CLAIMS

1. A skin microbe sampler comprising:

a plurality of solid microneedles extending from a support surface, wherein the microneedles are dimensioned to penetrate an epidermis layer of the skin and to access a dermis layer to obtain microbes residing in the skin and wherein the microneedles are configured to obtain microbes residing beyond 50% of the depth of stratum corneum of the epidermis.

2. The microbe sampler of claim 1, wherein the microneedles are configured to obtain microbes residing at a depth that is more than 20 microns and no more than 300 microns from a skin surface.

3. The microbe sampler of claim 1 or 2, wherein the microneedles comprise a shape that tapers from a base to a tip.

4. The microbe sampler of any one of claims 1 to 3, wherein the microneedles comprise a cone shape that is substantially devoid of patterning on the surface of said cone shape.

5. The microbe sampler of any one of claims 1 to 4, wherein the microneedles have a needle height in the range of from 1 mm to 2.2 mm.

6. The microbe sampler of any one of claims 1 to 5, wherein the microneedles have an aspect ratio in the range of 0.5 to 4.

7. The microbe sampler of any one of claims 3 to 6, wherein the base comprises a width of from 0.5 mm to 1.5 mm.

8. The microbe sampler of any one of claims 1 to 7, wherein the microneedles are spaced at a distance of from 0.5 mm to 2.0 mm from each other on the support surface.

9. The microbe sampler of any one of claims 1 to 8, wherein the microneedles are disposed on the support at an average needle density of 0.1 needles/mm^2 to 0.6 needles/mm^2.

10. The microbe sampler of any one of claims 1 to 9, wherein the microneedles are arranged in one or more 8x4 array(s).

11. The microbe sampler of any one of claims 1 to 10, wherein the microneedles and the support surface form a unibody.

12. The microbe sampler of any one of claims 1 to 11, wherein the microbe sampler is collapsible to reduce its original surface area for fitting into a chamber having an opening that is smaller than its original surface area.

13. The microbe sampler of any one of claims 1 to 12, wherein the microneedles are derived from 3D printing.

14. A method of sampling microbes residing in a skin, the method comprising:

providing a skin microbe sampler comprising a plurality of solid microneedles extending from a support surface, wherein the microneedles are dimensioned to penetrate an epidermis layer of the skin to obtain microbes residing in the skin;

contacting the microbe sampler with the skin to allow the microneedles to penetrate the epidermis layer of the skin;

allowing microbes residing in the skin to adhere to the microneedles that have penetrated the epidermis layer of the skin; and

removing contact of the apparatus from the skin.

15. The method of claim 14, further comprising identifying the presence of microbes on the solid microneedles after removing contact of the microbe sampler from the skin.

16. A method of making the skin microbe sampler of any one of claims 1 to 13, the method comprising:

forming a plurality of solid microneedles that extends from a support surface, wherein the microneedles are dimensioned to penetrate an epidermis layer of the skin and to access a dermis layer to obtain microbes residing in the skin and wherein the microneedles are configured to obtain microbes residing beyond 50% of the depth of stratum corneum of the epidermis,

wherein the forming step comprises 3D printing the solid microneedles and/or molding the solid microneedles from a negative mold of the solid microneedles.

17. A mold for making the microbe sampler of any one of claims 1 to 13, the mold comprising:

a negative imprint of the solid microneedles.