Submitter Name: Morteza Mahmoudi
Submitted email: mmahmoudi@bwh.harvard.edu

Development of Innovative Protein Corona Nanosystem Technology for Early Detection of Substance Abuse Disorders

Morteza Mahmoudi[1]

[1]Center for Nanomedicine and Department of Anesthesiology, Brigham and Women's Hospital, Harvard Medical School

Opioid use disorder (OUD) is regulated by a wide range of interacting network of genes and pathways which control a variety of phenotypes. The current advances in the fields of proteomics and genomics showed limited success for either development of suitable drugs to diminish the risk of addictive relapse or define at-risk populations. We hypothesized that the changes in metabolites and plasma protein compositions, which reflect the spectrum of health and OUD, can drastically change protein corona composition (i.e., a layer of adsorbed proteins at the surface of nanoparticles) mostly in terms of the concentrated low-abundant proteins. The unique feature of the protein corona is that the participated proteins at the surface of nanoparticles rarely correspond to the most abundant proteins in plasma. Identification of these unique proteins can be used not only not only for detection and screening of patients who may be vulnerable to OUD but also for identifying novel protein markers involved in addictive behavior. By uniquely combining liposomes, metabolomics, protein corona, sensor-array technologies, and advanced machine learning strategies, we developed an innovative label-free nanosystem and found that there were substantial differences between protein corona profiles of healthy individuals and OUD patients treated with methadone. More specifically, coronas of OUD patients (treated with methadone) had substantial higher and lower contribution of immunoglubulins and coagulation proteins (respectively) compared to the healthy individuals. In addition, the machine learning approach revealed the proof-of-concept of excellent prediction capacity of the proposed nanosystem for detection of methadone addicted patients.