Driving the Future of Nuclear Medicine

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All that wants to stay must decay.
—Freely adapted from J.W. von Goethe, "Denn alles muß in Nichts zerfallen, wenn es im Sein beharren will"

Nuclear medicine thrives by continuous change. Twenty years ago, the introduction of PET/CT, followed by SPECT/CT and PET/MRI, fundamentally changed our field and required nuclear medicine physicians to learn the interpretation of multimodality studies.

Currently, the success of radioligand therapy and theranostics again tremendously affects the required knowledge, expertise, and therefore training of nuclear medicine specialists. However, this is just the beginning. . .indeed, digital PET, new PET tracers, a wave of new theranostic compounds, and the rise of artificial intelligence and machine learning will change the daily practice of nuclear medicine even more.

Even in a field familiar with constant novelty, these anticipated changes can induce a wide spectrum of various emotions, ranging from curiosity to fear, from creating opportunity to being threatened. As we believe the best way to adapt to the future is by driving it, the editors of *The Journal of Nuclear Medicine* have designed a supplement addressing the most relevant challenges and opportunities faced by our field.

Whereas nuclear medicine is an independent specialty in many European countries (e.g., France, Germany, and Italy, among others), it is widely integrated within radiology in the United States and more recently also in The Netherlands. When multimodality imaging was introduced 20 y ago, this integration made sense for logistic and financial reasons (*1*). Now, the rise of theranostics demands training and expertise in clinical skills and therefore hints to a close relationship to medical oncology or radiation oncology. The question whether nuclear medicine should be independent, integrated within radiology, or better be associated with internal medicine/radiation oncology will be thoroughly discussed by Czernin et al. (*2*).

The emergence of theranostics, targeting the same receptor for imaging and therapy, already affects significantly today's nuclear medicine practices (*3*). The somatostatin receptor 2–targeting Lutathera for neuroendocrine tumor patients is now approved by the Food and Drug Administration and widely reimbursed. In terms of incidence, the even more relevant prostate-specific membrane antigen–directed theranostic PSMA-617 is in the midst of a prospective phase III trial (VISION trial). The early success of these theranostic concepts appears to be just the beginning. Langbein et al. dare a look ahead and sketch the future of theranostics and precision oncology in nuclear medicine (*4*).

Lutathera and the promising data of PSMA-617 attracted big pharma as the acquisitions of both compounds by Novartis for a combined 6.0 billion USD have shown. After decades of ignorance, Wall Street has taken notice of the innovation and potential of nuclear medicine. One of the commercial pioneers in the field, Mike Sherman (former CEO of Endocyte), provides an insight on how to make nuclear medicine and Wall Street a symbiotic relationship and what each stakeholder can appreciate and learn from one another (*5*).

Despite the innovations, the exciting advances of theranostics, and the increased demand for nuclear medicine specialists, the lack of young talent, especially in the United States but elsewhere as well, is one of the biggest challenges. Steve Larson writes about why young residents should choose nuclear medicine and what is needed to rejuvenate nuclear medicine facilities throughout the United States (*6*).

The buzzwords Artificial Intelligence, Deep Learning, Big Data, and "Omics" are currently dominating the discussion about the future of medicine in general and radiology in particular. Because of the rapid progress of machine learning in the interpretation of medical images, dire predictions have been made about the future of radiology as a clinical discipline (*7–9*). Nensa et al. focus on the use case "nuclear medicine" for artificial intelligence, highlighting associated challenges but also opportunities (*10*). As a consequence of the advances in algorithms, deep learning, computing power, and the introduction of digital PET allowing for fast dynamic image acquisition trigger the hope of finding clinical evidence and relevance for radiomics. Hatt et al. stipulate that data are also images; they give an overview of striking advances made over the last 5 y and also look into the future (*11*).

The editors believe that exciting times lie ahead for nuclear medicine. We do believe that our specialty needs to embrace the opportunities and overcome the challenges but most importantly take ownership of driving the future of our field. We thank all the contributors, reviewers, and sponsors for accompanying us on this journey and profoundly hope that this supplement triggers lively discussions and, more importantly, joint actions!

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