



# Psychoneuroimmunology

## Part I: Physiology

*Susan M. Bauer-Wu, DNSc, RN*

Since its early days, nursing has appreciated the connection between mind and body. Even when the dualistic Cartesian perspective that the brain was separated from the rest of the body pervaded Western medicine during the majority of the 19th and 20th centuries, nursing embraced a holistic view of patient care. Florence Nightingale, in her *Notes on Nursing* published in 1862, eloquently wrote about the healing power of sensory stimulation and personal connection.

During the past 30 years, scientific inquiry has led to a greater understanding of human physiology and the dynamic relationship between psychological, neuroendocrine, immunologic, and other physiologic processes. The purpose of this article is to provide an overview of the physiology of the connection between mind and body, referred to as psychoneuroimmunology (PNI). Oncology nurses will benefit from this information because it relates to the scientific basis for many of the integrated therapies and nonpharmacologic interventions that are integral to the care of patients with cancer.

PNI is a growing and relatively new discipline. The term was coined in 1981 after Dr. Robert Ader and his colleagues identified serendipitous findings while they conducted classical behavioral conditioning experiments with rats (Ader, Felten, & Cohen, 1981). During conditioning experiments focused on vomiting, the researchers gave rats cyclophosphamide laced with sweetened water, then administered sweetened water alone. As hypothesized, the rats became conditioned to vomit when given sweetened water alone. Unexpectedly, however, young, healthy rats also were sicker and died much sooner than anticipated after receiving only sweetened water. Further in-

vestigation found that the rats also experienced a conditioned response of immunosuppression: Even when they did not receive chemotherapy, their immune systems responded as if they had. This seemingly simple finding caught the investigators by surprise and sparked a great deal of controversy. Prior to the study, neurological activities were recognized as distinct and separate from the immune system.

### The Nervous System

In general, the functions of the brain structures are as follows.

- The cerebral cortex provides for cognitive and interpretative processes.
- The cerebellum is involved in motor functions and physical movements.
- The limbic system controls emotional states and motivational drives.
- The brain stem is involved in a number of sensory and motor activities, including respiration, arterial pressure, equilibrium, pain, and the waking and sleep cycle.
- The hypothalamus plays a major role in controlling a multitude of vegetative and endocrine functions (Bloom & Lazerson, 1988).

Bidirectional communication occurs between these various brain structures through peptide substances called neurotransmitters (Bloom & Lazerson, 1988; Guyton, 1991). Examples of neurotransmitters that perform important roles in neurocommunication and the regulation of brain activities are norepinephrine (NE), serotonin, dopamine, and endogenous opiates (i.e., enkephalins and endorphins).

Sensory information is sent to the central nervous system (i.e., brain and spinal

cord) via the peripheral nervous system (i.e., cranial and spinal nerves). Upon stimulation of a sensory nerve fiber by something either outside or inside the body, a cascade of complex activities occurs. Afferent signals, which move toward a nerve center, first are transmitted from the peripheral nerves to the brain stem. The brain stem, which consists of the mesencephalon, pons, and medulla oblongata, connects the forebrain and the spinal cord. From the brain stem, the afferent signals are transmitted to the thalamus. The thalamus, located in the center of the brain, acts as a chief traffic relay station, directing sensory signals to a variety of brain structures: the cerebral cortex, cerebellum, limbic system, brain stem, and hypothalamus. Efferent fibers, which convey nervous impulses to effectors, transmit responses from the brain to the periphery via motor, sympathetic, or parasympathetic nerve pathways (Guyton, 1991).

The hypothalamus is one of the most important structures involved in PNI. It plays

---

*Susan M. Bauer-Wu, DNSc, RN, is director of The Phyllis F. Cantor Center at Dana-Farber Cancer Institute in Boston, MA. This article is one of a two-part series. Part I comprehensively reviews the principles of psychoneuroimmunology. In reader and Oncology Nursing Society member surveys, seasoned clinicians and advanced practice nurses have requested this advanced level of information. Part II, which will be published in an upcoming issue of the Clinical Journal of Oncology Nursing, will discuss the clinical application of this information.*

Digital Object Identifier: 10.1188/02.CJON.167-170