



SPECIAL SESSION 04

Electrochemical Sensing of Neurotransmitters: From Molecular Detection to Neurological Diagnostics

Neurotransmitters are the brain's chemical messengers, playing critical roles in cognition, mood, motor control, and overall neurological health. Dysregulation of neurotransmitters including dopamine, serotonin, glutamate, and GABA underlies numerous neurological and psychiatric disorders such as Parkinson's disease, Alzheimer's disease, depression, anxiety, and schizophrenia. Real-time, selective detection of these molecules represents a frontier challenge in chemical sensing with profound clinical implications for early diagnosis, treatment monitoring, and personalized medicine.

This special session bridges ISOEN's traditional focus on artificial olfaction with emerging biomedical applications in neurochemical monitoring. While electronic noses detect volatile organic compounds in breath and headspace, neurotransmitter sensors, such as electronic tongues, detect non-volatile signaling molecules in biological fluids and neural tissue. Both domains demand advanced pattern recognition, high selectivity within complex biological environments, and compact sensor architectures—key competencies of ISOEN expertise. Recent advances in electrochemical biosensors, nanomaterial-enhanced electrodes, implantable microelectrodes, and wearable devices now enable neurotransmitter detection with unprecedented sensitivity and temporal resolution.

The proposed session will explore electrochemical sensing technologies including voltammetric microelectrodes, enzyme-based biosensors, aptamer-functionalized sensors, and carbon nanomaterial platforms. Applications span invasive neural probes for basic neuroscience research, minimally invasive sampling of cerebrospinal fluid, and non-invasive monitoring via blood, saliva, sweat, and tear fluid. Clinical translation topics include biomarker validation for neurodegenerative diseases, continuous monitoring for medication optimization, and integration with digital health platforms. Critical challenges to be addressed include achieving selectivity among structurally similar neurotransmitters, maintaining sensor performance in biofouling environments, biocompatibility for chronic implantation, and regulatory pathways for medical device approval.

This session brings together researchers in electrochemical sensing, neuroscience, biomedical engineering, analytical chemistry, and clinical neurology to advance the next generation of neurochemical diagnostic tools—transforming our ability to monitor brain health at the molecular level.

Special Session Organizer



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*The accepted papers after proper registration and presentation will be included in the conference proceedings, which will be published in **IEEE Xplore**. The proceedings will be submitted to be indexed by **EI Compendex** and **Scopus**.

* Paper Submission Closes: **19 January 2026**

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