

How Retained Primitive Reflexes Can Negatively Impact Daily Life



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Financial Disclosure



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About Me



- Live in Brandon with my husband, Tyler, and our twin girls
 - Diagnosed with ADHD at age 32 😊
 - One child diagnosed with ADHD at age 6

- Graduated from MS State in 2009
 - Bachelor of Science, Kinesiology/Clinical Exercise Physiology
- Graduated from UMMC in 2012
 - Masters of Occupational Therapy
- AOTA Board Certified in Pediatrics
 - April 2022
 - Pediatric practitioner since graduating in 2012
- Clinic Director, Occupational Therapist
 - Beyond Therapy for Kids, Brandon (MS)
 - Opened in October 2022

Learning Objectives



- Define the primitive reflexes that impact attention, concentration, focus, sensory processing/integration/modulation, balance, and coordination
- Discuss how this is related to ADHD, Dyslexia, Autism Spectrum Disorder (ASD), Sensory Processing Disorder
- Discuss improvement of foundational skills in improved quality of life
- Define Occupational Therapy and the OT's role on the pediatric treatment team
- Briefly discuss treatment/treatment approaches for addressing retained reflexes and foundational skills

Occupational Therapy



What is an OT?



- OT: Occupational Therapist (or Occupational Therapy)

“Occupational therapists and occupational therapy assistants focus on the things you want and need to do in your daily life. Occupational therapy intervention uses everyday life activities (occupations) to promote health, well-being, and your ability to participate in the important activities in your life. This includes any meaningful activity that a person wants to accomplish, including taking care of yourself and your family, working, volunteering, going to school, among many others.”

Occupational Therapy



- Improvement in functional tasks is the overall goal
 - Activities of Daily Living (ADL)
 - Instrumental Activities of Daily Living (IADL)
- We achieve this by:
 - Addressing foundational skill deficits
 - Addressing specific skill deficits
 - Adaptations and/or compensatory strategies

Reflexes



What Is a Reflex?



- **Reflex:** involuntary motor movement in response to external sensory stimulus
- Intrauterine (spinal), ***Primitive (brainstem)***, Postural (midbrain and cortex)
 - ✧ Primitive Reflex: neonatal reflexes
 - Retained Primitive Reflex (RPR)

Hierarchy



Intrauterine

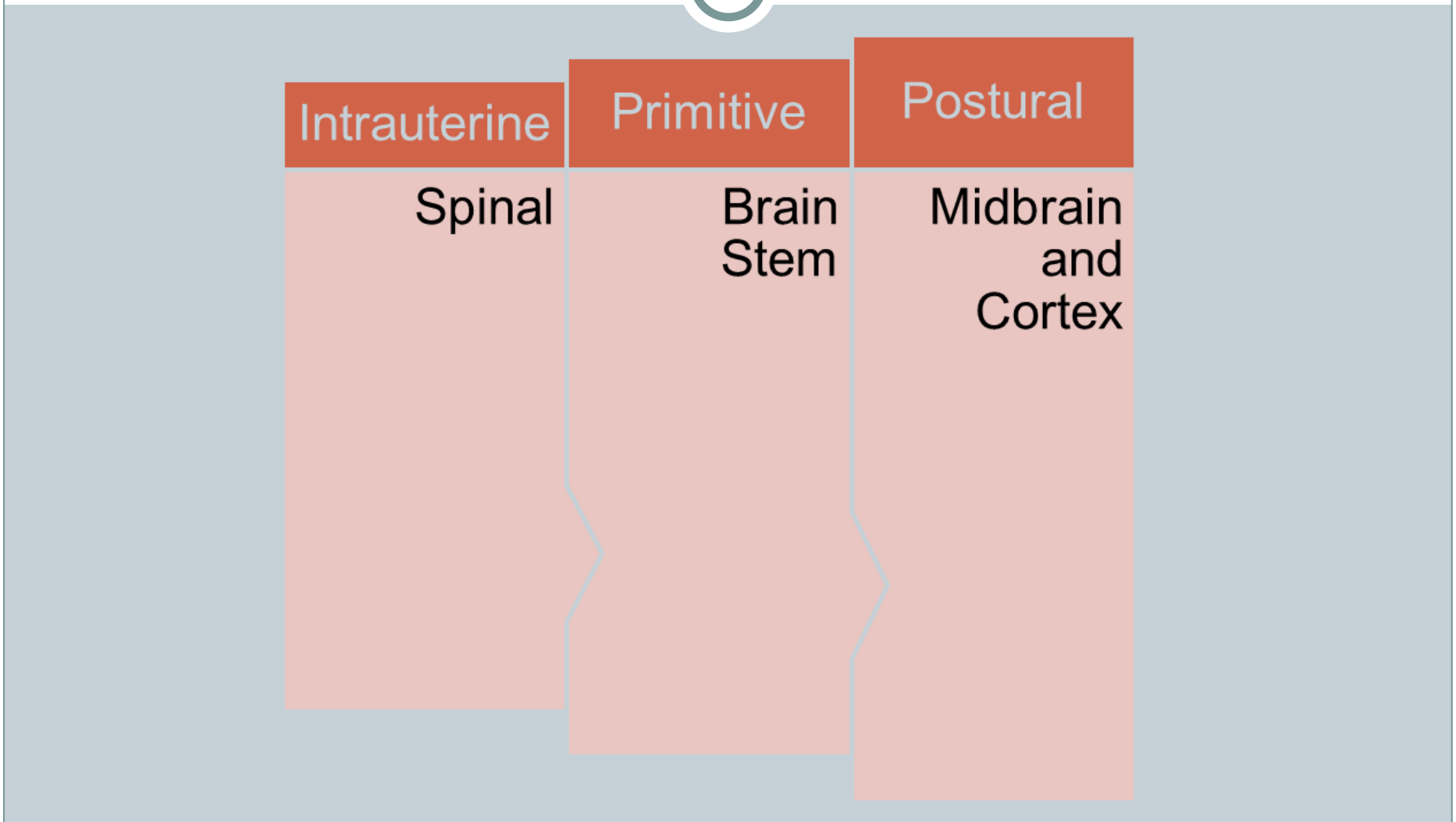
Spinal

Primitive

Brain
Stem

Postural

Midbrain
and
Cortex



What Are Primitive Reflexes?



- Most develop in the womb
- Present at birth
- Most should integrate by 6 months old
 - Integration: reflexes are **dormant**
- Protection for the infant and initiate patterns and skills for voluntary movements
 - ex: ATNR and hand-eye-coordination for reaching
- Some are believed to assist in the birthing process
 - C-section, forceps, vacuum may interrupt
- Precursors to the postural reflexes

The Primitive Reflexes



What Are The Primitive Reflexes?



- *Moro (precursor: Fear Paralysis)*
- *Asymmetrical Tonic Neck Reflex (ATNR)*
- *Symmetrical Tonic Neck Reflex (STNR)*
- *Tonic Labyrinthine Reflex (TLR)*
- *Spinal Galant Reflex*
- *Palmar Grasp Reflex*
- *Plantar Reflex*
- *Babinski Reflex*
- *Rooting Reflex*
- *And more!*

Why Don't Reflexes Integrate?



- **Damage to CNS**
 - Cerebral palsy, TBI
 - Re-emerge in degenerative diseases, Alzheimer's and Multiple Sclerosis
- **Severe psychological stress/trauma**
 - Chronic school stress
- **Maternal stress, illness, drug/alcohol use during pregnancy**
- **Severe illness/infection as infant**
- **Environmental toxins**
- **Complication with vaccinations**
- **Resuscitation**
- **Prolonged jaundice**
- **High fever during first 18 months**
- **Chronic ear infections, excessive fluid**
- **Preterm birth, low birth weight**
- **Traumatic birth**
 - C-section, forceps, vacuum
- **Container use, lack of tummy time**
- **Skipped crawling or minimal crawling**
- **Severe allergic reactions**

Do They Come Back?



- Can re-emerge in traumatic events (TBI/ABI) and degenerative conditions (Alzheimer's, multiple sclerosis)
- Can re-emerge with chemical causes of neurodegeneration
- Can re-emerge with traumatic psychological events
 - They never fully go away; they “go to sleep” so if needed they can reappear for survival

Primitive Reflexes

Primitive Reflex	Purpose	What the Reflex Looks Like in a Baby:	When It Appears	Should Integrate by:	Signs of Retention
FPR Fear Parlysis Reflex	protective mechanism, response to perceived threat	Freezing reaction - similar to deer in headlights	5th to 8th week in Utero	before birth	anxiety, poor self esteem, sleep/eating disorders, aggression, fear of failure or embarrassment, phobias
Moro	Insant arousal of survival systems	Automatic reaction to a sudden change in sensory stimuli. Startle response. Primitive fight or flight reaction	birth	2 to 4 months	hyper sensitivity, hyper reactivity, poor impulse control, sensory overload, social and emotional immaturity
Rooting Reflex	to assist baby to find food, breastfeeding	Baby automatically turns head towards touch on their cheek	birth	3 to 4 months	picky eater, thumb sucking, dribbling, speech and articulation problems
Palmar Reflex	to assist baby's grasp development	Hand closes when object is places in the palm	birth	5 to 6 months	poor fine motor skills, poor manual dexterity, poor handwriting
ATNR Asymmetrical Tonic Neck Reflex	To assist baby through birth canal and to develop cross pattern movements	Activated by turning the head to the left or right side. As the head is turned, the arm and leg on the same side will extend while the opposite limbs bend.	birth	6 months	Difficulty with: eye-hand coordination, handwriting, crossing vertical midline, visual tracking
STNR Symmetrical Tonic Neck Reflex	preparation for crawling	Arms bend and legs extend when the head is bent down. Arms straighten, legs bend when the head is bent backwards.	6 to 9 months	9 to 11 months	tendency to slump while sitting, poor muscle tone, W-sitting, poor eye-hand coordination, inability to sit still and concentrate
TLR Tonic Labrynthine Reflex	head management and postural stability	Forward TLR: Head bendt forwards causes body and limbs flexion. Backwards TLR: Head bent backwards causes body and limb extension	in utero	3 1/2 years	poor muscle tone, W-sitting, toe-walking, poor balance, motion sickness, spatial orientation issues, gravitational insecurity
Spinal Galant Reflex	assists baby with birth process, crawling and creeping	Hip rotation when back is touched on either side of the spine	birth	3 to 9 months	unilateral or bilateral posture issues, fidgeting, bedwetting, clothing issues, poor concentration, poor short term memory

Moro



Moro



- *MULTISENSORY*
 - The ONLY reflex triggered by all senses
- Begins to emerge 9-12weeks GA
- Present at birth (40wks GA)
 - can be difficult to elicit in preterm infants
- Role: survival in first months, alert or arouse and summon assistance, facilitates first breath of life
- Should integrate between 4-6 months of age
- Primitive startle response
 - Noise, touch, temperature, movement*, light, visual
 - Withdrawal, claspings

Retained Moro



- Hypersensitivities, including visual “sensory overload”
 - light
 - Unable to “block” visual stimulus
 - Immature eye movement patterns
 - Babies are “stimulus bound” attending to the visual stimulus that catches attn
 - Parts vs whole
- Hypersensitivity to sound
- Over-reactivity “FIGHT OR FLIGHT”
- Decreased attention, increased distractibility
- Anxiety
 - Withdrawn and fearful
 - Overbearing and controlling
- Social immaturity
- Vestibular difficulties, balance and coordination difficulties
- Allergies and illness
- Aggressive
- Tense muscle tone
- Whole body movement patterns

TLR



TLR



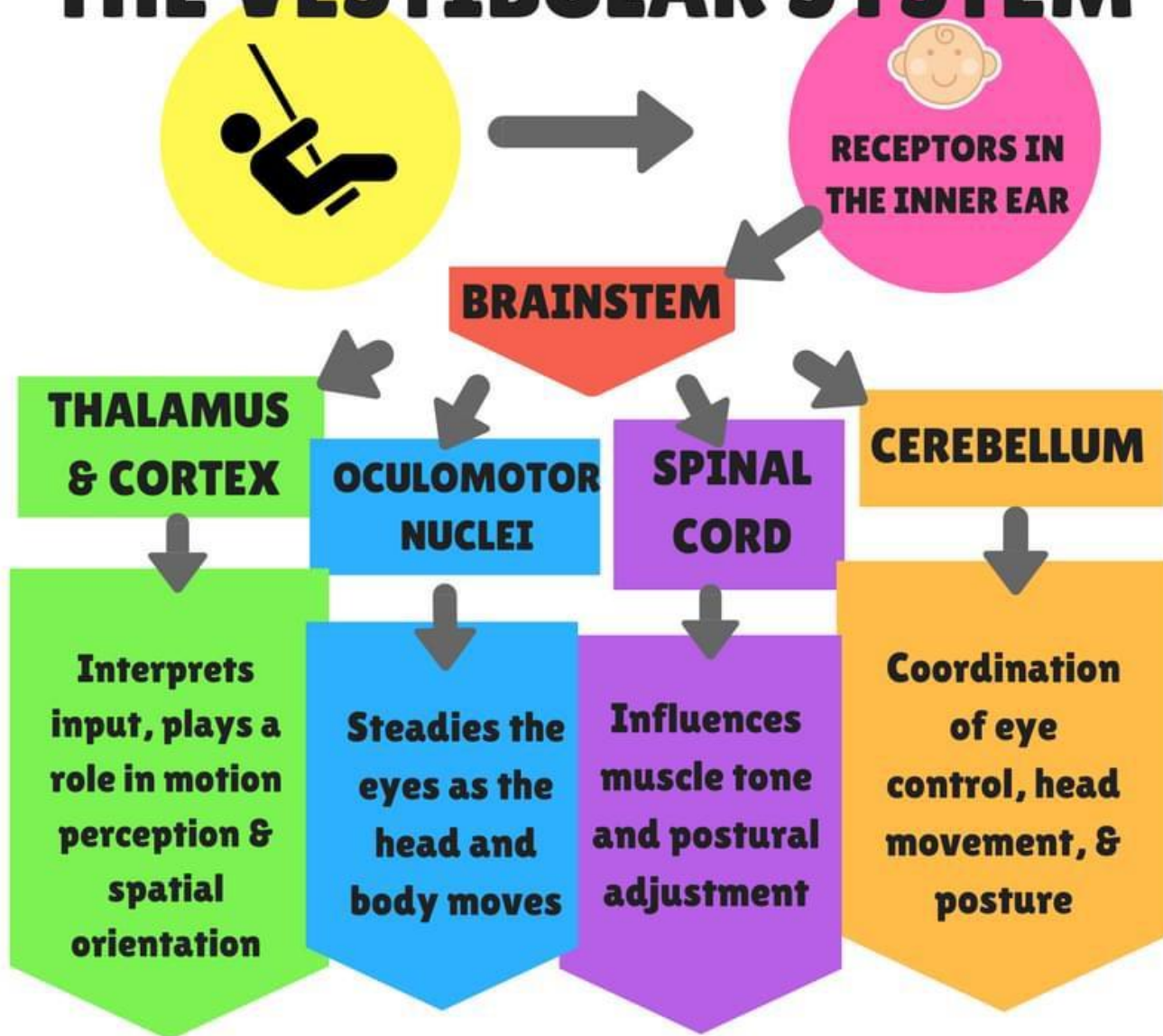
- Originates/receptor in the otolith of inner ear
 - Controlled by head/neck flexion and extension
 - HIGH correlation with overall vestibular processing
- 30 weeks GA (12 wks?)
- Gradual integration with emergence of righting, protective, and equilibrium reactions
 - Not expected to fully integrate until 3-3.5yrs
- Primitive response to gravity, head control/alignment
 - Role: muscle tone, helps baby “straighten out” after birth
 - *Precursor to postural control*

Retention of TLR



- Poor muscle tone
- Toe walking
- W sitting
- Poor balance
- Postural difficulties
- Poor spatial orientation
- Poor sequencing skills
- Gravitational insecurity
- Motion sickness, vertigo
- Visual perception difficulties
- Articulation difficulties *feeding*
 - In extension, 45deg ext promotes tongue thrust
- Dysfunction in control of eye movements
 - Postural control required for control of eye movement

THE VESTIBULAR SYSTEM



TLR and Head Control



“Stable perception is an important precursor to cognitive understanding (conception) and...to visualize concepts based on earlier concrete experiences (abstract information), and can affect both learning and emotional behavior.”

(Attention, Balance, and Coordination/ The A.B.C. of Learning Success, 2nd edition. By: Sally Goddard Blythe)

ATNR



ATNR



- 18wks GA, coinciding when mother begins to feel fetal movements
- Integrated between 4-6m old (can persist up to 3.5 years old when sleeping)
- Rotation of head
 - Supine, “fencing position”
 - Early vestibular integration
- prone, baby turns head to one side
 - SIDS research
- Teaches early hand-eye coordination
 - Learning to use vision
 - Newborns have stimulus-bound effect
 - Eyes/head/arm/hand act as unit
 - Helps develop central and peripheral vision, extends vision from near to distance
- Helps develop muscle tone and homo-lateral movement
- Assists in birthing
- Prepares for rolling (retention inhibits rolling)

ATNR



- Decreases as head control improves, visual skills improve, control of movement patterns exercised
- Motor and visual skills work together to “make sense” of the world
 - Includes integration of other sensory systems
 - Ex: visual understanding of texture from touch
 - Mouthing objects, hand to mouth only as ATNR recedes (*midline)
 - Sucking inhibits ATNR

ATNR in Infant



Retention of ATNR



- Difficulty with hand-eye coordination
- Interfere with left/right body integration
- Decreased mouthing of objects and midline holding
- Difficulty crossing midline, physically and visually
- Interference with rolling, crawling, sitting when head turned
- Compensatory patterns (ipsilateral), skipping milestones
- Sitting balance, same side leg ext/opposite leg flexion w/ head rotation
- Poor handwriting
- Physical and visual crossing midline, extended arm position, pencil grasp
 - Shifting in chair, rotation of paper 90 degrees
 - Writing cannot become automatic
- Decreased reading and writing *comprehension*
 - Strong predictor of delayed reading ability

(Jordan-Black 2005, McPhillips-Sheedy, 2004)
- Motor action not automatic, cognitive efforts on motor function vs processing information
- Chronic Neck/Shoulder pain
- Difficulty with visual tracking
- Decreased visual perception skills
- Difficulty with spelling and grammar

STNR



STNR



- 30wks GA, present at birth, recedes, re-emerges at 6-8m of age
 - Inhibited around 11m
- In preparation for crawling
 - Head extends, arms extend, legs flex
 - Assists in breaking up full body patterns (TLR), upper body and lower body
 - Rocking back and forth assist in integration
 - Cannot crawl with STNR present
- Learning pull to stand
 - Pull on side of crib, head flexes, legs extend. Reach up for mama, legs flex, sits.
- May help align occipital and sacral regions of spine
- Assists in developing visual accommodation
 - Movement between near and far point
 - Creeping on hands and knees coincides with development of depth perception
- Creeping/crawling on **hands and knees** assists in *integrating visual systems, body awareness and proprioception, balance, and gravitational security*

Retention of STNR



- Poor posture, predisposition to stand with head forward
 - first reflex to re-emerge in elderly, CNS degeneration
 - Structure → function, posture → structure
- Decreased muscle tone
- W sitting
- Slumped posture
- Interfere with upper/lower body integration
- Poor sitting posture in chair
 - May prefer floor, 'anchored' position in chair, or head on table
- Decreased attention, "ADHD symptoms"
- Poor hand-to-mouth coordination
 - Self feeding, messy
- Toe walking
- Poor hand-eye coordination
- Poor visual accommodation skills
- Decreased vertical tracking (Aligning columns, judging heights, stepping onto escalator)

STNR



Positions prompted by STNR

Spinal Galant



Spinal Galant



- Stimulation of vertebral column, flexion towards stimulus
 - Defense or avoidance reaction
- Theories:
 - transmission of sounds in-utero
 - assists in birth
 - facilitates mobility of trunk to assist in later mobility
- Spinal reflex
- Integration *begins* during first 2-3months of age
- Remains in part until 6-9months.

Retention of Spinal Galant



- Bedwetting
- Fidgeting, falling out of chair, sitting on edge of seat
- Poor concentration
- Sensitivities to clothing
- Decreased short term memory
- Postural difficulties
- Can contribute to development of scoliosis
 - Research showing treatment of scoliosis should include integration of SG, if present. (8)

Conditions, Deficits, and Disorders





- Symptoms of RPR can have a significant negative impact on their own
- *Now imagine if RPR are layered onto one (or more) of the following diagnoses...*

ADHD



- Inattention
- Forgetfulness (but may also easily recall random facts/information)
- Hyperfocus on certain interests and/or activities
- Hyperactivity, fidgeting
- High potential for distractibility/”off task” behavior
- Difficulties initiating and completing tasks
- Impulsivity
- Sensory processing and modulation difficulties
- Time management difficulties
- May appear anxious
- Difficulties with organization and sequencing
 - *(may compensate with very specific organization strategies; may seem rigid in routines)*

Dyslexia



- Difficulties in remembering/naming letters, numbers, colors
- Difficulties in sequencing
- Difficulties with accurate/fluent word recognition
- Difficulties in word finding
- Frequent word substitutions
- Poor spelling and decoding abilities
 - omits, inserts, transposes letters
- Letter reversals (b/d, p/q), inversion of letters (u/n, d/q, b/p)
 - Letter reversals are common up to age 7/2nd grade; should decrease in frequency
- Difficulties in reading and reading comprehension

<https://www.mayoclinic.org/diseases-conditions/dyslexia/symptoms-causes/syc-20353552>

<https://www.understood.org/en/articles/faqs-about-reversing-letters-writing-letters-backwards-and-dyslexia>

<https://www.msl-orton.com/symptoms-of-dyslexia/>

Autism Spectrum Disorder



- Difficulties in social interactions/situations
- Challenges in reading nonverbal cues
- Limited/repetitive patterns of behavior
- May have poor eye contact
- Restricted interests
- Difficulties in play skills, developmental progression of play
- Speech and language difficulties, verbal communication challenges
 - Delayed talking, variations in language processing and language progression
 - Difficulties understanding puns, figures of speech, riddles, jokes
- Repetitive movements/motions and/or sounds
- Difficulties with sensory processing and modulation
- Difficulty generalizing information/concepts or may grossly over generalize
- Rigid routines

<https://www.mayoclinic.org/diseases-conditions/autism-spectrum-disorder/symptoms-causes/syc-20352928>

<https://www.understood.org/articles/what-is-autism>

Sensory Processing Disorder



- Difficulties processing/organizing (“making sense of”) input coming from various sensory systems
 - Tactile
 - Gustatory
 - Olfactory
 - Auditory
 - Visual
 - Vestibular
 - Proprioception
 - Interoception
- Hyper-responsive, Hypo-responsive, mixed
- Results in avoidance or seeking behaviors
- May seem anxious
- May have emotional outbursts

What Is The Connection?



Movement initially from reflexes



Sensory input, engagement with environment



form basis of early learned movement patterns



Continued stimulation of sensory organs and receptors



Continued growth of neurological connections




Continued inhibition of primitive reflexes



Continued stimulation and growth of higher level/more sophisticated regions

Theory of Cause/Effect



- If primitive reflexes are not integrated, they “hold back” related and more complex skills
 - Remember: primitive reflexes are brainstem level control/actions
- Several primitive reflexes are bilateral 
 - Retention creates deficits in whole brain maturity, imbalance in R/L communication

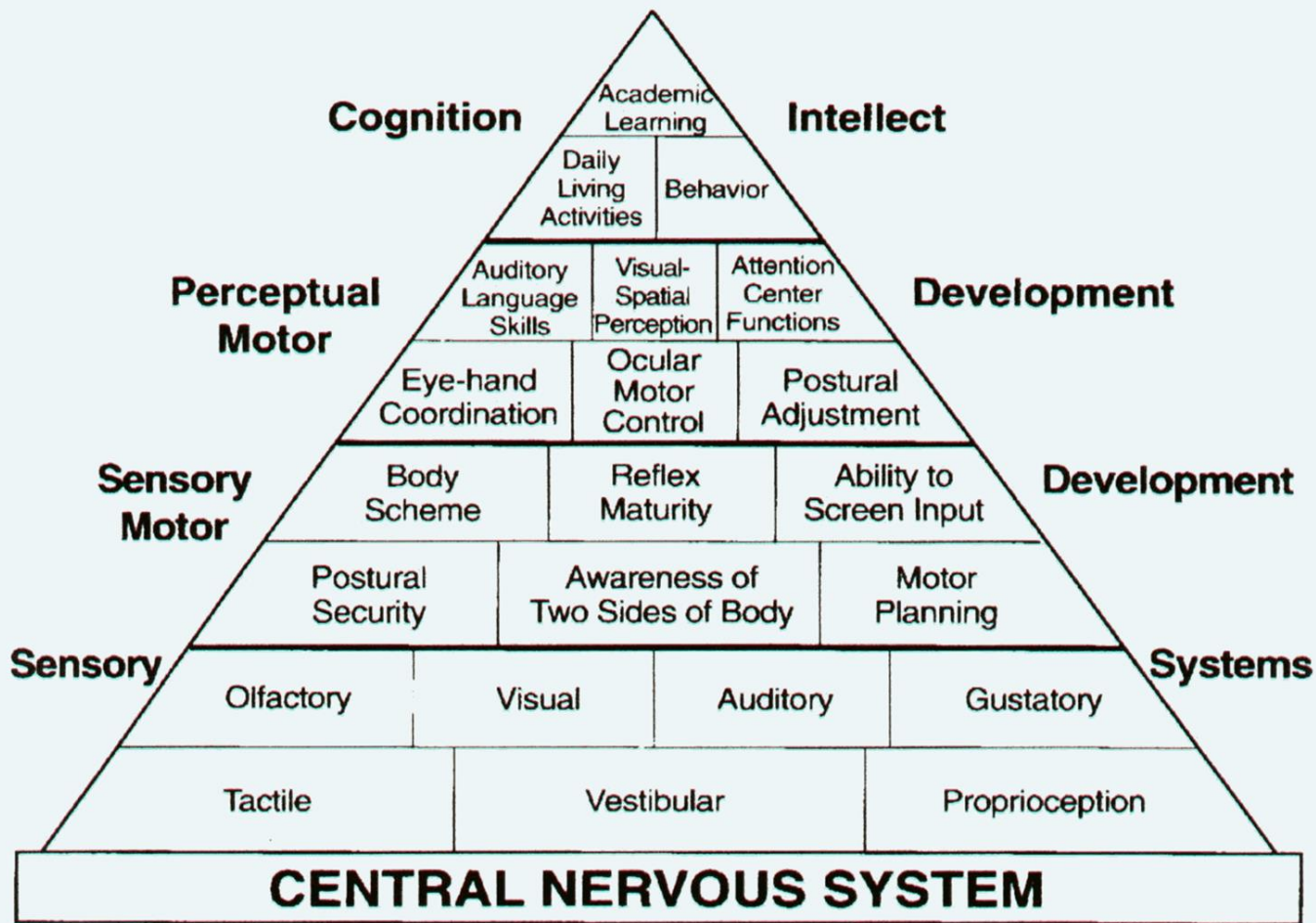


Figure 5. Pyramid of Learning. (Williams & Shellenberger, 1-4)

Why Does It Matter?



- **MISMATCH** between intended movement patterns and body's reaction
 - Creating decreased ability to learn with cortical energy placed on control of body
- **CANNOT** have effective oculomotor skills with underlying foundational problems and miscommunication between systems
- Impedes on various higher-level motor, sensory, and learning skills

- *Does integration of reflexes and foundational skill work “fix” ADHD, Dyslexia, ASD?*
 - Absolutely not.
 - Sensory Processing Disorder? Possibly.
- *Can integration of reflexes and foundational skill work help lessen the symptoms and improve overall progress and QOL??*
 - Absolutely.

What Do We Do?



- Integrate the retained reflexes
- Work on improving bilateral integration and bilateral coordination
- Work on improving specific sensory processing skills
 - Vestibular, Visual
- Work on improving multi-sensory processing skills
 - Layering task demands

Constant and fluid progression of skill building



- **Bilateral Integration:** refers to the fluid communication between R/L cerebral hemispheres
 - Involves cross-midline patterns (information traveling fluidly across corpus collosum)
- **Bilateral Coordination:** the ability to use R and L sides of the body for different tasks (stabilizing paper while writing, stringing beads)
- Bilateral integration maturity imperative for bilateral coordination maturity
 - spectrum, not on/off
 - Skill levels correlate/correspond

How Do We Know Foundational Skill Work Helps?

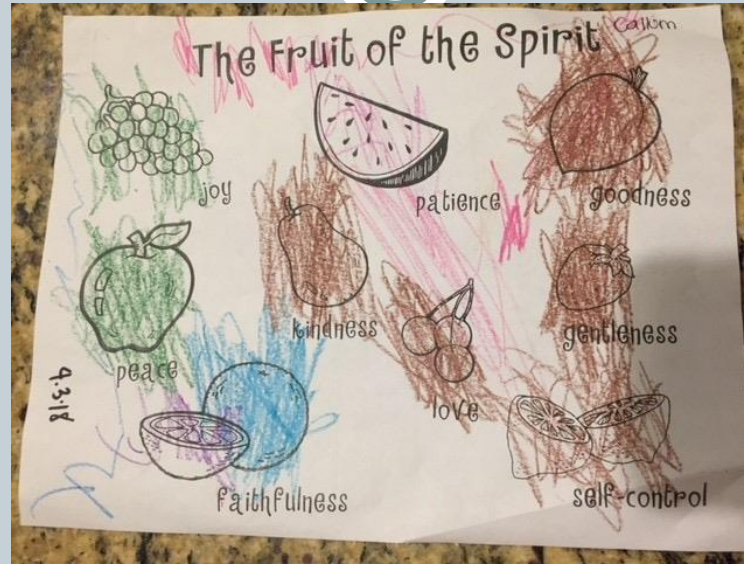


- Milestone achievement/skill progression
- Beery VMI scores, pre and post tests
- Caregiver report of symptoms (including Sensory Profile)
- Teacher report of progress in classroom and improved grades
- Progress reports from other professionals
 - Audiology
 - Optometry
 - ✦ COVD QOL checklist

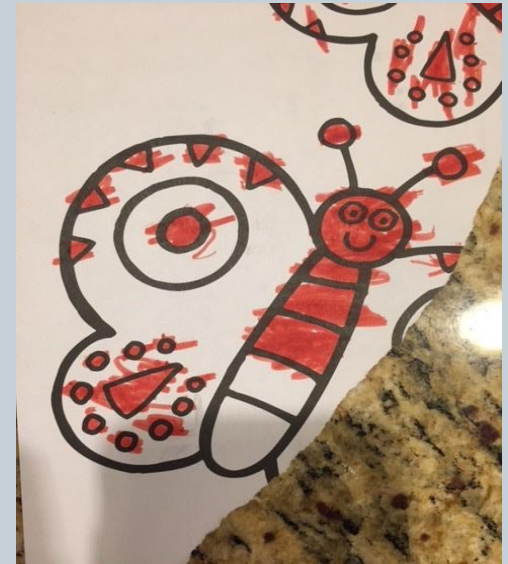
Coloring Progression



March 2018



April 3, 2018



April 30, 2018

Research



- “The results of the present research indicate that students who retain ATNR, STNR, and/or TLR may benefit from therapy services that focus on integrating these reflexes in order to promote the development of visual skills needed for success at school.” (3)
- “...an association between primitive reflexes and the development of ocular movements in fifth grade students with reported reading problems. They indicated that the MR, TLR, STNR, and ATNR were associated with decreased precise saccadic eye movements, in addition to poor reading performance, with TLR showing the strongest association with deficit.”(3)

Research



- “The findings of the three studies all suggested that there is a **significant relationship between retained primitive reflexes and ADHD in children**. The first study showed significant correlations... for ATNR and anxiety, ATNR and perfectionism, STNR and CPQ, and STNR and impulsivity-hyperactivity. Significant correlations...were found between ATNR and CPQ, ATNR and impulsivity-hyperactivity, and **STNR and learning problems**. The second study showed a significant correlation between **ATNR scores and ADHD symptoms**...CPQ subscales including anxiety, impulsivity-hyperactivity, learning problems, and conduct problems were significant...The third study showed **Moro and Galant reflexes in children with ADHD** were much more prevalent than those reflexes in healthy children.” (4)

- CPQ: Conners Parent Questionnaire

Research



- “There were significant associations between the saccadic eye movement parameters and the primitive reflexes, especially as related to STNR and TLR, in those children with reading problems” (5)

Research



- “Individuals with ASD and other neurobehavioral disorders have also evidenced a reduction of interregional brain connectivity ([25](#), [27](#), [43](#), [44](#), [94](#), [95](#), [102](#), [134–139](#)). The corpus callosum appears to be the brain area associated with the reduced cortical connectivity found in individuals with ASD ([140](#)). This implies that the most frequently evidenced functional disconnectivity observed in childhood involves hemispheric interaction. This is a notable reported characteristic difference between ASD and normally developing toddlers ([141](#))” (11)

Research



- “Numerous authors have reported on an association between clumsiness and incoordination, particularly in gait and posture, and ASD, ADHD, and other neurobehavioral disorders of childhood ([163](#), [169](#), [170](#)).” (11)

Research



- “Mature responses in a child's psychomotor behavior can only occur if the central nervous system has reached the appropriate level of maturity ([21](#), [210](#), [212](#)). The process consists of the transition from brainstem reflex response represented in [Figure 2](#) to cortically controlled responses ([213](#)).” (11)

Research



- “In longitudinal studies of 3- to 6-month-old infants' motor development of high-risk (HR) infants, over 70% of infants with motor delay later demonstrated communication impairment. Motor development is associated with a normally automatic progression in which infant maturation inhibits more primitive motor responses ([217–219](#)).” (11)

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