We claim:

1. A method of right atrial pacing of a heart of a patient comprising:

stimulating right atrial tissue of the heart using a right atrial lead of a dual chamber cardiac pacemaker to pace the heart with a stimulus architecture protocol; and

stimulating local sympathetic and/or parasympathetic tissues with the stimulus architecture protocol proximate to the paced right atrial tissue causing nervous system activity that inhibits the autonomous nervous system to reduce blood pressure.

2. The method of claim 1 where stimulating right atrial tissue of the heart using a right atrial lead of a dual chamber cardiac pacemaker to pace the heart with a stimulus architecture protocol comprises stimulating right atrial tissue with a selected composite amplitude of the pacing stimulus, a selected number of sub-pulses within the pacing stimulus totaling the composite delivered amplitude, a selected frequency of the sub-pulses, a selected duration of the sub-pulses, and/or a selected refractory period before another impulse can be generated,

where the selections are determined by an artificial intelligence derived stimulus architecture protocol.

3. The method of claim 1 where stimulating right atrial tissue of the heart and stimulating local sympathetic and/or parasympathetic tissues with the stimulus architecture protocol comprises stimulating the right atrial tissue of the heart and stimulating local sympathetic and/or parasympathetic tissues using an optimized stimulus protocol devised by artificial intelligence for the patient to reduce blood pressure selected from the group selectively varied stimulus amplitude, selectively varied stimulus duration, selectively varied the ascent and descent phase slopes of stimulation, selectively varied number of impulses delivered in a train or a succession of closely spaced stimuli, selectively varied frequencies of the impulses delivered as a train or a succession of closely spaced stimuli, and/or selectively varied amplitudes of the individual impulses delivered as a train or a succession of closely spaced stimuli,

where intensity of delivered right atrial stimuli may be subthreshold or suprathreshold; and where the impulses may be propagated or nonpropagated, depending on the timing of the impulse, as determined by the stimulus architecture protocol.

4. The method of claim 3 where stimulating the right atrial tissue of the heart and stimulating local sympathetic and/or parasympathetic tissues using an optimized stimulus protocol devised by artificial intelligence for the patient to reduce blood pressure comprises:
determining if a cardiac beat is required; and
supra-threshold pacing the heart and causing a neuro-inhibitory feedback to lower blood pressure, if a cardiac beat is required.

5. The method of claim 3 where stimulating the right atrial tissue of the heart and stimulating local sympathetic and/or parasympathetic tissues using an optimized stimulus protocol devised by artificial intelligence for the patient to reduce blood pressure comprises:
determining if a cardiac beat is required; and
sub-threshold pacing the heart to only produce a neuro-inhibitory effect on blood pressure without pacing the heart, if a cardiac beat in not required.

6. The method of claim 1 where stimulating right atrial tissue of the heart and stimulating local sympathetic and/or parasympathetic tissues with the stimulus architecture protocol comprises stimulating the right atrial tissue with a right atrial pacing lead with multiple pacing electrodes such that one pacing electrode comprises a conventional right atrial pacing lead, and one or more other pacing electrodes are arranged and configured to be disposed anatomically proximate to atrial tissue proximate to sympathetic and/or parasympathetic ganglionic tissues for the purpose of stimulating those ganglionic tissues to lower blood pressure.

7. A closed loop system comprising:
a blood pressure measuring device for transmitting a blood pressure reading;
an applications module receiving the blood pressure reading from the applications module, where the applications module operates under an algorithm that uses the measured blood pressure reading to calculate a selected stimulus architecture of which selectively stimulates the right atrial tissue of the heart and selectively stimulates local sympathetic and/or parasympathetic tissues using an optimized stimulus protocol devised by artificial intelligence for the patient to control blood pressure; and

a cardiac pacemaker communicated with the applications module to regulate right atrial pacing for the purpose of controlling blood pressure.

8. The closed loop system of claim 7 where the pacemaker determines if a cardiac paced beat is required and where the pacemaker applies supra-threshold pacing to the heart and causes a neuro-inhibitory feedback to lower blood pressure according to a stimulus architecture generated by the applications module, if a cardiac beat is required.

9. The closed loop system of claim 7 where the pacemaker determines if a cardiac paced beat is required and where the pacemaker applies sub-threshold pacing to the heart causing a neuro-inhibitory feedback back to lower blood pressure according to a stimulus architecture generated by the applications module, if a cardiac beat is not required.

10. The closed loop system of claim 7 where the applications module includes a PressurePace module for first determining an optimal right atrial pacing rate and includes a Stimulus Architecture Algorithm module (SSA) to calculate the selected stimulus architecture based on the optimal right atrial pacing rate from the PressurePace module.

11. The closed loop system of claim 7 where the applications module constructs an algorithm that uses the measured blood pressure reading to calculate a selected stimulus architecture algorithm for regulating right atrial pacing using artificial intelligence using the measured blood pressure reading.

12. The closed loop system of claim 11 where the applications module constructs an algorithm that uses the measured blood pressure reading to calculate a selected stimulus architecture algorithm for regulating right atrial pacing using artificial intelligence using the measured blood pressure reading and at least input selected from the group of patient age, sex, medications, ambient temperature, altitude, patient's instantaneous reports of symptoms, or other parameters deemed relevant by the attending cardiologist.

13. The closed loop system of claim 7 where right atrial pacing for the purpose of lowering blood pressure is carried out via the multi-electrode pacing electrode, having at least one conventional right atrial pacing electrode and one or more other pacing electrodes arranged and configured to be disposed anatomically proximate to atrial tissue proximate to sympathetic and/or parasympathetic ganglionic tissues for the purpose of stimulating those ganglionic tissues to lower blood pressure.

14. A cardiac pacing lead for stimulating right atrial tissue of the heart and stimulating local sympathetic and/or parasympathetic tissues with the stimulus architecture protocol comprising:
a conventional right atrial pacing lead; and
one or more other electrodes arranged and configured to be disposed anatomically proximate to atrial tissue or proximate to sympathetic and/or parasympathetic ganglionic tissues for the purpose of stimulating those ganglionic tissues to lower blood pressure.

15. The cardiac pacing lead of claim 14 where the conventional right atrial pacing lead and one or more other electrodes deliver a plurality of selected stimulus architectures to the right atrium of a heart which selectively stimulates the right atrial tissue of the heart and selectively stimulates local sympathetic and/or parasympathetic tissues respectively, using an optimized stimulus protocol devised by artificial intelligence for the patient to control blood pressure.

16. The cardiac pacing lead of claim 14 where conventional right atrial electrode delivers a supra-threshold pacing to the heart and at least one of the other electrodes causes a neuro-inhibitory feedback to lower blood pressure according to a stimulus architecture generated by the applications module, if a cardiac beat is required.

17. The cardiac pacing lead of claim 14 where conventional right atrial electrode delivers a sub-threshold pacing to the heart and at least one of the other electrodes causes a neuro-inhibitory feedback to lower blood pressure according to a stimulus architecture generated by the applications module, if a cardiac beat is not required.

18. The cardiac pacing lead of claim 14 where a pacing stimulus can be delivered on one electrode without delivery of a pacing stimulus being delivered on other electrodes.

19. The cardiac pacing lead of claim 14 where the one or more other electrodes can deliver energy with a specific protocol to the right atrial tissue affecting blood pressure without inducing cardiac pacing.

20. An apparatus comprising:

a wrist attachment;

a skin contact sensor disposed in the wrist attachment for real-time measurement of an ANS function to measure skin sympathetic or parasympathetic activity of a patient; and

a blood pressure sensor disposed in the wrist attachment for real-time measurement of blood pressure of the patient;

whereby measurement of the ANS function is available for use in reduction of blood pressure of the patient.

21. The apparatus of claim 20 further comprising:

an applications module receiving the real-time measurement of the ANS function, where the applications module operates under an algorithm that uses the real-time measurement of an ANS function to calculate a selected stimulus architecture of which selectively stimulates the right atrial tissue of the heart and selectively stimulates local sympathetic and/or parasympathetic tissues using an optimized stimulus protocol to control blood pressure; and

a cardiac pacemaker communicated with the applications module to regulate right atrial pacing for the purpose of controlling blood pressure.

22. The apparatus of claim 21 where the applications module operates under an algorithm by using artificial intelligence to stimulate the right atrial tissue of the heart with the optimal stimulus protocol to control blood pressure.

23. The apparatus of claim 20 in combination with a smartphone, where the skin sensor is communicated with the applications module through the smartphone.

1. A computing device, comprising at least one processor and at least one memory comprising instructions that, when executed by the processor, cause the device to:

receive a physiological input value;

calculate a pacing rate based on the physiological input value;

determine a supra-threshold stimulus protocol to produce cardiac pacing and stimulation of one or both of local sympathetic tissue or parasympathetic tissues to modify the physiological input value, based on the pacing rate; and

determine a sub-threshold stimulus protocol to produce feedback inhibition of a portion of an autonomic nervous system to modify the physiological input value, based on the pacing rate, wherein each of the supra-threshold stimulus protocol and the sub-threshold stimulus protocol comprises a respective composite amplitude of pacing stimulus, frequency of sub-pulses, duration of sub-pulses, and refractory period between a current pacing stimulus and a subsequent pacing stimulus.

2. The computing device of claim 1, wherein the respective composite amplitude of pacing stimulus is reached based on a number of sub-pulses, the number of sub-pulses having amplitudes totaling the composite amplitude of pacing stimulus.

3. The computing device of any of claims 1-2, wherein the instructions further cause the device to cause a pacing device to apply one of the supra-threshold stimulus based on determining that a paced cardiac beat is indicated or the sub-threshold stimulus based on determining that a paced cardiac beat is not indicated.

4. The computing device of any of claims 1-3, wherein the physiological input value is a blood pressure value.

5. The computing device of any of claims 1-4, wherein the instructions cause the device to calculate the pacing rate by:

comparing the physiological input value to a target physiological input value; and

determining the pacing rate based on comparing the physiological input value to the target physiological input value.

6. The computing device of claim 5, wherein the target physiological input value is based on one or more of a patient state, a patent demographic, a patient medication, an ambient condition, or a patient symptom.

7. The computing device of any of claims 1-6, wherein the instructions further cause the device to:

receive a skin sympathetic or parasympathetic activity (SKNA); and

calculate the pacing rate further based on the SKNA.

8. The computing device of claim 7, wherein the SKNA is received from at least one of a high-pass or a band-pass filter.

9. The computing device of any of claims 1-8, wherein the instructions further cause the device to:

receive autonomic nervous system (ANS) activity from one of an direct sensor or an indirect function; and

calculate the pacing rate further based on the ANS activity.

10. The computing device of claim 9, wherein the indirect sensor is a non-invasive sensor.

11. The computing device of any of claims 1-10, wherein one or both of the supra-threshold stimulus protocol or the sub-threshold stimulus protocol are output by an artificial intelligence (AI) model.

12. The computing device of claim 11, wherein the AI model is trained to output a stimulus protocol based on training data comprising the physiological input value and one or more of ANS activity, a patient age, a patient sex, a patient medication, an ambient temperature, or a patient symptom.

13. A system for determining stimulus protocols, the system comprising:

one or more pacing electrodes;

an algorithmic module;

a pacing module;

at least one memory storing instructions; and

at least one processor executing the instructions to perform operations, the operations comprising:

receiving, at the algorithmic module, a physiological input value;

calculating, at the algorithmic module, a pacing rate based on the physiological input value;

determining, at the pacing module, a supra-threshold stimulus protocol to produce cardiac pacing and stimulation of one or both of local sympathetic tissue or parasympathetic tissues to modify the physiological input value, based on the pacing rate; and

determining, at the pacing module, a sub-threshold stimulus protocol to produce feedback inhibition of a portion of an autonomic nervous system to modify the physiological input value, based on the pacing rate, wherein each of the supra-threshold stimulus protocol and the sub-threshold stimulus protocol comprises a respective composite amplitude of pacing stimulus, frequency of sub-pulses, duration of sub-pulses, and refractory period between a current pacing stimulus and a subsequent pacing stimulus.

14. The system of claim 13, wherein the operations further comprise one of causing a pacing device to apply the supra-threshold stimulus based on determining that a paced cardiac beat is indicated or causing a pacing device to apply the sub-threshold stimulus based on determining that a paced cardiac beat is not indicated.

15. The system of any of claims 13-14, wherein the physiological input value is a blood pressure value.

16. The system of any of claim 13-15, wherein the operations further comprise:

receiving, at the algorithmic module, a skin sympathetic or parasympathetic activity (SKNA); and

calculating the pacing rate further based on the SKNA.

17. The system of any of claim 13-16, further comprising one of a direct or indirect autonomic nervous system (ANS) activity sensor, wherein the operations further comprise:

receiving ANS activity from the one of the direct or indirect ANS sensor; and

calculating the pacing rate further based on the ANS activity.

18. A computing device, comprising at least one processor and at least one memory comprising instructions that, when executed by the processor, cause the device to:

receive a physiological input value;

calculate a pacing rate based on the physiological input value;

receive one of an indication that a paced cardiac beat is indicated or that a paced cardiac beat is not indicated;

determine, based on receiving the indication that the paced cardiac beat is indicated, a supra-threshold stimulus protocol to produce cardiac pacing and stimulation of one or both of local sympathetic tissue or parasympathetic tissues to modify the physiological input value, based on the pacing rate, wherein the supra-threshold stimulus protocol comprises a first composite amplitude of pacing stimulus, a first frequency of sub-pulses, a first duration of sub-pulses, and a first refractory period between a current pacing stimulus and a subsequent pacing stimulus.; and

determine, based on receiving the indication that the paced cardiac beat is indicated, a sub-threshold stimulus protocol to produce feedback inhibition of a portion of an autonomic nervous system to modify the physiological input value based on the pacing rate, wherein the sub-threshold stimulus protocol comprises a second composite amplitude of pacing stimulus, a second frequency of sub-pulses, a second duration of sub-pulses, and a second refractory period between a current pacing stimulus and a subsequent pacing stimulus.

19. The computing device of claim 18, wherein the one of the indication that a paced cardiac beat is indicated or that the paced cardiac beat is not indicated is based on a pacing device protocol.

20. The computing device of any of claims 18-19, further comprising providing the supra-threshold stimulus protocol if the indication that a paced cardiac beat is indicated.