CLAIMS

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 selected from: compression, elongation, shear and torque, on the at least one resilient container, a sensor array configured to provide physical characteristic data from the tissue culture, 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 the 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, in which 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 a biostructure having predetermined three dimensional (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, in which the first bio-ink is a composition comprising viable cells suspended in a bio-compatible dispersing medium, and/or a bio-compatible polymer, and/or a bio-compatible monomer, and/or a bio-compatible 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, in which the second bio-ink is a composition of: bio-compatible compounds suspended in a bio-compatible dispersing medium, and/or the bio-compatible polymer, and/or the bio-compatible monomer, and/or the bio-compatible 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, in which the third bio-ink comprises means for functionalizing the bio-compatible polymer, the bio-compatible monomer, or the bio-compatible 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. A method according to Claim 1, in which 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. A method according to Claim 3, in which the physical characteristic is at least one of: viscosity, density, weight, opacity, specific volume, relative water activity, pH, tensile strength, and compressive strength.

5. A method according to Claim 4, in which the sensor array comprises at least one of: a timer, a viscometer, a load cell, an actinic radiation source, a camera, and a hygrometer.

6. A method according to Claim 5, in which the tissue culture is configured to emulate a bovine muscle tissue, a porcine muscle tissue, an avian muscle tissue, a gnatha muscle tissue, chrondrichthyes muscle tissue, osteichthyes muscle tissue, and caprine muscle tissue.

7. A method according to Claim 1, in which the system further comprises means for affecting at least one of: osmotic stress, and fluid stress.

8. A method according to Claim 7, in which 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.

9. A method according to Claim 7, in which the means for affecting fluid stress comprises a tube affecting fluid communication between two resilient containers.

10. A method according to Claim 2, in which the inkjet bioprinting module is configured to provide the tissue culture.

11. A method according to Claim 10, in which the tissue culture further comprises a bio-compatible scaffolding configured to deliver nutrients to the tissue scaffolding.

12. A method according to Claim 10, in which the at least one resilient container is coated with a material configured to promote adhesion between the tissue culture and the resilient container.

13. A method according to Claim 11, in which the bio-compatible scaffolding comprises: PEGylated-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.

14. A method according to Claim 13, in which 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, cell population manipulated from a specific type of cell to another, or cell composition comprising one or more of the foregoing cells; and the bio-compatible polymer.

15. A method according to Claim 10, in which the second bio-ink comprises extracellular material (ECM).

16. A method according to Claim 15, in which the ECM 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.

17. A method according to Claim 1, further comprising admixing bio-compatible pellets to the at least one resilient container, configured to impose a predetermined shape to at least a portion of the tissue culture.

18. A method according to Claim 17, further comprising a step of transferring the physically manipulated tissue culture to an incubator; and growing the tissue culture.

19. A method according to Claim 18, in which 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.