

Biology and Pathology

Central Nervous System

Pathophysiology and Imaging of Neurodegenerative Diseases

Karl Herholz

Manchester, UK

Learning Objectives:

- Overview on current imaging techniques related to the pathophysiology of human neurodegenerative disease
- Insight into the perspectives and challenges for imaging in translational research

Most neurodegenerative diseases are characterized and probably caused by pathological protein depositions. The most frequent is amyloid deposition in Alzheimer's disease (AD), which can now be imaged clinically with specific PET tracers, including ¹¹C-PIB, ¹⁸F-PIB (flutemetamol), and ¹⁸F-florbetapir. Other pathological proteins are phosphorylated tau in neurofibrillary tangles

(AD) and Pick bodies (Frontotemporal Dementia), and alpha-synuclein in Parkinson's disease (PO) and Dementia with Lewy bodies (DLB). Tracers for these are under development. PET and SPECT imaging techniques have also been developed for impaired neurotransmitter systems in PO and DLB (dopamine synthesis, transport and vesicular storage; vesicular monoamine transporter) and AD and DLB (acetylcholine esterase, nicotinic receptors). Changes in functional activity and connectivity are being imaged by FOG PET, techniques for blood flow measurement (PET, SPECT, ASL), fMRI (activation and resting state studies), MR tractography, EEG and MEG. Most techniques are applicable to experimental animals and humans, thus providing essential tools for translational research and "reverse translation" by stimulating experimental research on issues detected primarily in human disease.