WHAT IS CLAIMED IS:

1. A molecular delivery device comprising:

a substrate having a surface, and

a plurality of nanowires attached to the surface;

wherein the substrate is electrically conductive, at least a portion of the nanowires are 20-10,000 nm in height and 10-500 nm in diameter, and at least a portion of the nanowires comprise a semiconductive or insulating material and ~~the nanowires~~ are coated with an electrically conductive layer, wherein the electrically conductive layer is in direct contact with the nanowires.

2. The device of claim 1, wherein each of the nanowires is attached to the surface along a substantially vertical direction to the surface.

3. The device of claim 1, wherein each of the nanowires is formed of a semiconductor, a compound semiconductor, a metal oxide, a metal, carbon, boron nitride, or a combination thereof.

4. The device of claim 3, wherein the semiconductor is silicon.

5. The device of claim 1, wherein each of the nanowires is 20-10,000 nm in height and 10-500 nm in diameter.

6. The device of claim 5, wherein the height is 100-5,000 nm and the diameter is 50-250 nm.

7. The device of claim 6, wherein the height is 800-1,200 nm and the diameter is 70-180 nm.

8. The device of claim 1, wherein the electrically conductive layer is formed of a metal, a metal oxide, a semiconductor, a compound semicoductor, a metal nitride, or combination thereof.

9. The device of claim 1, wherein the density of the nanowires is 0.05-10 μm^{-2}.

10. The device of claim 9, wherein the density is 0.1-5 μm^{-2}.

11. The device of claim 10, wherein the density is 0.2-2 μm^{-2}.

12. A method of delivering a molecule to a cell, the method comprising:

providing a substrate having a surface and a plurality of nanowires attached to the surface, wherein ~~both~~ the substrate ~~and nanowires are~~is electrically conductive, wherein at least a portion of the nanowires comprise a semiconductive or insulating material and are coated with an electrically conductive layer;

contacting the nanowires with the cell to allow penetration of one or more nanowires into the cell, wherein the cell is immersed in a bath solution containing the molecule; and

applying a current or voltage waveform between the substrate and an electrode in the bath solution, whereby the molecule enters into the cell through transiently formed pores on cell membrane.

~~13. The method of claim 12, wherein the nanowires are coated with an electrically conductive layer.~~

~~14.~~13. The method of claim 12, wherein the molecule is a DNA, a RNA, a protein, a polysaccharide, or a small molecule.

~~15.~~14. The method of claim 12, wherein the cell is a prokaryotic cell or a eukaryotic cell.

~~16.~~15. The method of claim ~~15~~14, wherein the eukaryotic cell is a primary cell, a transformed cell, or a cancerous cell.

~~17.~~16. The method of claim ~~16~~15, wherein the primary cell is a neuron, a neuroblast, a beta cell, a myocyte, an osteoblast, a fibroblast, a kerotinocyte, a monocyte, an immune cell, a stem cell, or an oocyte.

~~18.~~17. The method of claim 12, wherein the amplitude of the voltage waveform is 0.1-10 V.

~~19.~~18. The method of claim ~~18~~17, wherein the amplitude is 3-7 V.

~~20.~~19. The method of claim ~~19~~18, wherein the amplitude is 4-6 V.

~~21.~~20. A method of delivering a molecule to a cell, the method comprising:

providing a substrate having a surface and a plurality of ~~electrically conductive~~ nanowires, each of which has a first end and a second end, wherein the substrate and each of the nanowires are coated with an electrically insulating layer except for the first and second ends of each of the nanowires, the first end is attached to the surface, and the second end is coated with an electrically conductive layer, wherein at least a portion of the nanowires comprise a semiconductive or insulating material;

contacting the nanowires with the cell immersed in a bath solution containing the molecule to allow penetration of one or more nanowires into the cell; and

applying a current or voltage waveform between two electrodes, one connected to the first end of each of the nanowires and the other placed in the bath solution, whereby the molecule enters into the cell through transiently formed pores on cell membrane.

~~22.~~21. The method of claim ~~21~~20, wherein the molecule is a DNA, a RNA, a protein, a polysaccharide, or a small molecule.

~~23.~~22. The method of claim ~~21~~20, wherein the cell is a prokaryotic cell or a eukaryotic cell.

~~24.~~23. The method of claim ~~23~~22, wherein the eukaryotic cell is a primary cell, a transformed cell, or a cancerous cell.

~~25.~~24. The method of claim ~~23~~22, wherein the primary cell is a neuron, a neuroblast, a beta cell, a myocyte, an osteoblast, a fibroblast, a kerotinocyte, a monocyte, an immune cell, a stem cell, or an oocyte.

~~26.~~25. The method of claim ~~21~~20, wherein the amplitude of the voltage waveform is 0.1-10 V.

~~27.~~26. The method of claim ~~26~~25, wherein the amplitude is 3-7 V.

~~28~~27. The method of claim ~~27~~26, wherein the amplitude is 4-6 V.

28. The device of claim 1, wherein the semiconductive or insulating material comprises silicon, silicon oxide, silicon nitride, silicon carbide, iron oxide, and/or aluminum oxide.

29. The device of claim 1, wherein the electrically conductive layer comprises gold, silver, and/or platinum.

30. The device of claim 1, wherein at least a portion of the nanowires are individually addressable.

31. The method of claim 12, wherein the semiconductive or insulating material comprises silicon, silicon oxide, silicon nitride, silicon carbide, iron oxide, and/or aluminum oxide.

32. The method of claim 12, wherein the electrically conductive layer comprises gold, silver, and/or platinum.

33. The method of claim 20, wherein the semiconductive or insulating material comprises silicon, silicon oxide, silicon nitride, silicon carbide, iron oxide, and/or aluminum oxide.

34. The method of claim 20, wherein the electrically conductive layer comprises gold, silver, and/or platinum.

35. The method of claim 20, wherein the electrically insulating layer comprises silicon oxide, aluminum oxide, and/or silicon nitride.