Electrochemical Sensors for the detection of neurotransmitters: from plasma to *in-vitro* neurodegenerative models.

Alessandro Silvestri
Department of Molecular Sciences and Nanosystems Ca' Foscari University of Venice Venezia, 30170, Italy
Alessandro.silvestri@unive.it

The amount of disability, illness, and premature death caused by neurological diseases is continuously growing (+18% since 1990). In 2021, 1 in 3 people was affected by a neurological condition making it the leading cause of disability worldwide [1]. An excess or a deficiency of neurotransmitters released by the neurons can be symptomatic of neurodegenerative disorders. For example, dopamine plays a fundamental role in the pathophysiology of Parkinson's disease, as disorders in dopamine synthesis, storage, and transportation, have been demonstrated to promote neurodegeneration. [2] The development of analytical platforms able to detect and monitor real-time neurotransmitter concentration in realistic in-vitro neuronal models is fundamental. In this work, we present electrochemical sensors able to detect monoamine neurotransmitters in complex biological systems such as plasma [3] or in-vitro neurodegenerative models. At the core of these sensors, there are engineered carbon nanotubes that cover a triple function: foster neuronal growth by improving the synaptic interconnection, [4] provide conductivity, and work as a transducer, catalyzing the oxidation of the target neurotransmitters. The validation of the sensor was performed using neuronal models obtained by differentiating induced pluripotent stem cells into dopaminergic and glutamatergic neurons. The sensors were able to detect and quantify dopamine in real-time, providing a powerful tool for drug screening and molecular pathology of Parkinson's disease.

References

[1] Steinmetz, J. D. et al. *The Lancet Neurology*, 2021, 23, 4, 344 – 381.
[2] Zhou, Z.D. et al. *Transl. Neurodegener*. 2023, 12, 44.
[3] Misia, M. et al. *Carbon*, 2024, 229, 119550.
[4] Cellot, G. et al. *Nature Nanotech* 2009, 4, 126–133.