

HISTORY & INTRODUCTION

OUTLINE TOPICS

Objectives	Early Dev.	Localization	Phrenology	Generalists
Language	Connectionism	Physiology	Phil. Roots	Science
	LINKS	TERMS	QUIZ	RETURN

Lesson Objectives

1. Describe the significant early developments which contributed to our current understanding of brain-behavior relationships.
2. Discuss the phrenology story and indicate the hypotheses that were correct versus those which weren't and explain why.
3. What is the current status of the mind body problem?
4. Explain the evidence for and against localization of function.
5. Explain what Pierre Florens & Karl Lashley meant by equipotentiality.

A. Early Developments Related to Physiological Psychology

Early Egyptians Thought heart & liver were the vital organs; "not the brain"

Alcmacon (5th Century): Thought brain was "seat of the soul"

Plato 4th Century): Also thought brain was "seat of the soul"

Hippocrates (400 BC):

- a. Emphasized that the brain was organ of intellect.
- b. Brain controlled senses and movement.
- c. Lesion produces a contralateral effect.

Aristotle (3rd century BC): believed function of the brain was to cool the blood. **Herophilus (3rd century BC):**

- a. Brain was organ of intellect.
- b. Third ventricle responsible for cognition.
- c. Fourth ventricle was seat of soul.

Galen (2nd century BC): Influenced medical thought for 1000 years.

- a. First experimental physiologist.
- b. Concluded it was not the **ventricles** but the brain that was important.
- c. Frontal lobes was seat of soul.

Catholic Church during the middle ages, proposed view of natural & animal spirits.

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B. Localization of Function

1. **Franz Joseph Gall (1758-1828)** promoted the concept of localization of function.
2. **Meynert** - Frontal - motor and the posterior - sensory.
3. **Bouilland & Broca (1800's)** - left frontal area for expressive language function.
4. **Wernicke (1800's)**- left temporal receptive language function.
5. **Fritz & Hitzig (1890)** - mapped the motor strip (*pre-central gyrus of the frontal lobes*).
6. **Helmholtz** - measured speed of conduction of nerves (90 ft/sec)
7. **Ferrier & Munk (1900's)** - identified areas for vision, audition, & skin senses
8. **Overemphasis** on localization remained from the 1880's to the 1930's.

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C. Phrenology

Gall (1758-1828):

- a. Faculties located in different organs or centers in the brain.
- b. Centers in the cortex were expansions of lower centers.
- c. Centers were independent in function but able to interact.
- d. Corpus collosum joined the 2 hemispheres.

Phrenology:

- a. Based on the idea that behavior (mind) can be divided into components (faculties).
- b. Specific faculties related to specific cortical areas.
- c. Use of faculty related to cell growth.
- d. Growth produced a bump on the skull.

Spurzheim (1880's): Elaborated Gall's theory.

Vesalius:

- a. Initially supported Galen's ideas but overcame this thinking.
- b. Thought mental functions were in corpus alba.

Willis (1664): Thought that the corpus striatum was responsible for mental functions.

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D. Generalists

- **Flourens** used the experimental method to try to refute the claims of the phrenologists.
He was the first to employ the term **equipotentiality**
- **Hughlings Jackson** was resistant to localization.

- a. He approached the problem from the idea of level of construction rather than specific localization.
- b. His ideas were too complex for the time.

- **Monakow, Head, & Goldstein**

- a. Many functions are the result of activity of the whole brain.
- b. Categorical behavior - highest level, dependent upon mass of the brain rather than specific localization.

- **Marie (1906)** examined one of Broca's brains and found widespread damage attacking his theory.

- **Lashley (1930's)** discovered data which tended to refute localization.

Found size of damage more predictive of effect than specific location.

Mass action Specific function is shared by all neurons in association cortex.

Equipotentiality - All neurons within a sensory area share equally in determining function.

- **Chapman & Wolff (1950's)** demonstrated Lashley's findings with humans.

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E. Language

- **Broca (1861)**

- a. Investigated expressive language area in patient named Tan.
- b. Studied 8 patients overall.
- c. Found that the posterior 1/3 of the left inferior frontal gyrus functioned as the *center for motor images of words*
- d. This was the first time that a complex mental function had been localized in a particular part of the cortex.

- **H. Jackson (1868)** Postulated two types of language functions.

- **Wernicke (1874)**

- a. Discovered the receptive language area in the posterior 1/3 of the superior temporal cortex.
- b. This area was identified as the area for the sensory images of words.

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F. Connectionism

- **Goldstein (1927, 1944, 1948)** acknowledged localization but stressed that brain functions such as ability to deal with abstraction resulted from the interactions of the brain as a whole.
- **During WWII** localization was abandoned for wholistic approach.
- **H. Jackson** emphasized levels of function.
- **Luria** discussed functional systems.
- **Geschwind** held theory of brain function oriented toward connection.

- **Functionalism:** Natural selection and Evolution
 - **Functionalism** - assumes characteristics of living organisms perform useful functions.
 - **Mutations** - occur frequently and a few offer a *selective advantage*.

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Biological Roots of Physiological Psychology

G. Experimental Physiology

- **Muller** - first to advocate use of experimental techniques to physiology. Also developed the **doctrine of specific nerve energies**
- **Florens (1800's)**
 - a. First scientific studies related to brain function.
 - b. Found that the brain functions as if composed of areas of specific function.
 - c. But specific areas interact to function as a whole.
 - d. Studying pigeons & chickens, he found that loss of function depends upon the extent of damage (equipotentiality).
- **Galvani** - found that electrical stimulation of nerve caused muscle to contract. Even if separated from nerve, stimulation caused contraction.

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H. Philosophical Roots of Physiological Psychology

Animism: Basic theory that all things are controlled by animating spirits.

Mind-Body Question

- **Dualism** - belief that reality was divided into 2 categories: material & spiritual. (Thought mind and body were separate).
- **Aristotle:** Thought the mind was separate from the body & could not be destroyed.
- **Descarte:**
 - a. Believed **ventricles** controlled body via hollow tubes (nerves).
 - b. Pineal body was thought to be the controlling mechanism.
 - c. Thought the soul was in the pineal gland.
 - **Monism** - belief that reality consists of an unified whole. (Belief that mind and body were the same.)
 - **Free will** - able to control our behavior; mind not constrained by physiology. In the lab must act like **determinists** (look for physical causes of behavior).
 - **Pluralism** - mind, brain, and scientific knowledge.

Psychoneural Identity Hypothesis - mental and brain processes are one and the same (without brain there can be no mind).

I. Contributions of Modern Psychology

The Goals of Research - Two forms of scientific explanation (generalization & reduction)

- **Generalization** - explain behavior as examples of general laws.
- **Reduction** - explain phenomena in terms of simpler phenomena.
- **Levels of Analysis** - cellular, intercellular, behavioral, and social.

Physiological research involve both generalization & reduction.

The Scientific Method:

Objectivity,
Observation,
Experimentation,
Controls,
Statistical Evaluation,
Independent verification of results.

J. The Value & Ethics of Research with Animals

Terms to Know

Aristotle	dualism	doctrine of specific nerve energies
Hippocrates	monism	Fritz & Hitzig
Herophilus	pluralism	Helmholtz
Galen	Wernicke	Scientific Method
Versalius	Florens	Geschwind
Willis	Broca	Goldstein
Gall	Muller	Luria
Phrenology	H. Jackson	psychoneural identity hypothesis
ventricles	Localization	Generalization