During sleep there’s even more activity and more learning going on in an infant’s brain than an adult’s, as Annette Karmiloff-Smith explains.

**SLEEP AND MOTOR CORTEX**

Sleep forces us to conserve energy. Yet, after the very early months of life, neuronal barons in motor cortex cause many body movements to occur during sleep, and researchers believe that these contribute to building muscle strength and mobility.

**EARLY IN LIFE**

Small movements do not occur during REM sleep, but they increase substantially over the first year and beyond, suggesting a tight link between sleep movement and physical development. Once these movements occur during REM sleep, this facilitates the practice of respiration, movement, and facial expressions like smiling and frowning.

**SIGNS OF A BISECTED ENNANGLED BRAIN**

There is a common misconception that babies sleep more soundly on their tummies, prompted by the fact that they move less in this position. However, the ability to aroused relatively easily from the sleeping state is a crucial protective mechanism against respiratory complications as well as other problems such as overheating.

By awakening spontaneously, the baby is able to increase heart rate and breathing, and adjust blood pressure. This facilitates the practice of respiration, movement, and facial expressions like smiling and frowning.

**SLEEP AND LEARNING**

Children need to learn to pass from one state to the other, to learn the basis of conditioning and to establish the link between sleep and motor cortex. Non-REM sleep is strongly related to the break-down and restoration of brain function, and REM sleep is strongly related to the practice of respiration, movement and facial expressions like smiling and frowning.

**A NEUTRAL CHILD**

While there are five phases of adult sleep, infant sleep comprises only two broad states – Active Sleep and Quiet Sleep. It takes many months for children’s sleep patterns to resemble those of adults.

**FIRST TWO YEARS**

During the first two years, sleep cycles are shorter (60 to 70 minutes versus adult cycles of 90 minutes). Moreover, whereas adults start the night in deeper non-REM sleep, infants fall directly into Active REM-sleep during the first 40 minutes of a sleep state before entering quiet sleep. This then changes at around six months of age, when infants start their sleep with Non-REM phases.

**SLEEP AND MOTOR DEVELOPMENT**

Active sleep is specifically characterised by high levels of electrical activity in the brain, together with low eye and body movements. Young children may seem restless, make noises and only open their eyes when they are in the phase of active sleep. This involves lighter sleep, much easier to wake from. It is also the time when adults experience dreams, but the question of whether infants experience dreams is a matter of scientific debate. So, when infants are in the deep phase of sleep, loud music is unlikely to waken them, but in the active phase, the slightest whisper can cause them to stir.

**SLEEP AND DISEASE**

The different sleep states are controlled by activity of excitatory and inhibitory neurons located in several centres of the brainstem and forebrain. Non-REM sleep is strongly dependent on integrity of neocortex and thalamus and is characterised by decreases in general metabolism and body temperature.

**SLEEP AND MOTOR DEVELOPMENT**

Although a firm link between sleep and physical growth remains to be established, scientists believe that it is during non-REM phases that growth hormone is liberated. By contrast, REM phases are much like wakefulness in terms of electro-encephalographic activity, a time when the brain re-organises daytime experiences into long-term memory.