illumination, and verification (Heilman, 2005; Wallas, 1926) (Figure 4-1). Preparation is development of the knowledge and skills required to do a task, which includes a basic predisposition or talent for performing that task; it also requires understanding, training, and experience for creative output. Incubation is a period of time when notions, ideas, and directed thinking are set aside. Moments of insight come during a temporary distraction or relaxation. Ramon y Cajal (1852-1934), a father of modern neuroscience, lends credence to the need for incubation. In his book Advice for a Young Investigator, he wrote “If a solution fails to appear…and yet we feel success is just around the corner, try resting for a while. Several weeks of relaxation and quiet in the countryside bring calmness and clarity of the mind” (Cajal, 1916, p. 35). Illumination is the “aha!” moment, that moment when an undiscovered thought or idea is revealed, often after a period of incubation. Finally, the output of the creative process requires verification to justify the idea or completed work as a result of using the “new” approach. This verification may come from the scientific community, mathematics, or another source. Verification also may occur through the confirmation or affirmation of those who apply the creative output that resulted from the process.

Each of these four stages of creativity may be traced to different structures in the brain (Figure 4-2).

**Figure 4-1.** Stages of creativity.

**Figure 4-2.** Illustration of the brain with lobes and identified areas.

**Unit 1: Structures and Functions of the Central Nervous System: A Brief Overview**

Roles of the Central Nervous System in Creativity

Cognition is the term used to describe a wide range of tasks processed by the brain. Simple cognitive processes include tasks such as seeing, hearing, and responding to pain or fear. At the more complex end of the spectrum are the higher cognitive functions, known as executive functions. These include attention, perception, memory, insight, and abstract thinking. Creativity is also considered a higher cognitive function by most neuroscientists who study it. The neural basis for the higher cognitive functions is the cerebral cortex of the brain. Recent theories of the neural correlates of cognition put emphasis on the frontal cortex for providing these higher attributes, including self-awareness, problem solving, divergent thinking, and other executive functions. Research also suggests that the entire brain can be activated when people are engaged in creative tasks (Fink et al., 2009; Heilman, Nadeau, & Beversdorf, 2003). Furthermore, it is well established that neuronal activity patterns in the cerebral cortex change in response to lived experiences and learning (Buonomano & Merzenich, 1998; LeDoux, 2002). The postulate is that creativity occurs when preparation through experience and learning takes place, and this is a requirement, not an option.