

# **Clinical Investigation of the Dopaminergic System with PET and 18-F-Fluoro-L-DOPA**

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Positron Emission Tomography (PET) is a tool that provides quantitative physiological information. It is valuable both in a clinical environment, where information is sought for an individual, and in a research environment, to answer more fundamental questions about physiology and disease states. PET is particularly attractive compared to other nuclear medicine imaging techniques in cases where the anatomical regions of interest are small or when true metabolic rate constants are required. One example with both of these requirements is the investigation of Parkinson's Disease, which is characterized as a presynaptic motor function deficit affecting the striatum. As dopaminergic neurons die, the ability of the striatum to affect motor function decreases. The extent of functional neuronal damage in the small substructures may be ascertained by measuring the ability of the caudate and putamen to trap and store dopamine, a neurotransmitter. PET is able to utilize a tracer of dopamine activity, 18-F-L-DOPA, to quantitate the viability of the striatum.

This thesis work deals with implementing and optimizing the many different elements that compose a PET study of the dopaminergic system, including: radioisotope production; conversion of aqueous 18-F into [18-F]-F<sub>2</sub>; synthesis of 18-F-L-DOPA; details of the PET scan itself, measurements to estimate the radiation dosimetry; accurate measurement of a plasma input function; and the quantitation of dopaminergic activity in normal human subjects as well as in Parkinson's disease patients.