# Physical Therapy and Other Non-Pharmacological Interventions WHY and HOW?

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THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

# Objective

- 1. To understand the neuroplastic benefits of exercise for people with Parkinson's disease.
- To understand evidence based recommendations for exercise mode, frequency, and duration for people with Parkinson's disease.
- To learn the benefits of high intensity exercise using RPE scale for monitoring in order to maximize exercise response.
- To learn objective outcome measures used in therapy to manage mobility and participation in life.
- To understand the need for community based exercise to align with current literature.

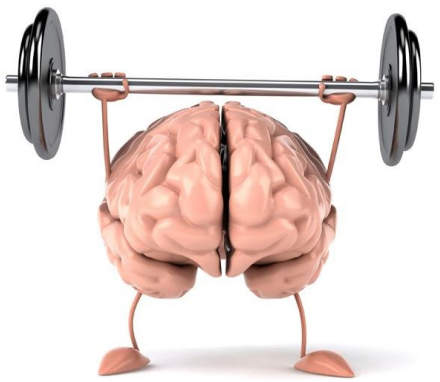
# First things first…

- Everyone should EXERCISE!
  - General Benefits of Exercise
    - Improved heart function
    - Improved circulation
    - Improved respiration
    - Improved balance and mobility
    - Improved strength
    - Improved flexibility
    - Improved endurance
    - Improved self-esteem
    - Improved every day function

# Additional benefits for people with PD…

- Neural Plasticity
  - The ability for the brain to change, structurally and functionally, with activities and experiences
    - Our brain changes and adapts based on the experiences, activities, and environmental changes
  - Lifelong process that underlies learning and memory
  - This process aids in the recovery of function following neurologic injury or disease



# Neuroplasticity and Parkinson's Disease

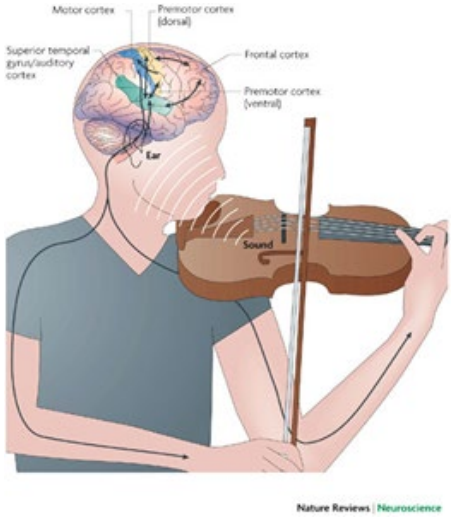
- Strong scientific evidence now exists to indicate brain plasticity or positive changes in response to training and in response to an injury or disease such as PD

- Through specific training/activities neural changes in the brain occur to help "re-learn" mobility and movement tasks
  - 1. Chemical level changes
  - 2. Tissue level changes
  - 3. Functional level changes

# Neuroplasticity and Parkinson's Disease

- How to optimize Neuroplasticity
  - Activities should engage and the strengthen the neural pathway by placing demands simultaneously on:
    - Sensory system (awareness of body)
    - Cognitive system (thinking about how the task is completed)
    - Motor system (the action of moving)



# Neuroplasticity and Parkinson's Disease

- Dosage and engagement are important:
  - Intensive (should be difficult but do-able)
  - High Repetition (the brain learns through repetition of task)
  - Attention (should require you to pay attention to complete)
  - Motivation
  - Consistency (the action and feedback need to be consistent for learning)

# What We Know About Exercise and Parkinson's Disease

- Exercise is beneficial and should be part of regular management programs.
  - Resistance training improves strength
  - Endurance training improves cardio-respiratory fitness
  - Intensive exercise may have beneficial effects on functional measures including walking performance (reduced fall risk, improved turning, and sit to stand), posture, balance, UPDRS scores, and quality of life
  - Inconsistencies in dosage and interventions limit the current conclusion using meta-analysis of available randomized controlled trials.
  - No studies find deterioration in any outcomes following exercise
  - Intensive exercise are feasible, safe, and beneficial in PD
    - Uhrband et al. 2015

# What We Know About Exercise and PD

- Rehabilitation programs should begin as soon as possible
- Programming should be comprehensive and include aerobic exercise, strength training, and other intensive exercise interventions focused on amplitude of functional movement and postural control
- Programs should last several weeks, be intensive, and be repeated

  - Tambosco et al 2014

# What We Are Still Learning About Exercise and PD

- What is the most effective dosage of exercise including duration and frequency?
- The specific exercise prescription including intensive versus voluntary exercise interventions
- The most effective means of forcing exercise effort

- A developing body of evidence is around the importance of forced aerobic exercise training and potential neuroprotection, CNS alteration, and global improvements in motor function.
  - Alberts J.L 2011

# Cardinal Signs of Parkinson's Disease

- Resting Tremor
  - Not much response to treatment
- Bradykinesia
  - Slow/small movements and postural responses
  - Speed/amplitude dysregulation across motor systems
- Rigidity
  - Co-contraction/muscle stiffness/postural alignment changes
  - Secondary loss of axial mobility
- Postural Instability (abnormal postural reflexes)

# Additional Motor Symptoms

- Impaired kinesthesia
  - Awareness of the position and movement of parts of the body
  - Learning automatic and re-learning tasks are heavily sensory dependent
- Developing research in looking at additional sensory system dysfunction including changes to sense of smell, vision, and touch

# PD-Specific Exercises: BIG AND EFFORTFUL

- Treat Bradykinesia
  - Increased amplitude movements, deliberate movement with focus on increased effort of movement above perceived baseline (not necessarily faster)
- Treat Rigidity
  - Strengthening postural extensors in function, improve axial mobility, rhythmical truncal rotation
- Treat Postural Instability
  - Balance reaction training within functional movement
- Treat Impaired Kinesthesia
  - Provide feed back through intact sensory systems: eyes and ears are good (verbal feedback and mirroring)

# Parkinson's Outcome Project

- Clinical study of 12,000 participants with PD in 5 countries.
  - Regular exercise (more than 2.5 hours per week) is associated with:
    - Lower degree of mobility impairments
    - Reduced caregiver burden
    - Reduced impairment in activities of daily living

- National Parkinson's Foundations Parkinson's Outcome Project

# Great news…but what exercise should we do?

- Animal studies indicate an enormous capacity of the PD brain to reshape itself with self produced activity

- **Interventions supported by research to promote plasticity in the brain**
  - Action Observation Training
  - Treadmill/Treadmill + Cognitive Exercises
  - Aerobic Exercise
  - High Intensity Exercise
  - Rhythmical Music

# Action Observation Training

- Visual and Auditory feedback about movement based exercise

- Teaching motor strategies that are impairment specific
  - Size of movement: BIG with EFFORT
  - Specific movements: PD specific
  - Effort of movement: INTENSIVE
  - Awareness of Movement and Posture: CUEING of performance
  - Cognitive Tasks: Practice the above 3 principles with addition of cognitive task simultaneously

# Aerobic Exercise

- Cardiovascular fitness exercises involving sustained periods of increased heart rate and oxygen consumption
- Increased neural activity in the hippocampus, striatum, and cerebellum in people with PD.
- The functional brain changes correlated with changes in aerobic fitness
  - Slows disease progression in animal research
  - Enhances neuroplasticity
  - Helps improve mobility and quality of life measures
  - Improves cardiovascular fitness and endurance
  - Decreases fatigue and motor symptoms of PD
  - Helps to improve breathing

# Forced Effort Aerobic Exercise

A developing body of research is showing the potential for global motor improvements with forced effort aerobic exercise

Forced aerobic exercise: Maintaining consistent effort measures (RPE, RPMs, Strides per minute, step frequency) during 60-80% of HR max—EFFORT MORE IMPORTANT THAN RESISTANCE

# High Intensity Exercise

- Intermittent bouts of high intensity strength training followed by mild-moderate bouts of sustained movement exercises alternating throughout session

- Acutely increases substantia nigra and prefontral brain activity in people with PD

- If repeated frequently over time (i.e. exercise training), may serve as a potential mechanism underlying exercise-induced PD-specific clinical benefits
  - Kelly et al., Med Sci Monit, 2017; 23:6064-6071

# Rhythmical Music and Dance

- Activate neurons serving motor control and increase blood flow in regions such as the hippocampus and frontal, temporal, and parietal cortices

- Incorporates BIG movements, socialization and positive interactions, and timing of movement to the beat
- Research shows that dance can help with:
  - Walking ability
  - Balance, postural control, and confidence in mobility
  - Movement initiation and motor control
  - Quality of life and sense of well-being

# Motor Activity + Cognitive Activity = Dual Tasking

- Difficulty dual tasking has been shown to severely effect gait performance, increase falls, and increase rate/extent of freezing
  - Raffegeau TE et al., Parkin Rel Dis 2018 https://doi.org/10.1016/j.parkreldis.2018.12.012

- The addition of cognitive training to a motor activity apparently modifies the effects of the training on the magnitude and lateralization of prefrontal cortex activation and reduces falls
  - Maidan et al., Neurorehabil Neural Repair, 2018;32:200-208

# Functional Carryover Tasks

- Relating the PD-specific exercises back to functional tasks.
  - Using motor learning principles the important part is that we incorporate the principles of the exercises back to function
  - Provide appropriate cueing in frequency, mode, and timing with reduction over time to promote learning. Vary environment, complexity, and consider dual tasking as appropriate
- Common functional impairments: sit<>stand, rolling, supine<>sit, car transfer, gait, turning (narrow spaces especially), curbs

# Exercise as Prevention

Exercise and activities have been shown to assist with “re-learning” movement strategies

**BUT**

Exercise and activities are also important in the prevention of secondary impairments that are associated with limitations in mobility as well the potential for exercise to be neuroprotective

# Other Non-pharmacologic interventions

- Speech Therapy
- Occupational Therapy
- Pelvic Floor Physical Therapy
- Psychology
- Social Work
- Nutrition and Diet
- Sleep Health

# Bridging the Gap between formal PT and ongoing life long exercise

- Creating a culture of exercise for people with PD
- A combination of available exercise
  - Home exercise programs
    - Patient specific considerations
  - Community based exercise
    - Traditional gym
    - Outdoors
    - PD-specific exercise classes

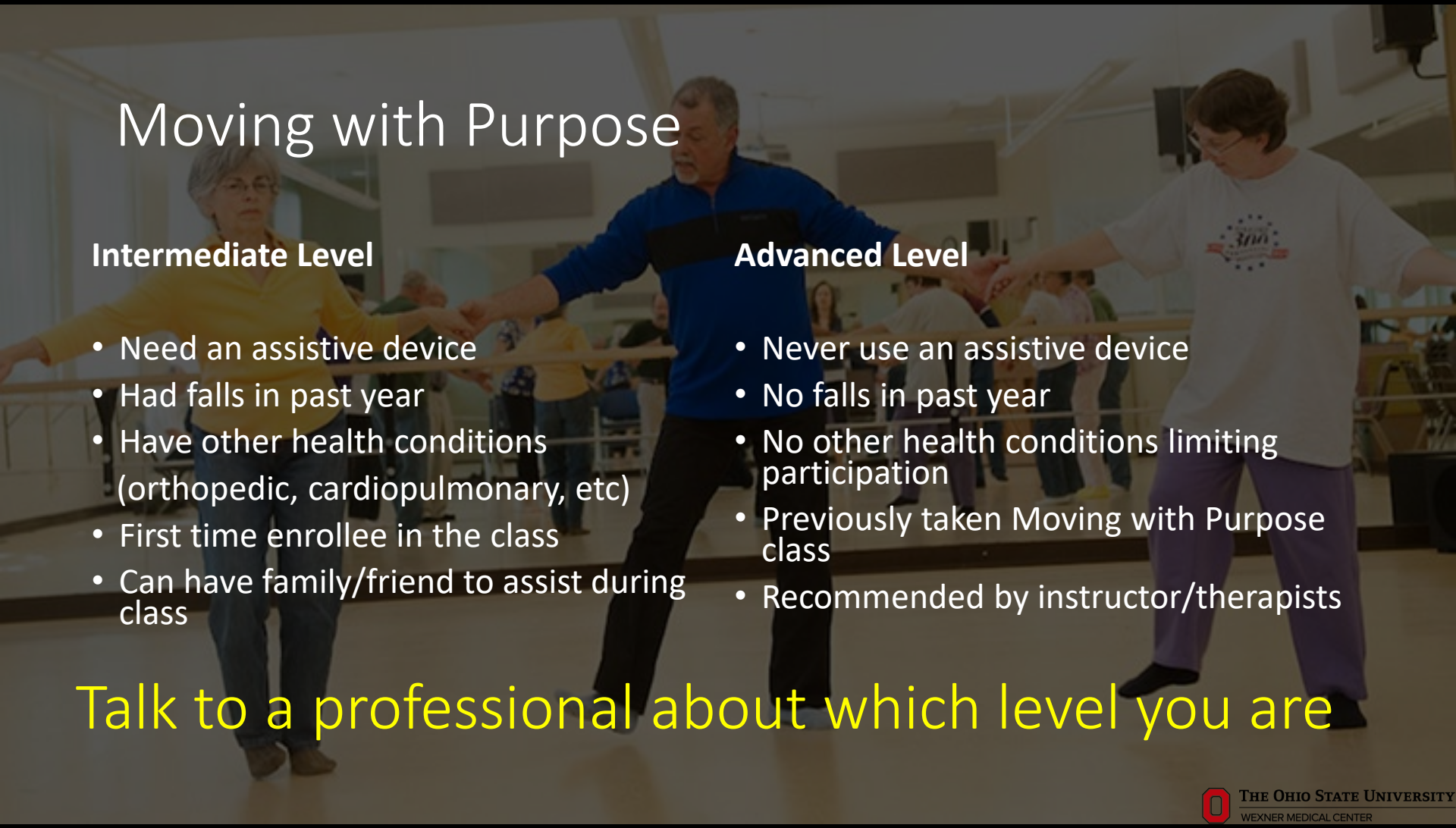
 

# Forced Effort Aerobics

Instructed by exercise physiologists with knowledge and background in treating individuals with Parkinson's disease

Licensed PT will screen participants to determine appropriate parameters, equipments and conduct outcome measures to track progress

Class will include: stretching, forced exercise, education



# Moving with Purpose

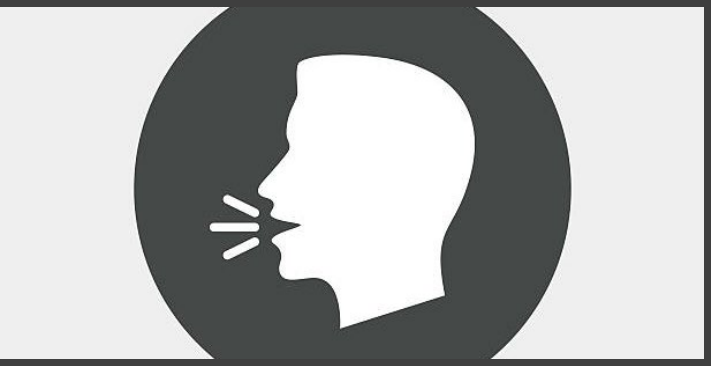
**Intermediate Level**

- Need an assistive device
- Had falls in past year
- Have other health conditions (orthopedic, cardiopulmonary, etc)
- First time enrollee in the class
- Can have family/friend to assist during class

**Advanced Level**

- Never use an assistive device
- No falls in past year
- No other health conditions limiting participation
- Previously taken Moving with Purpose class
- Recommended by instructor/therapists

Talk to a professional about which level you are



# Shout Voice Class

Led by speech pathologists and speech pathology graduate intern

Class will include:

- diaphragmatic breathing
- vocal warm-ups
- reading/repeating functional phrases/sentences
- cognitive tasks

The Ohio State University
Wexner Medical Center

# Outdoor Nordic Pole Walking

Instructed by a licensed physical therapist knowledgable in Parkinson's disease

Benefits include:

- Additional stability
- Increased upper body muscle activation
- Increased total energy expenditure
- Postural support

**POLES ARE PROVIDED**

The Ohio State University
Wexner Medical Center

COLUMBUS DANCE FOR PARKINSON'S

Photo credit: Columbus Dance for Parkinson's Facebook Group

THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER


*This program is supported by a community grant from the Parkinson's Foundation.*

# Four OSU Outpatient Rehabilitation Locations

**Martha Morehouse**

**Outpatient Care**

2050 Kenny Road

Columbus, OH 43221

**Outpatient Rehabilitation Gahanna YMCA**

551 YMCA Place

Columbus, OH 43230

**Outpatient Rehabilitation Hilliard YMCA**

6048 Woodsview Way

Hilliard, OH 43026

**Outpatient Rehabilitation Powell YMCA**

7798 North Liberty Road

Powell, OH 43065

# Resources


- ALBERTS, J.L., S.M. LINDER, A.L. PENKO, M.J. LOWE, and M. PHILLIPS. It is not about the bike, it is about the pedaling: forced exercise and parkinson's disease. Exerc. Sport Sci. Rev., Vol. 39, No. 4, pp. 177Y186, 2011L. Tambosco, L. Percebois-Macadré, A. Rapin, J. Nicomette-Bardel. Effort training in Parkinson's disease: A systematic review Annals of Physical and Rehabilitation Medicine, Volume 57, Issue 2, 2014, pp. 79-104.
- M. Miller Koop, A. B.Rosenfeldt, J. L.Alberts. Mobility improves after high intensity aerobic exercise in individuals with Parkinson's disease. Journal of the Neurological Sciences. Volume 399, 15 April 2019, Pages 187-193.
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- Tajiri N, Yasuhara T, Shingo T, et al. Exercise exerts neuroprotective effects on Parkinson's disease model of rats. Brain Res. 2010; 1310: 2007.


 

# Thank You

Wexnermedical.osu.edu