Neurological Case Reports

Editorial
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Evolution of Neurosurgery

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Editorial

This journal of Neurological Case Reports will review and show case important information and research from world experts in their chosen fields. The case studies will offer opportunities to learn from each other's experience and, at the same time, challenge the reader to look beyond mere facts and develop deeper into some of the fundamental issues at the root of the problem. Genomics and proteomics are increasingly important fields that hold many of these answers. Each of us has a baseline biological identity that we carry in our genes and in whose information highway holds the answers on our neurological development and disease susceptibility. This genetic information repository holds the answers many important biological questions and so it is of little surprise that a myriad of research fields have developed over the past 6 decades to further explore our genes. My interest lies in mining the repositories of different genomes for evolutionary clues describing those processes that have helped to shape the human brain, as well as the brains of our simian cousins and our earliest ancestors. I would therefore like to develop an argument in this short article towards understanding mankind's cerebral development through computational analyses to reveal just some of the evolutionary reasons for why our brain is as it is.

In November of 1859 two events, one in the burgeoning field of neurological surgery, and the other in the well established practice of observational biology, occurred almost simultaneously. In London the first hospital solely devoted to the treatment of neurological and neurosurgical disease - the National Hospital for Diseases of the Nervous System including Paralysis and Epilepsy was officially opened at Queen's Square. It is presently the National Hospital for Neurology and Neurosurgery and is affiliated with the University College London [1]. It has been at the forefront of developments in the fields of neurological surgery and computational neurosciences and in doing so has helped to improve the path to recovery from assorted neurosurgical diseases. At the same time the first edition "On the Origin of Species by Means of Natural Selection" was published wherein Charles Darwin first described in detail his many years' worth of evidence establishing his theory of speciation by gradual evolution which was governed by the process of natural selection [2]. These facts supporting the science of speciation have ultimately transformed both the way we view life on earth and our role in its wonderful breadth and complexity. It is not hyperbole to suggest that Darwin's 'dangerous' idea stands as one of the greatest single scientific formulations in human thought [3]. It is through a better understanding of these evolutionary mechanisms that will allow us, for example, to better understand and explain the presence of numerous inherited diseases, and to identify genes of future medical importance. From this we will better understand the different genetic processes by which pathogens adapt to our immunity and how they are able to defeat and deceive our different medical interventions. One might speculate that no less is this goal of understanding the evolution of human traits than it is to ask the fundamental question as to what makes us human. Evolution through natural selection is a process wherein 'cascades of small chance steps', accumulate over vast periods of time to achieve exquisite adaptive complexities [4]. This elegant solution of small changes over very long stretches of time enables exquisitely complex anatomy such as the eye and the complex electro-neurochemistry that is the mind, to have evolved into their present day human 'states of the art'. It is discouraging therefore to still uncover neurology and neurosurgery residents naïve to these facts and who still question its legitimacy, or worse, those who espouse creationism as its equal. How can this be? Might it be in part due to the word '"theory" of evolution' and its lay association with a hypothesis? Most realize that the word 'theory' in the scientific sense means fact. Stephen Jay Gould explains that "… 'Fact' can only mean 'confirmed to such a degree that it would be perverse to withhold provisional assent" [5]. A reasoned understanding of the theory of evolution underpins the logical explanations behind many developmental abnormalities and rare biological conditions and phenotypes that we see in practice. We may then better understand each of these conditions in terms of natural selection having acted at the level of the gene and having consequences at the organism level. We are all here, containing many biological foibles and much

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hidden worth as the result of all of our ancestors being successful descendents in an unbroken sequence from time immemorial and each surviving to contribute to the gene pool. It is for the gene pool to adapt to the changing environmental circumstances through genetic variation introduced through mutation. Sexual reproduction shuffles these mutations upon which natural selection will, in a non-random fashion, remove some from the gene pool. Thus our genetic material contains, buried within it, all of our ancestral information concerning both selection and mutation. The challenge and adventure therefore lies in the discovery of methods to best decipher this RNA, DNA and protein 'archive' in ways that will discover clues to our evolutionary development. As an example, one could ask the question - which genetic factors are involved in the evolution of increasing brain size over time? To answer this one might look at individuals that are associated with a smaller-than-normal, or underdeveloped cranium and brain. The condition of primary microcephaly (congenital underdevelopment of the cerebral cortex and supporting structures) is seen in different populations and is associated with 5 different loci. One gene ASPM (Abnormal spindle-like microcephaly associated) has been identified through genetic linkage analysis and is expressed only during brain cortical development [6]. This gene's evolutionary lineage was further investigated using computational genomics that looked at the ratio of amino acid-changing (non-synonymous) Single Nucleotide Polymorphisms (SNPs) to non-amino acid changing (synonymous) SNPs in the DNA among different species across evolutionary time scales [7]. This revealed that ASPM has been positively selected for in the human lineage when compared to our simian relatives and therefore may illustrate just one of many selective pressures that have influenced the development of large brains in humans. As the power of computer-driven enquiries improves we are able to search phenomenally large genomic data bases and ask questions on what controlling mechanisms and markers direct development at the level of the gene and gene products. We are able to trace and explore some of the rudimentary reasons that have led to different selective pressures on our ancestral phenotypes and to postulate on why these adaptive changes have occurred, and why in such a direction. "The problem of neurology is to understand man himself". This moniker on the dedication plaque next to the main entrance of the Montreal Neurological Institute is attributed to the neurosurgeon Wilder Penfield who founded the MNI in 1933. It reminds the public of the commitment hundreds of researchers and clinicians have made to better understand and treat neurological illness. We cannot underestimate the importance of understanding our origins be it from our surgical predecessors from decades ago in London and Montreal who witnessed the power of our brain to heal itself and set out to better understand these processes, or from our ancestors millennia ago, that through advantageous mutations and positive selective pressure has led to our big healing brain.

References

1. Wikipedia contributorsin Wikipedia. The Free Encyclopedia. 2018.
2. Darwin C. On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life. 1859.
3. Dennett DC. Darwin's Danderous Idea. Evolution and the Meanings of Life. 1995.
4. Dawkins R. The Dawn of Evolution. New Scientist. 2005.
5. Gould SJ. In Hen's Teeth and Horse's Toes: Further Reflections in Natural History. W.W.Norton & Company New York London. 1981:253-62.
6. Bond J, Roberts E, Mochida GH, Hampshire DJ, Scott S, Askham JM, et al. ASPM is a major determinant of cerebral cortical size.Nat Genet. 2002;32(2):316-20.
7. Evans PD, Anderson JR, Vallender EJ, Gilbert SL, Malcom CM, Dorus S, et al. Adaptive evolution of ASPM, a major determinant of cerebral cortical size in humans. Hum Mol Genet. 2004;13(5):489-94.