Developing the protein-concentrating nanofluidic chips for early diagnostics of neurodegenerative disorders

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Motivation and Aim: Mainly due to the worldwide aging problem, neurodegenerative disorders have accounted for more than 70 % of all dementia and has obviously become a serious health problem to be coped with. Here we present a bilateral collaborative project in neurophysiology supported by SB RAS (Russia) and MOST (Taiwan) and entitled "Developing the protein-concentrating nanofluidic chips for early diagnostics of neurodegenerative disorder". The goal of the project is to develop electrokinetic protein preconcentration in nanofluidic channels which could be used to detect Aβ, Aβ-like proteins and Lcn2 at low concentrations in plasma for early diagnosis of disease.

Methods and Algorithms: Registration of certain proteins at very low concentration in peripheral plasma is expected to be a promising diagnostic approach at early stages of neurodegenerative disorders (such as Alzheimer's disease or Parkinson's disease).

Results: We developed electrokinetic concentration of proteins in nanofluidic channels which could be used to detect low concentrations of molecular biomarkers (Aβ, Aβ-like proteins and Lcn2) in plasma. The chips achieve the enrichment of proteins basing on the exclusion-enrichment effect in a nanofluidic channel and are expected to preconcentrate a sample up to 10^3–10^6-fold that would allow using routine immunodetection methods for determining biomarker levels.

Conclusion: The proposed device is easy to operate and compact. We plan to use highly sensitive immunoassay technology to detect different forms of Aβ, Aβ-like proteins and their ratio and Lcn2 levels in different tissues in several models of neurodegenerative damage. Research groups of highly qualified biologists and physicists from SB RAS and Taiwan were involved into the project and collaborated effectively [1, 2].

References
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