FOUNDATION OF THE SOCIETY FOR THE STUDY OF NEUROPROTECTION AND NEUROPLASTICITY

International School of Neurology

UMF IULIU HAȚIEGANU UNIVERSITY OF MEDICINE AND PHARMACY CLUJ-NAPOCA

RoNEURO Institute for Neurological Research and Diagnostic

FUNDATIA JURNALULUI Journal of Medicine and Life

Seminars

Department of Neurosciences University of Medicine and Pharmacy "Iuliu Hatieganu" Cluj-Napoca | Romania

26 - 30 MARCH, 2018

RONEURO INSTITUTE FOR NEUROLOGICAL RESEARCH AND DIAGNOSTIC

37 MIRCEA ELIADE STREET | CLUJ-NAPOCA | ROMANIA

Welcome Address

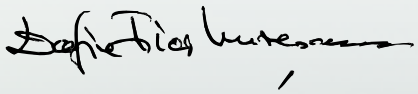
It is a pleasure to welcome you to the 50th edition Seminars - March 26-30, 2018. The seminar is hosted by the Department of Neurosciences, Faculty of Medicine, "Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca. This seminar aims to establish itself as a highly useful framework that will enable local specialists to benefit from the expertise of our invited speakers who are part of associated international faculty of our Department of Neurosciences Cluj-Napoca, Romania and RoNeuro Science network. Our scope is to flourish over years and set up an educational vector aiming to meet our junior and senior specialists' needs.

In contrast to large international conferences, the intention behind these seminars is to create an informal and intimate setting, which hopefully will stimulate open discussions. As organizers, we would therefore be deeply grateful if you participate and share your time with us.

We are looking forward to your active participation in this educational event!

With consideration,

Prof. Dr. Dafin F. Muresanu,
Chairman Department of Neurosciences, Faculty of Medicine,
"Iuliu Hatieganu" University of Medicine and Pharmacy,
Cluj-Napoca, Romania



Program Coordinator

Dafin F. Mureşanu

Co-Chair EAN Scientific Panel Neurorehabilitation

President of the European Federation of NeuroRehabilitation Societies (EFNR)

Past President of the Romanian Society of Neurology

Professor of Neurology, Chairman Department of Neurosciences "Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania

Organizers

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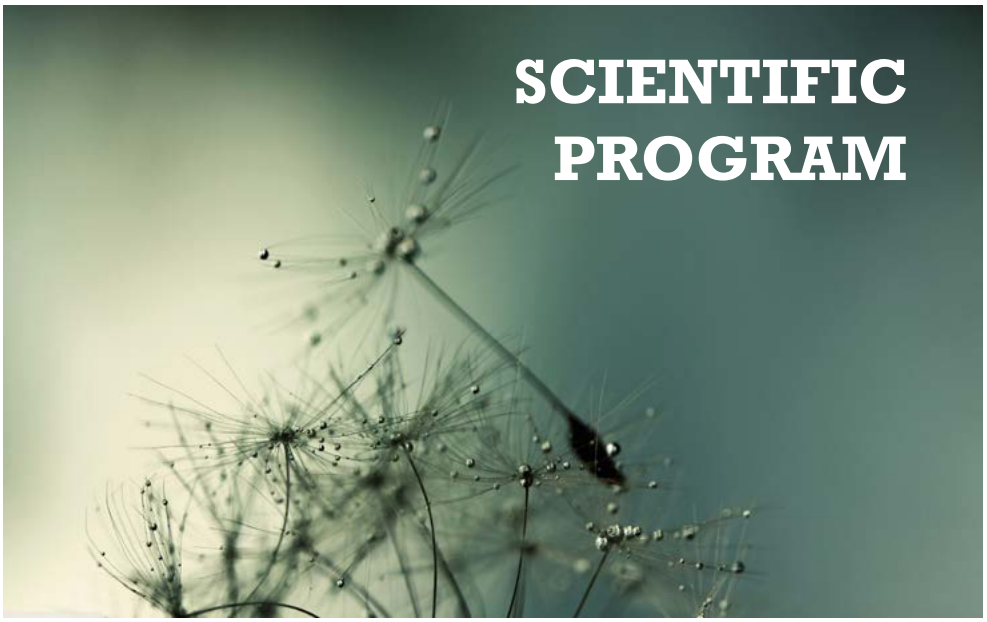
SPEAKER

SPEAKER

Dr. Amzica has been initially formed as a control engineer with a M.Sc. in bioengineering. He then worked as a design engineer for biomedical equipment. He eventually received a Ph.D. in neurobiology at the Laval University in Quebec City (Canada), followed by a post-doctoral training in neurophysiology with the late Dr. Mircea Steriade. Presently he is a professor at the University of Montreal. He is credited to day with contributions to the discovery of the slow (<1 Hz) sleep oscillation, of the cellular mechanism of transforming slow sleep oscillations into spike-wave seizures, and of the mechanisms underlying the dialogue among neurons and glial cells during sleep, wakefulness and paroxysmal discharges. Recently he took interest in investigating the cellular activities during deep coma (mainly burst-suppression) and discovered a new cerebral state (Nu-complex) that appears in a coma that is deeper than what was previously known as the last frontier of a living brain, the EEG isoelectric line.

Florin Amzica

/Canada


SCIENTIFIC
PROGRAM

Scientific program

26 March, 2018

Neurophysiological bases of the electrical (and magnetic) activity of the brain

09:00 - 12:00 Liquid composition, structure of the cellular membrane, diffusion, Gibbs-Donnan equilibrium, osmose

14:00 - 17:00 Starling hypothesis, trans-membrane transport mechanisms, membrane potential, Nernst equation, action potential, synapses

27 March, 2018

Principles of the electroencephalographic signal - physiology

09:00 - 12:00 From cell to field, from field to scalp, dipoles, structures generating dipoles

14:00 - 16:00 Techniques to record EEG, filters, EEG signals (waves vs. oscillations)

16:00 - 17:00 Hands on session (recordings)

28 March, 2018

Principles of the electroencephalographic signal - pathology

09:00 - 12:00 Vigilance states and associated EEG

14:00 - 17:00 Epilepsy, coma and cerebral death

Scientific program

29 March, 2018

Analysis of the electroencephalographic signal

09:00 - 12:00 Evoked potentials, spectral analysis (FFT), qEEG

14:00 - 17:00 Hands on session (analysis)

30 March, 2018

Clinical applications of electrophysiological recordings

09:00 - 12:00 Deep brain stimulation (DBS), blood-brain barrier, optical recordings, magnetoencephalography, etc.


ABSTRACTS

Abstract

SYLLABUS OF THE COURSE

The objective of the course is to provide a comprehensive account of the genesis of the electroencephalogram. The course, designed in an open and informal format, will rely on two pedagogical approaches: theoretical lectures and hands on sessions. The starting point is at the basic elements that constitute the building blocks of the electric (but also magnetic) signal in the brain. The knowledge will then progress to the fundamental principles that govern the interaction between these elementary mechanisms to eventually reach the final stages of the EEG generation. We will consider several basic questions that commonly arise in the realm of electroencephalography. This gives the opportunity of bridging concepts of basic neurophysiology and the phenomenology of electroencephalography. Among such topics, we will question:

(1) Which sources of neuronal activity are reflected in EEG/EMG signals?
(1) Besides post-synaptic potentials (PSPs), do other types of membrane potentials, such as action potentials, also contribute to EEG signals?
(2) What is the neurophysiological evidence underlying the Equivalent Dipole model and is this model sufficient to account for EEG and MEG signals?
(3) How does the transfer from the cortex to the scalp take place to be picked up by EEG electrodes?
(4) Do glial cells also contribute to the EEG/MEG?
(5) Based on the polarity of scalp EEG potentials can one guess whether the sources are excitatory or inhibitory?

Once the genesis of the EEG signal will be clarified, we will spend time on procedures of reading and analyzing the EEG. Emphasis will be placed on the correct identification of individual EEG waves and/or oscillations with their spectral (frequency) correlation. Several physiological and pathological situations will be used as examples. This module is meant to enrich the participant's knowledge of several clinical situations (vigilance states, epilepsy, ICU monitoring) in which the EEG recording is useful, as well as the pathophysiological mechanisms at work during the respective clinical conditions, correlated with their respective EEG patterns.

At this stage of the course, participants will have the opportunity to learn how to perform high quality EEG recordings and, in a second session, how to use available analysis software to quantify the respective recordings. It is essential to understand that no software, however sophisticated, can grant correct interpretations of recordings in the absence of the intimate knowledge of the neurophysiological mechanisms.

Finally, several less typical applications of the electrophysiological signals will be presented with the intention to suggest some promising research tools.

Abstract

At the end of the course, participants are expected:

(a) to have a thorough understanding of the cerebral processes contributing to the EEG signal
(b) to gain a critical view the EEG procedure
(c) to know how to obtain (or require) high quality recordings
(d) to understand the advantages and limitations of the EEG technique
(e) to exploit the analysis resources of EEG computers to provide correct descriptions/diagnostics.

The 1st module (Neurophysiological bases of the electrical (and magnetic) activity of the brain) deals with concentrated notions of applied physiology, seeking to revive a few concepts that are necessary for the understanding of the basic electric phenomena underlying the information transmission within the nervous system. By elaborating on the structure of the cellular membrane I intend to lay the bases for its electrical properties that will explain the crossing of the membrane mainly by ions, thus generating elementary currents. In turn, these electrical currents depend on diffusion forces and the equilibrium laws determined by Gibbs and Donnan.

Although osmotic processes and the Starling hypothesis are less "electrical" in nature, they establish parameters for the proper functioning of the cellular elements and constitute a first prerequisite for the understanding of the blood-brain barrier (seen in module 5).

The central interest in this module is to understand how individual nervous cells (neurons, glia, endothelial cells of blood vessels) become polarized and keep their polarization under rest conditions, while modifying it during information processing. To achieve this goal, we will explain the latest knowledge about cellular membrane potential, action potentials and synaptic communication. The electrophysiological behavior of glial cells will also be considered, especially within their interaction with neuronal elements. Furthermore, the students will be prepared to the upcoming knowledge that EEG patterns are the result of intricate exchanges among neurons, glia and blood flow.

The 2nd module (Principles of the electroencephalographic signal - physiology) will be devoted to the transformation of individual cellular currents (as seen in module 1) into coherent parenchymal currents, and further into dipoles that will generate the electroencephalographic (EEG) and magnetoencephalographic (MEG) signals. This will explain how apparently separate cerebral activities converge to produce coherent EEG waves, and how events with an electric substrate cross an isolating structure such as the skull.

Abstract

Then, basic techniques of using EEG machines (recording and filtering) of the cerebral electric signals will be detailed. A first presentation of the basic EEG phenomena, seen as waves and/or oscillations, will occur at this point, to offer simple, elementary notions about the graphoelements encountered during EEG recording sessions. The purpose of this is to make EEG users able to infer and select from the recorded EEG signals the cellular processes and structures involved in a given state.

This module will be concluded with a hands-on session during which participants will follow the various steps, starting with the preparation, and continuing with the setting and securing of a EEG recording procedure.

The 3rd module (Principles of the electroencephalographic signal - pathology) will be devoted to the various clinical situations during which the EEG recording is of pertinence. Each of the situations will be presented with its own peculiarities and requirements. This module will also constitute a pretext for the students to receive recent and structured knowledge on several topics.

In more detail, we will discuss the specifics of the sleep EEG recordings, which is a long-term recording and requires good quality, stable recordings. The understanding of these requirements is difficult unless one understands the various cerebral processes at work during sleep. Therefore, we will present the anatomical structures and cellular interactions generating the various characteristic sleep waves (delta waves/oscillations, spindles, etc.).

Furthermore, since epilepsy is one of the pathologies that require compulsory EEG assessment, we will present common principles underlying the genesis of spike-wave patterns during epileptic seizures, the dialogue between neurons and glial cells contributing to the characteristic electric discharges, as well as various phenomena at work during the initiation, propagation/generalization and arrest of seizures.

In a third instance, we will learn about specific EEG patterns during coma, including a recently discovered wave associated with very deep coma. Although continuous monitoring of coma is not a compulsory procedure, understanding dynamic aspects of the comatose graphoelements is paramount for the correct reading of the comatose patient.

Finally, confounding patterns situated at the border between sleep, epilepsy (status epilepticus) and coma (burst-suppression state) will be discussed. Time allowing, I would like to trigger a reflection on the neurophysiological and clinical aspects of cerebral death.

The 4th module (Analysis of the electroencephalographic signal) will be dedicated to the handling of EEG recording. The basic approach will rely on the fact that EEG data represent actual time series. Such manipulation has both clinical and (fundamental) research applications. In both cases, users need to be aware and understand the pitfalls of data manipulations. The approach will have a first theoretical level dealing with evoked potentials, spectral analysis (fast Fourier transform – FFT), and quantitative EEG

Abstract

(qEEG). Examples will be presented and typical applications, as well as consequences will be discussed. In a second time, participants will have a hands-on session during which they will be able to test by themselves the manipulation of EEG data.

The 5th module (Clinical applications of electrophysiological recordings) has two purposes: (a) to discuss, at the request of the participants, possible rebel issues presented in modules 1-4; and (b) to present, in the remaining time, a few advanced applications of neurophysiologic recordings that are mainly used either in the clinical environment (deep brain stimulation – DBS, magnetoencephalography – MEG) or in research laboratories (intactness of the blood-brain barrier as measured by the EEG, optical recordings, ionic recordings). The main goal of these presentations is to raise the awareness of the participants to some less "orthodox" methods of investigating the nervous system and to broaden the potential of electrophysiological recordings. I would emphasize that this second goal of the module will also tighten and reconnect some of the basic knowledge seen in the first 2 modules with real clinical applications.

În prezent nu există date care să susțină un regim standardizat pentru intensitatea și durata tratamentului pentru RSE. Intensitatea tratamentului este de obicei dictat de manifestarile pe cEEG, scopul tratamentului fiind incetarea crizelor electrografice sau suprimarea progresiei. Date limitate sugerează că activitatea de fond EEG nu prezice controlul crizelor. Se recomandă ca manifestarile cEEG, nu nivelurile serice de droguri, ghideaza terapia. Durata optimă de menținere a controlului crizelor convulsive electrografica la pacienții cu RSE nu este cunoscută, deoarece există puține date pentru a indica ce durata a tratamentului este necesară pentru a menține controlul. În mod obișnuit, controlul electrografic a crizelor se menține timp de 24-48 ore, urmată de retragerea treptată a AED în perfuzie continuă. Pacientii pot avea RSE recurent la retragerea inițială a perfuziei AED continu, care necesită o revenire la doze anterioare sau mai mari de AED infuzie continuă pentru o perioadă suplimentară de timp, cu sau fără adăugarea unui alt agent. Rapoartele disponibile sugereaza ca pacientii pot fi tratati în mod eficient pentru RSE timp de săptămâni la luni, după care poate să apară o recuperare funcțională completă. Prin urmare, durata cumulată a tratamentului cu medicamente antiepileptice in perfuzie continuă nu pare a fi un indiciu de prognoza pe termen lung.

Nu exista date pentru a ghida trecerea de la un tratament de perfuzie continuă la terapia de întreținere intermitentă după rezolvarea RSE. În general, medicamentele de întreținere sunt date în doze suficiente pentru a menține concentrațiile terapeutice în timpul și după intreruperea perfuziei continue. Concentrațiile terapeutice pot depăși concentrațiile țintă pentru mai multe medicamente antiepileptice și dozare trebuie sa fie individualizat pentru a realiza controlul convulsiilor si pentru a minimiza efectele adverse. Succesul regimului de întreținere este predicata de multe caracteristici clinice, inclusiv EEG model, cauza SE, boli sistemice concurente, și profilurile de interacțiune medicament-medicament.

Notes

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