



Biological Explanations of Emotion

This Factsheet examines explanations of emotion from a biological perspective. It should be read in conjunction with **Factsheet 203** which examines explanations of emotion from a psychological perspective. The Factsheet includes examiner comments, and the worksheet gives you the opportunity to apply what you have learned to exam-style questions. Words in bold are explained in the glossary.

The examiner will expect you to be able to:

- Discuss somatic processes associated with emotion.
- Explain the role of the nervous system in emotion.
- Explain the role of the endocrine system in emotion.
- Provide research evidence to support biological explanations of emotion.
- Critically evaluate biological explanations of emotion.
- Discuss the interaction of biological and psychological factors in emotion.

A. Introduction



Expressions of Emotion

Emotion is a feeling, usually linked to an experience. Emotions are based on individual perceptions and are therefore subjective. You and I might both have a shared experience but the emotional response that each of us has is likely to be different. The biological perspective suggests that emotion is a physiological process. The terms biological and physiological refer to processes inside the body, which are also referred to as **somatic** processes. Bodily responses to emotion can be explained in terms of arousal of the nervous system and **neurological** processes, or in terms of arousal of the **endocrine** system and hormonal processes. These somatic processes may be associated with facial expressions, which are also somatic processes, and which may be linked with positive or negative emotion.

B. The Body's Response

Perspiration can indicate strong emotion

An emotion-evoking event in the environment, such as danger, provokes a state of **arousal** in the body, such as anxiety. Two systems work together to induce arousal; these are the nervous system and the endocrine system. The nervous system has two parts. The somatic system controls voluntary movement and the autonomic system works involuntarily. The autonomic nervous system plays an important role in emotion. In response to a trigger, it stimulates the adrenal medulla, an endocrine gland, to produce the hormone adrenaline. This hormone prepares the body for fight or flight by increasing cardiovascular and respiratory activity and decreasing digestion.



We might experience the effects of this as rapid heart beat, shortness of breath, and perspiration. Prolonged exposure to a stimulus stimulates the hypothalamus, an endocrine gland located in the brain, to release the hormone corticotropin releasing factor (CRF). This hormone stimulates the pituitary gland, also in the brain, to release adrenocorticotropic hormone (ACTH), which stimulates another endocrine gland, the adrenal cortex. This gland produces the hormone cortisol, which increases digestion to give the body energy. Psychologists believe it is possible to measure emotion by measuring the actions of the autonomic nervous system. One method is the **galvanic skin response**, which measures the increase in the skin's rate of electrical conductivity, which occurs when subjects sweat during emotional states. Psychologists can also measure blood pressure, muscle tension, heart rate, and respiration as indicators of emotion.

***Exam Hint:** It is not necessary to learn the names and actions of all the parts of the endocrine and nervous systems. However, a basic understanding will help you to explain the role of the systems in emotion.*

C. Psychoevolutionary Theory

Fear is a primary emotion

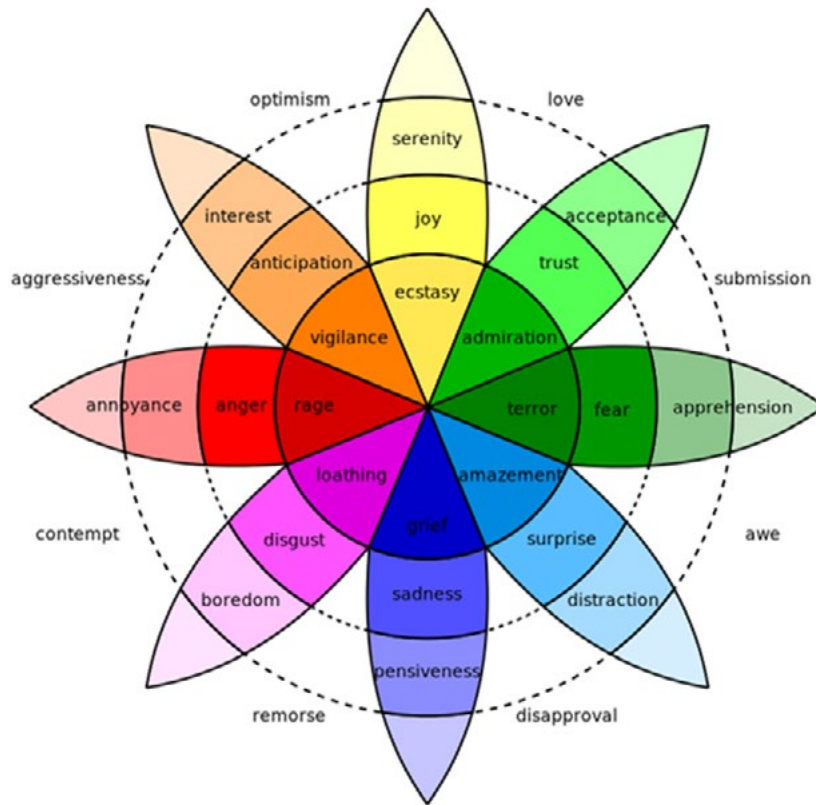


The psychologist Robert Plutchik suggested that emotions are biologically determined, primitive responses that have evolved to increase the survival of the species. His theory is therefore known as a **psychoevolutionary** theory of emotion. Plutchik suggested that there are eight primary emotions and that these emotions trigger behaviours that enhance survival and reproductive success.

Primary emotions:

- Anger
- Fear
- Sadness
- Disgust
- Surprise
- Anticipation
- Trust
- Joy

The purpose of emotion, according to Plutchik, is to create an interaction between an individual and a stimulus in order to resolve the emotion and restore equilibrium. Plutchik believed that all emotions have evolved from eight basic emotions and illustrated their relationship to each other in a diagram known as a Wheel of Emotion (Plutchik, 1980). The diagram also illustrates the intensity of different emotions. For example, emotions that are linked to threat (e.g. vigilance, terror) or those that are linked to sexual attraction (e.g. ecstasy) are felt most intensely, which is shown by their position in the centre of the wheel. In evolutionary terms, these emotions would be most important in triggering behaviours that would enable survival and enhance reproductive success.



Plutchik’s Wheel of Emotion

Plutchik’s wheel of emotion illustrates the eight basic emotions (second ring from centre) and their basic opposites. For example, joy and sadness, trust and disgust, surprise and anticipation. The wheel also shows the relationship between feelings on the outer ring and associated emotions. For example, optimism relates to joy and anticipation (opposite to disapproval), while awe is linked with fear and surprise (opposite to aggression).

Exam Hint: You won’t be expected to reproduce Plutchik’s wheel of emotion but it would help support your explanations of emotion if you are familiar with the principles of this model.

D. Emotion and Physiological Response

What comes first – action or emotion?

Psychologists have tried to explain the relationship between emotion and physiological response. Some suggest the body reacts first and the emotion comes later, others suggest it’s the other way round. Here are three different theories:



Walter Cannon and Philip Bard had a different view. They suggested that the initial response to an event is emotional, and this informs the physiological response which follows. So, if an individual experiences the emotion of fear, this will be followed by a physiological ‘fight or flight’ response. It was Cannon who first suggested the phrase ‘fight or flight’ which was later developed to include ‘freeze’.

iii. Le Doux’s Theory



Joseph LeDoux suggests there is an emotional part of the brain that is innately programmed to respond automatically to danger. He argues that this is different from conscious emotion, which is learned through experience.

Exam Hint: Make sure you can explain the main principles of the different theories that link emotion and physiological response.

i. James-Lange Theory



William James and Carol Lange suggest that the first response an individual has to any experience is physiological which is then followed by an emotional response based on their perception of the experience.

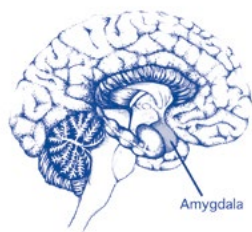
ii. Cannon-Bard Theory



E. Neurological Theories of Emotion

Emotional processing in the brain

Le Doux's theory has a cognitive component as it includes prior experience. This is supported by a laboratory study to discover how the brain stores emotional memory. Le Doux made lesions in specific neural pathways of rats in order to determine the functions of the damaged pathways. When lesions were made in the auditory cortex, where the brain processes sound, it was found that the rats could still be conditioned to fear sound. When lesions were made in the auditory thalamus, the rats were less susceptible to a fear response. While most of the cells in the auditory thalamus transmit to the auditory cortex, some also transmit to the **amygdala**. This is an area of the brain implicated in emotion. Le Doux therefore concluded that the biological factor of brain damage affects emotion.



In further studies, Le Doux discovered two separate neurological pathways for the fear response. The short route goes from the sensory store in the thalamus to the amygdala. This is effective during times of danger as it leads to a quicker response, but the response is often inaccurate. The longer route crosses the neo-cortex and the hippocampus before triggering a fear response. Le Doux argues that there is an evolutionary advantage of having two separate pathways for fear responses. While the longer route is slower, it allows for a more thorough evaluation of a situation, and therefore a more appropriate response.

Children's facial expressions Gazzaniga et al. (2000) conducted an experiment to investigate emotional responses following brain damage to the pre-frontal lobe and amygdala in children with autism. They found that the children struggled to name emotions from a set of facial expressions and concluded that brain damage impaired the children's ability to recognize emotion. This study also supports the proposal that the pre-frontal lobe and the amygdala are related to emotional processing.



These studies support biological factors in emotion and identify the amygdala and surrounding brain processes as central components. Le Doux's theory also supports interaction with cognitive factors in emotion because the situation is appraised through the long route.

Examiner Comment: Candidates who demonstrate engagement with the material in order to relate both physiological and cognitive aspects of emotion gain higher band marks.

E. Two-factor Theory

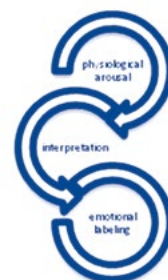
How do you perceive the situation?

Schacter and Singer proposed that physiological arousal interacts with emotional interpretation and labeling of physiological arousal. They suggested that the interpretation of physiological arousal determines which emotion is evoked, while the ^{SEP}intensity of that emotion is determined by the intensity of the physiological arousal. They suggested that if an individual experiences bodily arousal, they look for clues in their environment to try to explain it. This appraisal of the situation results in the physical experience being labeled as an emotion.



This theory takes into account perception of the situation, which is a cognitive function, as well as biological response. Schacter and Singer's theory is therefore known as the two-factor theory.

Schacter and Singer (1962) tested their two-factor theory of emotion in a study using 184 male college students. Participants were told they would receive an injection of Suproxin in order to test its effects on vision, although they were actually given adrenaline and deceived about the true aim of the study. The men were split into four groups. Group 1 was told the effects of adrenaline. Group 2 was given no information. Group 3 was told false effects. Group 4 was given a placebo. The researchers found that participants who were given information on the effects of adrenaline showed minimal changes in emotion (observed and self-reported), while those who had not been informed of the effects showed much higher changes in emotion. They concluded that emotion is influenced by explanations of the state of arousal. This study supports the proposal that emotion is influenced by a combination of both physiological changes and cognitive labeling.



Exam Hint: It is less important to reproduce details of psychological studies and more important to state how findings support theories of emotion.

F. Conclusion

There is evidence to suggest a biological basis of emotion. Empirical studies support the role of neuroanatomy and endocrine activity in emotion and have highlighted specific areas of the brain that are active in different emotions. However, if emotion were purely biological, there would be no role for thought, experience, and perception, which have been suggested by alternative researchers. It is important, therefore, to evaluate each psychological study and theory presented in terms of both its strengths and limitations, and to also consider the way that physiological and psychological factors interact to influence emotion.

Glossary

Amygdala: area of the brain implicated in emotion.

Arousal: bodily state in response to an environmental trigger.

Endocrine: system of glands that produce and secrete hormones.

Galvanic skin response: test that measures the increase in the skin's rate of electrical conductivity as an indicator of emotion.

Neurological: to do with nervous system.

Psychoevolutionary: theory that suggests psychological processes have evolved to ensure the survival of the species.

Somatic: physiological or bodily processes

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Worksheet: Biological Explanations of Emotion

Name _____

1. Outline the bodily response to an environmental trigger.

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2. Outline and evaluate the psychoevolutionary theory of emotion.

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3. Discuss one alternative biological theory of emotion.

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4. Outline the role of neurological processes in emotion.

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5. To what extent can psychological theories explain the role of biological and factors in emotion.

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