CME 3
Radiopharmacy + Oncology & Theranostics + Translational Molecular Imaging and Therapy Committee
Friday, October 23, 09:00-10:30

Session Title
Finding the Right PET Companion for ImmunoOncology

Chairperson
Margret Schottelius (Lausanne, Switzerland)

Programme
09:00 - 09:29 Nicolas Aide (Caen, France): Why Do we Need PET Companion Tracers in Immunooncology?

09:29 – 09:58 Sandra Heskamp (Nijmegen, Netherlands): Going Beyond FDG - Development of Tailored PET Companion Tracers

09:58 - 10:27 Niklaus Schaefer (Lausanne, Switzerland): The Next Step - From Companion Diagnostics Towards Immunotheranostics

Educational Objectives
1. To understand the basic principles of immunotherapy and the role of pre- and posttherapeutic functional PET imaging in the prediction and assessment of therapy response, respectively
2. To obtain a comprehensive overview over relevant molecular targets for PET imaging in the context of immunotherapy, the fundamental differences compared to “classical” tumor imaging and the challenges associated with these differences as well as an outlook on new tracer developments addressing these challenges.
3. To be able to put PET imaging in the immunooncological setting into a broader perspective, allowing nuclear physicians to exploit the power of nuclear medicine approaches to its full potential within the context of immunotherapy.

Summary
Cancer immunotherapy, i.e. the concept of enhancing tumor-specific immunity via e.g. adoptive T-cell transfer, CAR-T cell infusion, immune checkpoint inhibition (PD-1, PD-L1, CTLA-4) or other interventions, has evolved as a very powerful therapeutic approach in clinical oncology and has moved forward at a tremendous pace during the last years. However, only a fraction of the cancer patients undergoing immunotherapy experience long-term remission, and thus there is an urgent clinical need for improved patient selection for immunotherapy as well as an early and accurate assessment of therapeutic efficacy. Currently, most of the clinical experience in the monitoring of immunotherapy relies on the use of [18F]FDG, demonstrating a clear utility, but also the limitations of a general metabolic tracer as a PET companion diagnostic in this specific context.
Therefore, intense preclinical research is ongoing, striving to provide a more and more detailed and accurate insight into the highly complex and interwoven mutual relationships between the tumor, the cells of the tumor microenvironment (TME) and the immune system. Given the complexity of this interplay, its individual kinetics, the multitude of distinct cell types contributing to or preventing efficient therapy and the resulting abundance of molecular biomarkers present on tumor cells and cells of the TME, the identification and selection of clinically relevant targets for molecular imaging represents a true challenge. However, novel radiopharmaceuticals specifically targeting distinct subsets of immune cells, even capturing their activation state, are currently emerging, and first clinical data are available, providing for the first time a true choice concerning the “right PET companion diagnostic” for immunotherapy.

Given these tracer developments alongside with a rapidly expanding knowledge of the roles and functions of different (immune) cell types in the TME, preventing or facilitating successful immunotherapy, moving forward towards implementing nuclear medicine-based theranostics in immunooncology (“immunotheranostics”) is the logical next step. The power of theranostics, lying in the ability to accurately quantify and subsequently specifically target cells expressing a given molecular marker using targeted endoradiotherapy, is as of yet unexploited in the context of immunotherapy, but will, with the advent of novel tracers, certainly receive substantial attention in the near future.

**Key Words**
Immunotherapy, Checkpoint inhibition, PD-1, PD-L1, CTLA-4, T-cell, PET, companion diagnostic, theranostics