Today, with so many research groups working with functional magnetic resonance imaging (fMRI), one might ask why the classic procedures of nuclear medicine such as positron emissions tomography (PET) and single photon emission computed tomography (SPECT) are still so important. After all, fMRI, unlike PET and SPECT examinations, implicates no exposure for the patient to radiation (even if the dose involved in PET and SPECT examinations is far lower than the radiation involved in any simple CCT examination). However, to assess neuroreceptor and neurotransporter availability, which is so crucial for pharmacological research, there is no alternative to PET and SPECT. They also deliver direct evidence that the genetic constitution of transporters and receptors can directly influence their in vivo availability [1].

One advantage of investigations using nuclear medicine, particular PET with its higher spacial resolution screen and more precise data quantification, is the possibility of absolute quantification of basal blood flow or glucose metabolism, while fMRI always measures the difference between states of activity and control conditions. We generally assume that the patient or control groups do not differ in regard to their blood flow while in control conditions. It is, however, precisely this assumption which is now being challenged. The blood flow in the amygdale could be higher in subjects who tend to react with anxiety and who are confronted while in a dark confined scanner with undefined (“neutral”) stimuli such as the fixation cross, while blood flow is lower when emotionally neutral scenes are presented (for example a tool or any other neutral object) [2]. Genetic factors come into play at this point which obviously influence the neurotransmission of particular monoaminergic messenger substance systems and thus modulate amygdala reactivity) [3,4]. Multimodal imaging can be used to quantify the interaction between neurotransmitter systems (by measuring receptors or transporters with PET or SPECT and/or by determining the genetic constitution of the binding site) and the condition-dependent changes in blood flow (as indirect indication of cerebral activation, measured with fMRI).

The course will provide a brief introduction on methodic aspects of PET and SPECT processes and will describe the possibility of combining PET/SPECT with genetic findings and functional examinations.