



Title: PRESENCE OF NEUROGLOBIN IN THE SUBSTANTIA NIGRA IN A MURINE MODEL OF PARKINSON’S DISEASE: AN IMMUNOHISTOCHEMICAL STUDY

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Neuroglobin

Member of the globin superfamily

Hexacoordinated heme group with O₂ fixation capacity (Dewilde 2001)

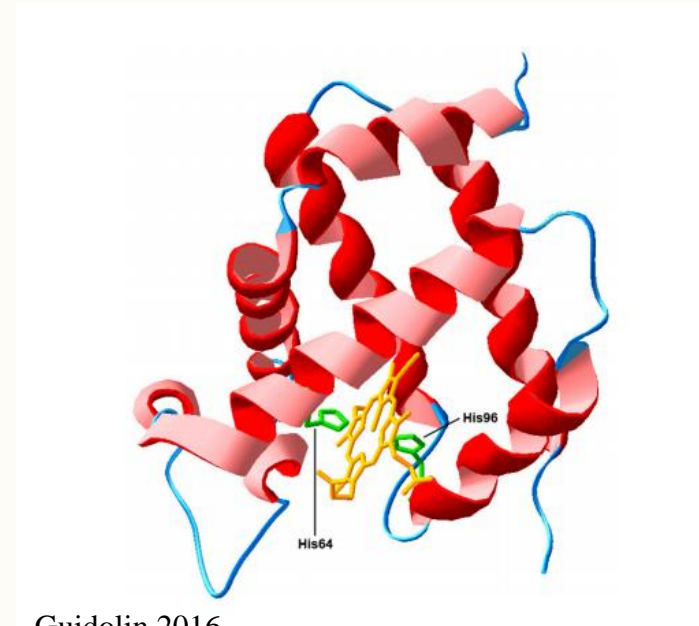
Discovered in 2000 (Burmester 2000)

Presence in CNS, retina, intestines and endocrine glands (Wystub 2003)

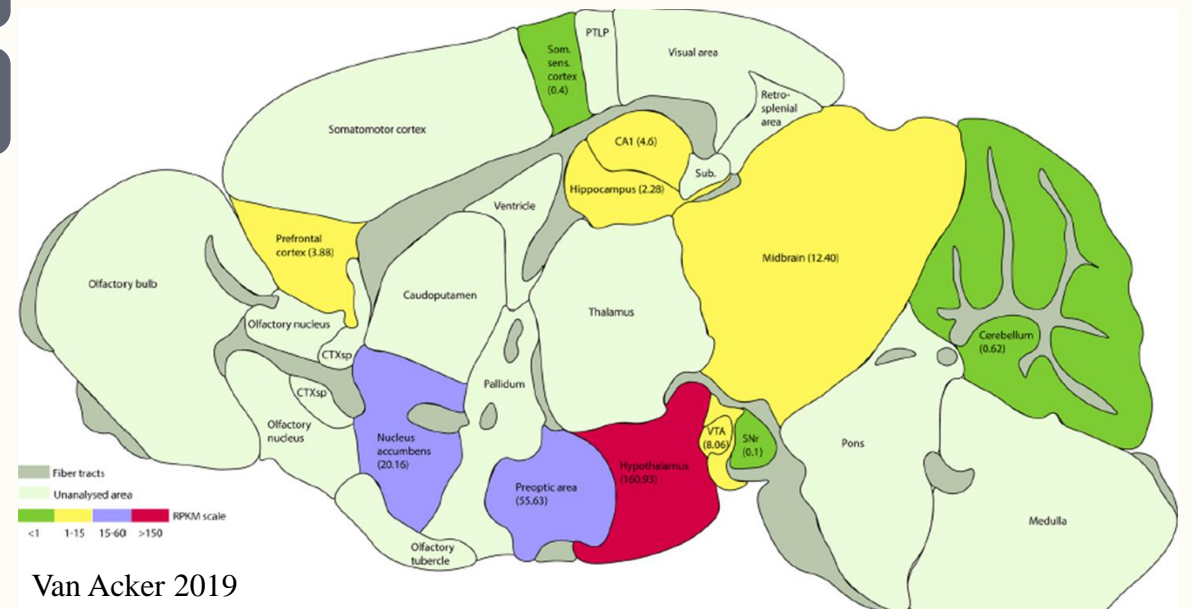
Constitutive expression in neurons (Wystub 2003)

Inconspicuous functions in physiological context

Introduction

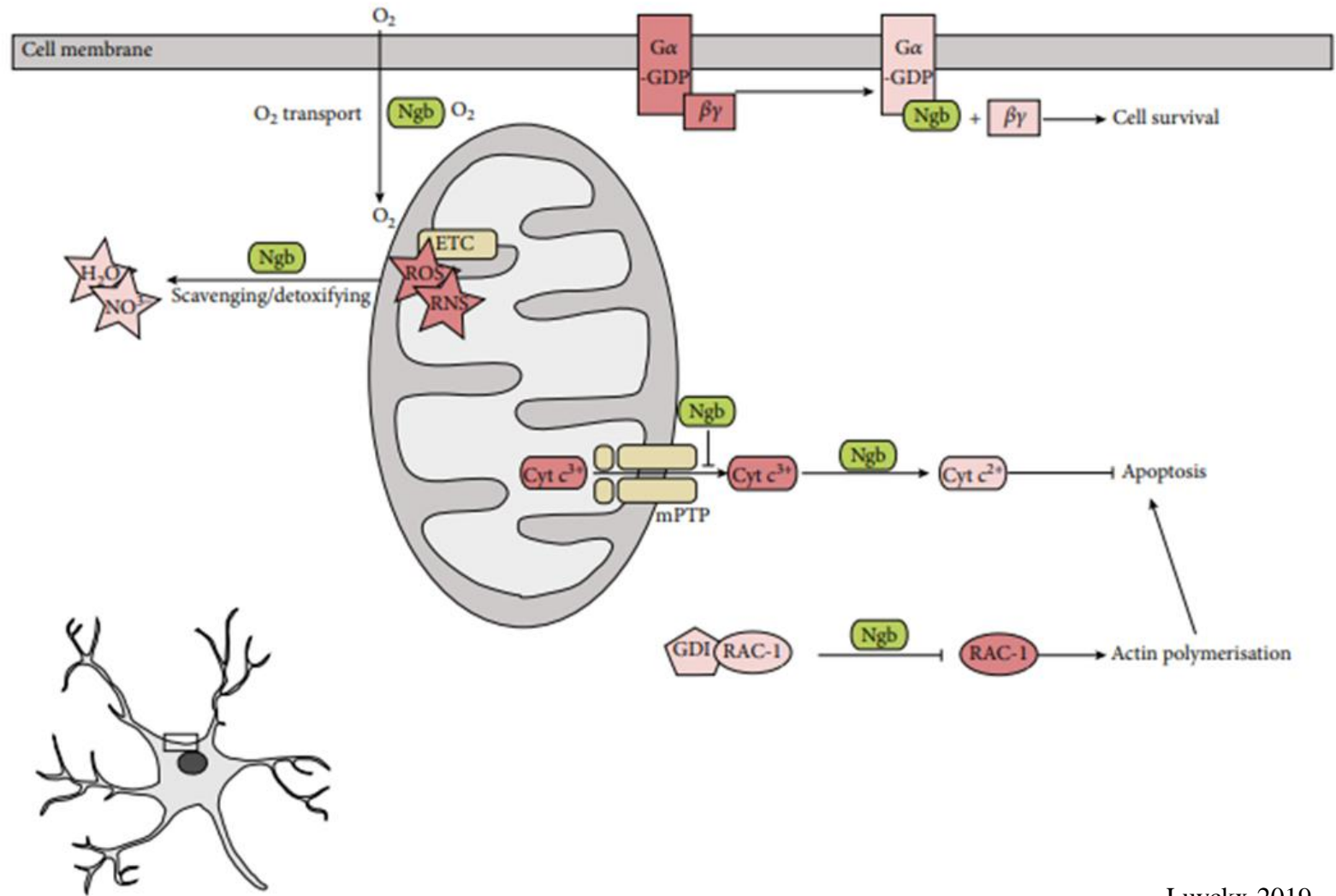


Guidolin 2016



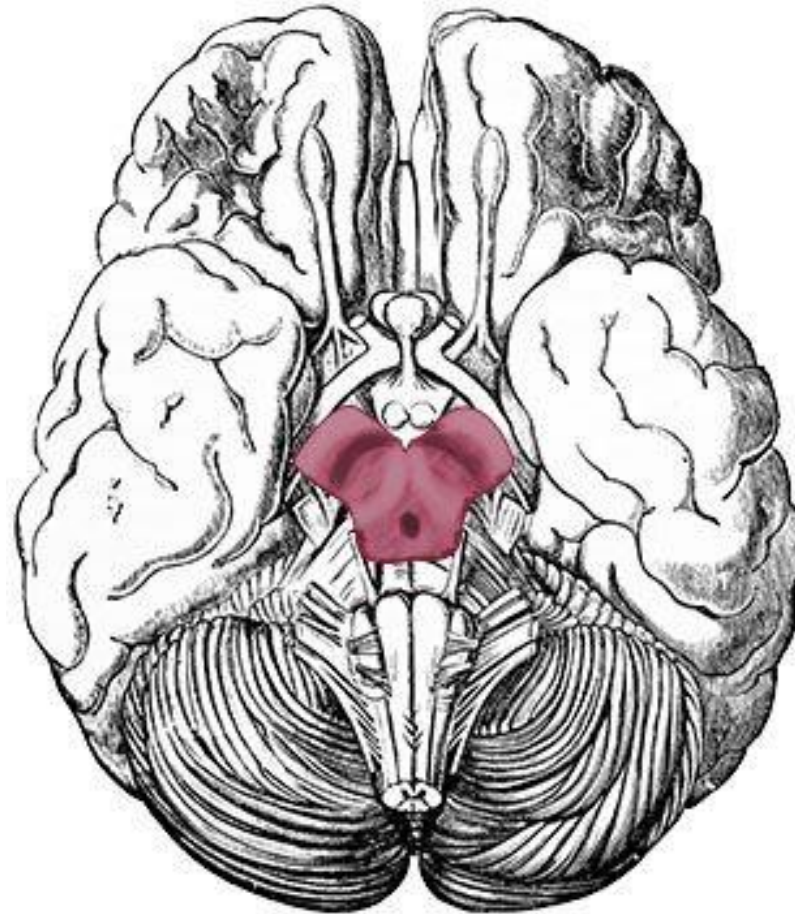
Van Acker 2019

Neuroglobin functions



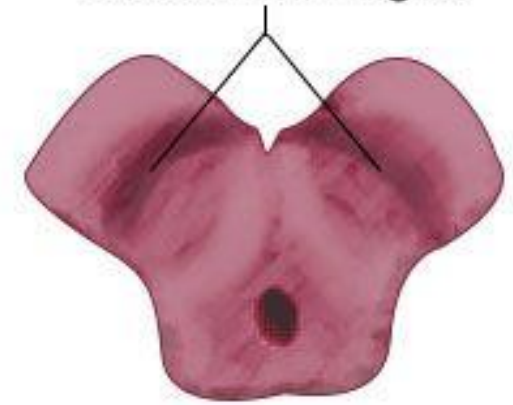
Introduction

Substantia nigra



Cut section of the midbrain where a portion of the substantia nigra is visible

Substantia nigra



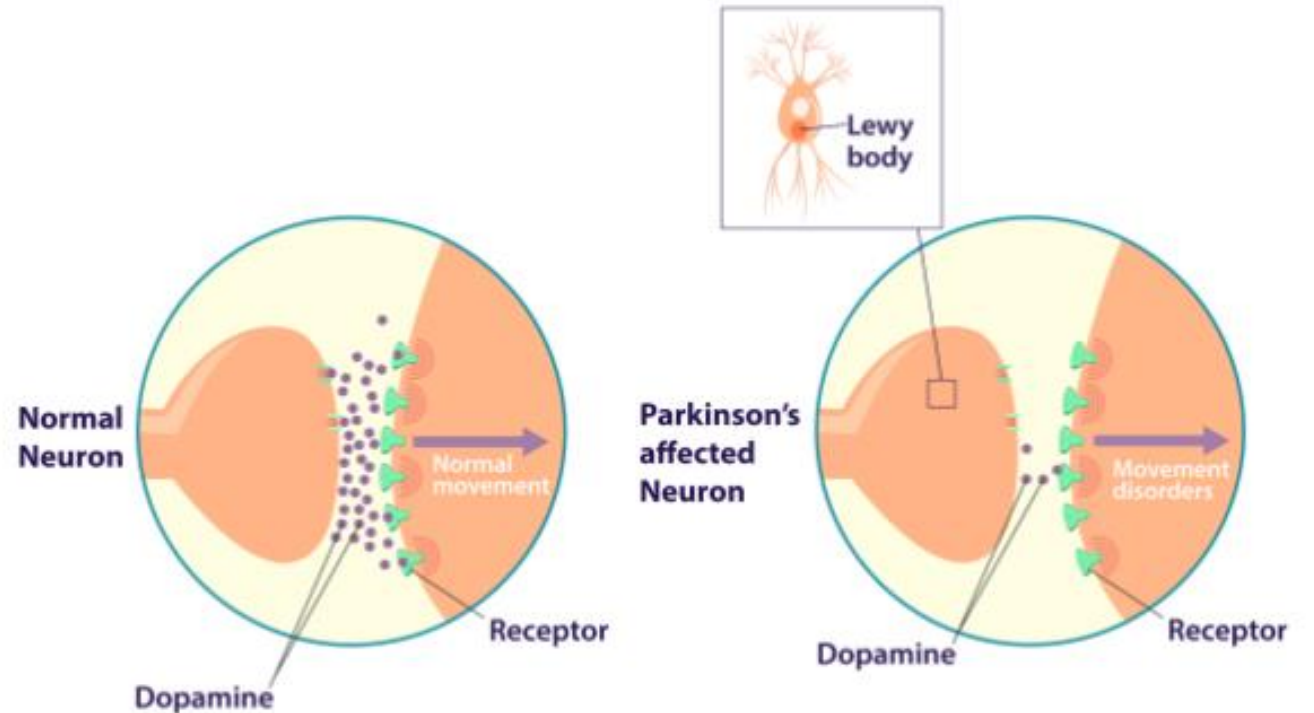
Reduced substantia nigra as visible in Parkinson's disease



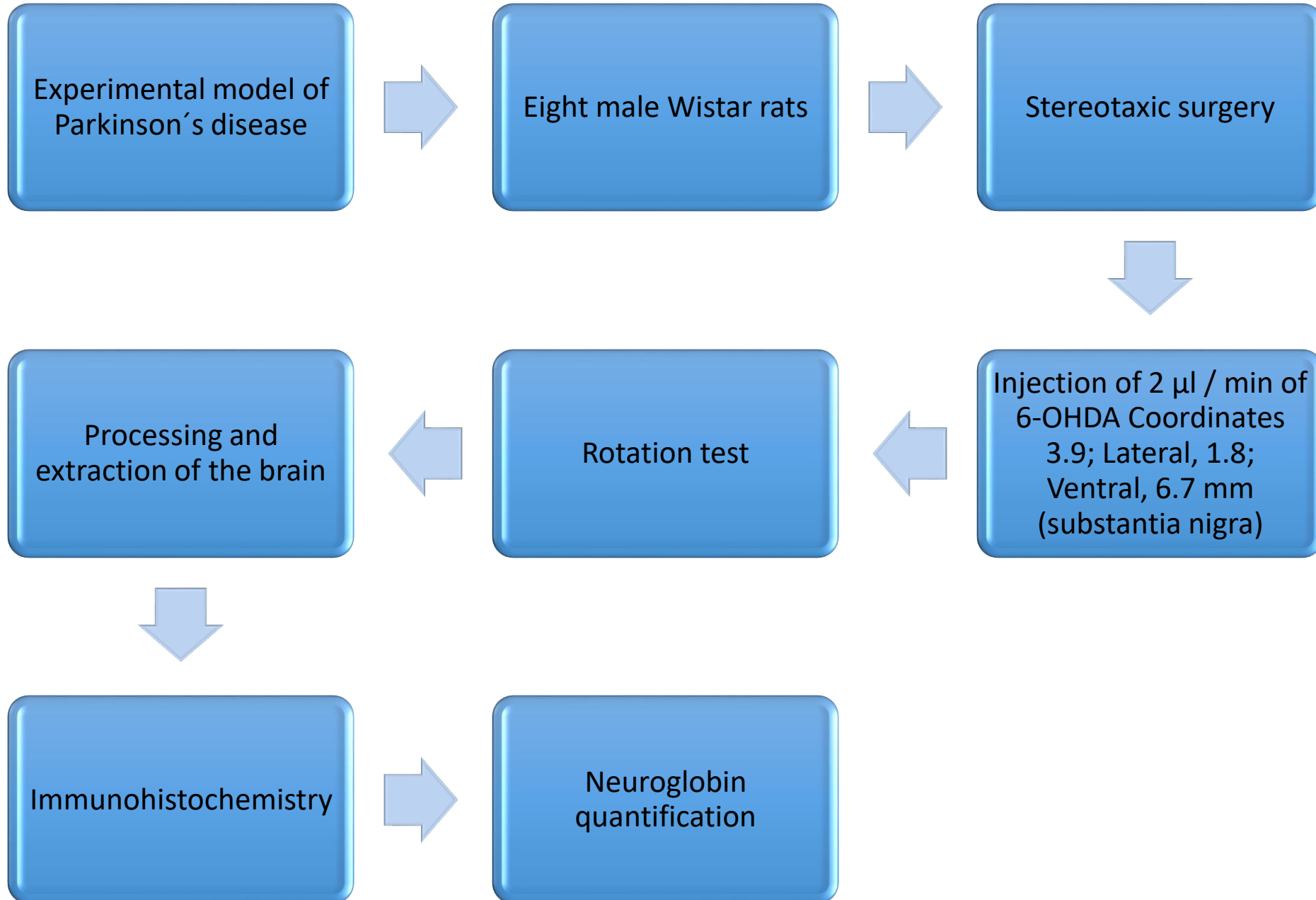
Introduction

Parkinson's disease

- Chronic neurodegenerative disorder
- Motor disturbances (slow voluntary movements, resting tremor, muscle stiffness, and impaired gait and balance) (Stacy, 2009).
- Affects up to 3% of the population over 60 years old (Tysnes & Storstein, 2017).
- In Mexico a prevalence of 40-50 cases per 100,000 inhabitants / year.
- Affects 4.1-4.6 million people over 50 years of age around the globe.
- Loss of dopaminergic cells in the substantia nigra (SN) (Hornykiewicz, 2006).
- Fibrillar aggregates (Lewy bodies) in soma of vulnerable neurons lead to neuronal dysfunction, oxidative stress and apoptosis.
- Human neuroglobin showed a protective effect against the formation of α -synuclein aggregates in yeast and mammalian cells (Kleinknecht 2016).



Methodology



Methodology



Figure 1. Stereotaxic surgery for induction of murine model of Parkinson's disease



Figure 2. Automatic lap counter for rotarod test



Figure 3. Brain section at ventral midbrain level, showing the lesion in *substantia nigra* (black arrow).

Results

A reconstruction area -
Bregma coordinates -6.00
mm and interaural 2.96 mm,
according to Paxinos



Figure 4. Reconstruction of *substantia nigra* sections (blue box)

Results

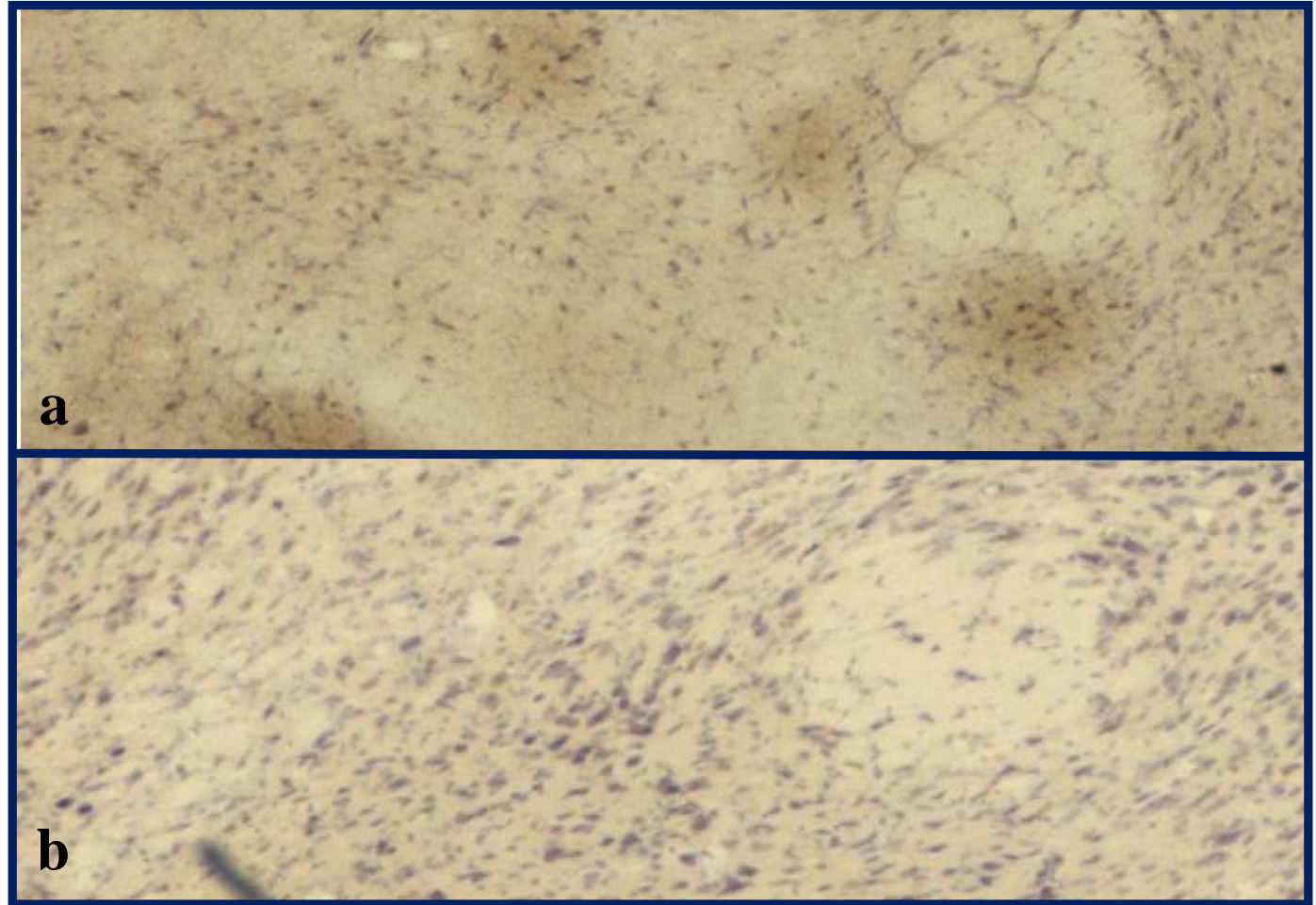
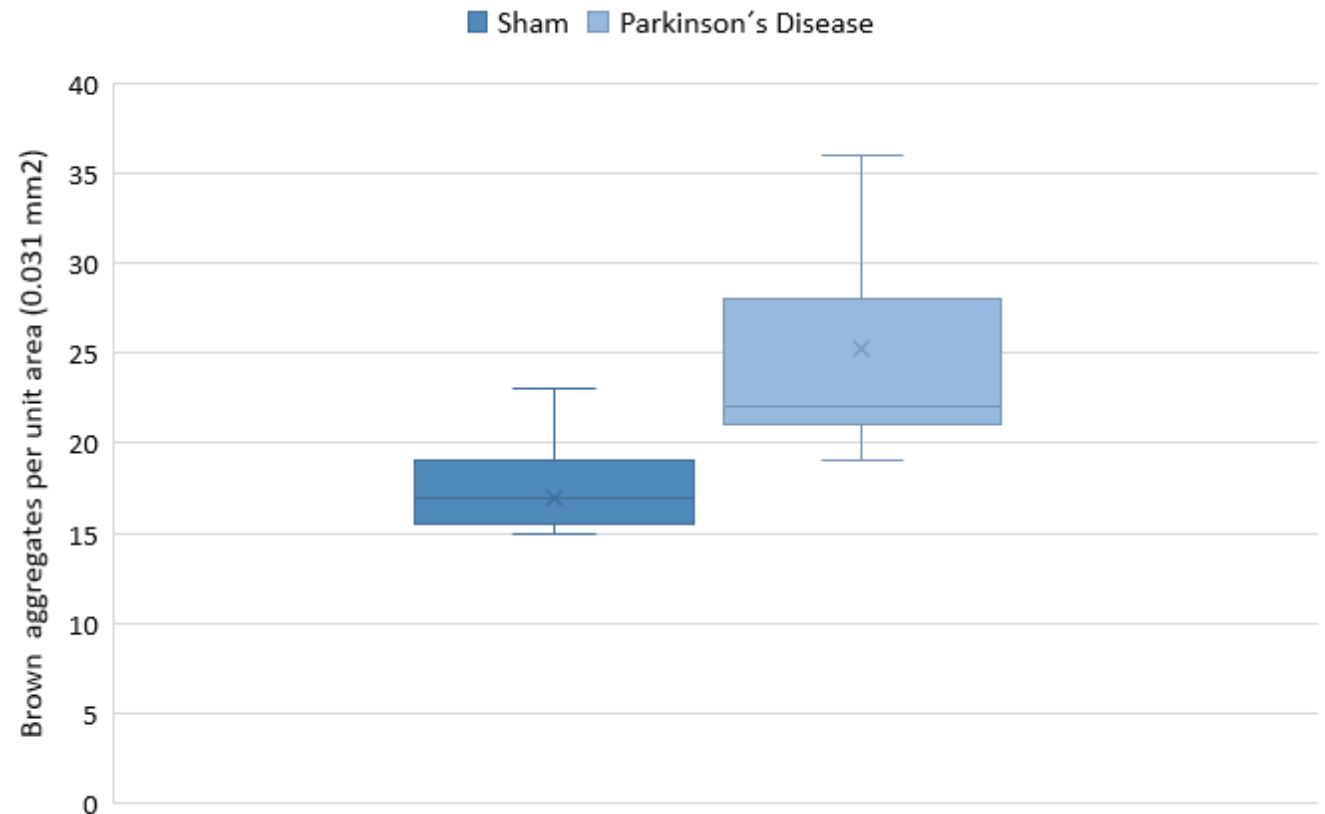


Figure 5. Immunohistochemistry of neuroglobin in *substantia nigra* of murine model of Parkinson's disease. Points correspond to NGB aggregates. a. Sham. b. Parkinson.

Results

Presence of NGB when the 6-OHDA lesion is present ($\bar{X} = 25.22 \pm 2.005$) compared to control ($\bar{X} = 17 \pm 1.179$), according to the density of NGB aggregates found in the target area (0.031 mm²) in the triplicate counts that were carried out ($t(16) = -3.535$ $p < 0.003$)



Conclusions

We found presence of neuroglobin in *substantia nigra* in sham op, area where it had not been previously described

Its presence was lower than in experimental subject ($X = 25.22 \pm 2.005$ vs $X = 17 \pm 1.179$, $t(16) = -3.535$ $p < 0.003$)

Our study shows the first report of NGB presence in *substantia nigra* and a statistically significant increase of the protein when the lesion was present, corresponding to the main area affected in PD due to the loss of dopaminergic neurons.

We suggest that an increase in NGB in *substantia nigra* could indicate a upregulation dependent on damage and neurodegeneration.

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