Health Promotion: Stress Adaption and Concepts of Psychobiology

Objectives:

1. Define adaptation and maladaptation.
2. Identify physiological responses to stress.
3. Explain the relationship between stress and diseases of adaptation.
4. Describe the concept of stress as an environmental event.
5. Explain the concept of stress as a transaction between the individual and the environment.
6. Discuss adaptive coping strategies in the management of stress.
7. Review Psychobiology and the implications for Nursing Practice.

Reading Assignment: Townsend, Chapters 1 and 4

Lecture Outline:

I. Introduction
   A. Stress lacks a definitive definition.
   B. Adaptive: is a healthy response to stress which has been defined as restoration of balance to the internal environmental system. This includes responses directed at stabilizing internal biological processes and psychological preservation of self-identity and self-esteem.
   C. Maladaptive: is a response to stress that disrupts the integrity of the individual. It is considered negative or unhealthy.

II. Stress as a Biological Response
   A. Hans Selye defined stress as a “non-specific response by the body to any stressor placed on it.”
      This syndrome of symptoms has come to be known as the “fight or flight” syndrome.
B. Selye called the general reaction of the body to stress the **General Adaptation Syndrome (GAS)**. He described the reaction in three distinct stages:

1. **Alarm Reaction Stage.** During this stage, the physiological responses of the "Fight-or-flight syndrome are initiated.
   a. The hypothalamus stimulates the sympathetic nervous system, which in turn stimulates the adrenal medulla.
   b. The adrenal medulla releases epinephrine and norepinephrine into the bloodstream.
   c. Changes in the eye include pupil dilation and increased secretion from the lacrimal glands.
   d. In the respiratory system, the bronchioles and pulmonary blood vessels are dilated and the respiration rate is increased.
   e. Changes in the cardiovascular system result in an increase in force of contraction, resulting in increased cardiac output, heart rate, and blood pressure.
   f. The GI system undergoes decreases in motility and secretions.
   g. Effects on the liver result in increased glycogenolysis and gluconeogenesis and decreased glycogen synthesis.
   h. Ureter motility increases. In the bladder, the muscle itself contracts, whereas the sphincter relaxes.
   i. There is increased secretion from the sweat glands.
   j. In general all systems can be effected.

2. **Stage of Resistance.** The individual uses the physiological responses of the first stage as a defense in the attempt to adapt to the stressor. If adaptation occurs, the third stage is prevented or delayed. Physiological symptoms may then disappear.
   a. The hypothalamus stimulates the pituitary gland.
   b. The pituitary gland releases adrenocorticotropic hormone (ACTH), which stimulates the adrenal cortex.
      1. The adrenal cortex releases mineralocorticoids, resulting in gluconeogenesis, immunosuppression, and an anti-inflammatory response.
      2. The adrenal cortex also releases mineralocorticoids, resulting in increased retention of sodium and water.
   c. The pituitary gland releases vasopressin (antidiuretic hormone (ADH)), which results in increased blood pressure and fluid retention.
   d. The pituitary gland releases growth hormone, which produces a direct effect on protein, carbohydrate, and lipid metabolism, resulting in
increased serum glucose and free fatty acids.

c. The pituitary gland releases thyrotropic hormone (TTH) which stimulates the thyroid gland, resulting in an increase in the basal metabolic rate.

d. The pituitary gland releases gonadotropins, the initial response of the release is an increase in secretion of sex hormones. Later, with sustained stress, secretion is suppressed, resulting in decreased libido or impotence.

3. **Stage of Exhaustion.** Occurs when there is a prolonged exposure to the stressor to which the body has become adjusted. The adaptive energy is depleted, and the individual can no longer draw from the resources for adaptation described in the first two stages. Disease of adaptation may occur, and, without intervention for reversal, exhaustion and even death can ensue.

III. Stress as an Environmental Event

A. **Definition.** This concept defines stress as a “thing” or “event” that triggers the adaptive physiological and psychological responses in an individual. The event is one that creates change in the life pattern of the individual, requires significant adjustment in lifestyle, and taxes available personal resources. The change can be either positive or negative.

B. **Miller and Rahe Recent Life Changes Questionnaire.** Designed to measure stress. (See attachment - Life Event Scale)

C. **Illness.** It is unknown whether stress overload predisposes a person to illness or actually precipitates it, but there does appear to be a link.

D. **A weakness in the Miller and Rahe tool** is that it does not take into consideration the individual’s personal perception of the event or his or her coping strategies and available support systems at the time of the life change.

IV. Stress as a Transaction between the Individual and the Environment.

A. **This definition of stress emphasizes the relationship between the individual and the environment that is appraised by the individual as taxing or exceeding his or her resources and endangering his or her well-being.**

B. **Precipitating event.** A stimulus arising from the internal or external environment and perceived by the individual in a specific manner. Stress determination depends on the individual’s **cognitive appraisal.**

C. **Individual’s perception of the event.** When an event occurs, an individual undergoes a primary and secondary appraisal.

1. **Primary Appraisal.** The individual makes a judgment about the situation in one of the following ways:

   a. **Irrelevant.** The event is judged irrelevant, when the outcome holds no significance for the person.
b. **Benign-positive.** The outcome produces pleasure for the person.

c. **Stress.** Appraisals that include harm/loss, threat or challenge.

(1) **Harm/loss.** Refers to damage or loss already experienced.

(2) **Threat.** Appraisals perceived as anticipated harm or losses.

(3) **Challenge.** The individual focuses on potential for gain or growth, rather than on risks associated with the event.

2. **Secondary appraisal.** An assessment of skills, resources, and knowledge that the person possesses to deal with the situation.

3. **The interaction** between the primary appraisal of the event that has occurred and the secondary appraisal of available coping strategies determines the individual’s quality of adaptation responses to stress.

C. **Predisposing Factors:** Elements that influence how an individual perceives and responds to a stressful event. They include genetic influences, past experiences, and existing conditions.

1. **Genetic influences.** Circumstances of an individual’s life that are acquired by heredity. (e.g., family history of physical and psychological conditions).

2. **Past Experiences.** Occurrences that result in learned patterns that can influence an individual’s adaptation response (e.g., previous exposure to the stressor, learned coping responses, and degree of adaptation to previous stressors).

3. **Existing conditions.** Vulnerabilities that influence the adequacy of the individual’s physical, psychological, and social resources for dealing with adaptive demands (e.g., current health status, motivation, developmental maturity, severity and duration of the stressor, financial and educational resources, age, existing coping strategies, and a support system of caring others).

V. **Stress Management**

A. **Involves the use of coping strategies in response to stressful situations.**

B. **Adaptive coping strategies** protect the individual from harm (or additional harm) or strengthen the individual’s ability to meet challenging situations. These are:

1. **Awareness**—the first step in managing stress.
2. **Relaxation**—individual experience.
3. ** Medication**—reduction in blood pressure.
4. **Interpersonal communication with Caring Others**—talking it out.
5. **Problem-solving**
   a. Assess the facts of the situation.
   b. Formulate goals for resolution of the stressful situation.
   c. Study the alternatives for dealing with the situation.
   d. Determine the risks and benefits of each alternative.
   e. Select an alternative
   f. Implement the alternative selected.
   g. Evaluate the outcome of the alternative implemented, if the choice is ineffective, select and implement a second alternative.
C. Maladaptive coping strategies allow the conflict being experienced to go unresolved or to intensify.

VI. Psychological Adaptation to Stress

A. Anxiety: diffuse apprehension that is vague in nature and is associated with feelings of uncertainty and helplessness. There are four levels of anxiety.

1. Mild anxiety
2. Moderate anxiety
3. Severe anxiety
4. Panic anxiety

B. Ego defense mechanisms

1. Compensation
2. Projection
3. Denial
4. Rationalization
5. Displacement
6. Reaction formation
7. Identification
8. Regression
9. Intellectualization
10. Repression
11. Sublimation
12. Introjection
13. Suppression
14. Isolation
15. Undoing

VII. Concepts of Psychobiology

I. Introduction

A. The 101st legislature of the US designated the 1990's as the “decade of the brain” with the challenge for studying the biological basis for behavior.

B. In keeping with the “neuroscientific revolution”, greater emphasis is placed on the study of the organic basis for psychiatric illness.

II. The Nervous System: An Anatomical Review

A. The Brain

1. The forebrain
   a. The cerebrum
      (1) Right and left hemispheres connected by a deep groove of neurons called the corpus callosum.
(2) Each hemisphere is divided into four lobes named for the overlying bones in the cranium:
   (a) Frontal lobe
   (b) Parietal lobe
   (c) Temporal lobe
   (d) Occipital lobe

b. Diencephalon. Connects the cerebrum with the lower brain structures. Consists of the following:
   (1) The thalamus
   (2) The hypothalamus
   (3) The limbic system

The limbic system is sometimes called the “emotional brain” and is associated with feelings of fear and anxiety; anger and aggression; love, joy and hope; and with sexuality and social behavior.

The limbic system regulates emotional behavior.

2. The midbrain is responsible for visual, auditory and balance reflexes.

3. The hindbrain consists of:
   a. The Pons
   b. The Medulla
   c. The Cerebellum

B. Nerve tissue

1. The nerve cells of the central nervous system (CNS) tissue are called neurons.

C. Autonomic nervous system (ANS) has two divisions:

1. The sympathetic division is dominant in stressful situations and prepares the body for “fight or flight.”

2. The parasympathetic division dominates when an individual is in a relaxed, non-stressful condition.
D. **Neurotransmitters** are chemicals that convey information contained in action potentials, across synaptic clefts to neighboring target cells. The four major categories are:

1. **Cholinergics**
   a. Acetylcholine (increased levels can cause depression)

2. **Monamines**
   a. Norepinephrine
   b. Dopamine
   c. Serotonin
   d. Histamine

3. **Amino Acids**
   a. Gamma aminobutyric acid (GABA)

4. **Neuropeptides**
   a. Opioid Peptide
   b. Substance P
   c. Somatostatin

E. **Neuroendocrinology**

1. Endocrine functioning in the CNS is under the direct control of the hypothalamus, which has direct control over the pituitary gland, sometimes called the “master gland”.

2. Circadian rhythms follow a near 24 hour cycle and may influence a variety of regulatory functions.

3. Neurochemical influences: A number of neurochemicals have been shown to influence the sleep-wake cycle:
   a. Serotonin and its precursor L-tryptophan, have been shown to induce sleep.
   b. Norepinephrine and dopamine may play a role in REM sleep.
   c. GABA plays a role in sleep facilitation.

VIII. **Genetics**

A. **The goal of behavioral genetics is to clarify the role that genetic factors play in the determination of behavior.**

B. **Genotype**- the total sets of genes present in an individual at the time of conception and coded in the DNA.

C. **Phenotype**- physical manifestations of a particular genotype (example, eye color,
height, blood type, language, and hair type). Phenotypes may be genetic or acquired. 

Most psychiatric disorders are a combination of both.

D. Various types of studies have been conducted to determine etiological factors associated with psychiatric illness:

1. Familial-compare the percentage of family members with the illness to those in the general population or a specific control group (example-schizophrenia).

2. Genetic-search for a specific gene that is responsible for the individual having the illness (example-Down syndrome).

3. Twin Studies-examine the frequency of a disorder in identical and fraternal twins.

4. Adoptive Studies-allows comparisons to be made of the influences of genetics versus environment on the development of a psychiatric disorder.

IX. Psychoimmunology

A. Normal immune response

1. Neutrophil, monocyte, and macrophage cells are responsible for nonspecific immune reactions. If this fails, then specific immune mechanisms take over (cellular and humoral responses).

2. With the cellular response, the T lymphocytes (T4 in particular) become sensitized to and specific for the foreign antigen when the body is invaded.

3. The humoral response is activated when antigen-specific T4 cells communicate with the B lymphocytes in the spleen and lymph nodes. B cells then produce antibodies specific to the foreign antigen.

B. Implications for psychiatric illness:

1. Studies have hypothesized that the immune system becomes depressed and that individuals become more susceptible to physical illness following exposure to a stressful stimulus or life event resulting in suppression of lymphocyte proliferation and function.

2. Certain neurochemicals may influence the immune system:
   Growth hormone may enhance immunity.
   Testosterone and norepinephrine may decrease immunity.
   Serotonin has been shown to enhance and decrease immunity.

3. Decreased immunity has been associated with grief, bereavement and depression. Immunological abnormalities have been associated with alcoholism, autism, dementia.

4. The role of neuroimmunology remains unclear in the relationship to onset and course of schizophrenia.
C. Implications for Nursing Practice

1. Psychiatric nurses must integrate knowledge of biological science into their practices if they are to ensure safe and effective care of people with mental illnesses.

2. Psychiatric nurses must have a specialized knowledge concerning:
   a. Neuroanatomy and neurophysiology
   b. Neuroendocrinology
   c. Circadian rhythms which follow a near 24-hour cycle in humans and may body temperature regulation, and patterns of activity such as eating, drinking, and hormone secretion.
   d. Genetic influences
   e. Psyoimmunology
   f. Psychopharmacology
   g. Diagnosite technology
      1. Electroencephalography (EEG)
      2. Computerized EEG mapping
      3. Computer tomographic (CT) scan
      4. Magnetic resonance imaging (MRI)
      5. Positron emission tomography (PET)

X. SUMMARY

Stress has become a chronic and pervasive condition in the United States today. We live in a world of uncertainties, with a sophisticated media that keeps us informed and knowledgeable about the upheavals occurring around the world. In the United States we live in the “fast lane,” a continuous drive for advancement, competitiveness, and the search for “the good life” have created a stress epidemic that has individuals, corporations, and health professionals searching for ways to calm the collective masses.