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Proteomics: Contributions to Clinical Research in Neuroscience

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The complexity of the clinical neuroscience demands the tireless search to discover mechanisms in charge of maintaining physiological states and of generating nervous system-related pathologies. Biological systems are made of numerous elements, from which proteins have a high functional significance. They control most of the cellular processes, act as structural components, cell-surface receptors, enzymes, antibodies and hormones. This plurality of functions increases the possibility of occurring infirmities as a result of problems in the formation of proteins. Therefore, it is imperative to fully know the proteome in distinct neurological situations, as proteomes are extremely dynamic and variable. Naturally, the future of neuroscience will call for the participation of proteomics. It will contribute to the uncovering of errors in the production of proteins and in the molecular interactions that lead to the development of diseases.

Use of proteomics in the clinical research involving neuroscience

Proteomics have been an important technological platform adopted to perform biomedical research. Its purpose is to promote benefits to human health as it provides the understanding of the nervous system physiology and of its related diseases. Proteomics is also intended to prevent diseases affecting individuals with higher likelihood of developing them, as well as to improve diagnostics, to delay progression and to detect therapeutic targets. With the aid of proteomics, neuroscience advances towards an important direction in order to foster health by means of a medicine focused on the individual rather than the disease.

In the medical field, there has been an intense search to formulate vaccines with the purpose of developing specific medications and discover biomarkers in several diseases. In such context, proteomics plays a critical role in the study of proteins associated with normal functions and those associated with neurological diseases. Patients with cerebral alterations, such as Alzheimer's Disease (AD), Parkinson's Disease (PD), and multiple sclerosis, will surely benefit from advanced technologies to prevent, diagnose, and treat them.

AD is a multifactorial and complex disease characterized by a progressive neurodegeneration resulting in cognitive impairment. Gradual and irreversible destruction of neurons is the most common cause of dementia in elders. AD's pathogenesis still requires a considerable amount of effort and studies in order to be elucidated, even after years from the discovery of Amyloid-β and Tau. Proteomics techniques, based on mass spectrometry, have been employed to study proteome changes related to AD in different sample types such as those in *post-mortem* cerebral tissues, in the blood plasma and in the cerebrospinal fluid. Studies have been refined to the point of achieving a customized intervention in AD. Furthermore, Precision Medicine (PM) has been adopted to trace risks, to diagnose, to treat and to prevent AD. This method of applying medicine consists in organizing the target population, which is heterogeneous, into similar groups concerning genotype and clinical conditions. The use of this strategy focuses on an individualized treatment with specific agents in order to be more effective. PM is an international collaboration of clinical researches in fields such as Neurology, Psychiatry and Neuroscience dedicated to implement such practice. Successful research on the application of PM in AD and in other neurodegenerative diseases will result in innovative therapies, followed by the improvement of safety levels and increase of the percentage of satisfactory results in the employed treatment. In PM-related studies, there is an emphasis on genetic studies in order to classify patients with AD. However, we must emphasize the importance of the proteomics in order to obtain the specificity degree of treatments. Proteomics is the main area

of the functional genomics, complementing data generated by both genomics and transcriptomics, thus representing a bridge between genes and their products, the proteins. Equally important is the bioinformatics applied to proteomics. Bioinformatics analyzes proteins using software such as *Mascot*, developed by *Matrix Science*, with the purpose of characterizing, identifying and predicting potential protein post-translational changes.

Individuals affected by PD and other neurodegenerative diseases have also benefited from genetic stratification technology to obtain more effective therapeutic results. To sum up, precision medicine has grown in access thanks to the fast development of the molecular biology and of computational approaches. Despite the criticisms regarding the use of PM, we must expect that it will become an accessible strategy to improve the life quality of patients affected by neurodegenerative diseases in the near future.

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