What is Parkinson’s Disease?

A chronic neurodegenerative disorder that affects how a person...

Symptoms develop gradually and get worse over time.

Each person experiences Parkinson’s disease differently.

MOVES
People with Parkinson’s disease experience motor symptoms.

THINKS
Parkinson’s disease can impact a person’s cognition.

FEELS
Parkinson’s disease can impact a person’s emotions and motivation.
**SUBSTANCES NIGRA (SN)**

SN is part of the Basal Ganglia structures of the brain.

1. **SN Cells Die Off**
   Leads to ↓ in dopamine production

2. **Motor Clinical Symptoms Develop**
   After ~50% SN cell loss

3. **Diagnosed with PD**
   Goes to MD
   Identifies “Cardinal Signs” of Parkinson’s disease

---

**Dopamine**

A neurotransmitter guiding motivation, decision making, and motor performance

Dopamine loss leads to PD symptoms

When there is less dopamine to send messages between cells, a person will experience symptoms of Parkinson’s disease, such as changes in motivation, decision making, and motor performance.

Dopamine = Gas for several brain circuits

Think of dopamine as gas that fuels the BG’s motor circuit (automatic, coordinated motor movements), the associative circuit (perceptual-motor function, learning & memory, complex attention, executive function), and the limbic circuit (mood and motivation).

Loss of dopamine = circuits don’t turn on/off appropriately

When a brain doesn’t have enough dopamine, there isn’t enough gas in the tank to make sure the brain circuits function properly. This leads to changes in how a person with PD moves, thinks, and feels.
Key Motor and Non-Motor Symptoms

Parkinson's is more than just its cardinal signs

**CARDINAL SIGNS**
- Bradykinesia
- Rigidiry
- Tremor
- Postural instability

**OTHER MOTOR SYMPTOMS**
- Ambulation
- Incoordination
- Posture
- Balance
- Fine motor
- Speech

**NON-MOTOR SYMPTOMS**
- Cognition
- Sensory
- Mood
- Autonomic regulation
- Pain
- Sleep

Exercise Helps Parkinson’s Symptoms

In addition to medical management like medications, surgery, physical therapy, etc.

Research protocol variability!!!

- Different types: Classic ↔ Contemporary
- Different PD stages: Early ↔ Late
- Different frequency, intensity, timing

**Motor Function**
Exercise improves walking function, balance, and strength in people with PD

**Cardiovascular Fitness**
Exercise improves heart and pulmonary function in people with PD

**Non-Motor Symptoms**
Exercise improves non-motor symptoms like cognitive changes, mood dysregulation, and sleep problems in people with PD

What “active ingredients” should all Parkinson's-specific exercise programs include in order to be safe and effective?
PD Exercise Program Active Ingredients

The 4 core “active ingredients” to every Parkinson’s-specific exercise plan

- **Cardiovascular training** is safe and well-tolerated in PwP
  - People with PD have the potential to improve cardiovascular fitness
  - Cardiovascular training has been shown to have neuroprotective and neurorestorative effects

- **Secondary muscle weakness**: aging, sedentary lifestyle, bradykinesia • rigidity impact power
  - Strength training is safe and well-tolerated
  - PwP have the potential to improve their strength

- **Rigidity contributes to inflexibility and pain in people with PD**
  - Stretching is safe and well-tolerated in PwP
  - PwP **probably** have the potential to improve their flexibility (more research needed!)

- **Up to 70% of PwP fall each year**
  - PwP have the potential to reduce their fall risk with exercise
  - Balance and agility training is safe and well-tolerated in PwP if they are Parkinson’s-specific

---

Key Motor and Non-Motor Symptoms

Parkinson’s is more than just its cardinal signs

- **Cardinal Signs**
  - Bradykinesia
  - Rigidity

- **Other Motor Symptoms**
  - Ambulation
  - Incoordination

- **Non-Motor Symptoms**
  - Cognition
  - Sensory

- **Brain**
  - Rigidity
  - Ambulation
  - Ncoordination/inflexible Program Selection

- **COG**
  - Cognition

- **SENSORY**
**B.R.A.I.N.S. Framework™**
Parkinson’s-Specific Exercise Scaling “Active Ingredients”

**A / Hypo / Bradykinesia**
- Kinesia = movement
  - A-kinesia = no movement
  - Brady-kinesia = slow movement
  - Hypo-kinesia = smaller movement

_A Speed-Amplitude Dysregulation_
Big, accurate movements come out slower. Fast movements come out smaller and imprecise.
**B.R.A.I.N.S. Framework™**

**Bradykinesia**
- Speed-amplitude dysregulation
  - Big accurate movements come out slower
  - Fast movements come out smaller and imprecise

**Progression/Regression Ideas**
- Progression examples:
  - Bigger movements while keeping the same speed
  - Drive extensor motor output — high effort, powerful, whole body movements
- Regression examples:
  - Add visual cues/targets for mvt size
  - Slow down pace to focus on big mvts

**Sequential Incoordination + Inflexible Program Selection**
- Coordinating, timing, and synchronizing body parts
- Stringing together complex movement sequences
- Delay or inability to adapt or refine the motor plan to the situation
**Motor Control/Learning**

A crash course!

**MOTOR PROGRAM**
A group of instructions encoded in your neural pathways that tell you how to perform a movement.

**FLEXIBLE PROGRAM SELECTION**
The process when your brain adapts or changes the neural circuits for the motor program because of:
- Change in context
- Past experience
- Assumption

**SET**
- (SET SHIFTING)
- (TASK SWITCHING)

**SET (SHIFTING)**
- (TASK SWITCHING)

**Impact of Motor and Non-Motor Symptoms on Exercise**
©2022 Synaptic Physical Therapy, Inc. • www.synapticacademy.com
Motor Control/Learning
A crash course!

Program 1 + Program 2 + Program 3 = MOTOR PLAN → MOTOR GOAL

STAND UP → WALK → TURN THE CORNER → AVOID LAUNDRY → TURN AT TOILET → SIT DOWN


Motor Control/Learning
A crash course!

Motor Learning
Movement Scale and Cost
Motor Automaticity
Flexible Program Selection

REWARD

Inflexible Program Selection and Sequential Incoordination

Ex. Freezing
- When switching from standing to walking
- Difficulty with:
  - Suppressing unnecessary sensory information
  - Preparing
  - Responding

Ex. Imbalance
- When someone cuts them off
- Difficulty with:
  - Coordinating body parts
  - Timing and synchronizing body parts into rhythmic movement patterns
  - Stringing together complex movement sequences

Ex. Delay
- In response time when switching to different punch
- Difficulty with:
  - Delay or inability to adapt or refine the motor plan to the situation

Ex. Fall
- When switching the task and there’s not enough time to PREPARE and RESPOND

Ex. Rolling
- May move slowly or get stuck
- Difficulty with:
  - Coordinating body parts
  - Timing and synchronizing body parts into rhythmic movement patterns
  - Stringing together complex movement sequences

Ex. Timing
- May struggle with synchronizing punches, dance steps, or battle ropes if music is too fast

Ex. Frustration
- Or trouble succeeding if exercise sequence starts out too complicated

Progression/Regression Ideas

- Progression Examples:
  - Direction switching
  - Keep it unpredictable
- Regression Examples:
  - Start simple + break it down
  - Add rhythm and timing cues (may mean slowing it down, not speeding it up!)

B.R.A.I.N.S. Framework™
Synaptic Academy™ Exclusive: Parkinson’s-Specific Exercise Scaling Active Ingredients

Sequential Incoordination + Inflexible Program Selection
- Coordinating, timing, and synchronizing body parts
- Stringing together complex movement sequences
- Delay or inability to adapt or refine the motor plan to the situation

SAFETY!
MOTIVATION!
EXTERNAL FOCUS!

B.R.A.I.N.S. Framework™

Synaptic Academy™ Exclusive: Parkinson’s-Specific Exercise Scaling Active Ingredients

CogNition

- Changes in all cognitive domains but has biggest impact on these four:
  - Perceptual-motor function
  - Learning & memory
  - Complex attention
  - Executive function

Cognition: Executive Function

Anything to do with reasoning, problem-solving, and planning for the future.

Planning & Decision Making
The ability to organize, prioritize, and anticipate in order to make reasoned choices.

Working Memory
The ability to temporarily and consciously hold information in your mind so that you can use it for reasoning, problem-solving, and making decisions.

Error Correction
The ability to know when you’ve made a mistake as well as to react and adapt to avoid future errors.

Inhibition
The ability to stop automatic or impulsive responses.

- Organizing, prioritizing, anticipating, planning (including workouts!)
- Manipulate information in real time to use for reasoning, problem-solving, decisions
- Detecting and correcting a motor mistake and adapting to avoid it in future
- Doing an unsafe exercise even though cautioned not to
- Suddenly stopping one motor program to switch to another
- Responding to one set of instructions while ignoring another

Impact of Motor and Non-Motor Symptoms on Exercise | ©2022 Synaptic Physical Therapy, Inc. • www.synapticacademy.com
CognNition
- Changes in all cognitive domains but has biggest impact on these four:
  - Perceptual-motor function
  - Learning & memory
  - Complex attention
  - Executive function

Progression/Regression Ideas
- Progression Examples:
  - Add a math challenge
  - Add go/no-go to an exercise
- Regression Examples:
  - Reduce distractions
  - Give more time for exercises that involve anticipating and planning

Final Take-Aways
Integrating the Fab4Fitness Framework™ and B.R.A.I.N.S. Framework™

Try to include cardiovascular, strength, flexibility, and balance into your fitness program.

When in doubt, slow things down a bit and focus on big, vigorous movements.

Bradykinesia = Big, accurate movements come out slower. Fast movements come out smaller and imprecise.

Work with a physical therapist and a personal trainer who specializes in helping people with PD.