

Limitations of Cell/Tissue Engineering Therapies

- Please comment on the limitations of cell and tissue engineering therapies. Use your prior experience in the workplace to inform your comments if applicable.
 - Remember that we are interested in your point of view as a creative, thoughtful biomedical engineer.
- Respond to at least two of your classmates.

I identified these challenges that Cell/Tissue Engineering therapies must address:

- Difficulties in expanding stem cells in culture (for example difficulties to expand hepatocytes or pancreatic islet cells in culture).
- Be able to handle a vast range of exerted forces like in bone tissue.
- One repeated challenge faced by tissue engineering is the need for proper vascular and nerve supply which is a critical requirement for example in dentin/pulp engineering.
- Enduring extreme environments like the high acidity of the intestine.
- Defensive immune response from the receiving host leading to rejection of the cells or tissues.
- Safety and risk concerns like off target tumor formation.
- Delivery through highly protected parts of the human body like delivery through the brain-blood-barrier.
- Biomaterials to be biocompatible with the environment of intervention and with proper ligand adhesion for proper cell motility.
- Tissues with appropriate mechanical properties to sustain real-life biological stresses.
- Long life sustainability with self-regenerating and self-repairing capabilities. At the same time, in some situations, support materials need to be biodegradable after a specific time of biochemical exposure.
- Possibility of responding to biochemical signals for reprogramming i.e., turning off growth after complete healing. There is also the need to be able to monitor progression of regeneration.
- Scientific coordination and infrastructure development are required to accommodate the research in terms of biological, computational and data resources.
- Better quantitative methods to measure chance of success when translating therapies from animals, 2D-3D cell cultures or organ-on-chips models, to humans with faster delivery times.
- Manufacturing challenges in material sourcing, standardization and production to large scale.
- Speed during the bioprinting process, it is apparently not fast enough (I have never used a bioprinter).
- Clinical trials to design relevant to the drug therapies for FDA approval.