Chemically tuning dynamic networks and supramolecular assemblies to enable synthetic extracellular matrices for tissue engineering

Propositions

Accompanying the dissertation

Chemically tuning dynamic networks and supramolecular assemblies to enable synthetic extracellular matrices for tissue engineering

by

Shahzad Hafeez

Maastricht, 14th November 2023

1. Life is dynamic and so are the building blocks of life: molecules and cells.
2. Molecules exhibit dynamic motion, and understanding molecules' dance can enable control over macroscale material properties.
3. The extracellular matrix (ECM) is a hydrogel made of supramolecular fibrous assemblies that exhibit controlled dynamicity and viscoelasticity.
4. Imine-type dynamic covalent cross-links with distinct equilibrium constants (K_{eqs}) can be employed for fine-tuning viscoelasticity, self-healing, and bioinks development (**chapter IV**).
5. Modular mixing of benzene-1,3,5-tricarboxamide (BTA) supramolecular monomers can be employed for tuning dynamicity, mechanical properties, and control of cell aggregation in three-dimensional (3D) culture (**chapter V**).
6. Desymmetrization via activated esters can enable the rapid synthesis of multifunctional BTA monomers and supramolecular hydrogelators (**chapter VI**).
7. Systematic variation of carbon atoms from 6 to 12 on BTA enables the generation of fibrous hydrogels with controlled viscoelasticity, stress relaxation, and supramolecular bioink development (**chapter VII**).
8. Reinforcement of BTA supramolecular assembly with key covalent bond formation is a powerful strategy for designing ECM mimetic tough hydrogels and bioinks (**chapter VIII**).
9. Academic research is not a linear progress and definitively not a success first. Science should make more room for failure and we can still be scientists by sharing failed and unclear results.
10. A positive mindset, patience, perseverance, and being farsighted are key traits required for a great PhD.
11. Scientific thought and its creation is the common and shared heritage of mankind (Abdus Salam, Nobel laureate).