Epilepsy accounts for a significant burden of global diseases, affecting an estimated 50 million people worldwide and 5 million newly diagnosed every year. Despite being one of the oldest recorded disease, with documented cases dating back to 4000 BCE, epilepsy is still associated with significant psycho-social disturbances such as fear, misunderstanding, discrimination, and stigma. Unpredictability of seizures destroy self-confidence, causes stress and contributes to the social withdrawn. Patients with epilepsy has a higher risk of morbidity and mortality. These are associated with physical consequences of uncontrolled seizures as fractures, scalding, bruising, but also comorbidity with other disorders, either systemic or psychiatric. Thus, the seizure freedom is now a major goal in treating epilepsy. However, for nearly 30% of patients suffering epilepsy, despite the availability of many antiseizure medication (ASM) with different target molecular mechanisms, proper control of seizures is not satisfactory and patients are diagnosed as drug resistant.

Drug resistant epilepsy diagnosis is challenging mostly due to the variations of the symptoms. Fast diagnosis is crucial as it stand behind an improvement of life quality, prevent epilepsy associated morbidity and mortality and diminish economic burden to the family and the whole society. Thus, early capturing patients with a higher probability of initial and/ or acquired resistance, is now unmet clinical need in epilepsy treatment.

One of the strategy to improve diagnosis and prognosis of drug resistance in epilepsy by looking for a reliable, noninvasive and economical peripheral biomarker. In the recent years, miRNAs have received a lot of attention in that context. miRNA are small molecules with an ability to cross the blood-brain barrier, stability in the peripheral blood, tissue specificity and easy detection. However, the role of miRNAs as potential biomarker of drug resistant epilepsy is unclear. Also, today available techniques for miRNA detection, provide high accuracy and sensitivity on the one hand, however on the other hand they also possess some disadvantages. These may be time consuming, create artefacts, and demand initial sophisticated sample preparation that in turn increase the costs and time of the analysis. Thus, a novel techniques for miRNA detection are necessary to develop. Electrochemical methods based on the detection and quantification of miRNAs could give an early diagnosis.

Our project aims to answer for unmet clinical and diagnostic needs for indication the most promising miRNAs (biomarkers) for drug resistant epilepsy diagnosis and elaboration of electrochemical techniques in the form of sensors as an alternatives for available miRNA techniques. The use of electrochemical techniques is advantageous due to simplicity of measurement, low detection limits and possibility of miniaturization. Two following major objectives will be evaluated during the project:

1. **Using high-throughput molecular methods, we aim to capture expression pattern of peripheral miRNA that will be accompanied by the resistance to ASMs in population of patients suffering epilepsy being under the care of the Institute of Psychiatry and Neurology in Warsaw, Poland. This stage will allow to indicate three the most significant miRNA in the context of drug resistant epilepsy.**
2. **Development of biosensors for specific miRNA detection with the application of electrochemical techniques that works on the basis of DNA and/or RNA hybridization event. Biosensors will be developed to be available for the detection of miRNAs indicated in the objective 1.**

Our multidisciplinary project aims to develop a miRNA biosensors enabling indication a patients being at risk of DRE. Thus, the significance of the project will potentially have broad significance. 1. Indication new possible mechanisms responsible for DRE; 2. Assessment of possible usage of miRNAs based biosensors for indication of patients with DRE; 3. Development of biosensors for specific miRNA detection with the application of electrochemical techniques that will be crucial for our purposes, but also may give a basis for development of miRNAs specific for other disorders; 4. Potential development of miRNAs panel that in the future could enter the clinic and improve management of patients with DRE.