Parkinson's Disease: Clinical Implications for Fall Prevention

1

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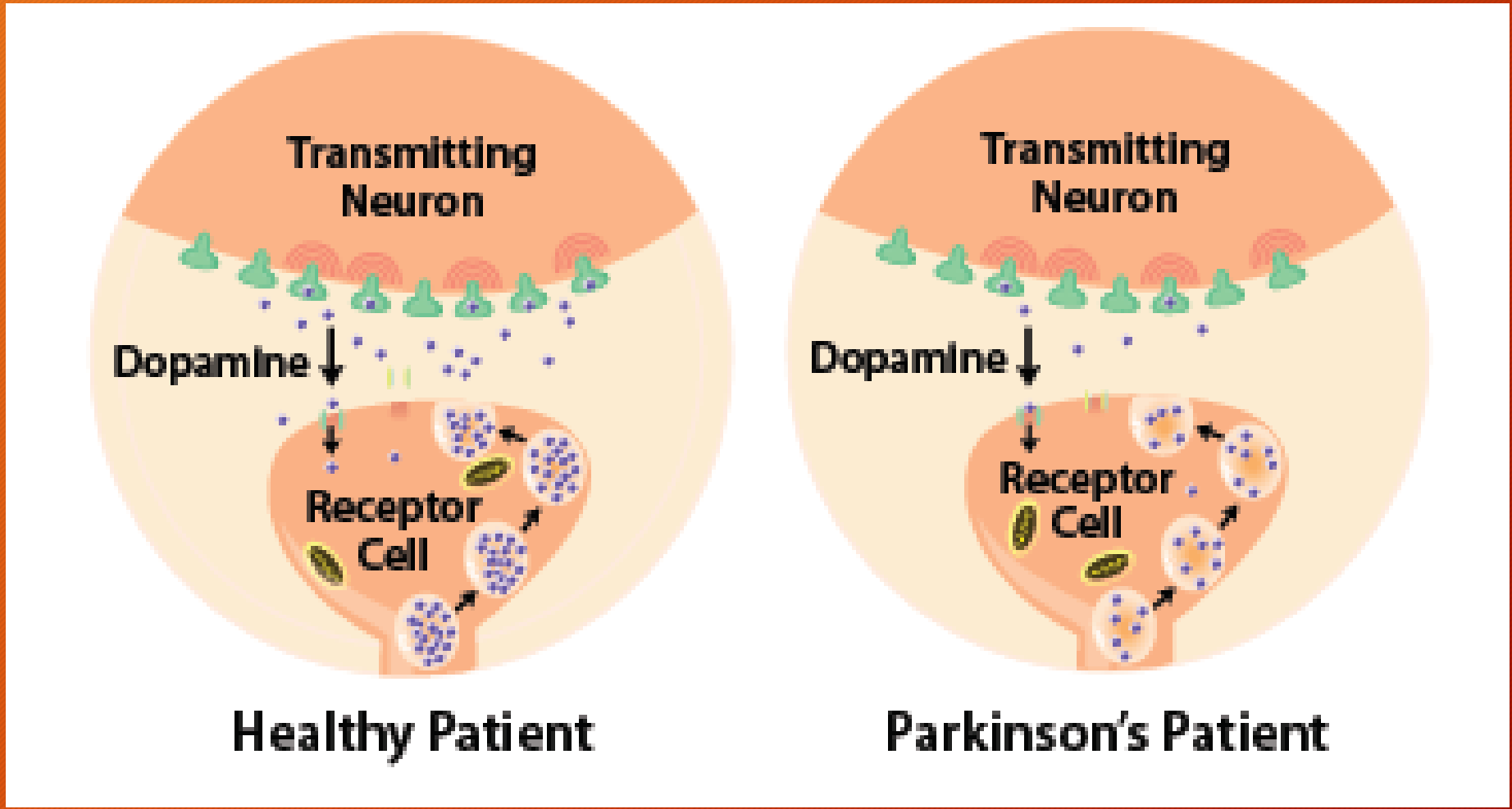
Objectives

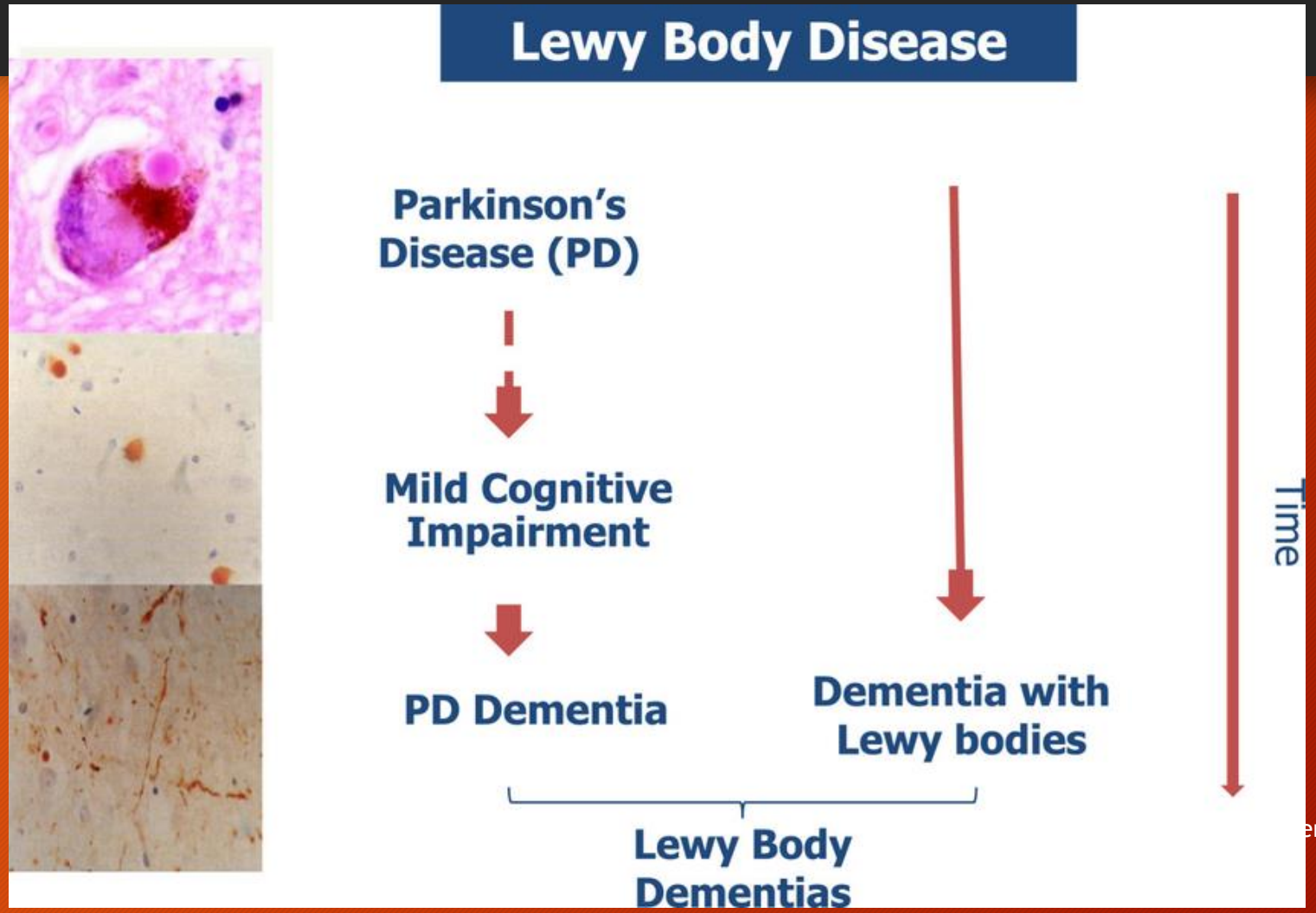
- Describe Parkinson's Disease – pathology, prevalence and treatment trends.
- Discuss reasons why individuals with Parkinson's Disease pose a particular challenge for fall prevention.
- Identify four methods in which fall prevention programs can include interventions that target individuals suffering with Parkinson's Disease.

What is Parkinson's Disease?

- Parkinson's Disease (PD) is a chronic, progressive neurodegenerative disorder characterized by slowness in the initiation and execution of movement (bradykinesia), increased muscle tone (rigidity), tremor at rest, and gait disturbance
- The exact cause of PD is unknown and although it's not considered a hereditary condition, genetic risk factors should be evaluated for their interplay with environmental factors – about 15% of patients with PD have a positive family history for the disease
- The pathologic process of PD involves degeneration of dopamine-producing neurons in the substantia nigra of the midbrain which disrupts the normal balance between dopamine and acetylcholine in the basal ganglia
- Dopamine is responsible for functioning of the extrapyramidal motor system, including control of posture, support and voluntary motion (manifestations of PD do not occur until 80% of neurons in substantia nigra are lost


Transmitting Neuron
Dopamine
Receptor Cell
Healthy Patient
Transmitting Neuron
Dopamine
Receptor Cell
Parkinson's Patient

PD and Lewy Bodies



LBDA
LEWY BODY DEMENTIA ASSOCIATION

EARLY DIFFERENTIATING SYMPTOMS

	LBD	Alzheimer's	Parkinson's
Decline in thinking abilities that interferes with everyday life	Always	Always	Possible years after diagnosis
Significant memory loss	Possible	Always	Possible years after diagnosis
Planning or problem-solving abilities	Likely	Possible	Possible
Difficulty with sense of direction or spatial relationships between objects	Likely	Possible	Possible
Language problems	Possible	Possible	Possible
Fluctuating cognitive abilities, attention or alertness	Likely	Possible	Possible
Changes in mood	Possible	Possible	Possible
Hallucinations	Possible	Unlikely	Possible
Severe sensitivity to medications used to treat hallucinations	Likely	Unlikely	Possible
Changes in walking or movement, such as slower, smaller steps, problems using hands, tremors	Possible	Unlikely	Always
Balance problems and/or falls	Possible	Unlikely	Possible
Rapid eye movement (REM) sleep behavior disorder	Possible	Unlikely	Possible

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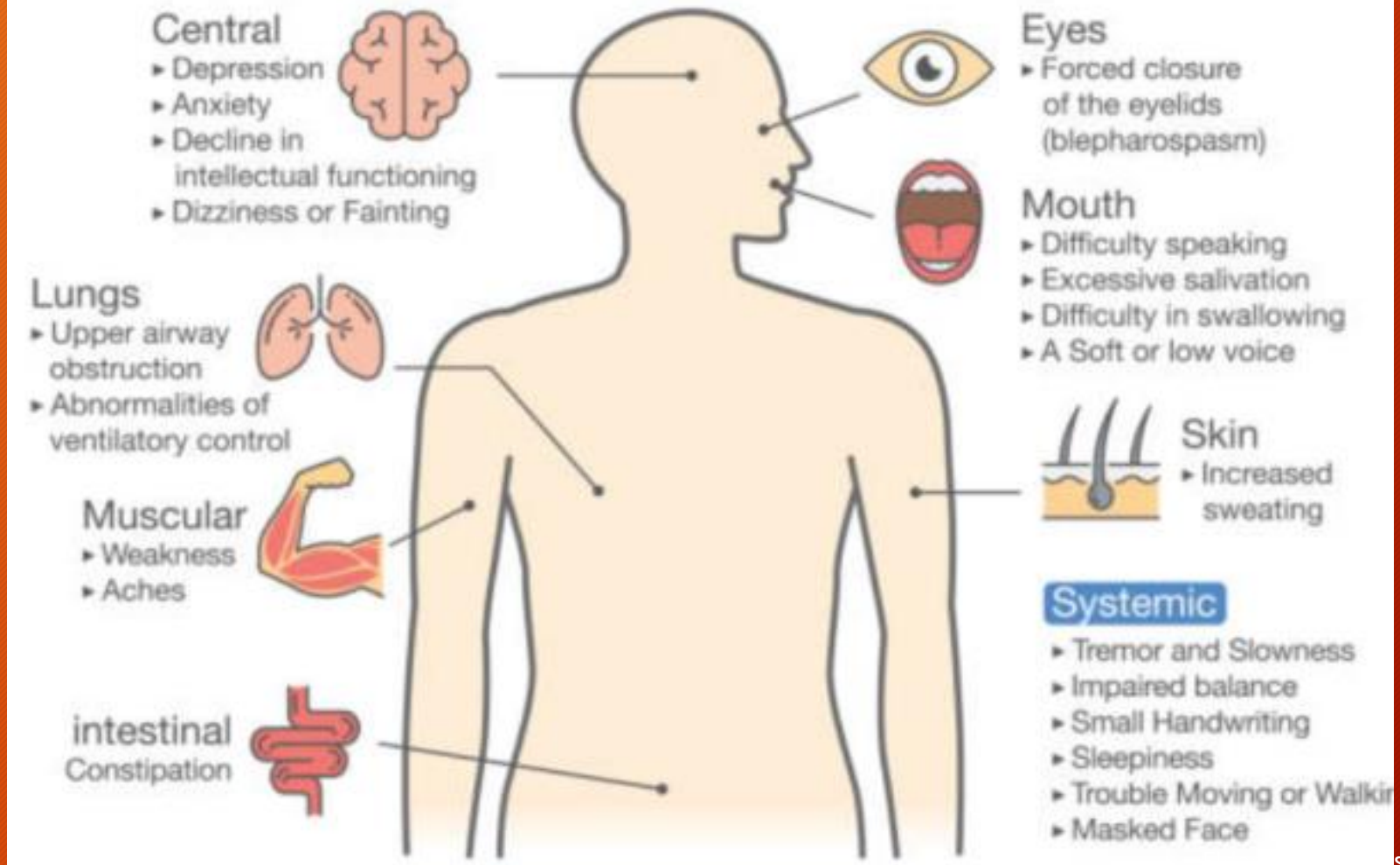
WE'RE HERE TO HELP

Visit the LBDA website at lbda.org to learn more about LBD, find resources to get the help you need, and connect with the LBDA community.

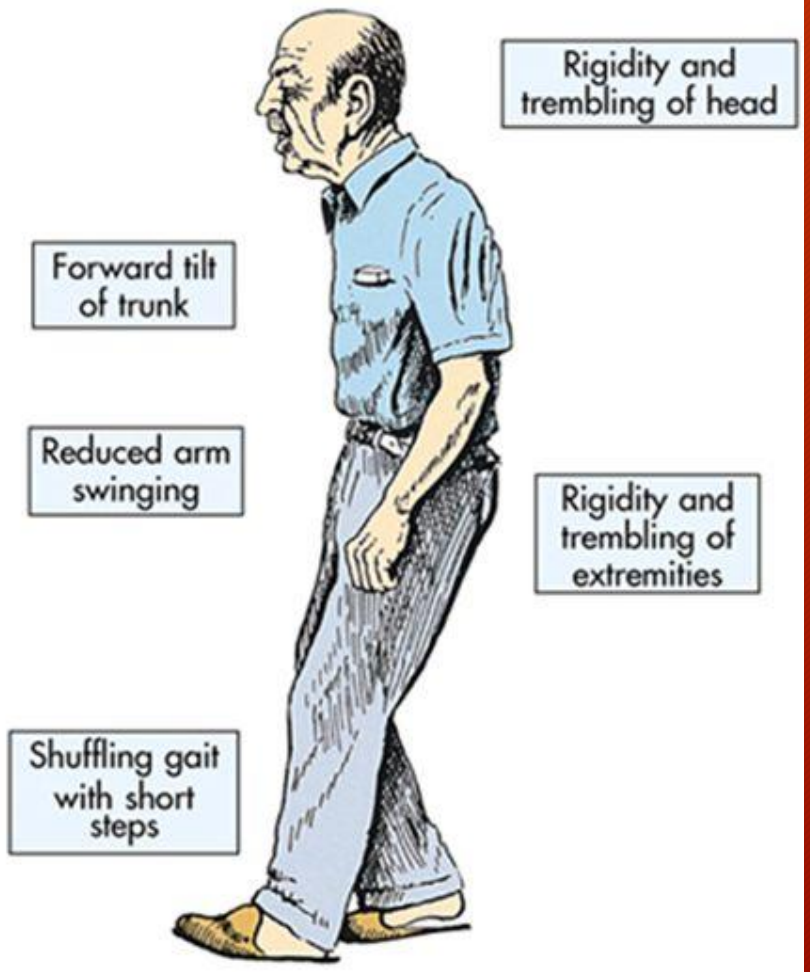
Symptoms of Parkinson's Disease



PALi Parkinsonism

TRAP

- **T**remor
  - Unilateral
  - 4-6 Hz
  - Pill- rolling
  - Worse at rest
- **R**igidity
  - Lead pipe
  - Cog-wheeling
- **A**kinesia/Bradykinesia
  - Serpentine Stare (Hypomimia)
  - Reduced arm swing
  - Reduced frequency and amplitude of
  - repetitive movements
  - Worse with co-stimulation
- Loss of **P**ostural reflexes
  - Pull test
  - Difficulty turning around
  - Early falls



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Non-Motor symptoms of PD

- Depression
- Anxiety
- Apathy
- Fatigue
- Pain
- Urinary retention
- Constipation
- Erectile dysfunction

Complications of PD

- Dyskinesias (spontaneous, involuntary movements)
- Weakness
- Increased neurologic problems (higher risk of dementia)
- Neuropsychiatric problems
  - Depression
  - Hallucinations
  - Psychosis
- Dysphagia (trouble swallowing)
  - Aspiration
- Urinary tract infections (UTI)
- Skin breakdown
- Orthostatic hypotension

Sleep Disturbances and PD

- Sleep problems are common and include difficulty staying asleep at night, restless sleep, nightmares, and drowsiness or sudden sleep onset during the day.
- In particular, rapid eye movement (REM) behavior disorder is a preparkinsonian state that occurs in about one third of patients with PD. It is characterized by violent dreams and potentially dangerous motor activity during REM sleep.

What is the Prevalence of PD?

- Nearly one million will be living with Parkinson's disease (PD) in the U.S. by 2020, which is more than the combined number of people diagnosed with multiple sclerosis, muscular dystrophy and Lou Gehrig's disease (or Amyotrophic Lateral Sclerosis)
- Approximately 60,000 Americans are diagnosed with PD each year.
- More than 10 million people worldwide are living with PD.
- Incidence of Parkinson’s disease increases with age, but an estimated four percent of people with PD are diagnosed before age 50.
- Men are 1.5 times more likely to have Parkinson's disease than women.

930,000
people in the U.S. with PD by 2020

1.2 million
people in the U.S. with PD by 2030

PARKINSON'S DISEASE
IN THE UNITED STATES

AS MANY AS
1.5 MILLION AFFECTED BY PARKINSON'S DISEASE

ABOUT
60,000 NEWLY DIAGNOSED EACH YEAR

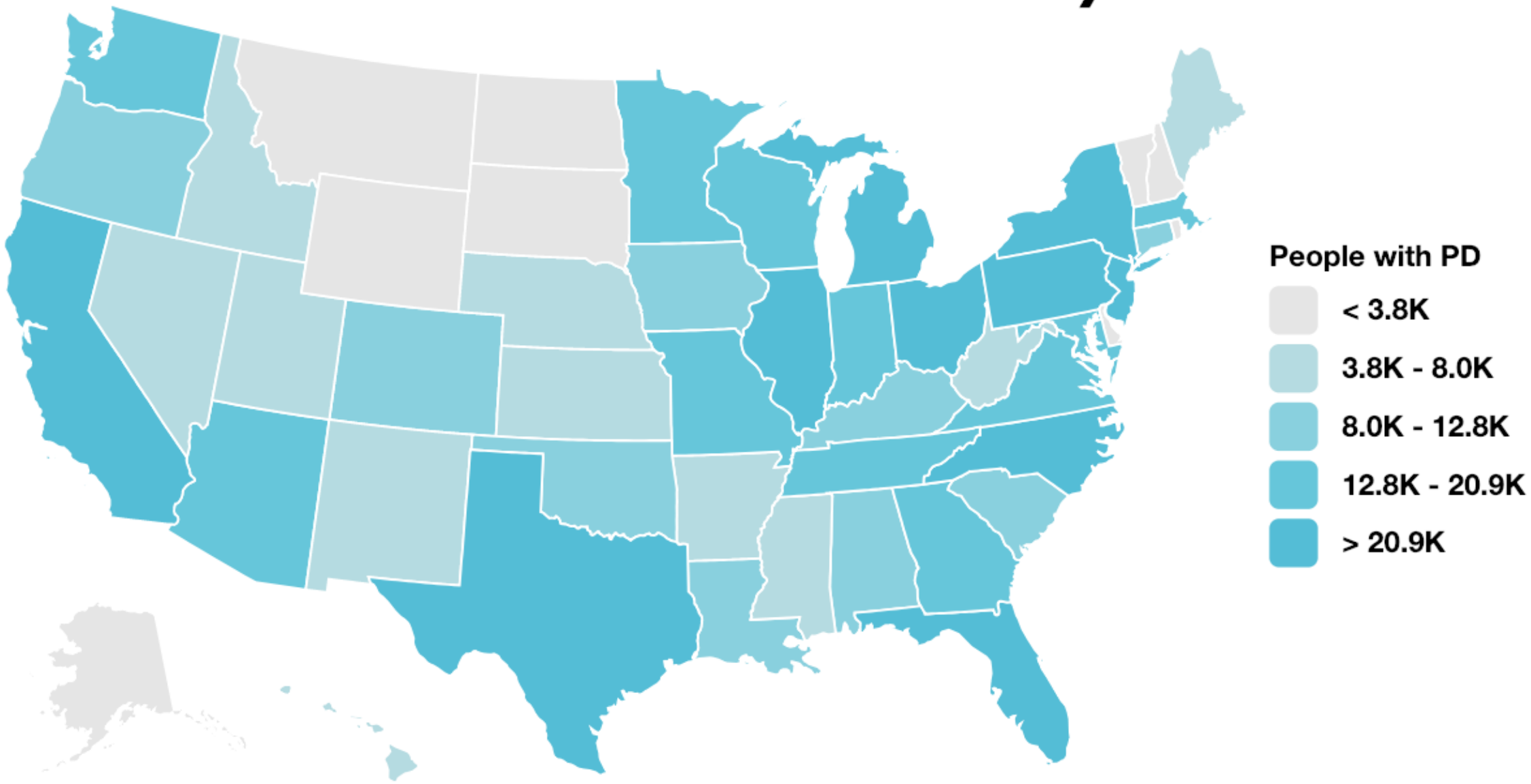
MORE THAN
23,000 DIE FROM THE DISEASE EACH YEAR

Source: Parkinson's Action Network, National Center for Health Statistics

Impact on Healthcare system

- The combined direct and indirect cost of Parkinson's, including treatment, social security payments and lost income, is estimated to be nearly **$25 billion per year in the United States** alone.
- Medications alone cost an average of **$2,500 a year** and therapeutic surgery can cost up to $100,000 per person.

Parkinson's Prevalence by State*



Current Treatment Options

Current Treatment Options (Pharmacologic)

- Sinemet (Levodopa/Carbidopa)
- Requip (repinirole) / Mirapex (pramipexole)
- Neupro (rotigotine) transdermal patch
- Anticholinergic drugs (Cogentin) or antihistamines (diphenhydramine)
- Exelon (rivastigmine) / Aricept (donepezil)
- Amitriptyline

Medical Interventions

- Deep brain stimulation (DBS) – placement of an electrode in the thalamus, globus pallidus, or subthalamic nucleus and connected to a generator placed in upper chest (now individualized)
- Ablation surgery – involves locating, targeting, and destroying an area of the brain affected by PD
- Transplantation – transplantation of fetal neural tissue is inserted into the basal ganglia and designed to provide dopamine-producing cells in the brain (research ongoing)

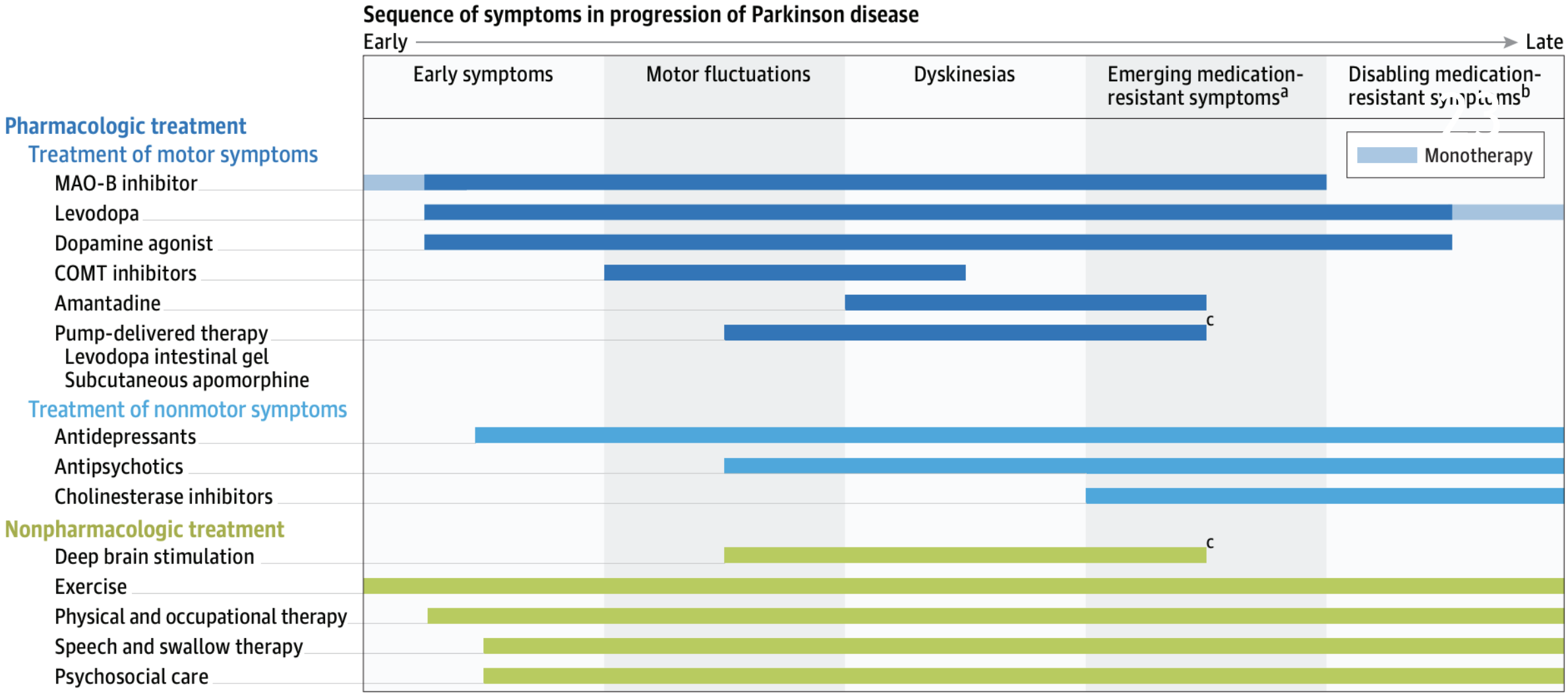
Complementary Therapies

- Nutrition therapy
- Deep breathing
- Yoga
- Tai Chi
- Chiropracty
- Meditation/Mindfulness
- Massage
- Whole body vibration therapy
- Psychotherapy
- Progressive relaxation (sensory deprivation)
- Guided imagery
- Acupuncture
- Dance
- Music
- Pet
- Theracycle (forced rate exercise)
- Audiology consult (inner ear issues)

Future of Treatment Options

- Use of medical marijuana (THC / CBD)
- Dietary management (research ongoing)

Figure. Symptom Progression and Proposed Treatment of Parkinson Disease



Bars indicate approximate periods of initiation and duration of each treatment except where noted. COMT indicates catechol-O-methyl transferase.

For the treatment of motor symptoms, drugs are usually added sequentially. Monoamine oxidase type B (MAO-B) inhibitor monotherapy may be started in the early symptom period followed by the addition of levodopa or a dopamine agonist. As symptoms progress, other drugs may be added and then discontinued as medication-resistant symptoms and adverse effects emerge. Levodopa may be continued through late stages of the disease as monotherapy.

Medication-resistant symptoms refer to symptoms resistant to medications for the treatment of motor symptoms.

[a] Gait dysfunction, soft speech (hypophonia), and memory and cognitive problems.

[b] Dysphagia, falls, and memory and cognitive problems.

[c] Beyond this point, pump-delivered therapy and deep brain stimulation should not be initiated but may be continued if already prescribed.

Falls and Parkinson's Disease

24

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P-UK: Top 10 research priority areas

1. Balance and falls
2. Stress and anxiety
3. Uncontrollable movements
4. Personalised treatments
5. Dementia
6. Mild thinking and memory problems
7. Monitoring symptoms
8. Sleep
9. Dexterity
10. Urinary problems

http://www.parkinsons.org.uk/content/our-top-10-research-areas-improving-everyday-life

Who falls?

60% annually
87% at 20 year

Circumstances

Intrinsic
Posture change
Direction
Indoors, bedroom
Simultaneous activities

Consequences

Broken bones
Hospital admission
Injuries
Worry and fear of falling
Social isolation
Stress for carer

Does the lack of dopamine produced in the brain increase the risk of falls?

Do dopaminergic drugs increase postural stability?

Do they decrease the risk for falls?

When do individuals with PD fall?

- Position changes
- Turns
- Doorways
- Changes in flooring (color block changes)
- Obstacles
- Footwear
- Medications (orthostatic hypotension)
- Amyloid deposition in the brain

Fall Risk

Johns Hopkins

Fall Risk Assessment Tool for Home Health Care

If patient has any of the following conditions, check the box and apply Fall Risk interventions as indicated.

High Fall Risk - Implement High Fall Risk interventions per protocol
- ☐ History of more than one fall within 6 months before admission
- ☐ Patient is deemed high fall-risk per protocol (e.g., seizure precautions)

Low Fall Risk - Implement Low Fall Risk interventions per protocol
- ☐ Complete paralysis or completely immobilized

Do not continue with Fall Risk Score Calculation if any of the above conditions are checked.

FALL RISK SCORE CALCULATION – Select the appropriate option in each category. Add all points to calculate Fall Risk Score. (If no option is selected, score for category is 0)	**Points**
Age *(single-select)* ☐ 60 - 69 years (1 point) ☐ 70 -79 years (2 points) ☐ greater than or equal to 80 years (3 points)	
Fall History *(single-select)* ☐ One fall within 6 months before admission (5 points)	
Elimination, Bowel and Urine *(single-select)* ☐ Incontinence (2 points) ☐ Urgency or frequency (2 points) ☐ Urgency/frequency and incontinence (4 points)	
Medications: Includes PCA/opiates, anticonvulsants, anti-hypertensives, diuretics, hypnotics, laxatives, sedatives, and psychotropics *(single-select)* ☐ On 1 high fall risk drug (3 points) ☐ On 2 or more high fall risk drugs (5 points) ☐ Sedated procedure within past 24 hours (7 points)	
Patient Care Equipment: Any equipment that tethers patient (e.g., IV infusion, chest tube, indwelling catheter, SCDs, etc.) *(single-select)* ☐ One present (1 point) ☐ Two present (2 points) ☐ 3 or more present (3 points)	
Mobility *(multi-select; choose all that apply and add points together)* ☐ Requires assistance or supervision for mobility, transfer, or ambulation (2 points) ☐ Unsteady gait (2 points) ☐ Visual or auditory impairment affecting mobility (2 points)	
Cognition *(multi-select; choose all that apply and add points together)* ☐ Altered awareness of immediate physical environment (1 point) ☐ Impulsive (2 points) ☐ Lack of understanding of one's physical and cognitive limitations (4 points)	
Total Fall Risk Score (Sum of all points per category)	
SCORING: 6-13 Total Points = Moderate Fall Risk, >13 Total Points = High Fall Risk	

JOHNS HOPKINS MEDICINE

Potentially Modifiable Risk factors to Falls in PD	
Generic	**PD Specific**
• Inappropriate polypharmacy & sedative medication • Postural hypotension • Arrhythmia • Arthrosis • Improper use of walking aids • Anxiety/fear of falling • Weakness due to inactivity or malnutrition • Visual/oculomotor impairment • Daily alcohol • Environmental hazards • Other co-morbidities (eg vertigo, neuropathy) • Depression (?medication related) • Osteoporosis	• Disease severity • PD medication (eg anticholinergics, high dose L-D) • Slow mobility • Shuffling, small stepping gait • Freezing of gait & festination • Posture • Postural instability • Difficulty with transfers • Cognitive impairment • Axial rigidity • Dyskinesia • Dual tasking (PD pts have dysexecutive problems) • Nocturia (associated with nocturnal falls) • Loss of arm swing
Details regarding evidence base and suggested approach for each factor available in following paper: Van der Marck et al. Consensus-based clinical practice recommendations for the examination & management of falls in patients with Parkinson's Disease[5].	

What do we know right now?

Disruption in the neural pathway from the brainstem (responsible for upright posture and balance)

Disruption in neural pathway originating in frontal lobe (higher functioning)

These are contributory – NOT CAUSATIVE

Distraction and displacement in Parkinson's Disease

Fix the Freeze

- Have patients who are at risk for falling and tend to “freeze” while walking do the following:
  - Consciously think about stepping over imaginary or real lines on the floor
  - Drop rice kernels and step over them
  - Rock from side to side
  - Lift the toes when stepping
  - Take one step backward and two steps forward
  - Laser shoes


Stay
active
prevent
falls
PIRP
APPROVED
PATIENT INFORMATION
REVIEW PROCESS

Friendly Fixes

- Work with caregivers to share knowledge
- Use an upright chair with arms and elevate the back by 2 inches
- Remove rugs and excess furniture
- Elevate toilet seat and add arms
- Simplify clothing through use of Velcro and zippers instead of strings and buttons/holes
- Manage sleep problems
- Work to address psychoemotional well-being
- Promote cognitive exercises
- Address nutritional needs
- Daily exercise regimen


WHERE DO WE
GO FROM
HERE?

Nicotinic Receptors

Receptor (Primary receptor subtype)	Main synaptic location	Membrane response	Molecular mechanism	Agonists	Antagonists
Skeletal muscle (N_M) Adult $(\alpha_1)_2\beta_1\varepsilon\delta$ Fetal $(\alpha_1)_2\beta_1\gamma\delta$	Skeletal NMJ (Post-junctional)	Excitatory End-plate depolarization Skeletal muscle contraction	↑ Cation permeability (Na^+、K^+)	Ach Nicotine Succinylcholine	Atracurium Vecuronium d-Tubocurarine Pancuronium α-Bungarotoxin α-Conotoxin
Peripheral neuronal (N_N) $(\alpha_3)_2(\beta_4)_3$	Autonomic ganglia Adrenal medulla	Excitatory Depolarization Firing of postganglionic neuron Depolarization & secretion of catecholamines	↑ Cation permeability (Na^+、K^+)	Ach Nicotine Epibatidine Dimethylphenylpiperazinium (DMPP)	Trimethaphan Mecamylamine
Central neuronal (CNS) $(\alpha_4)_2(\beta_4)_3$ (α-Bungarotoxin-insensitive)	CNS Pre- and post-junctional	Pre- & post-synaptic excitation Pre-junctional control of transmitter release	↑ Cation permeability (Na^+、K^+)	Cytisine Epibatidine Anatoxin A	Mecamylamine Dihydro-β-erythrodine Erysodine Lophotoxin
$(\alpha_7)_5$ (α-Bungarotoxin-sensitive)	CNS Pre- and post-synaptic	Pre- & post-synaptic excitation Pre-junctional control of transmitter release	↑ Cation permeability (Ca^{2+})	Anatoxin A	Methyllycaconitine α-Bungarotoxin α-Conotoxin IMI


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Resources

- https://www.Parkinson.org
- KP Neuroscience Movement Disorders Program (1470 Maria Ln, Ste 420, Walnut Creek, CA)
- PD Active (Berkeley/Oakland) https://pdactive.wordpress.com/
- Dance Moves Me! For PD (Walnut Creek) http://dancemovesme.com/

Bay Area Classes

Tuesday Class: Walnut Creek

Where: Congregation B'nai Tikvah
25 Hillcroft Way
Walnut Creek, CA 94597

When: Every Tuesday *(ongoing)* **Time:** 1:00 - 2:30

Fee: $10/class - no charge for care partners

Park in the lot. There is disabled parking to the left, where you will see a few green doors . The green door furthest to the right leads in to our room, with a ramp. If you do not need the disabled entrance, come in the main entrance. Our room is to your left.

Pre-registration suggested: Contact Debbie Sternbach 510-653-8362


#UNITE FOR
PARKINSONS
WORLD
PARKINSON'S
DAY
THURSDAY
11 APRIL 2019

Event Details

Location: Embarcadero Plaza | **MAP**

Registration Opens: 9:00 a.m.
Walk Start time: 10:30 a.m.

Contact: Gena Lennon
ph: 415-963-0304
glennon@parkinson.org

KEEP CALM it's QUESTION TIME

References

- https://parkinson.org/Understanding-Parkinsons/Statistics
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