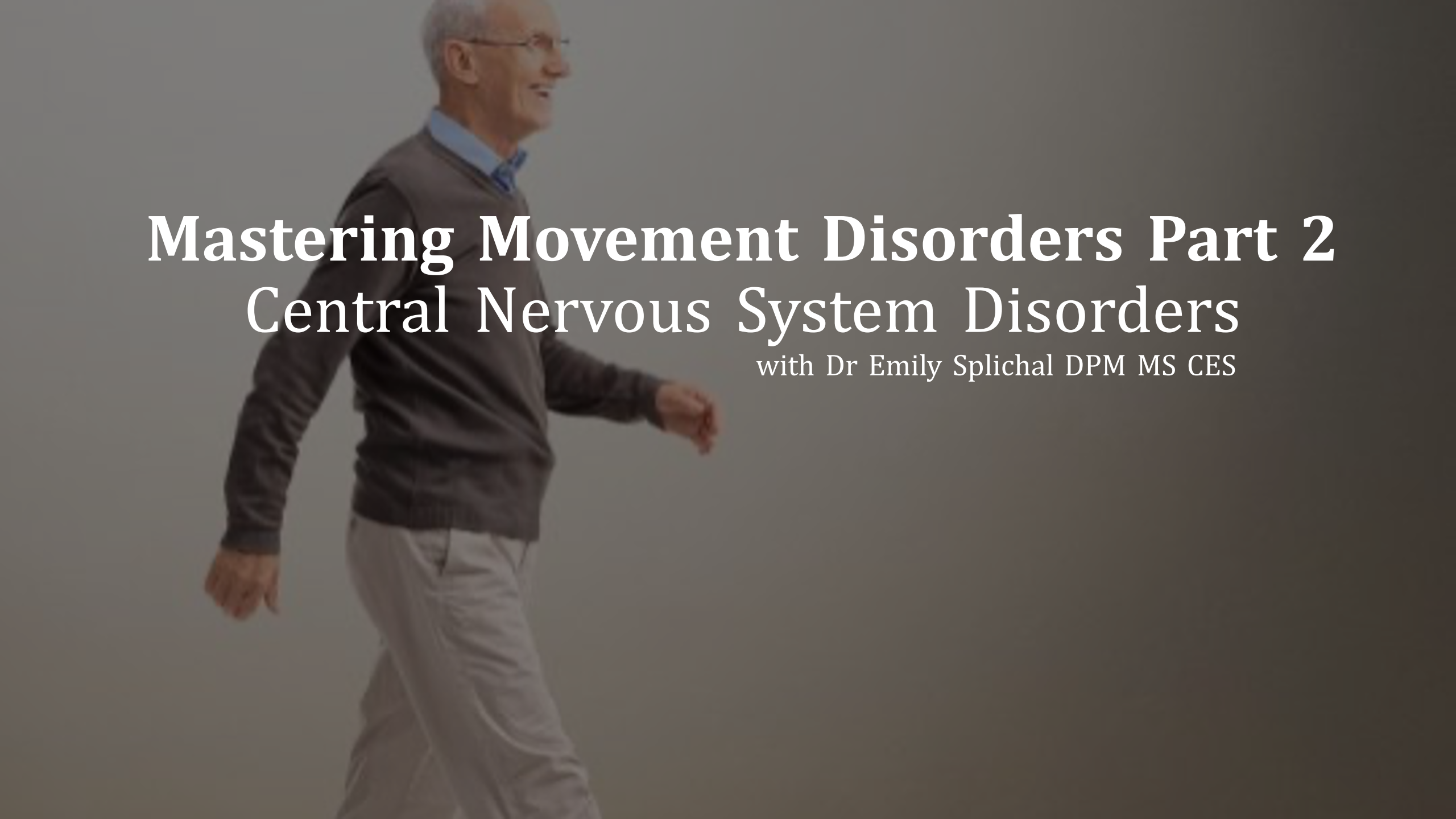


A man with white hair and glasses, wearing a dark sweater over a light blue collared shirt and light-colored trousers, is walking from left to right. He is smiling and looking towards the right. The background is a solid dark grey.

Mastering Movement Disorders Part 2

Central Nervous System Disorders

with Dr Emily Splichal DPM MS CES



A 4-Part Series

Part 1 – Peripheral Nervous System

Part 2 - Central Nervous System

Part 3 – Connective Tissue Disorders

Part 4 – Psychogenic Movement Disorders

Central Nervous System

Contains the majority of the nervous system including the brain, spinal cord, retina, optic nerve, olfactory nerves

Microscopically, there are differences between the neurons and tissue of the CNS and the (PNS)

Spinal nerves extend from spinal cord to peripheral tissue
31 spinal nerves (form plexuses)

The spinal cord relays information up to the brain through spinal tracts to the thalamus and ultimately to the cortex.
12 cranial nerves

Understanding Movement Disorder Vocabulary

Upper Motor Neuron vs. Lower Motor Neuron

- Stroke, Parkinson's, ALS, Cerebral Palsy
- Peripheral neuropathy, polio, spinal cord injury

Myoclonus

Involuntary, rhythmic, muscular contractions and relaxations. Often a sign of certain neurological conditions, particularly associated with upper motor neuron lesions

- Sudden jerk when sleeping

Dyskinesia

A category of movement disorders that are characterized by involuntary muscle movements similar to tics or chorea

Paroxysmal indicates that symptoms are noticeable only at certain times

- Paroxysmal Dyskinesia
- Paroxysmal Dystonia

Cholinergic of or relating to the neurotransmitter Acetylcholine

- PNS, Brain stem, neuromuscular junctions all use Ach
- Nootropics

Neurotransmitters

- GABA – inhibitory neurotransmitter, prevents over-excitation
- Dopamine
- ACh – excitatory, ANS
- NE, Epi -
- Serotonin – 90% of our 5-HT receptors are in GI sys

Intention Tremor

Intention tremor is a dyskinetic disorder characterized by a broad, low frequency tremor. Usually perpendicular to the direction of movement. Often overshoot or undershoot one's target, a condition known as dysmetria.

Central Nervous System Disorders

Parkinson's Disease

Cerebellar Ataxia

Stroke (Ischemic event)

Dystonia



Parkinson's Disease

2nd most common progressive neuro-degenerative disorder (Alzheimer's is first)

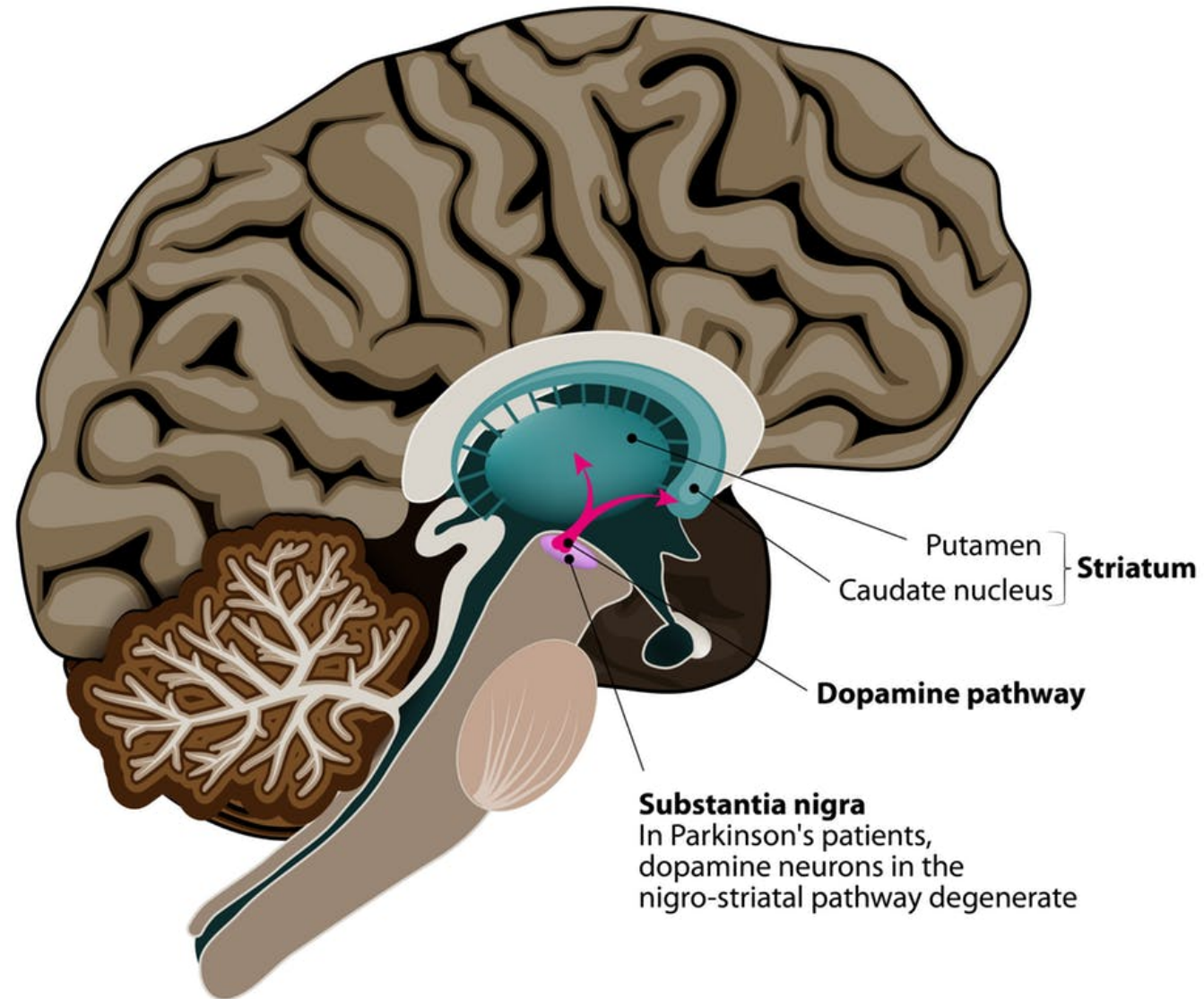
Caused by a loss of dopamine-secreting neurons in an area of the midbrain – substantia nigra

Characterized by tremor, rigidity, and bradykinesia (slowed movement), with postural instability

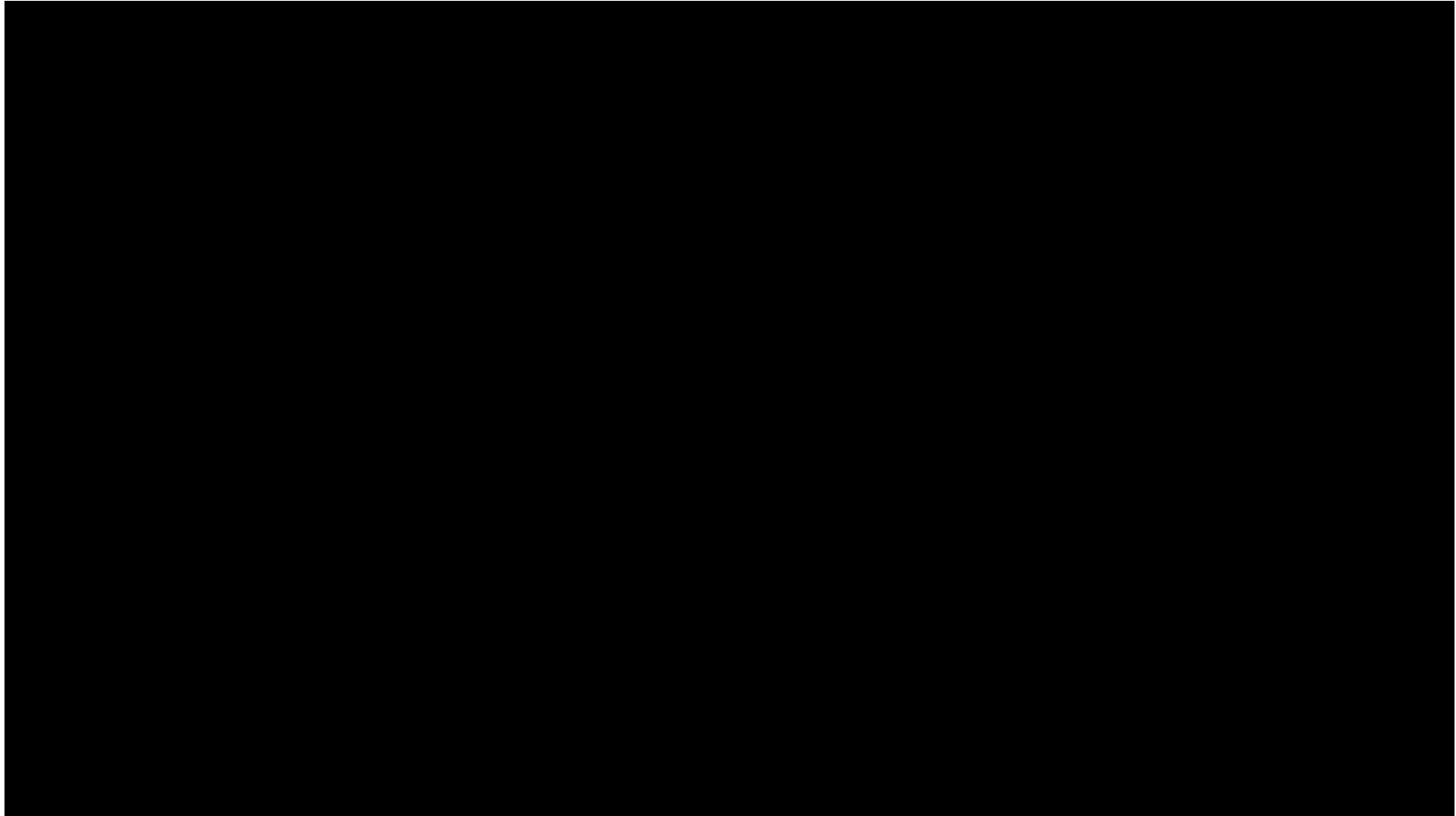
Must present two of the following clinical features: resting tremor, bradykinesia, rigidity and/or postural instability



PARKINSON'S DISEASE



Walking with Parkinson's Disease



Freezing and Hesitation with PD

Sudden and transient break (motor block) in the walking motion

Can be caused by the presence of a visible obstacle in the path, a change in the pattern of design on the floor, walking in narrow spaces (through a door) or turning

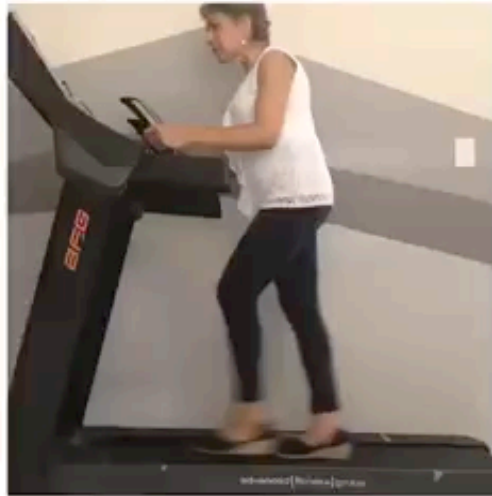
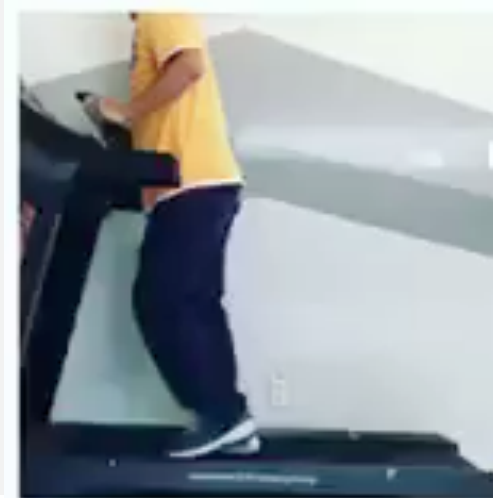
Can also be associated with festination, postural instability, and falling



Breaking the Freezing Gait

Audio Stimulation (Rhythmic)
Marching vs Stepping Forward
Weight Shift First

Naboso Insoles + Freezing Gait



Before

With NABOSO®
NEURO INSOLES



Before

With NABOSO®
NEURO INSOLES

Dual Tasking & Motor Learning

Prefrontal cortical activity is heightened during the performance of cognitive tasks, fine motor tasks and dual tasks

Learning new skill – learning to drive

Prefrontal activity increases as we age or in case of chronic neurological condition.

Periods of increased activity executing speed changes, complex walking tasks that require careful control of posture and of limb movements

Training for Dual Tasking

Train for direct recall:

- i.e. have them tell you the names of all their friends, family, or people they work with
- Name body parts, kitchen

Train for spatial awareness:

- i.e. have them tell you how many stop signs are between your location and their house

Train for decision making:

- Cue each punch with "blue" or "green"
- Progression:
 - When you call "blue" they have to hit "green" and vice versa



Cognitive Examples

- Count backwards from 100 by 3's, etc.
- Spell words forwards / backwards
- Name USA presidents starting with current and work backwards in order
- Name body parts (arms, ears, toes, nose, etc.)
- Name kitchen appliances
- Math equations
- Alphabet forwards / backwards
- Name every model of car by a specific auto manufacturer

The Stroops Test

This exercise makes you smarter by working both sides of your brain. Your right brain wants to say the color, while your left concentrates on saying the word

RED	GREEN	BLUE	YELLOW	PINK
ORANGE	BLUE	GREEN	BLUE	WHITE
GREEN	YELLOW	ORANGE	BLUE	WHITE
BROWN	RED	BLUE	YELLOW	GREEN
PINK	YELLOW	GREEN	BLUE	RED

Mirror Reading

Since I don't smoke, I decided to grow a mustache, it is better for the health. However, I always carried a jewel-studded cigarette case in which, instead of tobacco, were carefully placed several mustaches, Adolphe Menjou style. I offered them politely to my friends: 'Mustache? Mustache? Mustache?' Nobody dared to touch them. This was my test regarding the sacred aspect of mustaches.



**All brain training /
neuroplasticity training should
be performed in a sensory rich
environment**

Clark et al. (2014), who found that **wearing
textured insoles can reduce prefrontal cortical
activation during walking** in older adults with
mild somatosensory deficits

www.nabosotechnology.com

Parkinson's Regeneration Training Book

www.neuromotortraining.com

PARKINSON'S REGENERATION TRAINING

NEUROPSYCHOMOTOR REHABILITATION:
an integrative and fitness-based approach
to improving movement and cognition



Karl Sterling

Foreword by Dr. Perry Nickelston

Central Nervous System Disorders

Parkinson's Disease

Cerebellar Ataxia

Stroke (Ischemic event)

Dystonia



Ataxia

A neurological loss of voluntary coordination of muscle movements that can include gait abnormality, speech changes, and abnormalities in eye movements.

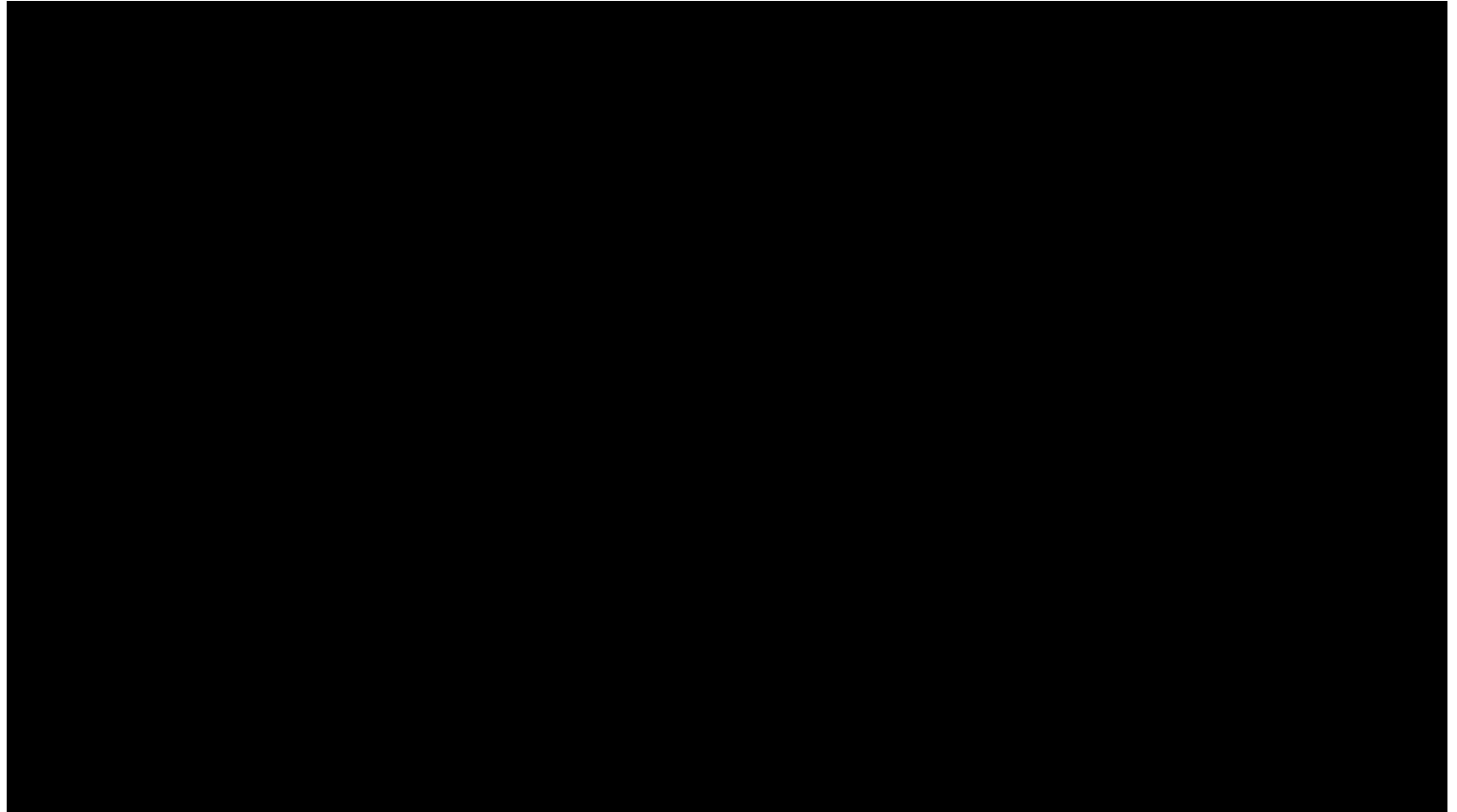
Ataxia is a clinical manifestation indicating dysfunction of the parts of the nervous system that coordinate movement, such as the cerebellum

Cerebellar

Sensory

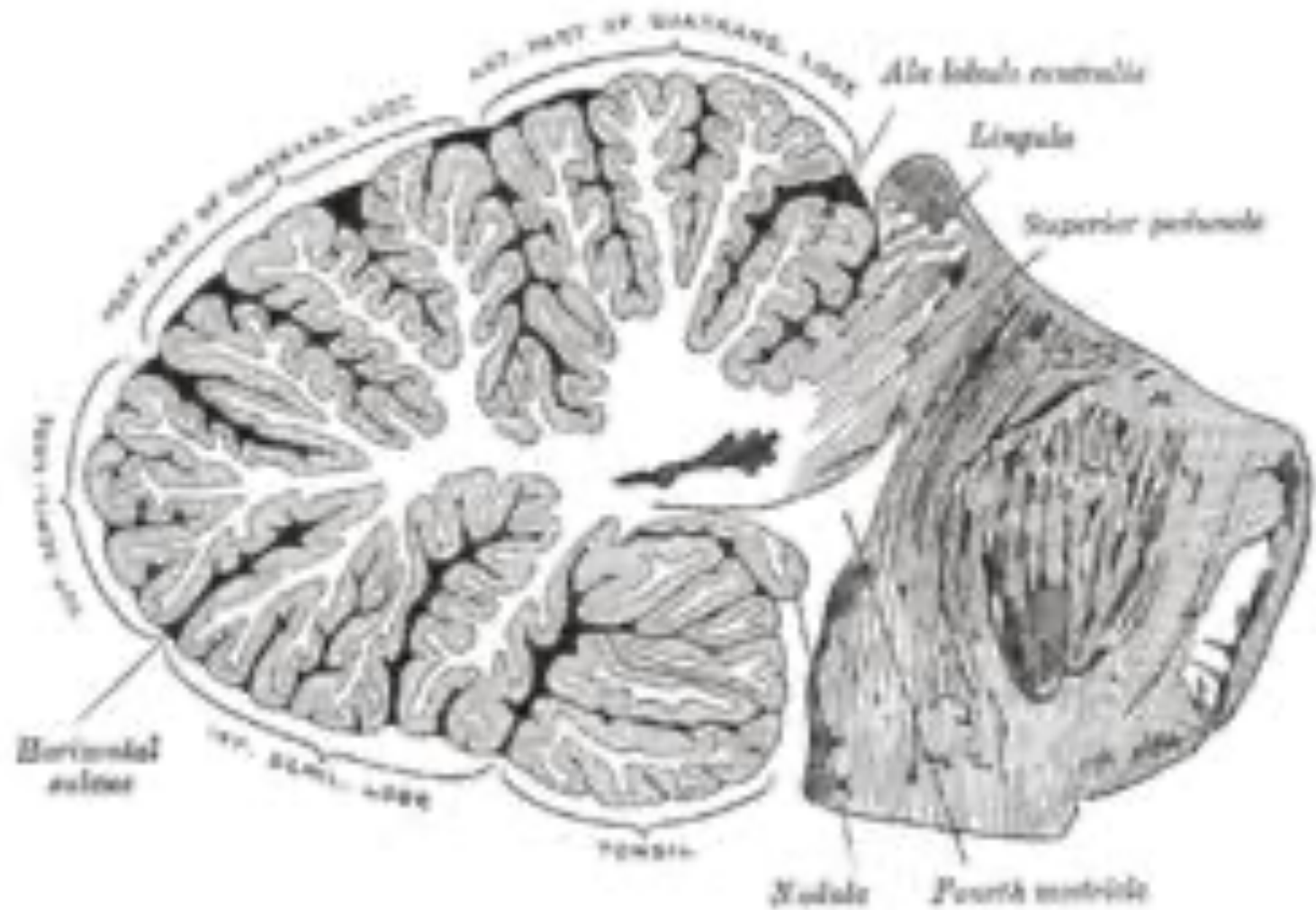


Cerebellar Ataxia





Has more
neurons
than the
entire CNS
combined



The Cerebellum

Balance (oldest function)

Gets input from inner ear

Trunk stability

Gets input from vestibular system

Coordination of limb movement

Error detection and immediate correction

Receives info from proprioceptors (muscle spindles, GTO)

Cerebral Cortex Communication

Fine motor movement, eye-hand coordination



Cerebellar Ataxia

Gait ataxia is one of the most common and debilitating motor disorders associated with cerebellar damage. Jerky movements, imprecise movements

Focal lesion (stroke)

Degeneration

Classic hypotonia

Decreased subconscious **proprioceptive input** to GTO & muscle spindles



Motor Learning & Ataxia

Error Detection

Perturbations during exercise execution

Re-enforcement learning

Reward after success execution

Sensitive to excess noise (input)

Weights to limb improves multi-joint movements

Weights to the torso (asymmetrical placement)



www.otvest.com

Central Nervous System Disorders

Parkinson's Disease

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Stroke – Ischemic event

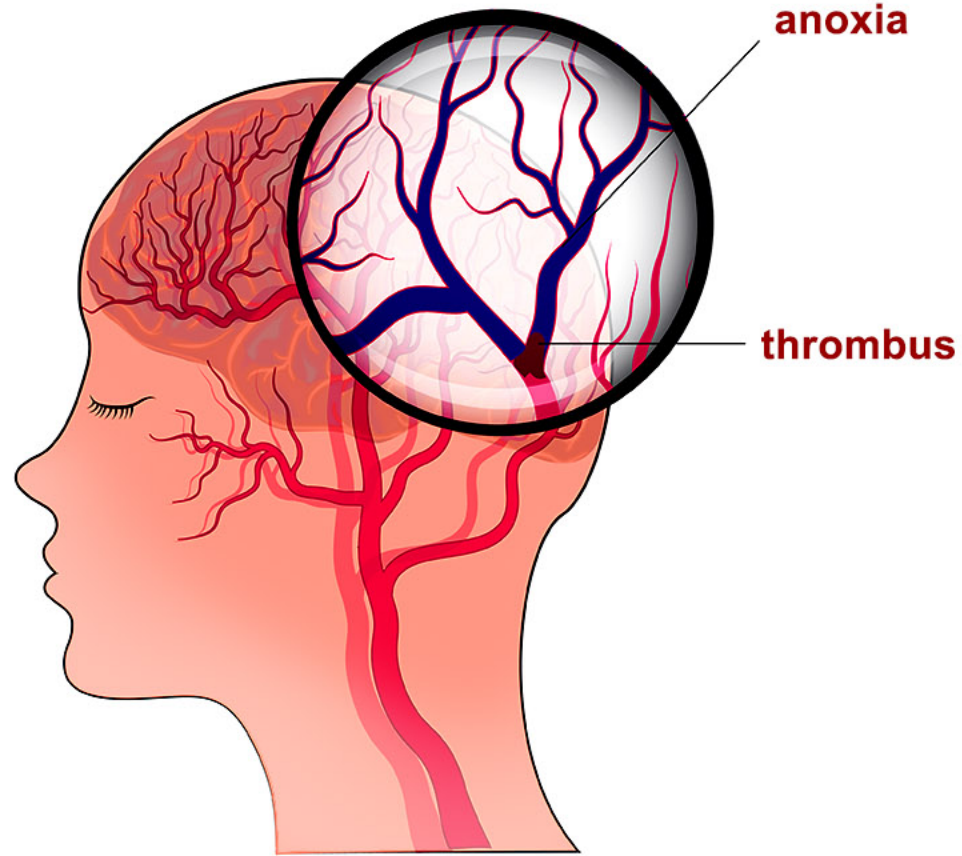
Narrowing or blocking of artery in brain
Decreased blood flow causes ischemia

Ischemic stroke

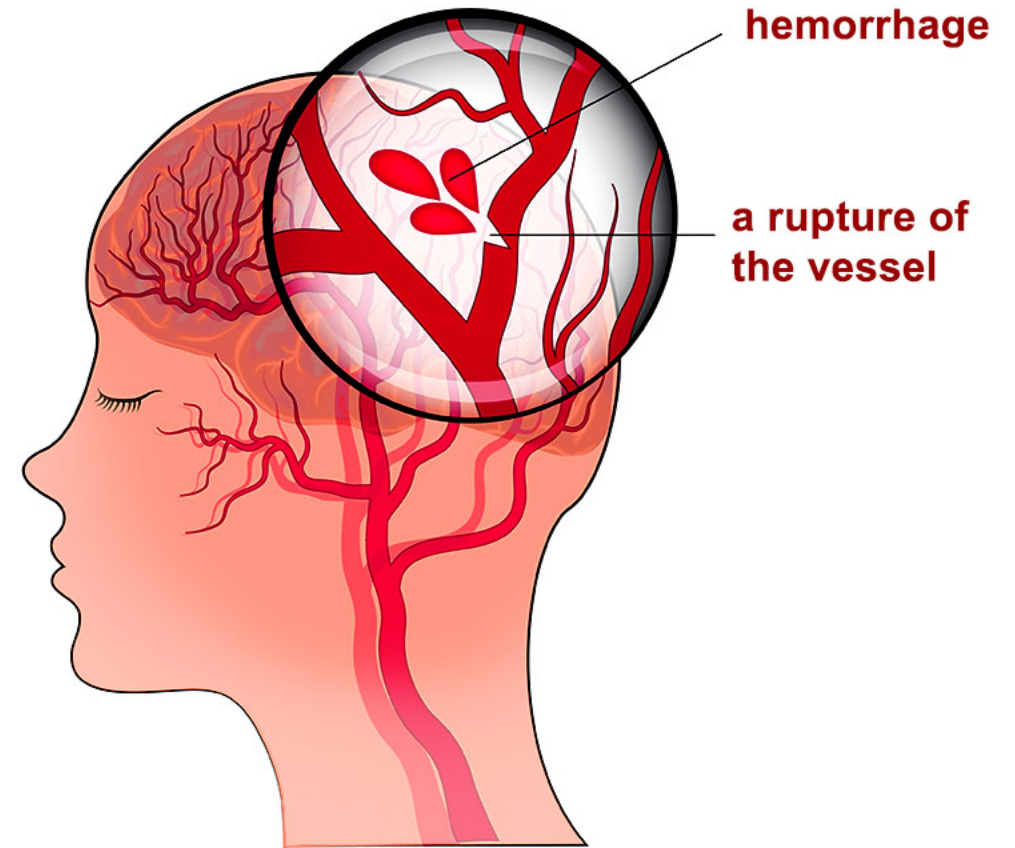
Embolism (clot) released and gets lodged in narrowed artery
Artery can burst due to pressure, bleeding to brain
Aneurysm is a weak spot in a blood vessel can burst
Bleeding causes pressure and damage to brain tissue

Hemorrhagic stroke

Two Types of Stroke

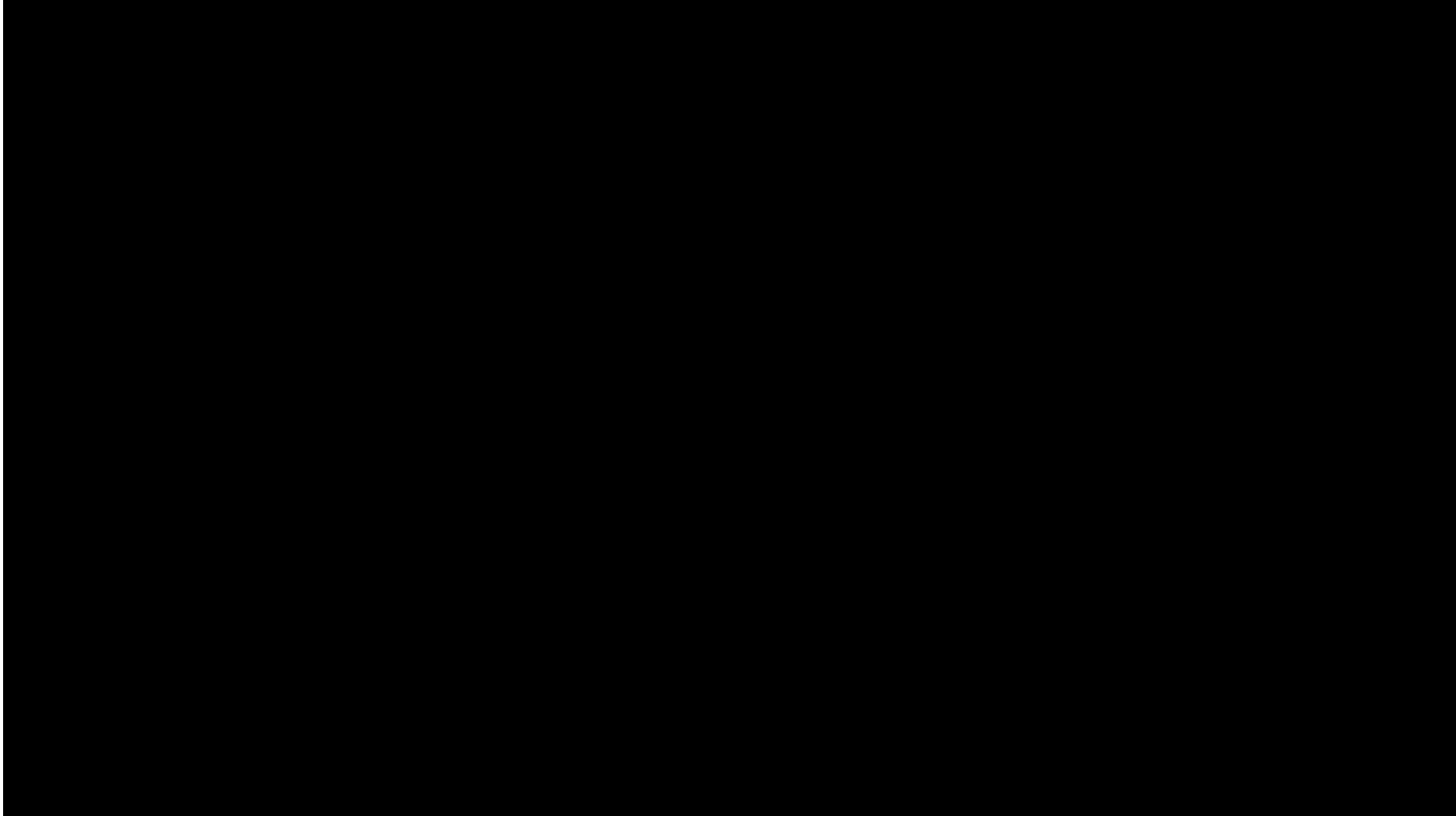


Ischemic Stroke



Hemorrhagic Stroke

Hemiplegic Gait



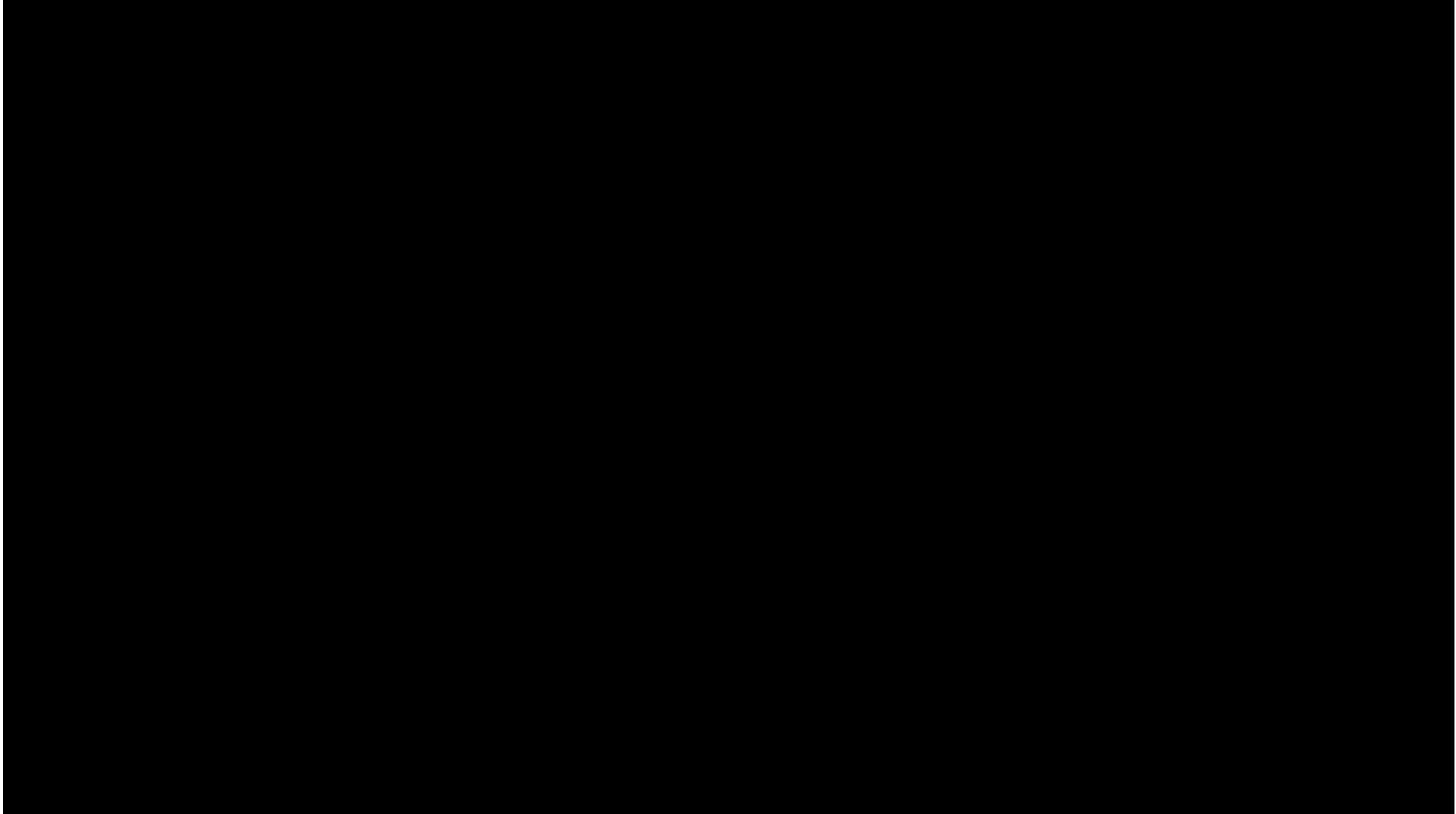


Gait Retraining Post-Stroke

Avoiding foot drop +
knee hyper-extension



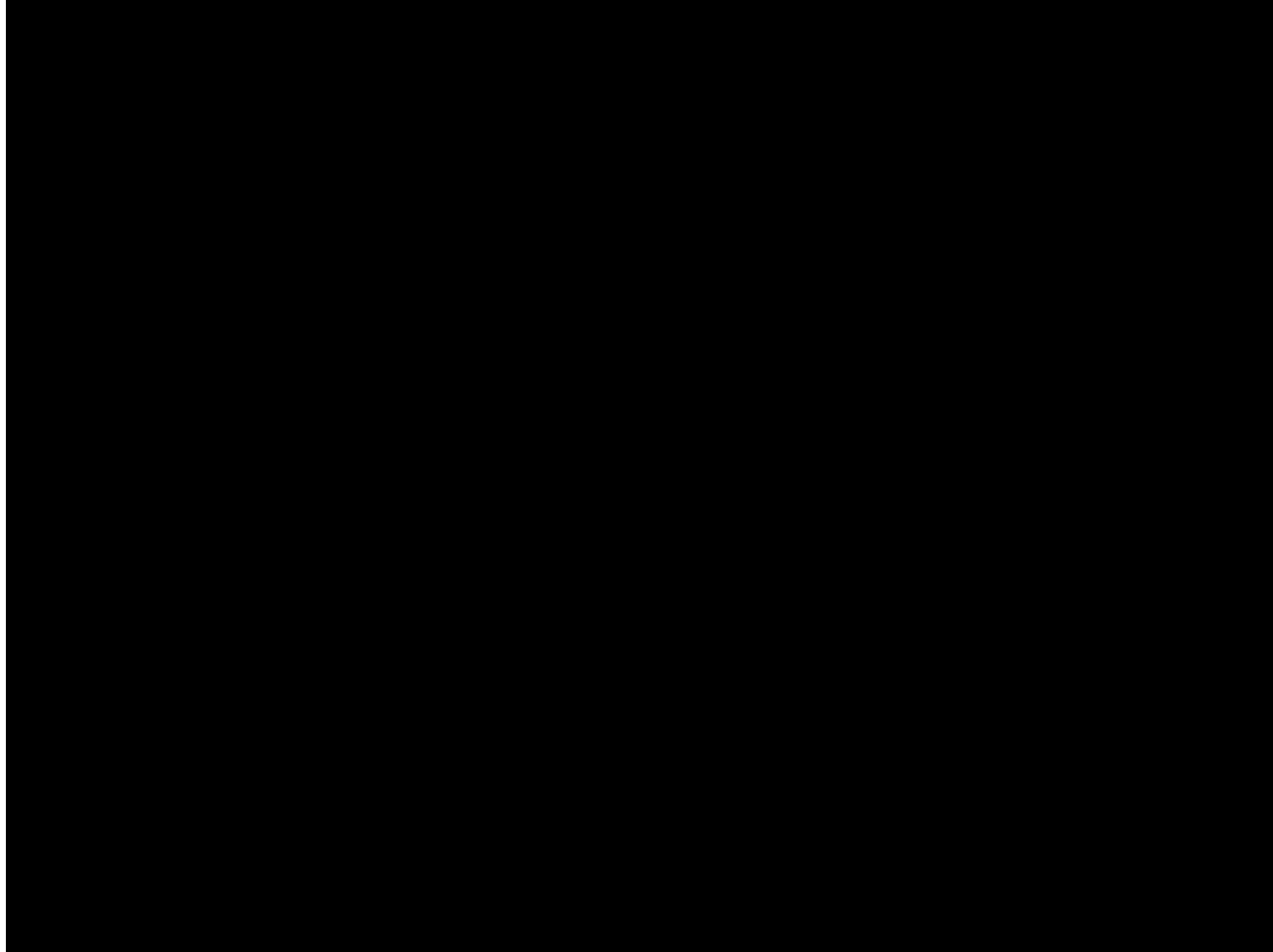
What's the global impact of foot drop?



Innovations in Neuro Rehab

Walking Poles (symmetrical stride)
Smovey (symmetrical swing)
Naboso (proprioceptive input)
Whole Body Vibration (proprioceptive input)
Hypersphere (proprioceptive input)

Urban Poling & Gait Symmetry



Smovey & Gait Symmetry



Central Nervous System Disorders

Parkinson's Disease

Cerebellar Ataxia

Stroke (Ischemic event)

Dystonia



Dystonia

Co-contraction and overflow of EMG activity of inappropriate muscles

Reduced spinal cord and brainstem inhibition

possible role of sensory feedback in the generation of dystonic movements.

This causes altered thalamic control of cortical motor planning and executive areas, and abnormal regulation of brainstem and spinal cord inhibitory interneuronal mechanisms.

Dystonia

Generalized

Focal (Cervical, Foot, Hand)

Multifocal

Segmental

Action induced (musicians, writer's cramp)

Inherited, Acquired (Parkinson's), Idiopathic (Functional)

Functional Dystonia

Hands, fingers, feet, toes

Associations of stress triggers and paroxysmal dystonia

Distraction during the event

fMRI shows smudging of homunculus map

Difficult to resume discrete movements

Runner's Dytonia

Rare, disabling, adult-onset focal dystonia involving proximal lower limbs. When recognized early, it may be treated effectively with either anticholinergic drugs, anticonvulsants, levodopa, or botulinum toxin injections

Motor Learning & Dystonia

Weight bearing during all rehab tasks

Increases sensory input

Weights to limbs to drive proprioceptive awareness

Botox!

Focal dystonia

Toxin A , Toxin B – Clostridium botulism (canned food)

Identified 19th Century

1978 – Strabismus, spasms

1989 – Botox A

2020 - 4 toxins available now for spasms, dystonia

Botox Mechanism of Action

ACh that connects nerve to muscle

Botox reduces over activation of ACh

Reduced spasm – no effect on nerve signals or brain activation



Part 3

Connective Tissue Disorders

