# The Bigbrain Model: An Atlas, A Chimera Or A Glance Into The Future?

G K Matis, O I Chrysou, T A Birbilis

**Citation**

G K Matis, O I Chrysou, T A Birbilis. *The Bigbrain Model: An Atlas, A Chimera Or A Glance Into The Future?*. The Internet Journal of Neurosurgery. 2013 Volume 9 Number 2.

**Abstract**

The past twenty years have witnessed a spectacular change of printed brain atlases into digital and multidimensional ones. This evolution has facilitated the meta-analysis of scientific information from all fields of neurosciences [1]. One further step in this dynamic process is considered to be the construction of the *BigBrain* model in the context of the *European Human Brain Project* [2] for which the European Commission awarded 500 million euros over 10 years this January (2013) [3].

The research was conducted by the Montreal Neurological Institute (Montreal, Canada) and the Research Centre Jülich (Jülich, Germany). The scientists used a microtome to cut a complete paraffin-embedded brain of a 65-year-old female coronally. Seven thousand four hundred sections of 20μm thickness were acquired and subsequently stained for cell bodies. Then the histological sections were digitized and reconstructed into a 3D digital brain, resulting in a total data volume of 1 Tbyte [2].

The *BigBrain* is actually a reference brain. It attempts to bring research to the microstructural level. Since now, structural imaging based on Magnetic Resonance Imaging (MRI) has achieved a spatial resolution of 1mm. This resolution may be good enough for accumulating information for brain gyri and sulci or even for subcortical nuclei, but by no means is it adequate for integrating information at the level of cortical layers or cells [2]. This gap could be bridged using a framework that builds on acquiring images with thickness of microns [3].

According to the researchers this highest resolution 3D digital brain model yet made could be of great value in the following cases [2]:

·Addressing stereotaxic positions in the brain at micrometer range.
·Localizing transmitter receptor distributions, fiber bundles, and genetic data.

·Generating realistic input parameters for modeling and simulation.

The *BigBrain* data set is freely available on the web after a quick registration process [4]. This development in conjunction with the launch in USA (April 2013) of the *Brain Research Through Advancing Innovative Neurotechnologies Initiative* (a 100 million US dollars project) [3] signify a new era for brain research. The reconstruction of human brain at cellular resolution and thus redefining the traditional neuroanatomy maps, [2] seems now less than a Chimera.

## References

## Author Information

**Georgios K. Matis**
Department of Neurosurgery, Medical School, Democritus University of Thrace
Alexandroupolis, Greece
gkmatis@yahoo.gr

**Olga I. Chrysou**
Department of Neurosurgery, Medical School, Democritus University of Thrace
Alexandroupolis, Greece
olgachrysou@hotmail.com

**Theodossios A. Birbilis**
Department of Neurosurgery, Medical School, Democritus University of Thrace
Alexandroupolis, Greece
mpirmpil@otenet.gr