

## PROGRAMME

# Technology, Pharmacology & Artificial Intelligence

## Sunday, March 03, 2024

**Session Date/Time: Sunday, March 3, 2024 - 15:30 - 17:00**

MR 333 (Level 3)

### **Technology, Pharmacology & AI Workshop: Monitoring EEG in Paediatric Anaesthesia**

Workshop Fee: 10 USD

For this child, at this particular moment, how much anaesthesia should I give? Determining drug requirements in paediatric anaesthesia is challenging, as children can have a more variable response to drugs compared to adults, depending on their age, developmental stage, co-morbidities, and neurodevelopmental status. The brain is the primary site of action for sedative-hypnotic drugs, yet it is not routinely monitored during general anaesthesia or sedation in children. This is likely due to the fact that until recently, physiologically principled approaches for anaesthetic brain monitoring have not been well articulated. Our knowledge of anaesthetic brain mechanisms has developed rapidly in recent years. We now know that anaesthetic drug effects that are clearly visible in the electroencephalogram (EEG) reflect underlying anaesthetic pharmacology and brain mechanisms, in both adults and children. Recent clinical data have shown that anaesthesia-induced isoelectric events are prevalent in children receiving general anaesthesia. Anaesthesia-induced isoelectricity is a state of oversedation beyond what is required to maintain unconsciousness, suggesting that current models of anaesthetic management often predispose children to oversedation.

In this workshop, we will illustrate how EEG monitoring can be used to guide anaesthetic management in paediatric patients and improve patient safety. We will begin by reviewing how drug-specific and dose-dependent EEG signatures seen in adults are visible in children and infants, including those with neurodevelopmental disorders. We then discuss the clinical evidence that the existing model of anaesthetic dosing in children, which does not use the EEG, leads to unnecessarily deep anaesthesia. We will discuss the practical aspects of EEG monitoring in paediatric anaesthesia, including its applications and limitations, as well as how to troubleshoot problems during monitoring. Finally, we review detailed case studies which illustrate how the EEG can be used to guide anaesthetic management and enhance patient safety.

1. Understand age-dependent changes in anaesthesia-induced brain activity in infants and children, and how this activity relates to development of underlying brain circuits.
2. Understand the prevalence of isoelectric events in infants and young children undergoing general anaesthesia and how to identify and prevent these.
3. Understand the practical applications and limitations of EEG monitoring.
4. Understand how EEG monitoring can be used to guide anaesthesia care in infants and children.

#### **Monitoring EEG in Paediatric Anaesthesia**

*Patrick Purdon, United States*

#### **Monitoring EEG in Paediatric Anaesthesia**

*Choon Looi Bong, Singapore*

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### Monday, March 04, 2024

**Session Date/Time: Monday, March 4, 2024 - 14:00 - 15:30**

MR 333 (Level 3)

#### **Technology, Pharmacology & AI Workshop: Monitoring Neuromuscular Block**

Workshop Fee: 10 USD

This workshop will provide state-of-the-art knowledge on neuromuscular monitoring during all phases of neuromuscular block, that is during onset, deep and shallow block, and finally how to assess return to normal neuromuscular function to avoid residual neuromuscular block. The objectives are to review the basic principals, routine applications, common pitfalls and recommendations for routine use of neuromuscular monitoring in the perioperative period.

##### **Monitoring Neuromuscular Block**

*Stephan Thilen, United States*

**Session Date/Time: Monday, March 4, 2024 - 14:00 - 15:30**

MR 334 (Level 3)

#### **Technology, Pharmacology & AI Workshop: Simulation-Based Workshop to Understand Anaesthetic Drug Interactions**

Workshop Fee: 10 USD

The workshop will provide hand-on instruction in the use of free open source web based pharmacokinetic / pharmacodynamic simulator programs. At a minimum, the program will teach the use of stanpumpR (see <https://stanpumpR.io>). Other programs may be added depending on accessibility, function, and open-source availability. Participants are encouraged to bring their own laptops.

1. Understand the basis of pharmacokinetic and pharmacodynamic models, including how “best in class” models are selected.
2. Understand how to model multiple drugs, both in advance of providing anaesthesia care and in real-time during the course of anaesthesia.
3. Understand the ability of such models to incorporate drug interactions.

##### **Simulation-Based Workshop to Understand Anaesthetic Drug Interactions**

*Steven Shafer, United States*

##### **Simulation-Based Workshop to Understand Anaesthetic Drug Interactions**

*Pamela Flood, United States*

**Session Date/Time: Monday, March 4, 2024 - 16:10 - 17:40**

MR 334 (Level 3)

#### **Technology, Pharmacology & AI Workshop: A “Fireside Chat” about Total Intravenous Anaesthesia: Theoretical and Practical Considerations**

Workshop Fee: 10 USD

Theoretical and practical aspects of total intravenous anaesthesia is the focus of this interactive workshop/discussion. The session is organised as a “Fireside Chat:” Mini-lectures (5 min) followed by question and answers (10 min) addressing selected topics. A host will moderate the session, interviewing Dr. Egan and interacting with the audience. The audience

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will be asked to share their insights and experience.

### Learning Objectives:

1. Describe the advantages of gaining access to the circulation via the lung for drug administration.
2. Define the term posology and understand how posology is different in anaesthesiology compared to other medical disciplines.
3. Explain how a surfing analogy can be helpful in understanding an approach to optimising anaesthesia posology.
4. Distinguish the three different practice domains for intravenous anaesthesia (i.e., dose, concentration, and effect).
5. Explain how pharmacokinetic-dynamic models are applied to the clinical realm through simulation.
6. Analyze the key kinetic-dynamic attributes of common total intravenous anaesthesia drugs (e.g., bolus front-end kinetics, infusion back-end kinetics, propofol Cp50 reduction by opioids, etc.).
7. Appraise how propofol and opioid kinetic simulations can inform anaesthesia posology decisions.
8. Describe some clinical tips and tricks for optimising total intravenous anaesthesia.
9. Explain how a target controlled infusion system is different than using a standard calculator pump.

### **A “Fireside Chat” about Total Intravenous Anaesthesia: Theoretical and Practical Considerations**

*Pamela Flood, United States*

### **A “Fireside Chat” about Total Intravenous Anaesthesia: Theoretical and Practical Considerations**

*Talmage Egan, United States*

**Session Date/Time: Monday, March 4, 2024 - 16:10 - 17:40**

MR 333 (Level 3)

### **Technology, Pharmacology & AI Workshop: Coding Neural Networks with Keras**

Workshop Fee: Complimentary

The workshop will provide hand-on instruction in the use of Keras to program neural networks. Course instruction will be in the R programming language, or on Python using the Google Colab notebooks. Participants are encouraged to bring their own laptops.

1. Understand the basic building blocks of neural networks.
2. Understand the fundamental steps of neural network parameter estimation and validation.
3. Understand the Keras commands associated with each step.
4. Understand the application of RStudio / R for basic neural network creation, and Google Colab / Python for creation of more complex neural networks.

### **Coding Neural Networks with Keras**

*Steven Shafer, United States*

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### Wednesday, March 06, 2024

**Session Date/Time: Wednesday, March 6, 2024 - 09:45 - 11:15**

MR 325 (Level 3)

#### **Technology, Pharmacology & AI Workshop: Starting to Use AI**

Workshop Fee: Complimentary

The workshop will address the transformative field of Artificial Intelligence (AI) in Anaesthesiology and Critical Care. The workshop aims to elucidate the basic principles of supervised learning, focusing on the intricacies of data preparation, including the management of missing values using imputation techniques, inconsistency detection, and others.

Attendees will have the opportunity to participate in a live demonstration of an AI pipeline with the deployment of a predictive model. Through this demonstration, participants will gain practical insights into the application of supervised learning techniques, providing a comprehensive understanding of how AI can be effectively integrated into the field of anaesthesia and intensive care.

This workshop aims to stimulate discussion on the evolving role of AI in optimising patient care and clinical decision-making in anaesthesia and critical care. It will provide a basic insight into an AI pipeline and does not require prior field knowledge. The AI pipeline will be demonstrated only using open source software using the statistical language R.

1. To understand the differences of the three modalities of machine learning: supervised, unsupervised and reinforcement learning.
2. To demonstrate the necessity of data preparation including exploratory data analysis, handling of missing data and understanding the categories of data.
3. To understand the main parts of an typical AI pipeline: Splitting the data in a training-, validation- and test-set; training the model; making predictions; evaluation of the quality of the predictions.
4. To demonstrate some pitfalls in machine learning like overfitting, asymmetrical problems, etc.

#### **Starting to Use AI**

*Jens Meier, Austria*