# Editorial

# Imaging in the Age of Molecular Medicine

During recent years there has been tremendous progress in understanding the molecular mechanisms of diseases and many new therapeutics has been developed that directly interfere with molecular pathways. The use of these disease-specific treatments can improve therapy outcome and significantly decrease side effects, which leads to a better life quality of the patient. On the other hand, there is increasing risk of exposing the patient to a non optimal therapy and also resistance to the treatment may develop more rapidly, which requires adaptation of the therapy regimen. As a consequence molecular treatments should be individualized and tools should be developed allowing to track the disease course at pathophysiological and molecular level.

The aim of this special issue is to make the reader aware of different disease specific and theranostic imaging concepts that may gain increasing importance in clinical routine in future. The first two articles introduce optical [1] and photoacoustic imaging [2] as new molecular imaging techniques that currently are translated to the clinics. Their physical principles, current use, and potential clinical indications are discussed in detail. The next two articles continue the discussion about optical imaging and summarize findings on new enzymatically activatable optical probes [3] as well as strategies to track genetically modified cells expressing fluorescent proteins [4].

In the article of Slabu and colleagues a new concept of labelling stent material with iron oxide nanoparticles is presented, which may help to improve stent placement in interventional MRI procedures and to control the correct stent localization and its interaction with the neighboured tissue [5].

The articles from Gaertner [6] and De Saint-Hubert [7] review the current strategies of imaging hypoxia and apoptosis in tumors with nuclear imaging. The reliable assessment and monitoring of these two characteristics can significantly help to better understand tumor response to treatment and to improve individualization of anti-neoplastic therapy. This is particularly true for radiation treatment, where tumor resistance often is associated with hypoxia and decreased apoptosis rate.

The following articles focus on monitoring tumor response to systemic treatments: Bone metastases occur in many tumor diseases and to date their imaging is mostly restricted to quantifying lesion size. However, lesion size has shown to be an uncertain measure for predicting and monitoring therapy response. Therefore, new functional and molecular imaging strategies to monitor bone metastases response to antiangiogenic and other tumor therapies are discussed in the article of Bäuerle et al. [8].

Not only for bone metastases formation but also for many other solid tumors angiogenesis is one of the key processes for invasive and systemic tumor growth. Several antiangiogenic substances have already entered clinical use and others are currently evaluated in clinical trials. How tumor angiogenesis can be characterized and how antiangiogenic therapy effects can be assessed by multimodal functional and molecular imaging, the reader will find in the article of Lederle and colleagues [9]. For antiangiogenic drugs as well as for every other systemically applied anti-tumor agent optimal delivery to the tumor tissue and considerably low accumulation in healthy tissues are important preconditions for a successful therapy outcome. Here polymeric and other nano-carriers have shown to be capable of improving therapy efficacy. In this context, Kunjachan and coworkers review the use of imaging for monitoring drug release from polymeric and other carriers [10].

In summary, it is the idea of this issue to inspire the reader to use novel non invasive (molecular) imaging tools to improve and to individualize therapy concepts. Please also note that disease-specific and theranostic imaging can improve molecular therapy in more applications than can be covered in this issue and that even more indications still have to be discovered.

## REFERENCES

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