

CLAIMS

I claim:

1. A method of performing active auscultation comprising:
 - directing a broadband acoustic signal into user's body toward a target of interest, wherein the broadband acoustic signal is a pulse that comprises a plurality of frequencies;
 - receiving an acoustic signal from the user's body, the received acoustic signal corresponding to the broadband acoustic signal; and
 - determining a characteristic of the received acoustic signal, wherein the characteristic is at least one of an intensity and a frequency of the received acoustic signal.
2. The method of claim 1, wherein the broadband acoustic signal is a first broadband acoustic signal and the received acoustic signal is a first received acoustic signal, the method further comprising:
 - receiving a second acoustic signal from the user's body, the received acoustic signal corresponding to a second broadband acoustic signal projected into the user's body;
 - determining a characteristic of the second received acoustic signal, wherein the characteristic of the second received acoustic signal is at least one of an intensity and a frequency of the second received acoustic signal;
 - comparing a characteristic of the first and second received acoustic signals; and
 - providing an indication of the comparison to an operator.
3. The method any of claims 1 or 2, further comprising:
 - comparing the characteristic of the acoustic signal to a predetermined value.
4. The method of claim 1, further comprising:
 - adjusting at least one of a duration of the broadband signal, an intensity of the broadband signal, and frequencies included in the broadband signal responsively to the determined characteristics of the acoustic signal.

5. The method of claim 1, wherein the broadband signal comprises a plurality of frequencies between 2,000Hz and 30,000Hz.
6. The method of claim 1, wherein a duration of the pulse within the range of 0.1 seconds and 2 seconds.
7. The method of claim 1, wherein the target is at least one of a heart and a lung of the user.
8. The method of claim 1, wherein the target is the user's lung, the method further comprising:
 - determining a volume of air trapped in the user's lung responsively to the determined characteristic.
9. A method comprising:
 - receiving, by a processor, a detected acoustic signal from a receiver, the detected acoustic signal corresponding to an acoustic signal directed toward a target within the body of a user in a pulse and responsively emanating from the user, the acoustic signal comprising a plurality of frequencies; and
 - analyzing, by the processor, the received acoustic signal to determine a resonant frequency for the target.
10. The method of claim 9, wherein the target is the user's lung, the method further comprising:
 - determining, by the processor, a volume of trapped air present in the user's lung responsively to the resonant frequency.
11. The method any of claims 9 or 10, further comprising:
 - comparing the resonant frequency of the target to a predetermined value.
12. The method of claim 9, further comprising:
 - adjusting at least one of a duration, an intensity of the broadband signal stimuli, and frequencies included in the broadband signal stimuli responsively to the determined resonant frequency of the target.

13. The method of claim 9, wherein the broadband signal stimuli is between 2,000Hz and 30,000Hz.
14. A method for performing active auscultation comprising:
 providing, by a processor in communication with an emitter, signal stimuli to the emitter so that the emitter produces acoustic energy of a plurality of frequencies, the acoustic energy being directed towards an organ of a user;
 receiving, by the processor, via a receiver in communication with the processor, an acoustic energy response that corresponds to the acoustic energy of the plurality of frequencies directed towards the organ;
 analyzing, by the processor, the received acoustic energy response to determine a resonant frequency for the organ.
15. The method of claim 14, wherein the plurality of frequencies directed towards the organ includes a set of discrete frequencies.
16. The method of claim 15, wherein the signal stimuli cause the emitter to produce acoustic energy that cycles through the set of discrete frequencies over a predetermined period of time.
17. The method of claim 14, wherein the signal stimuli cause the emitter to produce acoustic energy that includes a series of pseudo-randomly selected frequencies.
18. The method of claim 14, wherein signal stimuli cause the emitter to produce a burst of acoustic energy that includes the plurality of frequencies.
19. The method any of claims 14-18, further comprising:
 determining, by the processor, a volume of air trapped in the organ based on the resonant frequency for the organ.
20. The method any of claims 14-18, further comprising:
 receiving, by the processor, information pertaining to the user; and
 correlating the received information with the resonant frequency of the organ.

21. The method of claim 20, wherein the received information pertains to one or more of a physiological characteristic of a user, a diagnosis of a user, a size of the organ, a shape of the organ, a type of fluid in the organ, a type of gas in the organ, a location of the emitter, a location of the receiver, a level of ambient noise, and an orientation of a user.
22. The method of claim 14, wherein signal stimuli cause the emitter to produce a broadband signal with one or more of a predetermined frequency response and a predetermined frequency bin.
23. A system, comprising:
a processor configured to:
provide signal stimuli to an emitter in communication with the processor such that the emitter produces acoustic energy of a plurality of frequencies, the acoustic energy being directed towards an organ of a user's body;
receive, via a receiver in communication with the processor, an acoustic energy response that corresponds to the acoustic energy of the plurality of frequencies directed towards the organ;
generate, a comparison between the acoustic energy response and a predetermined threshold; and
determine, based on the comparison, one or more resonant frequencies for the organ.
24. A method of performing active auscultation comprising:
providing, by a processor in communication with an emitter, a first signal stimuli to the emitter such that the emitter produces acoustic energy of a first plurality of frequencies that is directed towards an organ;
receiving, by the processor, via a receiver in communication with the processor, a first acoustic energy response that corresponds to the acoustic energy of the first plurality of frequencies directed towards the organ;
providing, by the processor, a second signal stimuli to the emitter such that the emitter produces acoustic energy of a second plurality of frequencies that is directed towards the organ;

receiving, by the processor, via the receiver, a second acoustic energy response that corresponds to the acoustic energy of the second plurality of frequencies directed towards the organ;

generating, by the processor, a comparison between the first acoustic energy response and the second acoustic energy response; and

determining, by the processor, based on the generated comparison, one or more characteristics of the organ.

25. The method of claim 24, wherein the one or more characteristics of the organ includes one or more of sound frequency over time and sound intensity over time.

26. A wearable auscultation sensor comprising:

an emitter configured to project an acoustic signal into a user's body;

a receiver configured to receive an acoustic signal emanating from the user's body; and

a noise cancelling device configured reduce ambient noise in the received acoustic signal.

27. The wearable auscultation sensor of claim 26, wherein the noise cancelling device comprises noise-cancelling circuitry specifically designed to cancel unwanted ambient noise.

28. The wearable auscultation sensor of claim 26, wherein the noise cancelling device adds a signal that is 180 degrees out of phase with targeted ambient noise to filter the ambient noise from the received signal.