

UNIT IV



Foundation of
Psychiatric Advanced
Practice Nurse'
Practice

Brain Functioning and Brain Development

By Eris F. Perese

While mankind's brain has been shaped by evolution (Gaze, 1989), each individual's brain is shaped by genetic influences, prenatal development of the brain, and post-natal experiences and interactions with the environment (Bartley, Jones & Weinberger, 1997; Toga & Thompson, 2005). Each uniquely molded brain produces the individual's behaviors—motor activities, thinking, speaking, planning, creating, and loving—with different regions of the brain having different functions (Andreasen & Black, 2006; Bear, Connors & Paradiso, 2007).

The brain functions to gather information about individuals' internal and external worlds, to analyze the information, and to carry out the best response to the need for adaptation, whether it is to an opportunity, challenge, or stressor (Higgins & George, 2007; McEwen, 2009). Compromised brain functioning is manifested in symptoms or in clusters of symptoms that form the basis for diagnosing psychiatric disorders (Hedaya, 1996; Kandel, Schwartz & Jessell, 2000). As LeDoux (2002) says, "The essence of who we are is encoded in our brains and brain changes account for the alterations of thought, mood, and behavior that occur in mental illness" (p. 260).

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PART ONE: Brain Functioning

Advanced practice psychiatric nurses study the brain and its functioning in order to understand how the brain regulates emotions, thoughts, and behaviors. With this information, advanced practice psychiatric nurses are able to recognize impairments of patients' functioning; they are also able to plan interventions that promote restoration of optimal functioning and compensate for compromised functioning. In studying the brain, advanced practice psychiatric nurses build a foundation for understanding the brain's plasticity and the brain's ability to change throughout the lifetime. They create a framework for understanding the biopsychosocial treatment interventions of psychotherapies, pharmacotherapy, and psychosocial interventions, all of which bring about change at the biological level by altering synaptic connections and gene expression; these alterations lead to new patterns of behaviors (Kandel, 2005; McEwen, 2009).

To understand the brain and how it functions, advanced practice psychiatric nurses must look at both the nervous system and at neurotransmission.

Neurotransmission

Michael Decker and Larry Butcher (1992) state in their "Ode to Neurotransmission:"

We may live without conscience, we may live without heart.

We may live without poetry, music and art.

We may live without politics or nuclear fission.

But no one can live without neurotransmission. (p. 12)

Informational Substances

Neurotransmitters

Traditionally, neurotransmitters have been thought to share the following characteristics. They are:

1. Manufactured by a cell.
2. Stored in presynaptic terminals.
3. Released into the synaptic cleft in response to stimulation, where they create an action in the post-synaptic receptor.
4. Have a specific mechanism for termination of action (Kandel, et al. 2000, p. 281).

Classical Neurotransmitters: Monoamines

The brain functions to gather information about individuals' internal and external worlds, to analyze the information, and to carry out the best response to the need for adaptation, whether it is to an opportunity, challenge.

Epinephrine and Norepinephrine (NE)

The 5HT1 receptors are found in high concentrations in the limbic area.

Noradrenergic Neurotransmitter System

The purposes of a psychiatric assessment interview are to gather information that will enable the formulation of a diagnosis and differential diagnoses; to establish a therapeutic relationship with the client; to reassure the client that help will be provided

5HT1 receptors. The 5HT1 receptors are found in high concentrations in the limbic area. They are also located on serotonergic neuron cell bodies, where they serve as autoreceptors that regulate the activity of the serotonin neuron (Szabo et al., 2009). There are six subtypes of the 5HT1 receptor (Melchitzky & Lewis, 2009):

- Subtype 5HT1A: These receptors are involved in regulation of body temperature, eating, and sexual behavior and are implicated in depression and anxiety. Blockage of subtype 5HT1A receptors is associated with an antidepressant, anxiolytic, and anti-aggressive action. Blockage of 5HT1A receptors that function as autoreceptors post-synaptically cuts the feedback that shuts off serotonin. Thus, using a medication that blocks the 5HT1A receptors will prevent the feedback that shuts off serotonin, making more serotonin available.
- Subtype 5HT1B: These receptors are involved in anxiety, movement disorders, food intake, sexual activity and aggressive behaviour.
- Subtype 5HT1C: The 5HT1C classification is no longer used because it is similar in structure and function to Subtype 5HT1D.
- Subtype 5HT1D: These receptors are involved in motor action, vasoconstriction, migraine headaches, and appetite. These receptors are located in the cortex, caudate, limbic system, hypothalamus, basal ganglia, and spinal cord.

Mesolimbic Dopamine Pathway

The brain functions to gather information about individuals' internal and external worlds, to analyze the information, and to carry out the best response.

Part One: Summary

The brain carries out a vast array of functions, from insuring survival to enabling individuals to love, to learn, to move, and to create. Specific components of brain functioning are carried out by two very different hemispheres, by complex brain structures and primitive brain structures, and by electricity and neurochemicals working together. Understanding the functioning of the brain is the cornerstone of the knowledge base of advanced practice psychiatric nurses.

Part One: Key Points

- The nervous system has two parts: the peripheral nervous system and the central nervous system (brain and spinal cord).

- Brain functioning includes: thinking, planning, evaluating, learning, emotional responses, motor functioning, and behavioral responses.
- The brain is divided into right and left hemispheres that have specialized functions.
- Brain hemispheres are connected by the corpus callosum.
- The cerebral cortex covers the hemispheres and is made up of neurons that convey information and glial cells that support the neurons.
- The cerebral cortex is divided into four lobes—frontal, temporal, parietal and occipital—that have specialized functions.
- The limbic system is a more primitive part of the brain that is involved with emotions of fear, rage, love, and reward.
- Meninges are three layers of coverings that protect the brain.

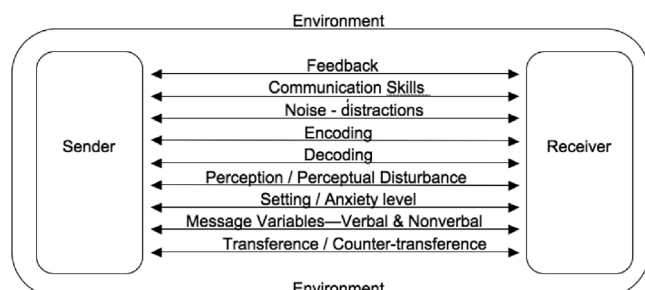
PART TWO: Brain Development

The symptoms of psychiatric disorders are manifestations of impaired brain functioning that may be due to compromised brain development. Common psychiatric disorder symptoms include impairments or deviations in perceptions, thoughts, feelings, emotions, and behaviors.

Assessment

The purposes of a psychiatric assessment interview are to gather information that will enable the formulation of a diagnosis and differential diagnoses; to establish a therapeutic relationship with the client; to reassure the client that help will be provided; to begin to develop a treatment plan based on the information obtained; and to produce a written document for the client's record that is organized in a standard format.

FIGURE 4-1: Factors that Influence Communication



Adapted from Wenburg, J. and Wilmot, W., (1973)

This interview proceeds in a standardized format:

A. Introduction

1. State if client was the sole informant, if history was obtained from previous psychiatric records, or if other persons provided the information.

2. State who referred client for evaluation, if the client was self-referred or brought in by a family member, friend, or other person.
3. Indicate how reliable you think the information is.

B. Reason for Referral for Evaluation/Chief Complaint

The interviewer may have information from the emergency room or from a family doctor that states the reason for referral. If not, then the interviewer should ask the client what problems he or she is having at this time or asks the client to tell him why he/she is being referred.

State the reason why the client has come for treatment in the client's own words. Add a sentence with information to expand on the client's statement. The reason for referral and how the client provides the information is a starting point for the clinician to begin to hypothesize about the diagnosis.

C. Mental Status Exam

1. Emotional expression can be assessed by asking clients to describe their feelings. The client's tone, posture, and facial expressions are all considered. Note the mood, which is the client's subjective report, of how they are feeling. Note *affect*, which is the clinician's observation of the range and depth of emotional responses. Some typical words to describe affect are as follows:
 - a. *Full*, meaning that the client is expressing a wide range of feelings.
 - b. *Flat*, which means that the client has minimal responses that reflect little or no emotion.

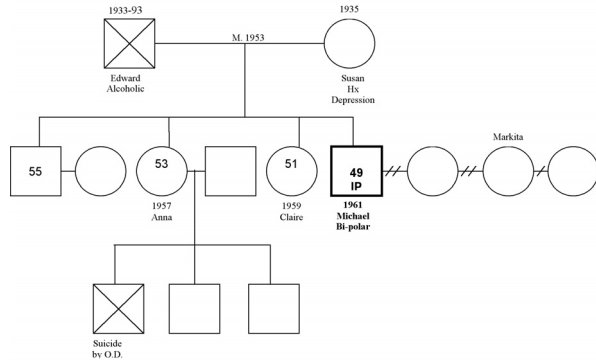
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FIGURE 4-2: Sample Genogram. In this genogram, the Identified Client is Michael, a forty-nine year old male with a diagnosis of bi-polar disorder. His father was an alcoholic, now deceased, and his mother has a history of depression. He has been married twice and is currently separated from his third wife. He is the youngest of four siblings: he has two older sisters and one older brother. His sister Anna's son committed suicide by an overdose. Genograms can be expanded to include additional detail about psychiatric, medical, and social history and will allow the clinician to refer to family members with accuracy. Legend: IP = Identified client; □ = Male; ○ = Female; ___ = Married; | = Child of; X = deceased; / = separated; // = divorced; — = unmarried couple; siblings listed with oldest on the left.



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Answers to Case Study 23-1 Questions

Subtype 5HT1A: These receptors are involved in regulation of body temperature, eating, and sexual behavior and are implicated in depression and anxiety. Blockage of subtype 5HT1A receptors is associated with an anti-depressant, anxiolytic, and anti-aggressive action. Blockage of 5HT1A receptors that function as auto-receptors post-synaptically cuts the feedback that shuts off serotonin. Thus, using a medication that blocks the 5HT1A receptors will prevent the feedback that shuts off serotonin, making more serotonin available.

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TABLE 2-2 NEUROPEPTIDES: LOCATION, ACTION, AND IMPLICATIONS FOR PSYCHIATRIC DISORDERS

Neuropeptide	Location	Action	Implications for Psychiatric Disorders
Vasopressin (Known as the anti-diuretic hormone) (Panksepp & Harro, 2004)	Multiple systems of the brain	Regulates anterior pituitary gland. Potentates release of ACTH/ Involved in memory, biological rhythms, reward, tolerance, adaptation and aggression (Ferris, 2005).	Decreased in depression and increased in mania
Cholecystokinin (CCK)	Throughout CNS including spinal cord, limbic system, hippocampus, and prefrontal cortex	Regulates emotional systems. Modulates feeding (satiety), sex and pain. Involved in learning associated with adverse events	Anxiety disorders, panic attacks, and depression (Hebbs, Poulin, Roach, Zacharko & Drolet, 2005)
Corticotropin-releasing factor (CRF)	Hypothalamus	Stimulates adrenocorticotrophic hormone (ACTH) release from the pituitary; e.g. increase production of cortisol. Is involved in cognition, adaptation to stress, mood and memory (Aborelius et al., 1999; DeSouza & Grigoriadis, 2002)	Increased CRF is linked with depression. Reduced CRF is linked with mania. It may be involved with Alzheimer's disease (Nemeroff et al., 1988).
Neurotensin (endogenous neuroleptic (Sharma et al., 1997, p. 294)	Amygdala, hypothalamus and basal ganglia Struggle with loneliness, have intense roller-coaster Be hyper vigilant about separations Become anxious, clinging; feel impotent rage	Acts as antagonist at dopamine receptors.	Low levels of neurotensin among non-medicated individuals with schizophrenia. Increased levels in neurotensin following treatment with antipsychotic medications (Sharma et al., 1997)
Galanin	Locus ceruleus, prefrontal cortex, and limbic system	Involved in learning, memory, pain control, food intake, reward, neuroendocrine control, cardiovascular regulation and modulation of anxiety (Brewer, Echevarria, Langel, & Robinson, 2005)	Deficits of galanin are associated with increase of anxiety-like behaviors (Bonne, Drevets, Neurmeister & Charney, 2004). There is an increase of galanin over the course of Alzheimer's disease (Counts et al., 2001)
Somatostatin (SRIF) (known as "growth hormone release inhibiting hormone): 1. Struggle with loneliness, have intense roller-coaster romances; fall in love easily 2. Be hyper vigilant about separations 3. Become anxious, clinging; feel impotent rage 4. Feel that their attachment needs will never be met	Limbic system, hypothalamus	Regulated by acetylcholine, norepinephrine, dopamine and serotonin; linked with GABA Tend to: • Struggle with loneliness, have intense roller-coaster romances; fall in love easily • Be hyper vigilant about separations • Become anxious, clinging; feel impotent rage • Feel that their attachment needs will never be met	Reduced SRIF in patients with depression, acute multiple sclerosis, Parkinson's disease, Alzheimer's disease and in maternally deprived children (Kellaway, 1989). Increased SRIF in patients with mania, depression, schizophrenia and schizoaffective disorder. Highest in patients with mania (Sharma, Bissett, Janicak, Davis & Nemeroff, 1995)
Substance P	Through the CNS; colocalized with serotonin (Sregeyev et al., 1999).	Pain perception; anxiety; memory; neurochemical response to stress,	Increased in patients with schizophrenia and depression (Rimon et al., 2002).
Opioid: Endorphins	Limbic system and hypothalamus. Released in response to pain, exercise, and hot chili peppers (Howard, 2006).	Regulate the hypothalamus-pituitary-adrenal axis	Epilepsy, Parkinson's disease, addiction and anorexia

Based on Persaud, U. V. N., Path, F. R. C. & Path, F. F., 1990; Torrey et al., 1994

BOX 2-2 Functioning of Receptors in Pharmacotherapy

The activities of receptors in response to the administration of psychotropic medication include:

- Receptor agonists. A medication that fits the receptor the same as the naturally occurring neurotransmitter and activates the receptor in the same way as the neurotransmitter.
- Receptor antagonists: The receptor function is blocked by the medications so that a neurotransmitter can not bind with the receptor.
- Action on autoreceptors: Autoreceptors serve as a feedback mechanism to stimulate or inhibit the release of a neurotransmitter. They are usually found on the pre-synaptic neuron.
- Inhibition of regulation of enzymes that metabolize the neurotransmitters.
- Down regulation: The medication acts to decrease the rate of neurotransmitter receptor synthesis (takes days to weeks).
- Up-regulation: The medication acts to increase receptor synthesis

BOX 3-1 Effects of Divorce on Children, Adolescents, Young Adults, and Adults**Children***Infants*

- Respond to parents' mood with loss of appetite, upset stomachs, and spitting up

Preschoolers

- Fear being left alone; fear abandonment, fear being forgotten
- Cling and cry more often
- Seek familiar toys
- May be angry, uncooperative
- May be cranky and have periods of crying
- May regress to earlier behaviors

Sources: Amato, 2000; Rogers & Rose, 2002; Amato, 2006

BOX 2-5 Decade of Discovery Findings

Mental illnesses/ psychiatric disorders are disorders of the development of brain circuitry and synaptic connections and functioning.

Epigenetics— the study of changes in gene activity that do not involve alterations of the genetic code:

External stimuli such as early life stressors can modify the expression of genes.

Mirror neurons are associated with mimicry and empathy
Deep brain stimulation developed for treatment of depression and obsessive-compulsive disorder.

Human brain is plastic and highly responsive to environmental stimuli across the life span.

Connections between neurons can change within minutes of stimulation.

Neurogenesis (birth of new neurons) takes place in certain brain regions such as hippocampus throughout life.

BOX 4-1 Psychiatry Intake (Compressed) for the Initial Interview

Name/ID # _____

Referral Source Name/Address _____

Reason for Referral _____

Telephone _____

Emergency Contact _____

(Obtain Release of Information if client permits contact)

List primary language /culture/ race: _____

Accommodations needed: (translator, etc): _____

List any vision/hearing barriers: _____

Accommodations needed: _____

i. Chief complaint and history of present illness (Onset of illness, duration, precipitating factors, current symptoms): _____

ii. Past psychiatric history (Indicate last treatment, date, and provider. Include source of assessment information.): _____

iii. Current substance abuse (type, frequency, and date of onset, most recent use, and amount. Include history of substance abuse and treatment): _____

iv. Family psychiatric and substance abuse history: _____

v. Allergies: _____

vi. Current Medications (*Psych & Physical* medications; reactions/responses): _____

Current medical problems (indicate LMP, pregnancy/contraceptives): _____

Primary Care Physician: _____

CASE STUDY 23-1

Young Adult Male With Schizophrenia

Demir is a 20 year old first year college student from Turkey. He is the first member of his family to attend college and has taken out student loans to make it possible. Police brought Demir to the psychiatric emergency room of a general hospital after he smashed the TV in his parent's home. Two days prior to this incident, his roommate, Jonathan, had driven him home: an eight-hour trip. Jonathan said that he was very worried about Demir because he had been skipping all of his classes except philosophy.

History

History of Present Illness

It had been Demir's custom to pray five times a day, but, that day and evening, he had paced the floor instead. For the past several weeks, he would eat only food in sealed containers that he had bought. During the drive home, Demir had talked in a stream of jumbled words, but some were clear: "They are coming after me. They will kill me".

Past Psychiatric History

Inpt. Psych. Hx: First admission 2 months ago, as described above. Outpt. Psych. Hx: One year ago, drug counseling. Attempted court ordered counseling last month.

Demir's parents were astonished by the changes in their son in the two months since they had last seen him. He had lost weight, was disheveled, and was shivering in the thin shirt he was wearing. His father had taken charge of the situation saying, "There's nothing wrong with him that a good night's sleep won't fix."

Using M & RM theory, the advanced practice psychiatric nurse determines that the following needs are unmet:

- Safety for self and others;
- Health care for medical problems and psychiatric disorder;
- Information about his illness and treatment options;
- Connectedness to friends, social support networks, religious groups, and academic counselors.

The internal resources that Demir has to use in adaptation include:

- Intelligence as indicated by academic achievement and ability to speak three languages (Turkish, English, and French);
- Ability to form a friendship;
- Sense of self identity;
- Perseverance in accomplishing tasks,
- Resourcefulness as seen in obtaining financial assistance;
- Love for family;
- A sense of purpose in life;
- Religious faith.

The external resources that he has to use in adaptation include:

1. Financial resources;
2. Housing (college and parent's home);
3. Transportation (parents and friend);
4. Support from his family and his roommate;
5. Student health insurance;
6. Academic counseling from college.

Adaptation is dependent upon meeting the patient's needs through the use of internal and external resources. Nurses facilitate the patient's use of available resources and the development and acquisition of additional needed resources.

(Source: Lorraine A. Lopez, PMH NP-BC)

TABLE 1-4 NURSING THEORY OF ADAPTATION: MODELING AND ROLE-MODELING

Attachment sources	Basic Needs	Patient's Internal Resources	External Resources	Promotion of Biopsychosocial Health: Outcomes
<ol style="list-style-type: none"> 1. Close family (parents, spouse, partner, siblings) 2. Extended family 3. Neighbors 4. Co-workers 5. Community, e.g., clergy, health care providers 6. Service providers; e.g., meals-on-wheels, traveling libraries, home care 7. Pets 8. Valued causes; e.g., political, environmental, global 	<ol style="list-style-type: none"> 1. Food, water, clothing, safe housing and other essentials for survival including information 2. Money or purchasing power 3. A clear concept of self-identify, 4. One person in a persisting interdependent contact, 5. A group to belong to that claims the individual as a member, 6. A role in life and 7. A sense of meaning to life <p>(HANSELL, 1976)</p>	<ol style="list-style-type: none"> 1. Trust 2. Hope 3. Love 4. Fidelity 5. Ability to care for others 6. Self-identity 7. Self-Competence 8. Will-power 9. Wisdom <p>(WALSH, VANDEN-BORSCH, & BOEHM, 1989).</p>	<ol style="list-style-type: none"> 1. Information 2. Social support 3. Health care 4. transportation 5. Financial assistance 6. Case management 7. Rehabilitation services 8. Spiritual support 9. Legal aid 10. Advocacy 	<ol style="list-style-type: none"> 1. Reduction of distressful symptoms 2. Improvement of functioning 3. Prevention of disabilities 4. Development of resilience 5. Attainment of optimal level of recovery 6. Enhancement of quality of life

(Adapted from Erickson, Tomlin and Swain (1983) *Modeling and Role-modeling*)

BOX 2-9 Functioning of Receptors in Pharmacotherapy

The activities of receptors in response to the administration of psychotropic medication include:

Appetite/sleep disturbance (specify)	Mania/ hypomania
Assaultive/destructive ideation/behavior past or present	Med/surg factors complicating illness
Bizarre behavior/ delusional thinking	Paranoia
Body rigidity/immobility	Positive drug/alcohol screen
Depressed mood, psychomotor depression	Severe agitation, anxiety, panic (specify)
Domestic violence/abuse	Severe eating disorder
Failed outpatient treatment	Severe impairment in familial, vocational or educational functioning
Hallucinations: specify	Social withdrawal
History of non-adherence to treatment	Somatic preoccupation
Homicidal threat/plan/ideation	Substance abuse
Hostility/poor impulse control	Suicide attempt/plan/ideation
Impaired judgment/ memory	Toxic medication reaction
Impaired memory/ orientation	Other (specify)

CHECKLIST

Appetite/sleep disturbance (specify)	Mania/ hypomania
Assaultive/destructive ideation/behavior past or present	Med/surg factors complicating illness
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Impaired judgment/ memory	Toxic medication reaction
Impaired memory/ orientation	Other (specify)

TABLE 11-7 MEDICATIONS USED TO TREAT PTSD

Medication	Outcomes	Treatment Considerations
SELECTIVE SEROTONIN REUPTAKE INHIBITORS (SSRIS)		
		SSRIs are effective for PTSD among civilian populations but less effective for combat trauma PTSD (Mohamed & Rosenheck, 2008; Institute of Medicine, 2008; Raskind, 2010). SSRIs are effective for daytime symptoms but not for sleep disturbances and nightmares (Stein, Pederson, Rothbaum, et al. 2008).
Fluoxetine (Prozac) (Blocks serotonin reuptake pump; desensitizes serotonin receptors, especially 5HT 1A receptor; increases norpinephrine and dopamine)	Reduction of overall PTSD symptoms and improvement of intrusion and arousal symptoms (Connor, Sutherland, Tupler, et al. 1999; Martenyhi et al., 2002). Reduction of avoidant and numbing symptoms (Davidson, Hughes, Blazer, et al. 1991; Nagy, Morgan, Southwick, et al. 1993). Decrease of vulnerability to stress and improved resilience (Connor et al., 1999). No difference between fluoxetine and placebo (Van der Kolk et al. 2007)	Not FDA approved for PTSD at this time (Ursano et al., 2006; Zhang & Davidson, 2010).