

CLAIMS

1. A skin microbe sampler comprising:
a plurality of solid microneedles extending from a support surface, wherein the
5 microneedles are dimensioned to penetrate the epidermis layer of the skin to obtain
microbes residing in the skin.
2. The microbe sampler of claim 1, wherein the microneedles are
configured to obtain microbes residing at a depth that is more than about 20 microns
10 and no more than about 300 microns from the skin surface.
3. The microbe sampler of claim 1 or 2, wherein the microneedles are
configured to obtain microbes residing beyond 50% of the depth of the stratum
corneum of the epidermis.
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4. The microbe sampler of any one of claims 1 to 3, wherein the
microneedles comprise a shape that tapers from a base to a tip.
5. The microbe sampler of any one of claims 1 to 4, wherein the
20 microneedles comprise a cone shape that is substantially devoid of patterning on the
surface of said cone shape.
6. The microbe sampler of any one of claims 1 to 5, wherein the
microneedles have a needle height in the range of from about 1 mm to about 2.2 mm.
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7. The microbe sampler of any one of claims 1 to 6, wherein the
microneedles have an aspect ratio in the range of about 0.5 to about 4.
8. The microbe sampler of any one of claims 4 to 7, wherein the base
30 comprises a width of from 0.5 mm to 1.5 mm.
9. The microbe sampler of any one of claims 1 to 8, wherein the
microneedles are spaced at a distance of from about 0.5 mm to about 2.0 mm from
each other on the support surface.

10. The microbe sampler of any one of claims 1 to 9, wherein the microneedles are disposed on the support at an average needle density of about 0.1 needles/mm² to about 0.6 needles/mm².

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

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

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13. The microbe sampler of any one of claims 1 to 12, 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.

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14. The microbe sampler of any one of claims 1 to 13, wherein the surfaces of the microneedles comprise an adhesion coating on their surfaces for enhancing adhesion of the microbes on the microneedles.

15. The microbe sampler of any one of claims 1 to 14, wherein the microneedles are derived from 3D printing.

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

contacting the microbe sampler of any one of claims 1 to 15 with the skin to allow the microneedles to penetrate the epidermis layer of the skin;

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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.

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17. The method of claim 16, further comprising identifying the presence of microbes on the solid microneedles after removing contact of the microbe sampler from the skin.

18. A method of making the microbe sampler of any one of claims 1 to 15, the method comprising:

forming a plurality of solid microneedles that extends from a support surface, wherein the microneedles are dimensioned to penetrate the epidermis layer of the skin to obtain microbes residing in the skin,

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

19. The method of claim 18, further comprising coating the microneedles with an adhesion coating on their surfaces for enhancing adhesion of the microbes on the microneedles.

20. A mold for making the microbe sampler of any one of claims 1 to 15, the mold comprising:
a negative imprint of the solid microneedles.