BIOSYSTEMATICS: THE LIFE SCIENCE THAT DIRECTS THE GROWTH AND DEVELOPMENT OF A NATION

By

REGINALD EDEMAYIBO UGBOROGHO

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THE LIFE SCIENCE THAT DIRECTS THE GROWTH AND DEVELOPMENT OF A NATION

An Inaugural Lecture Delivered at the University of Lagos on Wednesday 17th December, 1997

By

REGINALD EDEMAYIBO UGBOROGHO
B.Sc. (Durham), M.Sc. (Waterloo), Ph.D. (Lagos) P.G.C.E. (Southampton), MNYAS, CBiol, FNIBiol, FLS

Professor of Biology and Chairman, Senate Publications Committee
UNIVERSITY OF LAGOS

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1.0 INTRODUCTION

As long as I live, I shall remain a Christian Scientist. Thou hath taught me to love my enemies, for there lies my strength. Now, considering these - FAITH, HOPE and LOVE of these three, the GREATEST is LOVE! (I Corinthians 13:13).

Mr. Vice-chancellor, the Chairman of Senate and the Chief Executive of our great University, the University of Lagos. I thank you most sincerely for giving me the opportunity to deliver this inaugural lecture. It is a debt that this unique or perhaps unusual Unilag environment has made me owe for the past thirteen years. I see this presentation as a unique one. First, I am presenting it in a month I consider as a special month of every year. Second, the Lecture is the FIRST in a new session in which we hope to conclusively readjust the University academic year back to what it used to be. I am eternally grateful to my Lord and God for making it possible for me to fulfil His wish this DAY in the presence of this heterogeneous or should I call it august. or "December" audience.

Mr. Vice-chancellor, Sir, as of now, the Lord has given me the rare privilege of working with six select human beings called Vice-Chancellors. These gentlemen are Professors S.O. Biobaku (1965-1972), J.F. Ade Ajayi (1972-1978), B.K. Adadevoh, of blessed memory, (1978-1980), O.A. Adesola (1981-1988), O. Alao (1988-1995) and your dedicated and active self, Jelili Adebisi Omotola (1995-date). Every one of these gentlemen did great things for the University of Lagos, but none earned the title "Mr. Active V C." In just over two years of your appointment as the vice-chancellor of our FIRST CLASS University, you unfolded to this society and indeed the entire nation the uniqueness of your BIOGENESIS.

2.0 BIOSYSTEMATICS: MY FIELD OF SPECIALISATION.

Let me now introduce my field of specialisation to the audience. A simple approach is to separate the complex term into two words: -

1. *Bio*- life and living things, otherwise known as Biology and
2. *Systematics* - a scientific and methodical approach to the study of things.

By early forties or perhaps earlier, Biologists began to carry out more detailed research on living things with the view to finding a more embracing word for the totality of research areas that could sum up the various approaches to the study of organisms or experimental taxonomy. According to Davis and Heywood (1967), Camp and Gilly (1943) introduced a new word to cover the various accepted areas of Taxonomy. This they called "BIOSYSTEMATY". The word was used (i) to delimit the natural biotic units and (ii) to apply to these units a system of nomenclature adequate to the task of conveying definite information with respect to their defined limits, relationships and dynamic structure. Thus, several higher plant researchers have been using the words Biosystematics or systematics in place of Taxonomy.

According to Clasen, Keck and Hiesey (1945) in Davis and Heywood (1967), Biosystematics is made up of genetics, Cytology, comparative morphology and ecology.

On the other hand, Lawrence (1951) simply equated systematics to Taxonomy and Nomenclature. While Simpson (1961) defined systematics as the scientific study of the kinds and diversity of organisms and of any and all relationships among them; Mayr (1969) identified systematics as the science of the diversity of organisms.

From the above account, it is necessary to consider some other definitions of taxonomy proposed by Biologists.

Core (1955), the then Head of the Department of Biology, West Virginia, U.S.A., defined Taxonomy as a science concerned with

identification, nomenclature and classification of the various kinds of plants composing the mantle of vegetation covering the earth, whilst Davis and Heywood defined it as the study of classification including its bases, principles, procedure and rules.

According to Mayr (1969), Taxonomy is the theory and practice of classifying organisms. This is more definite than his statement reported above. On the other hand, Talbot (1971), a then reader in Mycology in the University of Adelaide, South Australia made the following statement about taxonomy. According to him, "In taxonomic analysis, the immense number of different kinds of organisms may be studied in a variety of ways (e.g., morphological, physiological anatomical, genetical or ecological) in order to obtain as complete a picture as possible of the organisms with which one is working".

Ugborogho (1983), after considering the various definitions of Taxonomy proposed by different Biologists and with his research experience in experimental taxonomy, came to the conclusion that taxonomy is "The all embracing subject area of Biology". However, since evolutionary biology is the source of raw material for Taxonomy and since Biosystematics comprises evolutionary biology and other subject areas of biology as well as nomenclature, I rather support the use of Biosystematics in place of Taxonomy and nomenclature. After all, you cannot describe or name what is not in existence.

In view of the above, I hereby state that my subject areas of specialisation and interest are Biogeography, morphology, Cytology, Cytogenetics/Genetics, Reproductive biology, Hybridization, Evolution, Taxonomy, Nomenclature and synonymy.

2.1 Justification of Discipline

The justification for the above claim of subject areas could be confirmed by my qualifications, the titles of my M.Sc. And Ph.D.

Theses, the courses I have initiated, developed and taught in this University and my published works.

2.1.1 Qualification

B.Sc. Botany & Zoology, Durham, England, 1964.
M.Sc. Biology, Waterloo, Canada, 1971.
Ph.D. Biology, Lagos, Nigeria, 1981.
P.G.C.E. Teaching of Biology, Southampton, England, 1968.
C. Biol. Chartered Biologist, London, England, 1985.
FNIBiol. Foundation fellow of the Nigerian Institute of Biology, 1990.
FLS. Fellow of the Linnean Society, London, England, 1982. A society of Biologists.

2.1.2 Titles of Theses

M.Sc.: **A *Cytotaxonomic* Study of *Cerastium arvense Linnaeus* in North America**. University of Waterloo, Canada 1970

Ph.D.: ***Biosystematic* Studies on the Nigerian species of *Sida Linnaeus (Malvaceae)*** 1978. Degree Awarded after a period of crisis, in April 1981

2.1.3 Courses Initiated, Developed and Taught from 1971 - Date

I have got the privilege of teaching Thirty (30) courses, (Twenty-two (22) at undergraduate level and eight (8) at Postgraduate level) in different academic Units in this University. The Units are NCE (now off the system), COSIT, Botany and Biology. Some of the courses are: -

2.1.3.1 At Undergraduate Level:

Anatomy of Flowering plants; Angiosperms: Form & Function; Angiosperm Taxonomy; Biology of Algae, Bryophytes, Pteridophytes & Gymnosperms; Cytogenetics; Cytology & Plant Micro-Techniques;

Evolution (Plants & Animals); Genetics, Organisms (Animals & Plants) and the Environment; Reproduction, Growth and Development (Animals & Plants) and Systematic Biology.

2.1.3.2 At Postgraduate Level

Advanced Cytogenetics, Application of Research Methods in Biology, Breeding Systems and Current Trends in Cytotaxonomy.

2.1.3.3 Published Works

Some of my published works are as listed under references.

With the above information, I believe. I can safely claim to be a Biosytematist and that my discipline which is very broad is Biosystematics.

3.0 My Research Contributions to Biosystematics PLUS

My researches were directed towards finding more information that could further elucidate the complex nature of the field of Biosystematics. Consequently, I made serious efforts to research into the different subject areas of the field as shown below. I should add that I devoted more time to the study of angiosperms than any other organisms but with special interest in animal pollinators.

3.1 Biogeography

This may be defined as the scientific study of living things in relation to different environment or otherwise referred to as Environmental Biology. Thus, such study reveals direct relationship between organisms and the ecology of the habitat in which they thrive. New organisms that evolve as a result of the interaction between the initial organisms and the environment are called ecotypes and ecospecies. Thus it is necessary to study the distribution of organisms in diverse ecologies and environments.

My study of *Cerastium arvense L.* In Canada showed that the complex species extends throughout most of Europe and North America and South America and Asia. In some areas, notably eastern North America, it has developed weedy tendencies. Throughout its range, but particularly in North America, it shows a remarkable degree of variation. No wonder Fernald & Weigand (1920) wrote, "... accordingly (we) are leaving *C. Arvense* as a perplexing, polymorphous species, not wholly abandoned but cheerfully commended to others who care to attack it...."

In 1968 my M.Sc. project supervisor, Professor J.K. Morton, gave me this critical species as a project. I accepted the challenge and in less than two years I solved the problem by coming out with FIVE acceptable SUBSPECIES.

1. Subsp. *fuegianum* (Hook. f.) Ugborogho comb. et stat. nov.
2. Subsp. *vehitinum (Rafnesque)* Ugborogho stat. nov.
3. Subsp. *strictum (L.)* Ugborogho comb. nov.
4. Subsp. *arvense L.*
5. Subsp. *maximum* (Holl. & Britt) Ugborogho stat. nov. Ugborogho 1977.

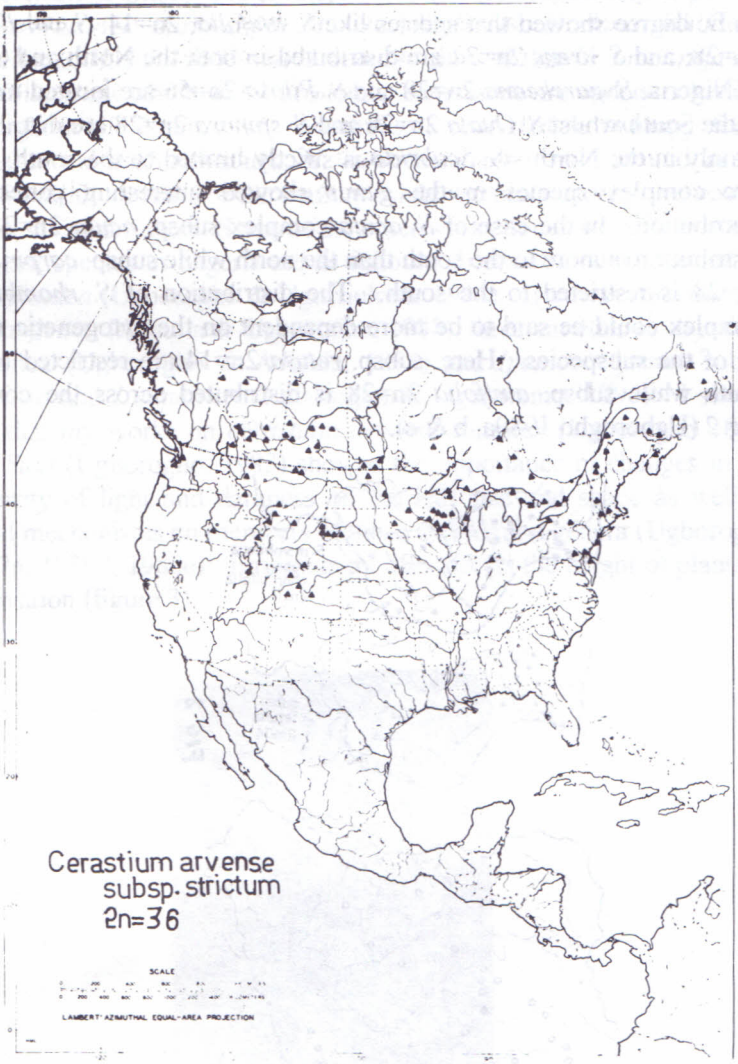


Figure 1 shows the distribution of the subspecies strictum, which is the most variable taxon.

My work on the very critical genus *sida* which I studied for my Ph.D. degree showed that species like *S. linifolia*, 2n=14, *S. cordifolia*, 2n=28; and *S. urens* 2n=32 are distributed in both the North and South of Nigeria; *S. garckeana* 2n=28 and *S. Pilosa* 2n=56 are located mainly in the South whilst *S. Ovata* 2n=28 and *S. spinosa* 2n=28 are distributed mainly in the North. *S. Scabrida* is strictly limited to the south. The two complex species in the genus showed interesting pattern of distribution. In the case of *S. acuta* complex subsp. *acuta* 2n=28 the distribution is more to the south than the north while subsp. *carpinifolia* 2n=28 is restricted to the south. The distribution of *S. rhombifolia* complex could be said to be more dependent on the cytogenetic make up of the subspecies. Here, subsp. *retusa* 2n=14 are restricted to the south while subsp. *alnifolia* 2n=28 is distributed across the country *Fig.2* (Ugborogho 1980a, b & c).

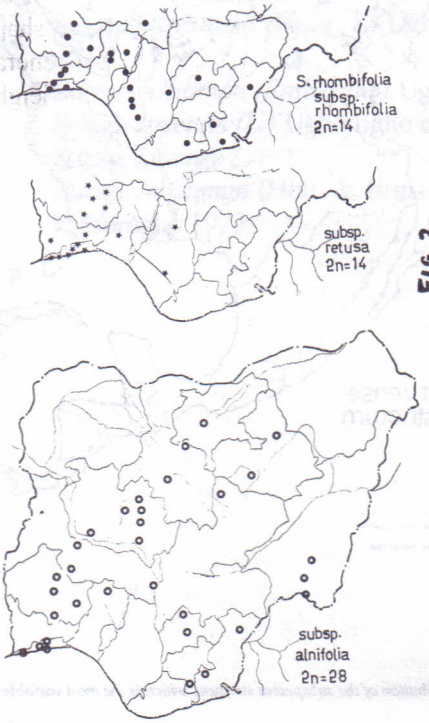


FIG 2

The work of Shofoyeke & Ugborogho (1983) on *Hibiscus asper, H. cannabinus, H. surratensis, H. congestiflorius, H. lunarifolius, H. rostellatus, H. sabdariffa* and *H. scotellii* showed that *H. sabdariffa* and *H. cannabinus* which are of economic importance are widely cultivated throughout the country. *H. rostellatus* is restricted to swampy forest areas of the southern states, *H. surratensis* often encountered in the humid southern parts of the country while the other species are limited to the savanna region. Some of the other works done on the distribution of plant species in Nigeria are as follows: *Triumfetta cordifolia* and *T. rhomboidea* (Ugborogho & Ugochukwu, 1984), *Asystasia calycina* and *A. gangetica* (Adetula & Ugborogho, 1988), three varieties of *Asystasia* complex (Ugborogho & Adetula, 1988) and *Ipomoea carnea* subsp. *fistulosa* and *I. aquatica* (Ugborogho & Ogunwemo, 1996). I should add that my works on *cerastuim arvense* complex (Ugborogho 1974) and *Sida* (Ugborogho, 1983) showed the importance of changes in the intensity of light and darkness on the leaf size and shape as well as floral mechanisms on members of those species and genera (Ugborogho 1977a, 1980d, 1980e). Environment also affects the height of plants in cultivation (figure 3)

Fig 3: *Sida Urens(* A) seedling cultivated under shade; (a) seedling cultivated in the open *Source: Ugborogho 1978*

3.2 Comparative morphology

The comparative study of form and structure of animals and plants shows the resemblances and differences among organisms within the same complex species, genera, families, order or even kingdom. Some of the authors who used vegetative and flora characteristics in many floras for specific, generic and familial delimitation are as follows: Linnacus 1753, 1754; Burmann, 1768; Hooker and Bentham, 1849; Hutchinson & Dalziel 1954, 1958, 1968 and Ugborogho 1977b, 1980a, b, & c. Besides the separation of plants into distinct species by the use of macro-morphological features, many complex genera and species have been delimited by the use of micro-morphological features like stomata and pollen grains *(figure 4, see p.18)* into varieties and subspecies- North American *cerastuim* arvense (Ugborogho, 1973); *Sida rhombifolia* complex (Ugborogho, 1982); *Lycopersicum esculentum* (Ugborogho & Sodipo 1985); *Vigna ungniculata* (Ugborogho & Agomo, 1989); *Asystasia gangetica* complex (Ugborogho & Adetula, 1988); *Amaranthus L.* (Ugborogho and Oyelana, 1992a & b); *Ipomoea* L. (Ugborogho *et al*, 1992); and Dioscorea L. (Ugborogho *et al*, 1993).

With my work on the stomata of *Dioscorea alata, D. Cayenensis* and *D. Rotunda*, I showed that cultivars of a species could be separated into different groups based on the number of length and breadth of stomata (Table 1). I also showed that on the average stoma surrounded with more epidermal cells are often bigger in than those with fewer epidermal cells around them.

Table one. Duncan multiple range test for the variables: Mean stomata number, Length (um) and breadth (um) for D. alata.

ACCENSSION NUMBER		GROUP	ACCENSSION	LENGTH	GROUP	ACCENSSION	BREADTH	GROUP
Serial No.			Serial No.			Serial No		
4	33.50	A	5	36.31	A	3	23.96	A
2	32.50	,A-B	6	32.34	B	6	22.93	A-B
5	30.30	B	3	32.05	B	5	22.34	B
3	26.70	C	1	31.08	B	2	21.76	B
1	23.20	D	2	30.43	B	4	21.61	B
6	22.20	D	4	30.14	B	1	19.70	C
		4 GROUPS			2 GROUPS			3 GROUPS

3.3 Cytology and Cytogenetics

According to Swanson (1968), Cytology, the study of cells, had its beginning in 1665 when the Englishman, Robert Hooke, first saw

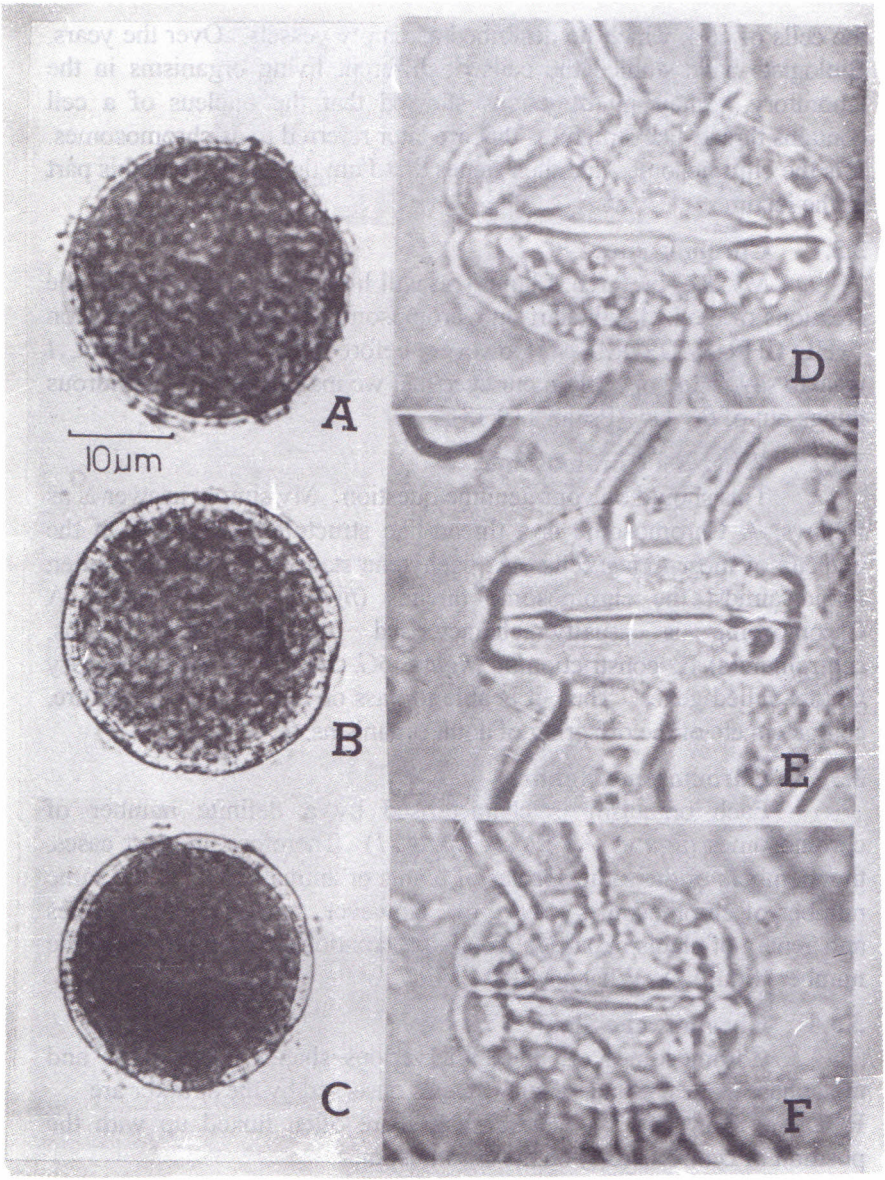


Fig. 4: Photomicrographs of pollen grains & stomata of *Cerastium arvense* complex A & D – Diploid plant: Subsp. Strictum;; B & E - Introduced tetraploid (subsp. *Arvense;* C & F – Native tetraploid (subsp. Maximum) *Source : Ugborogho*

the cells of cork which he described as empty vessels. Over the years, Biologists have studied the cells of different living organisms in the laboratory. Their investigations showed that the nucleus of a cell contains thread-like structures that are later referred to as chromosomes. It is the chromosomes and their genes that I am dealing with in this part of the lecture.

3.3.1 Chromosomes

My dear brethren, I hope you will like to know more about the creations of God. I will start on Chromosomes in general and later on "THE CHROMOSOME". However, before I go into the subject, I wish to say, "God open thou our eyes that we may behold the wondrous things out of thy law (Psalm 110:18)".

3.3.2 What is a Chromosome?

This should be your genuine question. My simple answer is as follows: A Chromosome is a thread-like structure that occurs in the nucleus of most living cells. At pachytene stage, a nucleolus is often found amidst the chromosome threads (*figure 5M, see p.20*). A Chromosome is usually characterised by two arm lengths, centromere(s) or constriction(s) (*figure 6G, see p.20*) and hereditary factors called genes. Thus, it is able to pass on and control the nature, characters etc of the offspring of adult organisms.

3.3.3 Chromosome Number

Each organism is characterised by a definite number of chromosomes *(figures 7 & 6, see pp20-21*). Therefore, in most cases, the members of the same species of plants or animals possess the same number of chromosomes (*figure 6*). However, some complex species and genera of plants in particular exhibit variations in their chromosome number (figure 7). What a MIRACLE!

3.3.4 Chromosome Shape

Chromosomes often exhibit various shapes at anaphase and metaphase stages. Some of such shapes observed by the speaker are ROD, V, J, L, and U. These shapes are often linked up with the position of centromere(s) on the chromosomes.

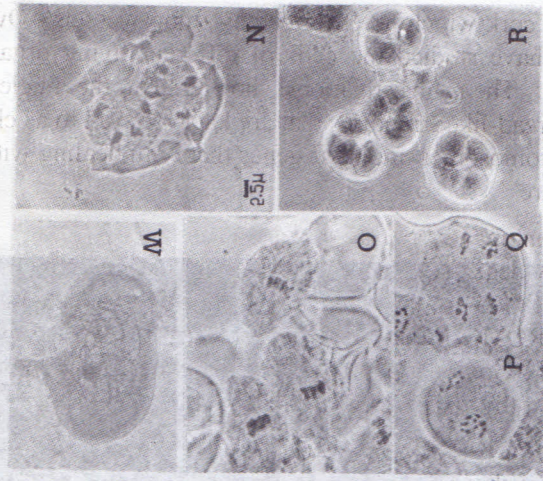


Fig. 5 Meiotic phases; M- *Asystasia gangetica*, Pachytene stage; O – *Datura metel* – Equitorial Metaphase; P – Anaphase I; Q – Anaphase II with bridge; N – Telophase II; R – Tetrad

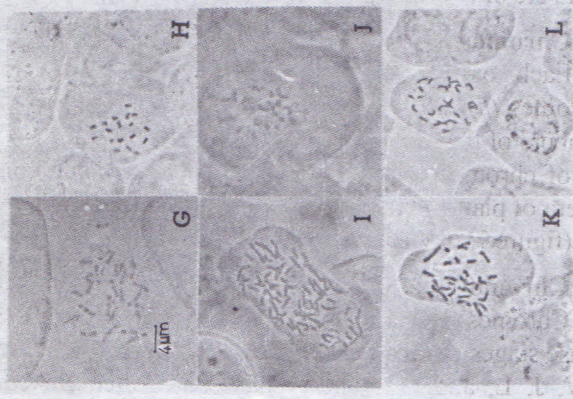


Fig. 6 G – *Crinum jagus*, 2n = 22(Arrowed chromosome – Discentric); H – *Allamanda catharitica*, 2n = 18; I – *Haemenocaulis littoralis*, c.2n = 66; J – *Sida urens*, 2n = 32; K – *Caladium bicolor*, 2n = 28; L – *Datura innoxia*, 2n = 24

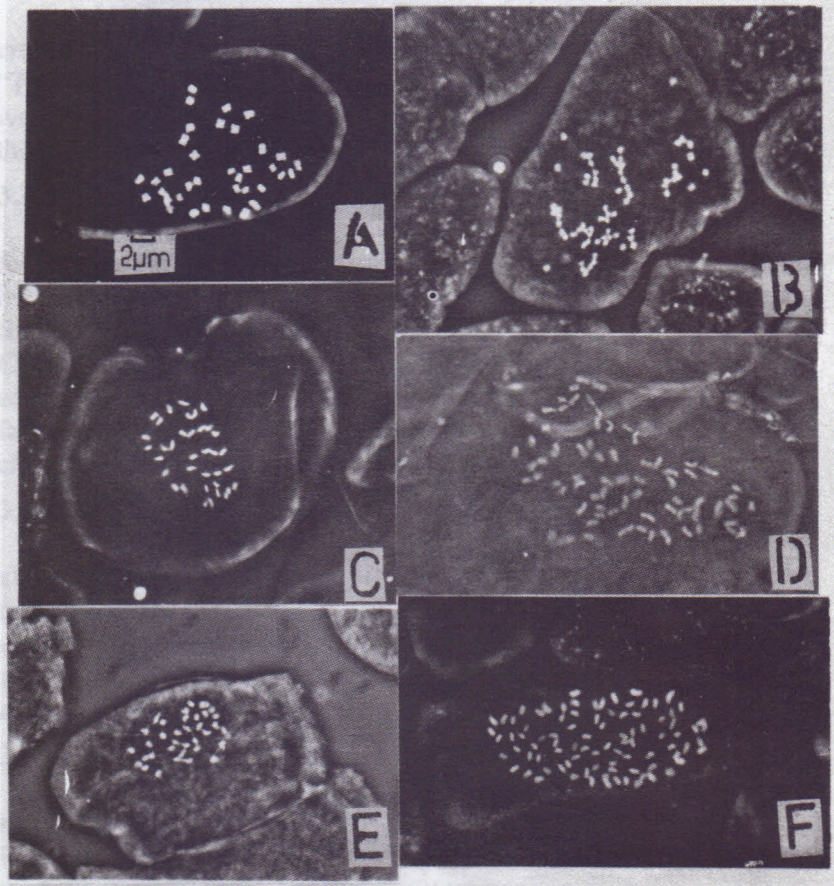


Fig. 7 Mitotic chromosomes of *cerastium arvense* L. complex; (a) A,C &E – Varieties of subsp. *Strictum*, 2n = 36; (b) B – subsp. *Arvense*, 2n = 72; D – subsp. *maximum* 2n = 72; F – *Pentaploid arvense*, 2n = 90; Source: Ugborogho 1970

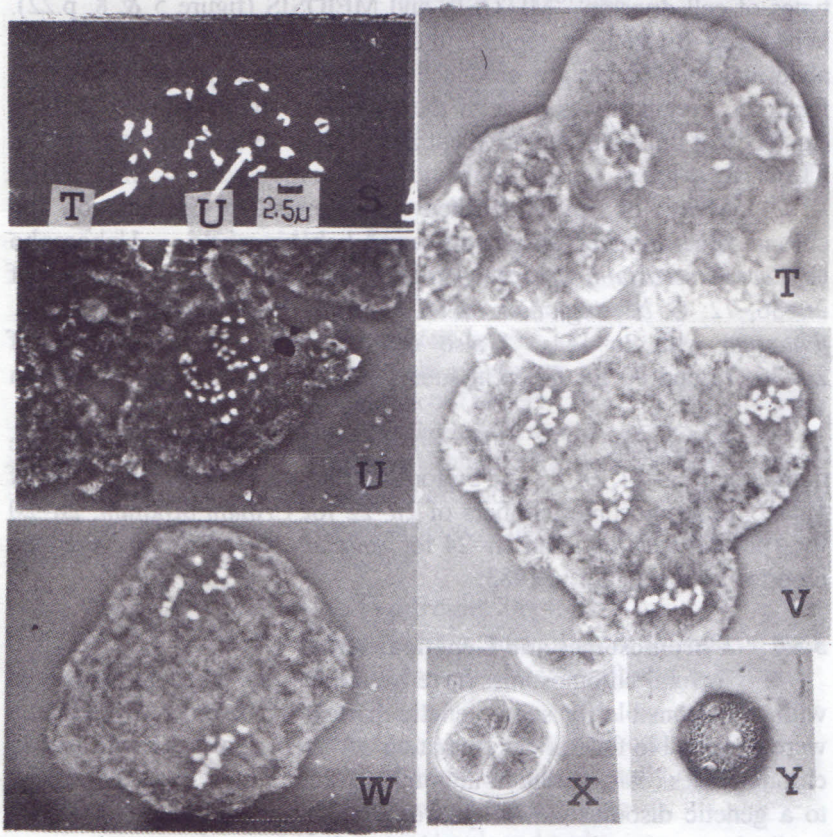


Fig.8 Meiotic phases of *Cerastium arvense*; S – Diakinesis with Univalent (arrowed v) & Trivalent (arrowed T); U- Early Anaphase I; W – Late Anaphase I; T – Telophase I with 4 leggards; V – Anaphase II/Early Telophase II; X – Tetrad; Y – Pollen grain

3.3.5 Chromosome Size

In some species of organisms, chromosomes are of the same size (figure 7, figure 6H & J) while they differ appreciably in others (figure 6G, H, & K). Generally, the size of chromosome ranges from about 1.0um to 16um or even more.

3.3.6. Chromosome Behaviour

The behaviour of chromosomes can be appreciated in the two types of cell division - MITOSIS and MEIOSIS (figure 5 & 8, p.22). When cell division is regular, the offspring is normal. However, abnormal individuals are produced when divisions are irregular. In figure 5, irregularity is seen in the formation of bridge - Q and the existence of univalent and trivalent as in figure 8S and four laggards in 8T.

Many of my published works contain information on chromosome number shape, size and behaviour e.g., Ugborogho (1972) on *cerastuim arvense* complex with chromosome number of 2n=36, 72; C. *beeringianum and C. Tomentosum* with 2n=72 and *C. fontanum* with 2n=144. I also reported chromosome numbers of 2n=36, 72 and 90 for different subspecies of *Cerastuim arvense L.* in 1973.

Ugborogho 1975, 1980, 1982a & b also reported chromosome numbers of 2n=14, 28, 32 and 56 for different subspecies and species of *Sida L.* Chromosome numbers of 2n=22 for *Crinum ornatum*, 2n=20 for *Thevetia neriifolia* and 2n=24 for *Solanum macrocarpon* were also reported by the author in 1983.

3.3.7 Chromosomes and Genetic Diseases

Several chromosomes have been identified as being associated with or responsible for some genetic diseases or disorder while others were responsible for sex determination. A normal human being has 46 chromosomes. Any variation in number whether more or less will lead to a genetic disorder called syndrome. Syndrome is a collection of medical symptoms that represent a bodily disorder.

Types of Syndromes

i. **Down's Syndrome**: (Trisomy 21) with 2n=46+1=47 chromosomes. Here chromosome Number 21 appears thrice instead of just twice. This condition is a tragic instance of trisomy in human. It is manifested as follows:

1. Mental retardation
2. Below average height
3. Somewhat sloping forehead
4. Low or flattened nose bridge
5. Low set ears
6. Short broad hands
7. Cardiac malformation
8. Mouth usually open with protruding tongue.

The life expectancy is short while sexual maturity is hardly attained. Incidence in ca.1 in 600 births.

ii **Edward's Syndrome**: (Trisomy 18) with 2n=46+1=47 chromosomes. It is manifested as follows:

1. Malformed low-set ears
2. Small, receding lower jaw
3. Flexed, clinched fingers
4. Cardiac malformation and
5. Various deformities of the skull, the face and feet.

Death takes place generally around three to four months of age or at times up to 2 years or more. Incidence is ca. 0.3 per 1000 births.

iii. **Klinefelter's Syndrome**: 2n=46+1=47.

The individuals have a general male phenotype with normal external genitalia. It is manifested as follows:

1. Small testes
2. Sperms are usually not produced
3. The persons are usually mentally retarded
4. Arms are longer than average
5. Breasts are developed and
6. Voice tends to be higher pitched than in normal males.

They are sex chromatin positive. Karyotype shows 47 chromosomes i.e. 47, XXY.

iv. **Turner's Syndrome**: 2n=(AAXO). This is another major sex anomaly in which the individual is phenotypically female. It is manifested as follows:

1. Poorly developed ovaries
2. Webbed neck
3. Low-set ears
4. Broad chest
5. Under developed breasts
6. Slightly below average intelligence
7. Usually sterile
8. Somatic chromosome number is 45, i.e. X (AAXO). *Burns 1976.*

3.3.8 Mutation

This is a sudden change in the genotype of an individual that could result in the establishment of several mutant genes and different combinations of chromosomes.

Factors Which Cause Mutation

Some of the well-known factors, which influence gene mutation and chromosomal aberrations, are Temperature, Ultra-violet radiation, X-rays, Neutrons, Chemicals and Aging. I hereby comment on two of the factors:

i. **Aging:** Seeds and pollen grains that have been aged for some time show higher mutation rates than the unaged ones of similar genetic constitution. It is also known that aged human beings show higher mutation rates during the formation of sex cells - eggs and sperms. This is due to irregular meiosis in the gonads of the aged human. Consequently, some abnormal children are born by the aged. This is one of the reasons why women are usually advised to stop having babies after Forty (40) years of age. Since male human is reproductively viable for a longer period than his female counterpart, he stands a chance of

producing and discharging irregular sex cells for a longer period. It is therefore unwise for a young lady to marry an old man if she is still sexually viable.

ii **Chemicals**: Some of the chemical mutagens, which have been used to induce mutation and aberrations, are Colchicine, Ethylmethane, Sulphonate (EMS) and Sodium Azide. The mutagenic effects of colchicine on Lycopersicum esculentum were reported by Ugborogho & Sodipo in 1985. Some of the aberrations were chromosome bridges, fragmentations; lagging chromosomes and doubling of chromosome number (polyploidy). Besides, the chromosomal aberrations, a mutant produced curly leaves with distorted stem. Observations made by the author in 1993 on the controls and treated plants of vigna unguiculata revealed significant differences between the two plants with reference to the sizes and shapes of some macro- and micro morphological features.

a. The stomata of the cotyledons of the treated plants were bigger than those of the controls.
b. The first foliage leaves of all the treated plants were generally smaller than those of the controls.
c. Curly leaves were present on the shoot of VITA7.
d. Pollen grains of the treated plants were bigger than those of the controls and a new pollen grains tetraporate type was formed.
e. Stomata of the leaves of treated plants were bigger.
f. A Tetraploid plant with bigger petal evoived. Obute & Ugborogho (1994) also reported interesting variations between controls and treated plants of some cultivars of *Vigna unguiculata.*

The effect of the drug thalidomide on developing human embryo and foetus were reported in Europe in the early 60's. Some children inherited the recessive gene for seal-like limbs while others displayed "phocomelia". Therefore, one can conclude that mutations and aberrations may be favourable or unfavourable and lethal. Favourable mutations may lead to the evolution of new varieties, subspecies or even species. It is also a well-known fact that mutations give rise to anenploids like the ones discussed above under syndromes.

3.4 Reproductive Biology

Reproduction is the act, method or process of producing offspring or duplicating life. This is a primary activity of all matured organisms. Organisms usually reproduce themselves or produce young ones by asexual or sexual means. Asexual reproduction requires only one parent organism. It involves only mitotic cell division and it can lead to the production of a large number of cells. It conserves genetic types or limit genomes. The term is often used in connection with unicellular organisms, which undergo binary or multiple fission e.g. in Chlorella, Chlamydomonas, Amoeba, Euglena etc. In higher plants, the term often used is 'vegetative' reproduction.

On the other hand, sexual reproduction involves sexual cycles in which meiosis, fertilization and mitosis alternate with each other. There are three main cycles viz.: Haplontic, Diplontic and Haplodiplontic cycles.

Most higher plants experience both asexual or vegetative and sexual reproductive activities while most higher animals carry out only sexual reproduction.

3.4.1 Vegetative Reproduction/Propagation

My work on *Cerastuim arvense* showed that it is a perennial herb. The lower nodes of the stem are free rooting when they make contact with the soil. This character enhances rapid propagation of the plant in cultivation and in nature. During the spring break up, portions of the plants, which inhabit riverbanks, Lakeshores and cliffs, are often attacked and carried some distance by the shifting ice. Such tuft of plants eventually come to rest on a new shore-line where the plants they contain can grow rapidly because they have already established root system (Ugborogho, 1977b).

A wild cowpea plant which I was maintaining in a screen house at International Institute of Tropical Agriculture (IITA), Ibadan was accidentally decapitated by my research assistant. I was unhappy by the incident, but I did not throw away the stem. Instead, I continued to water it. After a few weeks, a shoot grew out from the base of the stem in the soil.

Within my premises at Unilag, I planted some *Carica papaya* (pawpaw) trees. When I observed that the fruits produced by one tree was not good; I cut off half of it. After a few weeks, I observed up to thirteen (13) shoots sprouting near the cut-end.

The third example was a *Millettia thonningii* tree that wind uprooted opposite the Faculty of Science Porter's Lodge. Again within few weeks I observed shoots sprouting from the roots. This shows that even the roots of the plant have shoot initials as the stem.

3.4.2 Sexual Reproduction

a. *In plants*: Many angiosperms are self-compatible. These include *Sida scabrida*, *Hibiscus sabdariffa*, *Abelmoschus esculentus*, *Vigna unguiculata*, *Arachis hypogea Datura metel etc*. On the other hand, some species are self-incompatible. While self-incompatibility may be due to *dioecism* like in *Zea mays*, it may be due to heterostylic situation like in *Portulaca grandiflora* complex where some varieties have stigmas which are at the same level with the anthers and others with stigmas above with anthers. In the case of *Cerastuim arvense* where stigmas make contact with anthers and have pollen grains make easy contact with stigmas; there is usually no fruit setting. Such plant is an outbreeder (Ugborogho, 1977b).

Some flowers exhibit special flora floral movements usually referred to as flora mechanism. Plants whose flowers open and close early are usually separated from those that open late and close early or late. *Sida* species exhibit various opening and closing periods (Ugborogho, 1977a, 1980).

Sexual Polymorphism

This is a floral arrangement in which an inflorescence is made up of three or more sexual types. In the case of *Carica papaya*, there are three distinct trees-staminate, pistillate and Andro monoluous. The andromonoecious each with a male flower and a hermaptrodite. In the case of Amaranthus species, an inflorescence may possess more than four different floral set-ups (Ugborogho & Oyelana, 1993).

b. The Miracle of Creation

Under NORMAL condition, when a sexual activity between a man and a woman takes place, two sex cells (egg and sperm) often meet each other. The egg carries an either "X" chromosome while a sperm carries "X" or "Y" chromosome. As illustrated below, the fusion and fertilization of an egg by a sperm carrying "X" chromosome gives rise to a female child whilst if the sperm involved in the fusion carries "Y" chromosome, a male child is produced.

X *x* X	=	Female child (XX)
X *x* Y	=	Male child (XY)

What an astonishing miracle!

Now let us look into the Holy Book of Knowledge, the Bible. The records are vivid. God created Adam first and using a rib from him (Adam), He created Eve to assist him (Genesis: 1:27; 2:7, 21-22). Does this action of God suggest the superiority of a man over a woman? While the men (males) in this Auditorium may be tempted to answer "Yes", most, if not all the women (females), may answer "No".

Let us go back to the biological facts. As mentioned above, under normal conditions, once a "Y" chromosome is present in a human ZYGOTE, the outcome is a MALE CHILD (XY). On the other hand, if "XX" are present in a ZYGOTE, a FEMALE CHILD comes into existence. Therefore, it is clear that the male human is at fault when his wife fails to deliver a male child.

Could we then say that the same set-up occurred in ADAM and EVE at the time they were created? If so, then the MIRACLE is UNIQUE. Thus, I humbly submit that overall, the male human is the

most "DYNAMIC FORCE" in the human family whilst the "Y" chromosome is "THE BOSS AND THE MIRACULOUS MIRACLE".

Perhaps I should add that whereas a female human normally carries her pregnancy for nine (9) months before delivery, a female dog carries its for about two and a half (21/2) months while the eggs of a female Agama lizard is incubated in the soil for about two months.

My published works on reproductive biology are on *Cerastium arvense* (1977b), *Sida L.* (1978), *Thevetia neriifolia Jussieau* (1982), *Datura L.* (1982), *Hibiscus* (Ugborogho & Shofoyeke, 1983), *Vigna unguialata* (Ugborogho & Agomo, 1989), *Ipomola* (Ugborogho & Ogunwenmo, 1991), *Amaranthus L.* (Ugborogho & Oyelana, 1993), *Tridax procumbens* and *Eclipta alba* (Ugborogho & Mensah, 1982), *Triumfetta cerdifolia & I. Rhomboidea* (Ugborogho & Ugochukwu (1984) *and Ipomea triloba* (Ugborogho & Ogunwenmo, 1997).

3.5 Hybridization

Hybridization is the crossing of two individuals of different populations, species or genera having different adaptive gene complexes. A cross between two compatible individuals may lead to fertile or reproductively viable offspring. It may also lead to the exhibition of dominant and recessive characters with the progeny resembling more of one parent than the other. However, if the parent organisms are not quite compatible, their progenies may be partially or totally sterile.

Thus, reproductive Biologists talk of dominant and recessive genes and the actions of such genes in organisms or hybrids in this case. The success of hybrids depends on the availability of new ecological niches or habitats, restoration of fertility in the progenies of partly sterile hybrids as well as the retention and constancy of viable new gene combinations.

According to Scott-Emuakpor & Ugborogho (1980f), the cross between *Sida scabrida* and S. *acuta* subsp. *carpinifolia* exhibited a procumbent habit like S. *scabrida* but with ca. 100% while the hybrid obtained from a cross between S. *scabrida* and *S. garckeana* through procumbet produced less than 50% fertile pollen grains. In addition, the hybrid between *S. rhombifolia* subsp. *retusa*

and *S. rhambifolia* subsp. *rhombifolia* produced less than 50% fertile pollen grains (Ugborogho 1982a)

A Cross between a Female Human and a Dog - Is it possible?

According to the *Lagos Horizon* of Tuesday, October 3 - 10, 1989 page 13,

> "Distraught mum Zoraida Perez burst into tears recently and confessed: Evil Nazis gave me a barking Dog - Baby" The stunned mother was duped into giving birth to the hairy, howling puppy - boy after a secret gene - bending p. Vicious neo - Nazi doctors - disciples of Hitler's Sicko quacks who experimented with people cruelly injected the innocent peasant girl with the sperm of a mongrel in a sick experiment to create a rabid - race of hound men"

The Dog-baby, apart from other features, had the face of human, nose of a bull-dog, hairy body and toes with claws. What we see here is the genetic relationship between that dog and possibly other dogs and human.

In view of the above, it is imperative that for the purpose of marriage, each human should select his/her partner based on good positive characters especially with reference to good health and thinking ability rather than material wealth. This is to ensure that couples don't produce offspring with homologous recessive genes, which could lead to genetic diseases like sickle-cell anaemia and haemophilia.

Sickle - Cell Anaemia

Many red blood cells exhibit sickle/curved shape in this genetic disease. Under normal condition, the haemoglobin of most persons is of a particular chemical structure and is known as *haemoglobin A*. A variant of this haemoglobin called *haemoglobin S*

is involved in the sickle-cell disorder. Thus, the genes responsible for haemoglobin types could be Hb^A and Hb^S.

Studies have shown that most people belong to the genotype Hb^A Hb^A. Therefore, their erythrocytes possess only haemoglobin A and are bi-concave disk-shaped. Persons with sickle-cell anaemia are of the genotype Hb^S Hb^S and are characterised by several symptoms, especially chronic haemolytic anaemia. The erythrocytes in the blood of such persons are usually sickle cell shaped. These distorted red blood cells, apart from impeding circulation of blood by blocking capillaries, cannot properly perform their function of carrying oxygen and carbon dioxide to and from the tissues. Such condition produces infarction in an organ thereby leading to serious pain, tissue destruction and death, often before the attainment of reproductive age. I add that, as at now Medical Doctors can prolong the life span of such patients through the applications of certain medications.

Hb^A Hb^A	:	Normal Persons
Hb^A Hb^S	:	Persons with sickle-cell trait
Hb^S Hb^S	:	A Sickler

Note that marriages between carriers usually lead to the production of sicklers, in addition to other combinations e.g. Hb^A Hb^A, Hb^A Hb^S and Hb^S Hb^S. Here S is a recessive gene while A is dominant.

HAEMOPHILIA

This is a disorder or genetic disease in which blood clotting is deficient due to lack of the necessary substrate thromboplastin. The gene involved is a sex-linked recessive type.

3.6 EVOLUTION

This is an interesting though often controversial subject area of Biological Sciences. It may be defined as changes that occur in successive generations of organisms related to descent. Perhaps, I should first define it as the origin and inter-relationship between and among organisms.

Several theories have been propounded on *evolution* by scientists of different academic statures and disciplines. I feel that some of the theories may be taken with a pinch of salt. I am fully

convinced that all of them have contributed in one form or another to the understanding of the science of life.

For the purpose of this lecture, I like to mention and discuss a few theories.

3.6.1 Earlier Theories

Some of the earlier theories of evolution are as follows:

i. *The Theory of Eternity of the Present Conditions:*
The believers of these theories contend that there is neither beginning nor end to the universe. According to them, life forms that existed millions of years ago remained unchanged till today and will continue to be the same throughout eternity. Is this true? Think about the varieties of plants and animals around you. Look again at your children and give an answer.

ii *Theory of Special Creation:*
This is a theory propounded by believers and preachers of different religions. For Christian Religion, read the Book of Genesis in *the Holy Bible*. Although I may not be able to prove this scientifically here, I believe that God is the "AUTHOR OF LIFE AND THE UNIVERSE". It is easier to talk about inter-relationship of organisms than their origin in such an environment. I shall do just that along the line so that you may draw your conclusions.

iii *The Theory of Catastrophism:*
This theory was propounded by Cuvier (1769 - 1832), a Palaeontologist who carried out research on fossil fauna for a long period of time in Paris. He believed that on one occasion or another world-wide catastrophes brought about the death of old fauna and their extinction led to the creation of new fauna.

Please think about this theory when you are less busy.

iv. *The Theory of Spontaneous Generation:*

This is one of the oldest theories of the origin of life. It was believed by some individuals that even complicated forms of life might arise spontaneously from non-living matter. According to Dodson (1960), Aristotle believed that mosquitoes and fleas arose from putrefying matter. Tadpoles and worms are supposed to have arisen from mud; a meal worm should have arisen from flour spontaneously. Even large and complex animals like rats have been supposed to have arisen spontaneously from non-living matter. Redi, an Italian physician of the seventeenth century, who was not convinced of the theory, carried out an experiment to prove his case. He exposed meat in containers which were covered over with fine mesh cloth. No maggots appeared on the putrefying meat, but flies laid their eggs on the cloth covers, and maggot developed there. He came to the conclusion that the maggots which ordinarily appeared in spoiling meat were not spontaneously produced. A century later, similar experiments were also performed by an Italian Priest, Spallanzani, on meat. In this case, the meat was boiled in sealed container, no organisms developed in it, even if it had been previously infected. The experiment has been modified and used for food preservation. Thus the theory started to lose credibility. Louis Pasteur (1822 - 1895), a French Scientist now known as the founder of bacteriology, carried out experiment with bacteria. He kept boiled broth in a closed container, with air entering by a capillary tube which was bent to form a trap for solid particles. Even though the broth was freely exposed to air, yet no bacteria appeared on it. Thus, it became clear that it was air-borne bacteria that infected exposed broth or other

suitable media. So you can see how difficult and long a period it takes to develop an aspect of the science of Evolution.

3.6.2 Modern Theories

A few modern theories are considered here.

i. Lamarck's Theory of Inheritance of Acquired Characters

Lamarck (1744 - 1829) was a French Biologist. He was probably one of the first Biologists who put up a modern theory of evolution. His theory was virtually linked up with organisms and environment. His research experience convinced him that species were not constant, but derived from pre-existing ones.

His theory could be easily sub-divided into three headings:-

(a) Influence of environments on organism

(b) Use and disuse of parts of an organism and

(c) Inheritance of acquired characters. Lamarck illustrated his belief with a large mammal, giraffe. He presumed that the giraffes had proportions much like typical mammals originally, but as they strained to reach the leaves of trees which were higher than them from generation to generation, their necks grew longer in response to their desire to reach the leaves. He then concluded that long neck, as a character, was inherited by a giraffe due to that exercise. The conclusion did not go down well with his immediate colleagues. Even though his conclusion may not be well placed at that time, it is true that environment could modify organisms, hence ecotypes of plants have been recognised.

ii. Darwin's Theory of Natural Selection

Darwin, was an English Natural Scientist who published his book on "Origin of Species" in 1859, after reasonable observations on organisms in their natural environments. He was also quite knowledgeable in the Science of heredity. Darwin's theory could also be sub-divided into three sub-headings:-

(a) Over production and a consequent struggle for existence

(b) Variations and their inheritance

(c) Elimination of unfavourable variations or survival of the fittest.

The theory was quite acceptable to Biologists to the extent that it was regarded as the principal mechanism of evolutionary change or as the cornerstone of evolutionary biology.

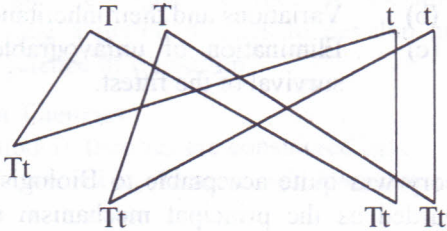
With reference to the first arm of the theory, there is no doubt that over- production of offspring could lead to competition which at times, in human population, may even lead to unhealthy rivalry. The struggle of Secondary Schools graduates to gain admission into the vacant places in the Nigerian Universities today is a good example in support of that arm of the theory. The case of a Dog-baby is evidence of variations and their inheritance. This is because the Dog-baby exhibited some characters of human and dog.

In the struggle for existence, the individuals showing variations in the right directions survive and the variations are transmitted to the offspring. This is survival of the fittest. Thus, human beings with AA and AS combinations usually stand better chance of transferring their genes to the next generation. So one can conclude that Darwin's conclusions were scientific.

iii Johann Gregor Mendel. 1822 - 1884

Mendel was a Mathematician and the son of an Austrian farmer. He taught mathematics for some time and then he became a Monk in the Augustine Monastery at Brunn with plant breeding as a hobby. He carried out his breeding experiments using two distinct pea plants (*Pisum Sativum*). The plants were pure breeds for Tallness and Shortness.

He observed that a cross between a tall plant and a short plant gave rise to hybrid plant which were all Tall(F1). The second generation obtained through inbreeding provided plants some of which were Tall while others were short. Analysing his observations mathematically, he represented Tall Parent by TT and short one tt.



The mathematical assessment showed that the ratio of Tall plants to short ones is 3.:1. That he referred to as *Monohybrid* ratio. Here TT & tt are Homozygotes while Tt's are Heterozygotes.

The first law indicates that only ONE member of a pair of contrasted characters is contained in a gamete.

In the second experiment, he used plants which were pure breeding for Two Dominant characters. Analysis of the results gave a ratio of 9 : 3 : 3 : 1 which he referred to as *DIHYBRID RATIO*. Thus, a second law as proposed. This is known as "Independent assortment or segregation of germinal units. Here, one of a pair of contrasted characters may be combined with either of another pair.

The rediscovery of Mendel's law in 1990 about 35 years after they were published placed the study of heredity and evolutionary biology on an entirely new foundation.

Evidence of Evolution

There are several evidence to confirm organic evolution. These may be in form of morphological reproductive and cytological relationships between and among species of the same genus or family or between families or even class. Ugborogho (1983) demonstrated relationships and possible evolution of *sida* species with reference to chromosome numbers, vegetative structures and crossability between *taxa*. Sodipo and Ugborogho (1990) also showed variations in the morphology of fruit raised from one seedling.

Some of the features that show the relationship between man and other primates are as follows:

i. The retention of five digits (fingers and toes) which possess bails instead of claws.

ii Thumb and first toe separated from the other digits.

iii The presence of two(2) premolars in each jaw of man and the other old world monkeys

iv The presence of external ears (*pinnae*) which are pressed close to the sides of the head, with the edges rolled over

v. Babies are breast-fed by female human and chimpanzee in a similar pattern.

It is also known that animals of different classes often respond in a similar pattern to their needs in similar environments. For example, *Rana sylvatica* and *Polypedates*, tree frogs, Amphibians), develop adhesive pads on their fingers and toes like wall *gecko* and tree *gecko* (p*tychozoon*), r*eptiles*) and t*arsius*, a primate.

Several other examples that are related to genetic abnormalities or mutations have been reported for human beings.

i. A Siamese child was born with two heads, two hind limbs, two fore limbs, one anus and one broad chest and abdomen in the Tangale Waja Local Government Area of Bauchi State. (*Daily Times* of 25/05/85)

ii. A baby with four legs and two male organs was born in Kutsanama Maternity Clinic near Harare City Centre, S. Africa. (*Sunday Tribune*, July 4, 1985)

iii A hermaphrodite baby was born at Sacred Heart Hospital, Lantoro Abeokuta, Ogun State, Nigeria (*Sunday Tribune*, July 4, 1985).

iv. A baby with three legs, two male organs one mouth, two tongues was born on the Island of Bali, Indonesia (*Daily Times*, Jan. 26, 1988).

v. A Nigerian Soccer Star confessed of having male and female sex organs (*Weekend Vanguard*, Nov. 1, 1997).

vi. The Koma people still walk nude (*Saturday Champion*, November 22, 1997). Presently, the Koma people are the most primitive human beings in Nigeria.

WHO SAYS THERE IS NO EVOLUTION?

3.7 Taxonomy

Taxonomy or systematics has been defined or explained in different ways in section 3.0 above. With reference to the over all definitions of taxonomy, I wish to state that I have contributed reasonably to the subject matter. This claim is confirmed by my works on *cerastium arvense* (1977b), *Sida* Species (1978a, 1978b, 1980b, c & d) on *Datura* (1987), *Dioscorea* (1993) and *Ipomoea triloba* (Ogunwenmo & Ugborogho, 1997). Table 2 is a summary of my work on the cytotaxonomy of *cerastium arvense* complex in North America and *Sida* species in Nigeria.

Table 2. Summary of Cytotaxonomy of *Cerastium arvense* Complex and *Sida* Species.

1.	*Cerastium arvense* complex		
I	Subsp.	*strictum (L.)*Ugbor.	2n = 36
ii	"	*fuegianun* (Hook.) Ugbor.	2n = 36
iii	"	*arvense* L.	2n = 72
iv.	"	*maximum* (Holl. & Britt) Ugbor.	2n = 72
v.	"	*velutinum (Rafinesque)* Ugbor.	2n = 72
vi.	Hybrid		2n = 90
vii	*Cerastium fontanu m Baumg*		2n = 144
2.	*Sida Species*		
I.	*S.*	*linifoliaJuss. ex cav.*	2n = 14
ii	*S.*	*cordifolia L*	2n = 28
iii	*S.*	*pilosa (Retz..)* Ugbor.	2n = 56
iv.	*S.*	*urens L.*	2n = 32
v.	*S.*	*sponosa (L.)* Ugbor.	2n = 28
vi.	*S*	*ovata forskal*	2n = 28
vii	*S*	*rhombifolia L. Subsp. rhombifolia*	2n = 14
viii	*S.*	*rhombifolia Subsp. retusa (L.)* Ugbor.	2n = 14
ix.	*S*	*rhombifolia Subsp. alnifolia* (L.)Ugbor	2n = 28
x.	*S*	*Scabrida* Wight & Arnott	2n = 28
xi	*S*	*acuta* Burman *f. Subsp. acuta*	2n = 28
xii	*S*	*acuta subps. Carpinifolia (L.f.)* Borssum Waalkes	2n = 28

xiii *S garckeana* Polak 2n = 28

1. Compiled from Index Kewensis, published between January 1976 & End of 1980, edited by R.A. Davies 1987 & Ugborogho 1972, 1973 and 1979.
2. Compiled from Index Kewensis, published between January 1981 and the end of 1985, edited by R.A. Davies 1987 & Ugborogho 1975, 1980 b,c&d 1982a,b, and 1983

3.8. Nomènclature

Nomenclature may be defined as an application of names to organisms.

3.8.1. The Importance of Names

Names serve two important purposes:-

I. They are for convenience in referring to organisms or as means of identification

ii They indicate relationships between organisms.

I shall now refer to a report published on a name on June 28, 1987. The title is "What is a name? According to the reporter, in 1950, a Nigerian, name withheld, narrated "how he was humiliated by a white man in Kaduna because of his foreign surname". The Nigerian was a posts and telegraphs inspector of lines.

According to the report, when a thunder storm disorganised communication lines in Kaduna, the then headquarters of the former Northern Provinces, the British resident there dispatched an urgent message to Lagos to send one of their best men to put the lines in order. The Nigerian was picked for the job and his name given to the resident who was also informed of the date the Nigerian was due to arrive in Kaduna by rail. On that day, the resident delegated the district officer (D.O.) to meet the Nigerian at the Kaduna Railway Station. When the train pulled up, the District Officer (D.O) went into the first class coach and met the only whiteman who came by the train, one Mr Strand, a U.A.C. official. Not seeing a white man bearing the name and unaware that the person was a Nigerian, the district officer (D.O.) went back to his office and reported to the

resident that the said officer was nowhere to be found whereas he had arrived Kaduna by the same train.

An hour later, the Nigerian managed to get to the resident's office and reported his arrival. "On hearing that, the already fuming resident ordered that he be brought before him and the following dialogue ensued.

"Resident:	What is it you call yourself?
Nigerian:	He called his name.
Resident:	Who gave you the name?
Nigerian:	My parents, Sir
Resident:	Were they slave in West Indies?
Nigerian:	Not at all, Sir
Resident:	Then how come you nigger go by that name?

Being disappointed, he said, "I wasted my time preparing for you thinking you are white. Now disappear and don't let me see that nasty face of yours again. Mr. Bunty will take you to the boy's quarters of the government rest house where you will fend for yourself".

The above was the situation prior to independence. But has it changed much since then? I think all Nigerians who answer foreign names must now change such names for typical Nigerian Names.

Now let me go back to biological names *per se*. At the earlier stage of identification of plants and animals, common names were assigned to organisms by taxonomists. Thus, only well-known organisms had names. Consequently, some organisms had too many names while others had just few. Even now in Nigeria, many commonly used plants have many names. According to Ugborogho (1983), the plant *Talinum triangulare* commonly called waterleaf by many Nigerians has been given different names in Nigerian languages. A few of them are listed below.

Efik	-	Mm, mm, Ilk or Mmon Mmon Ikon
Hausa	-	Ganya nruwa
Igbirra	-	Egure
Igbo	-	Ngbologi

Itsekiri	-	Uwan imila
Izon	-	Mindi Diriberi
Tivs	-	Ale Ifo
Yoruba	-	Gbure

Because of such observations, scientific names were designed by *Linnaeus* under the title BINOMIAL NOMENCLATURE. This is made up of GENERIC and SPECIFIC names. The first sets of names were *latinised*.

Some generic names established in commemoration of some persons, usually botanists or patrons of Botany or horticulture.

i. *Theophrasta* (Theophrastus): for the father of Botany.
ii. *Dioscorea*: for the author of the great *Materia Medica*
iii. *Turnera*: for the founder of British Botany.
iv. *Gerardia*: for the British herbalist.
v. *Nicotiana*: for Jean Nicot who introduced tobacco into Europe.
vi. *Theobroma* (god's food): for the Chocolate plant.

In a similar vein, specific names were given to plants – e.g.

i.	*rubra*	:	red
ii.	*alba*	:	white
iii.	*nigra*	:	black
iv.	*nana*	:	dwarf
v.	*tenuis*	:	thin
vi.	*tomentosa*	:	wooly
vii.	*esculentus*	:	edible

Mr. Vice-chancellor, Sir, in a lighter mood, I like to inform my audience that between 1979 and now my surname has been spelt in NINETY SIX different ways. Even when I write my name in capital letters, some typists and secretaries in Unilag will spell it wrongly. Ladies and gentlemen, please see your invitation cards for the correct spelling. My publications on *Cerastium arvense* (1977b) and *Sida* species (1980b, c & d) are connected with nomenclatural taxonomy.

3.9 Synonym

This word has the same or nearly the same signification as another. It could also be defined as any word, which is identical in meaning with another word of the same language, and of the same grammatical class. Three examples are shown below (I-III).

I. *Cerastium arvens L.*

Subsp. *Strictum (L.)* Ugborogho comb. Nov.

C. *Strictum L., Sp.* Pl. 439 (1753). Type: From Austrian alps, L603.21

C. *Elongatum Pursh*, Fl. Amer. I: 321 (1814). Type on plains of Columbia; M. Lewis, April. 22, 1806 (PH).

C. *tenuifolium Pursh*, l.c. Schuykill and Delaware, Pennysylvania; Topotype: Thomas Nuttall (PH).

C. *arvense latifolium* Fenzl, in Ledebour Fl. Rossica, I: 412 (1841). *Carvense latifolium* (Fenz) Rydberg, Men N.Y. Bot. Garden I: 147 (1900). Type: Rydberg 4023, HG 6419 (NDG).

C. *arvense angustifolium* Fenzl, in Ledebour Fl. Rossica, I: 413 (1841). C. *arvense angustifolium* (Fenz) Hollick & Britton, Torr. Bot. Club 14(3): 47 (1887). Named from North America. Topotype: HG 6422 (NDG).

C. *oreophilum* Greene, Pitt. 4:297-298 (1901). Type: Nr. Fort Collins, Colorado; C.F. Baker, s.n. May 7, 1896 (NY). Metatype: GH 6426 (NDG).

C. *effusum* Greene, l.c.p. 298. Type: Date Greek, Wyoming; Greene s.n. July 1, 1896; HG 6412 (NDG).

C. *scopulorum* Greene, l.c.p. 298-299. Type: Rocky Mts., Colorado; C.F. Baker, F.S. Earle & M. Traxcy 497 & 664 July, 1893; HG 6429 & HG 6428 (NDG).

C. *occidentale* Greene, l.c.p. 299-300. Type: Bear Greek, W. of Denvenr, Colorado; Greene s.n. July 24, 1889; HG 6416 (NDG).

C. *angustatum* Greene, l.c.p. 300. Type: Nr. Prince Albert, Saskatchewan; J. Macoun 12459, July 1896; HG 6388 (NDG).

C. *campestre* Greene, l.c.p. 301. Cypress Hills. N.W.T. & Manitoba.

C. *vestitum* Greene, l.c.p. 301-302. St. Annes, nr. Edmonton, Alberta.

C. *confertum* Greene, l.c.p.302. Stewarts Lake, British Columbia, C. patulum Greene, l.c.p. 302-303. Type San Francisco; Greene s.n. HG 6424 (NDG).

C. *sonnei* Greene l.c.p. 303. Type: Nevada, Califonia; Sonne 6, July 22, 1888; HG 6431 (NDG).

C. *subulatum* Greene, Ottawa Nat. 16 (2): 36 (1902). Type: Chilliwack Valley, British Columbia; J. Macoun s.n. GH 6432 (NDG).

C. *nitidum* Greene, l.c.p. 37. Type: British Columbia; HG 6415 (NDG).

C. *alsophilum* Greene, l.c.p. 37. Chilliwack Valley, British Columbia.

C. *graminifolium* Rydberg, Bull. Torr. Bot. Club 30:250 (1903). Type: Pullman, Whiteman Co., Washington; A.D.E. Elmer 177 June, 1897 (NY).

C. *arvense* var: pupurascens Boivin, Can. Field Nat. 65:4 (1951). Telegraph Trail, British Columbia.

Source: Ugborogho 1977.

Sida rhombifolia subsq. Alnifolia (L.) Ugborogho stat. Nov.

S. *alnifolia* Linnaeus, Sp. Pl. II. 684. 1753. From India. N. 866.5. Type: LINN, Lecto type BM.

S. *chinensis* Retzius, Obser. Bot. Iv. 29. 1781. From E. China. Type: L.D.

S. *canescens* Cavanilles, Diss. I.23 1785. From Senegal. Type: M.A. Microf. K.

S. *retusiflora* Stokes, Bot. Mat. Med. III. 527. 1812. Type:?

S. *capensis* De Candolle, Prodr. i.461. 1823-1824. Type: C-DC?

S. *phillippica* De Candole, Prodr. 462. 1823-1824. From Philippine Islands. Type: G-DC?

S. *obtusa* Richard, Essai D'une Fl. L'ile Cuba. I. 161. 1845. From Cuba. Type: P.

S. *riparia* Hochstetter ex Richard, Tent, Fl. Abyss. I.65,1847. From Abyssinia. Type: K.

S. *astryaefolia* Webb & Parlatore, Fl. Aethiop. 49. 1851. Type: Florence?

S. *longiges* Emey ex Harvey & Sonder, Fl. Capensis I. 167. 1860. From Cafraria and Port Natal Type: K.

S. *paraguariensis* Hochstetter ex Chodat & Hassler, in Bull. Herb. Boiss. Ser. ii. 294. 1905. Type: K.

S. *blepharoprion* Ulbrich in Notizbl Bot. Gartens Berlin vi.312. 1915. Type K.

S. *rhombifolia* var. Hutchinson & Dalziel, Fl. W. Trop. Afric. I(2): 339. 1958. From Ibadan. R.D. Meikle 909. Type: UIH.

Source: Ugborogho, 1980b.

III. ***Sida cordifolia*** *Linnaenus*. Sp. Pl. 684. 1753. From India,. N. 866, 12. Type: LINN

S. *rotundifolia* Lamarch. Ency. I.5. 1783. Type: P.

S. *altheafolia* Swartz: Nova Gen. 101. 1783. From Jamaica. Type: K.

S. *bourbonica* Cavanilles, Diss. i.9.t.10.f.2. 1785. From Island of Bourbon. Type: Microf. BM.

S. *herbacea* Cavanilles, Diss. i.19, t.13. f.l. 1785. From Island of St. Domingo. Type: M.A.

S. *micans* Cavanilles, Diss. i. 19 t.3. f.l. 1785. From Island of St. Domingo. Type: M.A.

S. *multiflora* Cavanilles, Diss. i. 18. T. 3. 1785. From Braxil. Type: M.A.

S. *truncata* Cavanilles, Diss. i. 35. T. 6 f.7. 1785. From Island of St. Domingo. Type M.A.

S. *suberosa* L'Heritier, Stirp. Now. 113. t.54. 1785-1791. From Hispaniola. Photo: BM.

S. *africana* Palisot de Beauvois, Fl. Owar. II. 87. 1816. Photo: P.

S. *conferta* Link, Enum. Hort. Berol. Ii 207. 1822. Type: B?

S. *pellita* Humboldt, Bonpland & Kunth, Nov. Gen. et sp. V. 263. 1822. From Orico, American Equator, Type: P.

S. *tomentosa* Vellozo, fl. Flum 277, vii. T. 14 1825. Photo: BM.

S. *aristata* Willdenow ex Sprengel. Syst. iii. 116. 1826. Willdenow n. 12716. Type: B.

S. *holosericea* Wildenow e Sprengel, Syst. iii. 112. 1826. Willdenow n. 12693. Type: B.

S. *velutina* Willdenow ex Sprengel, Syst. iii. 115. 1826. From India. *Willdenow* n. 12696. Type: B.

S. *decagyna* Schumacher, Beskr. Guin. Pl. 307. 1828. Type: C.

S. *byssina* Schrank, Syll. Ratisb. ii. 70. 1828. From Brazil. Type: Munich.

S. *vellosiana* Steudel, Nom. Ed. II (ii). 579.1841. From Brazil. Type: DC?

S. *vestita* Steudel, l.c.

S. *hamulosa* Salzmann ex Grisebach, Fl. Brit. W. Ind. 76. 1864. From Peru. Type: GOET?

S. *ciliosa* Bojer ex Baker, Fl. Maurit. 19. 1877. From Mauritius. Type: K?

S. waltheriaefolia Bojer ex Baker, l.c.

S. *variegata* (Grisebach) Krapovickas; Boletin Soc. Argent. 187. 1952. *Hieronymus* n. 597. Photo: BM.

Source: Ugborogho, 1980c

4.0 Moulding Human Lives

Mr. Vice-chancellor, Sir, I thank my Lord for the special privilege given to me to develop both the brains and minds of thousands of Nigerians and Foreigners through the TEACHING PROFESSION HE HAS ASSIGNED TO ME. I

have no regret even though as a University Professor, my take home pay can not take care of my basic needs.

I started my teaching career at my *alma mater*, Baptist Boys' High School, Oyo (now Olivet Baptist High School, Oyo) in May, 1955.

4.1 Teacher in Secondary/Post-Secondary Schools.

I have been privileged to teach several youths in nine Secondary Schools in Nigeria and one in England. Of the nine Schools in Nigeria, I was a full-time teacher in five and part-time in four. The schools in which I was a full-time Teacher are Baptist Boys High School, Oyo (now Olivet High School), 1955-1956, Baptist Boys High School, Abeokuta, 1957-1958, Ansar-Udeen Grammar School, Surulere, 1959, Ahmadiya Girls High School, Surulere. (now part of anothr School), August – December, 1964 and Queen's College, Yaba, 1964 – 1967.

4.2 Lecturer in Universities

(A) University of Waterloo, Waterloo, Canada.

Here I was a Graduate Assistant attached to some Academic Staff of the Department of Biology of the University.

(B) University of Lagos

(i) Teaching

I have Lectured in this University for over Twenty six years now. Without any ray of doubt, I have lectured thousands of students in this University over the years.

(ii) Supervision of Research Projects

As I stated above, my field of specialisation is very broad and so I have found it convenient to supervise students in different subject areas of Biosystematics.

(a) B.Sc. Projects

As at now, I have successfully supervised sixty seven (67) students.

(b) M.Sc./2Year M.Sc. /M.Phil. Projects

I am pleased to state that I have up-to-date-successfully supervised Nine (9) students in these categories.

(c) *Ph.D. Research Projects*

Two of my Ph.D. students – Dr. G.C. Obote and Dr. O.A. Oyelana – were awarded the Ph.D. Degree of the University of Lagos in 1995 and 1997 respectively. The other two will complete their write-ups early next year.

From the above account, I can safely say, with thanks to the Almighty God, that I have successfully produced up-to-date seventy eight (78) academic SONS and DAUGHTERS whose names will remain indelible in my academic records and who will remember the name "UGBOROGHO" throughout their existence on this terrestrial globe.

I should add that the above records also confirm that I have produced graduates in all the four categories of science degrees awarded in the University of Lagos. I also wish to state that my four Ph.D. students/Graduates have specialised in my main subject areas in Biosystematics namely, Cytogenetics and Breeding systems, Evolutionary Biology, Biology and Biosystematics.

I wish to also add that academics, especially Professors, who fail to produce Ph.D. Graduates before bowing out of the University system should see themselves as failures and disgrace to those who supervised them through think and thin to ensure that they were awarded Ph.D. degrees. After all, the joy of a teacher is to look behind and say:- that Director General, that Tycoon, that Pastor/Reverend, that Deacon/Deaconess, that Medical Doctor, that Headmaster,/Headmistress, that Lecturer/Professor, that Vice-Chancellor, that Commissioner/Minister, that Administrator/Governor and above all that Head of State/President was my student. I have virtually achieved all of the above. I thank the Lord for the privilege .

5.0 RELEVANCE OF BIOSYSTEMATICS TO THE GROWTH AND DEVELOPMENT OF A NATION

The two complex factors that govern the growth and development of an organism are environment and genetic system. The modification of these two factors usually affect the organisms positively or negatively. Thus a change in the environmental conditions which may eventually affect drastically the genetic system of a sexually reproducing organism which could lead to the formation of different sex cells that could fuse with other sex cells to form new varieties, subspecies and with time species.

As shown in section 3.0 above, the new organisms that evolve as a result of the changes may not survive in the old environment while some due to the presence of certain adaptive genes may survive, grow and develop to maturity. Those which survive will eventually propagate their kinds. If their offspring are defective in one form or another, the shortcoming will be exhibited or observed in the way they adapt themselves to the environment.

When there is mutation, several individuals may be formed in one go especially in micro-organisms like bacteria. The situation is different in higher animals like mammals which usually produce fewer offspring at a time. The situation is more pronounced in human which normally produces one offspring at a time.

My observations on the different types of syndromes reported above show clearly the danger of chromosomal aberrations. I wish to add that it is not all the defective aspects of a man that may be conspicuously revealed at adult stage. Thus it is possible for such human to transmit the inherited gene to his offspring.

In view of the existence of such defect in man, it is necessary to classify man according to the type of observable defects. Consequently, it may be possible to reduce the chance of abnormal person handling important or delicate assignments.

A case in point is that of a sickler who will not normally be able to withstand prolonged strain and stress. Such a person, for example, should not be appointed a football coach or assigned to any job that demands the use of a lot of energy within a short time. The same thing is true of someone whose brain is not fully developed.

Thus it is clear that in human society, some individuals perform poorly or excellently well due to the environment they originated from or they find themselves or due to their genetic constitutions. A person who is genetically fit will normally perform well except where a bad environment like corrupt society may change his approach to life. In such a case one can describe the individual as not being morally strong.

Under normal condition, only those with mental fitness go in for academic work and graduate with various degrees. They are usually referred to as intellectuals of various degrees. A few of such individuals usually generate ideas rather than waste their time discussing human. Such special mentally sound human beings are essential "commodities" in a given human society.

The intellectuals of such category may be referred to as the "Kings and Queens" of any country or nation while all the others are just to implement the decisions of the intelligent ones.

Come to think about it, how can you implement what you don't know? How can you give what you do not have? How can you see an object when you are blind? How can you develop a sustainable economy when you are not developed for such? How can you develop the manpower of your nation when you do not source the well developed brains for important assignments?

For a nation to grow and develop adequately, devoted visionary leaders and followers must be available to carry out all the national activities with sincerity and dispatch.

Since we now know that intellectuals are very important for the development of a nation, it shall be a disastrous mistake for the managers of any nation, through omission or commission, to deliberately down grade its intellectuals. Such omission or commission will automatically lower the standard of the nation in all its programmes of development.

6.0 RECOMMENDATIONS

1. To the Federal Government

a). As at now, the basic sciences are seriously being neglected. This is because most students who want admission into the Universities opt for applied sciences or presumed professional

courses within the sciences. If no definite action is promptly taken to curb such erroneous drive now, there will come a time when there will be no enough lecturers to teach the so-called professional courses. JAMB candidates depend mostly on basic scientists to prepare them for admission into Universities.

b). Science Teachers in Secondary Schools and Lecturers in the Universities should be paid special allowances to encourage them to remain in class rooms and Lecture Theatres. Don't let us deceive ourselves, without the basic sciences there will be no Engineers nor Medical Doctors.

c). Students should be encouraged to study pure sciences by awarding them scholarships and special allowances.

d). The word 'WAZOBIA' which appears to have found its way into the 'Nigerian Dictionary' is divisive and hence its use should not be encouraged. After all, many active Nigerians who have been working hard for the unity of this country are not from the three majority tribes.

e). Nigerian Lecturers have been looking forward to better conditions of service for some time now. I think it is time the Government released its hold on the new package of remuneration for Lecturers, Professors and other categories of staff in our Universities. This is to ensure that academics improve on the standard of teaching and research in higher institutions.

2. *To University of Lagos*

a) The University should institutionalise an "AWARD WINNING NIGHT" which should take place every year during which all categories of staff who have served the University for 15 or more years will be given special recognition and reasonable gifts.

b) The Faculty of Science should organise refresher programmes for secondary schools science teachers on annual basis.

c) The Department of Biological sciences, with five degree awarding Units, has definitely made its mark. That some Units have not been scrambled for by Jambites is not a good reason to reduce its number of programmes. The truth is that many youths usually opt for professional programmes in the belief that they will make quick money after graduation. We need more dedicated Biologists not just money seekers. The best bet for the University of Lagos at this point in time is to upgrade the Department into Faculty of Biological Sciences. That should embrace Biochemistry, Pure & Applied Biology, Botany, Microbiology, Marine Biology & Fisheries and Zoology. There should also be Diploma programmes in Fisheries and Horticulture. This arrangement will encourage the academics to work harder to develop their respective Departments by generating funds.

d) Mr. Vice-Chancellor, Sir,

Universities have been named after some individuals in this country and elsewhere. In this country, such individuals have been politicians or persons with royal blood. I think it is now time when academics should be given such recognition or honour.

As I had mentioned above, the late Professor Eni Njoku was the first vice-chancellor of this great Institution. He was the one who initiated the Faculty of Science through the establishment of Biology Research Unit soon after the University took off. I, hereby, recommend that the Faculty of Science should now be named after him thus changing its nomenclature to "ENI NJOKU FACULTY OF SCIENCE."

7.0 ACKNOWLEDGEMENTS

There is, no doubt, that I have on one occasion or another acknowledged the acts of kindness shown to me by all my mentors and benefactors. However, I wish to take advantage of this unique opportunity to express my thanks once again to some of them.

To start with, I thank God who has made it possible for me to deliver this lecture today. I give all the glory to him. I remember my late parents, Chief & Mrs. R. Ugborogho Dottie through whom the Lord brought me into this world. My mother left this world when I was four years old and my father followed when I was thirteen. May their souls rest in peace. They played their parts as parents when they were alive.

I thank my eldest half sister, Mrs. Felicia E. Ogbe, who has been quite kind to me all along. I wish her long and happy life. I am also grateful all my other half-sisters and my brother.

I remember my late Father-in-Law, Mr. Obotaru Ekpeminaghan, who gave me his daughter's hands in marriage. May his soul rest in peace. I am also grateful to my mother-in-law, Mrs. Lucy Ekpeminagham.

Reverend W. Joel Fergeson was the Principal of my *Alma Mater*, Baptist Boys High School, Oyo (now Olivet Baptist High School, Oyo). He was kind enough to appoint me a teacher in the school in May, 1955, about six months after the completion of the Cambridge School Certificate Examination.

I wish to remember late Alhaji Olasiji Layeni, Principal of Ansar Udeen Grammar School, Surulere for appointing me a teacher in his school in 1959 and for recommending me for the Federal Government scholarship which I used to study at Fourah Bay College, University of Durham. I wish to also remember, with gratitude to God, Late Mr. E.L. Akinsanya, Principal of B.B.H.S., Abeokuta who appointed me a teacher in his school in 1957. May his soul rest in peace.

I wish to place on record that the following dedicated Academics played special roles in my struggle to obtain the Ph.D. degree of the University of Lagos. These great Academic leaders are – Late Professor Ayodele Awojobi, former Head of the Department of Mechanical Engineering, Prof. Grace Alele Williams, Director Institute of Education, Prof A. Boyo, former Head of the Department of Pathology, College of Medicine and the former Vice-Chancellor, Late |Professor B.K. Adadevoh. May the Lord continue to protect all those left behind by the departed Professors.

Professor and Mrs. J.O. Ogunlade were exceptionally kind to me when I was seriously ill in 1993. I am particularly grateful to them.

My Vice-Chancellor, Sir, I thank you most sincerely for giving me the opportunity to serve this community further through my appointments as chairman of some important committees of this University. I have tried my best to perform my duties efficiently. May the Good Lord guard and guide you in your endeavour to upgrade the status of this University. Professor Matthew B. Scott-Emuakpor supervised my Ph.D. research project. He is a very responsible, reliable, hardworking and dedicated academic. He stood steadfastly by me during my 'Ph.D. Crisis'. May the Lord bless you in all your activities.

I must not forget the members of my nuclear family. I thank God for giving me three handsome males and one beautiful female. My only daughter and her handsome husband, Dr. Dele Ogunremi, came all the way from Canada to attend this lecture. My second child, Asangbemi, flew in from London only a few days ago while my most senior child, Joel, through whom God has given me a beautiful grand daughter, Omasan; sent me congratulatory message and some goodies.. My baby, who has decided to stay with me here in Nigeria instead of going to Canada is Gbubemi. He has been very helpful to me.

Last and not the least, I wish to sincerely thank my beautiful wife, and the mother of my four children, who has taken good care of me for the past thirty two (32) years. She is a wonderful lady and wife. She is a special gift of God to me.

8.0 THE END

Mr. Vice-chancellor, special Guests, Ladies and Gentlemen, the end of the matter is this, "Fear God and keep his commandments, For God will bring every deed into judgement, with every secret thing whether good or evil" Eccl. 12 : 13 – 14

Thank you and the Lord bless all of you abundantly.

Professor Reginald E. Ugborogho.
17th December, 1997.

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