Toward Human Development: The Physiological Basis of Sleep

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(Ed. Note: The complete footnoted version of this article can be ordered from the Waldorf Early Childhood office.)

"A child will flourish if there is a regular rhythm between the will working during the day when it is awake and the will building up the growing organism in sleep. Then the body can become that instrument for which the child was already longing before birth." (Glas, p. 76)

The human body is truly a work in progress, even into old age. We have the capacity to grow, to develop, and to create throughout life, but much depends upon the foundation that is laid in the period from birth to about seven years of age, when the child begins to lose the baby teeth. During this time, the basis of our humanity is formed. "The development of the physical body between birth and the change of teeth is the basis for the unfolding of the consciousness soul, that member of your soul-being in which the "I" first becomes revealed, between the ages of 35 to 42 years" (McAllen, p. 18). Indeed, throughout life, every human action—impulse transformed into deed, every thought, and word spoken is sounded through and limited by the physical body that is developed in the first seven years of life. The capacity of the child to learn in grade school through the awakened cognitive senses, for example, presupposes the well-developed nerve-sense-brain and the lower-will senses (life, touch, movement, and balance) in early childhood. (Aeppli, p. 64) The early growth years are crucial. And if we look harder at this enormous work of the young human being, we find that the only time that physical growth occurs is during *sleep*. In addition, sleep is the only time that the body restores and renews its forces from the demands of the day. So, why don't children sleep all of the time?

Young children are completely sense beings. We can even step back and say that sensation *forms* the embryo. (Klocek, p. 4) Through the *gates of the senses*, life forces flow. These cosmic forces are then "orchestrated" by the Ego (the "I") into physical matter. The myriad physiological systems are thus established. (The nerve-sense organs, brain, and nervous system can only be stimulated to form better during the first 8-9 years; after this time, their forming activity stops. (Glockler, *Healing Education*, p. 47) The circulatory, metabolic, and skeletal systems take longer.) "The nervous system develops through physical movement." (Glockler, *Birth of Etheric*, p. 30) The infant and the young child are totally given over to the environment, extending themselves into it, and actually *consuming* every single detail of life that meets the senses. Every color, smell, sound, taste, texture, word, shape, activity, and even the moods of others—everything is taken in. "Every psychic stimulus passes over into the circulation, the breath, the digestion. Body, soul, and spirit are still in unity. This is why every stimulus from the environment passes right down into the child's bodily nature." (Steiner, *Understanding Young Children*, p. 61) But, "because he is not yet in the position to catch and digest the sense impressions with consciousness, so can they penetrate without hindrance directly in to the child's organism." (Aeppli, p. 47) Yet, this *is* what forms the basis of physical development. What the child receives through the senses will become the child's physical body. It is also the reason why care and protection are so essential to provide healthy impressions as well as the avoidance of over-stimulation. "Assaults to the nerve/sensory system while it is being formed give the same damage as encephalitis." (Spitalny, p. 13)

In sleep, the *food* (impressions) of the senses are literally digested through the metabolism and are then transformed into the physical forming of the organs, brain-nerve-sense pathways, endocrine system, circulatory-rhythmic, lower senses, digestion, skeletal—the entire physical constitution. This occurs under the direction of the Ego through the etheric (life) forces. The etheric forces give life, form, energy, and health to the body, working strongly in the immune system and in all growth and repairing processes. These are the forces that dominate from birth to the change of teeth. (Poplawski, pp. 11–12) But, we also know that it is in sleep that the etheric body itself is renewed. This seems contradictory, but the renewal process is due to the cosmic nature of the etheric life body and to the spiritual realm of sleep. According to Rudolf Steiner, although the overall time spent in sleep is shorter, the "evolution" of the sleep life is more significant in many respects than that of waking life. "for the whole condition of the human

being, above all for the gaining and maintenance of health and hence for earthly life as a whole" (Steiner, *Driving Force*, pp. 3, 14) The physical body is the vessel for the higher members of the human being. Loving care and reverence for its development opens the door to the child's destiny. It is in sleep that children meet their angels. (von Kugelgen, p. 79)

The day's sense impressions are taken into sleep, forming the content that is used by the etheric to build up the physical body and at the same time, restoring essential life forces. How does this occur? The primary organ of the etheric is the liver. It is the dominant metabolic organ in the fetus (with the thymus) and in all growth processes in life. "It is the place of general substance formation and of the origin of human substance. In terms of substance, the process of becoming man occurs in the liver." (Hussman and Wolff, p. 205) The liver is also tremendously significant in the young child because it is the organic basis of the
will. Its proper development has far-reaching consequences in the life of the individual. "For you must know that the liver is not merely the organ modern physiology describes; it is pre-eminently the organ that gives the human being the courage to transform a deed which has been thought of into an accomplished deed." (Steiner, *Curative Education*, p. 19) For the school-age child, sufficient healthy sleep also supports metabolic processes that are responsible for "working over what was comprehended to the point at which the memory can retain it." (Steiner, *Balance*, p. 34)

The liver's vitalizing-restorative, growth related processes occur in deep sleep. Its functions are plant-like in the human being and follow a *rhythmic* sleep-wake cycle. This is very important. Sensations from the day are received by the sympathetic nervous system and are *reacted to* by the metabolism, which secretes into the lymph response substances by the impacted organ(s). These secretions may be digestive fluids, insulin, adrenaline, cortisol (stress hormones), epinephrine, etc. They are *sensed* by the liver and form a kind of fluid stimulus record which, through the building-up processes of the etheric during sleep, become transformed into the lung, heart, kidney, nervous system, brain, the liver itself, etc. Carbohydrates are synthesized into sugars (glycogen), which are then stored in the liver during its "night" assimilatory phase beginning at 3 p.m. and peaking at 3 a.m. These stored sugars are converted to blood glucose during the daytime for the activities of consciousness beginning at 3 a.m., through the catabolic (breaking down) influence of the gall bladder in the liver until about 3 p.m. Here, we can see the importance of going to sleep early: 6:30-8:00 p.m. for children and 9-10:00 p.m. for adults. Staying up late causes the liver to reverse its storing-up activity intended for the next day and to instead begin converting glycogen to glucose for energy, thus we get a "second wind" (especially children). This explains the worn-out feeling the next morning and the daylong physiologic struggle to keep up. (Johnson)

"Life continues during sleep, and the forces that are active and creative during the waking state receive their strength and renewal from what is given to them by sleep human being who does not continually draw strength for his weakened forces from sleep must of necessity destroy his life." (Steiner, *Occult Science*, pp. 48–49) The catabolic breakdown (awake) phase of the gall-liver is a *destructive* process that is necessary for consciousness. The incarnation of the individual into earthly substance requires "fire" or warmth (to carry the Ego), and air. Beginning at birth, this condition is created in the oxidative, combustion breakdown of formative substance (prepared by the liver in sleep), releasing warmth. (It isn't until about 9 years of age that the child can regulate his warmth organism.) The awake/ breakdown phase is related to the nerve-sense system, whose proper function and development eventually leads to the *thinking* capacities beginning after the change of teeth. At that time, formative growth forces are then metamorphosed into intellectual forces. During sleep is the only time that the nervous system can rest, repair, and build up. During waking hours, there is "no possibility for new cell growth." (Glockler, *Healing Education*, p. 46) The destructive forces of consciousness (nerve-sense system) are balanced by the restorative forces of sleep (liver-metabolic system). These two systems are mediated by the rhythmic system. The sleep-wake rhythm supports human growth and consciousness.

"Everything of a rhythmical nature contains a special force." (Aeppli, p. 68) Rhythm is the balance between the life processes of rest and movement. The physiologic representative of this balance is the heart, the primary organ of the rhythmic system. The cardiovascular system, in particular the heart, is the mediator between the nerve-sensory system and the metabolic system. In the dynamics of these three physiologic systems, we can see the inter-related

rhythms of sleeping, breathing, birth and death. In the contracting events of awakening, inspiration, and systole are the incarnating tendencies of the nervous system. In the expanding events of falling asleep, expiration, and diastole are the excarnating tendencies of metabolism. (In reality, the nerve senses are relatively still, cold, and deathlike. In comparison, the metabolic system is in full, active movement.) Rhythm exists as the third state as a result of the polar existence of rest and movement, something new. It brings the possibility for freedom. "In the human heart, the earthly and the cosmic are intimately united between rest and movement, space and time, form and substance tendency, systole and diastole, the human ego experience can develop in freedom experienced within the heart muscle stands between the two, as is appropriate for feeling as a half-conscious soul capacity; conscious thinking is based on the nerve-sensory system and unconscious will on the metabolic system." (Husemann and Wolff, pp. 319, 323) Rhythm truly is the carrier of life (Steiner). Healthy development of the heart and the rhythmic system is essential for life and is the physical basis for the unfolding of the *feeling* life beginning in adolescence.

Lack of a rhythmic lifestyle places great demands on the heart as the central organ of rhythm. Excessive stimulation, now part and parcel of modern life, creates inner, often constant unconscious stress, leading to "fight or flight" physiologic responses. The metabolism, by way of the adrenal glands, produces stress hormones such as adrenaline, cortisol, dopamine, and noradrenaline as a result of the strain on the nervous system. (Weissbluth, pp. 64–65) In young children, fatigue produces the same metabolic response, causing wakefulness, irritability, and being generally wound-up. It can be very difficult then to calm down and to go to sleep. The more sleep-deprived a child is, the more excitable he will be, and some children in this condition are constantly in various states of arousal. The stress hormones produced in response to arousal tax the liver greatly. Blood pressure, breath, and heart rate accelerate, as well as many other processes, which the heart as *central* to the rhythmic system must mediate. Over time, this can become pathological and hence the increase today in cardiovascular (rhythmic) diseases. Steiner called the "loss of the middle" (Husemann and Wolff, p. 390) a serious problem of our time as it represents the loss of the being of man. Physiologically, the organ most affected is the heart. But also spiritually speaking, the heart is the organ which is most related to the ego, the "I". (Husemann and Wolff, p. 394) Many serious heart ailments in adults, as well as numerous other illnesses, have to do with the prolonged *inner* reaction of the physical body to the influences of stress, emotions, desires, anger (i.e. the forces of the astral) that damage the life processes. For the young child, over-stimulation, along with lack of sufficient sleep and rhythm, compromise healthy physical development, setting the stage in adulthood for impaired life processes, with perhaps increased difficulty in mastering the astral forces. Improper development of the liver rhythm (sleeping-waking) is particularly detrimental in a child. Then "it is possible that the person will remain inactive despite his best intentions, despite proper initial development, the liver is not properly formed, then a will-defect develops that is expressed in the child's wanting to do something that does not pass over into the carrying out of the will impulse but remains stuck in thinking" (Steiner). This realization of the liver as an organ of the will is of the greatest significance for education, psychiatry, and therapy." (Husemann and Wolff, p. 214)

Many cosmic and biological rhythms exist that affect the human being. Scientist Gunther Wachsmuth (1893-1963) studied the rhythmical life sphere of the earth's organism which he called the "respiration sphere." (Falck-Ytter, p. 109) This sphere of the earth's life (etheric) forces affects atmospheric, meteorological patterns, and all life on the planet. Its supersensible existence is expressed in several interesting phenomena. The "semi-diurnal atmospheric pressure wave" caresses the earth rhythmically twice in each 24-hour period, moving like a mighty wave around the planet. This brings about high pressures at 9 a.m./9 p.m. (in breath) and low pressures at 3 a.m./3 p.m. (out breath). There are also corresponding electrical and magnetic occurrences. The electric potential between the atmosphere and the earth's surface, as well as the oscillations of the earth's magnetic field have the same respective high and low points/phases. In addition, compass readings of magnetic North are strongly deflected to the East at 9:00, and at 3:00 return to the West. "Human life is influenced by the rhythm of the sphere of forces. In the morning, from 8:00 to 10:00 the human being is most efficient. From about midday on, there is a "sleepy" crisis, lasting until about three. Following this, a phase of mental awakening begins which reaches a high point at around 9:00 p.m. and then fades away again later in the evening. A repeated crisis at 3:00 a.m. is not usually noticed by a sleeping human being, but is the hour when night-workers have greatest difficulty in keeping awake. This ebb of energy is also reflected by the fact that it is often the time of human death. These rhythmical effects of the sphere of forces mould important

life processes, even in the formation of the embryo, and strongly influence the nature of the human being like a pulse acting from without that infiltrates the basic framework of the human constitution." (Falck-Ytter, pp. 109–111) Dr. Michaela Glockler, M.D. speaks about the same physiological rhythms of the school child when she states that, "In school, children tend to be alert in the morning, but then are all tired out between 1:00 and 2:30 p.m. when they experience a sharp decline in their physiologic activity. In the later afternoon, there is a second peak when they are happy and like to be active, and then a second decline before the later evening when they want to sleep." (Glockler, *Healing Education*, pp. 59–60) Each of these rhythms corresponds to the liver, sleep-wake rhythm.

"In sleep, the organism returns to the activities that came at the starting point of its development, in the embryonic period and early infancy. In the waking state, processes coming at the end of human development, processes of aging and dying, predominate." (Steiner and Wegman, p. 63) In consideration of healthy physical development, one cannot stress enough the need for long periods of rest and sleep for young children. In fact, due to the increasing pace of life, *more* sleep is needed now than ever before to offset the physiologic strain on the young body. "Small, but constant deficits in sleep over time tend to have escalating and perhaps long-term effects on brain function some learning disabilities and Attention Deficit Hyperactivity Disorder or ADHD are attributed in part to sleep deprivation." (Weissbluth, pp. 58–59) (Interestingly, ADHD is then treated with stimulant medications.) Immune function is also lowered. In addition, the developing lower senses are seriously affected. The child's *sense of life* is diminished by a shortage of sleep. Through the life sense, the child can experience feeling good in his body, that the world is good. "In the sense of life we experience all our metabolic processes, all the forces which build and form our body. All of this is experienced as a kind of well being so long as we are well. The sense of life for us is a happy sense, a happy experience." (Konig, p. 107) But, it is the sense of touch, the sense of "bodily form and extension," which suffers most from the lack of sleep. "The sensation we have of being enclosed in a sheath, we owe to the processes taking place in sleep." Without an adequate feeling of "boundary," given by the sense of touch, the child is exposed or "thin-skinned," and consequently over-sensitive and awkward in space. (Kohler, pp. 58–59)

So, how much sleep do children need? (Fried)

Newborn - 16 hours
8 mos. to 1 year - 15 hours
1 to 2 years - 14 hours
4 to 5 years - 12 hours
6 to 7 years - 11 hours
8 to 9 years - 10-11 hours
10 years - 10 hours
14 years - 8 hours or more
(dependent upon timing of rapid growth spurts)

For young children, these sleep amounts include naptimes. Naps are extremely beneficial. "Long naps occurring at the right times make the child feel rested missed nap is sleep lost forever." (Weissbluth. pp. 27, 208) Children do not make up their naps at night, just as they do not make up a good night's sleep in the morning. They are beings of the sun and are healthiest when they go to bed early and "rise with the sun." Naps allow a child's nervous system much needed rest. The type of nap-sleep varies according to the time of day. Morning naps have more REM (rapid eye movement) sleep and help with brain maturation (in early life). This nap is dropped first. The afternoon nap has more non-REM sleep, which is more important for physical restoration. (Weissbluth, p. 25) Non-REM (quiet) sleep is characterized by slow brain waves of high amplitude, regular, deep respiration, slow, rhythmic heart rate, some muscular tone, and lower blood pressure than in waking states. A greater percentage of this stage is experienced with increasing age. REM sleep is characterized by irregular, high frequency brain waves, involuntary muscular twitches, rapid eye movements associated with dreaming, shallow respiration, rapid heart rate, and variable blood pressure. Infants and young children spend about half their sleeping time in REM sleep that correlates with physical growth. (Jensen, p. 433) Growth hormone (GH) levels rise sharply during sleep (Jensen, p. 1031) but some research

shows that GH levels are lowered by elevated cortisol (a stress hormone), reasserting the previously stated need to protect the developing nerve-sense system of the young child and to provide more sleep.

Children who do not nap have elevated stress hormones that also cause increased alertness and irritability. The nap should last for at least 30 minutes (an hour is better) and is best spent in a stationary place (not in a car, rocking chair, etc.). Afternoon naps need to end by 2:30 or 3:00 p.m. at the latest. The liver begins its night restorative phase at that time and sleeping later than 3:00 displaces the night-time sleep, causing the child to have difficulty falling asleep by 7:00 or 8:00 p.m. According to Philip Incao, M.D., "the more hours of sleep before midnight, the better. Sleep after 3:00 a.m. is less restorative because of the liver rhythm, which begins its wakeful-will-stimulating (more active flow of bile) mode from 3:00 a.m. to 3:00 p.m., roughly." Interestingly for children, the *more* regular sleep that they get, the *easier* it is to fall asleep. "Children who are not overtired sleep much better and more quietly at night," writes Norbert Glas, M.D. (p. 76) Children ages 3-6 still need a nap of 1-3 hours. A child of 5-6 years may give up the nap *if* she is regularly going to bed early, by around 7:00 p.m., and is not showing signs of sleep-deprivation which for children are the opposite of those shown by adults. Instead of yawning and becoming quieter, children become more excitable. Inda Schaenen, author of *The 7 O'Clock Bedtime*, makes a strong case for a 7:00 bedtime and says that once the *parent* determines how much sleep the child needs, this need becomes "nonnegotiable." (p. 6) Although some may not sleep, all children including "non-sleepers," benefit from an enforced rest-time. Being able to pause (to be still and quiet) is a skill that eludes even many adults. Children need desperately to learn this. As always, a fair amount of firm inner conviction is required of the adult to secure for the child what he needs.

Steiner said that, "Before age nine, the most important thing is for children to learn how to properly sleep" (Glockler, *Forces*, p. 47) Audrey McAllen describes sleeping as a "breathing rhythm between the soul-spirit and the earthly body." She adds that learning to sleep and learning to eat, "to take in substance and transform it, an action of the ego" are the two most "important educational factors" in the life of the young child. (p. 24) As we have seen, the transformation of substance, whether it is through the digestion of food or sensory impressions occurs on the physiologic level by way of the liver metabolism during sleep. How do we teach children to sleep properly? The breathing image given by Audrey McAllen is the key. Learning to sleep is learning to breathe. Without rest, the human being is continually breathing in. We are really speaking about a *rhythmic* function. Rhythm is living, breathing, life giving, never exactly the same, but regular. The young child's rhythmic (cardiovascular) system is not yet developed, but the health and building up of the entire physiology depends *upon* rhythm. Rhythm must be imprinted in the early years from without. The child learns to sleep by having adults that understand the profound importance of sleep. Sacrifices are usually necessary today to create a rhythmic lifestyle that allows for an unhurried pace. This includes regulating when the child sleeps and awakens, mealtimes, when and how much play, limiting stimulation, consistency, predictability–a slow, even tempo with rests at regular intervals. The *quality* of sense impressions that are ingested during the day also have a tremendous influence on the child's ability to sleep. (Glockler, *Forces*, p. 47) Heavy meals after 3 p.m. are a burden for the liver, which begins its night regenerative phase then. A special nightly ritual before bedtime such as a candle with a simple story, and a prayer or verse is *golden food* for sleep. This forming of the day, week, month, and year by the adult creates habits in the young child that literally form the physiological systems (particularly the rhythmic system), as well as future habits and the capacity to adapt. A sleep-habit life is thus developed which provides the basis for *more* sleep. The child then lives securely within real limits and form, a kind of swaddling that engenders trust, happiness, and healthy development of the nerve-sense, rhythmic, and metabolic systems. This establishes the foundation for the higher capacities of thinking, feeling, and willing. (Steiner, *Physiology*, p. 33) Sleep provides growth and life renewing processes as well as the bridge to becoming truly human.

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