We claim:

1. A method of therapeutically treating a subject comprising:

sensing sympathetic nerve activity in the subject;

communicating the sensed sympathetic nerve activity to a processor;

identifying at least one input data set correlated to a physiological end point in the subject using machine learning in the processor;

processing the at least one input data input set to experientially optimize an algorithmically defined physiological goal defined in at least one output data set by the machine learning in the processor; and

dynamically controlling a therapeutic device in real time with the processor using the at least one output data set to treat the subject mediated by the therapeutic device by establishing or tending to establish the physiological goal in the subject.

2. The method of claim 1 where processing the at least one input data input set to experientially optimize an algorithmically defined physiological goal defined in the at least one output data set by the machine learning in the processor comprises comparing instantaneous input data to continuously updated archived input data to determine a unique input data set, Wi, that is most likely to result in the physiological end point at the time of comparison.

3. The method of claims 1 or 2 where the physiological end point is blood pressure as dynamically affect by exercise by the subject.

4. The method of any one of the claims 1 – 3 where using machine learning comprises using a wavelength filter combination that correlates with exercise intensity to process the input data sets sensed between heart beats.

5. The method of any one of the claims 1 – 4 where using machine learning comprises identifying a unique wavelength filter combination to measure sympathetic nervous system output for rate modulation of a pacemaker.

6. The method of any one of the claims 1 – 5 where using machine learning comprises identifying a unique wavelength filter combination to treat DRH and HFpEf using PressurePace^{AI} as defined in PCT/US19/59703.

7. The method of any one of the claims 1 – 6 where using machine learning comprises identifying a unique wavelength filter combination to identify a wavelength filter combination to "know" when the patient with a pacemaker is exercising, and how intense the exercise is to improve pacemaker rate modulation.

8. The method of any one of the claims 1 – 7 where sensing the sympathetic nerve activity comprises sensing during the electrically quiet period between heartbeats, when the pacemaker is not pacing, to measure nearby autonomic nervous system.

9.1. An improvement in a method for treating a patient comprising;A method for modifying a therapeutic device setting, the method comprising:

Sensingreceiving a first sympathetic nerve activity (SNA) signal, the first signal being generated by a SNA sensor; using machine learning/AI, so that a plurality of combinations of, and a plurality of sequencing of a filtering process of the SNA are employed, including using more than one filter combination in short sequences;

receiving a physiological endpoint;

providing the first SNA signal and the physiological endpoint to a machine learning model trained to output a subset of the first SNA signal based on the physiological endpoint;

receiving the subset of the first SNA signal output from the machine learning model;

determining a first current physiological state based on the subset of the first SNA signal;

determining the therapeutic device setting based on the first current physiological state and the physiological endpoint; and

causing a therapeutic device to be modified based on the therapeutic device setting.

~~processing data derived from a plurality of surface or skin electrodes that sample the electrical signals sensed from central nervous system activity in response to a predetermined stimulus; and~~

~~determining one or more electrical frequencies or wavelengths using AI/machine learning algorithms used for:~~

~~monitoring the data;~~

~~calibrating the data; and~~

~~forming a basis of feedback inhibition to the nervous system.~~

2. The method of claim 1, further comprising:

receiving a second SNA signal, the second SNA signal being generated by the SNA sensor;

providing the second SNA signal and the physiological endpoint to the machine learning model;

receiving a subset of the second SNA signal output by the machine learning model based on the second SNA signal and the physiological endpoint; and

determining a second current physiological state based on the subset of the second SNA signal.

3. The method of claim 2, further comprising training the machine learning model based on the first current physiological state and the second current physiological state.

4. The method of claim 2, further comprising:

determining an updated therapeutic device setting based on the second current physiological state and the physiological endpoint; and

causing the therapeutic device to be modified based on the updated therapeutic device setting.

5. The method of claim 1, wherein the subset of the first SNA signal excludes portions of the first SNA signal collected during a blanking period.

6. The method of claim 5, wherein the blanking period corresponds to a duration of time during which the therapeutic device outputs an electrical impulse.

7. The method of claim 1, wherein the physiological endpoint is a target blood pressure.

8. The method of claim 7, wherein the target blood pressure is one of a systolic blood pressure, diastolic blood pressure, or mean arterial pressure.

9. The method of claim 1, wherein the SNA sensor is associated with a wearable device.

10. The method of claim 1, wherein receiving the first SNA signal further comprises:

receiving a sensed SNA signal;

amplifying the sensed SNA signal to generate an amplified sensed SNA signal; and

processing the amplified sensed SNA signal using a band pass filter to generate the first SNA signal.

~~10. The improvement of claim 9 further comprising creating a real-time dynamic autonomous feedback loop to continually adjust nervous system feedback inhibition for an optimal effect.~~

11. An improvement in a method for treating a patient comprising;

sensing sympathetic nerve activity (SNA) using machine learning/AI, so that a plurality of combinations of, and a plurality of sequencing of a filtering process of the SNA are employed, including using more than one filter combination in short sequences;

processing data derived from a plurality of non-electric sensors, such as sound or heat signatures, in response to a predetermined stimulus; and

inducing or calibrating a sensed nervous system response to detect and/or calibrate a feedback inhibition for a defined therapeutic effect.

12. The method of any one of the claims 1 – 11 further comprising using a cardiac electrode as a sensing or stimulating element and applying the stimulus during the quiet period of the cardiac cycle, either with predetermined timing, or several stimuli in sequence using a BaroPace™ algorithm,

whereby a BaroPace™ stimulus architecture algorithm delivers an optimal frequency, amplitude, timing, and sequence of multiple stimuli, as an optimal magnitude of an individual stimulus either as a pacing level stimulus, or as a sub-threshold stimulus, which is performed in a combination in a predetermined sequence, namely first a supra threshold stimulus followed by a subthreshold stimulus during the quiet period.

13. The method of any one of claims 1 – 2 further comprising providing cardiac pacing via a standard pacing electrode or a pacing electrode arranged and configured for sympathetic nerve stimulation or near cardiac ganglia; and applying a pacing stimulus at a subthreshold amplitude alone or in combination with other pacing stimuli, or a subthreshold stimulus to produce nervous system inhibition, or a non-nervous system effect, including but not limited to a stimulated release of atrial naturietic peptide or other tissue factor related to a hemodynamic effect,

whereby a feedback not related to the nervous system is employed.

14. The method of any one of the claims 1 – 13 further comprising adjusting stimulus strength and stimulus architecture or protocols to produce an optimal feedback effect for

a specific endpoint that is not cardiac rhythm disturbances, including but not limited to a reduction in blood pressure.

15. The method of any one of the claims 1 – 14 further comprising adding or layering more than one sensor input or add more than one type of stimulation using artificial intelligence to one or more locations on the body using one or more types of stimuli, so that the central nervous system is inhibited in response to more than one stimuli or inputs, which include blood pressure and the patient's subjective report of symptoms.

16. The method of any one of the claims 1 – 15 further comprising controlling cardiac pacemaker rate modulation by adding a new measure of exercise intensity via monitoring of the central nervous system which does not involve stimulation, instead uses a filtered signal that measures the degree of exercise intensity in a quantitative manner without the inhibition of the nervous system.

17. A method for cardiac treatment of a patient comprising:

monitoring nervous system activity to treat DRH and/or HFpEF in combination with BaroPacing or PressurePace AI using the disclosed trend analysis, or Stimulus Architecture Algorithm (SAA), as defined and disclosed in "An Intelligently, Continuously And Physiologically Controlled Pacemaker And Method Of Operation Of The Same ", International Pat. App. PCT/US20/25447; and "Method of Treatment of Drug Resistant Hypertension by Electrically Stimulating the Right Atrium to Create Inhibition of the Autonomic Nervous System, " International Pat. Appl., PCT/US20/44784.

18. The method of any one of the claims 1 – 17 further comprising using the method to treat cardiac arrhythmias.

19. A method of providing a cardiac treatment comprising:

combining the nervous system sensing with BaroPacing to treat a patient including the use of a class of drugs, that without BaroPacing does not produce a therapeutic response; and

at the same time eliminating one or more drug classes that currently are in use further improves treatment benefits.

20. The method of claim 19 where treating the patient using a class of drugs comprises treating a patient with ACEI/ARB provides a therapeutic drug effect not present without BaroPacing, and removing the adverse effects on heart rate modulation experienced with beta blockers, which are eliminated from the treatment protocol.

21. A method of monitoring and processing of nerve activity intelligently mediated by artificial intelligence or machine learning not dependent on the intervention or analysis of a physician comprising:

performing continuous, rapid, real-time data acquisition and processing;

dynamically varying band-pass filtering to sample a wider dynamic spectrum of nerve activity; and

acquiring and simultaneously analyzing more than one nervous system activity marker.

22. A method for controlling a pacemaker comprising:

sensing the activity of the parasympathetic or autonomous nervous system (ANS), specifically including the vagal nerve, either from a peripheral (skin or otherwise) sensor, or directly from an electrode in or near the heart, such as a pacemaker lead or other in vivo sensing element connected internally or externally to the pacemaker; and

data processing the sensed activity of the parasympathetic or autonomous nervous system (ANS) to generate a cardiac control signal for use in the pacemaker.

23. The method of claim 22 where sensing the activity of the parasympathetic or autonomous nervous system (ANS) comprises sensing the ANS through a base station

wristwatch sensor communicated to a pacemaker to generate a corresponding base station processed output signal used by AI to control the pacemaker, and sensing the ANS through a peripheral sensor communicated to the base station wristwatch sensor to generate a corresponding peripheral sensor processed output signal used by AI to control the pacemaker.

24. The method of claim 23 where data processing the sensed activity of the parasympathetic or autonomous nervous system (ANS) to generate a cardiac control signal for use in the pacemaker comprises combining analysis of processed ANS signals from the base station wristwatch sensor and analysis of at least one other peripheral sensor.

25. A method for controlling a pacemaker comprising:

generating a calibration signal from a standard generator or physiological sample;

amplifying the calibration signal;

selective bandpass filtering the amplified calibration signal according artificial intelligence or operator control to obtain an optimal signal for a selected cardiac state;

amplifying the optimal signal to obtain a signal strength indicator, a frequency indicator and/or ECG timing indicator of a cardiac function or dysfunction; and

communicating the processed and amplified optimal signal to a pacemaker control circuit.

26. The method of claim 25 where a raw ANS signal is received and processed according determinations derived from the processed calibration to reiteratively determine the processed optimal signal through selective control of bandpass filtering using the signal strength indicator, the frequency indicator and/or ECG timing indicator of a cardiac function or dysfunction, and amplifying the reiteratively determined the processed optimal signal and communicating the amplified reiteratively determined the processed optimal signal to a pacemaker control circuit.

27. A method of controlling the rate modulation of a cardiac pacemaker using a right atrial pressure (RAP) sensor comprising:

controlling the pacemaker during first selected conditions using a standard RAP algorithm; and

controlling the pacemaker during second selected conditions using PressurePace algorithms.

28. The method of claim 27 where the first selected condition is a default condition where standard rate modulation is always applied, but in the second selected condition standard rate modulation is turned off and replaced with PressurePace rate modulation or a blend the two, when ANS discrimination becomes active, defined as "blended hierarchal software with PressurePace in the primary control position".

29. The method of claim 27 where the first selected condition is a default condition where standard rate modulation is not applied and where the second selected condition is where standard rate modulation and PressurePace are combined, blending or alternating the application of the two types of rate modulation algorithms according to how the range of rate modulation settings available is learned through machine learning.

30. A method of any one of the claims 1 - 29 further comprising:

sensing and storing an ANS data set in a mobile monitor;

downloading the stored ANS data set into a computer;

selectively filtering and processing the downloaded data to generate an AI-based pacemaker control algorithm; and

uploading the AI based pacemaker control algorithm into a programmable pacemaker.

31. The method of claim 30 further comprising repeating the steps of sensing and storing, downloading, selectively filtering and processing, and uploading with

~~multiple ANS data sets over time for a patient to generate a final AI-based pacemaker control algorithm.~~

~~32. The method of claims 30 or 31 further comprising sensing and storing ECG and other cardiac and vascular data with the ANS data and/or patient entered event notes with the ANS data sets.~~

~~33. An improvement in a rate modulation method in a pacemaker implanted into a patient subject to exercising comprising modifying the rate modulation method to include machine learning, wherein the pacemaker performs machine learning controlled by a software subroutine that learns the patient's exercise profile and then updates the rate modulation programming on the fly.~~

~~34.~~11. A system comprising:~~for operating a device using the method of any one of the claims 1 - 33.~~

a memory configured to store processor-readable instructions; and

a processor operatively connected to the memory, and configured to execute the instructions to perform operations that include:

receiving a first sympathetic nerve activity (SNA) signal, the first SNA signal being generated by an SNA sensor;

receiving a physiological endpoint;

providing the first SNA signal and the physiological endpoint to a machine learning model trained to output a subset of the first SNA signal based on the physiological endpoint;

receiving the subset of the first SNA signal output from the machine learning model;

determining a first current physiological state based on the subset of the first SNA signal;

determining a therapeutic device setting based on the first current physiological state and the physiological endpoint; and

causing a therapeutic device to be modified based on the therapeutic device setting.

12. The system of claim 11, wherein the operations further include:

receiving a second SNA signal, the second SNA signal being generated by the SNA sensor;

providing the second SNA signal to the machine learning model;

receiving a subset of the second SNA signal output by the machine learning model based on the second SNA signal and the physiological endpoint; and

determining a second current physiological state based on the subset of the second SNA signal.

13. The system of claim 12, wherein the operations further include training the machine learning model based on the first current physiological state and the second current physiological state.

14. The system of claim 12, wherein the operations further include:

determining an updated therapeutic device setting based on the second current physiological state and the physiological endpoint; and

causing the therapeutic device to be modified based on the updated therapeutic device setting.

15. The system of claim 11, wherein receiving the first SNA signal further comprises:

receiving a sensed SNA signal;

amplifying the sensed SNA signal to generate an amplified sensed SNA signal; and

processing the amplified sensed SNA signal using a band pass filter to generate the first SNA signal.

16. A method for modifying a therapeutic device setting, the method comprising:

receiving input signals comprising a sympathetic nerve activity signal (SNA) and an electrocardiogram activity (ECG) signal;

providing the SNA signal and the ECG signal to a machine learning model trained to output a subset of the SNA signal based on the ECG signal;

receiving the subset of the SNA signal output from the machine learning model;

receiving a physiological endpoint;

determining a first current physiological state based on the subset of the SNA signal;

determining the therapeutic device setting based on the first current physiological state and the physiological endpoint; and

causing a therapeutic device to be modified based on the therapeutic device setting.

17. The method of claim 16, wherein the subset of the first SNA signal excludes portions of the SNA signal collected during a blanking period.

18. The method of claim 17, wherein the blanking period corresponds to a duration of time during which the therapeutic device outputs an electrical impulse.

19. The method of claim 17, wherein the machine learning model is configured to determine the blanking period based on the ECG signal.

20. The method of claim 16, wherein the SNA signal is generated at a first sensor and the ECG signal is generated at a second sensor.