



Title: Molecular Imaging in Early Detection of Alzheimer's Disease

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Molecular imaging permits evaluation and follow up in the living brain of patients of the basic molecular mechanisms highlighting disease progression. Earliest metabolic signs of Alzheimer's disease reflecting the effect of pathological processes on neuronal circuits are assessed *in vivo* with 2-deoxy-2-[F-18]fluoro-D-glucose. Most recently imaging probes for detection of amyloid neuropathology (both tau and β amyloid deposits) (e.g., [F-18]FDDNP) and neuronal losses (e.g., [F-18]MPPF) were developed. They provide specific access to the visualization of brain pathology accumulation in the living brain of dementia patients and its consequences, most specifically losses of critical neurons associated with memory deficits and other neuropsychiatric impairments. [F-18]FDDNP is the only available molecular imaging probe able to detect tau pathology in the living brain of patients, not only in Alzheimer's disease, but also in frontotemporal dementia and progressive supranuclear palsy. The combination of molecular probes targeting various disease processes allows for detailed monitoring of disease progression, facilitates diagnosis and permits development of strategies for therapeutic interventions. The understanding of biochemical and cellular mechanisms involved in the development of various dementias demonstrates that molecular imaging becomes significant when used as a tool for detection of early changes during the pre-symptomatic stages or as a tool to guide prevention well before dementia is clinically detectable. Since successful treatment is the logical goal, detecting the disease when brain damage is expected to be still limited is of essence.