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Rapid and sensitive detection – biosensors as innovative analytical tools

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The evolution of biosensors was driven by the need for faster and more versatile analytical methods for application in important areas including clinical, diagnostics, food analysis or environmental monitoring, with minimum sample pretreatment. Rapid and sensitive neurotransmitters detection is extremely important in modern medicine. These compounds mainly occur in the brain and central nervous system of mammals. Any changes in the neurotransmitters concentration may lead to many diseases, such as Parkinson's or schizophrenia. Classical techniques of chemical analysis, despite many advantages, do not permit to obtain immediate results or automatization of measurements. Chemical sensors have displaced the conventional analytical methods – sensors combine precision, sensitivity, fast response and the possibility of continuous-monitoring. Our research is focused on develop optical and electrochemical biosensors or sensors for neurotransmitters detection. In developed optical biosensor for detection of dopamine, we used graphene quantum dots (GQDs) for detection system. In such sensor dopamine molecules coats the GQD surface – in result occurs quenching of fluorescence due to Resonance Energy Transfer (FRET). Changes in fluorescence correspond to specific concentrations of the neurotransmitter in tested sample, so it is possible to accurately determine the concentration of dopamine in the sample. Our research also has proved facile and convenient method for epinephrine, norepinehrine and also dopamine determination based on laccase and tyrosinase-based oxidation of catecholamine derivatives. The resulting sensors (built of electrode modified with graphene quantum dots or semiconducting polymer and laccase) exhibits good performance, strong affinity between enzyme and neurotransmitter, fast response to the substrate and good linear range.