
INTERNATIONAL BRAIN
IBRO
RESEARCH ORGANIZATION
ISN
International Society for Neurochemistry
SPONSORED
IBRO/ISN
NEUROSCIENCE
SCHOOL, IBADAN
2017
FEBRUARY
05-02-2017 TO 11-02-2017
VENUE: BISCORDINT INNOVATION HUB
OPPOSITE FACULTY OF TECHNOLOGY, UI
THEME
Phytochemical Therapy
for Neurological Diseases
FURTHER INFORMATION 08035222447

Theme of School: Phytochemical Therapy for Neurological Diseases

Date: 5th February – 11th February 2017 (Sunday to Saturday)

Venue: Biscordint Innovation Hub (BHI), University of Ibadan

Host/Convener Prof J.O. Olopade

Local Organising Committee Members:

Dr Ayo Olude

Dr Taiwo Bademi

Dr Joan Adekanbi

Dr Olamide Adebiyi

Dr Mayowa Igado

Dr Adedunsola Obasa

Amany Ladagu

Mrs Rachael Folarin

Mr Ramoni Shina

Dr Funmi Olopade

Dr Oluwaseun Mustapha

Dr Folusho Atiba

Dr Omotola Abdulmalik

Dr Levi Usende

Overview

With the growing interest of the world in natural medicine and natural product chemistry, the school was organised to properly train students and put them through hands-on practicals on the use and evaluation of phytochemicals for several disease conditions directly related to the brain. The school covered topics related to phytochemical analysis (including fractionation and characterization), basic neurocellular anatomy, neurodegenerative processes, behavioural testings, neurotoxicology and neurological medicine, and conduct practicals in the areas of plant extraction, behavioural testings, immunohistochemistry and western blotting.

Participants

The school participants were selected by the School Organising Committee. Thirty students were selected from 99 applicants. Eleven students were selected from Cameroun, 1 from Sierra Leone while the other 18 were from Nigeria.

Name and Country of Students

	STUDENTS		**COUNTRY**
1	Abaïssou	Hervé Hervé	CAMEROON
2	Agnes	OUAFO	CAMEROON
3	Ajayi	ABAYOMI	NIGERIA
4	Ajibola	MERAIYEBU	NIGERIA
5	Antoine	KADA	CAMEROON
6	Ayodele	AKINYEMI	NIGERIA
7	Benneth	BEN_AZU	NIGERIA
8	Bilqis	LAWAL	NIGERIA
9	Constant	PIEME	CAMEROON
10	David	FOSTING	CAMEROON
11	Edem	EDEM	NIGERIA
12	Emmanuel	ESOM	NIGERIA
13	Farmanga	NGOBEH	SIERRA LEONE
14	Franklin	ZEMO GAMO	CAMEROON
15	Idowu	OYELEYE	NIGERIA
16	Jamil	DAUDA	NIGERIA
17	Judith	POUADJEU	CAMEROON
18	Lohik	MBOLANG	CAMEROON
19	Lucien	NKONO NKON	CAMEROON
20	Lydia	IOR	NIGERIA
21	Michael	GABRIEL	NIGERIA
22	Monsurat	GBADAMOSI	NIGERIA
23	Olusegun	ADEOLUWA	NIGERIA
24	Olusegun	OMOTOSO	NIGERIA

25	Opeyemi	OGUNSUYI	NIGERIA
26	Oritoke	ALUKO	NIGERIA
27	Osarume	OMOROGBE	NIGERIA
28	Rudy	SIMO	CAMEROON
29	Sunday	OLATUNJI	NIGERIA
30	Valentine	UCHEAGU	NIGERIA

Names and affiliations of School Faculty:

	NAMES	ADDRESS	SCIENTIFIC INTEREST	EMAIL
1	Dr. Taiwo Elufioye (TE)	University of Ibadan	Pharmacognosy, Medicinal plant research, Aging and Neurodegenerative Diseases	toonitaiwo@yahoo.com
2	Prof. Marina Bertivoglio (MB)	University of Verona, Italy	Cellular and Functional Neuroanatomy	marina.bentivoglio@univr.it.
3	Prof. James Connor (JC)	Penn State University, USA	Behavioral Sciences, Aging and Neurodegenerative Diseases	jconnor@hmc.psu.edu
4	Prof. Adeboye Adejare (AA)	University of the Sciences, Philadelphia, USA	Pharmaceutical sciences, NMDA receptor blockers	a.adejar@usciences.edu
5	Prof Adesola Ogunniyi (AO)	Department of Medicine, , University of Ibadan, Nigeria	Neurodegenerative diseases	aogunniyi53@yahoo.com
6	Prof. Richard Brown (RB)	Dalhousie University Halifax, NS Canada	Behavioural Science, Biological Psychology, Experimental Psychology	rebrown@dal.ca
7	Prof. Oye Gureje (OG)	Department of Psychiatry, University of Ibadan, Nigeria	Psychiatric diseases	oye_gureje@yahoo.com
8	Dr. Bamidele Owoyele (BO)	Department of Physiology, University of Ilorin, Nigeria	Physiology of Pain	deleyele@yahoo.com
9	Prof. James Olopade (JO)	Department of Veterinary Anatomy, University of Ibadan, Nigeria	Neuroanatomy and Environmental Neurotoxicology	jkayodeolopade@yahoo.com

School Timetable

TIME	SUNDAY 5th	MONDAY 6th	TUESDAY 7th	WEDNESDAY	THURSDAY	FRIDAY	SAT
MODULES/SUBJECTS		Phytochemical Analysis	Functional Neuroanatomy Neuropathology	Epidemiology of Neurological Diseases in Africa	Biology and Therapy of Neurological Diseases	Cell Culture and Behavioral Testing	
7.30-9.00		Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
9.00-11.00		Opening Ceremony/	MB/RB	AO/OG	JC/JO	BO/TE	Departure
11.11.15		IBRO Advocacy Talk	B	R	E	A K	
11.15-12.00	Arrival	RB	JC	BO	AA	RB	
1200-1.00	and	LUNCH	BREAK	LUNCH	BREAK	LUNCH	
2.00-5.30		Phytochemical Analysis AA, TE	P R A	C T I	C A L S 2:30-4:30	Student's Presentations/Patent Talk/Round Table Discussion	
6.00-7.30	Registration	Short Break/Talk on Ethics in Research/Professional Skills Talk AO/MB	DINNER	DINNER	Open Talk; MB 5:00-7:00	DINNER	
7.30-9.30		Short Break Survival Skills JO DINNER	Cellular neuropathology MB	Epilepsy and Neuronal Wiring MB Student's Presentations	DINNER	Dinner and Send Off Party/ Certificate Presentation	

Short Description of Lectures

1. Phytochemical Analysis: Lectures on plant collection, preservation, extraction, constituent separation, and characterization. A lecture will be on Drugs and Blood Brain Barrier dynamics
2. Functional Neuroanatomy and Neuropathology: Lectures on general gross and cellular anatomy, regions specific functions, brain cell types and cytoarchitectural changes in disease.
3. Epidemiology of Neurological Disease in Africa: Lectures on neurological diseases common to the African continent like epilepsy, stroke, dementia and psychiatric illnesses. Another lecture was on pain

4. Biology and Therapy of Neurological disease: These had topics on environmental neurotoxicity, iron homeostasis in the brain and development of drugs for neurological therapy 5. Day 5 Lectures was on toxicological testings' using Cell Cultures, the principles of LD_{50}, apoptotic assays. The principle of tests for behaviour in mice was addressed.

Short Descriptions on Practical Sessions

Phytochemical Analysis: Making aqueous and ethanolic extractions, Demonstration of different chromatographic techniques such as Thin Layer, Preparative, Thin Later, column, Vacuum Liquid chromatography etc.

Immunohistochemistry: Demonstration of ethical euthanasia and perfusion in rat and immunohistochemistry of myelin in the brain

Behavioural Testing: Demonstration of Open field, hanging wire, Morris water maze and novel object tests.

Accommodation and Transportation

The students and Faculty were accommodated in the University of Ibadan Hotel which is located within the University Premises and about 2 km away from Biscordint Innovation Hub (BIH). Buses and cars were provided to pick up and drop the students and Faculty from the hotel and BHI and vice versa.

DAY 1- Arrival

6th FEBRUARY 2017 DAY 2- OPENING CEREMONY

The opening started at 9:00am with the Vice Chancellor Prof A.I. Olayinka in attendance. In his opening address he welcomed the students and Faculty of the IBRO/ISN School and wished them a wonderful stay in the University.

Prof. Richard Brown gave the advocacy lecture where he stated that the Africa continent as a whole need to give more attention to give more attention to the subject "neuroscience" as there is an increase in neurological disorders in the continent. He advised thst the University should take a lead in this regard and he used the Dalhouise University Halifax, Canada as a model. After his lecture, the Vice Chancellor presented him a plaque as a gesture from the University.

The ceremony ended at 10:05am

Attendance from the University Community

Prof. Toyin Odeku- Director, Office of International Program

Prof M.O. Oyeyemi- Dean, Faculty of Veterinary Medicine

Dr Toyin Ajala- Department of Therapeutics, Faculty of Pharmacy

Dr. Nike Akioye- Department of Veterinary Surgery and Reproduction, Faculty of Veterinary Medicine

The Day 2 lecture was on **PHYTOCHEMICAL ANALYSIS**

FIRST SESSION by Prof Adeboye Adejare

His lecture was titled "Phytochemical based drug Discovery: From Crude to Refined"

He stated the need for development of new drugs as some of the existing drugs for current therapy are not optimal as well as problem of microbial resistance.

He also observed that attention is been shifted to drug from plant origin. He emphasized some central nervous system (CNS) drugs that are of natural origin (such as morphine, galantamine etc)

He further stated that plants must be screened for biological activity, isolated, characterized, pass through clinical trials before they can be approved for use. He also emphasized the need for post-clinical examination of such drugs. However, he observed that less than 1% of new drugs are approved for use because of several pharmacokinetics and pharmacodynamics reasons. He encouraged the students that although the process of development of drugs is a long one, the result of such research is very rewarding.

SECOND SESSION: Dr Taiwo Elufioye

She defined phytochemicals as"plant-derived chemical compounds with potential health-promoting properties" such as phenols, flavonoids, alkaloids, terpenoids, sulforaphane, saponins, naphthodianthrones, anthraquinone, courmarins etc

She said phytochemical analysis refers to the extraction, screening and identification of the medicinally active substances found in plants and other natural sources and it involves extraction, screening and identification of the active substances in plants. She analysed the various options available for each of the process.

ETHICS IN RESEARCH- Prof Adesola Ogunniyi

He started his lectures by defining the word "research" as well as types and processes involved in research. He emphasized that ethical reviews are important to

1. ensure that the study is of value to the society
2. Identify potential for abuse of research participants
3. Ensure the safety of vulnerable populations (such as pregnant women, children)
4. Identify potential for scientific misconduct (such as plagiarism and falsification of result)

He also stressed the need for informed consent in any intending research.

He further highlighted that the "Belmont Principles" should always guide research protocols i.e. Respect for persons, benevolence and justice.

He concluded that the benefits of any research must always outweigh its risks and that the benefits of research will be lost if unethical practices are not curtailed. He further stated that IRB is essential for ensuring compliance with ethical principles.

PROFESSIONAL SKILLS by Prof. Marina Bentivoglio

In her lecture she stated that "formulating a good research question" is a prerequisite to the overall success of any study. She emphasized the importance of record keeping in any experiment. In addition, she took the students through the elements of good curriculum vitae. She strongly advised against publishing in predatory journals. She gave several personal experiences to further drive home her points.

SURVIVAL SKILLS FOR AN ACADEMIC MAZE: THE CHALLENGE OF THE AFRICAN ENVIRONMENT by Prof. James Olopade

In his lecture he itemised some challenges for which are peculiar to the African Setting such as low funding for academia and relatively poor mentorship. However, he used himself as examples that notwithstanding these challenges are surmountable. He concluded by giving some elements that are needed for academic excellence and listed organisations such as IBRO, ISN and Humboldt that give grants and fellowship to students and academia.

7th FEB., 2017 (DAY 3) - FUNCTIONAL NEUROANATOMY/NEUROPATHOLOGY

The first lecture for the day was by **Prof Marina Bentivoglio** titled **Cellular neurobiology overview**

Prof Marina Bentivoglio stated that neurological disorders are due to a variety of pathogenetic mechanisms (infection, trauma, neurodegeneration, etc.) and these result in structural / functional dysregulation of neurons. She also highlighted the differences between the central and peripheral nervous systems. She concluded by examining the basic structure of neurons and functions of glial cells were also discussed.

The second lecture for the day was by **Prof Richard Brown** titled **What have we learned about ageing and dementia from mouse models of Alzheimer's disease?**

Prof Richard Brown gave a lecture on his past research studies which were majorly aimed at determining the age-related decline in cognitive functions in transgenic mouse models of Alzheimer's disease as well as use the mouse models to test new drugs to improve cognitive function. He however stated that many genetic and environmental factors may influence the results.

He reviewed the different strains of Alzheimer's model mice and observed that there exist some age-related sensory deficits in vision and hearing, age-related motor deficits and sex differences. He concluded that at the moment there is no "perfect" model of mouse model of Alzheimer's disease as there are roadblocks which make it impossible to translate results from mouse model to human subjects.

The third lecture for the day was by **Prof James Connor** titled **Two Studies on Manipulation of Dietary Iron: Development of a Medical Food.**

Prof Connor emphasized the need for Fe in the body especially and stated that Ferritin is an iron storage protein that also acts as a temporary store preventing toxic build-up of iron levels and thus widely distributed in living organisms. He also added that ferritin is neuroprotectant, neurotrophic factor, found in nuclei of developing cells and has specific receptor on oligodendrocytes.

From results of studies from his laboratory, he emphasized that ferritin binding in the developing mouse brain follows the pattern of myelinogenesis both spatially and temporally.

Prof Connor stated that with the high prevalence of iron deficiency with its attendant anaemia, this has made Fe deficiency the most prevalent nutrient disorder in the world (WHO) thus there is a need for a novel dietary iron supplement?

He said research from his lab is targeted on developing medical food from yeast (*Saccharomyces cerevisae)* that expresses H-ferritin. He said previous studies had shown improvement in anaemic animals after 2 weeks dietary intake of 6mg/kg iron dose in the yeast. He concluded that efforts are on-going to test the nutritional yeast on human subjects in an effort to manage iron deficiency.

PRACTICALS

The students were divided into 3 groups

1. Immunohistochemistry-brain dissection, euthanasia, perfusion and immunohistochemistry of myelin in the brain was demonstrated
2. Behavioural Test- demonstration of Morris water Maze, Open field test, light/dark transition box, Forced Swim Test, Balance Beam, Hanging wire and Grid suspension Test
3. Phytochemical Analysis- students were taking round the Herbarium. Demosntartion of various plant extraction methods, vacuum column and thin layer chromatography was also done

The fourth lecture for the day was by **Prof Marina Bentivoglio** titled **Cellular neuropathology**

Prof Marina Bentivoglio defined neurodegeneration as neuronal cell death and that it occurs in a variety of pathological conditions (e.g stroke and seizures)

She further added that neuroinflammation involves astrocyte microglia activation (with or wihout T cell recruitment), release of inflammatory mediators (cell responses, proliferation, migration), gene induction/upregulatio. She also said neuroinflammation can accompany neurodegeneration or can occur independently and that it is the hallmark of nervous system infections. She made a distinction between the following terms

- Neuroinflammation: beneficial and may become detrimental
- Neurotoxicity: detrimental (irreversible or reversible)
- Neurodegeneration: detrimental (irreversible)

She stated that neurological disorders are always due to structural/functional dysregulation of neuron and that during neuroinflammation there is the release of pro-inflammatory and anti-inflammatory cytokines. She emphasized the role of astrocytes and microglia response in neuroinflammation.

She concluded by stating that some neurodegenerative diseases are associated with aging with emphasis on Alzheimer's (neuronal loss, deposition of abnormal proteins known as amyloid plaques in neurons or extracellularly), Parkinson's disease (Degeneration of nigro-striatal dopaminergic neurons, hyperactivity of cholinergic neurons and Amyotrophic lateral sclerosis (ALS) that leads to progressive degeneration of motor neurons (upper and lower motor neurons) which innervate striated muscles.

8th FEB., 2017 (DAY 4) – EPIDEMIOLOGY OF NEUROLOGICAL DISEASE IN AFRICA

The first lecture for the day was by **Prof Adesola Ogunniyi** titled **Epidemiology of Neurological Diseases in Africa**

He started his lecture by giving the common neurological disorders in African Communities (Migraine, Stroke, Epilepsy, Peripheral Nerve Disorders, dementia, Myelopathy, neurodegenerative diseases)

He analysed the risk factors associated with each of these disorders. He concluded that his lab has been involved in Tailored Hospital-based Risk Reduction to Impede Vascular Events after Stroke (THRIVES) which is a study tailored to improve risk factor control, improve quality of

life and prevent another occurrence of stroke in patients who have had previous episode(s) of stroke using a set of innovative interventions.

The second lecture for the day was by **Prof Oye Gureje** titled **Epidemiology of Mental Disorders**

Prof Oye Gureje introduced his lecture by saying that "mental health problems are common and universal" Numbers of People Affected (Global, 2002). He also highlighted the prevalence of major psychiatric disorders in primary health care across Nigeria where he noted that children are not immune from these disorders such as depression, conduct disorder and anxiety. He said The Ibadan Study of Ageing (ISA) Depression in the elderly revealed that depression is more common amongst urban residents, people with disability and caregiver, presence of arthritis, diabetes, hypertension, or asthma doubles the risk of having depression.

He also highlighted the socio-economic adverse effects of mental disorders (impairment of role functioning, marital dysfunction, parental role impairment). From his past studies he said at least 1 out of every 12 Nigerians will have a mental illness in their lifetime and that 1-2 of every 8 Nigerians will experience a mental illness.

He further opined that "The Disability Adjusted Life Year (DALY)" is an indicator of the time lived with a disability and the time lost due to premature mortality.

He stressed that the burden of mental, neurological, and substance use (MNS) disorders is on the increase (41%) between 1990 and 2010 and gave the common symptoms of mental disorders.

He ended his lecture by stating that most psychiatric disorders lack validating biological attributes and cultural biases has further hindered treatment.

The third lecture for the day was by **Dr Bamidele Owoyele** titled **Pain treatment and Phytotherapy**

Dr Bamidele Owoyele gave the definition, classification and pathways of pain according to the International association for the study of pain IASP (2017)

He identified the various animal models of pain (thermal stimuli, injecting various noxious chemical irritants/inflammogens e.g. – formalin, carrageenan, or Complete Freud's Adjuvant (CFA) into the paw, use of acetic acid writhing and colorectal distension models, use of transgenic mice expressing sickle haemoglobin (HbS) etc.

He also stressed the general method of treating pain (Use of NSAIDs, Localized anaesthetic, acupuncture, physical therapy, surgery etc)

He stressed that his past research involved the use of plants for pain treatments such as *Allium spp, Khaya senegalensis* (leaves&stem bark), *Bryophyllum pinnatum*, *Alstonia boonei* (root&stem bark), *Ageratus conizoides* (leaves), *Vernonia amagdalina* (leaves) etc. He also gave analysis on some plant derived analgesic products. In his lectures he stated that traditional medicine is closely linked with peoples' cultures and it is not going to vanish if and when western health care becomes unavailable. He said natural products are perceived as gentler, cheaper, safer and may be taken as supplement in diet. He argued that in the past plants have provided a source of inspiration for novel drug compounds. He concluded that research on Phytotherapy should be holistic and that side effects, interaction and handling of such herbs/plants should be studied.

The fourth lecture for the day was by **Prof Marina Bentivoglio** titled **Epilepsy and neuronal wiring**

She described epilepsy as a chronic condition of various aetiologies characterized by the occurrence of recurrent, usually spontaneous and unpredictable, epileptic seizures. She emphasized that to define a pathological condition as epilepsy the occurrence of two or more unprovoked seizures is necessary**.** She said epilepsy is the most common chronic neurological condition in the world and that 22% of its burden is estimated to be in Africa and that epilepsy can be treated. She said in the past epilepsy was considered a "demoniac disease" and the epileptic person as possessed by evil and that epileptic people were viewed with fear, suspicion and misunderstanding and were subjected to enormous social stigma.

She gave the prevalence across the countries in Africa.

She also said epilepsy can be caused by genetic and perinatal factors, infections (viruses, bacteria, parasites, and fungi), head injury, tumours

She examined various *in vivo and in vitro* models of epilepsy.

She further said experimental epilepsy can be reproduced and/or occur spontaneously such as the use of topical bicuculline (GABA-A receptor antagonist) or other chemo-convulsants, tetanus toxin, pilocarpine (i.p. injection to rats and mice) and kainic acid

She encouraged the students that these experimental studies are feasible and relatively cheap using behavioural evaluation, video-monitoring (24h/24h). She said for accurate interpretation of results an objective evaluation of the number, duration of seizures and interval between seizures must be determined. She further outlined some neuro-cellular events following epilepsy such as hyperexcitability, neuronal death, gliosis inflammation, synaptic reorganization of the mossy fibre pathway, cell differentiation and cell death (apoptosis).

9th FEB., 2017 (DAY 5) – BIOLOGY AND THERAPY OF NEUROLOGICAL DISEASE

The first lecture for the day was by **Prof James Connor** titled **Brain Iron: Models and Diseases**

Prof Connor in his lecture stated the need to maintain cellular iron (Fe) homeostasis to ensure oxygen transport, fatty acid synthesis and degradation, myelinogenesis and maintenance Neurotransmitter. He further stated that in toxic levels Fe reacts with H_2O_2 to form Hydroxyl radicals (Fenton Reaction).

He dwelt on several neurological diseases issociated with Iron mismanagement such as Alzheimer's Disease, Parkinson's Disease (Iron accumulation in Basal Ganglia), Pick's Disease, Neuroferritinopathy, Multiple Sclerosis, Restless Legs Syndrome (Iron deficient brain due to defect in iron transport)

He said iron enhances inflammatory responses and that the regional distribution of iron in the brain is similar in humans and animals. He showed several data from past research that indicated a correlation between iron and the effect of cognitive deficits on daily functional capacity. He further stated that mutation in the HFe gene is a co-morbid factors in age dependent neurological disorders as mutation in the gene is associated with iron overload (Hemochromatosis) and abnormal cellular iron uptake.

He summary he stated that HFe allelic variants are common in Caucasians and are found in increased frequency in late onset neurodegenerative diseases.

- HFe variants are associated with a range of phenotypic changes at the cellular level that would enable a pathogenic process to accelerate cell damage
- Animal model of ALS plus H63D variant has accelerated disease
- Maybe a model for identifying new targets
- HFe may be a new cancer target
- HFe genotype can be expected to alter treatment response

The second lecture for the day was by **Prof James Olopade** titled **Vanadium Neurotoxicity**

Prof. Olopade stated that Nigeria's crude oil is rich in Vanadium thus eEnvironmental and occupational exposure to this heavy metal is common in Nigeria. He stated that studies

have showed that vanadium crosses the blood brain barrier as well as milk and that soils around combustion sites have higher V level than natural.

He said that his past studies showed that long term exposure oligodendrocyte depletion and astrogliosis. He has also proposed a mechanism of action following vanadium toxicity in the brain. He said that vanadium toxicity has led to several behavioural impairments in rats, mice and zebra fish from his previous studies.

He showed images from Lacer Ablation Inductively Coupled Plasma Mass Spectrometry method (LA-ICP-MS) demonstrating Vanadium accumulation in rat brain following 18 month exposure and in groups in which vanadium was admisnistered for 3months and the withdrawn. He emphasized that although following withdrawa of V pathological findings was better than the group that was exposed chronically but lesions still persist and were never fully restored as in the control (unexposed) group. He further added that efforts are on-going in his lab to discover compounds that could mitigate the effects of V toxicity such as Vitamin E, Synthesis of Novel Compound from *Moringa oleifera* (MIMO 2) and *Grewia carpinifolia.*

He concluded his talk by showing some preliminary findings using low vanadium concentration and that at this low dose v may be beneficial to the systems.

The third lecture for the day was by **Prof Adeboye Adejare** titled **NMDA Receptor Antagonism: An Approach for Treatment of Alzheimer's and other CNS Diseases**

Prof Adejare stated that Alzheimer's disease (AD) is characterized by the progressive loss of selected neurons in discrete brain areas resulting in characteristic disorders of movement, cognition or both. He highlighted the socio-economic impact, symptoms, diagnosis, pathology, stages and risk factors of AD. His emphasis was on current therapy used in AD.

• Anticholinesterases – Donezepil, galantamine, Tacrine (obsolete because of dosage regimen)

• NMDA-R antagonist – Memantine(Namenda®)

He said no other FDA approved drug for over a decade now thus emphasizing the need to expedite action on new drug discovery for management of AD. He said past therapeutic approach involved the use of

• Anti-inflammatory agents - NSAIDs

• Monoamine oxidase inhibitors - Seleginine

• Vitamins E and C

• Statins • Aβ antibodies - AN-1792

• Aggregation inhibitors • Secretase inhibitors (β and γ)

• Cholineesterase inhibitors

• Receptors i.e. NMDAR

According to him the NMDAR is a ligand and voltage gated cation channel (Ca2+, Na+, K+, Mg+). That has been implicated in numerous physiological and behavioural processes (learning, memory, LTP, addiction, pain).

He said excessive stimulation of NMDAR has been implicated in excitotoxicity, involved in numerous CNS disorders including Stroke, Alzheimer's (AD) and Parkinson's (PD) diseases and that NMDAR antagonist can prevent excitotoxicity. He hghlihted that NMDAR antagonist can also be useful in depression, addiction, neuropathic pain and traumatic brain injury but cautioned against its undesirable side effects (hallucination, ataxia, delusions, altered mood and anxiety) which has limited their therapeutic use.

He mentioned several compounds/drugs that have failed clinical trials such as Selfotel (CG 519755), SDZ EAA 494 (D-CPPene), CPP, Sipatrigine, GV150526 (Gavestinel). Gacyclidine, Remacemide, ARL12495AA, Aptiganel,

He said efforts have been intensified in his lab to synthesis compound such as (AA-101) that are novel NMDA receptor antagonists. He said in this regard such novel compound should have *in vitro* neuroprotective activity, low toxicity and attenuate toxin induced cell

He emphasized that new strategy of drug discovery should be based on not only NMDAR antagonists but also polypharmacology (i.e. compounds should show activities in various CNS receptor models.

The fourth lecture was an open talk/2nd IBRO Advocacy talk by **Prof Marina Bentivoglio** titled **Partnership with Africa in the training of brain researchers: Hoping for developing neuroscience as a career at THE UNIVERSITY CONFERENCE CENTRE.**

This lecture was opened to the public as well as members from the university community. The director of the office of International Program Prof. Toyin Odeku represented the Vice Chancellor. Prof Adesola Ogunniyi represented the Provost, College of Medicine of the University.

Prof Marina Bentivoglio gave a little background of her sojourn in the field of neuroscience and its importance to the science world. She emphasized the many sub-fields of neuroscience (cognitive and neuropsychology, Behavioural and Neural Genetics behavioural neuroscience, cognitive neuroscience, computational Neuroscience, neurochemistry, neurodevelopmental disorders etc). She said scientists in neuroscience

from the African continent are not many and that effort should be made to study diseases and disorders from prenatal development to aging (e.g. mental retardation, learning disabilities, , pain, neuropathies, epilepsy, cerebral palsy, drugs of abuse and addiction, nutritional disorders, head trauma stroke, neuro-AIDS, cerebral malaria, Alzheimer's disease and dementia, anxiety, depression, autism, schizophrenia, etc)

She enlightened the public that societies such as Society of Neuroscientists of Africa (SONA) and Federation of African neuroscience societies foster the growth and awareness of neuroscience in Africa.

She said cerebral malaria, epilepsy, human African Trypanosomosis (HAT) ranks among the top candidates of neglected disease of mankind in Africa. She said the increase in life expectancy in Africa has also necessitated the need for research in aging-related diseases. She said the stigmatisation and socio-cultural beliefs associated with epilepsy in Africa has hampered its treatment across the continent. She concluded that clinical and basic neuroscience should go hand in hand to combat neurological diseases, countries in sub-Saharan Africa should commit to the formation of neuroscientists/neurologists/psychiatrists/ neurosurgeons/neuroradiologist and establish labs as well as give incentives for research (funds, careers).

She later responded to questions from the audience.

10th FEB., 2017 (DAY 6) – CELL CULTURE AND BEHAVIOURAL TESTING

The first lecture was given by Dr Rufus Akinyemi. on Parkinson's disease and herbal remedies for neurological diseases while Dr Elufioye spoke on phytochemical testing

There was a tour within the University and some ancient sites in the Ibadan metropolis. There was thereafter a visit to the University's Zoological Garden.

The climax of the school was a dinner/send forth party where certificate of attendance was presented to Faculty and students of the school. Prizes were also presented to the best 3 students' posters.

N:B The students elected David Fotsing (Cameroun) and Bilqis Lawal (Nigeria) as their Class President and Vice President respectively.

IBRO/ISN SCHOOL 2017 EXPENSES

Activity	Total Income($)	Expenditure($) from ISN funding
	ISN: 16,000	
Secretariat, printing, school materials		2,393
Accommodation-Students and Faculty		5,649
Travel Expenses-International and Nigerian Students		6,647
Practical Session		1,714
Faculty Travels		3,598
Total Expenditure from ISN Funds		20,001
	Other Sources of Income	
	IBRO: 21,520	
Travel for Faculty		3,876
Social Events		912
Venue Expenses		3,144
Feeding		9,080
Internal Transport		905
Transit Accommodation/Security		1,263
Global Pay Charges		2,340
Total Expenditure from IBRO Funds		21,520
	Total Income: IBRO + ISN 37,520	
Total Expenditure of the School		41, 521