

Finding Candidate Genes For Creativity in the Brain

Andrew Sun, Newton North High School, Newton MA 02460 & BioScience Project, Wakefield, MA 01880

Introduction

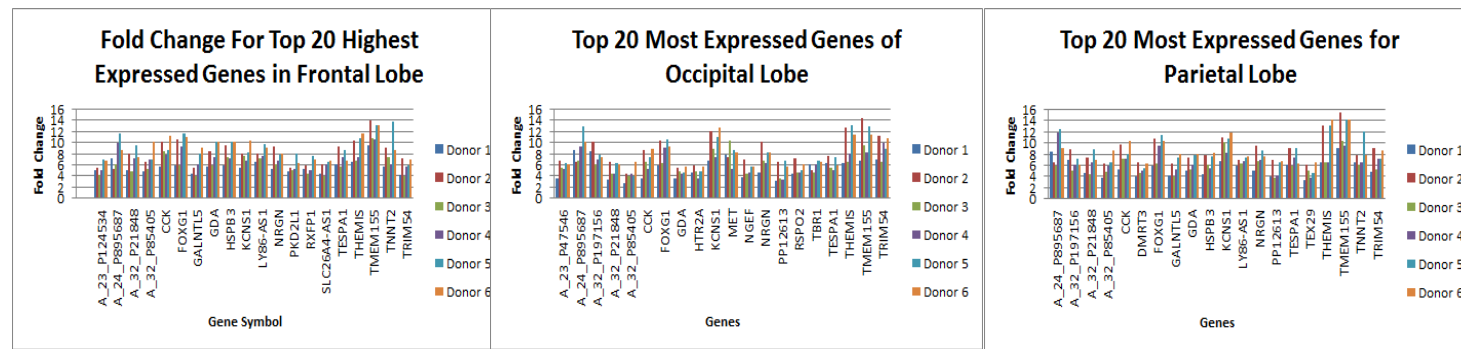
- Three Lobes of the Brain are commonly thought to be associated with creative thinking, namely the Frontal, Occipital, and Parietal Lobes.
- The function of the frontal lobe involves the ability to project future consequences
- The occipital lobe is related to visual creativity as it contains the primary visual cortex.
- The parietal lobe plays important roles in integrating sensory information from various parts of the body, including touch and sight.

Gene Overlaps among the Six Donors



Genes with fold expression above two which were common in all six donors were then found using a venn diagram. This helps to ensure that our findings are consistent among the population in general

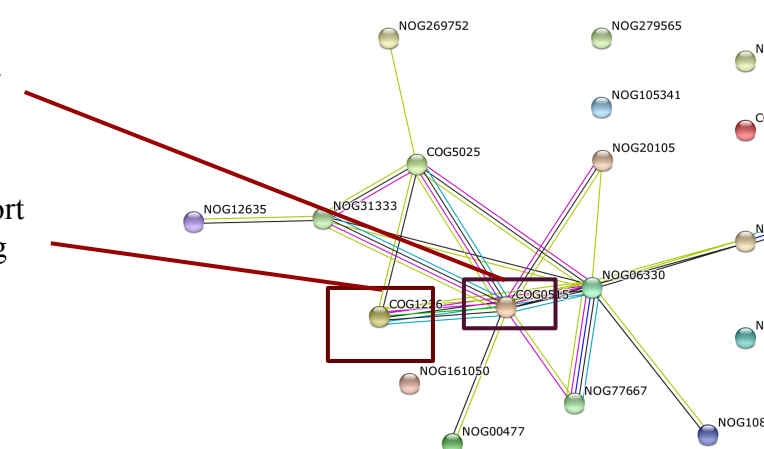
Graph of Highest Expressed Common Genes



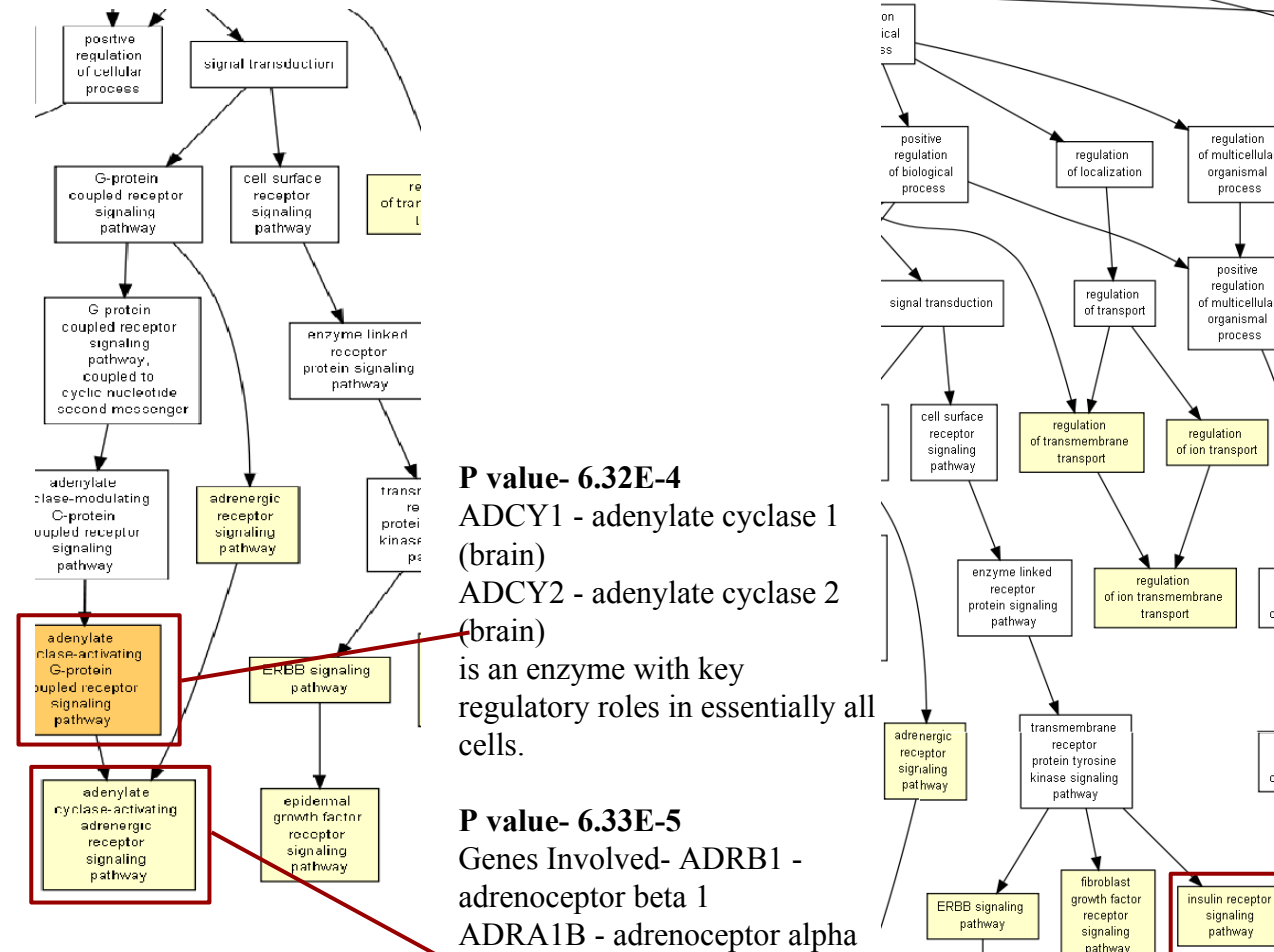
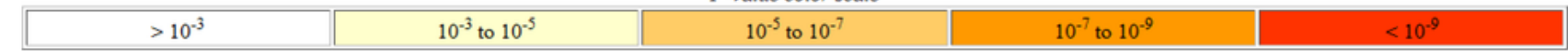
- The top 20 highest expressed genes in each lobe were found.
- The X axis contains the top 20 highest expressed genes that were common in each lobe of the brain, while the Y axis displays fold change.
- The Genes TMEM155, THEMIS, KCNS1 were especially highly expressed.

Functional Group Analysis

Serine/threonine protein kinase is a kinase enzyme that phosphorylates the OH group of serine or threonine(which have similar side chains). Involved in Kef-type K⁺ transport systems, predicted NAD-binding component



Enrichment Analysis

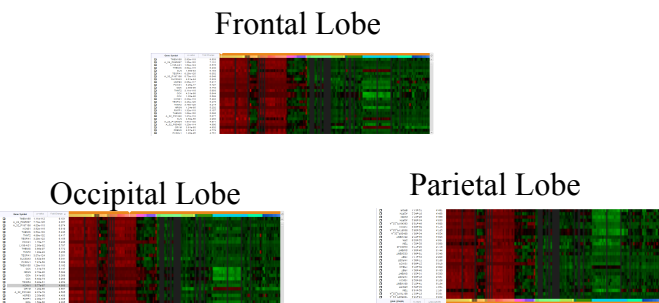


P value- 6.32E-4
 ADCY1 - adenylylating G-protein coupled receptor signaling pathway (brain)
 ADCY2 - adenylylating G-protein coupled receptor signaling pathway (brain)
 is an enzyme with key regulatory roles in essentially all cells.

P value- 6.33E-5
 Genes Involved- ADRB1 - adrenoceptor beta 1
 ADRA1B - adrenoceptor alpha 1b
 are targets of the catecholamines, especially norepinephrine (noradrenaline) and epinephrine (adrenaline).

P value- 2.72E-4
 Genes Involved- BAIAP2L2 - bai1-associated protein 2
 plays a big part in phospholipid binding and cytoskeletal adaptor activity.
 ATP6V1C2 - atpase, h⁺ transporting, lysosomal 42kda, v1 subunit c2
 ATP6V1B1 - atpase, h⁺ transporting, lysosomal 56/58kda, v1 subunit b1
 BAIAP2 - bai1-associated protein 2

Gene Overlaps in Areas of the brain



- These Heat Maps display the fold expression of genes in different areas of the brain.
- Each column represents a tissue sample.
- The colors indicate fold change values of each gene. Green=lower fold change, Red=higher fold change.
- Genes with fold expression above 2 were used in our analysis

Conclusions

- The genes which had consistently high fold expression values among all of the donors and lobes of the brain were TMEM155, THEMIS, and KCNS1.
- The TMEM155 gene is heavily involved with the coding of the transmembrane.
- The THEMIS gene protein product is involved in antigen receptor signaling, and is necessary for proper lineage commitment and maturation of T-cells.
- Gene KCNS1 plays a large part in controlling Voltage-gated potassium channels in the brain. Their main functions are associated with the regulation of the resting membrane potential and the control of the shape and frequency of action potentials which help control the thought process.
- Another notable gene in our findings is BAIA P2L2 because it plays a role in the regulation of insulin levels. In the brain, insulin is involved in forming new memories by promoting glucose uptake in the neurons of the hippocampal formation and the frontal lobes, It also strengthens the synaptic connections between brain cells,
- Our findings also support the growing claim that creativity is at least partially linked with bi-polar disorder. The gene ADCY2 has been thought to be a candidate gene for bi-polar disorder and our results find that ADCY2 is a highly expressed gene .