Large amplitude functional skill training as a foundation for comprehensive rehabilitation and fitness programming.

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Founder/CEO
Parkinson Wellness Recovery | PWR!

Parkinson Wellness Recovery | PWR!
A 501(c)(3) nonprofit founded in 2010 by Dr. Becky Farley

PWR! Vision
Communities where individuals with Parkinson disease have access to proactive research-based exercise (rehab/fitness) and wellness programming beginning at diagnosis and continuing for life (PWR!4LIFE)

PWR! Mission
To translate cutting edge research on exercise and brain change into real world programming TODAY that holds promise to slow disease progression, improve symptoms, restore function, and increase longevity and quality of life.

Model Community Neurofitness and Wellness Center for Individuals with Parkinson disease
Tucson, AZ

Implementing “Exercise4BrainChange”

Preliminary Report Investigating the Benefits of Neuroplasticity-principled Community-based Exercise Programs for People with Parkinson Disease.
PWR! Programs
Exercise, Educate, Enrichment, Empowerment

PWR! Workshops International
PWR! Instructor Training & Certification
PWR! Therapist Training & Certification
“Find a PWR! Professional” Website Database
www.pwr4life.org

PWR! Gym TUCSON AZ
Model Community NeuroFitness and Wellness Center
Specializes in early intervention and ongoing access to
PD-specific research-based programming

GET STARTED NOW! WHY & HOW?
For PWP and their Partners/Family International

PWR! Retreats International

“PWR!Gym Programs subsidized by donations and revenue from
workshops and retreats. $$$

PWR! Gym Tucson, AZ
GET STARTED NOW!
WHY & HOW?
For PWP and their Partners/Family International

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PWR! Retreats International

World Parkinson Congress
Portland OR Sept. 20-23, 2016

PWR! EVENTS
Official Coalition Partner – Leadership Conference
BOOTH #808 – exercise videos/demos
Renewal Room Group Exercise Demo: Nexus Brain/Body Agility

PWR!Gym Posters
1. A model community neurofitness and wellness center for people with Parkinson
disease. PWR!Gym 1-year group pilot data.
2. Short-term benefits of a progressive aerobic exercise and skill acquisition program for
people with mild to moderate Parkinson disease in a community group setting.
3. The effects of progressive aerobics and functional, amplitude-focused whole body
training (PWR!Moves®) in an individual with advanced PD through an integrated
physical therapy and PD-specific community exercise program - a case study.
How does Parkinson disease change the brain?

Loss of Pigmented, Dopaminergic Neurons in the Substantia Nigra pars compacta (SNpc)

200,000/side Normal
90% DA cell loss PD

50-60% cell death at Diagnosis!
Proceeds DX ~5-6 years

Lewy Bodies in Dying Substantia Nigra Neurons
Lewy body is the diagnostic hallmark of Parkinson's Disease

Lewy bodies are composed of α-synuclein.
Kumar & Cotran, Pathological Basis of Disease, 2015
What Causes Parkinson's Disease?
William Langston, MD; Parkinson's Institute, Sunnyvale, CA

*genes load the gun*

*the environment pulls the trigger*

Environmental and behavioral risk and protective factors for PD

Increase risk
- Pesticides
- Metals
- Industrial Solvents
- Head Injury
- Vibration?
- Obesity
- Depression

Decrease risk
- Cigarette smoking
- Caffeine
- Estrogen?
- Anti-inflammatory medications
- Exercise
- Urate enriched diet
- Mediterranean diet
- Longer use of oral contraceptives

What Causes Parkinson's Disease?
Accumulative Events and Factors Set Off a Cascade of Cellular mechanisms that Eventually Trigger Cell Death

Endogenous DA Neuron Vulnerability
Genetic Predisposition 1% Genetic 15% familial 85% sporadic
Environmental & Lifestyle Factors

Cell Death
**What Causes Parkinson's Disease?**

Cellular Mechanisms Contribute to Cell Death

- Dysfunction of Cell Garbage Disposal Machinery
- Results in Protein Aggregation (alpha-synuclein)
- Oxidative damage/stress
- Reactive Oxygen Species (ROS)
- Deficient Neurotrophic Support
- Mitochondrial Dysfunction
  - reduced complex I activity
- Decreased ATP
- Energy Crises

**Possible Meds?**

**Exercise?**

---

**Braak's Hypothesis of Parkinson's Disease Progression**

- Through the gut
- Through the nasal mucosa

_H. Braak et al. / Neurobiology of Aging 24 (2003) 197–211_

---

**Direct Pathways from the environment to the brain**

- Through the gut
- Through the nasal mucosa
The Parkinson’s Complex
Multiple systems compromised

Motor signs & symptoms

Other non motor signs & symptoms;
Autonomic Cognitive Emotional

Compromised system

--

Multi-system Brain Disease – Multisystem Approach
Potential Motor & Non Motor Targets of Exercise

Sensorimotor circuits
Reduced sequential coordination; Poor body in space awareness

Other non motor symptoms
Hyposmia, Fatigue, Cardiac abnormalities, REM Sleep Disorder, Diffuse pain, Seborrhea

Cognitive circuits
Reduced planning, working memory, & attentional focus

Emotional circuits
Apathy, Depression, Anxiety, Loss of self efficacy

--

Multiple Parallel Circuits through BG contribute to ability to move and re-learn

A Motor/Globusmotor Circuits
Bradykinesia, tremor, rigidity

B Associative circuit
Exec. Function & Attentional deficits

C Sensitivity circuit
Depression, apathy, anxiety
WHAT you do is important!
Exercise4BrainChange Essentials

Progressive Aerobics Training
Intensity/Beyond self-selected
Mechanism: Brain Health/Protection

Skill Acquisition
PD-Specific Skills - PWR!Moves
Reinforce dopamine circuits
Mechanism: Brain Repair/Adaptation

What you do matters!
Progressive aerobic exercise changes the brain
At a molecular, metabolic, and physiological level by ....

- Upregulates DA receptors
- Improves glucose utilization
- Improves immune system
- Suppresses oxidative stress
- Stabilizes calcium homeostasis
- Reduces inflammation
- Improves mitochondrial function/ATP production
- Increases growth/survival factors, neurotransmitters
  - BDNF and insulin-like growth factors
- Increased neurotransmitters in multiple emotional/cognitive/motor systems - ON; ready to activate
  - Dopamine, serotonin, glutamate, noradrenaline

Cotman & Berchtold 2002; Kleim JA, Jones TA, & Schallert T. 2003
What you do matters!
Skill acquisition (learning/re-learning) changes the brain
At a structural level by ....

Basic Science Rationale for Exercise as Disease Modifying
Animal models with PD show response to exercise
Brain changes identified vary with disease severity

Disease Modifying Mechanisms are Time Dependent

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Implications to Exercise and PD!

- Timing matters: early is better than later
- Intensity matters – dosage (freq/dur/work)
  • Forced Use – Beyond self selected effort
  • Intermittent bouts/Intervals
  • Vigorous aerobic training
- Specificity matters – Make it PD-specific
  • “use it or lose it” or “use it and improve it”
- Continuous (threshold) of exercise to sustain
- Inactivity/Stress is pro-degenerative

Why is brain change important in human PD?

Disease Modification

Slow disease progression  Vs  Slow motor deterioration/disability

Does it spare or rescue or rejuvenate vulnerable DA neurons?  NEUROPROTECTIVE
Does it normalize (reorganize) abnormal neural circuitry?  NEUROREPAIR
Is vigorous exercise is neuroprotective?

CONCLUSIONS - Progressive Aerobic Exercise Literature Review

Ahlskog J. Neurology 2011;77:288-294

Ongoing vigorous exercise and physical fitness should be highly encouraged.

PD physical therapy programs should include structured, graduated fitness instruction and guidance for deconditioned patients with PD.

Levodopa and other forms of dopamine therapy should be used to achieve maximum capability and motivation for patients to maintain fitness.

Conclusion!

Potential motor/nonmotor targets of aerobic exercise in general!

Speelman, AD et al. Nature Reviews Clinical Neurology 7, 528-534 (September 2011)

- Prevention of cardiovascular complications
- Arrest of osteoporosis
- Improved cognitive function
- Prevention of depression
- Improved sleep
- Decreased constipation
- Decreased fatigue
- Improved functional motor performance
- Improved drug efficacy
- Optimization of the dopaminergic system

Exercise benefits multiple systems

Earlier Exercisers do better!

Change in PDQ-39 Score From Baseline

“Do you exercise at least 2.5 hours/week?”

Defined by PWP

<table>
<thead>
<tr>
<th>Reported Exercise: Baseline/1-yr/2-yr</th>
<th>1 - YEAR</th>
<th>2 - YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES / YES / YES</td>
<td>0</td>
<td>1.8</td>
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<tr>
<td>NO / YES / YES</td>
<td>0.7</td>
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</tr>
<tr>
<td>NO / NO / YES</td>
<td>2.4</td>
<td>3.5</td>
</tr>
<tr>
<td>NO / NO / NO</td>
<td>3.4</td>
<td>6.2</td>
</tr>
</tbody>
</table>

* From a database of 3000 patients who started exercising at different times
* No matter when patients started exercise, they could benefit!
Cardio Challenge Class

Human Clinical Science Rationale for Exercise as Disease Modifying Brain changes identified in humans with early PD

Same results as shown in animals


PD Brains ON Exercise! Unlocked Potential!

Acute 3-h post exercise N=9 averaged

Aerobics + Skill = helps brain do more with less

-----forced “rate” pedaling on a tandem-----

It is Not About the Bike, It is About the Pedaling: Forced Exercise and Parkinson’s Disease. Alberts, Jay, Linder, Susan; Penko, Amanda; Lowe, Mark; Phillips, Michael. Exer Sport Sci Rev 2011
WHAT you do is important!
Exercise4BrainChange Essentials

Progressive Aerobics Training
Intensity/Beyond self-selected
Mechanism: Brain Health/Protection

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PWR!Moves vs. LSVT BIG?
Not a protocol. A comprehensive flexible, and adaptable framework to amplitude-focused training for rehab/fitness goals all levels of disease severity! Designed to directly target “4” foundational movements (PWR!Moves®) to counteract the primary deficits shown by research to interfere with everyday mobility.

<table>
<thead>
<tr>
<th>Deficit</th>
<th>Basic4</th>
<th>PWR!Moves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antigravity extension</td>
<td>PWR! UP</td>
<td></td>
</tr>
<tr>
<td>Weight shifting</td>
<td>PWR! ROCK</td>
<td></td>
</tr>
<tr>
<td>Axial mobility</td>
<td>PWR! TWIST</td>
<td></td>
</tr>
<tr>
<td>Transitions</td>
<td>PWR! STEP</td>
<td></td>
</tr>
</tbody>
</table>
Dopamine loss/disease progression correlates most strongly with severity of bradykinesia.

Speed/amplitude dyregulation problem
Big movements are slow; Fast movements are small
Scaling amplitude/speed requires the greatest amount of acceleration/power!

Occurs across motor control systems!
(fine motor, respiration, walking, speech, postural control)
Principles of LSVT®/LOUD applied to limb movement
(Farley & Koshland, 2005; Farley et al., 2008)

Why Amplitude?
Can be done in any position; anywhere; by anyone...(trained 😊)

Why FUNctional Training?
Bradykinesia interferes most with habitual, (overlearned) everyday movements. Dressing, walking, in/out bed, sit to stand

GOAL: Habit formation and maintenance!!! SO…train the skills they need for FUNction

PWRIMovesTM at a Glance

- Posture
- Weight Shift
- Trunk Rotation
- Transition
- Low Floor | Prone | Low Floor | Supine | High Floor | All-4's | Sitting | Standing
Non-exercise physical activity reduces motor symptoms in Parkinson disease independent from nigrostriatal degeneration


http://dx.doi.org/10.1016/j.parkreldis.2015.08.027

Fig. 1. Scatter plot of the distribution of duration of non-exercise physical activity and covariate-adjusted distal appendicular bradykinesia scores.

Why PWR! Moves make sense!
More functional movements correlates with less motor symptoms!

PWR! Up Focus: Posture/Alignment

Why: Counteract rigidity – stooped posture, weak extensors, spinal deformities. Reduce falls, freezing/hesitation. Improve gait and ability to step bigger.

PWR! Rock Focus: Weight Shifting

Why: Necessary to “get moving”, to turn, to roll, & retrain better balance and a wider base of support.
Trunk Rotation

**PWR! Twist Focus:** Trunk Rotation

**Why:** Reduces rigidity when practiced rhythmically. Necessary to “transition” body through space/postures.

---

Transition

**PWR! Step Focus:** Transition

**Why:** To move to a different location efficiently and effectively. To catch your balance, to strengthen muscles.

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**Multisymptom Targeted Stand Alone Exercise Program**

- **Rigidity** – reduced spinal flexibility and posture *(PREPARE)*
  - High effort for large amplitude sustained active stretch and awareness
- **Bradykinesia** – slow/small everyday move
  - High effort for large amplitude repetitive whole
- **Incoordination/Balance** *(FLOW)*
  - Link movement/action sequences (Agility)
- **Automaticity** – *(BOOSTS)*

---
Multisymptom Targeted Stand Alone Exercise Program

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- **Automaticity** – (BOOSTS)
Multiple Parallel Circuits through BG contribute to ability to move and re-learn

Bradykinesia, tremor, rigidity

Exec. Function & Attentional deficits

Depression, apathy, anxiety

Train attention for common everyday dual tasks.

PWR! BOOSTS “real world automaticity”

Bradykinesia is generalized across motor systems (speech, reaching, gait, fine-motor, respiration) – so integrate amplitude training across multiple systems….

involving voice/speaking, hands, breathing, eyes
Amplitude-focused FUNctional exercise can be instructed across disciplines, settings, tasks, function, ADL, lifestyle, and be integrated into any research-based approach (treadmill, cueing, pole walking, turning, agility, spinal flexibility, etc).
Exercise4BrainChange® Essentials

How you Practice is Important!

Optimal Brain Change

- Challenge attention, self-monitoring
- Attentional Focus
- Emotional Engagement
- Cognitive Engagement
- Physical Effort
- Real World Dual Tasks
  - Breathe, hands, voice, eyes
  - Drive motor output
  - Multiple systems

- Salient, Fun, rewarding

Drive motor output

Boosts!
**PWR!Moves Variations**

**Exercise 4 BrainChange Essentials**

*How you Practice is Important!*

- **Attentional Focus**
- **Emotional Engagement**
- **Cognitive Engagement**
- **Physical Effort**

**Optimal Brain Change**

- **Real World Dual Tasks Boosts!**
  - Drive motor output
  - Multiple systems
  - Breathe, hands, voice, eyes

- **Salient, Fun, rewarding**

**Use External Cues to Enhance Activation/Success**

*by Simplifying and Organizing Primary/Secondary Task*

- Makes movement easier, acceleration faster, improves timing to initiate and sequence
- Focuses attention on the critical aspects of movement – timing, distance parameters
  - Used more heavily when teaching a new task or with cognitive deficits
  - Use intermittently to avoid extinction/adaptation
  - Used to drive output and success and teach or reinforce; but require them to “attend” and internalize on “uncued” trials!!!
PWR!Moves Sitting – Ext. cues adv. PD PRE

PWR!Moves Sitting – Ext. cues adv. PD POST

PWR!Moves Sitting – Ext. cues adv. PD POST
Assist Activation, Remove Fear, Use External Cues

What PD-specific skill? What type of exercise?

Easy & Fun Visual Cue

FUN with Scarves Multidirectional Step and Reach
Exercise 4 Brain Change Essentials

How you Practice is Important!

- Challenge attention, self-monitoring
- Attentional Focus
- Emotional Engagement
- Salient, Fun, rewarding
- Cognitive Engagement
- Real World Dual Tasks Boosts!
- Optimal Brain Change
- Drive motor output
  Multiple systems
  breathe, hands, voice, eyes
- Physical Effort

See Section 2; Tables 5

PWR!Moves Progressions Challenge Cognitive Engagement

| Complexity | Add larger sequences in block
| Add novel PWR!Moves to FLOW
| Add common dual task conditions - PWR! Boosts
| Add secondary cognitive and motor loads |
| Environment | Add novel block contexts (e.g., economies, allowed surfaces, reduced visual) |
| Predictability | Low conditions of timing, distance, direction, speed accuracy and frequency challenge anticipatory and reactive postural responses. |
| Balance | Decrease support hands, vary base of support (e.g., different surfaces, and reduce use of vision) |
| Balance Coordination Patterns | Alter the patterns of arm/leg movements (asynchronous vs. alternating) |

Cognitive Dysfunction in PD

- Attention
  - Doing 2 things at once
- Set Switching
  - Ability to shift between tasks or rules
  - Adapting to changes in the environment
- Response Inhibition
  - Switching between tasks requires prioritizing the most important task (or inhibiting the irrelevant ones!).
- Reduced Self-Awareness related to more risky behavior
  - Inability to accurately judge speed, self-limitations
  - Prioritization
Optimal Brain Change Essentials

**Exercise 4 Brain Change Essentials**

**How you Practice is Important!**

- **Challenge attention, self-monitoring**
- **Attentional Focus**
- **Emotional Engagement**
- **Salient, Fun, rewarding**
- **Cognitive Engagement**
- **Physical Effort**
- **Drive motor output**
- **Multiple systems**
- **breathe, hands, voice, eyes**
- **Real World Dual Tasks Boosts!**

Optimal Brain Change

Social/Emotional Enrichment

- **HOW?**
  - Networking interactions
  - Engagement/Connectivity
  - Creativity/Self-expression

Socialization/Enrichment has been shown to:
- Improve balance
- Increase brain weight and neuronal connections
- Reinforce improved behaviors
- Improve mood/QoL
- Motivate!!!
Effective learning occurs in a supportive, empowering, and challenging environment

Assisted Whole Body Activation
- To reduce fear, anxiety
- To empower with potential and success
- To make exercising and movement FUN!!

EMPOWER/CONNECT/SUPPORT
Build FUNction through social interactions, complexity/novelty

optimize activity and stress management
- Find a COACH for LIFE
- Get regular tuneups/goal setting, assessments
- Train in use of FITBIT or Pedometer
- Stress Reduction
- Build Social Support

Recommendations
- Tai Chi
- Music/Drumming/Dance
- Sports/recreation
- Hobbies
- Exercise Buddies
- Laughter/Humor
- Mindfulness
- Meditation/Yoga
Barriers to Optimal Brain Change

**ACCESS FOR LIFE (Referrals/Resources)**

**Optimal Medications**

**Inactivity**
- Compromised systems are highly vulnerable to bouts of inactivity/stress/disease. Takes longer to recover, and may not return to baseline without an "intervention".

**Non Motor Symptoms**
- Psychological symptoms (stigma/social network/self-efficacy)
- Emotional symptoms (apathy, anxiety, depression)
- Cognitive symptoms (Reduced awareness and ability to self-monitor and correct and generalize movement)
- Autonomic symptoms (pain, sleep, blood pressure, ...)
- Comorbidities
TIME FOR NEW PARADIGMS
Exercise is Medicine – take it everyday!

- **Improve function**
  - Exercise

- **Disease severity – H&Y**
  - Loss of postural stability

- **Slow motor deterioration**
  - Optimize brain health/brain function

- **End Stage**

Meds alone are NOT enough for Optimal Wellness Recovery

- **Medications for PD primarily target dopamine related motor symptoms.**
  - **Motor:** Rigidity, Bradykinesia, Incoordination
  - **Emotional:** NO
  - **Cognitive:** NO
  - **Autonomic:** NO

- **Exercise targets many different motor AND non motor symptoms of PD.**
  - **Motor:** Rigidity, Bradykinesia, Incoordination
  - **Emotional:** Depression, Anxiety, Apathy
  - **Cognitive:** Attention, Executive Function
  - **Autonomic:** Sleep, Constipation, Pain

Are your patients optimally medicated for optimal participation and QoL?

- **LD/DA/MAO-B**

Effectiveness of Intensive Inpatient Rehabilitation Treatment on Disease Progression in Parkinsonian Patients: A Randomized Controlled Trial With 1-Year Follow-up. Giuseppe Frazzitta, MD et al. Neurorehab Neural Repair, Aug 15, 2011

Intensive bouts of exercise reduce need for medication over time (& fewer side effects!)

Differences statistically different (p < 0.0001) dashed lines = not significant

Unified PD Rating Scale III

- Time X Group P = 0.004

Avoid Inactivity/Stress!

- Prodegenerative --- Catalysts
  - Contributes to the disease process
  - Compromised systems are highly vulnerable to bouts of inactivity/stress/illness
  - Takes longer to recover

**Bottom Line:** Optimize rest, diet, stress, health, & lifestyle!

WALKING DISTANCE: 6 MINUTE WALK TEST

At DX, PWP are already below norms for HC. Begin EXERCISE/Physical Therapy AT DX!
Begins with loss of vigorous steps!
Train vigorous whole body movements starting day 1!!!

Stigma
Social Support
Pain
Communication
Cognition
Activities of Daily Living
Mood & Depression
Wellness

Factors Associated With Exercise Behavior in People With Parkinson Disease

Participants with high self-efficacy were more than twice as likely to engage in regular exercise than those with low self-efficacy

Efficacy = One’s belief in ability to succeed…plays a major role in how one approaches goals, tasks, & challenges.
Empower & Educate – Give Control!
Show people what they CAN do!
Identify what they WANT to do!

Expectations/Placebo enhance (or reduce) learning in PD. Nature Neuroscience 2014

LIVE WELL – ENRICH YOUR LIFE
Build Social Support Networks
Get a buddy
Keep doing what you LIKE to do.
FIND external sources of DOPAMINE!

Recommendations:
- Tai Chi/QiGong
- Music/Drumming/Dance
- Sports (box, tennis, etc.)
- Hobbies
- Exercise Buddies
- Laughter/Humor
- Mindfulness Training/classes
- Meditation/Yoga

Find a Team
- Improve your ability to achieve optimal fitness and FUNCTION.
- Tap into your social networks and support.
- Don’t try to do it all yourself.
- Get positive motivation and feedback OFTEN
Collaborations/Networks

- Referral from Doctor
- PWR! Therapist Assessment
- Regional PWR! Healthcare System:
  - A Theoretical PWR!4LIFE Model for a Lifetime of Optimal Care
  - PWR! Gym
  - Community Centered Exercise and Wellness Experts
  - Community Class
  - PWR! Therapist Re-assessment (3-6 months)

Optimal Learning and Brain Health!

- PWR! Therapist
  - 3-6 Month Assessments
  - 1:1 Intensive Rehab

- PWR! Instructor
  - Optimal PD-Specific Fitness Classes
  - Educational empowerment and resource referral

PWR!® Certified Therapist – Physical and occupational therapists that develop and prescribe comprehensive PWR! programming to address multiple symptoms and personalized goals for all levels of disease severity, fitness, and co-morbidities. They offer focused education, problem solving and coaching to empower and overcome barriers associated with PD.

PWR!Moves® Certified Instructors – Therapists and fitness professionals that specialize in the instruction of larger/lower functional movements (PWR!Moves®) in group classes and in their integration into community yoga, dance, sports, and personal training sessions.
Exercise IS the NEW Parkinson's Medicine!

Coordinate, develop and advocate for community programs & early continuous access.

World Parkinson Congress
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P.A.T.H.
ProActive Therapies
for PWP
Multidisciplinary Rehab Exercise & Wellness

www.pwr4life.org/path/

PARKINSON EXERCISE REVOLUTION !!!

The END!