Functional Magnetic Resonance Imaging (fMRI)

RTS 2

Background

Functional magnetic resonance imaging (fMRI) is a class of imaging methods developed in order to demonstrate regional, time-varying changes in brain metabolism, and is increasingly being used as a biomarker for disease, therapy, and pharmacological efficacy.[1]

The hope is fMRI can aid in the guidance of treatments and discover previously undetected abnormalities in the brain. The process of studying the brain's response to stimuli has been in existence since the late 1860's, and has continued throughout the past several decades.[2] (see **Figure 1**)

Magnetic resonance imaging utilizes fundamental physics and biological aspects of nuclear magnetic resonance.[3] Methods to study neurological images and abnormalities, such as diffusion tensor tractography and fMRI, were created.[3] It is noninvasive and provides high resolution scans, vessel identification, and develops a map of white matter connectivity through the use of diffusion tensor imaging (DTI).[4] (see **Figure 2**)

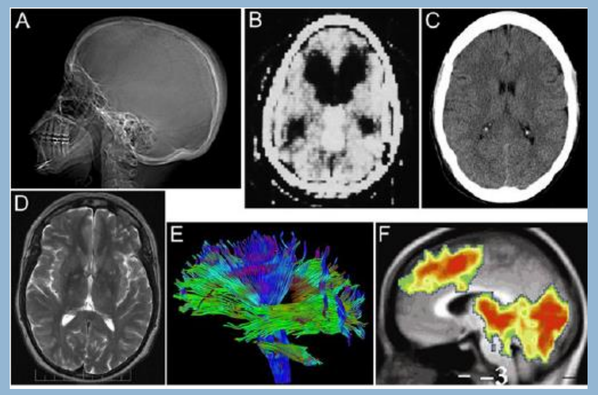

Figure 2. *(A) X-ray of a skull shows hard tissues but unable to see layers, (B) one of the first CT scans from 1971; beginning of cross sectional images, (C) newer CT scan with higher resolution and improved tissue contrast, (D) brain MRI showing small abnormalities, (E) DTI image in three dimensions, (F) fMRI image of individual looking at pictures, making decisions and recording responses.*[2]

Magnetic Resonance Imaging's History

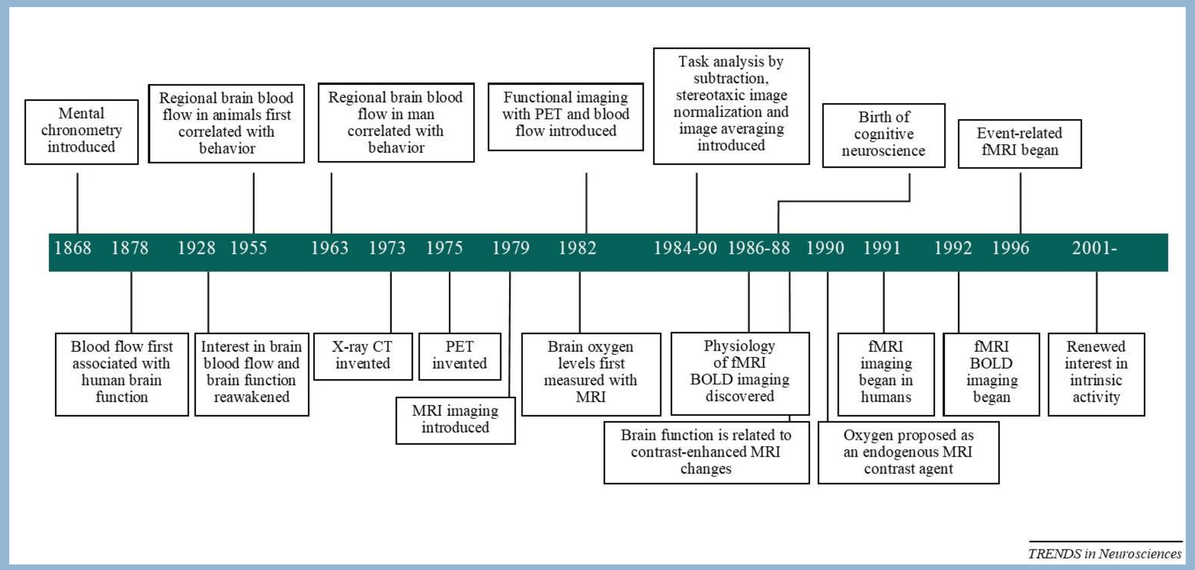

Figure 1. *Chronological order in the development of human brain imaging with PET and MRI.*[2]

Figure 3. *The brain on the left show synchronous activity between the posterior cingulated cortex (the larger red region) and the medial prefrontal cortex (smaller red region) in adults who had ADHD as children but no longer show symptoms. The brain on the right does not the synchronous activity for adults who continue to have ADHD.*[7]

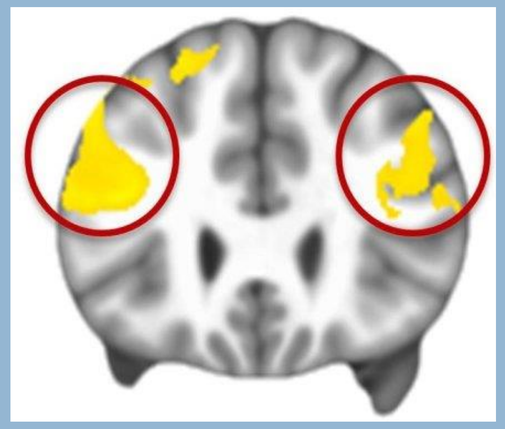

Figure 4. *Functional magnetic resonance (fMRI) scan of the prefrontal cortex in people with autism spectrum disorder during emotion regulation. The yellow areas within the red circles indicate the decreased activity.*[8]

Pathologies

Social neuroscience has provided researchers a wide array of behavioral disciplines to uncover. Studies reveal a correlation between brain abnormalities and Alzheimer's, Parkinson's, and Huntington's disease.[5] Although there is no current cure for these and other brain disease, strides have been made in understanding where the disease affects the brain.[5]

Functional MRI studies have also provided data regarding behavior controls in patients with attention deficit hyperactivity disorder (ADHD).[6] One study focused on adults who have previously been diagnosed with ADHD as children, but no longer have this disorder. "Their brains now look like those of people who never had ADHD,"[7] (see **Figure 3**).

In cases such as spectrum disorders, researchers study cases which determine how certain technologies and medications affect the prefrontal region of the brain, which is where autism spectrum disorder (ASD) is said to be housed.[1] Studies have found a connection with different regions of the brain in people with ASD.[1] (see **Figure 4**)

The basis of fMRI is a mainstay in basic imaging of the brain. It holds great hope for the future, as it will continue to play an important role in diagnosing and providing treatment opportunities to those in need.

References

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