CLAIMS

What is claimed is:

1. An apparatus for fabricating one or more nanopores in a membrane, where the membrane defines opposing planar surfaces and is comprised of at least one dielectric layer, comprising:

a first substrate having a common microchannel formed in an exposed surface of the first substrate;

a support structure disposed onto the exposed surface of the first substrate and configured to host a membrane;

an intermediate layer disposed onto the support structure and having at least one via formed therein;

a second substrate having one or more microfluidic channels formed in an inner surface of the second substrate, the second substrate being disposed on the intermediate layer with the inner surface facing the support structure such that the one or more microfluidic channels are fluidly separated by the membrane from the common microchannel;

a pair of electrodes arranged on opposing sides of the membrane, wherein the pair of electrodes generates an electric potential across the membrane and the at least one via in the intermediate layer fluidly couples the one or more microfluidic channels with an exposed surface of the membrane and is configured to create an electric field that is uniform in and around the via.

2. The apparatus of claim 1 wherein magnitude of the electric potential across the membrane results in the electric field having a value greater than 0.1 volt per nanometer.

3. The apparatus of claim 1 further comprises

a current sensor electrically coupled to one of the electrodes and operable to measure current flowing between one of the one or more microfluidic channels and the common microchannel; and

a controller interfaced with the current sensor, wherein the controller detects an abrupt increase in the measured current which indicates formation of a pore

and, in response to detecting the abrupt increase in the measured current, removes the electric potential applied across the membrane.

4. The apparatus of claim 1 wherein depth of the at least one via is greater than diameter of the at least one via.

5. The apparatus of claim 1 wherein the second substrate includes an array of microfluidic channels formed in the inner surface thereof and the intermediate layer includes a plurality of vias, such that each via in the plurality of vias aligns with one of the microfluidic channels in the array of microfluidic channels.

6. The apparatus of claim 1 wherein the one or more microfluidic channels have dimension on the order of microns.

7. An apparatus for fabricating one or more nanopores in a membrane, comprising:

a first substrate having a common microchannel formed in an exposed surface of the first substrate;

a membrane disposed onto the exposed surface of the first substrate, where the membrane defines opposing planar surfaces and is comprised of at least one dielectric layer;

an intermediate layer disposed onto the membrane and having at least one via formed therein;

a second substrate having one or more microfluidic channels formed in an inner surface of the second substrate, the second substrate being disposed on the intermediate layer with the inner surface facing the intermediate layer such that the one or more microfluidic channels are fluidly separated by the membrane from the common microchannel;

a pair of electrodes arranged on opposing sides of the membrane, wherein the pair of electrodes generates an electric potential across the membrane and the at least one via in the intermediate layer fluidly couples the one or more microfluidic

channels with an exposed surface of the membrane and is configured to create an electric field that is uniform in and around the via.

8. The apparatus of claim 7 wherein magnitude of the electric potential across the membrane results in the electric field having a value greater than 0.1 volt per nanometer.

9. The apparatus of claim 7 further comprises

a current sensor electrically coupled to one of the electrodes and operable to measure current flowing between one of the one or more microfluidic channels and the common microchannel; and

a controller interfaced with the current sensor, wherein the controller detects an abrupt increase in the measured current which indicates formation of a pore and, in response to detecting the abrupt increase in the measured current, removes the electric potential applied across the membrane.

10. The apparatus of claim 7 wherein depth of the at least one via is greater than diameter of the at least one via.

11. The apparatus of claim 7 wherein the second substrate includes an array of microfluidic channels formed in the inner surface thereof and the intermediate layer includes a plurality of vias, such that each via in the plurality of vias aligns with one of the microfluidic channels in the array of microfluidic channels.

12. The apparatus of claim 7 wherein the one or more microfluidic channels have dimension on the order of microns.