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**Title:** Unlocking the Potential of Reverse Bioengineering for In Vitro Living System Reproduction

**Abstract:**

The burgeoning field of "Reverse Bioengineering" aims to recreate living systems, including humans and animals, *in vitro*, thereby opening new frontiers in biotechnology and biomedicine. This novel research direction integrates pluripotent stem cells (PSCs) and micro/nanoengineering to harness the intrinsic regenerative potential of PSCs while providing them with the proper cellular environments needed for successful tissue and organ development. PSCs stand as promising tools for illuminating the intricacies of developmental processes in living organisms. However, the challenge lies in transforming these PSCs into fully functional tissues and organs, a hurdle in stark contrast, the micro/nanoengineering approach empowers researchers to create precise and tailored cellular microenvironments conducive to organ development, a feat unattainable with traditional macro-scale techniques. By synergizing the fields of stem cell biology and micro/nanoengineering, we have made significant strides in recapitulating and comprehending organ developmental processes within the confines of a microchip. primarily attributed to the inadequate cellular microenvironments available in conventional culture systems. Furthermore, microfluidic technology offers the opportunity to establish an artificial blood circulatory system, effectively interconnecting multiple organs, and facilitating the exploration of their intricate cross-talk, giving rise to what is commonly referred to as a "Body on a Chip (BoC)." The Body on a Chip (BoC) represents a significant achievement in Reverse Bioengineering, offering a platform to study the interplay between various organs and systems in a controlled, *in vitro* environment. In this presentation, we will showcase our pioneering work on the on-chip development of liver tissues and the study of liver-related diseases, as well as our investigations into early embryogenesis, all of which exemplify the immense potential of Reverse Bioengineering to revolutionize our understanding of living systems and advance the frontiers of regenerative medicine and drug development.