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Radiopharmaceuticals for PET imaging of brain functions

PET (Positron Emission Tomography) is one of the most effective methodologies for the functional and molecular imaging of human brain with high sensitivity and quantitative measurement. This consists from the coincident matrix detection technique and the in-vivo positron tracer. In 1976, the first brain regional glucose consumption mapping in human had been succeeded with ^{18}FDG in collaboration among of Brookhaven National Laboratory, NIH and Pennsylvania University. These regional glucose consumption mapping had led to understanding the function of central nerves system (specially, sensor cortex and mortar cortex). In 1982, the first neuro-receptor imaging (Dopamine D2) human brain in-vivo with ^{11}C-methylspiperon was succeeded in the collaborative work between Johns Hopkins Medical School and Uppsala University. This was the starting point of the molecular imaging by PET. After this, the compounds related to signal transduction (agonist, antagonist) were labelled with ^{11}C or ^{18}F and applied to determination of synapse activity. Dopaminergic, Serotonergic, Cholinergic, Histaminergic, GABAergic, Glutamatergic receptors can be determined by this method. Also positron labelled MAO inhibitor and ACh-esterase inhibitor are applied to diagnosis of Parkinson's disease (PD) and Alzheimer's diseases (AD). Recent highlight works in Brain PET research are the imaging of amyloidal plaque and active tau protein for AD patient. ^{11}C- and ^{18}F-labelled thioflavin analogs have been developed as amyloidal plaque marker. Active tau protein image by ^{18}F-THK compound (quinoline derivative) is closer related to cell denature than amyloidal plaque image. Another highlight work is the imaging of neuro-inflammation that may be important to find tissue denature at early stages in PD, AD and other neurodegenerative diseases. For this purpose, TSPO (translocator protein) ligand (phenoxy phenyl acetamide and oxo purine derivatives) is labelled with ^{11}C and ^{18}F. Development of PET methodology requires both factors such as the progressing of detection equipment and the finding of new radiopharmaceuticals which are suitable for functional imaging and molecular imaging.

Speaker Biography

Tatsuo Ido is a Chair Professor and the Director of Theragnostic Compound R&D Center, Neuroscience Research Institute, Gachon University (Republic of Korea) and Emeritus Professor of Tohoku University (Japan). He had completed his PhD of Pharmaceutical Sciences at Graduate School of Tokyo University (Tokyo, Japan) in 1970. He has investigated PET radio-pharmaceuticals for near 50 years at National Institute of Radiological Sciences (Chiba, Japan), Brookhaven National Laboratory (Long Island, USA) and Tohoku University (Sendai, Japan). In 1976 at BNL, he had succeeded first synthesis of ^{18}FDG and applied to human brain functional study. After retired as Professor of Tohoku University, he had continued his research work as Professor of High Energy Biomedical Research Center of Fukui University (Fukui, Japan). From 2007 to 2012, he had leaded stable supply of radioisotopes in Japan at Japan Radioisotope Association as Executive Director. From 2013 until present, he is working continuously in developing new PET radiopharmaceuticals in Neuroscience research field.

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