



Multi-scale imaging as an essential tool for precision medicine

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A new concept called “Transpathology” is proposed by Tian et al. in this issue of EJNMMI [1].

With the advent of multi-scale imaging technologies, comprehensive phenotyping of diseased tissue has become possible. Transpathology may provide the necessary link between ex vivo post-mortem tissue analysis and in vivo non-invasive imaging technologies. Disease processes start from molecular alterations of biological processes and may or may not proceed to structural alterations. Therefore, early in vivo disease detection and subsequent biological responses to therapeutic interventions have become an essential aspect of “precision medicine”.

In this paper, Tian and colleagues, as leading experts in molecular imaging, pathology and oncology, summarized the recent advances in their various fields, identified critical issues limiting progress, and suggested novel principles and strategies to advance this emerging field of Transpathology.

Post-mortem tissue analysis provides excellent delineation of structural and molecular information with very high spatial resolution. However, ex vivo tissue evaluation represents only selective probing of tissue defined by biopsy and surgical tissue samples. For this reason, the new field of “transpathology” is fascinating by guiding biopsy and surgical intervention, linking in vivo and ex vivo information at varying spatial resolution, types of biological information, and developing methodologies

for cross-validating in vivo information. Many of the labelling procedures developed in histology and biochemical assays have been transferred into the in vivo imaging environment. For example, as in cell phenotype imaging with PET linked to therapy in theranostics in patients with cancer. As outlined by Tian et al., medical fields such as pathology and imaging have to come closer together, developing unified approaches for regional disease characterization and responses to therapy. The recent introduction of AI technologies supports the cross-validation of imaging signals on various scales to better understand image information as markers of biological alterations of disease and responses to treatments.

The field “transpathology” will represent an essential step towards precision medicine in various diseases by providing integrated diagnostic tools coupled to therapies. Significant for this development is the further advancement of digital methods to further transform imaging studies into analytical assays and for alignment and co-registration of different sources of information. The anticipated advance of genetic analysis at the single-cell level may further promote the refinement concepts of data integration such as “transpathology”.

Declarations

Informed consent Not applicable.

Ethical approval Institutional Review Board approval was not required because the paper is an Editorial.

Conflict of interest The authors declare no competing interests.

Reference

1. Tian M, He X, Jin C, He X, Wu S, Zhou R, et al. Transpathology: molecular imaging-based pathology. *Eur J Nucl Med Mol Imaging*. 2021. <https://doi.org/10.1007/s00259-021-05234-1>.

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