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A brain disorder involving death/ damage to dopaminergic neurons, resulting in significant loss of dopamine release from the brain¹

2nd Most common neurodegenerative disease, affecting 6 billion people globally



Every hour, 2 people in the UK are told by doctors that they have PD



Currently NO conclusive diagnostic test and NO cure

Investigate Non-motor Symptoms

Insomnia (Sleeping difficulty)²

- Caused by **painful postures** and sleep disturbed by the urge to urinate

Dysphagia (Swallowing difficulty)³

- Reduction in dopamine in the brain weakens nervous system functioning
- Result in a **loss of normal muscles coordination** along the **oesophagus** (food passageway)

Chronic pain⁴

- Caused by **damages in muscle tissues** and dysfunction of pain regulatory systems in the brain
- Electroencephalogram** (a recording of brain's electrical activity) studies showed that PD patients have increased anticipation of pain
- Population-wide studies demonstrated a close link between pain and impulsive control behaviours, e.g. over-eating
- PD patients may develop **depression** and **anxiety** over time

Study Motor Impairments

Bradykinesia, Rigidity, & Postural instability⁵

- Damage in 2 major brain regions
 - Substantia Nigra** of Basal Ganglia (Excitation centre)
 - Reduce **dopamine stimulation of cortex**
 - Pedunculopontine Nucleus** (Communication centre between Basal Ganglia & Cerebellum)
 - Reduce **stimulation of cerebellum** (motor control centre in the brain)
- When muscles don't receive adequate stimulation from the brain:
 - Longer response time from brain to muscle → Leads to **bradykinesia** (slowness of movement)
 - Reduced stimulation of muscle → Leads to **rigidity**
 - Increased time for brain to correct movements → Leads to **postural instability** (e.g. prone to fall when seated)

Improve Non-invasive Screening

Aims to detect PD before physical symptoms arise

- Allows **earlier intervention**, improved disease monitoring and treatment outcomes

Neuromelanin-magnetic resonance imaging (NM-MRI)⁶

- Neuromelanin: Pigmented by-product of dopamine metabolism, which accumulates over time in the brainstems of healthy people
- In PD patients, the loss of neurons in the brain leads to **loss of neuromelanin**

Skin swab test⁷

- Developed after Joy Milne who has a condition that makes her extremely sensitive to smell
- Collect **sebum** (lipid-rich biofluid on the skin) from upper back and forehead of the individual
 - Identify compounds** in the sebum with biochemical tools
 - Compare** PD patients' sebum composition with that of undiseased people and develop it into diagnostic tools

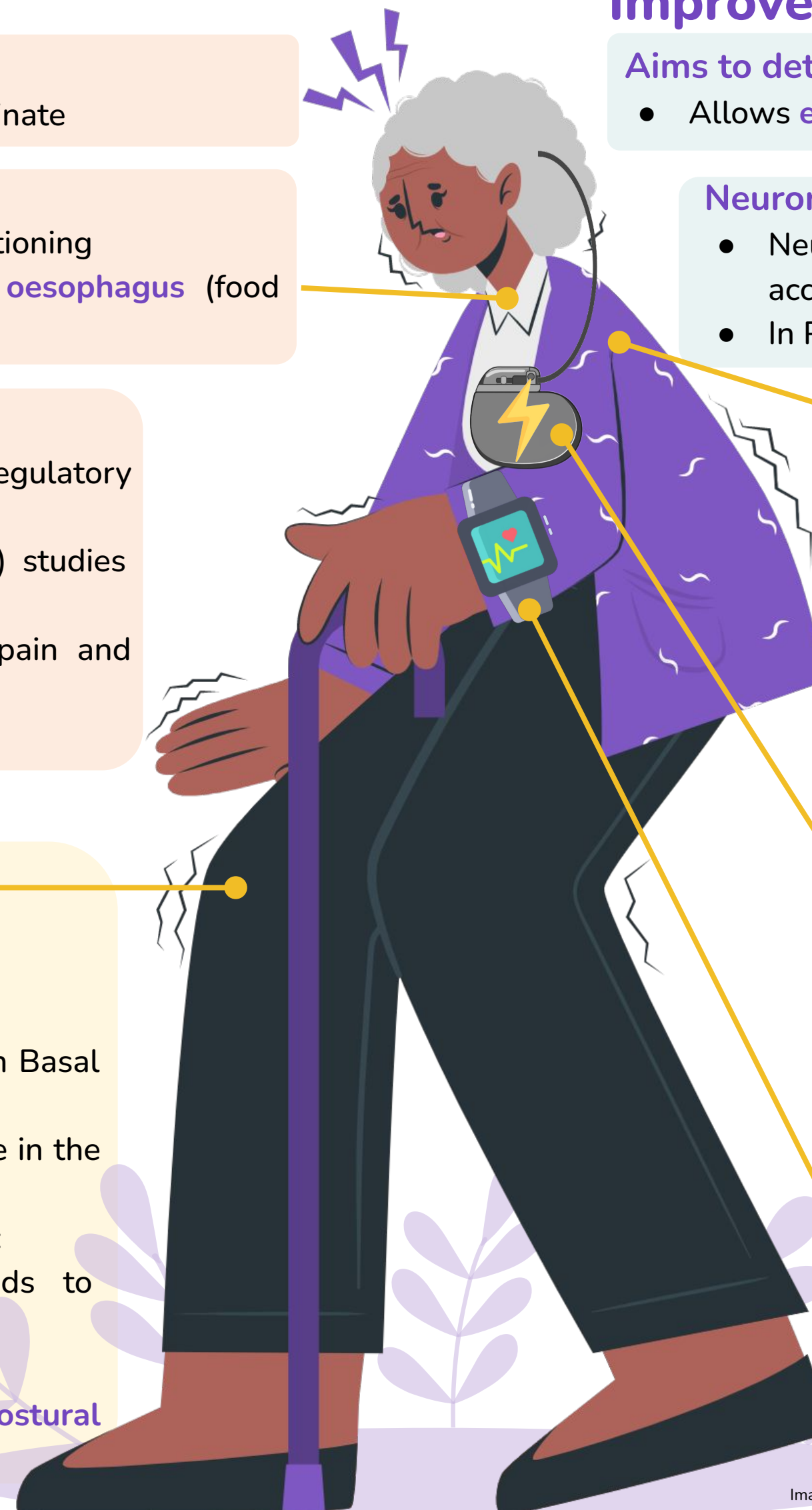
Improve Treatments

Deep Brain Stimulation (DBS)⁸

- Surgical therapy where **electric currents** are passed into the subthalamic nucleus (a movement regulation region in the brain)
- Improves both motor and non-motor symptoms**, thus enhances quality of life
- Effects proven by multiple clinical trials with over 6 months monitoring

Parkinson's KinetiGraph⁹

- A small **watch-like device** worn on the wrist to collect data on movements, daytime sleepiness and night-time sleep disturbances
- Help clinicians and research team evaluate how medications or DBS treatments affects symptoms → **Better management of symptoms**



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