

## **Prenatal biological correlates of emotion and the origins of music**

*Richard Parncutt*

University of Graz

### **Background**

The prenatal theory of musical origins assumes that the fetus learns to associate sound patterns (the mother's voice, heart, footsteps) and movement patterns (the mother's movements) with the mother's emotions. The ability of the fetus to hear and to remember patterns of sound has been repeatedly demonstrated empirically. The theory remains unclear about the fetus's original or direct source of information about maternal emotion.

Emotions have physiological, behavioral and experiential correlates. In the fetus, experiential correlates have uncertain status and are empirically inaccessible. We therefore avoid the term "prenatal emotion" and refer only to prenatal physiological and behavioral correlates of emotion, assuming that these can be stored in prelinguistic memory and thereby influence postnatal emotion.

Physiologically, emotion is associated with activity in the limbic system and amygdala. For example, axons from the sympathetic nervous system release norepinephrine to help certain organs prepare for vigorous activity (fight or flight). Corticosteroids are associated with fear and anxiety and are released from the adrenal cortex after a stressful event.

Hormonal transfer across the maternal placenta and through the umbilical chord could enable biochemical emotional communication between mother and fetus. The placenta is a filter that passes only certain biochemicals. Recent research demonstrates that these include some biochemical correlates of emotion.

### **Aims**

On the basis of recent physiological and medical literature, we ask whether, to what extent, and how fast the emotions of the mother can be communicated biochemically to the fetus via the placenta and umbilical cord, and explore implications for the nature and origins of music.

### **Main Contribution**

Recent empirical studies have demonstrated that prenatal stress in mammals affects postnatal behavior (mutual clinging, physical, mental and motor development, exploratory and social behavior, response to postnatal stressors) and that this process is mediated by both biochemical and behavioral communication between mother and fetus. Stress during pregnancy can increase maternal glucocorticoid levels, which can enter the fetal circulation and affect fetal brain development (e.g. hippocampal ontogeny). The concentration of corticotropin-releasing hormone in the amygdala is associated with emotionality and anxiety-like behaviors and can increase in the fetus following prenatal maternal stress.

### **Implications**

A biochemical mechanism for proto-emotional communication between mother and fetus could underlie strong associations between emotions and sound/movement structures in all musical cultures. Recent research in developmental psychology of music suggests that babies are born with sophisticated knowledge of emotional implications of sound and movement structures. This knowledge appears to be prenatally acquired and conceivably represents the ultimate basis upon which musical languages emerge and develop.

The theory of prenatal origins places women at the wellspring of musical creation. Musical structures are held to correspond to women's voices, heartbeats, and footsteps; musical gestures and dance to women's body movements; and musical meaning to women's emotions. The predicted correspondences are fuzzy, since all prenatal "experiences" are filtered and modified by factors such as the survival-driven selective attention of the fetus, postnatal non-linguistic associative recall, other social-psychological constraints, and generations of cultural development.

**Topic areas:** prenatal, emotion, origins, biology, gender