Commentary

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A Research on Clinical Translation

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Introduction

The International Society for Translational Research has updated its Guidelines for Stem Cell Research and Clinical Translation in order to address advances in stem cell science and other relevant fields, together with the associated ethical, social, and policy issues that have arisen since the last update in 2016. While growing to encompass the evolving science, clinical applications of stem cells, and the increasingly complex implications of stem cell research for society, the basic principles underlying the Guidelines remain unchanged, and they will continue to serve as the standard for the field and as a resource for scientists, regulators, funders, physicians, and members of the public, including patients. A summary of the key updates and issues is presented here. With any area of research, especially when it relates to humans and involves issues that may be considered ethically contentious, it is important to ensure it is subject to appropriate review and oversight.

The lung microbiome has been shown to reflect a range of pulmonary diseases—for example: asthma, chronic obstructive pulmonary disease (COPD) and cystic fibrosis. Studies have now begun to show microbiological changes in the lung that correlate with lung cancer (LC) which could provide new insights into lung carcinogenesis and new biomarkers for disease screening. Photoacoustic Computed Tomography (PACT) has generated increasing interest for uses in preclinical research and clinical translation. However, the imaging depth, speed, and quality of existing PACT systems have previously limited the potential applications of this technology.

To overcome these issues, we developed a three-dimensional photoacoustic computed tomography (3D-PACT) system that features large imaging depth, scalable field of view with isotropic spatial resolution, high imaging speed, and superior image quality. 3D-PACT allows for multipurpose imaging to reveal detailed angiographic information in biological tissues ranging from the rodent brain to the human breast. In the rat brain, we visualize whole brain vasculatures and hemodynamics. In the human breast, an in vivo imaging depth of 4 cm is achieved by scanning the breast within a single breath hold of 10 s. Here, we introduce the 3D-PACT system to provide a unique tool for preclinical research and an appealing prototype for clinical translation. Photoacoustic (PA) computed tomography (PACT) is a noninvasive hybrid imaging modality that combines the functional optical contrast of diffuse optical tomography with the high spatial resolution of ultrasonography. Triptolide (TP), a major extract of the herb Tripterygium wilfordii Hook F (TWHF), has been shown to exert potent pharmacological effects, especially an immunosuppressive effect in the treatment of rheumatoid arthritis (RA). However, its multiorgan toxicity prevents it from being widely used in clinical practice. Clinical translation of engineered tissues into regenerative medicine applications, and the effort to reduce the use of animals for the screening of drugs and other compounds, result in an increasing demand for human tissues engineered in vitro for implantation, in vitro screening systems and basic research.

Further development and optimization of in vitro models for quantitative studies of biophysical stimulation and mass transport in engineered tissues is seen as one of the high research priorities. The mesenchymal stromal cell (MSC) field continues to rapidly progress with a number of clinical trials initiated and completed, with some reported successes in multiple clinical indications, and a growing number of companies established. The field, nevertheless, faces several challenges. Persistent issues include the definition of a MSC and comparability between MSC preparations. This is because of inherent cell heterogeneity, the absence of markers that are unique to MSCs, and the difficulty in precisely defining them by developmental origin.