Claims

1. A system for generating and controlling application of pulsed electromagnetic fields (PEMFs) to one or more target tissues or target cells of a plurality of human subjects or a plurality of animal subjects, wherein for each of the plurality of subjects a corresponding PEMF regimen indicates each target tissue of the subject to which PEMFs are to be applied during a plurality of successive PEMF sessions associated with the PEMF regimen, the system comprising:

a set of PEMF coils;

a memory module and/or a database storing:

(a) for each of a plurality of distinct target tissue types, corresponding PEMF session efficacy window data that specifies at least one of (i) a maximum PEMF exposure time that the target tissue type is to receive during each PEMF session, and (ii) a maximum magnetic flux density that the target tissue type is to receive during each PEMF session; and

(b) for each of the plurality of subjects to which PEMFs are to be applied, PEMF regimen efficacy window data that specifies (i) a distinct target tissue ID corresponding to each distinct target tissue of the subject to which PEMFs are to be applied during PEMF sessions associated with the PEMF regimen for the subject, and at least one of (ii) a minimum time period between successive PEMF sessions corresponding to each target tissue ID, and (ii) a maximum or total number of PEMF sessions across a predetermined number of days or weeks corresponding to each target tissue ID;

a pulse generator coupled to the set of PEMF coils and configured to generate an output of electrical pulses to drive the set of PEMF coils; and

a controller in communication with the memory module and/or the database and the pulse generator, wherein for each of the plurality of subjects and each target tissue of each of the plurality of subjects to which PEMFs are to be applied in accordance with the PEMF regimen corresponding to the subject, the controller is configured to:

(a) control the output of the pulse generator in accordance with stored PEMF regimen efficacy window data corresponding to the subject to avoid or prevent exposure of the same target tissue of the subject to PEMFs more frequently than specified by the stored PEMF regimen efficacy window data, and

(b) control the output of the pulse generator in accordance with the stored PEMF session efficacy window data to avoid or prevent exposure of the same target tissue of the subject to PEMFs outside of the PEMF session efficacy window,

wherein during each PEMF session associated with each PEMF regimen, the controller controls the output of the pulse generator such that during each PEMF session, the set of

PEMF coils generates a plurality of PEMF pulses across a PEMF exposure time of at least 5 minutes but not longer than 15 minutes, wherein each PEMF pulse has a peak magnetic flux density between 0.1 – 5.0 mT and a rate of magnetic flux density change between 10 – 100 T/s.

2. The system as claimed in claim 1, wherein during each PEMF session, each PEMF pulse has a rate of magnetic flux density change between 35 – 65 T/s.

3. The system as claimed in claim 1, wherein the PEMF session efficacy data includes PEMF session signal parameters corresponding to multiple distinct target tissue types or target cell types, wherein the PEMF session signal parameters for each distinct target tissue type or target cell type comprise one of more of: amplitude, frequency, symmetry, field gradient, uniformity, and direction and duration of the PEMF pulses emitted by the set of PEMF coils during PEMF sessions corresponding to the target tissue type or target cell type, as well as a maximum PEMF exposure time or magnetic flux density dose for PEMF sessions corresponding to the target tissue type or target cell type, and wherein the controller is configured to retrieve PEMF session signal parameters from the memory module for controlling the output of the pulse generator.

4. A system for generating pulsed electromagnetic fields (PEMFs) for application to target tissues or target cells during a plurality of successive PEMF sessions, comprising:

a set of PEMF coils;

a memory module and/or a database;

a pulse generator coupled to the set of PEMF coils and configured to generate an output of electrical pulses to drive the set of PEMF coils; and

a controller in communication with the memory module and the pulse generator, wherein the controller is configured to:

control the output of the pulse generator such that during each PEMF session, the set of PEMF coils generates a plurality of PEMF pulses across a PEMF exposure time of at least 5 minutes but not longer than 15 minutes, wherein each PEMF pulse has a peak magnetic flux density between 0.1 – 5.0 mT and a rate of magnetic flux density change between 10 – 100 T/s.

wherein the memory module and/or the database store PEMF session signal parameters corresponding to multiple distinct target tissue types or target cell types, wherein the PEMF session signal parameters for each distinct target tissue type or target cell type comprise one of more of: amplitude, frequency, symmetry, field gradient, uniformity, and direction and duration of the PEMF pulses emitted by the set of PEMF coils during PEMF sessions

corresponding to the target tissue type or target cell type, as well as a maximum PEMF exposure time or magnetic flux density dose for PEMF sessions corresponding to the target tissue type or target cell type, and wherein the controller is configured to retrieve PEMF session signal parameters from the memory module for controlling the output of the pulse generator, and

wherein the PEMF session signal parameters corresponding to distinct target tissue types or target cell types comprise at least two of:

myoblast parameters specifying for each PEMF session a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 1.5 mT;

skeletal muscle parameters specifying for each PEMF session a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density between 1.5 – 3.0 mT;

cardiac muscle parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 3.0 mT;

lymphocyte parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 2.0 mT;

mesenchymal stem cell parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 3.0 mT;

chondrocyte parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 2.0 mT;

adipocyte parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 1.0 mT; and

smooth muscle parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 3.0 mT.

5. The system as claimed in claim 1, wherein for each target tissue ID, the PEMF regimen efficacy window data specifies a maximum number of PEMF sessions to which the target tissue corresponding to the target tissue ID is to be exposed to PEMFs across 3 days, 5 days, one week, 10 days, or two weeks.

6. The system as claimed in claim 5, wherein for at least one target tissue ID, the PEMF regimen efficacy window data specifies a maximum number of PEMF sessions per week less than or equal to 3.

7. The system as claimed in claim 1, wherein the set of PEMF coils is configured to generate magnetic field lines in a downward direction vertical with gravity.

8. The system as claimed in claim 1, wherein the set of PEMF coils comprises a plurality of coils configured to accommodate portions of a subject's leg.

9. The system as claimed in claim 1, wherein the set of PEMF coils comprises a pair of opposing saddle coils.

10. The system as claimed in claim 1, further comprising a seating device configured for supporting a subject in a seated position, and wherein the set of PEMF coils is configured to apply PEMF pulses through portions of the seating device.

11. The system as claimed in claim 10, wherein the set of PEMF coils is built into the seating device.

12. A system for generating and applying pulsed electromagnetic fields (PEMFs) to target tissues or target cells of a plurality of animal subjects during a plurality of successive PEMF sessions, the system comprising:

a set of PEMF coils configured for applying PEMFs to the animal subjects;

a memory module and/or a database;

a pulse generator coupled to the set of PEMF coils and configured to generate an output of electrical pulses to drive the set of PEMF coils;

a controller in communication with the memory module and/or the database and the pulse generator,

wherein the controller is configured to control the output of the pulse generator such that during each PEMF session, the set of PEMF coils generates a plurality of PEMF pulses across a PEMF exposure time of at least 5 minutes but not longer than 15 minutes, wherein each PEMF pulse has a peak magnetic flux density between 0.1 – 5.0 mT and a rate of magnetic flux density change between 10 – 100 T/s, and

wherein the memory module and/or the database store PEMF session signal parameters corresponding to multiple distinct target tissue types or target cell types, wherein the PEMF session signal parameters for each distinct target tissue type or target cell type comprise one or more of: amplitude, frequency, symmetry, field gradient, uniformity, and direction and duration of the PEMF pulses emitted by the set of PEMF coils during PEMF sessions corresponding to the target tissue type or target cell type, as well as a maximum PEMF exposure time ro magnetic flux density dose for PEMF sessions corresponding to the target tissue type or target cell type, and

wherein the controller is configured to retrieve PEMF session signal parameters from the memory module and/or the database for controlling the output of the pulse generator; and

an animal feeding station providing multiple feed access points at which the animal subjects collectively eat, wherein the set of PEMF coils comprises a plurality of PEMF coils, each of which is arranged along a portion of a structure that separates or segregates one feed access point from another.

13. The system as claimed in claim 4, wherein the set of PEMF coils comprises a Magnetic Resonance Imaging (MRI) system coil.

14. The system as claimed in claim 4, wherein the set of PEMF coils is configured to apply PEMF pulses to a cell culture medium containing the target cells during each PEMF session.

15. A method of configuring a pulsed electromagnetic field (PEMF) system that generates and PEMFs to one or more target tissues of a plurality of human subjects or a plurality of animal subjects, wherein for each subject a corresponding PEMF regimen indicates each target tissue of the subject to which PEMFs are to be applied during a plurality of PEMF sessions associated with the PEMF regimen, the method comprising:

providing each of:

(i) a set of PEMF coils;

(ii) a pulse generator coupled to the set of PEMF coils and configured to generate an output of electrical pulses to drive the set of PEMF coils;

(iii) a memory module and/or a database storing:

(a) for each of a plurality of distinct target tissue types, corresponding PEMF session efficacy window data that specifies at least one of (i) a maximum PEMF exposure time that the target tissue type is to receive during each PEMF session, and (ii) a maximum magnetic flux density that the target tissue type is to receive during each PEMF session; and

(b) for each of the plurality of subjects to which PEMFs are to be applied, PEMF regimen efficacy window data that specifies (i) a distinct target tissue ID corresponding to each distinct target tissue of the subject to which PEMFs are to be applied during PEMF sessions associated with the PEMF regimen for the subject, and at least one of (ii) a minimum time period between successive PEMF sessions corresponding to each target tissue ID, and (ii) a maximum or total number of PEMF sessions across a predetermined number of days or weeks corresponding to each target tissue ID; and

(iv) a controller coupled to the memory module and the pulse generator, and which is configured to control the output of the pulse generator to produce PEMF pulses during a plurality of successive PEMF sessions;

configuring, for each of the plurality fo subjects, the controller to (a) control the output of the pulse generator in accordance with stored PEMF regimen efficacy window data corresponding to the subject to avoid or prevent exposure of the same target tissue of the subject to PEMFs more frequently than specified by the stored PEMF regimen efficacy window data, and (b) control the output of the pulse generator in accordance with the stored PEMF session efficacy window data to avoid or prevent exposure of the same target tissue of the subject to PEMFs outside of the PEMF session efficacy window, wherein during each PEMF session associated with each PEMF regimen, the set of PEMF coils generates a plurality of PEMF pulses, wherein each PEMF pulse has a peak magnetic flux density between 0.1 – 5 mT and a rate of magnetic flux density change between 10 – 100 T/s~~;~~, and wherein the controller prevents the pulse generator from outputting electrical pulses to drive the set of PEMF coils for longer than 15 minutes during each of the plurality of PEMF sessions associated with each PEMF regimen, to thereby prevent the generation of PEMF pulses for longer than 15 minutes during each of the plurality of PEMF sessions associated with each PEMF regimen.

16. The method of claim 15, wherein configuring the controller comprises configuring the controller to control the output of the pulse generator such that during each PEMF session, each PEMF pulse has a rate of magnetic flux density change between 35 – 65 T/s.

17. A method of configuring a pulsed electromagnetic field (PEMF) system, comprising:

providing (i) a set of PEMF coils, (ii) a pulse generator coupled to the set of PEMF coils and configured to generate an output of electrical pulses to drive the set of PEMF coils, (iii) a memory module and/or a database, and (iv) a controller coupled to the memory module and the pulse generator, and which is configured to control the output of the pulse generator to produce PEMF pulses during a plurality of successive PEMF sessions;

configuring the controller to control the pulse generator such that during each PEMF session, the set of PEMF coils generates a plurality of PEMF pulses, wherein each PEMF pulse has a peak magnetic flux density between 0.1 – 5 mT and a rate of magnetic flux density change between 10 – 100 T/s;

configuring the controller to prevent the pulse generator from outputting electrical pulses to drive the set of PEMF coils for longer than 15 minutes during each PEMF session,

to thereby prevent the generation of PEMF pulses for longer than 15 minutes during each PEMF session;

storing in the memory module and/or the database a plurality of PEMF session signal parameter sets, wherein each PEMF session signal parameter set corresponds to a distinct target tissue type or target cell type, and wherein the plurality of PEMF session signal parameter sets comprises at least two of:

myoblast parameters specifying for each PEMF session a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 1.5 mT;

skeletal muscle parameters specifying for each PEMF session a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density between 1.5 – 3.0 mT;

cardiac muscle parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 3 mT;

lymphocyte parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 2 mT;

mesenchymal stem cell parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 3 mT;

chondrocyte parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 2 mT;

adipocyte parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 1 mT; and

smooth muscle parameters specifying a PEMF exposure time of 10 minutes and/or a peak PEMF pulse magnetic flux density of 3 mT;

accessing the memory module and/or the database with the controller to retrieve a set of PEMF session signal parameters prior to the initiation of a PEMF session; and

configuring the pulse generator with the controller prior to PEMF pulse generation such that the set of PEMF coils outputs PEMF pulses in accordance with the retrieved set of PEMF session signal parameters.