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CIC biomaGUNE
CENTER FOR COOPERATIVE RESEARCH IN BIOMATERIALS

seminar

Tuesday, 23rd July, 12.00 pm, Seminar Room

Host: Dr. Jordi Llop

The role of quantification in the future of clinical and preclinical PET

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Positron emission tomography (PET) is the most selective and sensitive (picomolar to nanomolar range) method for measuring molecular pathways and interactions *in vivo*. By using different tracers, a multitude of physiological, biochemical and pharmacokinetic parameters can be measured. These include blood flow (perfusion), oxygen and glucose metabolism, presynaptic and postsynaptic receptor density and affinity, neurotransmitter release, enzyme activity, synaptic density, drug delivery and uptake, gene expression, etc. For clinical studies a choice can be made between (1) a static scan with optimal statistics and spatial resolution and (2) a dynamic scan with good temporal resolution to follow the kinetics of the PET tracer. A static scan often suffices for diagnostic purposes, where the only purpose is to detect abnormalities in uptake (e.g. tumour detection). A static scan, however, contains signals from different biological processes (e.g. perfusion, non-specific uptake and specific uptake). In general, dynamic scans are required to fully quantify these underlying biological processes. In that respect, it is somewhat surprising that many studies in small animals, where diagnostics is not an issue, only make use of non-quantitative static scans.

In principle, the issues related to human PET scans also apply to PET scanning of small animals. In practice, however, many of those issues are more pronounced in studies of small laboratory animals, such as injected mass, measurement of arterial input functions and partial volume effects. For full quantification, the following components are required: (1) tissue time-activity curves describing uptake, retention and washout of a tracer, (2) input function describing delivery of the tracer to the tissues, and (3) a tracer kinetic model that is able to quantitatively extract the molecular parameter of interest from the previous two measurements. In this presentation all three components will be discussed, focussing on factors that may affect tissue time-activity curves (e.g. animal preparation, sensitivity, injected dose, scatter, attenuation, VOI selection, partial volume, spill-over) and on conditions in which a reference tissue model rather than an arterial plasma input model can be used.