

What is claimed:

1. A method of physically manipulating a tissue culture, implementable in a computerized system comprising: at least one resilient container operably coupled to a frame sized and configured to affect a predetermined regimen of stress and strain over at least one of four degrees of freedom on the at least one resilient container, and a central processing module (CPM) in communication with at least one processor and at least one non-volatile memory storage device having thereon a processor-readable media with a set of executable instructions, configured, when executed, to cause the at least one processor to: using a sensor array, receive physical data characteristic of the tissue culture; and based on the data, physically manipulate the at least one resilient container, the method comprising:
  - a. loading the tissue culture into the at least one resilient container; and
  - b. at predetermined intervals, based on the physical data characteristic of the tissue culture, affect at least one of stress, and strain on the at least one resilient container.
2. The method of claim 1, wherein the system further comprises an ink jet bioprinting module having
  - a. at least one microprocessor in communication with: a non-volatile storage device having thereon a microprocessor-readable medium with set of executable instructions configured to, when executed, to cause the at least one microprocessor to execute a method of inkjet bioprinting; and an image library corresponding to a two dimensional (2D) layer of at least one of cells, scaffolding, and connective tissue within the biostructure having predetermined 3D pattern of cells therein;
  - b. a first dispensing print head in communication with the microprocessor having: at least one aperture, a first bio-ink reservoir, and a first dispenser configured to dispense the first bio-ink through the aperture, wherein the first bio-ink is a composition comprising viable cells suspended in a bio-compatible dispersing medium and/or bio-compatible polymer, and/or monomer, and/or oligomer;
  - c. a second dispensing print head in communication with the microprocessor having: at least one aperture, a second bio-ink reservoir, and a second dispenser configured to dispense the second bio-ink through the aperture, wherein the second bio-ink is a composition bio-compatible

compounds suspended in a bio-compatible dispersing medium and/or bio-compatible polymer, and/or monomer, and/or oligomer;

d. a third dispensing print head in communication with the microprocessor having: at least one aperture, a third bio-ink reservoir, and a third dispenser configured to dispense the third bio-ink through the aperture, wherein the third bio-ink comprises means for functionalizing the bio-compatible polymer, monomer, or oligomer; and

e. a conveyor in communication with the microprocessor, operably coupled to each of the first, the second, and the third dispensing print heads.

3. The method of claim 1, wherein the four degrees of freedom are configured to compress, elongate, shear and apply torque to the tissue culture in the at least one resilient container.

4. The method of claim 3, wherein the system further comprises a sensor array configured to provide physical characteristic data from the tissue culture.

5. The method of claim 4, wherein the physical characteristic is at least one of: viscosity, density, weight, opacity, specific volume, relative water activity, pH, tensile strength, and compressive strength.

6. The method of claim 5, wherein the sensor array comprises at least one of: a timer, a viscometer, a load cell, an actinic radiation source, a camera, and a hygrometer.

7. The method of claim 6, wherein the tissue culture is configured to emulate a bovine muscle tissue, a porcine muscle tissue, an avian muscle tissue, a gnatha muscle tissue, chondrichthyes muscle tissue, osteichthyes muscle tissue, and caprine muscle tissue.

8. The method of claim 1, wherein the system further comprises means for affecting at least one of: osmotic stress, and fluid stress.

9. The method of claim 8, wherein the means for affecting osmotic stress comprises contacting the at least one resilient container with a membrane containing an agent with a higher chemical potential than the tissue culture at any given time.

10. The method of claim 8, wherein the means for affecting fluid stress comprises a tube affecting fluid communication between two resilient containers.

11. The method of claim 2, wherein the inkjet bioprinting module is configured to provide the tissue culture.

12. The method of claim 11, wherein the tissue culture further comprises a biocompatible scaffolding configured to deliver nutrients to the tissue scaffolding bulk.

13. The method of claim 11, wherein the at least one resilient container is coated with a material configured promote adhesion between the tissue culture and the resilient container.
14. The method of claim 12, wherein the biocompatible scaffolding comprises: PEGilated-methacrylate, chitosan, carrageenan, poly(lactic) acid, poly(lactic-co-glycolic acid), their methacrylate conjugates, co-polymers, interpenetrating networks or a composition comprising one or more of the foregoing.
15. The method of claim 14, wherein the first bio-ink comprises one or more of endothelial cells, muscle cells, fibroblast cells, mesothelial cells, pericyte cells, monocyte cells, plasma cells, mast cells, adipocyte cells, chondrocyte cells, cells population manipulated from a specific type of cell to another, or cells composition comprising one or more of the foregoing cells; a bio-compatible polymer; and optionally a photoinitiator.
16. The method of claim 11, wherein the second bio-ink comprises extracellular material (ECM).
17. The method of claim 16, wherein the ECM is comprises epidermal growth factor (EGF), basic fibroblast growth factor (bFGF), bone morphogenic protein (BMP), insulin-like growth factor (IGF), glucoseaminoglycan (GAG), Transforming growth factor (TGF) or extracellular matrix compound composition comprising the foregoing.
18. The method of claim 1, further comprising admixing biocompatible pellets to the at least one resilient container, configured to impose a predetermined shape to at least a portion of the tissue culture.
19. The method of claim 18, further comprising a step of transferring the physically manipulated tissue culture to an incubator; and growing the tissue culture.
20. The method of claim 19, wherein the system further comprises a housing operable to accommodate a plurality of resilient containers disposed in a structure operable to simultaneously, at predetermined intervals, based on the physical data characteristic of the tissue culture in the plurality of resilient containers, affect at least one of the same: stress, and strain on the plurality of resilient containers.