

Focus on the Body: Psychobiology

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I. BACKGROUND

A. Definition

- Biological psychology is the application of the principles of biology to the study of mental processes and behavior.
 - The goal of the work is to understand the biological processes underlying psychological phenomena.
 - Biological psychologists are often be interested in measuring some biological variable in an attempt to relate it quantitatively or qualitatively to a psychological or behavioral variable.
 - For example, biological theories explain schizophrenia by relating it to dysfunctional neurological processes (excess dopamine).

I. BACKGROUND

A. Definition

- The resulting accounts of behavior are *physical explanations* which *reduce* psychological phenomena to biological processes.
 - Reductionism is the basic idea that complex behavior can be explained by the breaking it down into simpler more smaller components.
- Biological reductionism differentiates this paradigm from all others.
 - Biological reductionism is more than finding the biological correlates of psychological phenomena, it is understanding the psychological phenomena as biological ones.

I. BACKGROUND

A. Definition

- Psychobiology involves *physical explanations* of behavior which is unlike other paradigms which offer *design explanations*.
 - **Physical Explanation:** Explanation of the behavior of a system by reference to what the system is made up of and laws that apply to its workings
 - **Design Explanation:** Explanation of the behavior of a system by reference to its function
 - People may be designed to learn from experience (Behavioral Psychology), process information (cognitive Psychology), psychologically grow and actualized (Humanistic Psychology) live in a community (Socio-cultural Psychology)

I. BACKGROUND

A. Social and Intellectual Context

- We review two key issues in understanding the basis of human behavior
 - Neurological basis of behavior
 - What is the role of the brain in behavior
 - Genetic basis of behavior
 - The role of hereditary in shaping human behavior
- Both assume that human beings are determined by internal biological forces.
 - The assumption does not fit well with prevailing American values of culture.

I. BACKGROUND

A. Social and Intellectual Context

- Genetic basis of behavior
 - In 1869, Francis Galton (1822 –1911, Darwin's cousin) published the first empirical work in human behavioral genetics, *Hereditary Genius*.
 - Galton intended to demonstrate that "a man's natural abilities are derived by inheritance, under exactly the same limitations as are the form and physical features of the whole organic world."
 - He conducted a family study on the inheritance of giftedness and talent.
 - Claims that genetic differences in IQ explain group differences in race back a social issue in the 1960s.

I. BACKGROUND

A. Social and Intellectual Context

- Genetic basis of behavior
 - The initial impetus behind behavioral genetic research was to demonstrate that there were indeed genetic influences on behavior.
 - In psychology, this phase lasted for the first half of the 20th century largely because of the overwhelming influence of behaviorism in the field.
 - Later behavioral genetic research focused on quantitative methods
 - Modern behavioral genetic research emphasizes applying techniques from molecular genetics to analyze individual genes that influence behavior.

I. BACKGROUND

A. Social and Intellectual Context

- Genetic basis of behavior
 - Genetic basis of behavior is the focus of ethology, sociobiology and evolutionary psychology.
 - **Ethology** is a branch of zoology and is the scientific study of the evolutionary basis of animal behavior
 - **Sociobiology** is a neo-Darwinian synthesis of scientific disciplines that explains social behavior in all species by considering the evolutionary advantages of the behaviors.
 - **Evolutionary psychology** attempts to explain mental and psychological traits—such as memory, perception, or language—as the functional products of natural selection.
 - Important differences between these approaches

I. BACKGROUND

A. Social and Intellectual Context

- Genetic basis of behavior
 - Sociobiology and Evolutionary Psychology address what is universal or species-specific in human social and cognitive behavior.
 - In contrast, Behavioral Genetics is the study of the genetic basis of human variation.
 - The reproductive process ensures that each individual born from a unique ovum has unique genetic codes.
- There is a genetic basis for what makes us the same as and what makes us different from everybody else

I. BACKGROUND

A. Social and Intellectual Context

- Neurological basis of behavior
 - It has its origins in ancient Greek philosophy through Descartes and the growth of medical science.
 - The story of the modern view of brain function is a fight between those who claim a mass action vs. localization of function in the brain
 - Debates during the 18th and early 19th Centuries were between those who believed that brain function could be localized to particular brain regions and those who believed that the brain acted as a whole.

I. BACKGROUND

A. Social and Intellectual Context

- Brain debate in the early to mid 19th Century
 - Franz Joseph Gall (1757-1828) and Johann Spurzheim (1776-1832) developed phrenology
 - The idea that specific human behaviors and characteristics could be deduced by the pattern and size of bumps on the skull.
 - Marie-Jean-Pierre Flourens (1794-1867) believed that parts of the brain had separate functions, but each of these areas functioned globally as a whole.
 - Flourens supported his theories with experiments in which he removed areas of the brain (mostly in pigeons) and showed that behavioral deficits increased with size of the [ablation](#).

I. BACKGROUND

A. Social and Intellectual Context

- Brain debate in the late 1800s and early 1900s
 - Fritsch (1838-1927), Hitzig (1838-1907), Broca (1824-1888) and Wernicke (1848-1904) in the late 1800s provided strong data to support the localization of function.
 - Wernicke and Broca identified the specific areas of the brain central in the production and comprehension of speech.
 - Golgi (1834-1902) and Brown-Sequard (1817-1894) among others championed a brain that acted as a whole.
 - Golgi argued for nerve nets and Brown Sequard found other brain areas contribute to language.

I. BACKGROUND

A. Social and Intellectual Context

- Brain debate
 - The debate is ultimately resolved with the notion of *neurological networks* and *interactions*.
- Three key figures in the resolution
 - Karl S. Lashley
 - Rejected specific localization of memories
 - Donald O. Hebb
 - Developed the neurological network idea
 - Roger W. Sperry
 - Split brain.

II. NEUROLOGICAL BASIS OF BEHAVIOR

A. Karl Lashley

- Karl Lashley (1890–1958)
 - Originally wanted to support the associationism of Watson with neurophysiological evidence.
 - He was searching for the elusive engram, the neurophysiological locus of memory and learning
 - Spent decades searching for it and eventually conceded that it was not possible to locate the engram.
 - Used the ablation method in a learning paradigm.



II. NEUROLOGICAL BASIS OF BEHAVIOR

A. Karl Lashley

- Karl Lashley
 - Mass action
 - Loss of ability to perform a learned behavior following destruction of parts of the cortex is related more to the amount than location of destruction.
 - Equipotentiality
 - Any part of a functional area of the brain can perform the function associated with that area.
 - If, following an ablation, any part of the area is spared, the function would still be maintained.



II. NEUROLOGICAL BASIS OF BEHAVIOR

A. Karl Lashley

- Karl Lashley
 - His best known paper, Lashley (1951) *The Problem of Serial Order in Behavior*
 - He addressed how behaviors consisting of a sequence of steps performed in some particular order, might be controlled.
 - He warned that the behaviorist "chaining" account for serial order can not account for such serial ordered behavior key for language and complex behaviors.
 - Behaviorism may be unable to account for uniquely human behavior.



II. NEUROLOGICAL BASIS OF BEHAVIOR

B. Donald O. Hebb

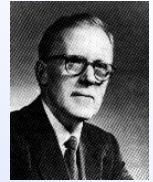
- Donald O. Hebb (1904 – 1985)
 - Lashley student, Penfeld associate
 - *Organization of Behavior* (1949)
 - Postulated neural interconnections called cell assemblies, which are complex package of neurons.
 - They develop with experience and experiences result from activated cell assemblies.
 - Reverberating neural activity allows neurons that were temporarily separated to become associated.



II. NEUROLOGICAL BASIS OF BEHAVIOR

B. Donald O. Hebb

- Donald O. Hebb
 - Cell assemblies become neurologically integrated to form phase sequences.
 - A phase sequence is “a temporally integrated series of assembly activities; it amounts to one current in the stream of thought.”
 - Learning involves the slow buildup of cell assemblies and phase sequences
 - Can be explained associationistically.
 - Rearranging cell assemblies and phase sequences for insight and creativity.



II. NEUROLOGICAL BASIS OF BEHAVIOR

C. Roger Sperry

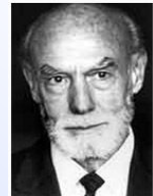
- Roger Sperry (1913-1994)
- Nobel Prize winner (1981) for his split brain research
 - Cutting (ablating) the corpus callosum and the optic chiasm essentially splits the brain into two separate brains with no exchange of information.
 - Early work was with animals but later he studied epileptic humans with their corpus callosum cut to limit seizures.



II. NEUROLOGICAL BASIS OF BEHAVIOR

C. Roger Sperry

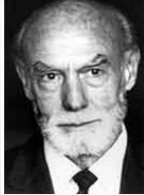
- Roger Sperry
 - Hemispheric specialization.
 - Each hemisphere is a conscious system
 - Both the left and the right hemisphere may be conscious simultaneously in different, even in mutually conflicting, mental experiences that run along in parallel
 - Research indicates caution in too much speculation regarding specialization and its impact on learning and educational practices.



II. NEUROLOGICAL BASIS OF BEHAVIOR

C. Roger Sperry

- Roger Sperry
 - Interactionist
 - Sperry was an interactionist concerning the mind-body problem
 - He believed that consciousness emerges from brain processes and once emerged has a causal relationship to behavior.
 - But each hemisphere has its own consciousness -- perceiving, thinking, remembering, reasoning, willing, and emoting, all at a characteristically human level,



III. GENETIC BASIS OF BEHAVIOR

A. Behavioral Genetics

- Behavioral Genetics study whether variations on behavioral and psychology phenomena are directly related to variation in genes.
- Heritability
 - Research by various researchers have investigated the heritability of intelligence and personality characteristics.
 - Family studies, Twin studies, and Adoption studies are research techniques.
 - There is still much argument and discussion regarding these highly sensitive subjects.

III. GENETIC BASIS OF BEHAVIOR

B. Ethology

- Ethology
 - Modern ethology began in the 1930s with Tinbergen (1907-1988) and Lorenz (1903-1989)
 - They were joint winners of 1973 Nobel Prize in medicine.
 - Studied species-specific behavior in an animal's natural environment to explain behavior in terms of evolutionary theory
 - Stickleback territoriality and duck imprinting reflect typical species behavior under specific environmental conditions.

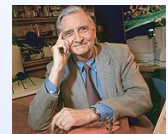


Konrad Lorenz (right) with Nikolaas Tinbergen (left), 1978

III. GENETIC BASIS OF BEHAVIOR

C. Sociobiology

- Sociobiology
 - Popularized by Edward O. Wilson
 - His 1975 book, *Sociobiology: The New Synthesis* was very controversial.
 - Complex ant social behaviors were explained by genetic control.
 - Biogrammar
 - Inherited structures that predisposes organisms toward certain kinds of social activities.
 - Leash Principle
 - There is a close relationship between culture and the satisfaction of biological needs
 - Biology holds culture on a leash



E. O. Wilson

III. GENETIC BASIS OF BEHAVIOR

D. Evolutionary Psychology

- Evolutionary Psychology
 - The goal of EP is to understand the design of the human mind which promotes evolutionary adaptation.
 - EP holds that humans are *adaptation executors* or *mechanism activators*
 - EP explores why and how as a species humans evolved adaptive abilities and skills to solve the problems of survival
 - Why are people social? How do humans choose mates? Why do people behave in altruistic ways?

III. GENETIC BASIS OF BEHAVIOR

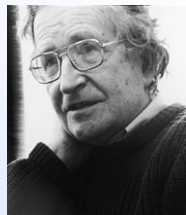
D. Evolutionary Psychology

- Evolutionary Psychology is different from ...
 - **behavior geneticists** which us interested in genetic based *differences* between people.
 - EP is relatively disinterested in diversity.
 - **Ethology** in exploring evolutionary basis of other psychological functioning than just social behavior.
 - Priority is given to the evolution of tendencies to process certain kinds of information (language, inference)
 - **Sociobiology**, who assume humans are *fitness maximizers* (reproductive success)
 - EP is more interested in the evolution of underlying mechanisms leading to adaptation.

III. GENETIC BASIS OF BEHAVIOR

D. Evolutionary Psychology

- Evolutionary Psychology
- Noam Chomsky
 - Central figure in evolutionary psychology
 - Argues that the human brain is genetically programmed to generate language.
 - Each child is born with brain structures that make it relatively easy to learn the rules of language.
 - Case for an evolved language module dismissed hope of a behaviorist account of a human language acquisition.



III. GENETIC BASIS OF BEHAVIOR

E. Genetics and Behaviorism

- Genetics and Behaviorism
- Genetic challenge to the universality of the laws of learning.
 - Keller and Marion Breland observed instinctive behavior began to interfere with the performance of operantly trained behavior (instinctual drift)
- Preparedness continuum
 - Different animals are biologically prepared to form certain associations and contraprepared to form others and this has been selected for through evolutionary principles.