

WHAT IS CLAIMED IS:

1. A method for delivering a substance across a cell membrane of a cell, the method comprising:
 - applying an alternating electric field to the cell for a period of time, wherein application of the alternating electric field increases permeability of the cell membrane; and
 - introducing the substance to a vicinity of the cell, wherein the increased permeability of the cell membrane enables the substance to cross the cell membrane.
2. The method of claim 1, wherein the cell is a cancer cell.
3. The method of claim 1, wherein the cell is a glioblastoma cell.
4. The method of claim 1, wherein the alternating electric field is applied at a frequency of about 200 kHz.
5. The method of claim 1, wherein the alternating electric field is applied at a frequency between 50 and 190 kHz.
6. The method of claim 1, wherein the alternating electric field is applied at a frequency between 210 and 400 kHz.
7. The method of claim 1, wherein the alternating electric field has a field strength of at least 1 V/cm.
8. The method of claim 1, wherein the cell is disposed in a body of a living subject, wherein the alternating electric field is applied to the cell by applying an electric field to the subject's body, and wherein the introducing comprises administering the substance to the subject.
9. The method of claim 8, wherein the cell is a cancer cell.
10. The method of claim 8, wherein the cell is a glioblastoma cell.

11. The method of any of claims 8-10, wherein the alternating electric field has a frequency between 50 and 190 kHz.
12. The method of any of claims 8-10, wherein the alternating electric field has a frequency between 210 and 400 kHz.
13. The method of any of claims 8-12, wherein the alternating electric field has a field strength of at least 1 V/cm RMS.
14. The method of any of claims 8-12, wherein the alternating electric field has a field strength between 1 and 4 V/cm RMS.
15. The method of any of claims 8-14, wherein the step of introducing the substance begins at a given time, and wherein the step of applying the alternating electric field ends at least 12 hours after the given time.
16. The method of claim 15, wherein the step of applying the alternating electric field begins at least one hour before the given time.
17. The method of any of claims 8-16, wherein the substance has a molecular weight of at least 1.2 kDa.
18. The method of any of claims 8-16, wherein the substance has a molecular weight of at least 4 kDa.
19. The method of any of claims 8-16, wherein the substance has a molecular weight of at least 20 kDa.
20. The method of any of claims 8-16, wherein the substance has at least one characteristic that ordinarily impedes the substance from crossing the cell membrane.
21. The method of any of claims 8-16, wherein the cell is a cancer cell that is innately resistant to treatment using the substance.

22. The method of any of claims 8-16, wherein the cell comprises a bacterium, and the substance comprises an antibiotic.
23. A method for attacking cancer cells, the method comprising:
applying a first alternating electric field at a first frequency to the cancer cells for a first period of time, wherein application of the first alternating electric field at the first frequency to the cancer cells for the first period of time increases permeability of cell membranes of the cancer cells;
introducing a substance to the cancer cells, wherein the increased permeability of the cell membranes enables the substance to cross the cell membranes; and
applying a second alternating electric field at a second frequency to the cancer cells for a second period of time, wherein the second frequency is different from the first frequency, and wherein the second alternating electric field at the second frequency reduces viability of the cancer cells.
24. The method of claim 23, wherein the cancer cells comprise glioblastoma cells, the first frequency is between 250 kHz and 350 kHz, and the second frequency is between 150 kHz and 250 kHz.
25. The method of claim 23, wherein the cancer cells comprise uterine sarcoma cells, the first frequency is between 125 kHz and 175 kHz, and the second frequency is between 75 kHz and 125 kHz.
26. The method of claim 23, wherein the cancer cells comprise breast adenocarcinoma cells, the first frequency is between 75 kHz and 175 kHz, and the second frequency is between 100 kHz and 300 kHz.
27. The method of claim 23, wherein the step of introducing the substance begins at a given time, and wherein the step of applying the first alternating electric field ends at least 12 hours after the given time.
28. The method of claim 27, wherein the step of applying the first alternating electric field begins at least one hour before the given time.

29. The method of claim 23, wherein the second period of time comprises a plurality of non-contiguous intervals of time during which the second alternating electric field at the second frequency is applied to the cancer cells, wherein the plurality of non-contiguous intervals of time collectively add up to at least one week.
30. The method of claim 23, wherein the cancer cells are disposed in a body of a living subject, wherein the first alternating electric field is applied to the cancer cells by applying a first alternating electric field to the subject's body, the second alternating electric field is applied to the cancer cells by applying a second alternating electric field to the subject's body, and wherein the introducing comprises administering the substance to the subject.
31. The method of any of claims 23-30, wherein the first alternating electric field has a field strength of at least 1 V/cm RMS.
32. The method of any of claims 23-30, wherein the substance has a molecular weight of at least 1.2 kDa.
33. The method of any of claims 23-30, wherein the substance has a molecular weight of at least 4 kDa.
34. The method of any of claims 23-30, wherein the substance has a molecular weight of at least 20 kDa.
35. A method for treating a tumor in a subject's body and delivering a substance across cell membranes in the subject's body, the method comprising:
applying a first alternating electric field at a first frequency to the subject's body for a first period of time, wherein application of the first alternating electric field at the first frequency to the subject's body for the first period of time increases permeability of the cell membranes in the subject's body;
administering the substance to the subject, wherein the increased permeability of the cell membranes enables the substance to cross the cell membranes; and
applying a second alternating electric field at a second frequency to the subject's body for a second period of time that is at least one week long, wherein the second frequency is different from the first frequency, and wherein the second alternating electric field at the

second frequency inhibits growth of the tumor.

36. The method of claim 35, wherein the tumor comprises a glioblastoma in the subject's brain, the first frequency is between 250 kHz and 350 kHz, and the second frequency is between 150 kHz and 250 kHz.

37. The method of claim 35, wherein the second period of time comprises a plurality of non-contiguous intervals of time during which the second alternating electric field at the second frequency is applied to the subject's body, wherein the plurality of non-contiguous intervals of time collectively add up to at least one week.

38. The method of claim 35, wherein the step of administering the substance begins at a given time, and wherein the step of applying the first alternating electric field ends at least 12 hours after the given time.

39. The method of claim 38, wherein the step of applying the first alternating electric field begins at least one hour before the given time.

40. The method of any of claims 35-39, wherein the substance has a molecular weight of at least 1.2 kDa.

41. The method of any of claims 35-39, wherein the substance has a molecular weight of at least 4 kDa.

42. The method of any of claims 35-39, wherein the substance has a molecular weight of at least 20 kDa.

43. An apparatus for treating a tumor in a subject's body and facilitating delivery of a substance across cell membranes in the subject's body, the apparatus comprising:
an AC voltage generator capable of operating at a first frequency between 50 and 500 kHz and a second frequency between 50 and 500 kHz, wherein the second frequency is different from the first frequency, the AC voltage generator having a control input, wherein the AC voltage generator is configured to output the first frequency when the control input is in a first state and to output the second frequency when the control input is in a second state;

and

a controller programmed to (a) place the control input in the second state so that the AC voltage generator outputs the second frequency, (b) accept a request to switch to the first frequency, (c) upon receipt of the request, place the control input in the first state so that the AC voltage generator outputs the first frequency for an interval of time, and (d) after the interval of time has elapsed, place the control input in the second state so that the AC voltage generator outputs the second frequency.

44. The apparatus of claim 43, further comprising:
a set of electrodes configured for affixation to the subject's body; and
wiring that connects an output of the AC voltage generator to the set of electrodes.
45. The apparatus of claim 43, wherein the first frequency is between 250 kHz and 350 kHz, and the second frequency is between 150 kHz and 250 kHz.
46. The apparatus of claim 43, wherein the first frequency is between 125 kHz and 175 kHz, and the second frequency is between 75 kHz and 125 kHz.
47. The apparatus of claim 43, wherein the first frequency is between 75 kHz and 175 kHz, and the second frequency is between 100 kHz and 300 kHz.
48. The apparatus of claim 43, wherein the interval of time is at least 12 hours.
49. The apparatus of claim 43, wherein the interval of time is between 12 and 72 hours.
50. The apparatus of claim 43, wherein the controller is further programmed to, subsequent to the receipt of the request, switch the control input back and forth between the first state and the second state.
51. The apparatus of claim 43, wherein the AC voltage generator is capable of operating at at least one additional frequency between 50 and 500 kHz, and wherein the AC voltage generator is configured to output the least one additional frequency when the control input is in at least one additional state, and
wherein the controller is programmed to cycle the control input through the second

state and the at least one additional state prior to receipt of the request, and to cycle the control input through the second state and the at least one additional state after the interval of time has elapsed.

52. The apparatus of claim 43, further comprising a user interface, wherein the request is accepted via the user interface.

53. The apparatus of claim 43, wherein the request is accepted via RF.