Reflexes:

The Foundation of Function

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About the Speaker

- University of Tennessee at Chattanooga – Class of 2023
- Doctoral Capstone: The Business of Reflexes
- Outpatient pediatrics/early intervention, pediatric acute care/NICU

What to Expect

Defining a Reflex

Reflex Characteristics

Neuroscience & Theories

Common Reflexes

Clinical Implications

Opportunities & Recap

“It’s like going back so that we can move forward.”

—Brittney C., a super cool mom

Reflex Definition

A reflex is an automatic, involuntary motor response to a specific sensory stimulus

Blythe & Blythe, 2012; Calvin & Ramli, 2020; Chandradasa & Rathnayake, 2019, Schultz-Krohn & Mclaughlin-Gray, 2018; Goddard, 2005

Reflex Characteristics

Onset

When the reflex is active

Integration

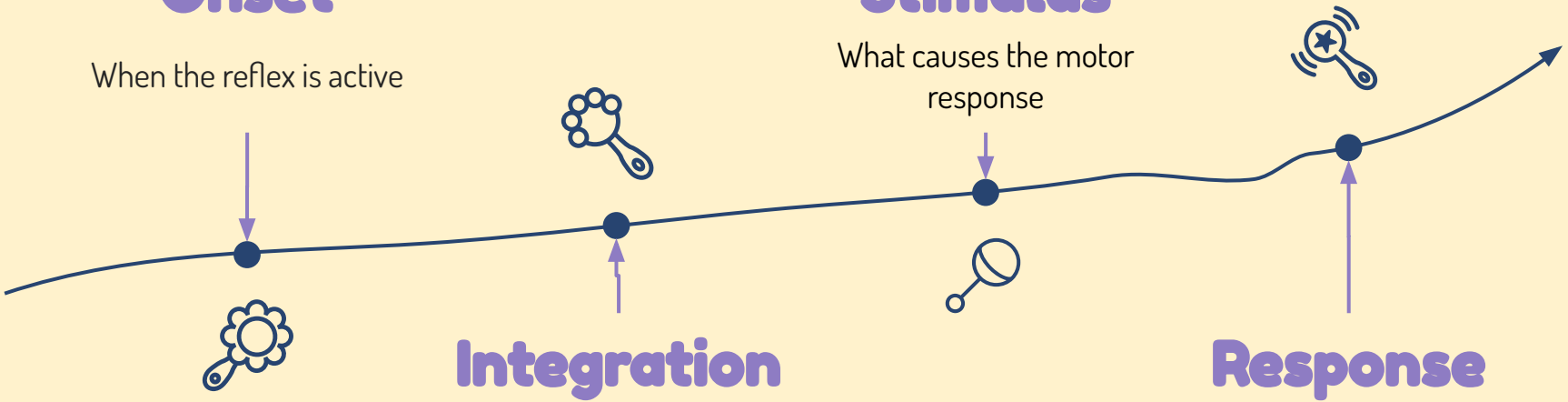
When the reflex disappears

Stimulus

What causes the motor response

Response

What happens when exposed to the stimulus



Reflex Characteristics: The Purpose

Survival

Initially, reflexes exist for an infant's survival and protection. Think about Moro, Rooting, Parachute, etc.

Development

Reflexes help a child to develop motorically, as well as to mature the nervous system

Blythe & Blythe, 2012; Calvin & Ramli, 2020; Chandradasa & Rathnayake, 2019, Schultz-Krohn & Mclaughlin-Gray, 2018; Goddard, 2005

The Neuroscience

Sensory Input, Motor Output

Brain Maturity

Trauma

Neuroscience: Sensory Input & Motor Output

- Sensory system registers the input
- Input goes up to the subcortical areas of the brain or the spinal cord
- Motor system is told to respond

Akbuga & Elioz, 2021; Gilmore & Spaulding, 2001; Abrams & Ivy, 2018

Neuroscience: Brain Maturity

- Many of the survival reflexes originate in the brainstem
- Central nervous system maturity as control of the reflex shifts from the brainstem to the cortex
- Shifting to cortical control allows the neural pathways to strengthen, myelinate, and mature

Calvin & Ramli, 2020; Chandradasa & Rathnayake, 2019; Hobo et al., 2014; Schultz-Krohn & Mclaughlin-Gray, 2018; Shaw & Soto-Garcia, 2021

Neuroscience: Trauma

- Think back to the purpose of a reflex: survival
- Emotional and physical trauma
- TBIs/CVAs
- Childhood history: NICU, foster, etc.

Masgutova & Masgutov, 2017; Chandradasa & Rathnayake, 2019; Schultz-Krohn & Mclaughlin-Gray, 2018; Yavuz et al., 2022; Blythe & Blythe, 2012; Walterfang & Velakoulis, 2005

Supportive Theories

Motor Control & Motor Learning

Ayres Sensory Integration (ASI)

Sensorimotor Frame of Reference (FOR)

Theory: Motor Control & Motor Learning

- Motor control: “study of the nature and causes of movement” (Gilmore & Spaulding, 2001, p. 2)
  - Postural control, movement, and balance stem from the functions of motor control.
- Motor learning: neuroplastic alterations in movement, emotions, and behaviors due to continual practice
  - True motor learning is achieved when a skill or motor pattern is evident and remains over time

Gilmore & Spaulding, 2001

Theory: Motor Control & Motor Learning

- Top down approach
- Reflex integration: similar principles/reasoning, opposite approach
- Reflex integration looks at the **building blocks** or developmental foundation in the neurological system of the child
- Reflexes are "the basic units of motor control" (Schultz-Krohn & Mclaughlin-Gray, 2018, p#)

O'Briet et al., 2020; Schultz-Krohn & Mclaughlin-Gray, 2018

Theory: ASI

- Sensory Integration: “the neurological relationships between sensation, movement, learning, and behavior” (Roley et al., 2020, p. 87)
- Regulation of the sensory system
- Bottom-up approach

Roley et al., 2020

Theory: Sensorimotor

- Purposeful reorganization of the brain where sensory input and motor output is interpreted and understood
- Motor function can be regained with strategic and purposeful sensory input
- Intrinsic vs extrinsic feedback
- Rood, Brunnstrom, PNF, and NDT

Schultz-Krohn & Pendleton, 2018; Gilmore & Spaulding, 2001

Theory: Sensorimotor

- Reflexes align with this FOR because:
  - Developmental progression and protective features of reflexes
  - Hierarchy of motor control systems in the CNS
  - Sensorimotor approach to OT intervention is the combination of motor control and motor learning principles with the knowledge and understanding of sensory integration

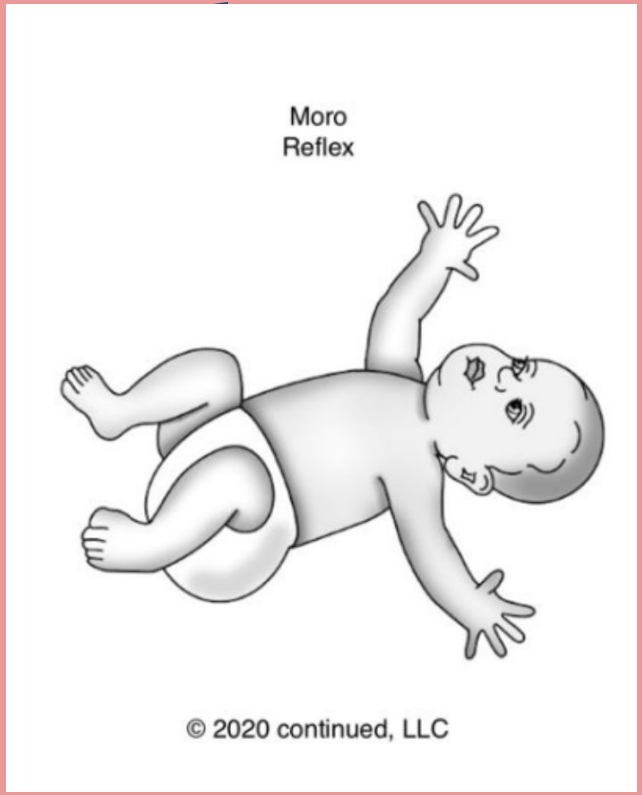
Schultz-Krohn & Mclaughlin-Gray, 2018

The Reflexes

Reflexes

- **Moro***
- **Landau***
- **Asymmetric Tonic Neck Reflex (ATNR)***
- **Symmetric Tonic Neck Reflex (STNR)***
- Tonic Labyrinthine Reflex (TLR)
- **Parachute Reflexes (AKA: protective extension, hands supporting)***
- **Palmar Grasp***
- Plantar Grasp
- Babinski
- **Spinal Galant***
- Spinal Perez
- Automatic Gait (AKA: Staggering Lower Extremity)
- Equilibrium Reactions
- Body Righting Reactions
- Traction (AKA: Hands Pulling)
- Trunk Extension
- Babkin Palmomental
- Leg Cross Flexion Extension

***Going over today!**



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Moro

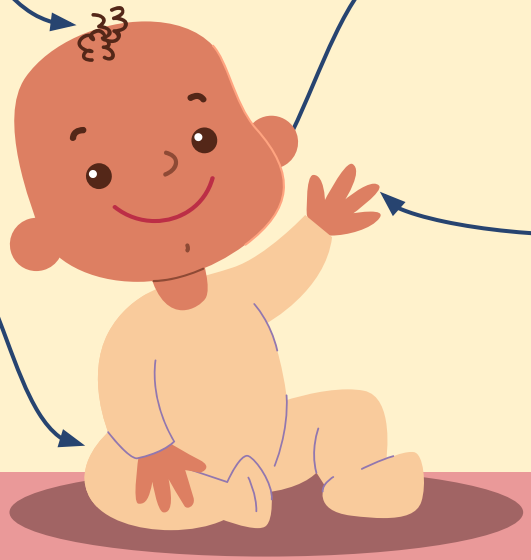
Moro

Age of Onset

Active at birth

Age of Integration

4 to 6 months



Stimulus

Head extending > 30*

Response

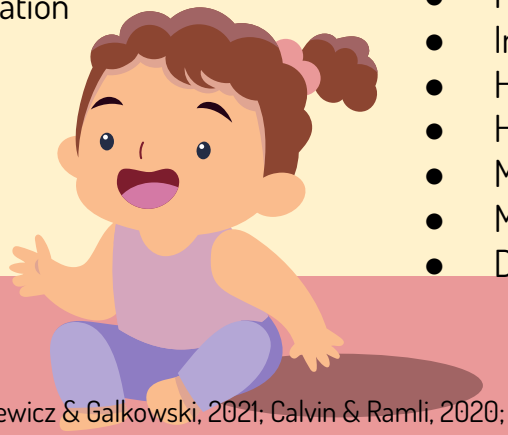
Arms extend, hands open, then arms flex and hands close

Smet & Lucas, 2020

Moro

Developmental Purpose

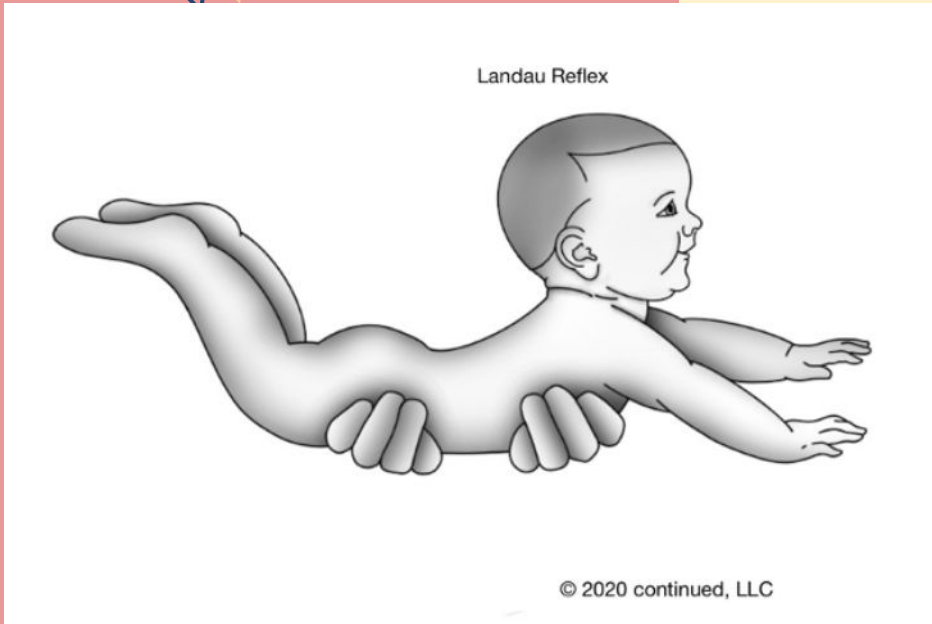
- Extension for first breath at birth
- Fight or flight activation
- Connection & Communication



Clinical Implications

- Poor head control
- Poor balance
- Poor protective reactions
- Poor focus and concentration
- Increased anxiety
- Hyperactivity
- Hypersensitivity
- Motion sickness
- Mistrust
- Dependency

Smet & Lucas, 2020; Akbuga & Elioz. 2021; Matuszkiewicz & Galkowski, 2021; Calvin & Ramli, 2020; Chandradasa & Rathnayake, 2019; Grigg et al., 2018; Goddard, 2005



landaureflex.png

Landau

Landau

Age of Onset

3-4 months

Age of Integration

12-24 months

Stimulus

Suspension and active/passive extension of the head

Response

Hips and legs extend; upper extremities extend and abduct; elbows typically flex

Smet & Lucas, 2020

Landau

Developmental Purpose

- Postural tone and strength
- Cervical and extensor tone and strength

Clinical Implications

- Decreased postural development
- Poor tolerance to tummy time
- Clumsy gross motor skills
- Depression
- Poor concentration

Smet & Lucas, 2020; Goddard, 2005

ATNR Sketch.png

ATNR

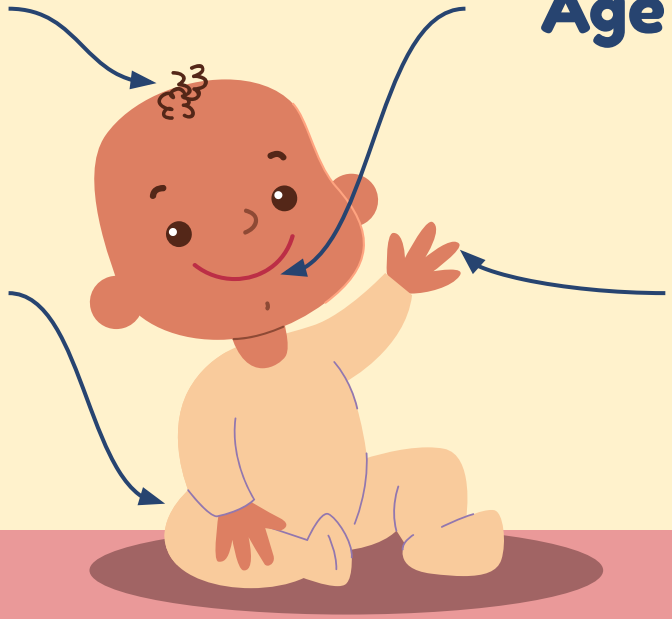
ATNR

Age of Onset

Active at birth

Age of Integration

Between 4 to 6 months



Stimulus

Unilateral cervical rotation to the left or to the right

Response

Extension of both the upper and lower extremities on the face side, flexion of both upper and lower extremities on the skull side

Smet & Lucas, 2020

ATNR

Developmental Purpose

- Active participation in the birthing process
- Foundation for crawling and creeping
- Hand eye coordination
- Harmony between both sides of the brain = harmony between both sides of the body

Clinical Implications

- Dyslexia
- Poor hand-eye coordination
- Poor balance
- Difficulty crossing midline
- Decreased rolling
- Poor reaching and grasping
- Poor attention, memory, and focus

Smet & Lucas, 2020; Calvin & Ramli, 2020; Chandradasa & Rathnayake, 2019; Gieysztor et al., 2015; Goddard, 2005

STNR-Reflex.jpg

STNR

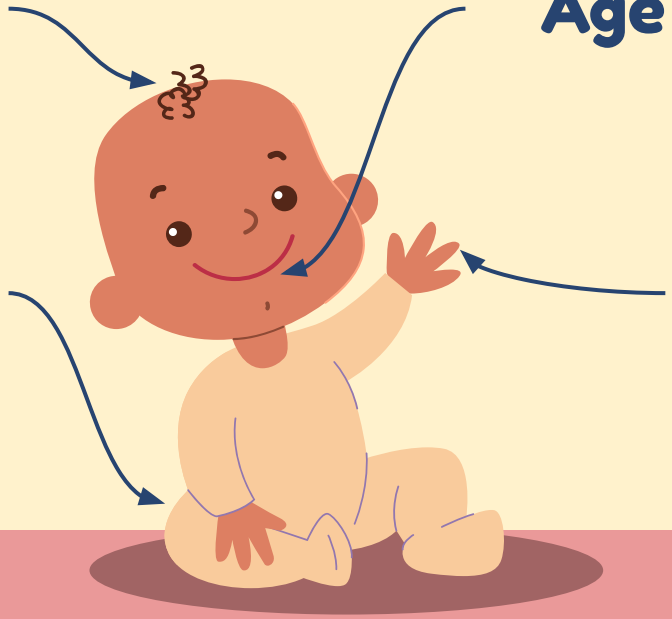
STNR

Age of Onset

Birth

Age of Integration

4-6 months



Stimulus

Forward flexion or backward extension of the head

Response

When the neck flexes, the upper extremities flex and the legs extend. When the neck extends, the upper extremities extend and legs flex

Smet & Lucas, 2020

STNR

Developmental Purpose

- Regulation of balance and differentiation of upper and lower body.
- Important for transitional movements.
- Developing stability and endurance against gravity.

Clinical Implications

- Academic challenges
- Poor posture
- Poor hand-eye coordination
- Poor focus and concentration
- Difficulty with gross motor patterns
- Positional and postural fatigue

Smet & Lucas, 2020; Calvin & Ramli, 2020; Matuszkiewicz & Galkowski, 2021; Gieysztor et al., 2015; Goddard, 2005

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Parachute/ Hands Supporting

Parachute

Age of Onset

6-9 months

Age of Integration

Lifelong

Stimulus

Loss of balance forward/backward/to either side

Response

Arms come out to support and brace for fall

Smet & Lucas, 2020

Parachute

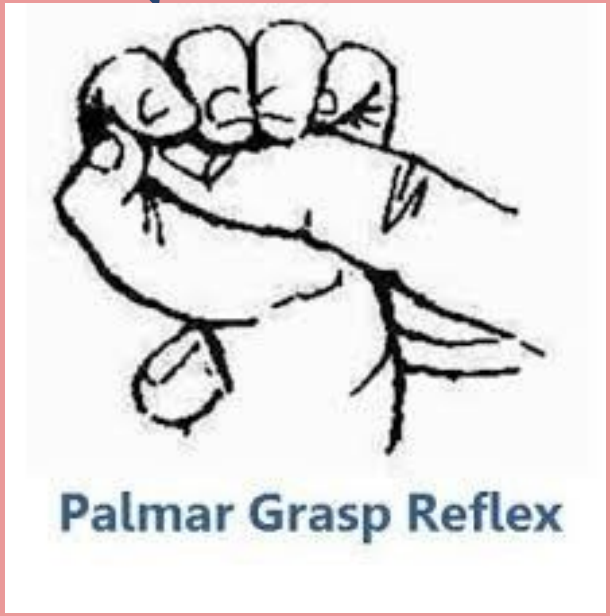
Developmental Purpose

- Protection
- Boundaries

Clinical Implications

- Poor protective responses
- Decreased ability to catch self and protect the face in a fall
- Pushing boundaries

Smet & Lucas, 2020



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Palmar

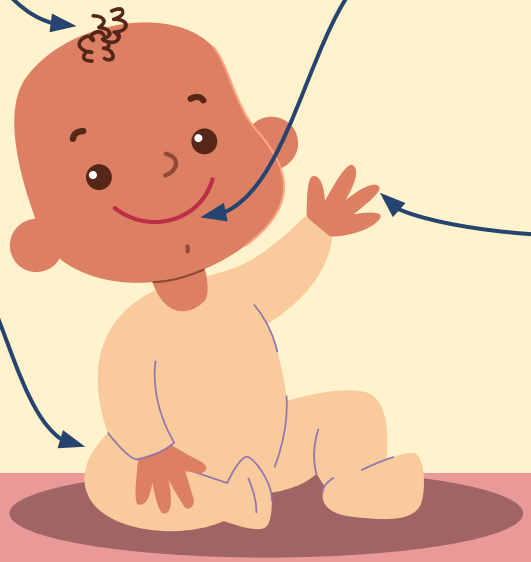
Palmar

Age of Onset

Birth

Age of Integration

4-6 months



Stimulus

Pressing at the base of the fingers on the palmar side of the hand

Response

Automatic fisting / finger flexion

Chandradasa & Rathnayake, 2019; Smet & Lucas, 2020; Goddard, 2005

Palmar

Developmental Purpose

- Fine motor skills
- Fine and gross motor coordination
- Hand-eye coordination

Clinical Implications

- Poor release of objects
- Challenges with handwriting, tying laces
- Poor hand-eye coordination
- Extreme or inefficient pressure applied to writing utensils
- Decreased endurance in hand musculature
- Declined speech, communication, and language development

Goddard, 2005; Smet & Lucas, 2020; Chandradassa & Rathnayake, 2019

Spinogalant.jpg

Spinal Galant

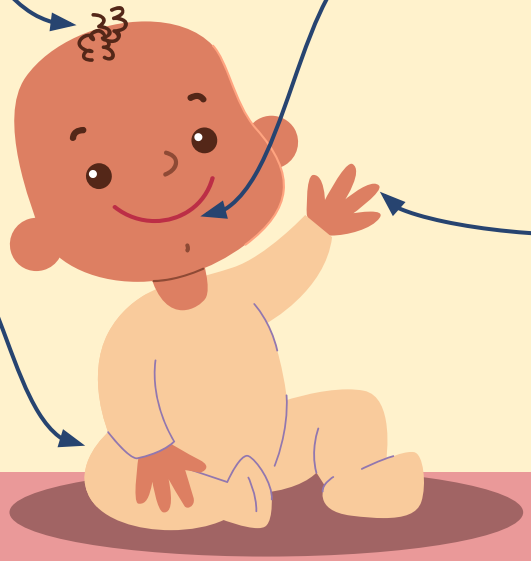
Spinal Galant

Age of Onset

Birth

Age of Integration

3-9 months



Stimulus

Superficial stroke lateral to the spine from T1 to sacrum

Response

Lateral flexion of the spine / upward hip rotation on stimulated side

Goddard, 2005; Chandradasa & Rathnayake, 2019; Matuszkiewicz & Galkowski, 2021; Blythe & Blythe, 2012

Spinal Galant

Developmental Purpose

- Empty the bladder
- Conduction of sound in utero

Clinical Implications

- Decreased balance
- Abnormal gait
- Poor concentration
- Increased risk of scoliosis
- Chronic enuresis beyond age 5
- Hyperactivity
- Sensory complaints
- Auditory processing challenges
- Gross motor coordination challenges

Matuszkieqicz & Galkowski, 2021; Calvin & Ramli, 2020; Chandradassa & Rathnayake, 2019; Grigg et al., 2019; Goddard, 2005

General Clinical Implications

Diagnoses & Populations

Practice Settings

Occupational Performance

Diagnoses & Populations

- Cerebral Palsy (CP)
- Autism Spectrum Disorder (ASD)
- Attention-Deficit Hyperactivity Disorder (ADHD)
- Developmental Delay (DD)
- Traumatic Brain Injuries (TBI)
- Cerebrovascular Accidents (CVA)
- Psychological Diagnoses
- Across the lifespan

Matuszkiewicz & Galkowski, 2021; Calvin & Ramli, 2020; Shaw & Soto-Garcia, 2021; Gieysztor et al., 2015; Akbuga & Elioz, 2021; Grigg et al., 2018; Walterfang & Velakoulis, 20015; Schott & Rossor, 2003

Practice Settings

- Outpatient Pediatrics
- Early Intervention
- School-based

Gieysztor et al., 2015; Akbuga & Elioz, 2021; Calvin & Ramli, 2020; Richards et al., 2022

Occupational Performance

- Academic skills
- Gross motor coordination skills
- Fine motor coordination skills
- Executive functioning
- Social participation
- ... Basically, everything

Okay... What now?

- Screening
- Understanding the reflex, purpose, and implications
- **PATIENT HISTORY!!!**
- Integrate that reflex!
  - Various protocols
  - Go with what you know
  - Incorporate it into activities and play
  - Think back to “baby stages”

Protocols & CEUs

RMTi

Rhythmic Movement Therapy, Kerstin Linde

MNRI

Masgutova Neurosensorimotor Reflex Integration, Dr. Masgutova

Dr. Pryor's CPRI

Certification in Primitive Reflex Integration, Dr. Karen Pryor

INPP

Institute for Neuro-Physiological Psychology, Sally Goddard

Brain Balance

Brain training protocol

And many others!

Key Takeaways

- Reflexes are important for survival and development
- It is hard to study and research, but when you look beyond surface level, the support is there
- Reflex integration is a root, foundational level intervention

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Thanks!

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