Light Penetration into the Skin and Absorption – How are they Related?
Light Penetration in Skin and Absorption – How are they related?

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>Penetration depth</th>
</tr>
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Epidermis 0.1 mm
Dermis up to 5 mm deep

Not to scale
Light Penetration in Skin

Wavelength

- 400-500 nm
- 500-550 nm
- 550-600 nm
- 600-1100 nm

Penetration depth

- 0.1 – 0.2 mm
- ~0.6 mm
- ~2 mm
- ~6 mm

Epidermis up to 0.1 mm deep

Dermis

Not to scale
Absorption

Fluence at skin surface = $F_0$

Fluence at depth $z = F_z$

$F_z$ may be only around 50%, or less, of $F_0$

Absorption coefficient is the same for both of these vessels

But... the smaller, shallower vessel may absorb MORE energy than the bigger, deeper vessel

So, the smaller vessel disappears, while the larger vessel survives

Smaller vessels tend to be nearer the skin surface, while larger vessels tend to be deeper...
Different wavelength

A longer wavelength, like red, will penetrate deeper into the skin compared to green.

But, the absorption coefficient at red is much less than that at green!

So there is less heat generated by the absorbed red light energy.

Not to scale
Wavelength and Absorption

The temperature rise in the targets depend on both the amount of light energy which reaches the depth of the target AND the amount actually absorbed by the target:

i.e. wavelength and absorption coefficient
Thanks for listening

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