

A map of the brain ~ Allan Jones

The author begins with his fascination for how humans have since long tried to explore different aspects of the brain just like we did for our physical world. We explored its structure, it's functioning, and the quest goes on. Now, showing a real brain picture, he explains about the vascular system(the spread of blood vessels across the brain), and that 20% of oxygen and blood flow is just spent for brain functioning. Holding two fists together, the brain is just slightly larger than that. Then he explains how tracking blood flow can help non-invasively to map activations in the brain and can visualize the working of different parts such as the cerebellum(responsible for coordinated body motions), temporal cortex(for audition), the prefrontal cortex(for complex thoughts such as decision making). Using different staining techniques, we've discovered that neurons are not uniformly distributed and their distribution correlates to their functioning. We've 86 billion neurons. Astrocyte glial cells support the neurons in CNS. Each neuron is connected to approx 10,000 other neurons through synapses. Every functioning of a neuron or a cluster of it is controlled by proteins. A combination of amino acids makes a protein, how they combine is encoded by genes(in DNA), the entire set of which in a human is called a genome. We've 46 chromosomes(23 from each parent), containing 25,000 genes. A cells' complete functioning is decided by what genes of it are turned on. To find out genes that are turned on, normal human brains are collected from the corpse within 24 hours of their death, then an MRI map is formed to form the anatomy, then diffusion tensor imaging is done to discover all neuronal connections, then they remove the brain from the skull, slice it, stain it to scan, then experts assign different anatomical labelings. Then we cut a 20-micron thin slice, again stained and analyzed, then a detailed map is formed by a large set of collections. More thin tissues are extracted, using suitable operations then a larger number of dots are stained on it, each representing a genome(with a scale of coloring from red to green showing highest to lowest turned on activated gene), which is roughly 60,000 and since a single being has 25000 of it, so it contains repeated genomes. What's the significance? We know there are drugs like antidepressants etc., their targets are proteins which they turn off or on. Now, looking at the genome map, we can study what drugs turn off or on what genes in turn what functions they affect, and can find better drug targets and optimize for drug discovery. Analyzing genes by studying the outlier functioning of a population can tell us what disease or disorder the gene's responsible for, but can't tell how they're present in CNS and how they respond to different biochemistry. We all feel our differences but our genes are 99% similar. One of the authors' experiments yielded genomic similarity of 90% for brain functioning genes only. So, we're similar at brain functioning level too, and that outliers of 10% are subtle to analyze but can yield important information, e.g., DISC1 gene is deleted in schizophrenia, but not all individuals with this gene deleted exhibit schizophrenia but they exhibit variance from normal functioning. Brain research is like an undiscovered continent and the future awaits more magnificent explorations.