WHAT IS CLAIMED:

1. A biosensor comprising:

a photonic sensing device comprising a substrate and, formed on or in the substrate, a three-dimensional structure suitable for producing an optical signal upon exposure to light;

a sheet of porous material covering the three-dimensional structure suitable for producing an optical signal, the sheet of porous material comprising one or more capture molecules; and

an optically clear cover layer connected to the photonic sensing device with the sheet of porous material between the cover layer and a portion of the photonic sensing device that contains the three-dimensional structure,

wherein:

the photonic sensing device comprises a 2D photonic crystal array, a ring resonator, a Mach–Zehnder interferometer, a toroidal microcavity, a Bragg reflector, a diffraction grating, a plasmonic waveguide, Archimedean whispering-gallery spiral waveguides, or a nanoplasmonic pore; and

the optically clear cover layer is removable and replaceable, whereby the sheet of porous material can be replaced, and the biosensor re-used,

and wherein the biosensor further comprises:

(i) a clamping mechanism that compresses the sheet of porous material between the cover layer and the portion of the photonic sensing device; or

(ii) an adhesive layer connecting portions of the optically clear cover layer directly to the substrate of the photonic sensing device.

~~2. The biosensor according to claim 1 further comprising:~~

~~(i) a clamping mechanism that compresses the sheet of porous material between the cover layer and the portion of the photonic sensing device; or~~

~~(ii) an adhesive layer connecting portions of the optically clear cover layer directly to the substrate of the photonic sensing device.~~

~~3. The biosensor according to claim 1, wherein the photonic sensing device comprises a 2D photonic crystal array, a ring resonator, a Mach–Zehnder interferometer, a toroidal microcavity, a Bragg reflector, a diffraction grating, a plasmonic waveguide, Archimedean whispering-gallery spiral waveguides, or a nanoplasmonic pore~~.

42. The biosensor according to claim 1, wherein the sheet of porous material comprises polyethylene, polyethylene terephthalate, nylon, glass, polysaccharides, or ceramics.

35. The biosensor according to claim 1, wherein the sheet of porous material is in the form of a paper.

46. The biosensor according to claim 35, wherein the paper has a thickness dimension of less than about 180 microns.

~~7. The biosensor according to claim 1, wherein the optically clear cover layer is removable and replaceable, whereby the sheet of porous material can be replaced, and the biosensor re-used.~~

85. The biosensor according to claim 1, wherein the one or more capture molecules is selected from the group of proteins or polypeptides, peptides, nucleic acid molecules, antigens, and small molecules.

69. The biosensor according to claim 1, wherein the one or more capture molecules are covalently attached to the sheet of porous material.

710. The biosensor according to claim 96, wherein the one or more capture molecules comprise a plurality of capture molecules covalently attached to the sheet of porous material at discrete locations.

118. The biosensor according to claim 1, wherein the substrate comprises an inlet for coupling light into, onto, or across the three dimensional structure and an outlet for coupling light that passes from, through, or past the three dimensional structure.

129. A detection device comprising:

a biosensor according to one of claims 1 to 118;

a light source that illuminates the photonic sensing device; and

a photodetection device positioned to measure light emitted by the photonic sensing device.

~~13~~10. The detection device according to claim ~~12~~ 9 further comprising one or both of a waveguide that couples light from the light source into the photonic sensing device and a waveguide that couples light from the photonic sensing device into the photodetection device.

~~14~~11. The detection device according to claim ~~12~~9, wherein the light source is a laser or broadband light source optionally with a filter.

~~15~~12. The detection device according to claim ~~12~~9, wherein the photodetection device is a spectrophotometer, photodiode array, photomultiplier tube array, charge-coupled device (CCD) sensor, complementary metal-oxide semiconductor (CMOS) sensor, or active pixel sensor array.

~~16~~13. A method of detecting a biological molecule comprising:

providing a biosensor according to one of claims 1 to ~~11~~8;

introducing a liquid sample into contact with the sheet of porous material; and

measuring a change in the light emitted by the photonic sensing device, whereby the change in the light emitted by the photonic sensing device indicates the binding of the biological molecule by the one or more capture molecules.

~~17~~14. The method according to claim ~~16~~13, wherein the extent of the change in light emitted by the photonic sensing device quantifies the amount of the biological molecule in the liquid sample.

~~18~~15. The method according to claim ~~16~~13, wherein the biosensor is reusable upon washing the biosensor and replacing the sheet of porous material onto which the liquid sample is introduced with a second sheet of porous material not previously contacted by a liquid sample.

~~19~~16. A method of making a biosensor comprising:

providing a photonic sensing device comprising a substrate and, formed on or in the substrate, a three-dimensional structure suitable for producing an optical signal upon exposure to light;

installing a sheet of porous material onto the substrate, whereby the sheet covers a portion of the photonic sensing device that contains the three-dimensional structure for producing an optical signal, the sheet of porous material comprising one or more capture molecules;

installing an optically clear cover layer over the sheet of porous material, whereby the sheet of porous material is present between the cover layer and the portion of the photonic sensing device,

wherein:

the photonic sensing device comprises a 2D photonic crystal array, a ring resonator, a Mach–Zehnder interferometer, a toroidal microcavity, a Bragg reflector, a diffraction grating, a plasmonic waveguide, Archimedean whispering-gallery spiral waveguides, or a nanoplasmonic pore; and

the optically clear cover layer is removable and replaceable, whereby the sheet of porous material can be replaced, and the biosensor re-used,

and further installing:

(i) a clamping mechanism that compresses the sheet of porous material between the cover layer and the portion of the photonic sensing device; or

(ii) an adhesive layer connecting portions of the optically clear cover layer directly to the substrate of the photonic sensing device.

~~20~~17. The method according to claim ~~19~~16, wherein the optically clear cover layer is removable and replaceable such that the biosensor can be re-assembled and re-used by:

removing the optically clear cover layer and the sheet of porous material after use of the biosensor,

washing the photonic sensing device; and

using a new sheet of porous material, repeating each of said installing steps.