“Developing nuclear science and technologies applied to the investigation of physio-pathological mechanisms and variations in response to external challenges”

*Note that the following topics/projects are only an indication. If your research aligns with the overall theme above, please apply.*

**Project 1. Role of mitochondrial proteins**

Our research focuses on mitochondrial proteins that have a variety of potential functions in both health and disease, notably during the activation of microglia, the brain’s resident immune effector cell. We are currently investigating the function, structure, ligand binding response and distribution of a protein that regulates energy production in mitochondria. This is highlighted by our recent work on the generation and characterisation of mice that lack the mitochondrial 18 kDa translocator protein/peripheral benzodiazepine receptor (TSPO/PBR; Banati et al., Nature Communications, 2014).

For this project, we are particularly interested in the role of this protein in Alzheimer’s Disease, Parkinson’s Disease, multiple sclerosis and neuronal injury. The project involves the measurement of mitochondrial protein expression and its correlation with neuronal and glial proteins (markers) in normal and transgenic mice. The techniques used will include cryo-sectioning of tissue, histology, immunohistochemistry, immunofluorescence, autoradiography, and radioligand binding assays. A background in medical sciences, or biology, or neuroscience and/or pharmacology is desirable, but the necessary technical skills will be acquired during the project.

**Contact:**

Dr Jun Liu, Bio-analytics Group Leader, GuoJun.Liu@ansto.gov.au

**Project 2. Three-dimensional reconstruction of histological slices.**

The 3D reconstruction of biological volumes (e.g. brain) arising from large cohorts of consecutive histological and/or autoradiographic 2D sections, offers significant advantages to interpretation of in vivo 3D datasets, resulting from PET/SPECT or MRI. Merging postmortem data sets with in vivo imaging allows bridging the gap between fundamental biological research relying on postmortem microscopic material analysis and preclinical applications relying on in vivo molecular imaging.

The aims of this project are:

i) implementing, at ANSTO LifeSciences, the tools, set-up and data workflow developed by Dr Andrew Janke’s group at CAI, Brisbane, to perform 3D reconstructions of histological slices.

ii) validating the methods using both data previously generated by Janke’s group for the adult brain and data acquired at ANSTO.

Good programming and scripting skills are required for this project.
Contacts:
Dr Anthonin Reilhac-Laborde, Quantification Task Leader, anthonin@ansto.gov.au
Dr Arnaud Charil, Imaging Group Leader, arnaudc@ansto.gov.au

Project 3. Utilization of Nonafyl fluoride as deoxyfluorinating reagent under microfluidic conditions.

The introduction of a fluorine atom into biochemically relevant contexts represents a high end priority, especially when dealing with the constraints related to the use of nucleophilic [18F]-fluoride. Nonafyl fluoride (NfF) have been used in the past to transform alcohols into nonaflates, which represent a good leaving group to be used in aliphatic nucleophilic substitution. Fluorinations could be achieved on in-situ generated nonaflates utilizing the fluoride coming from dissociation of NfF or, more typically, by adding external sources of fluoride. We would like to examine whether microfluidic conditions, which allow a closer vicinity of reacting species and an improved control of conditions, would enable direct deoxyfluorination of several model substrates without the addition of external fluoride sources. A positive outcome from this research will pave the way to a novel late-stage 18F-deoxyfluorination route.

The aims of this project are:

i. testing, at ANSTO LifeSciences, a small set of NfF deoxyfluorination reactions using simple model alcohols. This aim will be achieved by using high throughput flow chemistry systems, which allow automated operation and variation of reaction conditions.

ii. validating the best deoxyfluorinating conditions found on one biochemically relevant pharmaceutical, in order to support the basis for future 18F applications.

Good laboratory (organic and analytical) skills, as well as willingness to use automated chemical synthesis systems, are required for this project.

Contacts:
Dr Giancarlo Pascali, Radiochemistry Task Leader, Giancarlo.Pascali@ansto.gov.au
Dr Ivan Greguric, Head of Radiochemistry, Ivan.Greguric@ansto.gov.au