2nd NeurotechEU Summer School on
Preclinical Magnetic Resonance Imaging and Spectroscopy

This summer school provides a comprehensive and focused overview of preclinical **Magnetic Resonance Imaging (MRI)** and **Spectroscopy**, emphasizing translational neuroimaging. The program covers the entire spectrum, from the technical aspects of MRI hardware and the fundamental principles of image formation to the biological origins of different imaging contrasts. Participants will gain a solid understanding of widely used techniques such as relaxometry, diffusion-based imaging, and functional MRI, while exploring their biological underpinnings and key applications in biomedical and neuroscientific research. A combination of theoretical and hands-on sessions will provide practical experience in image preprocessing, data acquisition, and analysis. As a novel addition to previous editions, this year's course will introduce **artificial intelligence (AI)** applications for both data collection and analysis, highlighting its transformative role in modern neuroimaging.

Target: This introductory course is designed for Bachelor's and PhD students, as well as researchers with no prior experience in the field. It is intended for those who wish to learn or implement these techniques in their laboratories. Please note that this is not an advanced-level course.

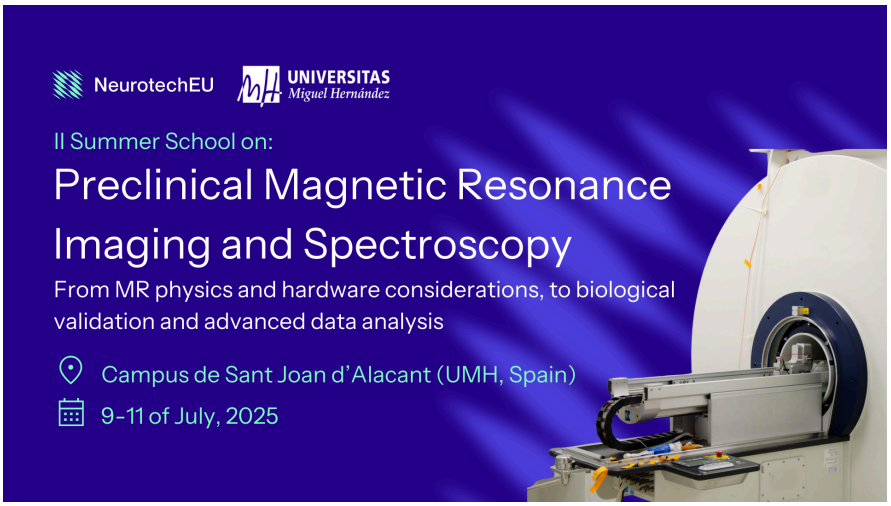
Host University: Universidad Miguel Hernández de Elche (UMH).

Dates: 9-11 July 2025

School Directors: Silvia de Santis and Santiago Canals, Instituto de Neurociencias CSIC - UMH.

Contact: neurotecheu@umh.es

Place: Campus de Sant Joan d'Alacant (UMH)



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Program:

Wednesday 9, July (Day 1)

Time:	
8:45 h - 9:00 h	Registration and Welcome
9:00 h - 10:30 h	Technical aspects of MRI hardware (David Moratal)
10:30 h - 12:00h	MRI contrasts and image formation (David Moratal)
Coffee break	
12h30 - 14h00	Theoretical basis of MR spectroscopy (Pilar López-Larrubia)
Lunch	
15h00 - 16h30:	Applications of MR spectroscopy (Pilar López-Larrubia)
16h30 - 17h30:	Practical session of data collection I (Mohamed Selim)
17h30 - 18h30	Practical session of data collection II (Mohamed Selim)

Thursday 10, July (Day 2)

9h00 - 10h30	Theoretical basis of functional Magnetic Resonance Imaging (fMRI) (Santiago Canals)
10h30 - 12h00	Applications of fMRI (Santiago Canals)
Coffee break	
12h30 - 14h00:	Theoretical basis of Diffusion-Weighted MRI (dw-MRI) (Silvia De Santis)
Lunch	
15h00 - 16h30:	Applications of dw-MRI (Silvia De Santis)
16h30 - 18h30:	Practical session of data analysis I (Mohamed Selim)

Friday 11, July (Day 3)

90h00 - 10h30	Machine Learning applied to MRI data acquisition (Maximilian Eggl)
10h30 - 12h00	Machine Learning applied to MRI data analysis (Maximilian Eggl)
Coffee break	
12h30 - 14h00:	Practical session of data analysis II (Mohamed Selim)
Lunch	
15h00 - 16h30:	Practical session of data analysis III (Maximilian Eggl)
(19h) Social activity and Dinner	

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Summer School Faculty:

- **Pilar López-Larrubia**

  Dr. Pilar López-Larrubia is a Tenured Scientist at the Instituto de Investigaciones Biomédicas Alberto Sols-Morreale (IIBM), a joint center of the Consejo Superior de Investigaciones Científicas (CSIC) and the Universidad Autónoma de Madrid (UAM). Her research focuses on the application of MRI and Spectroscopy to study central nervous system pathologies.

- **David Moratal**

  Dr. David Moratal is a Full Professor of Medical Imaging and Electronics at the Universitat Politècnica de València (UPV), Spain. His research focuses on medical imaging, particularly MRI, encompassing image processing, acquisition techniques, and the development of new technologies for data acquisition and reconstruction.

- **Maximilian Eggl**

  Dr. Maximilian F. Eggl is a researcher at the Instituto de Neurociencias de Alicante, a joint center of the Consejo Superior de Investigaciones Científicas (CSIC) and the Universidad Miguel Hernández (UMH). He specializes in the application of mathematical modeling and machine learning to neuroscience.

- **Mohamed Selim**

  Dr. Mohamed Kotb Selim is a researcher at the University of Nottingham, specializing in computational neuroimaging. Dr. Selim's research focuses on developing advanced imaging techniques to study the brain's structure and function.

- **Silvia De Santis**

  Dr. Silvia De Santis is a Tenured Scientist at the Instituto de Neurociencias de Alicante (CSIC-UMH), specialized in the development and application of advanced MRI techniques. Her research is centered on developing innovative, non-invasive MRI tools relevant to both basic and clinical neuroscience.

- **Santiago Canals**

  Dr. Santiago Canals is a Full Professor at the **Instituto de Neurociencias de Alicante** (CSIC-UMH). His research focuses on understanding communication brain networks in the context of memory formation and drug addiction. To this end, they combine fMRI with electrophysiological recordings, optogenetics, and pharmacogenetics.

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