LASHLEY, KARL SPENCER (1890-1958)

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Karl Spencer Lashley

Born: 1890 | **Died:** 1958
Nationality: American
Primary Field(s): Physiological Psychology, Neuropsychology

1. Summary

Karl Spencer Lashley was an influential American physiological psychologist renowned for his pioneering experimental work concerning the neurobiological basis of learning, memory, and localization of function in the brain. He received his Ph.D. in genetics from Johns Hopkins University in 1915, beginning his career working alongside the foundational behaviorist **John B. Watson**. Although Lashley utilized the rigorous experimental methodology associated with behaviorism throughout his career, he ultimately departed from the rigid stimulus-response dogma by focusing on the function of the **total organism**. This holistic approach aligned him closer to the Gestalt school of thought, enabling him to investigate complex behavioral mediation by the central nervous system.

Lashley's most significant contributions stemmed from extensive extirpation studies, primarily on rats and monkeys, where he systematically destroyed different amounts of cerebral tissue to record the effects on previously learned habits and future learning ability. His findings culminated in the development of the revolutionary principles of **equipotentiality** and **mass action**, which fundamentally challenged the 19th-century theories of highly specific functional localization within the cerebral cortex. His major work, *Brain Mechanisms and Intelligence* (1929), synthesized these findings, establishing him as a central figure in early neuropsychology.

2. Career Trajectory and Institutional Roles

Lashley's academic career was marked by significant appointments at leading institutions. After completing his work at Johns Hopkins (1915-1917), he accepted a teaching position at the University of Minnesota (1917-1926). He spent three years as a research psychologist at the Behavior Research Foundation in Chicago, followed by six years teaching at the University of Chicago. From 1935 to 1955, he served as a professor of neuropsychology at **Harvard University**. Concurrent with his Harvard professorship, he also directed the Yerkes Laboratories in Orange Park, Florida, between 1942 and 1955. His leadership was recognized by his election as president of the American Psychological Association (1929) and president of the Society of American Naturalists (1947).

3. Intellectual Context and Approach to Behaviorism

Lashley maintained a complex relationship with behaviorism. He was fundamentally a researcher committed to objective, mechanistic explanations of biological phenomena, avoiding the subjective controversies surrounding consciousness that embroiled many of his contemporaries. As he stated in 1923, "To me the essence of behaviorism is the belief that the study of man will reveal nothing except what is adequately describable in the concepts of mechanics and chemistry, and this far outweighs the question of the method by which the study is conducted."

However, his focus quickly diverged from the strict measurement of isolated stimuli and responses. Instead, he concentrated on how the organism as a unified system mediates complex actions. This functional and systemic perspective led him to conduct investigations on broad areas of animal behavior, including color vision, instinct, sex, heredity, and conditioning, although his primary focus remained the relationship between brain tissue and learned behavior. His adoption of a holistic view positioned his experimental neuropsychology closer to the concepts espoused by the **Gestalt school**, emphasizing integrated physiological functioning.

4. Challenging Specific Localization of Function

Prior to the 1900s, research, primarily involving the motor cortex, emphasized **specific localization**, suggesting that distinct, small areas of the brain were responsible for discrete functions (e.g., one specific spot controls arm movement, another controls leg movement). Lashley was instrumental in overturning this rigid view. His initial work in this area involved a collaboration with S. I. Franz, where they experimented with white rats, training them on specific tasks before destroying portions of their cerebral tissue. They found that the same function could sometimes be mediated by two different parts of the brain on separate occasions. This revolutionary discovery of **vicarious functioning** was published in a joint paper in 1917.

Lashley further developed this line of inquiry during the 1920s by systematically varying the amount of brain tissue destroyed and recording the impact on sensory discrimination and intelligence. He employed instruments such as complex mazes (measuring time and errors in learning before and after extirpation) and the innovative "jumping stand." The jumping stand required rats to discriminate between visual stimuli (like a triangle or circle) to gain access to a reward, allowing for precise measurement of cognitive and perceptual deficits following cortical damage.

5. Key Contributions: Equipotentiality and Mass Action

The core findings from Lashley's extirpation experiments were formalized into two major, interconnected principles:

Equipotentiality: This principle, an elaboration of the concept of vicarious functioning, posits that all parts of the nervous system are so closely interrelated that if one part responsible for a

particular function is destroyed, another "equipotential" area can take over that function. Lashley argued this was a basic biological principle for complex activities such as intelligence and motor learning. For instance, he showed that destruction of part of the motor cortex in monkeys, which initially caused temporary paralysis, eventually led to the reappearance of the lost ability over time, although usually in a somewhat less efficient form than before the damage.
Mass Action: This concept asserts that large amounts of equipotential brain tissue work together in complex processes such as learning and retention. Consequently, the loss in ability associated with complex tasks is proportional to the **extent of the damage** to the cortex, not the specific location of the lesion. Lashley found that up to about 15 percent of cortical destruction in rats resulted in no measurable impairment; beyond that threshold, the greater the amount of tissue destroyed, the harder it was for the rats to escape a problem box or relearn procedures.

6. Major Works

A Joint Paper with S. I. Franz on Effects of Cerebral Tissue Destruction (1917)
Behaviorism and Postulates of Objective Psychology (1923)
Brain Mechanisms and Intelligence: A Quantitative Study of Injuries to the Brain (1929)
The Problem of Serial Order in Behavior (1951)

7. Criticisms and Debates

While Lashley's principles revolutionized the study of brain plasticity, he himself noted that equipotentiality did not apply uniformly across all functions or species. He found, for example, that if the visual areas of a rat's brain were destroyed, the rat lost **pattern vision** but retained the ability to discriminate brightness, as brightness discrimination is mediated at a lower neurological level. However, in human beings, the visual cortex is necessary for both pattern vision and brightness discrimination, indicating greater functional specialization.

The principles of equipotentiality and mass action apply far more fully to lower animals and generalized tasks (like maze running) than to human beings, where a high degree of specific localization exists for primary sensory and motor functions (e.g., language processing or fine motor control). Subsequent research has refined Lashley's findings, acknowledging that while the brain exhibits remarkable plasticity and distributed processing (supporting equipotentiality), some functions remain highly localized. Nonetheless, his work remains foundational for establishing the concept of neurological plasticity and dynamic cortical organization.

Further Reading

Karl Lashley (Wikipedia)
Brain Mechanisms and Intelligence (Wikipedia)

Equipotentiality (Neuroscience)