

## Session/Title: Everything You Wanted to Know about MR-PET / Tracer 101

**Frederick T. Chin, Ph.D.**  
Head, Cyclotron Radiochemistry  
Department of Radiology  
Stanford University School of Medicine  
Email: [chinf@stanford.edu](mailto:chinf@stanford.edu)

### Highlights

- Positron emission tomography (PET) is powerful noninvasive imaging technique that employs radiolabeled pharmaceuticals.
- PET radiopharmaceuticals can be various chemical structures (e.g., small molecules, peptides, antibodies, other biomolecules) typically labeled with cyclotron-produced positron emitters such as carbon-11, fluorine-18, oxygen-15, and nitrogen-13.
- PET radiopharmaceuticals are categorized by function as 1) radiotracers and 2) radioligands that can be applied to study different areas of research including cardiology, neurology/psychiatry, and oncology.

**Target audience:** Research scientists and clinicians – including trainees – who either conduct research in hybrid imaging or (plan to) use MR-PET for clinical studies. The course session assumes no background in PET and only basic MR physics and technical knowledge.

**Purpose:** To introduce MR scientists and clinicians to the exciting field of Positron Emission Tomography (PET) specifically with respect to PET radiopharmaceutical production and familiarizing the audience with a few commonly-used PET radiopharmaceuticals.

**Educational objectives:** Participants will learn about basic radiochemistry principles regarding cyclotron radioisotope production of common PET isotopes and how they are used to synthesize common radiolabeled pharmaceuticals. They will also see some examples of how radiopharmaceuticals are applied in the fields of cardiology (e.g., [<sup>13</sup>N]ammonia), neurology/psychiatry (e.g., [<sup>11</sup>C]PIB, [<sup>11</sup>C]raclopride, [<sup>18</sup>F]florbetapir, [<sup>15</sup>O]water), and oncology (e.g., [<sup>18</sup>F]FDG, [<sup>18</sup>F]FPPRGD<sub>2</sub>, [<sup>18</sup>F]DOPA). The audience will eventually appreciate that PET is used to visualize specific radiolabeled molecules in living organisms with sensitivity in the picomolar range. Finally, the participants will realize that the development of more PET radiopharmaceuticals can expand the utility of the extremely sensitive functional imaging component of PET. Anatomical (structural) and functional (spectroscopy) MR imaging will complement the diagnostic power of PET to open new possibilities in MR-PET imaging for future patient management and clinical research.

### REFERENCES:

1. Weissleder R, Ross BD, Rehemtulla A, Gambhir SS, eds. *Molecular Imaging: Principles and Practice*. Shelton, CT: People's Medical Publishing House – USA; 2010.
2. Welch MJ, Redvanly CS, eds. *Handbook of Radiopharmaceuticals: Radiochemistry and Applications*. Chichester, West Sussex, England: John Wiley & Sons Ltd.; 2003.