Psychophysiology

Psychosomatics

Psychopathogenesis
Psychophysiology

focused on research of the effect of psychological stimuli and mental processes on physical activity and functions.

- it concerned with the relationship between mental (psyche) and physical (physiological) processes; it is the scientific study of the interaction between mind and body.

- utilizes **psychological methods** to study variables of psychological character.

- it uses **physiological methods** to study variables of physical character (electrophysiological methods, clinical – biochemical methods).
Psychophysiology

- any research in which the dependent variable (what the researcher measures) is a physiological measure, and the independent variable (what the researcher manipulates) is behavioral or mental

- these measures can provide information about processes including emotion, cognition, and the interactions between them

- In these ways, physiological measures offer a very flexible set of tools for researchers to answer questions about behavior, cognition, and health
• possible integration with other disciplines:
  a) **neurophysiology** – elucidation of the concrete mechanism of psychophysiological interactions
  b) **neuropsychology** – searching neurological mechanism of mental activity
  c) **neurobiochemistry, endocrinology, immunology** – contribute to the knowledge of concrete mechanism of the relationships between mental and physical activity
Psychophysiology

- Organism - complex system of structures and functions
- one function fulfills various functions
- one function is provided by various structures
- structure – functional ambiguity in the organism

Basic psychological variables

- emotion
- drive

Other variables are studied as causes of changes of emotion or drive.
Psychophysiological methods

1. Central Nervous System (CNS)
A) Structural magnetic resonance imaging (sMRI)
- is a noninvasive technique that allows researchers and clinicians to view anatomical structures within a human
- The participant is placed in a magnetic field that may be 66,000 times greater than the Earth’s magnetic field, which causes a small portion of the atoms in his or her body to line up in the same direction
- The body is then pulsed with low-energy radio frequencies that are absorbed by the atoms in the body, causing them to tip over
- As these atoms return to their aligned state, they give off energy in the form of harmless electromagnetic radiation, which is measured by the machine
- The machine then transforms the measured energy into a three-dimensional picture of the tissue within the body.
B) Functional magnetic resonance imaging (fMRI)
- is a method that is used to assess changes in activity of tissue, such as measuring changes in neural activity in different areas of the brain during thought
- This method is valuable for identifying specific areas of the brain that are associated with different physical or psychological tasks
- Glucose and oxygen, two key components for energy production, are supplied to the brain from the blood stream as needed.

C) Electroencephalography (EEG)
- is another technique for studying brain activation
- This technique uses at least two and sometimes up to 256 electrodes to measure the difference in electrical charge (the voltage) between pairs of points on the head
- These electrodes are typically fastened to a flexible cap (similar to a swimming cap) that is placed on the participant’s head
- From the scalp, the electrodes measure the electrical activity that is naturally occurring within the brain
- In contrast to fMRI, EEG measures neural activity directly, rather than a correlate of that activity.
D) Magnetoencephalography (MEG)
- noninvasively measuring neural activity
- the flow of electrical charge (the current) associated with neural activity produces very weak magnetic fields that can be detected by sensors placed near the participant’s scalp

E) Positron emission tomography (PET)
- a medical imaging technique that is used to measure processes in the body, including the brain
- this method relies on a positron-emitting tracer atom that is introduced into the blood stream in a biologically active molecule, such as glucose, water, or ammonia
Transcranial magnetic stimulation (TMS)
- a noninvasive method that causes depolarization or hyperpolarization in neurons near the scalp
- this method is not considered psychophysiological because the independent variable is physiological, rather than the dependent
- it does qualify as a neuroscience method because it deals with the function of the nervous system, and it can readily be combined with conventional psychophysiological methods
2. Peripheral Nervous System

A) **Skin Conductance** - measures the electrical conductance (the inverse of resistance) between two points on the skin, which varies with the level of moisture

- sweat glands are responsible for this moisture and are controlled by the sympathetic nervous system (SNS)
- increases in skin conductance can be associated with changes in psychological activity
- skin conductance provides relatively poor temporal resolution, with the entire response typically taking several seconds to emerge and resolve
- it is an easy way to measure SNS response to a variety of stimuli
B) cardiovascular measures

- include heart rate, heart rate variability, and blood pressure.
- The heart is innervated by the parasympathetic nervous system (PNS) and SNS
- Input from the PNS decreases heart rate and contractile strength, whereas input from the SNS increases heart rate and contractile strength
- Heart rate can easily be monitored using a minimum of two electrodes and is measured by counting the number of heartbeats in a given time period, such as one minute, or by assessing the time between successive heartbeats.
- Psychological activity can prompt increases and decreases in heart rate, often in less than a second, making heart rate a sensitive measure of cognition
- Changes in heart rate variability are associated with stress as well as psychiatric conditions
C) muscle activity - Electromyography (EMG)
- measures electrical activity produced by skeletal muscles
- similar to EEG, EMG measures the voltage between two points
- this technique can be used to determine when a participant first initiates muscle activity to engage in a motor response to a stimulus or the degree to which a participant begins to engage in an incorrect response (such as pressing the wrong button), even if it is never visibly executed.
- it has also been used in emotion research to identify activity in muscles that are used to produce smiles and frowns
- it is possible to detect very small facial movements that are not observable from looking at the face
- the temporal resolution of EMG is similar to that of EEG and MEG
D) pupil diameter, eye blinks, eye movements

- eye blinks are most often assessed using EMG electrodes placed just below the eyelid, or on the face near the eyes, because there is voltage across the entire eyeball.
- another option is a camera used to record video of an eye.
- this video method is particularly valuable when determination of absolute direction of gaze (not just change in direction of gaze) is of interest, such as when the eyes scan a picture.
- for example, when viewing pleasant or unpleasant images, people spend for different amounts of time looking at the most arousing parts.
- this, in turn, can vary as a function of psychopathology.
- the diameter of a participant’s pupil can be measured and recorded over time from the video record.
- pupil diameter is commonly used as an index of mental effort when performing a task.
Psychosomatic disorder

- an illness that connects the mind and body
- the physiological functioning of the body is affected by the psychological tensions that either cause a disease or worsen the pre-existing disease in a person
- it is also known as Psycho-physiologic disorder
- an improper stimulation of the autonomic nervous system, which regulates the functions of the internal organs, is responsible for the evolution of this disorder and leads to impairment of the functional organs
- the exact cause for the evolution of psychosomatic disorder is unknown
- studies reveal that the somatic disorders associated with mental stress are due to the hyperactivity of the nerve impulses sent from the brain to the other parts of the body
- it causes the secretion of adrenaline into the blood, leading to a state of anxiousness
- this condition can be triggered by various life factors as follows:
Factors:

Genetics: A few studies state that the peculiar genetic aberrations in an individual may turn into a direct cause for this condition.

Irregular biological conditions: Alteration in glucose metabolism, amino acid levels in serum, etc.,

Stress influence: Persons who experience stressful events like trauma, abuse, frequent illness, fear, depression, anger, guilt, insecurity, and other difficult situations

Family circumstances: Parental absence, behavior of parents toward the child, and relationship difficulties
If a person has a common medical condition like essential hypertension, then psychological factors like anxiety and stress will influence that condition in one of the following ways:

Medical condition + psychological factors influence of:

1. **Stress altering time:** Stress will alter the time period that is utilized for the development, worsening, or recovery from the general medical condition. For example, when a person is angry, it prolongs the duration of high blood pressure

2. **Intrusion of stress:** The psychological factors might intrude into the treatment provided for the general medical condition and create problems.

3. **Exacerbation:** Anxiety factors make the symptoms of the medical condition worsen, thereby increasing its severity.

4. **Generation of risk factors:** The stress component will generate many other risk factors associated with health issues like diabetes, headache, etc.
There are three general categories of psychosomatic illness:

1. A person has both mental and physical illness, whose symptoms and management complicate each other.

2. A person who experiences mental issues due to the medical condition and its treatment (patients feeling depressed because they have cancer and are taking treatment for it).

3. Somatoform disorder - person with mental illness experiences one or more physical symptoms, even if he does not have any associated medical condition.
Psychopathogenesis

- psychopathology derives from two Greek words: ‘psyche’, meaning ‘soul’, and ‘pathos’ meaning ‘suffering’
- psychopathology - the origin of mental disorders, how they develop and their symptoms.
- psychiatrists use the term psychopathology more than people in other professions
- within psychiatry, the term ‘pathology’ refers to disease
- the term ‘disorder’ is used, rather than ‘disease’. Other words for diagnosing distress within the mind remain: ‘symptoms’ meaning ‘signs’, ‘aetiology’ meaning ‘cause’, and ‘prognosis’ meaning ‘expected outcome’
Behavioral medicine

- biological, psychological, social – borders clear/unclear
- diseases controlled by genes (biological factor) - rearrangement of genes (under social control - choice of a partner)
- **Behavioral medicine** – bio-psycho-social model of disease
- Psychosomatic mechanism - related diseases: coronary heart disease, hypertonic disease, stomach ulcer, colitis ulcerosa, asthma bronchiale, pollen respiratory allergies, migraine, etc.
Psychopathogenesis

- Type of pathogenesis - *psychic (social) stimuli* → development of non-natural processes in the organism

- **Processing of the stimulus** - the stimulus is not ‘absolute’; personality mechanisms often play a role, (evaluation)

- **Processing may consist of more levels** - conditioned stimulus; conscious and rational processing; repetition in processing; personality mechanism; role of the memory; gradual processing (the person starts to accept/gives up/without acceptance - permanent processing)
Psychopathogenesis

- **Manifestation** of processing - *changes in behaviour* (short term/long term changes, personal mechanisms can mask the relationship, coping behaviour = acceptance of stimuli)

- Processing of stimuli can be:
  - **Adequate** (in harmony with a healthy state)
  - **Inadequate** (but still in harmony with a healthy state)
  - **Pathological** (manifestation of a disease or forming morbid processes)
Psychopathogenesis

• the mechanism of processing depends on one’s personality, actual state, psychological as well as somatic state
• the past experience – increase or decrease sensitivity of stimuli
• permanent personal characteristics (someone is vulnerable, senzitive to trivialities
• (astenic people rank also usual burdens as excessive)
• (anxious people treat most stimuli with anxiety
• (highly self-assertive people may have a permanent feeling of offence, of not being appraised sufficiently
Impulses frequently received pathologically

- Psychotrauma – macrotraumas (chronical - pathogenic in any personality), microtraumas - solitary can be neglected, chronical microtraumatization induces pathological condition

- Psychological conflict- external- collision of 2 different psych.phenomena in 2 personalities;
  - internal- collision in 1 personality- may be not conscious

- Frustration – when a need is not satisfied; may be not conscious
  - existential frustration (needs of sense of the life), manifest as a feeling of useless life
  - certain level of frustration can be found everywhere (tolerance of frustration)
  - manifest as increased emotional tension, which may or may not be thematized
  - the topic of frustration can be masked by rationalization
Impulses frequently received pathologically

- **Deprivation** - long-term reduction of important stimuli (sleep deprivation, sensoric deprivation, social deprivation)
- Hospitalism – long stay in hospital with monotonous activities
- emotional deprivation – import emotional stimuli are lacking
Psychopathogenesis induces different signs

- **Minor abnormalities** - not considered to be pathological (obstinate habits, aversions)
  - inadequately learned reactions, similar to conditioned reflexes, develop by the mechanism of conditioning

- **Complicated processing** - individual processing steps are linked to each other
  - tends to be chronic

- **on biological level** of the organism - effect on the secretion of substances

The real psychopathogenous process consists of *always both* levels:
1. psychologically interpreted
2. purely psychological
Psychopathogenic origin

1. **Psychological (psychopathological) manifestation** - physical signs of deranged health (psychosomatic manifestation)
   - abnormalities of lifestyle, habit, changes in character
   - not be perceived as illness

2. Cooperation with **endogenous disposition** for diseases
   - psychological stimuli deteriorate the course of the endogenous mental disease
Meanings of the stimulus

- more meanings of the stimulus simultaneously (e.g. Attention! – warning or threat)
- ambivalent disparate/not specific stimuli- can evoke conflict, uncertainty
- Different personalities- differently sensitive to psychopathogenesis
- Stressor- a factor which induces stress
- Psychic stressors - Emotionaly negative –distress
  - Emotionally positive – eustress
- Life events- extracted from the continuum of life as distinguishable - can evoke eustress or distress; often connected with the appearance of different illnesses
  - accumulation of life events- risk factor of illness
In different persons a stimulus can

- Maintain health unchanged
- Improve health
- Cause anomalies which are conform with health
- Cause one of the psychogenous psychic diseases
- Cause endogenous psychic disease
- Cause one of the severe social anomalies
Diagnosis

• Diagnosis of psychopathogenesis - hard to establish, errors can be made

Derivation of psychopathogenesis:

1. Clinical casuistic experience - often suggestive, but least reliable

2. Examination of experimental neuroses – (animal models) the reliability is never absolute

3. Extraction of psychic risk factors by statistical means (type of behaviour not personality)

   - statistical methods are applied
Iatropathogenesis

- when the psychopathogenous effect is caused by the doctor/health worker
- Most of iatropathogenous stimuli result in psychopathogenesis
- Health care environment, poorly organized healthcare - can also exert an iatropathogenous effect
- iatropathogenous effect of top medical equipment (complexity, the patient is lost in it, feels lonely)