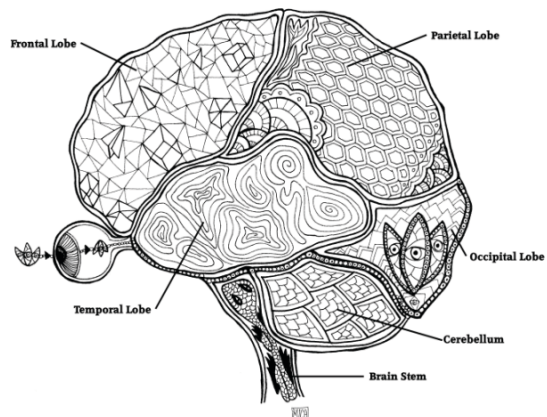


# Neuroplasticity

## Primitive Reflexes

## Tone



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1

## Financial and Non-Financial Disclosure

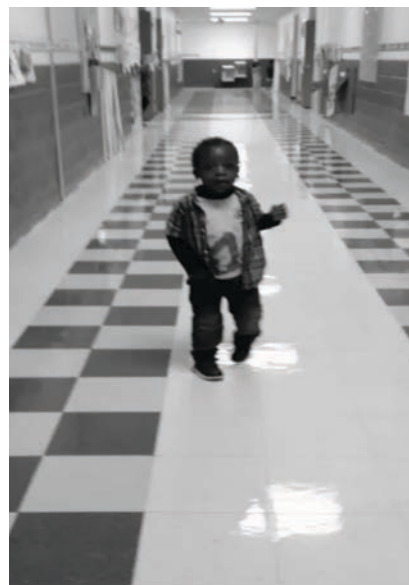
- I have financial interest in advertising my book
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- I am paid by STAR for giving this lecture.
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## Sensation is the Teacher

- Sensation enters the nervous system
- Processing occurs
- Expression is demonstrated through movement – motor
- If we do not like what we see in movement – change the sensation going into the systems
- Direct information into areas of the central nervous system that are working well.



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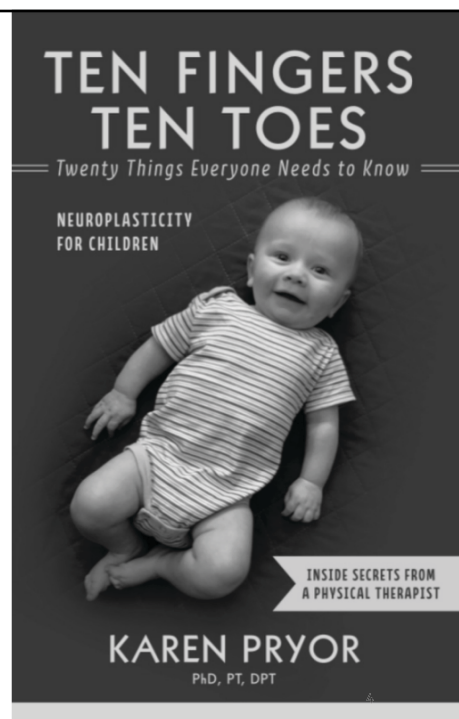
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## Treating the Nervous System

Changes Motor Skills Quickly

Specialty:  
Neuroplasticity Techniques

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## Seizure surgery - CHOP Move function

- MD and nursing had not seen a child move in the recovery room after surgery.
- They watched him in his hospital room.
- Medical personnel wanted to know how that happened.



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## Start at the Head – Close to the Brain

- Same as the fetus development
- Build brain function with micro-milestones
- Increased functional connections
- Practice makes pathways
- Have simple toys, equipment in the home



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## Case study

- Abnormal gait cycle
- Poor coordination
- Falls
- Poor perception of self



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## Prepare the Nervous System

- Location, location, location
- The child will reference everything from their position
- If a child does not know where they are in reference to their surroundings...
- They appear clumsy
- Falling often
- The child may be in fight or flight and watch everywhere they walk or move



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## Stimulation with the hands

- Stimulation of the skin – 3-D fashion
- Start at the head then move to neck and trunk
- Upper extremities to hands
- Lower extremities to feet
- Rub your arm and hand then close your eyes

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## Proprioception is Inside Information

- Proprioceptive stimulation –
  - Tap on elbow toward shoulder
  - Hand toward shoulder
  - Knee toward hip
  - Heel toward hip
- Bounce on ball or mat while sitting
- Pat on the diaper while holding the baby/child



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## Rotation, Rotation, Rotation

- Required
- Gross motor balance, visual tracking, agility
- Fine motor hand functions
- Start with the eyes and cervical spine
- Tone affects rotational ability
- Low tone may allow flexion and extension motions or a sinking of the trunk on extremities rather than support the body parts and rotate for coordinated motion



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## High tone or spasticity

- High tone may restrict the ability of the body to permit rotation when needed
- Challenges:
  - The child will have difficulty coming to sitting
  - The child will not be able to catch their balance in sitting and challenges pulling to standing
  - Walk with a wide based gait and difficulty or unable to jump
  - Numb and dumb to decrease tone

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## Low tone

- Low tone may allow flexion and extension motions or a sinking of the trunk on extremities in 4 point rather that support the body parts and rotate for coordinated motion
- In sitting the trunk may resemble a "C" shape
- **Tone is not the same as strength**
- Many times low tone in the "core" is actually low tone. Strengthening the muscles of the trunk may not change the problem, since tone is from the brain.
- Changing the low tone to typical prepares the child for strengthening
- Wake up the tone with short brisk stimulation

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## Rotation

- Eyes – up, down, right, left, near, far
- Visual tracking will lead the neck to rotate
- If persistent nystagmus – use vibrator (seizure precautions)
- Trunk – in supine bring knees up and rotate legs while leaving the upper body stationary on the floor

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## Rotation and Movement of Semicircular Canals

- Rock, roll and swing, vestibular stimulation and nystagmus resolution
- Upper extremities – roll like a clay snake – slowly supinate and pronate hand
- Hands – gently roll the fingers, improved fine motor skills
- Lower extremities – roll slowly internal and external rotation, assists in balance
- Feet – hold to the heel and slowly rotate the foot then the toes

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## Neuroplasticity

- **Find out what part of the nervous system is damaged, challenged and or not functioning as well as what is working well.**
- Example: If a child can not see because of cortical vision impairment, yet is able to hear.
- Combine visual tracking with sound.
- The nervous system will rewire function and travel on the patent fast track
- We have had 10 children diagnosed as blind, able to see and discharged by the Pediatric Neuro-ophthalmologist as having functional vision in 8 months of therapy.
- Obtain MRI, EEG, CT, diagnostic studies, birth history and medical care

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## Neuroplasticity

- The reverse is also true with hearing and vision and in the central nervous system, they are next door neighbors
- If a child is unable to hear or has hearing aids, combine activities with sound, vestibular and vision activities
- Our program has had 4 patients discharged with several sets of hearing aids handed to the parent, because they were no longer needed.

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## Sensory Stimulation

- Cranial nerve stimulation
- Vision – sound with lights or red toy
- Sound – Noisy toy
- Vestibular – Rock, roll and swing
- Stimulation to face with brisk hands, chilly fingers
- Smell – citrus – NIH 2014 study – Sniff out stem cell formation



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## Wake up the Body

- Hand brisk stimulation head -> toes
- Temperature – chilly fingers
- Vibration proximal to distal
- Proprioception – tap on joints

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## Weight Bearing

- Manual support
- If you don't like what you are seeing – change your hand position
- Hold to clothing if possible
- Your hands have energy and children give into being held
- Holding to clothing allows the child to attend to independent movements
- Sitting, 4-point, Tall kneeling, Standing
- Hand placement is most effective over joints rather than muscle bellies to promote independent motion.

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20



## Sensational Hand Placement

- Sitting – head drop forward – touch nose
- Hold wrists with index and thumb to promote protective response
- 4 point –tap on shoulders toward hands and hips toward knees
- Tall kneeling – Hold back of shirt in thoracic area
- Standing - hold shoulders of clothing
- Walking-hold top of shirt



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## Watch Their Tone

- Low tone and high tone are both driven by the central nervous system
- Low tone – feels floppy, difficulty with active movement against gravity
- High tone – spasticity, resistance to passive and active movements may demonstrate patterns of movement



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## Low tone

- May be diagnosis related or unknown
- Eyes may be misaligned
  - striated muscles in eyes follow tone in body
  - common presentation is medial eye with lateral rectus low tone
- May have difficulty rolling
  - eyes and neck lead rolling
  - slow movements
- Slow protective response is sitting
  - Inadequate trunk rotation
  - Slow response to vision, vestibular changes and stretch in trunk
- May demonstrate pes planus bilateral



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## High tone

- May be diagnosis related to higher center damage
- Influenced through sensation
- Numb and dumb areas to decrease tone and response to sensation
- Hand placement of the therapist around joints to decrease muscle contraction from tone
- Relationship to primitive reflex patterns



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# Primitive Reflexes

Cortical or midbrain damage

Lower brain centers are active

Brainstem – reptilian movement demonstration

Unable to roll or rotate

Eyes may move independently

Difficulty coming to sitting



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## Why? Delayed Integration of Primitive Reflex Patterns

- Damage to the cortex or underlying structures
- Lack of opportunity for movement and sensation
- Splinting, chairs, restricted movement
  - Free the child to explore
- On – off for supportive structures and bracing
- Whatever fires together wires together – Hebb Principle
- Whatever fires apart wires apart



HIE (Hypo-Ischemic Encephalopathy)  
Retained primitive reflexes  
Misalignment of eyes, facial symmetry

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26

## Integration of Primitive Reflexes Start at the Head

- Try to get the visual attention of the baby or child.
- The first signs of retention of primitive reflexes may be noted in the head, face, neck and eye muscle tone qualities
  - Identify the area of a challenge
  - Asymmetrical position
  - Higher or lower muscle tone
  - The child may be treated to decrease demonstration in the body and upper and lower extremities.



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## Sensory Experiences

- All primitive reflexes are elicited by sensory experiences – If the primitive reflexes are not demonstrated, check closely at the child's history, high or low tone, MRI scans and early trauma
- Treat the cause – Neurologically impaired sensation reception and interpretation
  - The symptoms will decrease with sensory treatments
- Since the learning process of the nervous system is through sensation - that is the avenue we must pursue.
- Children with misaligned eyes may tend to turn the head to improve eye alignment in self correction for improved 3 dimensional vision
- Infants can see things we are unable to see. (Nakashima, Kanazawa, et al. 2021)



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## Power Driver vs Passive Force

- What drives primitive reflex patterns?
  - Head and neck movements are regulated and dictated by the eyes/vision/vestibular
  - Vision connects to 80% of CNS and is a power driver
- Concern with active movements rather than passive for testing and treatment
- Reflex movements are patterned, we need to include face, neck, eyes and tongue
- Many times the reflex patterns are mixed



## Sensation and Movement

- Movement of a primitive reflex assists the baby in sensory awareness of their body and surroundings, but they must be able to detect sensation to adequately respond and progress through the integration process and achieve milestones
- Test with active motions because we want to observe voluntary motion interference, direct integration and how the child moves
- The patient performs active rather than passive movements in life
- Children with sensory processing disorders, Autism, Neonatal abstinence syndrome and more need therapy to increase sensory perception, interpretation and movement in the environment





## Customary Testing

- There are primary testing positions for testing primitive reflexes
- Obligatory primitive reflexes can affect the child in multiple positions and transitional movements



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31

## Testing

- Test in different positions and functional active movements- Prone, supine, sitting, standing, walk and run (Lead with visual stimulation)
- Gravity affects cranial nerve stimulation Semicircular canals – start motion, inertia, direction and speed changes and stopping

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32



## Testing in Prone

- Visual track to right and not if there are changes in tone qualities/ movement of upper and lower extremities.
- Next visually track to left
- Visually track toward chest – inferior – watch for flexion postures that are obligatory and not variable.
- Take the eye stimulation object superiorly – watch for extension, bilateral changes in arms or leg posture.
- When there are motions that interfere with control in prone and visual fixation on your light
- Dx: Smith Kingsmore Syndrome ATNR right
- Combine activities with cortical involvement to decrease reliance on primitive reflex demonstrations

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## Testing in Supine

- Visual track to right and not if there are changes in tone qualities/ movement of upper and lower extremities or curving of spine
- Next visually track to left
- Visually track toward chest – inferior – watch for flexion postures that are obligatory and not variable.

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34

## Reaching

- Have the child reach for a toy while tracking – ipsilateral and contralateral reaching
- When there are motions that interfere with control in prone and visual fixation on your light
- Watch to see if the child can come to midline
- Cross midline?

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## Crawling / Creeping

- Watch for symmetrical crawl / creep
  - Ipsilateral – Is there poor ability to rotate, increased tone to the point of spasticity?
  - Contralateral – watch for even movement of hands and knees
  - Bear crawl – may use this technique to compensate for low tone.
- Head turning and visual tracking – guide their vision
- Check for torticollis and mis-shaped head



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- Scooting on one hip – may lack rotation in neck and trunk. May have high tone in one side of the trunk, UE and LE. Mobilize neck, back, desensitize and add rotational movements
- Bunny hopping – May have poor rotation, address rolling and segmental separation of neck and trunk movements

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## Testing in standing

- Check for posture and alignment -Anterior, posterior or lateral
- Give the child a visual cue to look up at a rattle and/or light
- Watch to see if one of both legs are flexed or extended
- Have the child visually track to the right or left and watch to see if there are positional changes in the arms or legs.
- Note to see if there is loss of balance same direction or opposite direction of head turning
- Eyes and tongue in neutral positions – hands in midline
- Give the child direction – point to the noisy light/toy, eyes, tongue, arm



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## Test in Standing and Walking

- Note any movements or persistent positions that relate to primitive reflex patterns
- Ask where is the “thing”?
- Child may point, change in step length
- Nose up – toes up
- Nose down – toes down



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## Correcting the Gait Cycle

- Add beat music to even step frequency
- Increase speed of walking or running
- Point with both hands – reaching
- Have child close mouth



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## Integration of Primitive Reflexes

- Progress the testing and record movements
- Retest each month
- Note eye deviations, unequal step lengths
- Eyes and neck rotation dictate patterns of body and arm and leg movements
- Change direction of the eyes opposite of the primitive reflex pattern and give the child a more difficult task to engage higher cognitive centers.

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41

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- Zoom consultations available

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42

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46