

What is Claimed:

1. A device for vacuum-assisted *in vivo* electroporation of tissue, comprising:
a housing defining a chamber and at least one opening into the chamber;
at least one port extending through the housing, wherein the at least one port is remote from the at least one opening and is connectable to a vacuum source, such that the at least one port is configured to communicate vacuum pressure from the vacuum source to the chamber; and
a plurality of electrodes positioned within the chamber, wherein the plurality of electrodes are configured to deliver one or more electroporation pulses to a targeted portion of tissue extending through the at least one opening and at least momentarily held in the chamber responsive to the vacuum pressure.
2. The device of claim 1, wherein the at least one opening is a single opening, and the opening is circular.
3. The device of claim 2, wherein the housing has a wall defining an interior surface that at least partially defines the chamber, and the plurality of electrodes includes four electrodes extending along the interior surface, wherein the four electrodes are spaced from each other at ninety degree intervals.
4. The device of claim 2, further comprising a second port in addition to the at least one port, the second port configured for insertion of a jet injection device or a hypodermic needle into the chamber.
5. The device of claim 2, wherein the housing has an end surface opposite the at least one opening and a wall extending from the end surface to the opening, the wall defining an interior surface that at least partially defines to the chamber, wherein at least one first electrode of the plurality of electrodes extends from the end surface, and at least one second electrode of the plurality of electrodes extends along the interior surface, wherein the at least one first electrode and the at least one second electrode are concentric with each other.
6. The device of claim 5, wherein the at least one first electrode is a single electrode centrally positioned with respect to the end surface, and the at least one second electrode extends along an entire circumference of the interior surface.

7. The device of claim 1, wherein the plurality of electrodes have electrode surfaces that are exposed within the chamber, and at least some of the electrode surfaces are one or more of textured and protruding into the chamber.

8. The device of claim 1, wherein the housing is constructed of a material that is flexible, and the material comprises one or more of polycarbonate, polyetheretherketone, polyphthalamide, polyethylene, polytherimide, polyvinyl chloride, polytetrafluoroethylene, polyamide, polyimide, polysiloxane (silicone), polyethylene terephthalate, polyurethane, crosslinked or non-crosslinked rubbers, polyesters.

9. The device of claim 1, further comprising:
a signal generator in electrical communication with the plurality of electrodes and is configured to transmit the one or more electroporation pulses to the plurality of electrodes; and
a processor in electrical communication with the signal generator and at least one sensor positioned in the chamber, the at least one sensor configured to sense at least one parameter of the tissue during delivery of the one or more electroporation pulses and communicate feedback data of the at least one parameter to the processor, and the processor is configured to execute one or more algorithms utilizing the feedback data and adjust at least one pulse parameter of the one or more pulses during delivery of the one or more pulse.

10. The device of claim 1, wherein the plurality of electrodes are configured to apply pulses with potential magnitudes ranging from about 2 V to about 1000 V.

11. The device of claim 1, wherein the plurality of electrodes are configured to apply pulses with current magnitudes ranging from about 0.01 Amps to about 2.0 Amps, the pulses having pulse durations ranging from about 0.1 milliseconds to about 100 milliseconds.

12. The device of claim 1, wherein the at least one port includes an array of ports each extending through the housing and into the chamber, such that the housing comprises a manifold that defines the array of ports.

13. The device of claim 1, wherein the targeted portion of the tissue is at least one of skin tissue and adipose tissue.

14. A method of electroporating tissue of a subject, comprising:
placing a chamber adjacent to tissue of the subject;

applying vacuum pressure to the chamber, thereby drawing the tissue through an opening of the chamber and into contact with a plurality of electrodes extending along an interior surface of the chamber; and

delivering one or more electroporating pulses through the plurality of electrodes to the tissue, thereby creating an electroporation field within the tissue.

15. The method of claim 14, wherein the applying step comprising applying the vacuum pressure at a sufficient level to affix the tissue to the interior surface and distribute fluid within the tissue in the electroporation field.

16. The method of claim 14, further comprising injecting a substance into the tissue before the delivering step, wherein the delivering step comprises transferring the substance into cells of the tissue within the electroporation field through reversible pores formed in cellular membranes of the cells responsive to the electroporation field.

17. The method of claim 16, wherein the substance comprises nucleic acid that elicits an immune response in the subject.

18. The method of claim 14, wherein the applying step comprises applying pulses of varying vacuum pressure to the tissue and varying the duration of the pulses.

19. The method of claim 14, further comprising injecting a fluid into the tissue from an injection device that extends through a second port and into the chamber, wherein the injecting and applying steps are performed prior to the delivering step, and the injection device is one of an injection needle and a jet injection device.

20. A device for vacuum-assisted treatment of tissue, comprising:
a housing defining a chamber and at least one opening into the chamber;
a first port extending through the housing, wherein the first port is remote from the at least one opening and is connectable to a vacuum source, such that the first port is configured to communicate vacuum pressure from the vacuum source to the chamber; and
a jet-injection device that extends through a second port into the chamber, wherein the second port is opposite the at least one opening, wherein the jet-injection device is configured to deliver a jet injection of fluid to a targeted portion of tissue extending through the at least one opening and at least momentarily held in the chamber responsive to the vacuum pressure.