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Brodmann's brain map; the need for a modern brain map

Abstract

On 1909, Bordmann proposed his brain map model with 43 areas. In his model, he based on the hypothesis that structures similar in morphology will have similar functions. His model remained the classic brain map for the past century and used to shape our understanding of the brain. New technologies showed that the hypothesis Brodmann used in his model is not that accurate, these technologies, including brain imaging, raised the rationale for a new brain map model. In 2016, a new model that contained 180 distinct regions in each hemisphere is an example of how new technologies should be used in this regard.

Keywords: Brodmann, Brain map, Language, Cytoarchitectonic

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Introduction

Brodmann, a cornerstone in the neurology who's book, which has around 4000 citations, still forms the basis for localization of different brain functions. In this study, we will discuss how Brodmann's study shaped our understanding on brain anatomy and the rationale for new models for brain map using the modern brain imaging technologies.[1]

In his book, Brodmann draw a map for human brain that divide the cortex into distinct and localized areas, he used classic cell stains to categorize homologous parts of the cerebral cortex as cytoarchitectonicly distinct areas called "Brodmann's areas". In his experiments, he elucidated that fiber architecture that deals with the conduction pathways between brain itself on one hand and brain with the lower levels of central nervous system on the other hand are out of his study's scope. Brodmann brain map based on the hypothesis that morphologically uniform areas also have similar functions.

In the following years till reaching the late 90s, no major anatomical objections on his brain map proposed abide from further subdivisions on some Brodmann areas. But with the new technologies that can show the anatomical region, simultaneously, while doing the task, more evidence appear that question the hypothesis of uniform morphology means similar function, the hypothesis that Brodmann depended on for his proposed brain map.

An example on how new technologies changed the way we think of our brain is language, the old view on brain areas involved in speech were mainly proposed by Broca and Wernick, this old view supposed that language was associated with activation in Brodmann areas 22 and 44, corresponding to inferior frontal and posterior temporal gyri, respectively.[2-4] New brain imaging technologies, including functional magnetic resonance imaging and positron emission topography, proposed a new view for areas associated with language, these areas included Brodmann areas 6, 13, 20, 37, 38, 39, 40, 44, 45, 46, and 47. This example can show how new, more reliable technologies proved that morphologically different areas act together for the function of language.

The emergence of new technologies that can be used to study our brain from different perspectives should be used to form a universal model of the brain, a model that shows the precise anatomy of the brain along with areas associated with different functions and their brain tracts. A new study started, this approach in the form of meta-analysis using a large set of high resolution magnetic resonance images. This study delineated 180 areas per hemisphere bounded by sharp changes in cortical architecture.[5]

Conclusion

Brodmann's contribution in neurology pervaded almost every neurology textbook in the previous century, but the basis Brodmann used for his brain map model are outdated. The need for a new brain map that can show the detailed anatomy of brain and its tracts, and the correlation with each function using new technologies will improve our understanding of diseases that affect the brain and their effect on different functions.

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Conflicts of interest

Both authors declare no conflict of interest regarding this work.

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