

Omics Tools for Biomarker Discovery in Neuropsychiatric Disorders

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Original Submission

Received: March 24, 2017

Accepted: April 10, 2017

Published: April 20, 2017

Open Peer Review Status: Editorials, news items, analysis articles, and features do not undergo external peer review.

How to cite this article: Dipti Chourasia, Sumit Sethi. Omics Tools for Biomarker Discovery in Neuropsychiatric Disorders. *Insights Genet Genomics*. (2017) 1: 5.1

Conflict of Interest: We would like to declare that there is no conflict with other interests.

Acknowledgments: We thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, Brasília, Brazil) for financial support and fellowships. SS received a Young Talent Scholarship from the CNPq.

Insights in Genetics and Genomics

Introduction

Neuropsychiatric diseases, such as schizophrenia, bipolar disorder and depression, are a huge burden on society, impairing the health of those affected, as well as their ability to learn and to work [1]. According to the World Health Organization, the worldwide problem of neuropsychiatric disorders is 13% higher than others such as cardiovascular diseases and cancer [2]. Unfortunately, our understanding of pathophysiology of these disorders remains limited. One reason for this is the fact that most of mental disorders are not unitary conditions but may be a complex of psychopathological dimensions that are yet to be identified. In addition, present knowledge is also incomplete in predicting who will and who will not respond to a certain treatment. Such doubtfulness is worrying for patients and families who are continually involved in trial-and error selections in search of “the right fit” and for clinicians thus resorting to extensive substituting of medications and polypharmacy. So, there is a further requirement to scale up awareness in the study of psychiatric disorders in an effort to recognize at a system level the entirety of alterations that can contribute to the pathogenesis of these environments.

“Omics” strategies including genomics [3], proteomics [4], metabolomics [5], lipidomics [6,7] have been involved in the search for biomarkers and metabolic pathways in clinical applications. As a result of the development of these holistic approaches, a shift from hypothesis-driven to hypothesis-free studies has occurred, raising the possibility of identifying novel molecular entities and affected brain circuits that constitute candidate biomarkers.

In Psychiatry and Neurology, difficulties arise in developing biomarkers, due to the lack of direct access to the affected tissues. “Omics” approach, with the study of the metabolites of diseases of the central nervous system, has become useful to explain numerous aspects: information about disease mechanisms, identification of prognoses, diagnoses, and substitute markers for a disease state; the capacity for disease sub-classification based on metabolite profiles; identification of biomarkers for drug-response phenotypes, and for those that develop metabolites related to side effects (pharmacometabolomics); and the addition of important data in the development and discovery processes of new drugs [8].

We have recently described different omics approaches, summarize promising biomarkers reported in neuropsychiatric disorders, and conclude with commentaries on the future contribution of the -omics approach within the larger biomarker discovery framework currently employed in the field of neuropsychiatric disorders [1,6,7,9]. Furthermore, global mapping of uncharacteristic pathways in psychiatric disorders can lead to the identification of biomarkers of disease and response.

One of the major challenges that exists even today for the clinical diagnosis of mental disorders is the phenotypical heterogeneity that probably reflects neurobiological heteroge-

neity. Also, there is a requirement of precise attention on rare disease research as a model to study personalized medicine approaches for small cohorts of subjects. “Omics” strategies and development of clinical bioinformatics linking the identified molecular profiles with current clinical descriptions will focus on constructing a solid foundation for the molecular characterization of rare diseases for small patient populations. Longitudinal studies are needed to approve and expand on these initial findings.

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