Preclinical translational research study

- Plasma GFAP for populational enrichment of clinical trials in preclinical Alzheimer's disease
- Comparison of the biological characteristics of glioblastoma tumorspheres obtained from fresh and cryopreserved glioblastoma tissues
- Modeling of cancer stem cells and the tumor microenvironment Via NT2/D1 cells to probe pathology and treatment for cancer and beyond
- A modified surgical approach to induce circle Willis perforation in mice using the common carotid artery
- Engineering Exosomes for CNS Disorders: Advances, Challenges, and Therapeutic Potential
- Aging, mitochondrial dysfunction, and cerebral microhemorrhages: a preclinical evaluation of SS-31 (elamipretide) and development of a high-throughput machine learning-driven imaging pipeline for cerebromicrovascular protection therapeutic screening
- Plasma p-tau217 and tau-PET predict future cognitive decline among cognitively unimpaired individuals: implications for clinical trials
- CXCR3-mediated natural killer cell infiltration exacerbates white matter injury after intracerebral haemorrhage

A preclinical translational research study bridges the gap between basic scientific discoveries and their application in clinical settings. It focuses on validating new therapies, drugs, medical devices, or interventions in laboratory and animal models before advancing to human clinical trials.

Key Elements of a Preclinical Translational Research Study: Objective:

To evaluate the safety, efficacy, and mechanism of action of a new therapeutic approach before human trials. Model Selection:

In vitro (cell cultures, organoids) and/or in vivo (animal models) systems that best mimic human disease. Experimental Design:

Defining study endpoints (biological, functional, or behavioral effects). Randomization and blinding to reduce bias. Dose-response studies to determine optimal dosing. Outcome Measures:

Biomarkers, imaging, histopathology, molecular analysis. Functional or behavioral assessments in animal models. Regulatory Compliance:

Adherence to Good Laboratory Practice (GLP). Ethical approvals (IACUC for animal studies). Toxicology studies to assess safety. Translation to Clinical Applications:

Identifying potential human applications. Refining protocols for first-in-human trials.

Translational research – often used interchangeably with translational medicine or translational science or bench to bedside – is an effort to build on basic scientific research to create new therapies, medical procedures, or diagnostics. Basic biomedical research is based on studies of diseases processes using for example cell cultures or animal models.

The term translational refers to the “translation” of basic scientific findings in a laboratory setting into potential treatments for disease.

Surgeon-scientists are an essential component of the field of academic surgery, contributing to the fundamental understanding of disease and the discovery of innovative therapies. Despite this recognized value, the current landscape of academic medicine presents significant barriers to establishing and maintaining a successful career as a surgeon performing basic/translational research.

Peng et al. developed a fast, efficient, and complex culture system (IPTO, individualized patient tumor organoids) that accurately recapitulates the cellular and molecular pathology of human brain tumors. Patient-derived tumor explants were cultured in induced pluripotent stem cell (iPSC)-derived cerebral organoids, thus enabling the culture of a wide range of human tumors in the central nervous system (CNS), including adult, pediatric, and metastatic brain cancers. Histopathological, genomic, epigenomic, and single-cell RNA sequencing (scRNA-seq) analyses demonstrated that the IPTO model recapitulates cellular heterogeneity and molecular features of original tumors. Crucially, they showed that the IPTO model predicts patient-specific drug responses, including resistance mechanisms, in a prospective patient cohort. Collectively, the IPTO model represents a breakthrough in the preclinical modeling of human cancers, which provides a path toward precision oncology [1)].

There is a significant decline in the proportion of academic surgeons who are pursuing basic science/translational research, which represents a potential threat to the very identity of the translational surgeon-scientist.

Based on published literature and expert opinion, the Basic Science Committee of the Society of University of Surgeons prepared a roadmap to encourage and guide the next generation of surgeon-scientists as they embark on their academic careers.

This roadmap highlights key elements to consider in choosing an initial job and the importance of identifying a team of committed mentors. Expectations and guidelines for the first several years in practice are offered.

With guidance and mentorship, aspiring surgeon scientists can overcome the challenges inherent in choosing this career path and sustain the important legacy of those before them [2)].

Limitations in genetic stability and recapitulating accurate physiological disease properties challenge the utility of patient-derived (PD) cancer models for reproducible and translational research.

Uhlmann et al. genetically engineered a portfolio of isogenic human-induced pluripotent stem cells (hiPSCs) with different pan-cancer relevant oncoprotein signatures followed by differentiation into lineage-committed progenitor cells. Characterization on molecular and biological level validated successful stable genetic alterations in pluripotency state as well as upon differentiation to prove the functionality of the approach Meanwhile proposing core molecular networks possibly involved in early dysregulation of stem cell homeostasis, the application of the cell systems in comparative substance testing indicates the potential for cancer research such as identification of augmented therapy resistance of stem cells in response to activation of distinct oncogenic signatures [3)].

Translational neuro-oncology research

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1)
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3)
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