History of Cognitive Neuroscience

Jaime A. Pineda, Ph.D.
The Fundamental Circularity of Being

“The world is inseparable from the subject, but from a subject which is nothing but a projection of the world, and the subject is inseparable from the world, but from a world which the subject itself projects.”

Merleau-Ponty (1906-1961)
BODY-MIND RELATIONSHIP
(STRUCTURE-FUNCTION)

• BODY/BRAIN

• MIND
  - Memory
  - Attention
  - Language
  - Planning
  - Creativity
  - Awareness
  - Consciousness

Classical physics
BODY-MIND RELATIONSHIP  
(STRUCTURE-FUNCTION)

- BODY/BRAIN

- MIND
  - Memory
  - Attention
  - Language
  - Planning
  - Creativity
  - Awareness
  - Consciousness

Self-directed neural plasticity?  
Quantum physics and the causal efficacy of thought?
Claudius Galen (ca. 131-201)

- Expanded Aristotle’s ideas of Humors

The body is composed of a balance between the four elements present on earth—fire, earth, water, and air—which were manifested in the body as yellow bile (choler), black bile (melancholy), blood, and phlegm.

Galen’s “psychic pneuma”: “vital spirits” formed in the heart and were pumped to the brain, where they mixed with “pneuma” (air found in the cavities of the brain).

This model held sway for 1500 years.

Figure 1.1 Gregor Reisch

Galen – 2 A.D.
Andreas Vesalius
(1514-1564)

De Humani Corporis Fabrica (The Fabric of The Human Body) – 1543

Studied anatomy solely for structure

Did not get some of the convolutions of the brain right; argued that Galen was wrong; was branded a heretic and fled.
Figure 1.4

Human brain ventricles depicted during the Renaissance. This drawing is from De humani corporis fabrica by Vesalius (1543).
Rene Descartes  
(1596-1650)  

*De Homine* – 1662  

Mechanistic view of brain  

Pineal gland – gateway to soul  

“…ingenuity and originality were unfortunately based on pure speculation and incorrect anatomical observations.”  

“I think therefore I am”
Luigi Galvani
(1737-1798)

Professor of Obstetrics

Moves frog leg with static electricity

Detects electricity in the nerves of frogs
Cartesian Model

MIND: A FUNCTION OF THE BRAIN

FIGURE 2.5. Sensory and motor functions: Cartesian model showing that the same neurons serve both functions.

FIGURE 2.6. Sensory and motor functions: Bell-Magendie model showing that sensory and motor neurons are separate.

BEGINNING OF MODERN NEUROSCIENCE
Doctrine of Specific Nerve Energies
Franz Joseph Gall  
(1758-1828)

Analysis of the shapes and lumps of the skull would reveal a person’s personality and intellect.
Paul Broca
(1824-1880)

Anthropologist and anatomist

Paris educated MD pathologist

“Tan” aphasic patient died in April 1861

“We parlons avez l’hémisphère gauche”
Korbinian Brodmann
(1868-1918)

Established the basis for comparative cytoarchitectonics of the mammalian cortex.
Camillo Golgi  
(1843-1926) 

Golgi’s silver chromate stain shows dendrites, soma, and axons
Santiago Ramon y Cajal
(1852-1934)

Father of Modern Neuroscience

Neuron Doctrine
His failure to find a single biological locus of memory in the rat's brain (or "engram") suggested to him that learning was either impossible or memories were not localized to one part of the brain, but were widely distributed throughout the cerebral cortex.
Modern Phrenology
Summary

• Studying the adult human and animal brain gives us some insights into how it works:
  – Highly specialized
    • Division of labor
  – Highly interactive
    • Distributed cognition

To understand this complexity—must study not only the brain’s neuroanatomy and physiology but also its evolution and development  (simple $\rightarrow$ complex)
Sue Hespos, 2000 in Hot Science

• In the main, however, none of these methods has been successful in answering even the most basic questions of how the brain produces or encodes mental activity. The main reason for this failure has been the fact that these measures are asking questions as the wrong level. The ultimate basis of mental activity must be the informational state of a huge collection of neurons interacting, not en masse, but as an intricate web, a network in which the details of the intercommunicated information are salient. Measures of integrated activity such as the EEG or the EVBP simply do not assay the essence of the relationship between mind and brain.