Neurophysiological Foundation of the MNRI® Reflex Integration Program

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"All acts of conscious and unconscious life are reflexes in their origin." – I. M. Sechenov (1863/1995), world-known Russian physiologist


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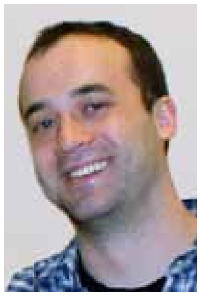
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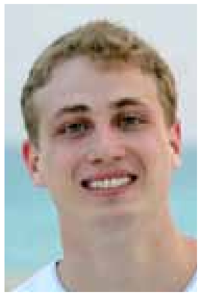
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In the fields of neurology and neurophysiology reflexes have been described in terms of their biological role, the character of the stimuli that trigger them, and the appearance of their motor responses in concrete behavior. I. M. Sechenov (1935, 1863/1961) and I. P. Pavlov (1927/1995) described a reflex as a biological static-dynamic unit: 1) pre-determining development of the nervous system, being unconditioned (non-changeable and strictly programmed by nature), and 2) simultaneously affected by experience and learning, creating *conditioned and specific* responses.

Research in the last century has shown that unconditioned reflexes are characterized by five distinct features. A reflex is 1) not an independent response (depends on a stimulus), 2) the result of feedback (of the nervous system) to a stimulus, 3) based on the excitation of the nervous system, 4) a response involving motor neurons that transmit nerve impulses from the central nervous system (CNS) to effectors (muscles and glands) all over the body, and 5) a response to change in the environment (Pavlov, 1927/1995; Sechenov, 1863/1961; Sherrington, 1947; Magnus, 1925; Vygotsky, 1986; Bernstein, 1997; Asratian, 1963, 1983) designed to maintain the organism's homeostasis.

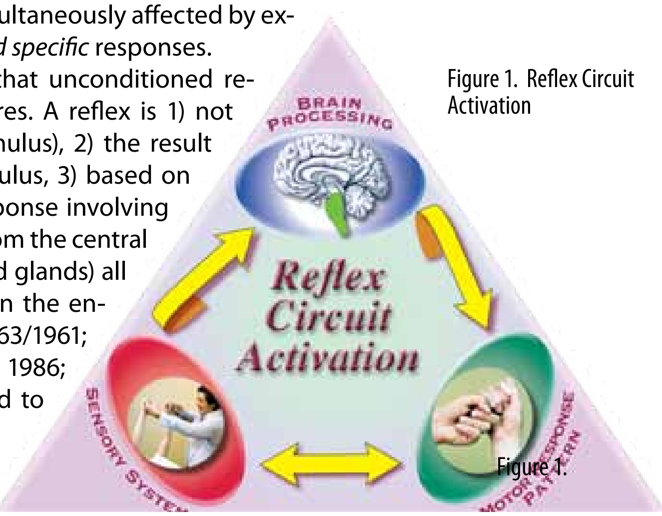

Figure 1. Reflex Circuit Activation

The MNRI® program follows traditional neurophysiology – classical, historical (Pav-

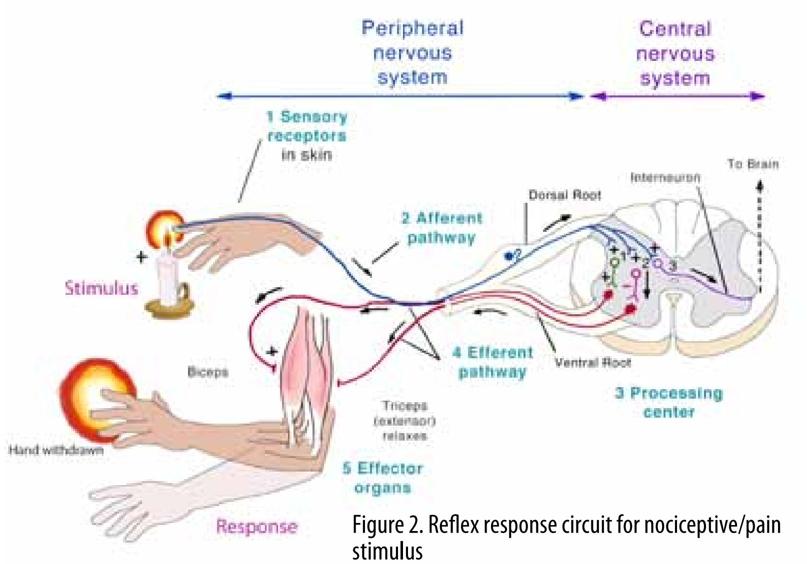

Figure 2. Reflex response circuit for nociceptive/pain stimulus

lov, 1927/1995; Sechenov, 1863/1995, 1961; Sherrington, 1947, and others), modern (Haines, 2002; Lundy-Ekman, 2002; Barker, Barasi, Neal, 2008; Barashniev, 2001, and others), and psychology (Sechenov, 1863/1995, 1961; Ukhtomsky, 1950-1952; Asratian, 1983; Luria, 1966, 1978; Anokhin, 1973, Konorski, 1969; Bernstein, 1997; Alexandrov, Sergienko, 2003; Goldberg, 2001, and others) in viewing primary reflexes as genetic/epigenetic inherent automatic responses of the CNS to adequate and specific stimuli (tactile, visual, auditory, vestibular, proprioceptive, or olfactory) in the form of adequate and specific motor/postural/glandular/pupillary/tympanic membrane reactions activating the organism's protection and survival strategies through the HPA-stress axis (hypothalamus-pituitary-adrenal triangle) (Masgutova, Akhmatov, 2013; Masgutova, Masgutov, 2013).

The Masgutova Method® uses the concept of reflex integration and a set of MNRI® programs focused on the restoration and maturation of primary motor patterns, reflexes and coordination systems to achieve optimal performance of natural mechanisms, neurodevelopmental processes, brain functioning, and sensory-motor integration. Activation of reflex patterns awakens natural genetic motor resources and self-regenerating programs, strengthens motor memory and sensory-motor coherence, and increases resilience. With this overall improvement in functioning, individuals are able to move toward realization of their full motor, social, emotional, and cognitive potential. (www.MasgutovaMethod.com).

The MNRI® Therapeutic Modality (Masgutova Neuro-sensory-motor Reflex Integration)

The Conceptual Basis

Each primary reflex is a unit serving the nervous system in the first order for protection and survival, and secondly, as a foundation for development. The reflex system involves complex supporting and opposing interrelationships among its motor patterns. In MNRI® this system is treated as a whole, much like the visual and auditory systems. Our experience shows that focusing on neurosensorimotor reflex integration in this way leads to treatment strategies and techniques that support neuromotor development and enhance function. Thus our focus is on the reflex system as a whole and the developmental process of its emergence, activation, maturation, and integration.

The Knowledge Base of MNRI® includes

• a deep understanding of motor development; its levels, stages, mechanisms, processes, and strategies and its physical structure and neurophysiology

• research on the correlation between poor performance of infant reflex patterns with a variety of developmental deficits in over 3,560 children

• analysis of the effects of MNRI® treatment programs on over 30,000 children.

Practical Applications of MNRI® theory include

• an assessment protocol to evaluate reflex pattern development in children and adults

• techniques that use sensory stimulation and the motor system to correct poorly functioning, dysfunctional, and pathological motor patterns

• therapeutic programs that integrate primary movements, controlled motor systems, and higher (intentional and conscious) motor and cognitive functions

• courses, training programs, and publications for professionals and parents.

A Reflex as a Unit of the Nervous System

The fundamental understanding of a reflex as a physical response directed by the brain was introduced by I. M. Sechenov (1995, 1961) and I. P. Pavlov (1927/1995). Stimulation from the sensory system in the form of impulses passes through neural pathways to muscles and glands, the response organs of an organism. Networks of neurons, referred to by Pavlov and Sechenov as reflex arcs, allow nerve impulses generated in response to a stimulus to transmit the data that cause a reflex (Pavlov, 1927/1995; Sechenov, 1995, 1961).

The reflex arc consists of:

1. The afferent nervous system (receptors and sensory nerve fibers bringing neural impulses to the brain). A vast system of sensory receptors detects stimuli, their strength and other qualities, and changes that occur continually in them both externally and inside the body. Our receptors monitor such things as touch, vibration, temperature, light, and sound from the external environment. Internal receptors detect functioning and changes in heart rate, pressure, pH, oxygen and carbon dioxide content, and levels of electrolytes. All of this information gathered together forms sensory input.

2. Certain brain centers whose task is to process sensory or proprioceptive information.

3. The efferent nervous system (efferent nerve fibers bringing neural impulses in the form of commands to the muscles and organs/glands to effect a response to the stimulus) (Pavlov, 1927/1995; Sechenov, 1995, 1961).

Since the times when I. Pavlov and I. Sechenov developed their theories of nervous system function, new data on neurology has validated and enriched their work.

The first part of the reflex arc is sensory input converted into electrical signals or nerve impulses that are transmitted to the peripheral nerve system and brain. These signals reach the spinal cord and medulla oblongata, pons or thalamus, and then the cortex, creating sensations, images, and thoughts. Output or decisions are made by our nervous system each moment based on an evaluation of sensory input and its meaning for the safety of the organism. The nervous system responds by sending signals to effector organs, causing muscles to contract or lengthen, or glands to produce appropriate secretions. The neuro-chemical basis for regulation of movement and posture is in the balance of neurotransmitters in synapses connecting sensory and motor neurons. Links between sensory and motor nerve systems derive from these unified mainly predetermined genetic and epigenetic 'codes' or reflex arcs.

Figure 3. Baby showing Bauer Crawling.

Reflex Definition

Thus our work is based theoretically on viewing a reflex as a unit of the nervous system presenting an unconditioned physical response to a sensory stimulus (Pavlov, 1927/1995; Sechenov, 1995, 1961; Sherrington, 1947), supported by a network of neural arcs and circuits linking sensory organs, processing centers, and muscles or glands (Pavlov, 1927/1995; Sechenov, 1995, 1961). Reflexes are part of our genetic and epigenetic inheritance. They function physiologically as codes and structures created by nature to ensure protection and neurosensorimotor development. Work with reflexes touches the underlying nerve net system of the body, a net similar to the infrastructure of a leaf or a building. Most importantly, reflexes serve a dual purpose as a foundation for 'learning' that 1) ensures survival and 2) supports gradual physical, emotional, and cognitive development (Masgutova, 2010).

Unconditioned and Conditioned Reflexes

Through their unconditioned inborn 'codes' of sensory-motor reactions, reflexes allow the organism to survive in the presence of stress or unexpected danger. Nature has transferred them from generation to generation as a rigid unchangeable bedrock of protection, always dependable and ready to help us survive (Pavlov, 1927/1960; Sechenov, 1961, 1863/1995; Sherrington, 1947; Ukhtomsky, 1950-1952; Bernstein, 1997; Anokhin, 1973; and Alexandrov, 2003). Some reflexes are simple (myotatic or knee-jerk reflexes), others are more complicated (Thomas Automatic Gait, Bauer Crawling). Still others are social involving parental, territorial, ritual, and group behaviors and exist only in relationships among humans: emotional resonance (compassion, sympathy for another person) for example, or social hierarchy where an individual becomes a marriage partner, parent, child, territorial host, newcomer, leader, or follower.

Scientists throughout the 20th century (Pavlov, 1903, 1927/1960; Sechenov, 1961, 1863/1995; Sherrington, 1947; Magnus, 1925; Ukhtomsky, 1950-1952; Bernstein, 1997; Anokhin, 1973; Luria, 1972, 1976; and Konorski, 1969) recognized that reflex activity involved both 'higher' and 'lower' nervous system activity. I. P. Pavlov (1903, 1927/1960) and I. M. Sechenov (1961, 1863/1995) found that lower nervous system activity determining the work of unconditioned reflexes is governed by the brainstem (medulla spinalis, medulla oblongata, pons, and midbrain) and cerebellum.

Conditioned reflexes, on the other hand, involve the higher nervous system. Inborn reflex motor patterns become conditioned with the development of motivation and intentional actions. A conditioned reflex is a variant pattern of an unconditioned (basic) reflex. It serves as the neurophysiological foundation for development of conscious motor control and future specialized executive functions of the left and right hemispheres and cortex of the cerebrum (frontal, temporal, parietal, and occipital lobes), areas of the brain that generate complex reasoning and support socialization. Conditioned reflex activity normally depends on higher nervous system functioning (Pavlov, 1927/1960; Sechenov, 1863/1995; Ukhtomsky, 1950-1952; Bernstein, 1997; Anokhin, 1973; Konorski, 1969).

At the beginning of treatment, our repatterning work is aimed at restoration, development, and maturation of dysfunctional or retained unconditioned reflexes. MNRI® targets reflex patterns normally active in infants of 0 to 4 months. Restorative work with these reflexes provides 'neurophysiological order' in specific reflex circuits in the lower brain. Only with a reliable foundation at this level of unconditioned reflexes, as the essential protective and survival strategies of the brainstem, can further development proceed smoothly. When this foundation is absent or unreliable, its functions are taken over by higher brain centers, which are then unavailable for intentional motor activities, socialization, and complex reasoning (Masgutova, Akhmatova, 2008).

Classification

Pavlov (1927/1960) subdivided unconditioned reflexes into three groups: simple, complex, and most complex. The most complex reflexes were subdivided into two categories: individual (alimentary, active or passive, defensive, aggressive, freedom-seeking, exploring, or playing) which enable an individual to survive, and species (sexual, parental, and territorial) which ensure the survival of the species.

V. P. Simonov (1991) classified unconditioned reflexes into three groups depending on needs and motivation. In neuro-physiology unconditioned reflexes are classified according to the location of their receptors in the body: deep in the body (proprioceptive: tendinous, periosteal, articular) or on the surface (dermal or mucosal) (Vojta, 1989). Hitting a tendon or periosteum with a hammer causes tendinous and periosteal reflexes to respond. The trigger for the proprioceptive reactions (tendinous and periosteal) in the limbs is their special 'conducive' position (muscle relaxation, middle postural position) (Barashnev, 2001; Haines, 2002).

Another investigator, J. Konorski (1969), classifies all inborn activity according to its biological role: self-preserving, defensive, and orientation reflexes.

Investigators who study infant development, such as pediatricians and psychologists (Barashnev, 2001), group reflexes into specific in utero (Sucking Reflex, Tonic Labyrinthine , Trunk Extension, Leg Cross Flexion-Extension, and others), infant (Bauer Crawling, Thomas Automatic Gait, and others), early childhood (Babinski, Spinal Perez, Landau, and others), and lifelong (Core Tendon Guard, Grounding, Stability) (Masgutova, Akhmatova, 2004, 2007; Masgutova, Akhmatova, 2008). It is important to note that all of them begin their

Figure 4. Ultrasound 3-D scan picture of A) 13 week unborn baby activating Leg Cross Flexion-Extension, B) Trunk Extension Reflex - vertical spine lengthening, C) Eye tracking (From materials by Prof. E. Ronin-Walknowska and Dr. S. Masgutova, 2006). Primary utero reflexes are the basis for the brain development and sensory-motor integration, which we use later postnatally for future neurodevelopment of everyday functioning and learning.

Table 1. Classification of the Dynamic and Postural Reflexes.

Type	Central/Core Reflexes		Peripheral Reflexes	
Response / Level	Dynamic	Postural	Dynamic	Postural
Simple	Spinal Galant Spinal Perez	Babkin Palmomental Fear Paralysis	Babinski Phillipson Leg Withdrawal Foot Grasp	Peripheral Limb Reflexes
Complex	Hands Pulling Leg Cross Flexion-Extension Thomas Automatic Gait Bauer Crawling Moro Segmental Rolling Spinning Flying and Landing Locomotion	Trunk Extension Symmetrical Tonic Neck Asymmetrical Tonic Neck Tonic Labyrinthine Landau Pavlov Orientation – "What is this?" Core Tendon Guard	Hands Grasp Sequential Fingers Opening Sequential Fingers Closing	Hands Supporting

development in utero and can be seen clearly from 10-12 weeks of gestation.

Reflex Classification in the MNRI® Model

Several criteria are used in MNRI® to define reflexes according to their role in protection or survival, the complexity of their motor pattern, the level of their neurophysiological circuits and their brain 'strategy' (Masgutova, 2002-2007; Masgutova, 1990; Masgutova, Akhmatova, 2004, 2007; Masgutova, 2011). This classification also serves for practical orientation in MNRI® re-patterning of dysfunctional and retained reflexes:

Simple: single action, unidirectional, and processed mainly on the level of the spinal cord

Complex: multi-component, requiring more than one action, multi-sequential, and processed mainly on the level of the brainstem

Central: whole body activation. Central or core reflexes require whole body movement. (e.g. Spinal Galant, Spinal Perez, Bauer Crawling, Thomas Automatic Gait)

Peripheral: involve the limbs and extremities (e.g. Hands Grasp, Babinski)

Dynamic: active continuing motor response

Postural: bringing the body into a static posture

(See above TABLE: Classification of the Dynamic and Postural Reflexes)

Dynamic reflexes present a natural sequence of motor reactions to specific sensory stimulus. They are governed by the sympathetic nervous system, which controls processes of excitation that increase and conduct motor activity, leading to fight or flight responses (Masgutova, 1990) when necessary (e.g. Moro, Thomas Automatic Gait, Hands Grasp Reflex). Postural reflexes, governed by the parasympathetic nervous system, activate one or more movements in order to bring the body into a specific static position. Their task is regulation in the frame of inhibition of motor activity in order to stop or pause, leading to the freeze response when necessary and/or to activating sensory perception and processing. When matured, these reflexes are the basis for postural control and equilibrium (e.g. Asymmetrical Tonic Neck, Trunk Extension, Landau). The brain strategy here is: quiet the body to engage vision and audition.

Problem Solving with MNRI®

The human brain has its own chronology, mechanisms, and processes for development of its main strategies: protection and survival (brain stem), behavior, habits, emotional response (interbrain or diencephalon), and cognition, conscious control, and self-awareness (cortex). Infant reflex activity and neurological maturation normally coincide with the development of the brainstem. Reflex circuits connecting sensory and motor neurons (α- and γ motor neurons) and muscle fibers must be well established for initiating movement and posture both for protection and survival and for normal functioning.

Dysfunctions and delays in motor development can usually be traced back to some form of stress or insult to the nervous system that interfered with the emergence, activation, maturation, and integration of the reflex system. MNRI® research and therapy aim at re-establishing or re-routing reflex circuits to replicate what would normally exist at the earliest stage of unconditioned neonatal development. Here, in the first 0 to 4 months of life, is the key for 'reanimation' of healthy protective brain strategies and true maturation and integration of automatisms and reflexes that will eventually support mental activity. With an understanding of developmental problems as Reflex Integration Disorders, MNRI® addresses causes in the neuro-sensory-motor system, thus drawing the attention of professionals and scientists to the importance of rehabilitation at the level of the extrapyramidal nerve net system and lower motor neurons.

MNRI® uses 'regressive progressive' repatterning techniques that 'remind' the brain-body system of its genetic neurosensorimotor programs. 'Regressive' refers to the way a child positioned in a particular posture is given a precise tactile or proprioceptive stimulus and helped actively or passively to replicate the exact motor pattern that would be elicited reflexively by that stimulus in a neonate. In going back (regressive) to the 'pure' innate form of the reflex, the brain recognizes and resonates with an inner template for growth and development (progressive) supplied by its genetic inheritance. With repetition, thanks to neurological plasticity, the relevant nerve net system can then rebuild according to its original code and subsequently mature and integrate.

The Infant Nervous System

The most important function of the infant's CNS at birth is to 'produce' motor activity in the form of primitive motor reactions and inborn reflexive responses. These primitive motor responses of infancy characteristically disappear in time. From L. S. Vygotsky's point of view they are of an atavistic character (generated from the lower level of the CNS – spinal cord) and can be compared with the old phylogenetic stages of CNS development. He distinguishes this early activity from infant reflex patterns, which originate in the brain (brain stem, interbrain) and are the basis for development of higher controlling and reasoning brain centers (Vygotsky, 1986).

In older psycho-physiological literature we often find assertions that infant reflex motor patterns disappear as a result of inhibition and extinguishing by the higher centers of the nervous system. In reality we see that infant motor responses are not lost, but reappear during stress and in association with pathological conditions, even in adulthood.

In theory and practice, the Masgutova Method® is in agreement with Vygotsky. The very early most primitive motor reactions do fade as the infant develops. But the first infant sensory-motor reflex patterns and movements do not disappear; they continue to work in connection with higher nervous system structures. They hand over some of their functions and become subjugated to younger and newer brain centers (Vygotsky, 1986). Rather than being inhibited or extinguished, infant sensory-motor reflex activity integrates with, and becomes part of the higher, controlled sensory-motor systems.

Early infant behavior is governed mainly by old sub-cortical and intercerebral centers. These lower, older brain areas grow up earlier than others and are already mature at the moment of birth, as they are essential for the evolution of all organic life. In utero and in early infancy when the cerebral cortex is still immature and connections between cortical and sub-cortical brain centers are not yet established, the lower brain operates more independently. As the cortex matures, sub-cortical centers are gradually subordinated to its regulation, inhibition, and control.

L. S. Vygotsky (1986) pointed out three special traits of basic nervous system functioning in newborn and infant sensory-motor development:

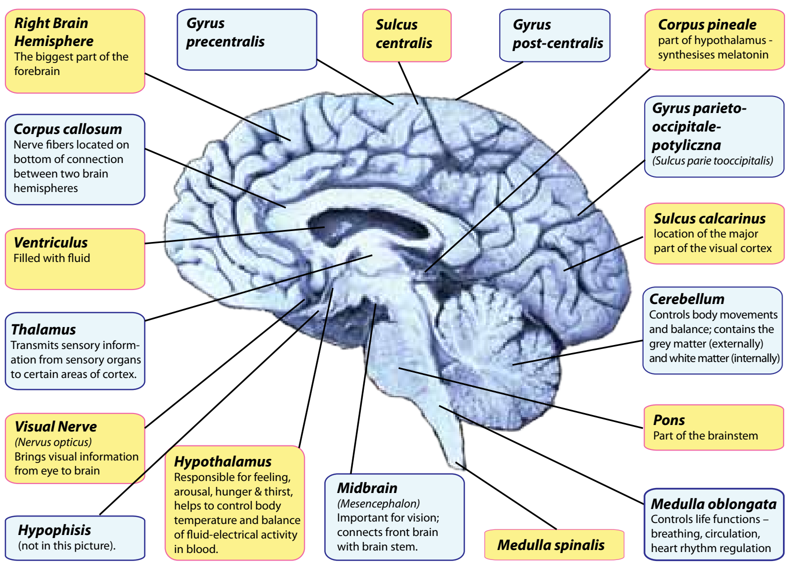

Figure 5. The parts of the brain.

1. 'Transfer' of functions to higher centers. The lower centers are unable to maintain their earlier type of functioning as the infant's learning increases and behavior becomes more complicated. The brainstem centers then transfer the greatest part of their functions to the cortical centers, thus supporting the progression of neurological development. Under control by higher centers movement becomes more nuanced, better adapted to varying conditions and more intentional.

2. 'Preservation' of lower centers. The oldest lower centers (brain stem) and their arcs do not disappear, but become subordinate to and inextricably entwined in cooperation with the higher centers (cortex). The union of lower and higher centers is so tight that it is difficult to separate them. However, the original circuits remain intact and can be observed in cases of injury to the nervous system.

3. 'Emancipation' of lower centers. In the earliest stages of newborn life the lower centers are 'emancipated' – free from control by the, as yet undeveloped, higher brain. This is the time during which unconditioned reflex activity is normal. Later, with conditioning by experience and learning and with the growth of higher brain centers, those previously automatic involuntary motor patterns are subordinated to the cortex and come under conscious control. If, however, the cortex is functioning poorly or 'separated' from the brainstem because of stress, shock, illness or injury, then the nervous system doesn't stop functioning, but has to rely on the subcortical and brainstem centers. The brainstem is then 'emancipated' again and pushed to function independently, but also maintains its primary protective functions. This is why, in cases of stress and pathology, the involuntary unconditioned reflexes become less subordinated to the cortex (less integrated with voluntary control) and more re-active, causing poor control of behavior, impulsiveness, and impaired decision-making. Thus a victim of a brain lesion may present an active Babinski response very like that of a newborn.

From L. S. Vygotsky's point of view, the reflex system as the oldest phylogenetic stage of CNS development, is the basis for development of the whole nerve system and cortex. Only neurologically matured and integrated reflexes can cooperate effectively with higher brain centers for controlled motor functions, cognitive processes, and conscious decision-making (Vygotsky, 1986).

When children present motor reactivity, impulsive behavior, and other delays; immature reflex development is often responsible. Attempting to inhibit or extinguish such involuntary reflexive motor activity seems like a reasonable approach. However, results have not been positive and the practice is no longer a standard intervention. An example, using the STNR (Symmetrical Tonic Neck Reflex), is presented below.

A retained STNR holds a child at the mercy of reciprocal reactivity linking the arms, legs, and neck. A boy with a hyperactive STNR, for example, is unable to sit still and focus. If he is asked to read in a sitting position and bends his head forward, then the automatism of the reflex causes his elbows to flex and his legs to extend. He may even impulsively stand up. When the teacher then asks him to sit, the opposite occurs – his lower limbs flex, but now his head and arms extend, taking his book out beyond his range of focus. Reflex inhibition might develop and strengthen his higher nerve system to control and suppress these reactive/impulsive reflex responses. This might even help him to adopt more appropriate habits and behavior. But would it assure the neurological maturation of a retained, delayed reflex? No. And would there be negative consequences? Yes. The child would become exhausted from constantly fighting to control the reflex motor activity. Sitting at a table through family dinners with both elbows and knees bent would be torture for him. He could never be an outfielder in baseball because reaching for a high ball would cause his knees to bend. In football he might be successful as a tackle or guard, but he'd be a poor passer or receiver.

In our experience we have seen that many habits and skills learned through reflex inhibition break down under stress and can even put a child at risk. A child, for example, whose Moro Reflex is hyperactive, may be excessively sensitive to vestibular stimulation, feel insecure in activities that involve movement, and be reluctant to participate in athletics. Normally when loss of stability in space is threatened, the Moro Reflex introduces a startle response, creates appropriate fear, and organizes a protective posture for possible falling down. An abnormally strong startle response due to vestibular hypersensitivity may also result in excessive timidity and lack of confidence, preventing a child from taking the normal risks necessary for new learning. While desensitization may calm down (inhibit or extinguish) the automatic response, it will not guarantee true maturation of the Moro neuro-circuitry. Just the contrary: in a situation of real danger an inhibited reflex will not fulfill its basic function and the child could actually sustain injury from falling with no fear and no protection from Moro's phase 2 motor pattern which should curl the body into a rolling ball to limit the harmful impact of a fall. Also, because a dysfunctional Moro Reflex is often mixed with reactivity in the Fear Paralysis Reflex circuit, failure to mature and integrate can also lead to dysfunction in both reflexes, including a predisposition to emotional fear and on-going challenges with defensiveness, avoidant behavior, and poor ability to learn.

Intervention using MNRI® would facilitate maturation and integration of any reflex that has failed to develop or has become dysfunctional. The goal would be:

1) activation of all components of the reflex circuit (receptors, sensory and motor pathways, synapses connecting the sensory and motor axons, and muscle fibers)

2) activation of the reflex circuit memory (sufficient repetition to establish the proper nerve pathways)

3) neurological maturation of the reflex circuit – myelinated axons and efficient neurotransmitter function

4) linking automaticity in the reflex response with conscious processes (mature inner control).

Reflex Circuit Memory

MNRI® re-patterning procedures propose sufficient repetitions of sensory-motor exercises approximating the sensory stimulation and unconditioned motor response of the reflex in order to activate long-term motor memory for stable nerve pathway function. This training aims at awakening the genetic motor memory encoded in the automatism of a reflex pattern and eliciting an automatic response to the stimulus. MNRI® uses its knowledge of neurophysiology to create techniques that support memory processes through activating motor neurons (alpha and gamma) with precise isometric and isotonic exercise of the particular muscles involved in the reflex pattern. In normal infant neurodevelopment, 10-15 activations of the reflex circuits are sufficient to myelinate the axons of the sensory and motor neurons (Pavlov, 1927/1960; Sechenov, 1961; Konorski, 1969). In the case of dysfunction and pathology this process can take several minutes to years depending on the extent of damage to the nervous system.

Neurological maturation of a reflex circuit means that the sensory and motor axons are myelinated (the peak of neural development) and all components of sensory processing and motor pattern expression are functioning properly. Myelination assures proper electrical conductivity in axons as well as production of the neurotransmitters at synaptic terminals. Neurological maturation of a reflex circuit creates several benefits for the nervous system and the body:

• *Freedom from automatisms.* To track the lateral movement of an object, for example, we should be able to move our eyes independently of our head. When the Head Righting Reflex is immature, its automatism links eye tracking with turning the head and shoulders; resulting in a limited field of vision and slower, less efficient visual processing. A matured, integrated Head Righting Reflex allows differentiation of eye movement from movement of the head and shoulders.

• *Reliable decoding of sensory input.* When danger is present the neurologically mature nervous system will activate its reflexes appropriately for protection and survival.

• *Regulation of the alarm state and support for cognition and communication.* When conditions are safe, the mature system will use reflex patterns, as Vygotsky (1986) says, for inner control over behavior and as the basis for emotional processing, cognition, and communication.

Automaticity in Reflex Responses and Conscious Processes

An unconditioned reflex is automatic, unconscious, and involuntary. This automaticity must mature, moving from the reactivity of infancy to a state in which a reflex activates automatically in response to real danger, and yet does not react inappropriately to stimuli that are not dangerous. Conditioned reflexes incorporate the effects of experience and learning, connecting the basic reflex (lower level of the nerve system) with higher brain structures. This is how internal control develops. Children with mature reflexes can maintain their posture, move, and use reflex motor patterns and their variants without having to think about it, so they are free to learn, interact, and grow naturally and easily. A child with immature and hyperactive reflexes must consciously try hard to initiate and control many functions that should activate and be controlled automatically. So when reflexes are delayed, hypo/hyperactive, or non-integrated, they interfere with cortical processing and impede development. Consequences of abnormal reflex development include hyper- or hypotonic muscles, metabolic diseases, neurotransmitter function deficits, vestibular dysfunction, poor brain plasticity, aberrant motor development, difficulties with auditory and visual processing, poor sensory-motor integration, delayed language, and poor social, emotional, and cognitive development.

Conclusion

Vygotsky's concept (1986) of infant reflexes as the basis for higher, controlled systems of motor skills and abilities that support cognitive functions shows clearly that reflex integration is the key to solving the problems of children and adults who experience dysfunction, delay, or regression in their motor, emotional, and cognitive functioning. By triggering the sensory system and replicating appropriate motor responses, MNRI® techniques reestablish or build connections between sensory and motor neurons.

MNRI® therapeutic modality aims at activation a reflex circuit by introducing an exemplary motor pattern, linking its components and sequences to replicate the exact biomechanics that support its original function. Rather than struggle with dysfunction and pathology, we instead invite the nerve system to explore and re-explore reflex motor patterns in accordance with their natural course of development (see the Leg Cross Flexion-Extension article in this book).

When reflex function is pathological, dysfunctional, immature, or lacks integration at any age, MNRI® techniques can re-route, re-connect or build new neural pathways and facilitate neurological maturation of its circuitry. Reflex integration exercises lead to overall maturation, including synaptogenesis, myelination, and brain plasticity. Their purpose is to provide sensory-motor coordination in a reflex circuit, regulation of the work of the sensory and motor neurons for easy postural control and motor development, and a solid foundation for intentional motor skills, inner control, emotional maturation, productive behavior, and cognitive abilities. The realization of one's highest potential necessarily rests on the foundation of reflex maturation and integration.

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