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# Impact of Motor Learning: Foundations of ASD and Motor Learning Theories

Presented by:

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Lisa J Roehl, PT, DPT  
Board-Certified  
Clinical Specialist  
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## Lisa Roehl, PT, DPT, Board-Certified Clinical Specialist in Pediatric Physical Therapy

- Lisa is a physical therapist with 10 years of experience in pediatrics. She received her Doctor of Physical Therapy degree from the University of South Carolina in 2009. Lisa has worked within outpatient pediatric clinics, serving a variety of patient populations and ages. She is trained in TheraSuit<sup>®</sup> and TheraSuit Method<sup>®</sup>, with the provision of an intensive therapy model for children with neurological disorders from 2011-2013 in Columbia, SC. She specializes in the neurological population and early motor reflex integration. Lisa became a Board-Certified Specialist in Pediatric Physical Therapy in 2019. Lisa currently works in Greenville, SC at Advanced Therapy Solutions, Kids.



# Mariah Woody, OTR/L

- Mariah is a graduate of the Medical University of South Carolina and grew up in Kentucky. Mariah is a former Applied Behavior Analysis therapist for children with autism, and that is how she fell in love with Occupational Therapy. Mariah is an Interactive Metronome provider, and Integrated Listening Systems provider, Kinesio Taping Practitioner®. She is trained in neuro-developmental techniques for the adult and pediatric populations, reflex integration, and also heavily trained in Cranial Sacral Therapy. She was the South Carolina Occupational Therapy Association President (2018-2020). She has passions in reflex integration, praxis, visual deficits, craniosacral therapy, and neuro-rehabilitation. She loves living in South Carolina with her husband, son, and dog.



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## Learning Outcomes

- Participants will be able to recognize the statistics of ASD, including prevalence, general characteristics and medical diagnosis criteria.
- Participants will be able to identify at least 3 motor learning theories.
- Participants will be able to identify at least 3 areas of focus within both occupational and physical therapy for the child with ASD, including sensory, fine and gross motor needs specific to this population.
- Participants will be able to identify how at least 3 different ways motor coordination is impaired for the child with ASD and its effects for the body to perform functional tasks.



# Autism Spectrum Disorder: Prevalence

- CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network
  - Only collaborative network to track the number and characteristics of children with autism spectrum disorder (ASD) in multiple communities in the United States
- About 1 in 54 or 1.85% of children have been identified with ASD in 2016\*
- Boys are more than 4 times as likely to be identified with ASD than girls
- Healthy People 2020 goal of increasing the percentage of children with ASD who receive their first developmental evaluation by 36 months of age
- About 18% for non-Hispanic white (white), non-Hispanic black (black), and Asian/Pacific Islander children
  - Lower for Hispanic children about 15%
- Prevalence of ASD varied considerably
- Higher than previous estimates since 2014



# ASD: Diagnostic Criteria

- Autism Diagnosis Observation Schedule – 2<sup>nd</sup> Edition (ADOS-2)
  - Involves semi-structured play-based activities for assessing social interactions and repetitive/restricted behaviors of children.
  - Scoring provides a comparison score of 1–10 to gauge the severity of the disorder, with higher scores indicating greater severity
- A child must have persistent deficits in each of three areas of social communication and interaction plus at least two of four types of restricted, repetitive behaviors
- Persistent deficits in social communication and social interaction across multiple contexts
  - Deficits in social-emotional reciprocity
  - Deficits in nonverbal communicative behaviors used for social interaction
  - Deficits in developing, maintaining, and understand relationships



## ASD: Diagnostic Criteria

- Restricted, repetitive patterns of behavior, interests, or activities
  - Stereotyped or repetitive motor movements, use of objects, or speech
  - Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior
  - Highly restricted, fixated interests that are abnormal in intensity or focus
  - Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment



## ASD: Diagnostic Criteria

- Symptoms must be present in the early developmental period
- Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning
- These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay



## ASD: Diagnostic process

- Developmental monitoring
- Developmental screening
- Formal evaluation providing diagnosis
- ASD can sometimes be detected at 18 months or younger
- By age 2, a diagnosis by an experienced professional can be considered very reliable
  - Disparities for black children persisted in early evaluation and diagnosis of ASD
  - Hispanic children continue to be identified as having ASD less frequently than white or black children



# Motor Learning

- Motor program: explains the stereotypic attributes of a complex movement pattern that persist as movement parameters and context is altered
- Motor symptoms are some of the earliest identifiable impairments
  - 50–85% children with ASD demonstrate consistent deficits in several aspects of perceptuo-motor performance
  - 70–75% of children with ASD demonstrate co-occurring moderate to severe intellectual disability
- Compared to typically developing children, children with ASD have universal difficulties in several aspects of motor function including:
  - Gross and fine motor performance
  - Aspects of praxis during performance of sequential, imitation-based tasks
  - Simultaneous coordination of the two sides of the body during rhythmic upper and lower-limb tasks
  - Social-motor coordination and interpersonal synchrony





# Theories of Motor Control: Maturation-based

- Neural maturation: Central nervous system controls motor development in a predetermined way
  - Linear developmental pattern
  - Certain predictable changes during neural maturation are the point of behavioral development
- Theory directs that the level of autism severity is related to lower development of the central nervous system: reflex patterns
- Involuntary reflex mature from reactivity to a conditioned response
  - Connecting basic lower level of the nerve system to higher brain
- Reflex circuit restorative strategies and techniques are aimed at supporting the maturation of the neuro-sensory-motor system







# Theories of Motor Control: Learning-based

- Trial and Error: Motor skills are learned, skills emerge as repeated actions are rewarded
  - Schema theory: motor development is a function of learning rules to evaluate, correct and update memory traces.
    - Recall, recognition, imitation
  - Task/skill specific basis utilizing past movement recall and sensory consequences
  - Lack of exposure or limited practice of skill can lead to deficit
  - Practice of a task with specific boundaries with feedback controlled for best learning





# Theories of Motor Control: Dynamic-based

- Interaction of brain-body-environment
- Non-linear development: Emergence of behaviors dependent on task and environment
- Explains development by a process in which different components interact with each other resulting in changes, which are the starting point for future changes
- Neuronal Group Selection Theory: incorporates both influences from the central nervous system and the environment
- Infants learn to select strategies from the motor repertoire that are adaptive to the specifics of the condition
- Emphasis on exploration in multiple environmental circumstances



# International Classification of Function for Children and Youth (ICF-CY)

- Independent of diagnosis
- ICF-CY framework includes personal factors that are inherent to the individual but not part of the individual's primary health condition.
  - Gender, race/ethnicity, educational level and coping strategies.
- Provides detailed classifications in the components of:
  - Body functions: physiological functions of body systems
  - Body structures: anatomical parts of the body
  - Activities: execution of tasks
  - Participation: involvement in life situations
  - Environmental factors: physical, social and attitudinal environment



## International Classification of Function for Children and Youth (ICF-CY)

- Transitions the focus on body functions and structures toward activities and participation
- Child-centered approach to a more context focused and family-centered approach
- ICF-CY can facilitate guidance for interventions and strength assessments by not only only seeing functional disabilities or limitations, but also individual strengths and abilities
- Developing ICF Core Sets for ASD



## Evidence-based practice and review

- Pediatric therapy is the incorporation of enriched environments.
  - Aiming to stimulate brain development by optimizing use of neuroplasticity.
- In response to the emergence of theories as described, new insights were incorporated to move toward a more functional approach (Tjitske, 2017)
  - Aiming to transfer motor activities into daily life activities.



# Evidence-based practice and review

- Beyond different cognitive functions, other aspects of the body are altered in ASD.
  - Motor coordination
  - Gastrointestinal problems
  - Voice and speech disfluency
  - Hypersensitivity issues
  - Immunological problems
  - Genitourinary problems
- These studies emphasize the importance of conducting multidisciplinary assessments in ASD to enable better treatment plans and prognosis (Madhi, 2018).



## Evidence-based practice and review

- How individual functioning might be improved without changing the individual, but by using enhancing environmental facilitators and reducing barriers (Madhi, 2018)
- Focus on strengths of the child with ASD
  - Memory and attention
  - Attention to detail
  - Intense focus

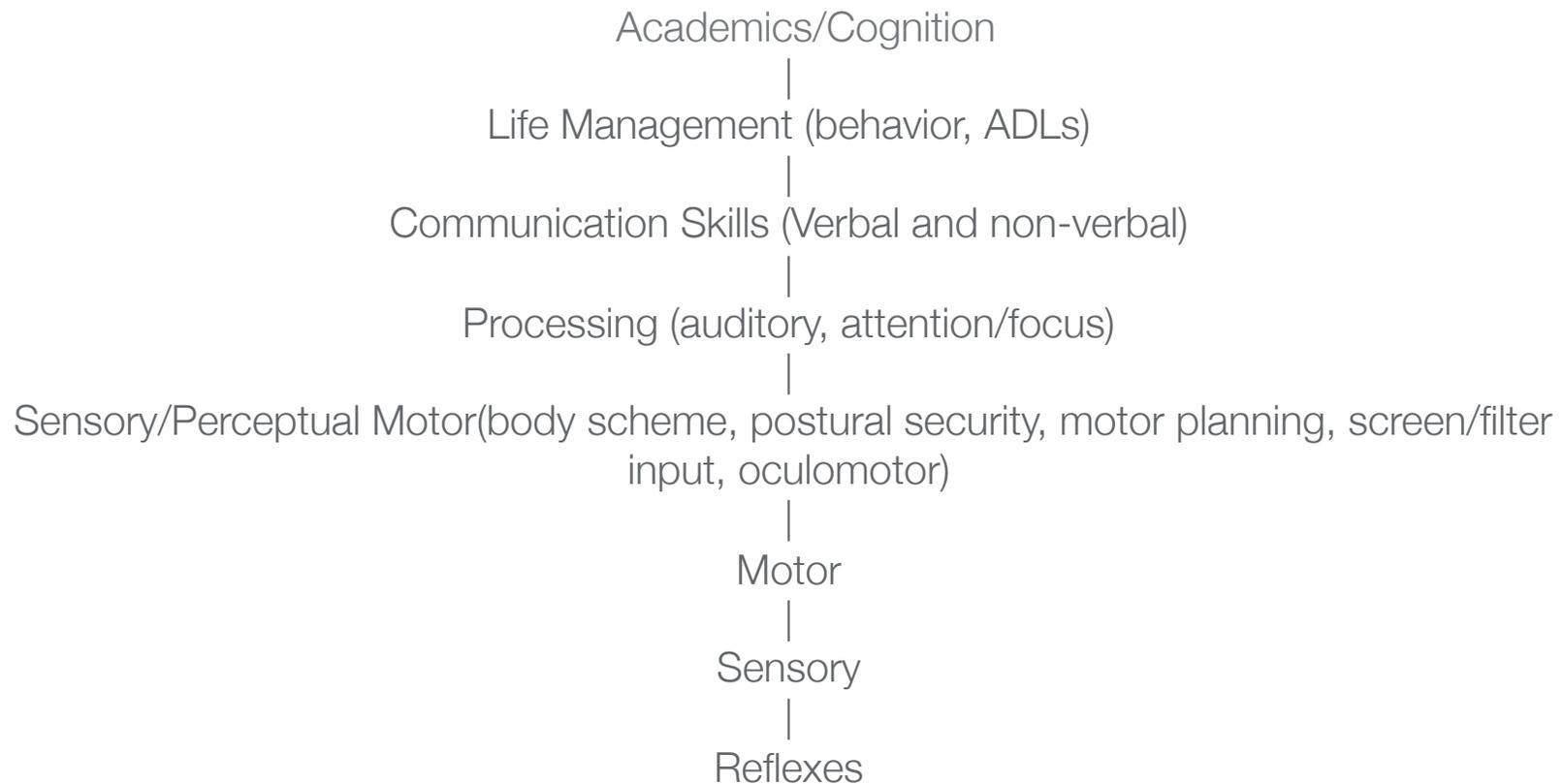


## Ways motor coordination is impaired with ASD:

1. Imitation skills (related to interpersonal synchronization, development on mirror neurons-- will go into this more in treatment strategies)
2. Cause/effect of how their body has impacted the environment and processing this information
3. Fluidity in movement
4. Bilateral coordination (climbing, buttons, etc.)
5. Many more!



# Pyramid of Learning



Please google the image or click here: [www.hol-solutions.com](http://www.hol-solutions.com), Hands on Learning Solutions, inc. Created by Laura Parker



# Occupational Therapy

- Basic fine motor impairments
  - Manual dexterity
  - Object manipulation and how to play with novel toys
  - Fine motor control/integration skills
  - Posture



# Occupational Therapy

- Other impairments
  - Visual-motor integration skills
  - Behavioral outcomes due to motor coordination
  - Sensory components
  - Social interactions/imitation
  - Play exploration



# Occupational Therapy

- Sensory integration
  - Over/under responder
  - Sensory Avoider/Seeker
  - Modulation, discrimination, processing
  - Body scheme/awareness
- Other thoughts:
  - Do they trust their body?
  - Do they know how their body feels?
  - Do they know how their body has interacted with their environment?



# Occupational Therapy

- Activities and Participation level
  - Executive functioning, self-esteem, interpersonal relationships, developmental milestones, exploring natural environment, communication skills, social interaction, self-care, domestic life, and conductance of general tasks and demands
  - Do they find joy in the tasks they participate in?



# Physical Therapy

- Basic gross motor impairments
  - Postural control
  - Bilateral coordination
  - Early developmental milestone importance: rolling, crawling
- Are they aware of their posture? Are they W-sitting? Are they limited in developmental skills? Have they been taught?



# Physical Therapy

- Gait abnormalities: toe walking, intoeing, overpronators
- Mobility
  - Beyond gait and physical endurance
  - Stairs, use of a playground
  - Bicycle, tricycle, hiking
- What is the cause of the gait changes? Is their sensory system regulated? Are they able to keep up with their peers and family? In the home? In the community?



## Both therapies together



- Imitation skills for social synchronization
- Rhythmicity and timing
- Playground skills
- ADL skills
- Fluidity in movement
- Functions of the cerebellum



## Important things to remember:

- Autism spectrum disorder is diagnosed through developmental monitoring, developmental screening and formal evaluation by a trained specialist
- Compared to typically developing children, children with ASD have universal difficulties in motor function
- Pediatric therapy is the incorporation of enriched environments
- Research emphasizes the importance of conducting multidisciplinary assessments in ASD to enable better treatment plans and prognosis
- How a child with ASD functions might be improved without changing the individual, but by using enhancing environmental facilitators and reducing barriers



# References

- As separate pdf supplied with course materials



# Questions?

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