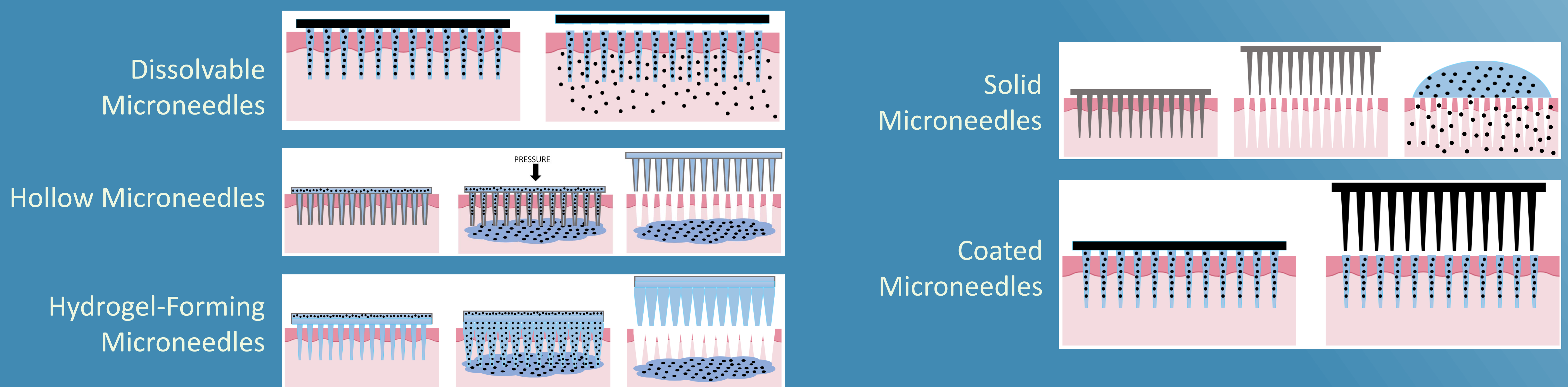
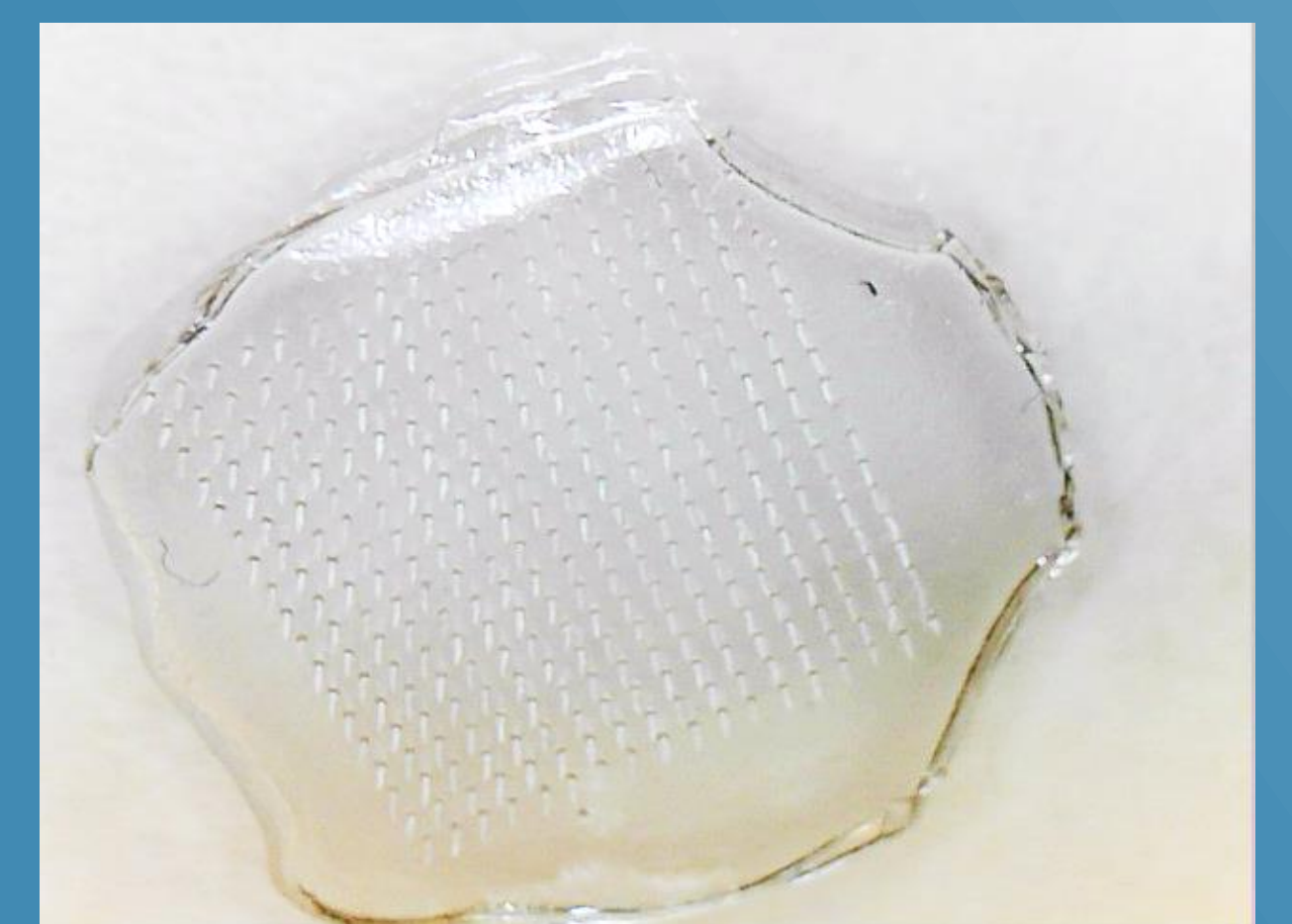


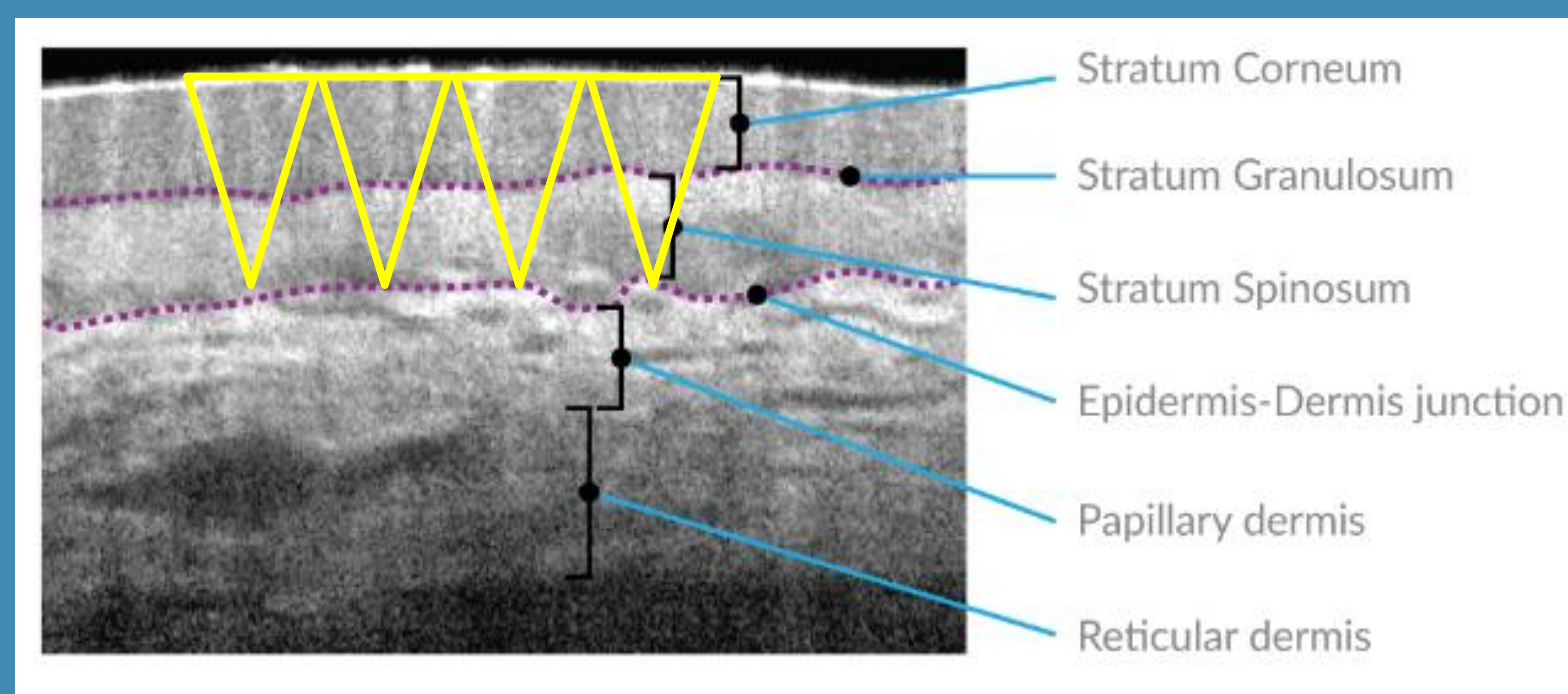
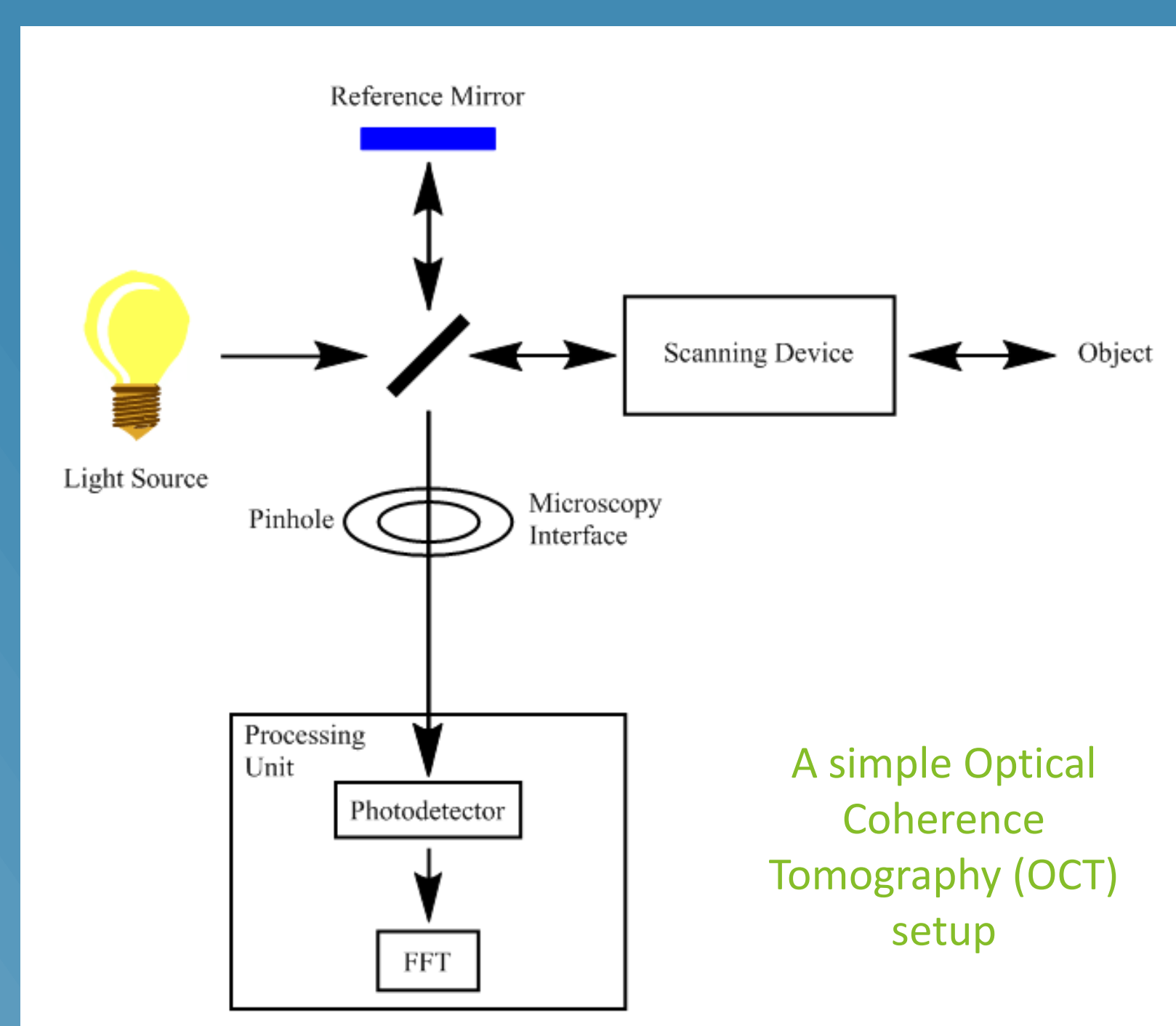
Microneedles are a form of transdermal drug delivery system and consist of microscopic hypodermic needles. They are widely used in cosmetics already and are a growing area of interest for use as drug delivery systems, for example for delivery of insulin, vaccination, cancer treatment and many more.



Microneedles can have a length of 50-1000 μm , which allows them to penetrate the skin up to the epidermis. There are many different types of microneedles which can vary in shape and geometry, depending on where they are going to be applied and what they will be applied for. It is important to image microneedles to observe where they deliver their cargo and what happens to this cargo after, and whether the needles can withstand penetration.



There are various imaging techniques to observe microneedles, such as confocal microscopy and light microscopy. However these techniques do not allow high enough resolution for imaging whilst in tissue. This is where optical coherence tomography (OCT) is used.



VivoSight, VivoSight Scanners
vivosight.com/researcher/vivosight-scanner/
(accessed 25 January 2019)

The yellow represents how deep the microneedles penetrate and how they sometimes appear translucent in OCT imaging as the matrix composition has a different refractive index to the skin

OCT is a form of non-invasive low-coherence interferometry that produces real-time cross-sectional images, which are high resolution, often with axial resolutions of 1-15 μm and penetration depths of 2-3 mm. The object is scanned using an optical beam which measures the time delay and the intensity of backscattered light. The backscattered light is correlated with a known reference path to give the optical path difference.

Microneedles are made from various matrixes depending on their application and this can cause issues with imaging. To see the microneedles in tissue, their refractive index needs to be different to the refractive index of tissue, which is around 1.4, to see the contrast. Using OCT for imaging microneedles in skin is still a developing area of research.