

INVITATION

IKTrace Seminar (IMAT–CCM)

Coffee, discussion, and academic exchange

FIFTH SEMINAR TALK

The long and winding road to dementia: exploring Alzheimer's disease trajectories through mathematical modelling

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Abstract

Alzheimer's disease (AD) is a complex neurodegenerative disease characterized by biological changes that can begin years before the onset of clinical symptoms. Among the processes associated with its early stages, neuronal hyperactivity has emerged as a potential contributor to disease progression. One possible mechanism involves amyloid- β ($A\beta$)-mediated alterations in glutamate uptake by astrocytes, non-neuronal cells that play a key role in regulating neuronal activity. However, the interplay between $A\beta$ accumulation, glutamate dynamics, and neuronal hyperactivity remains incompletely understood.

Mathematical modelling provides a framework for investigating these mechanisms and exploring how their interactions may shape disease progression. In this seminar, we will introduce a biophysical model describing the interplay between three main pathways: glutamate-mediated neuronal activity, $A\beta$ -dependent glutamate uptake, and activity-dependent $A\beta$ production. By integrating these processes into a unified mathematical framework, the model allows us to investigate how their interactions can give rise to different trajectories of AD involving neuronal hyperactivity.

Finally, we will discuss how local tissue properties shape the different trajectories of AD, illustrating why disease progression may follow different paths across the brain.

Event details

WHEN

October 28, 2026, 16:00-18:00

WHERE

To be confirmed

FORMAT

Coffee and discussion session

Keywords

- Alzheimer's disease
- Neuronal hyperactivity
- Amyloid- β –glutamate interactions
- Mathematical modelling

Seminar spirit

The IKTrace Seminar is conceived as a regular forum for exchange across research lines, teaching interests, and interdisciplinary initiatives. This fifth session opens a space for mathematical discussion, informal questions, and possible future collaborations.

Participation

Colleagues and students are warmly invited to attend, take part in the discussion, and share ideas related to their own research interests.