Neurogenomics as a New Upcoming Era in Neurological Disorder

Swapnil S. Patil*[1], Rohan D. Patil[2], Prakash V. Chavan[3], Suraj N. Pattekari[4] ,

Nisha M. Jagtap

Assistant Professor, Annasaheb Dange College of B. Pharmacy Ashta

Tal-walwa Dist-Sangli Maharashtra 416301

Corresponding author

Mr. Swapnil S. Patil

Abstract

Neurogenomics include the study of how genome useful in development, growth, structure and evolution of nervous system. The article discusses the role of genomics more specifically neurogenomics, in the neurosciences. Genomic technologies, particularly sequencing, have enabled the study of genes and their relation to neurologic disorders, with an emphasis on diagnosis and treatment. Genomics has an impact on the practice of neurology, particularly for the management of diseases lacking adequate diagnostics and therapeutics. Human genetics have diverse approach it identify the risk variants at whole genome. The ultimate goal of genomics is more effective treatments and perhaps preventative measures. We focus on various challenges and approaches in neurogenomics. The article highlts how the neurogenomics will beneficial in various neurological disorders all over world by overcoming the problems associated with it. There are various opportunities for researchers as well as scientist in neurological science because the application of genomic tools proved the potential to improve the healthcare and our understanding of diseases mechanism. To promote the neurogenomics research all over world the discussion should be done on challenges and approaches in neurogenomics by healthcares, researchers and scientist.

Key words- Neurogenomics, Disease, Gene, Neuroscience

Introduction

Neurogenomics is the interface of neurobiology and genome sciences. It is the study of how the genome as a whole contributes to the evolution, development, structure, and function of the nervous system[1]. What is starting to emerge from these recent advances is that the genetic architecture of common brain disorders is exquisitely complex and heterogeneous. Translating these discoveries into a better understanding of disease etiology and the generation of new drug targets represent important challenges for neuroscience research[2]. The discovery of DNA encompasses the physical size of DNA in numbers i.e. 3×10^9 as well as sub-field neurogenomics, examines the molecular mechanisms and the interplay of this molecular information and health interventions and environmental factors of neurological disorders. Neurologic science system can be characterized as the use of genomics to Neurology science and is a piece of atomic nervous system science. Neurogenomics is the investigation of qualities in the sensory system, especially those engaged with neurologic issue. In an expansive sense, neurogenomics is the investigation of how the genome adds to the advancement, improvement, structure, and capacity of the sensory system[2]. The firmly related term "neurogenetics" manages the job of hereditary qualities being developed and capacity of the sensory system just as examination and the executives of hereditary issue of the sensory system[4].

Neurologic science gained impressive ground during the most recent decade of the twentieth century (Decade of the Brain) with propels in therapeutics of beforehand untreatable infections. This was additionally the genomic decade, and the improvements in genomic advances have upset the act of medication during the postgenomic time[4]. Nervous system specialists are relied upon to stay up with the latest with progresses in neurogenomics, which is identified with other "omics."

At the convergence of neurobiology and genome science, neurogenomics is the investigation of how the genome overall adds to the advancement, improvement, structure, capacity and malady of the nervous system. While useful genomics examines the succession and structure of genomes just as their ouputs regarding transcriptomes and proteomes, neurogenomics handles the uncommon difficulties of contemplating the Nervous system. This is an exceptionally mind boggling tissue made by hundreds out of various cell types that are composed in circuits and present explicit capacity. By the reconciliation of learning on the anatomical and physiological association of neural systems with quality articulation information of explicit populaces of neurons, surprising cell capacities, metabolic pathways and administrative systems might be revealed while new electrophysiological investigations can be structured[3]. Neurogenomics can likewise give new prompts on the comprehension of neurodegenerative maladies by recognizing normal atomic pathways in neurodegeneration and cell type-explicit quality articulation designs that may underscore particular powerlessness of explicit neurons in sickness. Neurogenomics is by and by at an extremely energizing intersection since late disclosures have tested the great model of quality association and data stream giving potential new administrative layers of neuronal cell work: among them, the distinguishing proof of long non-coding RNAs and the depiction of substantial neuronal genome variations because of retrotransposition[5].

The Nervous system in vertebrates is comprised of two significant kinds of cells – neuroglial cells and neurons. Many various kinds of neurons exist in people, with fluctuating capacities – some of them process outer improvements; others create a reaction to upgrades; others arrange in concentrated structures (mind, spinal ganglia) that are answerable for insight, recognition, and guideline of engine capacities[7]. Neurons in these brought together areas will in general sort out in monster organizes and discuss widely with one another. Before the accessibility of articulation exhibits and DNA sequencing philosophies, analysts tried to comprehend the cell conduct of neurons (counting neurotransmitter arrangement and neuronal improvement and regionalization in the human sensory system) as far as the fundamental atomic science and natural chemistry, with no comprehension of the impact of a neuron's genome on its advancement and conduct. As our comprehension of the genome has extended, the job of systems of quality communications in the upkeep of neuronal capacity and conduct has gathered enthusiasm for the neuroscience investigate network. Neurogenomics enables researchers to ponder the sensory system of life forms with regards to these fundamental administrative and transcriptional systems. This methodology is unmistakable from neurogenetics, which underlines the job of single qualities without a system collaboration setting when considering the sensory system. The ultimate goal of genomics is more effective treatments and perhaps preventative measures[8]. This road from gene discovery to drug target, however, is arduous even for well-understood diseases with known pathophysiologies. With the realization that variants in hundreds of genes contribute to common brain disorders, delineating their point of convergence is a formidable challenge, and there is disagreement on which variants to focus on and how to best translate them into disease mechanisms and potential therapeutic targets[9,10,11]. Neurogenomic research is revealing that some rare disorders share similar molecular markers and mechanisms. By categorizing these rare disorders into clinical areas, we potentially reduce an otherwise lengthy process for the patient and advance the development of new treatment options. Greater

investment in new diagnostics that pinpoint molecular markers for disease will help remove the mystery that clouds the diagnosis of many disorders. Too few clinicians, including neurologists, can keep on top of the rapid evolution of genomic science and diagnostics. As a result, patients are often referred from physician to physician, and administered test after test, in a protracted process to diagnose and treat[12,13].

2. Neurogenomics and disease

A definitive objective of genomics is increasingly powerful medicines and maybe protection measures. This street from quality disclosure to medication target, in any case, is challenging in any event, for surely knew illnesses with known pathophysiologies[2]. With the acknowledgment that variations in several qualities add to basic mind issue, portraying their place of combination is an impressive test, and there is contradiction on which variations to concentrate on and how to best make an interpretation of them into malady instruments and potential helpful targets[3]. We trust this Focus will give our perusers a look into ongoing advances in neurogenomics and their potential for substantial neurobiological and helpful bits of knowledge. All risk variants for psychiatric and neurological disorders must ultimately affect the functioning of the brain, and elucidating the affected neural circuits in humans is a high priority[4].

Neurogenomic research is revealing that some rare disorders share similar molecular markers and mechanisms. By categorizing these rare disorders into clinical areas, we potentially reduce an otherwise lengthy diagnostic process for the patient and advance the development of new treatment options. Greater investment in new diagnostics that pinpoint molecular markers for disease will help remove the mystery that clouds the diagnosis of many disorders. Too few clinicians, including neurologists, can keep on top of the rapid evolution of genomic science and diagnostics. As a result, patients are often referred from physician to physician, and administered test after test, in a protracted process to diagnose and treat[4]. To alleviate this problem, medical societies need to do more to cultivate sub-specialists in neurogenomics—clinicians who have deep specialized expertise in specific neurological diseases, particularly rare disorders. With such experience, these experts can more efficiently and reliably diagnose the patient's disorder.

3. Approaches in Neurogenomics

3.1 Gene expression analysis

Gene expression analysis is one of the diverse scoped approaches for neurogenomics. The investigational study proves that the analysis of function of cell plays important role in neurological diseases. Secreted and transmembrane proteins provide critical functions in the signaling networks essential for neurogenesis.[14,15] Gene expression patterns can highlight potential gene functions in specific brain regions.

3.2 Herbal medicine and research approach in neurogenomics

There are largely scope for researchers in various countries for research on genomics and different areas. The country Ghana is providing research funds for researchers to study genomic regulation of disease like stroke, tuberculosis, malaria, AIDS. They are organizing various research programmes for genomics research scientist. Due to the more number herbal industries in African countries they are focusing on herbal medicine therapy for various diseases as well. As a rich biodiversity in Ghana, pharmacognosy investigate and the act of natural drug are basic in the nation[8]. While pharmacognosy inquire about for the most part centers around finding out the potential convenience of home grown items and other regular items as restorative operators against explicit maladies, assessment of the logical premise of the evident adequacy of these items is frequently deficient. The selection of neurogenomics would give a chance to improve the clinical materialness of pharmacognosy examine results.

3.3 Genomic study in neurological disorder

Neurodevelopmental disorders can include developmental brain dysfunctions manifesting as problems in neuropsychiatric, learning, language, speech, motor, and non-verbal communication functions. Although genomic factors have been shown to be involved in the biology of neurodevelopmental disorders, the evidence from African populations is scanty[9]. This genomic study plays vital role in neurodevelopment. Different high throughput techniques can be used here, including genome sequencing to characterise population-based genetic variants, possibly followed by RNA sequencing and epigenetic studies. Already, various genomic factors have been shown to be playing roles in behavioural conditions such as alcoholism, and nicotine and cocaine addiction. Since various model organisms are used in this area of research, platforms such as ENCODE,

modENCODE and InterMOD that allow the integration of genomic data and tools to support cross-species research may be useful here, and provide publicly-available data to use as a starting point for research[3,4].

3.4 Development of tools for diagnosis and treatment of neurological disorders

For finding of new disease in patient, diagnosing and during treatment of neurological disorder it make a challenge to clinician. For neurological disorder common diagnostic and treatment option may not work effectively. It is therefore essential that further research is conducted to identify novel, clinically-relevant disease biomarkers that will improve the development and application of genomic tools[16,17].

3.5 Gene mapping

Mapping and identifying the genomic codes in diseases is one of the great approach in neurogenomics. In a case study it was found that childhood apraxia of speech characterized by problems with the learning and execution of coordinated movement sequences of the mouth, tongue, lips and soft palate. Linkage mapping in this family identified a region on chromosome 7q31 that co-segregated perfectly with the disorder. An unrelated child with similar speech and language deficits was found to carry a *de novo* balanced translocation involving the same interval, which directly interrupted the coding region of a novel gene, *FOXP2*.[11] Next-generation sequencing is set to transform the discovery of genes underlying neurodevelopmental disorders, and so off er important insights into the biological bases of spoken language. Success will depend on functional assessments in neuronal cell lines, animal models and humans themselves.

4. Challenges in Neurogenomics

In various larger population countries it shows the genetic diversity and many of the people don't know about genetic profile. Basic biomedical research is the cornerstone for medical development and discoveries[2]. The strains are mostly important for genetic study of any species or animal and that strains are rarely available. Use of Model organism system is currently a challenge because modeling and assessment cannot be done easily in psychiatric disorders. A further complication to studying neurogenomic disorders is the heterogeneous nature of the disorder. In many of these disorders, the mutations observed from case to case do not stay consistent. In the case of neurogenomic disorders, such as genetic forms of epilepsy, neuromuscular disorders, dementia, and developmental disabilities overlapping clinical signs and symptoms often present a diagnostic challenge for neurologists, and even more so for generalists[3]. A dearth of clinical information available on rare disorders, and the infrequency with which primary care physicians come in contact with effected patients, makes diagnosis even more difficult.

The main challenge in front of neurogenomics is availability of low numbers of appropriately trained scientists and clinicians for clinical and experimental use of neurogenomics approaches, and lack of laboratory resources for this kind of research. Another challenge is the lack of degree programmes in genome science to train more scientists in this area[14]. The lack of government funding or local funding as well as industry initiative scheme for bioinformatics research, and genomic research in particular, is another impeding factor to the adoption and use of neurogenomics and related applications. It has been found that in various countries there is heavy burden of disease and disease related to neurological problems. In disease like malaria, Tuberculosis, HIV/AIDS peoples are in high percentage of burden it is likely to be associated with neurological disorders. This situation presents both a challenge and an opportunity to extend neurogenomics applications all over. While the complicated nature of investigating multiple diseases (for example, infectious diseases and their associated neurological problems) might prove challenging to scientists with inadequately-resourced laboratories, it would also provide an opportunity to explore how specific diseases (especially those prevalent in Africa) can affect neurological functions[11].

Conclusion

This field is enclosing a large scope in neuroscience with biomedical research and healthcare system all over world. Large scale research project initiate schemes are required to insist researchers to work on neurogenomics. Government-Industry, Private Industry –researcher is one of the road map of new era in neurogenomics. The first, and perhaps the most obvious, will be the application of functional genomics technologies to existing model systems for obtaining more global views of gene expression in the nervous system. Major advancement in diagnosing and treatment of disease in neuroscience is leading task in front of researcher. Neurogenomics information is essential for patient treatment diagnosis and care. It also beneficial to drug-drug interaction, side effect study etc.

Acknowledgment

References

[1]. Karikari, T.K., Aleksic, J., Neurogenomics: an opportunity to integrate neuroscience, genomics and bioinformatics research in Africa. Appl. Transl. Genomics vol. 5, ***(2015),*** *pp. 3–10.*

[2]. Mark S Boguski & Allan R Jones, Neurogenomics: at the intersection of neurobiology and genome sciences, Nature Neuroscience. Vol 7, Issue 5, ***(2004),*** *pp 429-433.*

[3]. Pelagia Deriziotis and Simon E Fisher, Review on-Neurogenomics of speech and language disorders: the road ahead, Genome Biology, Vol 14, Issue 204, ***(2013),*** *pp 1-12.*

[4]. Turhan Canli, Review on- Neurogenethics: An emerging discipline at the intersection of ethics, neuroscience, and genomics, Applied & Translational Genomics Vol 5, ***(2015),*** *pp 18–22.*

[5]. Thomas K. Karikari, Jelena Aleksic, Neurogenomics: An opportunity to integrate neuroscience, genomics and bioinformatics research in Africa, Applied & Translational Genomics, Vol 5, ***(2015),*** *pp 3–10.*

[6]. Jens R. Wendland and Michael D. Ehlers, Translating Neurogenomics into New Medicines, Biological Psychiatry, Vol 15, Issue 79, ***(2016),*** *pp 650-656.*

[7]. McCarroll SA, Hyman SE: Progress in the genetics of polygenic brain disorders: Significant new challenges for neurobiology Neuron, Vol 80, ***(2013),*** *pp 578–587.*

[8]. Harris, R.M., Hofmann, H.A.,. Neurogenomics of behavioral plasticity. Adv. Exp. Med. Biol. Vol 781, ***(2014)****, pp 149–168.*

[9]. Mohamed, W.M.Y., Neurogenomics: an Egyptian perspective. Appl. Transl. Genomics. ***(2015)****.*

[11]. Tsuji, S., The neurogenomics view of neurological diseases. JAMA Neurol. Vol 70, ***(2013)****, pp 689–694.*

[12]. Canli, T.,. Neurogenethics. In: Canli, T. (Ed.), The Oxford Handbook of Molecular Psychology. Oxford University Press, New York, Oxford. ***(2015)***

[13]. Lander, E.S. Initial sequencing and analysis of the human genome. Nature, Vol 409, ***(2001),*** *pp 860–921.*

[14]. Schuler, G.D. A gene map of the human genome. Science, Vol ***274****,* ***(1996)****, pp 540–546.*

[15]. Boguski, M.S. Comparative genomics: the mouse that roared. Nature, Vol 420, ***(2002)****, pp 515–516.*

[16]. Cowan, W. M.. The emergence of modern neuroanatomy and developmental neurobiology. Neuron, Vol 20, ***(2002)****, pp 413–426.*

[17]. Tecott, L.H. & Nestler, E.J. Neurobehavioral assessment in the information age. Nat. Neurosci. ***(2004)****, pp 462–466.*