outstanding Work

1. Full genomic sequence of gpMuc
2. Construction and selection of clones coding for gpMuc
3. Expression and purification of gpMuc
4. Biochemical characterization of gpMuc
5. Clinical trials of the vaccine (gpMuc)

Definition of terms

Genes: They are lengths (sequences) of genetic material (specific regions of the DNA) or information that results in a particular trait or characteristics.

Biotechnology: This is the application of the newer techniques such as recombinant DNA technology to produce new organisms or products not available using traditional techniques, so called living modified or genetically modified organisms (LMO and GMO).

DNA (Deoxyribonucleic acid): A nucleic acid that is a major constituent of chromosomes and is the hereditary material of the majority of living organisms.

Electroporation: A process whereby cells are treated with a very low electric current (using in solution) so that the cell membrane becomes porous and allows genetic material to pass through.

Living Modified Organism (LMO): Living organism resulting from modern biotechnology; an organism in which the genetic material has been altered in a way that does not occur naturally by mating and/ or natural recombination.

GMO: Genetically Modified Organisms

Living organism: A biological entity capable of replication or transferring genetic material. This definition covers plants, animals, fungi; micro organisms carried on the chromosomes and made up of DNA.

Clone: In molecular biology, a clone is an exact replica of all or part of a macromolecule (e.g. DNA).

Genomics: It is a discipline in genetics concerning the study of the genomes of organisms.

Proteomics: It is the large-scale study of proteins, particularly their structures and functions.

REFERENCES

Abel, U., Koch, C., Speitling, M., Hansske. F. G. (2002). Modern methods to produce natural- products libraries. *Curr. Opin. Chem.. Biol.*, 6(4): 453-458.

Aguiyi J.C., Johnson P.B., Obi C. I., Adoga G.I. and Igweh A. C. (1998). *In vitro* and *in vivo* evaluation of the antisnake effect of *Mucuna pruriens. West African Journal of Biological Sciences* 8: 30-36.

Aguiyi J. C., Igweh A. C., Egesie U. G and Leocini R. (1999). Studies on possible protection against snake venom using *Mucuna pruriens* protein immunization. *Fitoterapia* 70: 21- 26.

Aguiyi, J.C., Guerranti, R., Pagani, R., Marinello E., Blood chemistry of rats pretreated with *Mucuna pruriens* seed aqueous extract MP101UJ after Echis carinatus venom challenge. Phytother. Res. (2001). 15, 712-714.

Alvi, K. A. (2000). A strategy for rapid identification of novel therapeutic leads from natural products. In S. Cutler and H. Cutler (Eds.), *Biologically Active Natural Products.* CRC, Boca Ratson, FL. pp 185-195.

Artuso, A. (1997). Natural product research and the emerging market for biochemical resources. *J. Res. Pharmaceut. Econ.,* 8(2), 3-23.

Baucer, L.A (1997). Industrialization of drug therapy: Clinical Pharmacokinetics and pharmacodynamics, basic concepts of pathophysiology and pharmacotherapy. In J. T. DiPiro, G. R. Matze, L. M. Posey, R. L. Talbert, B. G. Wells, and G. C. Yee, (Eds) (L. M. Posey, Sect. Ed.), *Pharmacotherapy, A Pathophysiologic Approach*. 3rd ed. Appleton and Lange, Stamford, C T. Pp29-48.

Bindseil, K.U., Jakupovic, J., Wolf. D,. Lavayre, J., Leboul, J., Van der pyl, D. (2001). Pure compound libraries: a new perspective for natural product based drug discovery. Drug DIscov. Today. 6(16): 840-841.

Cannell, R. J. P. (1998). Follow- up of natural product isolation. *Methods Biotechnol.*, 4 (Natural Products Isolation): 425- 463.

Chan, K. (1995). Progress in traditional Chinese medicine. *Trends phamacol. Sci.*, 16(6):182- 181.

Chang S.T. and Miles P.G (2004). *Mushroom; Environmental impact.* Second edition, CRC press.

Chung, I., Kim, Y., Ahn, J., Lee, H., Chen, G., ManjiH. K., Potter, W. Z., Picker, D. (1995). Pharmacologic profile of natural products used to treat psychotic illnesses, psychopharmacol. Bull., 31(1), 139- 145.

Clark, A. M. (1996). Natural products as a resource for new drugs. *Pharmaceut. Res.*, 13/8:1133- 1141.

Compostella, F., Lay, L. (2001). Critical surveys covering the year 2000: Total syntheses of natural products. In A. Corbella (Ed.), Seminars in Organic Synthesis, Summer School, 26th, Gargano, Italy, June 18- 22, 2001. Societa Chimica Italiana. Rome, Italy, pp. 453- 581.

Concannon, J.A. DeMeo, T. E. (1991). Goldenseal: Facing a hidden crisis. *Endangered Species Bulletin.* 22(6): 10- 12.

Connolly, J. D. (1997). Natural products from around the world. Revista Latinoamer. Quim., 25(2): 77-85.

Cordell, G.A (1995). Natural products as medicinal and biological agents potentiating the resources of the rain forest. In P.F. Seidel, O.R. Gottlied, and M.A. colho Kaplan (Eds). *Chemistry of the Amazon*, American chemistry society symposium series, No 588, Washington, D.C, pp 8-18

Cordell, G.A. (1998). *Natural Products Updates*, 6(1), 2.

Cordell, G. A. (2002). Recent developments in the study of biologically active natural products. ACGC chem., Communiccation, 14: 31-63.

Cragg, G. M., Schepartz, S. A., Suffness M., Grever M. R. (1993). The taxol supply crisis. New NCI policies for handling the large- scale production of novel natural product anticancer and anti- HIV agents. *Journal of Natural Products*, 56: 1657- 1668.

Culled from Lullmann/Mohr/Hein/breger; Colour Atlas of pharmacology third edition, Thieme stuggart. New York 2005.

Davignon, J. P., Cradock J. C. (1987). In S. K. Carter and K. Hellman (Eds.). *Principles of Chemotherapy*. McGraw- Hill, New York, pp. 212- 250.

Thomas Henkel, Vice President Enabling Technologies, Bayer Healthcare. Pharma. R & D Europe Bayer A.G.

Frank Koehn, Director- Natural Products Discovery and Discovery Analytical chemistry. Wyeth Research.

Duke J.A (1981) *Handbook of legumes of world economic importance*. New York: Plenum press.

Faye L., Gomord V., Fitchette- Laine A.- C and Chrispeels M.J. (1993) Affinity purification of antibodies specific for Asn- linked glycans containing a 1-3 fucose or B 1-2 xylose. *Analytical Biochemistry*. 209: 104- 108.

Fitchette, A- C cabanes- Macheteau M., Marvin B., Satiat- Jeunemaitre B., Gomord V., Crooks., Lerouge P., Faye L., and Hawes C. (1999). Biosynthesis and imminolocalization of lewis A- containg N-glycans in the plant cell. *Plant Physiology* 121: 333- 343.

Fry B.G. and Wuster W. (2004) Assembling an arsenal; origin and evolution of the snake venom proteome inferred from phylogenetic analysis of toxin sequence. *Molecular Biological Evolution*. 21: 870- 883.

Fry B.G., Vidal N., Norman J.A., Vonk F.J., Scheib H., Ramjan S.F., Kuruppu S., Fung K., hedges S.B., Richardson M.K., Hodgson W.C., Ignjatovic V., Summerhayes E., and Kochra E., (2006) Early evolution of the venom system in lizards and snakes. *Nature* 439: 584- 588.

Fry B.G., Vidal N., van der Weerd L., Kochva E., and Renjifo C., (2009) Evolution and diversification of the Toxicofera reptile venom system. *Journal of proteomics* 72: 127- 136.

Grabley, S., Sattler, I. (2003). Natural products for lead identification: Nature is a valuable resource for proving tools. In A. Hillisch and R. Hingenfeld (Eds.), *Modern Methods of Drug Discovery*. Birkhauser Verlag, Switzerland, pp. 87- 107.

Greene H. W. (1983) Dietary correlates of the origin and radiation of snakes *American Zoology*. 23: 431- 441.

Greene H.W. (1997) *Snakes: The evolution of Mystery in nature*. University of California press, Berkeley.

Guerranti R., Aguiyi J.C., Leocine R., Pagani R., Cini G., Marinello E. (1999). Characterization of the factor responsible for the antisnake activity of *Mucuna pruriens* seeds. *Journal of preventive Medicine and Hygiene* 1(40): 25- 28.

Guerranti R., Aguiyi J.C., Neri S., Leocine R., Pagani R. And Marinello E. (2002). Proteins from *Mucuna pruriens* and Enzymes from *Echis carinatus* venom. Characterization and cross reactions. *Journal of Biological chemistry* 277(19): 17072- 17078.

Guerranti R., Aguiyi J.C., Ogueli I.G., Onorati G., Neri S., Rosati F., Del Bruno F., Lamparielo R., Pagani R. And Marinello E. (2004). Protection of *Mucuna pruriens* seeds against *Echis carinatus*. Venom is exerted through a multiform glycoprotein whose oligosaccharide chains are functional in this role. *Biochemical and Biophysical Research communication* 323: 484- 490.

Guitierrez J.M., Lomonte B., Leon G., Alape- Giron A., Flores- Diaz M., Sanz L., Angulo Y., and Calvete J.J. (2009) Snake venomics and antivenomics proteomic tools in the design and control of antivenoms for the treatment of snakebite envenoming. *Journal of proteomics* 72: 165- 182.

Hall I. Brown G. And Byars J. (1994) *The Black truffle*. New Zealand Institute of crop and Food Research, Wellington.

Harvey, A. (2001). The continuing value of natural products to drug discovery. *GIT Labouratory Journal*, 5(6): 284- 285.

Holt, G. A., Chandra, A. (2002). Herbs in the modern healthcare environment- An overview of uses, legalities, and the role of the healthcare professional. *Clinical Research Regulatory Affairs (USA)*, 19: 83- 107.

Houghton, P.J., Osibagun, (1993). I.M., Flowering plants used against snakebite. *Journal of Ethnopharmacol*ogy, 39: 1- 29.

Juarez P., Cosmos I., Gonzalez – candelas F., and Calvete J.J., (2008) Evolution of snake venom distegrins by positive Darwinian selection. *Molecular biology Evolution*. 25: 2391- 2407.

Khan M.D., R.I., Gatehouse J.A., and Boulter D. (1980). The seed proteins of cowpea (*Vigna unguiculata* L. Walp). *Journal of Experimental Botany*, (1599- 1611)

Koh D.C.I., Armugan A., and Jeyaseelan K., (2006) Snake venom components and their application in biomedicine. *Cell Molecular life science* 63: 3030- 3041.

Laing G.D., Renjifo J.M., Ruiz F., Harrison R.A. et al. A new Pan African polyspecific antivenom developed in response to the antivenom crisis in Africa. *Toxicon* (2003). 42: 35- 41.

Patrizzi L.D., Rosati, Guerranti R., Gerwig J.G., Kamerling J.P. (2006). Structural Characterization of N-glycans of gp-Muc from *Mucuna pruriens*. *Glycoconj Journal* 23:599-609.

Menez A (2002) *Perspectives in Molecular Toxicology*. John Wiley and Sons Ltd, Chichester, UK.

Metha, G., Singh, V. (2002). Hybrid systems through natural product leads: an approach towards new molecular entities. *Chemical Society Review*, 31(6): 324- 334.

Muthaura C.N., Rukunga G.M., Chhabra S.C., Omar S.A., Guantai A.N., Gathirwa J.W., Tolo F.M., Mwitari P.G., keter L.K., Kirira C.W., Mungari G.M., Njagi E.N. (2007) Antimalerial activity of some plants traditionally used in Meru district of Kenya. *Phytotherapy Research*. 21(9) 860- 867.

Nakanishi, K. (1999). An historical perspective of natural products chemistry. In S. Ushio (Ed.), *Comprehensive Natural Products Chemistry*. Vol. 1. Elsevier Science B.V., Amsterdam. Pp. 23- 40.

Pras N., H.J. Woerdenbag, S.Balterman , J.F. Visser, and W. Vanuden. (1993) *Mucuna pruriens*: Improvement of the biotechnological production of the anti- Parkinson drug L- dopa by plant cell selection. *Pharmaceutical world science* 15: 263- 268.

Quinn, R.J. (1999). High- throughput screening in natural product drug discovery in Australia utilising Australia's biodiversity. *Drug Development Research*, *46*(3/4): 250-254.

Rang, H.P; Drug discovery and development, http://intl. elsevierhealth.com/ catalogue/title.cfm? ISBN=97804403064203

Reid W.V., C.V. Barber., and A. La Vina. (1995). Translating genetic resource

right into sustainable development: gene co-operatives, the biotrade and lessons from the Philippines. *Plant Gen. Research Newletter* 102: 1-17.

Sausville, E., Johnson, J., Alley, M., Zaharevitz, D., Senderowiez, A. M. (2000). Inhibition of CDKs as a therapeutic modality. *Annals of N.Y. Academic Science*, 910 (Colorectal Cancer): 207- 222.

Schoental, R. (1965). Toxicology of natural products. *Food Cosmetics Toxicology*, 3(4): 609-620.

Simeon J.E. Herbs, An Indexed Bibliography, 1997- 1980: The scientific literature on selected herbs and aromatic and medical plants of the temperature zone Hamden, C T: shoe string press 1984.

WHO (2002). WHO Launches first global strategy on traditional and alternative medicine. *Press Release* WHO/38.

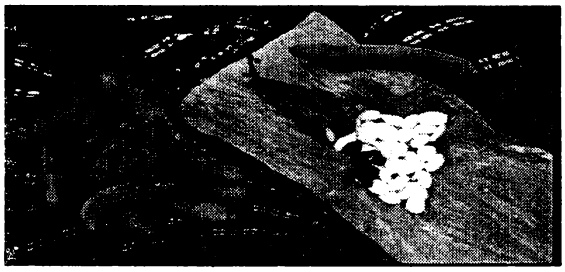
http://www.wordiq.com/definition/Biodiversity.

http://www.ericdigests.org/2000-2/biodiversity.html

http://www.dmoz.org/science/environment/biodiversity

APPENDICES

APPENDIX I



Plant Description of (1) *Mucuna pruriens leaves and pods climbing around a tree and, (2) Mucuna pruriens pods and seeds.*
***Mucuna pruriens* Taxonomy ID, 157653**

APPENDIX II

Table 2: Mineral element contents of *Mucuna pruriens* seeds (mg/100g dry matter)

Mineral Element	Content (mg/100g)
Sodium	76.42 ± 4.02
Potassium	200.40 ± 10.01
Calcium	162.30 ± 6.01
Magnesium	223.68 ± 15.01
Manganese	0.84 ± 0.12
Iron	1.00 ± 0.31
Copper	0.03 ± 0.01
Zinc	7.95 ± 1.24

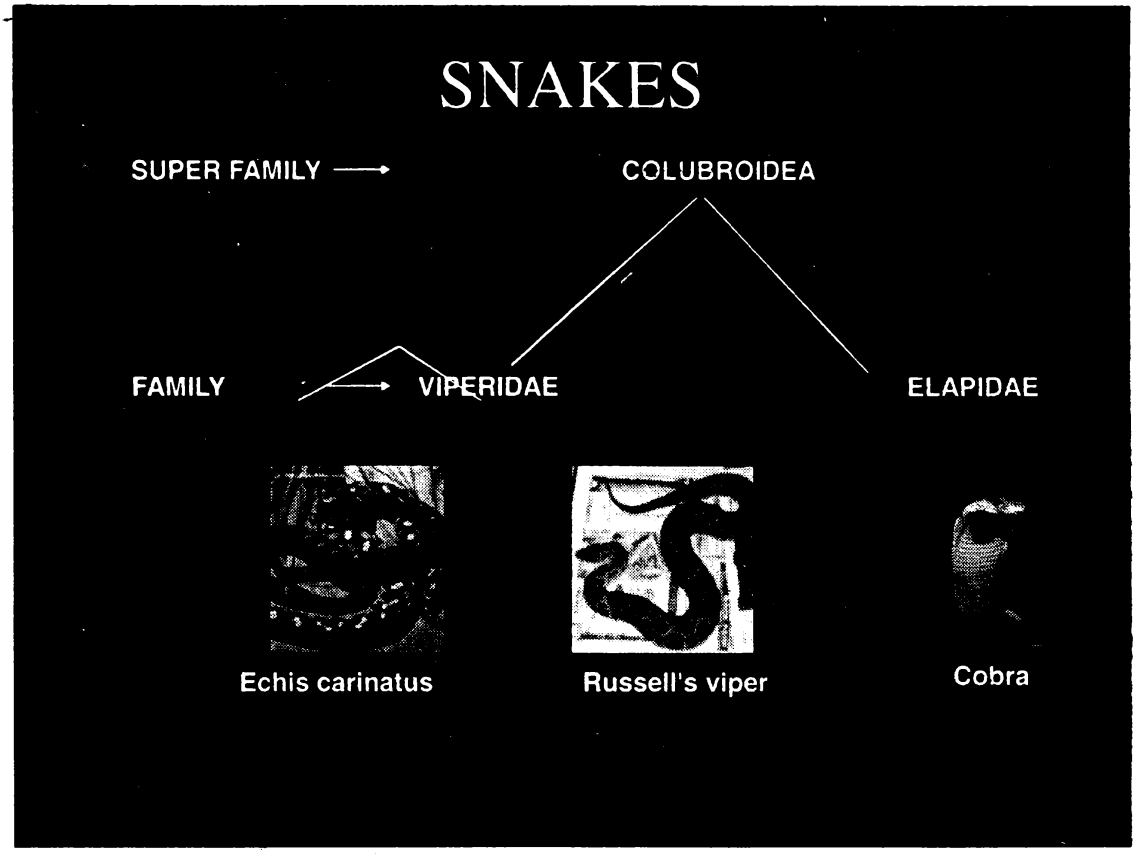
All values are mean of four separate determination ± S.D.

Table 3: Amino acid composition of *Mucuna pruriens* (g/16gN)

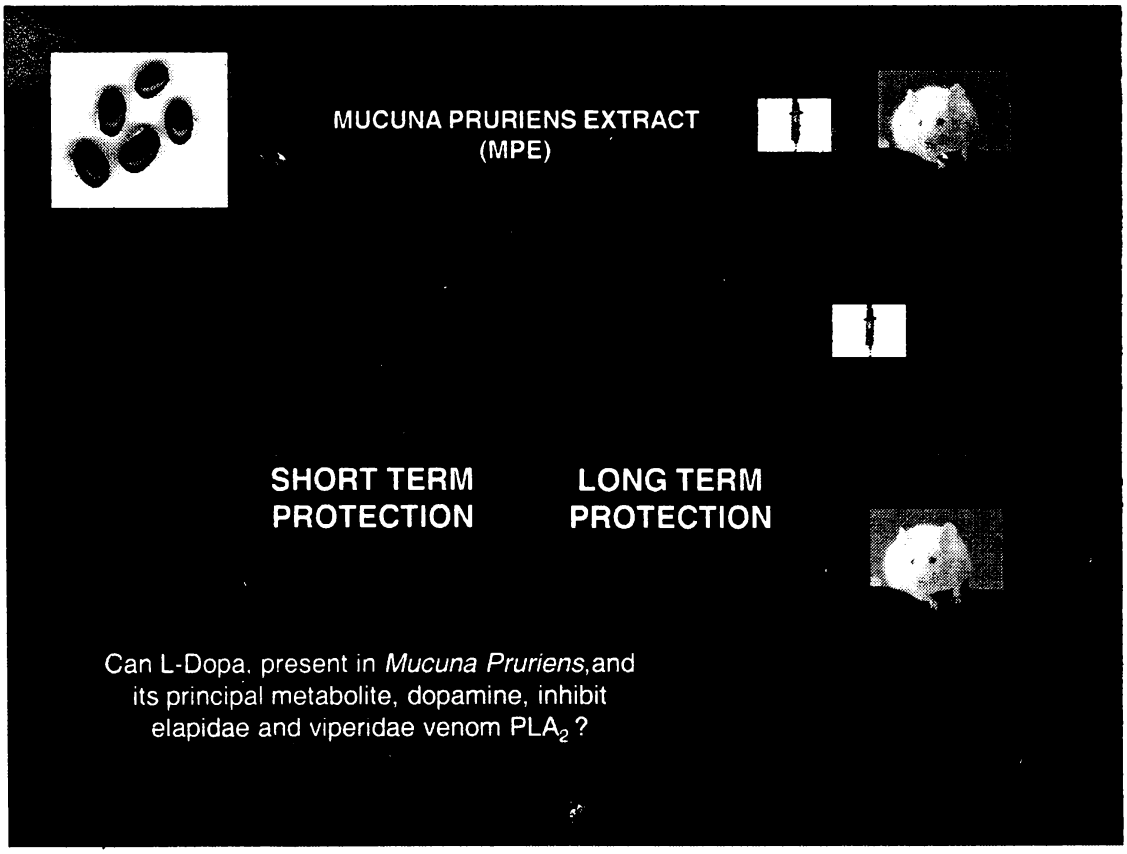
Amino acid	*Mucuna pruriens*	FAO references for proteins	Chemical score (%)
Isoleucine	3.18 ± 0.05	4.20	75.71
Leucine	7.39 ± 0.02	4.20	175.95
Lysine	3.83 ± 0.02	4.20	91.90
Methione	0.17 ± 0.02	2.20	32.22
Threonine	1.85 ± 0.03	2.80	66.07
Phenylalanine	4.42 ± 0.02	2.80	157.85
Valine	2.99 ± 0.03	4.20	71.19
Tyrosine	2.20 ± 0.01	2.80	78.57
Cystine	6.65 ± 0.03	2.00	332.50
Arginine	1.85 ± 0.03		
Histidine	4.08 ± 0.02		
Alanine	3.12 ± 0.02		
Serine	1.06 ± 0.03		
Proline	4.07 ± 0.02		
Glycine	4.09 ± 0.03		
Glutamic acid	8.91 ± 0.03		
Aspartic acid	2.12 ± 0.06		

The values are means of six determination FAO (1970).

APPENDIX III



APPENDIX IV



APPENDIX V

IN VIVO PROTECTION STUDY

Fractions	Dose (mg/kg)	Survivors/total			
		24h	1 week	3 weeks	3 weeks (Booster dose)
MPE	18	6/8	5/8	7/8	8/8
P	18	2/8	3/8	5/8	8/8
NP	18	5/8	3/8	2/8	2/8
Control	0	0/8	0/8	0/8	0/8

Time course of in vivo protective effect of MPE, P, and NP fraction against EV

APPENDIXVI

Antibodies against Snake Venom Raised by Mucuna pruriens

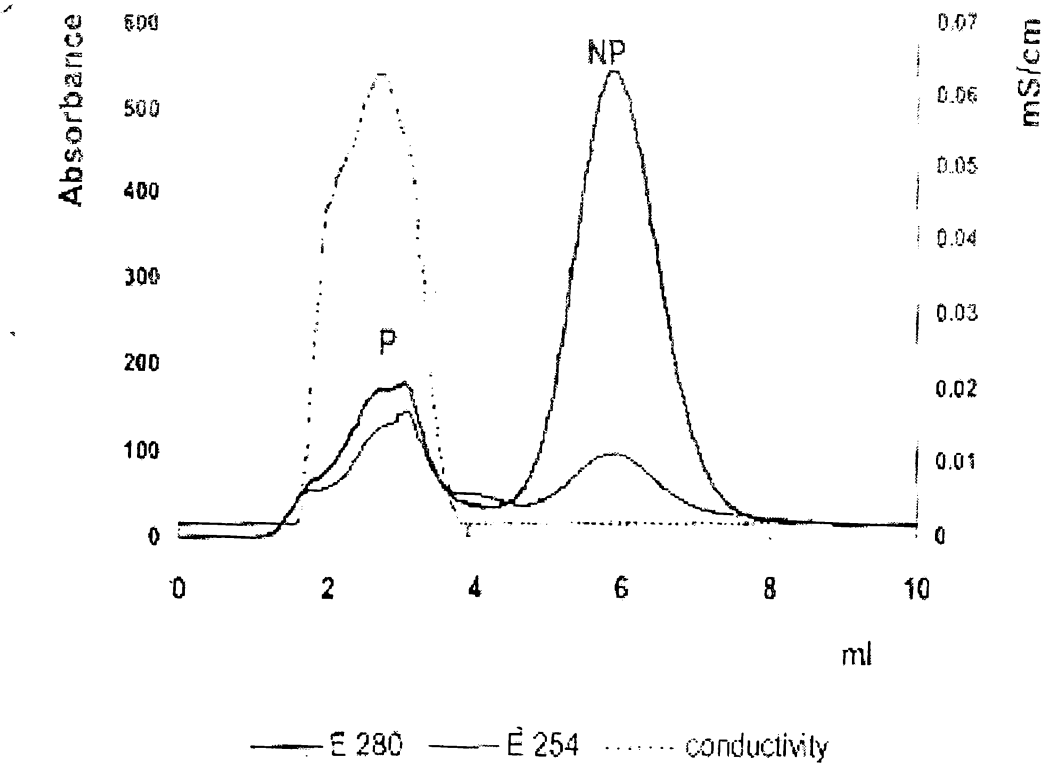
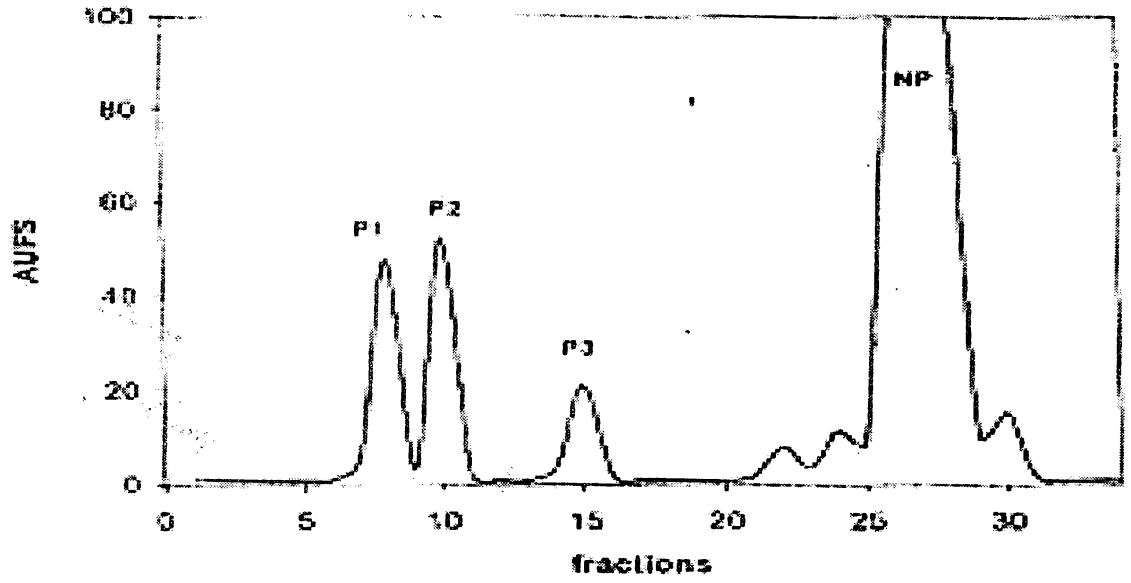


Fig. 1. Chromatographic separation of P and NP fractions of MPE. 5 ml of MPE solution (5.4 mg/ml) was loaded on a HiP
d eluted with 50 mM Tris buffer, pH 7, at a flow rate of 5 ml/min. The fractions were monitored at 280 and 254 nm and for ti
S, millisiemens

APPENDIX VII



B.

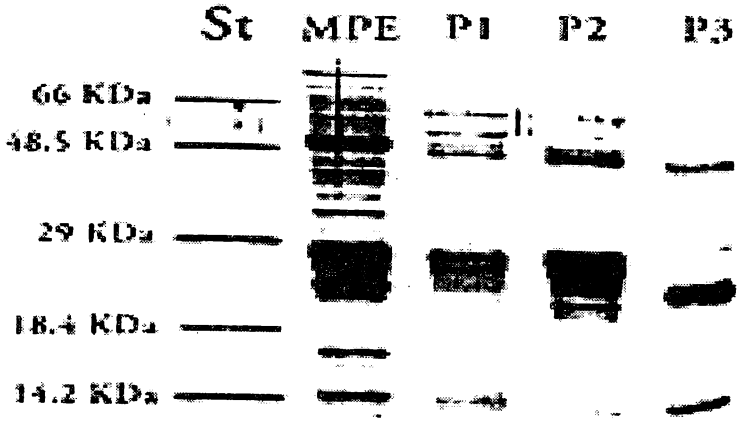
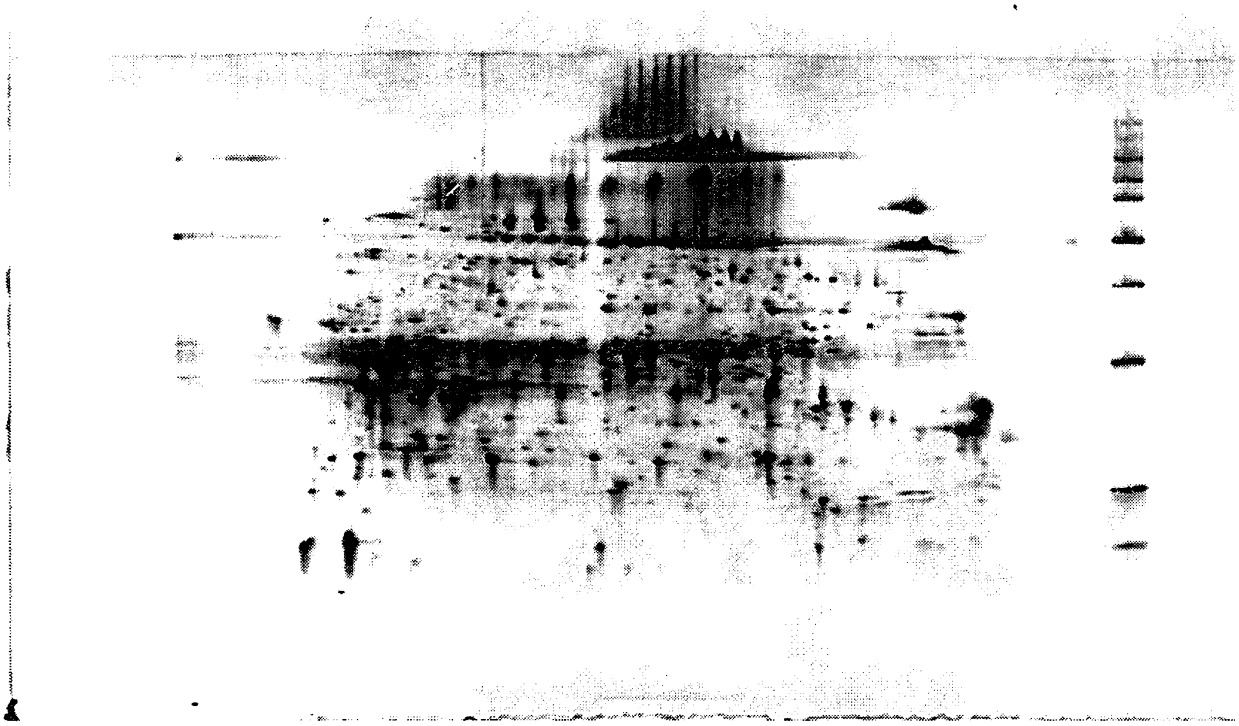


FIG. 2. **Chromatographic purification of MPE by gel filtration.** *A*, 5 ml of MPE solution (5.4 mg/ml) was applied to a Sephacryl S-200 HR column (2.6 × 80 cm) and eluted with 50 mM Na_2HPO_4, pH 7.5, at a flow rate of 1.5 ml/min. Three protein peaks at 280 nm (*P1*, *P2*, *P3*) and a non-protein fraction (*NP*) were obtained. *B*, SDS-PAGE of MPE and the fractions obtained in *A* were loaded and silver-stained. Molecular masses of LMW marker are indicated on the left (*St*). AUFS, absorbance units at full scale.

Appendix VIII

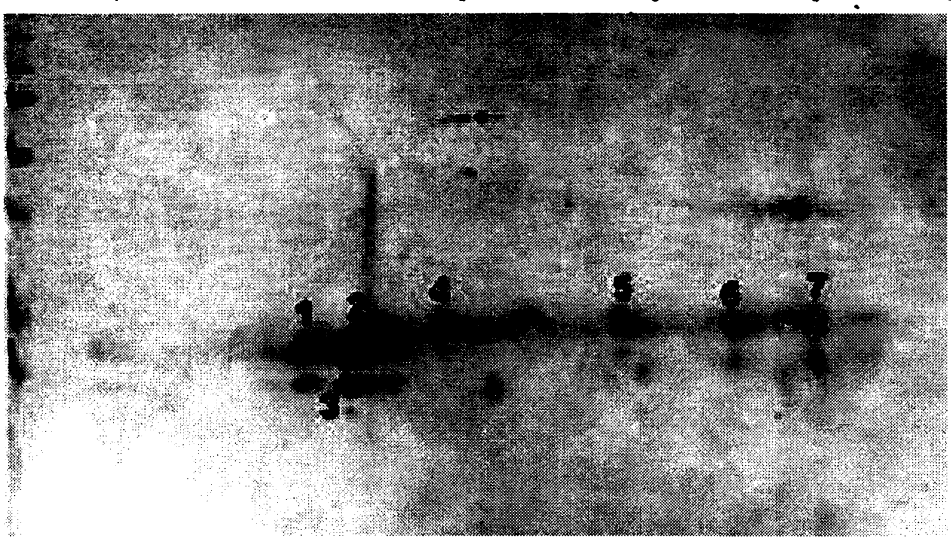
pH 1.....10



IPG pH 3-10 NL, 18 cm

Appendix IX

N-terminal aminoacid sequences of protein spots of gpMuc fraction.



Seven polypeptide spots of gpMuc from MPE separated by 2-D gel.

Spot n°		aa											
		1	2	3	4	5	6	7	8	9	10	11	12
	gP 1	K	D	D	R	E	P	V	R	D	T	D	G
A	gP 2	K	D	D	R	E	P	V	R	D	T	D	G
	gP 4	K	D	D	R	E	P	V	R	D	T	D	G
B	gP 3	K	D	D	R	E	P	V	R	D	T	K	R
	gP 5	K	N	D	G	E	L	V	R	D	T	Y	G
C	gP 7	K	N	D	G	E	L	V	R	D	T	Y	G
	gP 6	K	N	D	G	E	L	V	R	D	T		

Electrophoresis were electroblotted on PVDF and sequenced. Grouping of the similar sequences is indicated in the first column.

CURRICULUM VITAE

NAME: Prof. John C. Aguiyi

PRESENT ADDRESS: Department of Pharmacology,
Faculty of Pharmaceutical Sciences, University of Jos.
Jos, Nigeria.

PERMANENT ADDRESS: As above

DATE OF BIRTH: 8th October, 1957

LOCAL GOVERNMENT AREA: Ikwuano/ Amawom – Umuahia

STATE OF ORIGIN: Abia

NATIONALITY: Nigerian

CONTACT ADDRESS: BLOCK U17, FEDERAL LOWCOST HOUSING ESTATE, MIANGO ROAD, JOS. 08037016418; jca757 @ Yahoo.com.

MARITAL STATUS: Married with three children: Okey 20, Adaeze 18 and Chidera 10

PRESENT POSITION: Professor of Pharmacology

AREA OF SPECIALIZATION:

Pharmacology/Ethnopharmacology/Molecular Biology

EDUCATIONAL INSTITUTIONS ATTENDED:

Oboro Secondary School 1970 – 1974
Institute Statale per L'Agricotura Pieve San Stefano, Italy 1976 - 1981
University of Siena, Siena, Italy. 1981 – 1986
University of Jos, Jos 1994 – 1998

QUALIFICATIONS:

Ph.D Pharmacology 1998 (UNIJOS), Jos
Doctor of Pharmacy, 1986 (UNISIENA), Italy
Diploma DI Maturita Agricultural Technology 1981 Pieve San Stefano, Italy
WASC / GCE 1974

POST DOCTORAL: International Center for Biotechnology and Genetic Engineering, Trieste, Italy – 1991- 93.

PROFESSIONAL COURSES: European School of Medical Genetics Genova, Italy, 1992.

SCHOLASTIC HONOURS:

Scholarships:
Italian Scholarship, 1984 - 1986

Awards:

Pharmaceutical Belt (Siena) 1985
UNIDO Fellowship ICGEB (Trieste Italy), 1991 – 1993
UNESCO/MBCN Fellowship (3 months) (Siena) 1998
Italian Fellowship (IYR) (Siena) 1999/2000
UNESCO Fellowship (Siena) 2003
Association of African Universities (AAU) Kenyatta University – Kenya, 2004
UNESCO Fellowship (Siena), 2006

Recognitions:

First Nigerian Graduate of the Pharmacy Faculty, University of Siena, 1986
WHO Compliment, 1991
International Collaboration with Prof. E. Marinello, University of Siena, 1998 – date
Collaboration; Neimeth International PLC, Nigeria, 2001 – date
Friend of the Methodist Church Medal and Certificate, 2000
International Biographical Center (UK) professional of the year 2005
Abia State award for Excellence, 2006
International Collaboration: Department of Molecular Biochemistry, University of Malaya, Malaysia
ICGEB, Cape Town. South Africa
Patent of a novel antisnake vaccine (cobra and viper COVIP RP 14, 633).

WORKING EXPERIENCE/CAREER PROGRESSION:

One year as an Internee with Queen Elizabeth Specialist Hospital, Umuahia, 1987

One year youth service at Lafia General Hospital – 1988.

University of Jos, Faculty of Pharmaceutical Sciences, Department of Pharmacolgy, 1989- till date.

A two-year Postdoctoral Fellowship at the International Centre for Genetic Engineering and Biotechnology (ICGEB), Trieste Italy – 1991 – 1993.

Three months at the Institute of Biochemistry and Enzymology, University of Siena, Italy, (Research Visit), 1998.

One year at the Institute of Biochemistry and Enzymology, University of Siena, Italy, (Research Visit), 1999 – 2000,2003,2006.
One month at Kenyatta University,Nairobi,Kenya(Visiting Scientist)2004.

Visiting Pharmacology Lecturer in the Faculty of Medicine, Bayero University of Kano, 1995 – 1996.

One year Sabbatical Leave at the University of Malaya,Malaysia 2008-2009

Career Progression:

Lecturer II, Department of Pharmacology,University of Jos, 1989 – 1993
Lecturer I, Department of pharmacology,University of Jos,1993 – 1996
Senior Lecturer, Department of Pharmacology,University of Jos, 1996 – 1999
Reader, Department of Pharmacology,University of Jos, 1999 – 2005
Professor, Department of Pharmacology,University of Jos,2005
Acting Head, Department of Pharmacognosy,University of Jos, 1996 – 2000
Coordinator of Clinical Pharmacy,University of Jos, 1990 – 2003
Coordinator of Student's Projects Pharmacology,University of Jos, 1996 – 2003
Acting Head, Department of Clinical Pharmacy,University of Jos, 2003 – 2006
Head Department of Pharmacology,University of Jos,2006-2008
Post-Graduate Coordinator for Pharmacology,University of Jos, 2004 – 2006
Dean Faculty of Pharmaceutical Siences.University of Jos,Jos.2010-date

Academic Responsibilities:

Department of Pharmacology,University of Jos, Registration Officer, 1993 – 2003
Faculty of Pharm.Sci.,University of Jos, Curriculum Committee Member, 1995
Faculty of Pharm. Sci.,University of Jos, Time Table Officer, 1993 – 1998
Faculty of Pharm.Sci.,University of Jos, Representative to Medical Sciences Faculty Board, 1995 – 2006
University of Jos, Senate Representative (A & PC) Junior Staff Appraisal Committee, 2005 – 2006
University of Jos, Senate Admissions Committee Member, 2005 – 2006
Faculty Rep on Senior Staff Appraisal Complex C 2006-2008,2010
Coordinator, Collaborative Relationship with Universities of Siena, Italy and Kenyatta University, Kenya.

External Examiner in Clinical Pharmacy, ABU Zaria, 1995 – 1998.

External Examiner in Clinical Pharmacy, ABU Zaria, 2001 – 2003,2006

External Journal reviewer for two Journals, in the USA and U.K. 2002

External Examiner in Pharmacology, Faculty of Pharmaceutical Sciences, University of Nsukka, Nsukka, 2002 – 2004 and 2006.

External Examiner in Pharmacology (Ph.D), Faculty of Pharmacy, University of Benin, Benin,2005.

External Examiner in Pharmacology,College Of Medicine,University of Gambia,Banjul,The Gambia.2006.

External Examiner in Clinical Pharmacy, Faculty of Pharmaceutical Sciences, Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria, 2006.

Member Pharmacist Council of Nigeria Visitation Panel to Faculty of Pharmacy, University of Uyo, Uyo 2001.and 2010

Member Pharmacist Council of Nigeria Curriculum Committee 2001.

Member Pharmacist Council of Nigeria Visitation Panel to University of Ibadan 2004.
Member Pharmacist Council of Nigeria Visitation panel to Niger Delta University.2008
Member NUC accreditation Nnamdi Azikiwe University, Uwka, 2010.

Other Competences:

Facilitating and Training – Drug revolving funds, rational use of medicines.

Development and Management of training programmes for capacity building.

Development of health protocols e.g. EDL, ARUS and Standard Treatment Guidelines.

Oragnizing and facilitating workshops involving multidisciplinary team of health workers.

Project and organizational planning.

Drug Management Specialist.

Building public-private sector partnerships for purposes of expanding resources.

Providing technical assistance to Christian Health Association of Nigeria in institutional capacity building in related areas as drug supply management and design and implementation of intervention packages.

Membership of Professional Bodies:

- Nigerian Association of Academic Pharmacist
- Pharmaceutical Society of Nigeria
- West African Society of Pharmacology
- Nigerian Society of Biotechnology
- Nigerian Society of Pharmacognosy
- European Association of Medical Genetics
- Foundation for African Development through International Biotechnology (FADIB).
- American Diabetes Association
- New York Academy of Science.

Details of Teaching Experience at University Level:

Diploma Courses:Teaching of Pharmacology to 300 Level Medical Laboratory Students at National Institute for Veterinary Research Vom, Jos, 1991 – 2006

Undergraduate Courses:Teaching, and running practical pharmacology course to pharmacy, Medical and Medical Laboratory Students, 1989 – 2006

Teaching 400L and 500L Pharmacy students, Pharmacokinetics, Therapeutics and General Clinical Pharmacy practice.

Conducting Ward rounds (Hospital Visits) with 500L Pharmacy Students 1989 – 2006

Supervision of Undergraduate Student projects 1989 – 2001

Postgraduate Course:

Teaching and running practical Pharmacology courses for M.Sc. Pharmacology Students

Supervision of M.Sc. Theses

Supervision of Ph.D. Dissertations

Research Activities:

My research interests spread into Pharmacology/Ethnopharmacology, Genetic Engineering and Biotechnology.

Presently working on an antisnake vaccine protein purification and characterization studies in higher animals.

Construction of a vector for the cloning (large scale production) of the antisnake vaccine

Investigation into the insecticidal property of *Mucuna pruriens* seed for grain preservation.

Mushroom drug development research

PUBLICATIONS

PAPERS IN CIRCULATION:
Over 50 Journal Articles in both Local and International peer reviewed Journals.
Five book chapters in pharmacology and Clinical pharmacy published text books.

Community Services/Voluntary Community Services:

Patron Saint Paul Anglican Youth Fellowship Jos, - 2003 - 2004
Patron Abia State Students Association, University of Jos Chapter, 2004 - 2005
St. Paul's Private School Board Member,2001 - 2003
St Paul Academy Board Member,2001 - 2003
St. Paul's secondary school Kwata's Board Member,2001 - 2002
Patron Saint Paul Anglican Choir,2002 - 2003
Chairman, St. Paul Academy Board, 2003 – 2010
Patron Boys Brigade,Methodist Church,Umudike 2009-date

SHORT TERM COURSES/SEMINARS/WORKSHOPS ATTENDED

- Course on Genetic Pathology, Trieste (Italy 1991)
- Course on Medical Genetics, Genova, (Italy) 1992
- Workshop on Biotechnology Trieste (Italy) 1993
- Workshop on Biotechnology Quality Control, Siena (Italy) 1993.
- INRUD/WHO Workshop on DTC/TOT Uganda, 2004
- (Nigeria). Attended Several Local Conferences/Workshops.
- Organized INRUD, Nigeria DTC Workshop for the Northern Zone, 2005.
- Organized National Waste Management Workshop 2005
- Workshop on MCPD TOT Abuja, 2005
- WHO Workshop on Contemporary Issues in Pharmacy Practice Lagos, 2005.
- Attended several conferences both local and abroad

REFEREES:

Professor F.K. Okwuasaba
Department of Pharmacology and Toxicology
University of Jos
Jos, Nigeria

Prof. C. Akueshi
Dept. of Botany
University of Jos
Jos, Nigeria.

Professor Marinello
Institute of Biochemistry and Enzymology
University of Siena
Siena, Italy.

CITATION

The Vice Chancellor, Sir,

I am indeed very delighted and honoured to speak about this Icon of Science to this great gathering.

The Holy Bible in Proverbs chapter 3 verse 13 says that 'Happy is the man that findeth wisdom and the man that getteth understanding'.

Perhaps, this verse of the Bible best describes our Inaugural Lecturer, Prof. Aguiyi John C., the Oke'ossisi of Ndi Abia.

Ladies and gentlemen, Prof. J.C. Aguiyi is arguably, by every standard, a great son of Nigeria a WHO is WHO of the world, a scientist of great repute. I consider him a great achiever, a man of enormous intellect, and ability.

He is an accomplished and articulate scientist, a brilliant pharmacologist, a mentor and a visionary administrator. He is diligent and excels in his duties to students and staff. As a mentor, he has instilled the spirit of hard work and discipline among the staff and students of the Faculty of Pharmaceutical science.

Prof. Aguiyi was born on the 8th of October, 1957, to Prince Emmanuel Aguiyi and Princess Margaret Aguiyi in Amawom, Ikwuano Local Government Area of Abia state. After his primary school, he gained admission in to Oboro secondary school, Oboro, where he studied from January 1970 to June 1974. He then proceeded to the Institute Statale Per Agricultura, Pieve San-Stefano, Arezzo, Italy from where he obtained a Diploma Di Maturita in 1981. He then obtained a Doctor of pharmacy Degree from the University of Siena, Italy, in November 1986, and a Doctor of Philosophy in Pharmacy degree from the University of Jos in 1998. He was, thus, soundly equipped for teaching and research in Pharmacology.

Working Experience

On his return to Nigeria, he went in for Intership at the Queen Elizabeth Specialist Hospital, Umuahia, now the Federal Medical Center, Umuahia. He then

went through National Youth Service at Lafia General Hospital, Lafia, Nassarawa state. He joined the University of Jos in 1989 till date. Between 1991 and 1993 he trained at the International Center for Genetic Engineering and Biotechnology (ICGEB) for his Post-doctoral. He has enjoyed many international scholarships which includes the scholarships from UNESCO, UNIDO/ICGEB, Italian Ministry for Foreign Affairs, Association of African Universities (AAU), WHO and others. He has visited many universities in Nigeria and abroad as a visiting Scientist.
He has published widely both in international and local journals, and co-authored two books of Clinical Pharmacy and Pharmacology.

He is an international and local external examiner in Pharmacology and Clinical Pharmacy.

He has attended several conferences internationally and locally.

He has served on the Accreditation panel of The Pharmacists' Council of Nigeria (PCN) and the Nigerian Universities commission (NUC) to many Schools of Pharmacy in Nigeria.

He is the only lecturer in the faculty who has headed three departments: Pharmacognosy, Clinical pharmacy and Pharmacology; and is presently the Dean of the Faculty of Pharmaceutical sciences, University of Jos.

*He is a recipient of several international and local awards.
*He has a patent on a novel Anti-snake vaccine.
*He is Patron, Boys Bridge, Methodist Church, Umudike.
*He is also Patron, Abia state students' association (ASSA), Unijos chapter.
*Former Chairman, St. Paul's Academy Board of Governors.
*His profile is indeed inexhaustible.

Ladies and Gentlemen, may I invite you to appreciate this Oke'ossisi of Science, an erudite international scholar. A role model and mentor is who worthy of emulation. This icon of academic excellence attained the peak of his career through diligence and hard work.

Ladies and Gentlemen, I cannot say enough about Prof. Aguiyi and his professional calling. Suffice it to say, however, that Prof. Aguiyi is happily married to Princess Uche B. Aguiyi (Ugwueze), and blessed with three wonderful children:

Okechukwu Aguiyi – Son (Medical Student)

Adaeze Aguiyi – Daughter (Medical Student)

Chidera Aguiyi – Daughter (JSS 3 Student)

The vice chancellor, Sir, Ladies and Gentlemen, I present Prof. John C. Aguiyi to give his inaugural lecture.

INAUGURAL LECTURE UNIVERSITY OF JOS

S/N	NAME	TITLE	DATE	LECTURE SERIES
1.	Prof. E. Isichei	Towards A History of Plateau State		1
2.	Prof. A. C. Ikeme	The End of Myth: The Evolution	21st January, 1983	2
3.	Prof. P.N. Lassa	The Sorry State of Mathematics Education in Nigeria	20th January, 1984	3
4.	Prof. G.O.M. Tasie	The Vernacular Church and Nigeria Society	2nd July, 1997	4
5.	Prof. L.S.O. Liverpool	Paradoxes of the Complex	17th September, 1997	5
6.	Prof. E.H. Ofori	Crime and the Criminal Process in a Changing World	24th August, 1998	6
7.	Prof. Shamsudeen O.O. Amali	The Amalian two Theories on Cultural Creativity and Change	8th December. 1998	7
8.	Prof. Ardo C. Ezeomah	Educating Normadic Fulbe Pastoralists for Integration and Development	1st March, 1999	8
9.	Prof. Ibrahim James	Central Nigeria: What we do know. What We ought to know, What we do not know.	22nd June, 2000	9
10.	Prof. A. Adewole	The Poverty of Philosophy as a Factor in Nigeria's Educational Failure	24th August, 2000	10
11.	Prof. (Rev.) Sister Abang	Theresa the Education of the Exceptional Child in Nigeria: Challenges for the 21st Century	12th December, 2000	11
12.	Prof. K.I. Igweike	Consumer Protection in a Depressed Economy: Challenges in the New Millennium	13th March, 2001	12
13.	Prof. J. O. Ojoade	Internationalism Rooted in Proverbs: Proverbs Roots of Internationalism	25th March , 2004	13
14.	Prof. V. O. Aire	Thenatos and Eros: Death in Life and in French Literature	26th August, 2004	14
15.	Prof. P. Onumanyi	Progress in the Numerical Treatment of Stiffness	30th September, 2004	15
16.	Prof. J. A. Idoko	The Plague Among us: Where is the Cure?	28th October, 2004	16
17.	Prof. A. Nweze	The Nigerian Family in Health and illness: Issues of National Development	25th November, 2004	17
18.	Prof. K. I. Ekpenyong	Energy in Chemical Reaction Design	27th January, 2005	18
19.	Prof. Tseaa Shembe	Macro Molecules (Protein & Carbohydrate): Their Everyday Use animals	24th February, 2005	19
20.	Prof. Z. S. C,. Okoye	Food Borne Chemical Poisons: Not by Energy Alone	31st March, 2005	20
21.	Prof. G. E. Anekwe	From Microbes to Biochemical Breakthroughs	28th April, 2005	21
22.	Prof. E. B. C. Ufodike	Fry Fingerlings and Results: Availability to Finger for Frying or Breeding	26th May, 2005	22
23.	Prof. Henry Uzo Isichei	Orthodox Medicine Versus Alternative Medicine in the Management of Psychiatric Patients	28th July, 2005	23
24.	Prof. C. I. Ogbonna	The Impact of Industrial Microbiology And Biotechnology on a Developing Economy	31st August, 2005	24

25.	Prof. Efiong Udo Utah	Atmospheric Phenomena and Associated Electrical Processes	10th October, 2005	25
26.	Prof. M. Mbonu Ekwenchi	Impact of Photon on Chemical Studies	26th January, 2006	26
27.	Prof. Sonni. G. Tyoden	Of Citizen and Citizens: The Dilemma of Citizenship in Nigeria	9th March, 2006	27
28.	Prof. Emmanuel Bayode Ajulo	The English Language A Pragmatic Means to an End	25th May, 2006	28
29.	Prof. Efiong Udo Udo Akpan	Attitudinal Influences to Chemistry and Science Studies in Nigeria: A Major Problem in National Development	29th June, 2006	29
30.	Prof. Etannibi E. O. Alemika	Disorders and transformation of the Nigerian Criminal Justice System	27th July, 2006	30
31.	Prof. M. T. Yahya	Kith and Kin and Distant Relations: Correlation of Arabic Studies and other Academic Disciplines	21st September, 2006	31
32.	Prof. S. E. Agina	Foods, Food Microbiology and Wholesome Feeding for a Hungry Nation	30th November, 2006	32
33.	Prof. Ihenacho Izuka John	Index of Consistently Present Absent Excess Low Trace Elements Status among Hyperactive Children with Learning Disabilities: Its Implications in Special Education in Africa	28th September, 2007	33
34.	Prof. Cyril O. Imo	Religion, Morality and Globalization	26th October, 2007	34
35.	Prof. (Sir) John Oluwole Ogunranti, *KOJ (UK)*	8th Day of creation: Test Tubes, Genes and Baby Tubes	29th February, 2008	35
36.	Prof. David Jowitt	Varieties of English: The World and Nigeria	28th March, 2008	36
37.	Prof. Agbaji Emmanuel Ogezi	Geology, Time, Resources, Environment and Man	25th April, 2008	37
38.	Prof. Augustine Ufua Enahoro	Discourse on Women and the Nigerian Home Video: A Villa of Mysteries	4th June, 2009	38
39.	Prof. Umar Habila Dedem DANFULANI	Popular Religiosities, Corporate Faiths and the Impact of Globalization on the Religious Landscape in Contemporary Nigeria	4th December, 2009	39
40.	Prof. Gray Goziem Ejikeme	Low Emotional Intelligence, Drug Abuse And Child Maltreatment: Implications For Psychological and Social Work Services	25th February, 2010	40
41.	Prof. Ogoh Alubo	In Sickness and in Health: Issues in the Sociology of Health in Nigeria	19th March, 2010	41
42.	Prof. Janet O. M. Ande, FCNA	Non-Accountants Accounting Versus Accountants Accounting	30th April, 2010	42
43	Prof. Emeka E. Ike	Ionizing Radiation, Man and the Environment	30th July, 2010	43
44	Prof. Atiene Solomon Sagay	Facing the Challenges of Motherhood: that these Little Ones May Live	27th August, 2010	44
45	Prof. Hayward Babale Mafuyai	Female Vampires and Public Health in Nigeria	30th September, 2010	45
46	Prof. Gladys Asabe Oduah Bozimo	Of Terrorism and Terrorism: the Nigerian Typology: A Challenge to Social Studies Education	29th October, 2010	46
47	Prof. Kanchana Ugbabe, PhD (Australia)	'Mark on the Wall' Feminism and ecriture feminine: Trajectories, Gains, and Advances	28th January, 2011	47
48.	Prof. Irene Isoken Agunloye	Challenging the Master's Craft: Nigerian Female Playwrights in the Theatre of Men	25th February, 2011	48
49.	Prof. Aguiyi, John Chinyere,	Of Nature, Knowledge And Health: The Molecular Basis Of Natural Products Development	25th March, 2011	49