An Integrative Approach to Psychopathology
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• **One-Dimensional Models**
  – (e.g., linear causal model: toxoplasmosis causes schizophrenia)

• **Multidimensional Models** (all of these factors are interacting, covarying, or additively influencing the mental illness)
  – The Role of Genes
  – Neuroscience
  – Behavioral and Cognitive Sciences
  – Emotions
  – Cultural, Social, and Interpersonal Factors
  – Life-Span Development

• How Do We Put it All Together?
Components of Multidimensional Models

- Biological Factors
  - Genetics
  - Physiology
  - Neurobiology
- Behavioral Factors
- Emotional Influences
- Social Factors
- Developmental Factors

- All of these interact interdependently
The Nature of Genes

• What are genes?
  – Long molecules of DNA
  – Double Helix structure
  – Located on chromosomes
    • 46 chromosomes in 23 pairs (one from mother, one from dad)
    • Pairs 1 – 22 = body and brain development
    • Pair 23 = gender: female XX, male XY (mom gives X, dad gives Y).
How do genes exert their influence?

**Dominant vs. recessive genes**

- Single-gene determinants
  - Can be used to predict traits in Mendelian genetics

- (most common) Polygenetic influences
  - Influenced by many genes, each contributing only a tiny effect, all of which, in turn, may be influenced by the environment.
Gene-Expression

- IQ is 62% inherited (based on a Swedish twin study), but…. An early chaotic environment can trump this.

- **Gene expression and Epigenetics**
  - Although all cells contain our entire genetic structure, only a small proportion of the genes in any one cell are “turned on” or expressed. In this way, cells become specialized, with some influencing liver function and other affecting personality. What is interesting is that many factors that determine whether genes are “turned on: are in the environment in the form of social and cultural influences.

- Eric Kandel- learning affects genetic structure of cells
  - Activation of dormant genes
  - Continued development in the brain
    - Plasticity vs. hardwired
How Do Genes and the Environment Interact?

- **Diathesis:** A condition making one susceptible to developing a disorder (vulnerability).
  - Inherited tendency to express traits/behaviors
  - Genetic

- **Stress:**
  - Life events or contextual variables
  - Environmental

- Combining both yields activation under the right conditions
The Diathesis-Stress Model

- Disorder
- Life events (stressor)
- Genetic vulnerability (diathesis)
- Person #1 becomes alcoholic
- Stressor: long bouts of drinking in college
- Diathesis: genetic tendency to become alcoholic
- Person #2 doesn't become alcoholic
- Alcoholism

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Neural Diathesis-Stress Model of Psychotic Disorders

- **Inherited Constitutional Factors**
- **Acquired Constitutional Factors**
  - e.g. Prenatal Events
- **Stress**
  - e.g. Life events/EE
- **Neuromaturational Processes**
- **Constitutional Vulnerability**
- **Psychotic Outcome**
BACKGROUND: Recent evidence documents that cannabis use by young people is a modest statistical risk factor for psychotic symptoms in adulthood, such as hallucinations and delusions, as well as clinically significant schizophrenia. The vast majority of cannabis users do not develop psychosis, however, prompting us to hypothesize that some people are genetically vulnerable to the deleterious effects of cannabis.

METHODS: In a longitudinal study of a representative birth cohort followed to adulthood, we tested why cannabis use is associated with the emergence of psychosis in a minority of users, but not in others.

RESULTS: A functional polymorphism in the catechol-O-methyltransferase (COMT) gene moderated the influence of adolescent cannabis use on developing adult psychosis. Carriers of the COMT valine158 allele were most likely to exhibit psychotic symptoms and to develop schizophreniform disorder if they used cannabis. Cannabis use had no such adverse influence on individuals with two copies of the methionine allele.

CONCLUSIONS: These findings provide evidence of a gene x environment interaction and suggest that a role of some susceptibility genes is to influence vulnerability to environmental pathogens.
Reciprocal Gene-Environment Model

People with a genetic predisposition for a disorder may also have a genetically driven tendency to create environmental risk factors that promote disorder. (this can confuse understanding of the etiology or confound studies!)

- Genes shape how we create our environments
- Inherited predispositions or traits that increase one’s likelihood to engage in activities or seek out situations
- Example: Life events literature
Questions/Review

• Generate examples of how genes and environment exert influence on the development of mental illness:
  – Interaction Model
    • Diathesis-Stress model
  – Covariation/Reciprocal Model
Diathesis-Stress

Diathesis

less

more

Stress

less

more

Psychological Disorder
Reciprocal Gene Environment

Stress \rightarrow \text{Diathesis} \rightarrow \text{Disorder} \rightarrow \text{Triggers} \rightarrow \text{Stress}

Leads to situations of...
Neuroscience Contributions to Psychopathology

• The Field of Neuroscience
  – The role of the nervous system in disease and behavior

• Human Nervous System (2 Branches)
  – CNS
    • Brain and spinal cord
    • Process information received from sensory organs and reacts as necessary. It also sorts out what is relevant.
  – PNS branches
    • Somatic
      – Controls muscles
    • Autonomic:
      – Regulates cardiovascular, endocrine systems and aids in digestions and regulating body temperature
      – Sympathetic (activating)
      – parasympathetic (normalizing)
Central Nervous System

• The Neuron - basic building block
  – Soma
  – Dendrites
  – Axon
  – Axon terminals
  – Synaptic cleft

• Function: Electrical
• Communication: Chemical
  – Neurotransmitters
Major Structures of the Brain
Divisions of the Brain Stem

– Hindbrain (lowest part of the brain)
  • Medulla – Heart rate, blood pressure, respiration
  • Pons – Regulates sleep stages
  • Cerebellum – physical coordination

– Midbrain
  • Coordinates movement with sensory input
  • Contains parts of the reticular activating system (RAS)
    – Arousal and tension (sleep/wake)
Brain Stem, Forebrain

• **Thalamus and hypothalamus**
  – Relays between brain stem and forebrain
  – Behavioral and emotional regulation

• **Limbic system**
  – Emotions, basic drives, impulse control
  – Associated structures and psychopathology

• **Basal ganglia**
  – Motor activity
  – *action selection*, that is, the decision of which of several possible behaviors to execute at a given time
Divisions of the Forebrain

• Forebrain (Cerebral Cortex)
  – 80% of CNS neurons are here
  – Most sensory, emotional, and cognitive processing
  – Two specialized hemispheres
    • Left – verbal, math, logic
    • Right – perceptual
Neuroscience and the Brain Structure

- Lobes of the Cerebral Cortex
  - **Frontal**
    - Thinking and reasoning abilities, memory
  - **Temporal**
    - Sight and sound recognition, long-term memory storage
  - **Parietal**
    - Touch recognition
  - **Occipital**
    - Integrates visual input
Neuroscience: The Peripheral Nervous System

• The Endocrine System
  – Hormones (chemical messengers of the ES)
  – Works closely with immune system

• The Hypothalamic-Pituitary-Adrenal cortical Axis (HPA axis)
  – Integration of endocrine and nervous system