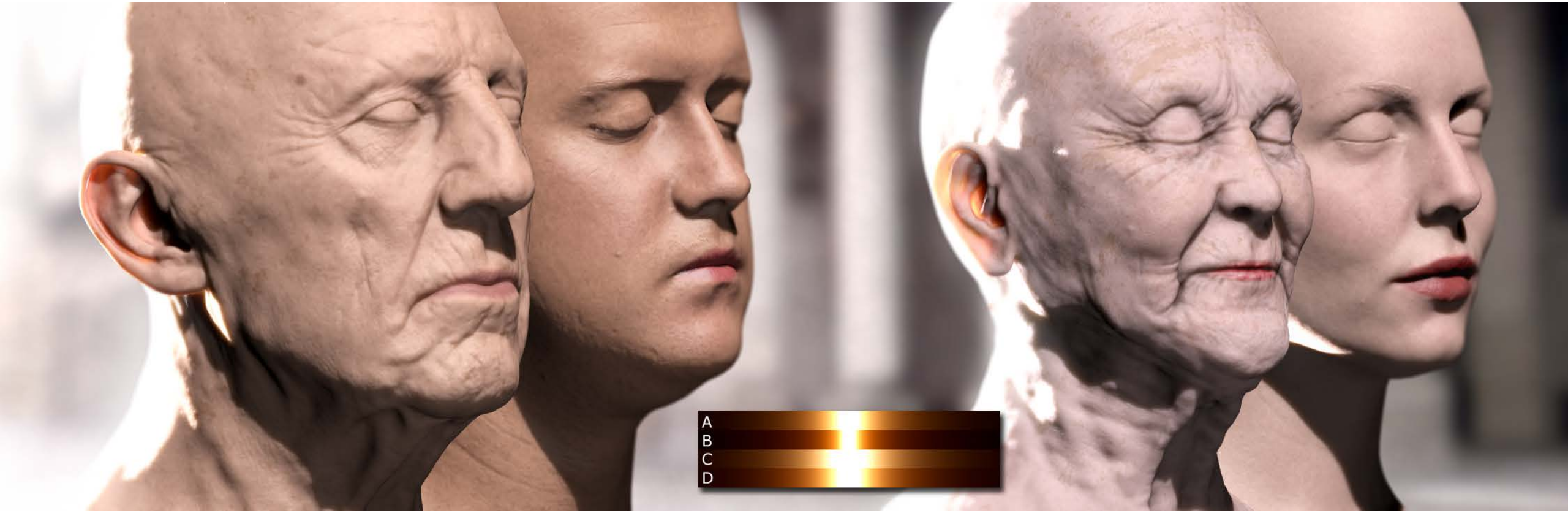
A Biophysically-Based Model of the Optical Properties of Skin aging

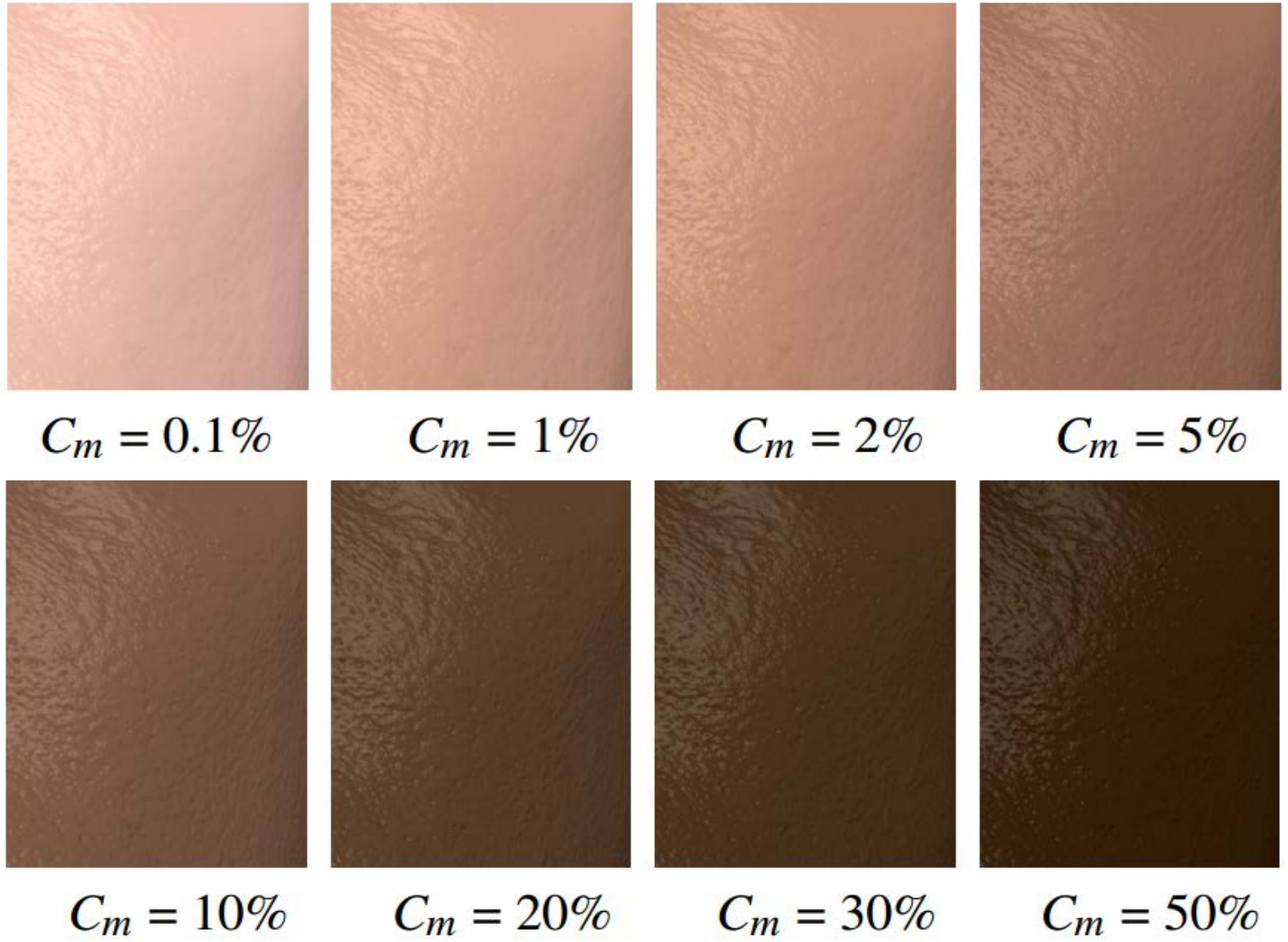
José A. Iglesias-Guitián Carlos Aliaga Adrián Jarabo Diego Gutiérrez



Graphics and Imaging Lab

Universidad Zaragoza
1542

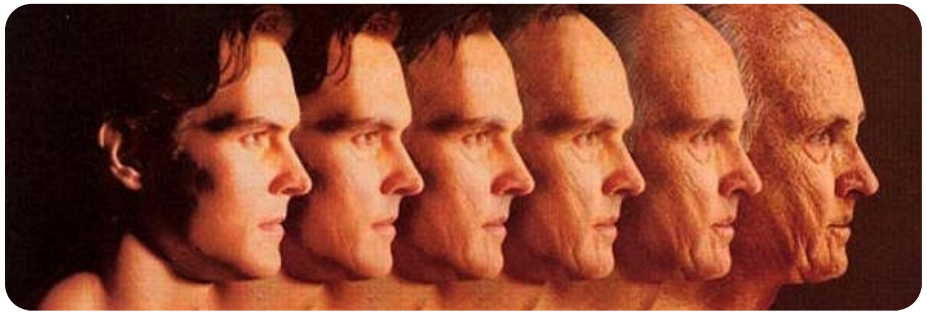
Jiménez et al. 2015



Donner and Jensen 2006

Donner et al. 2008


Jiménez et al. 2010



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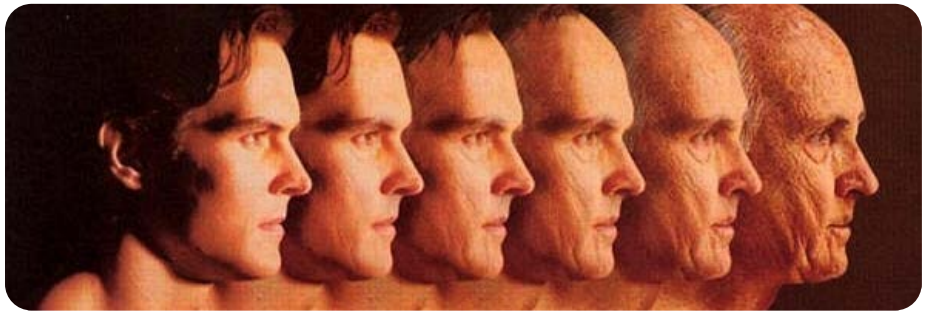
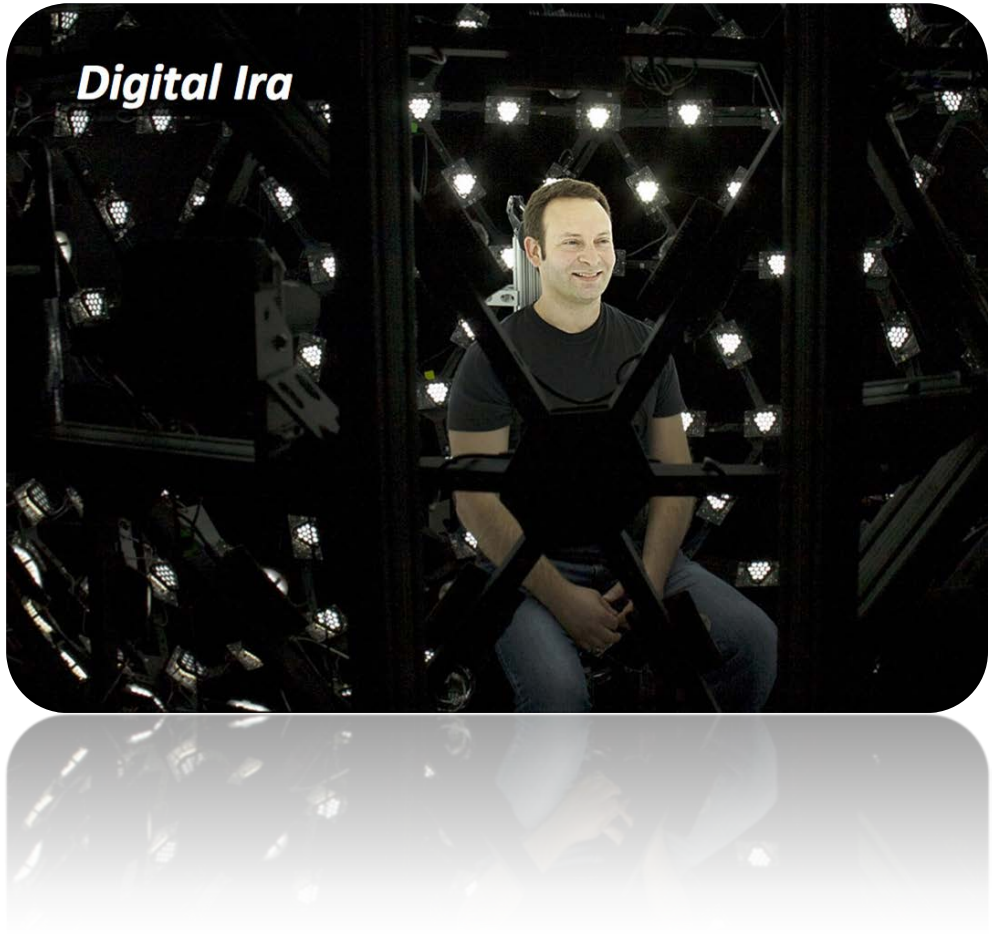
RENDER





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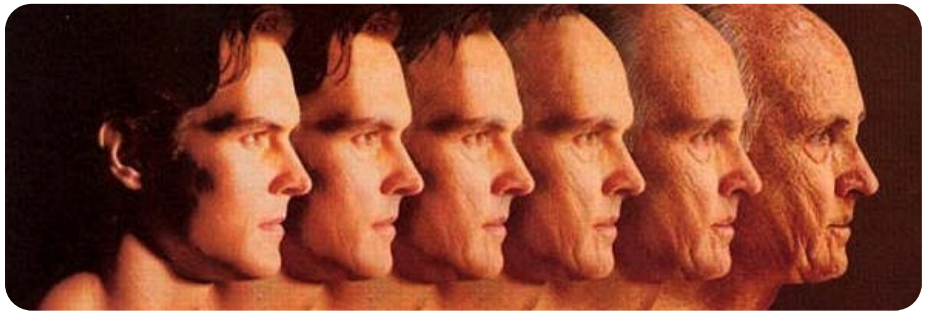
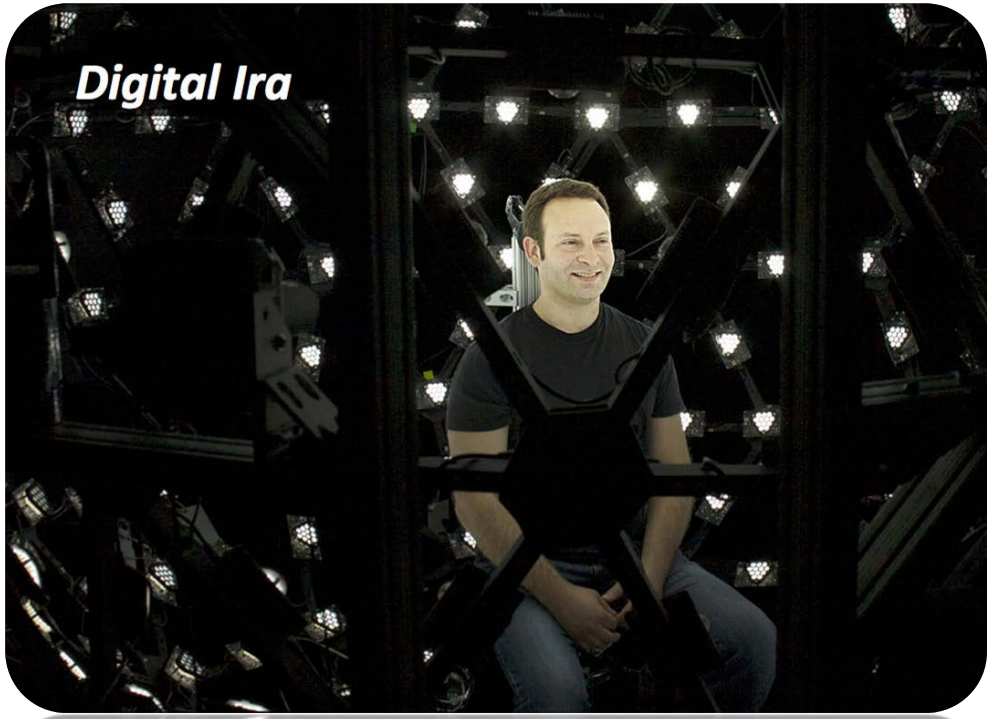
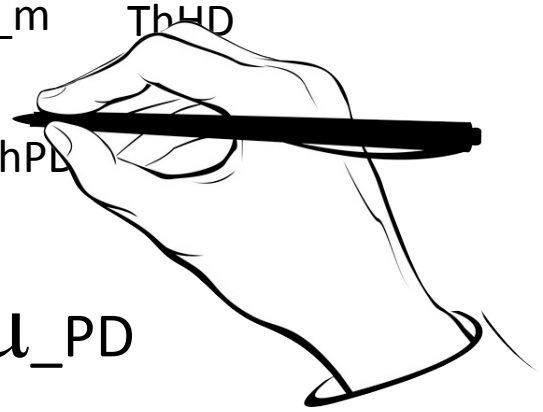




σ_RD ThLE
Rz
ThSC
Bck_m ThHD
D_abs
ThRD ThPL
σ_LE μ_PD



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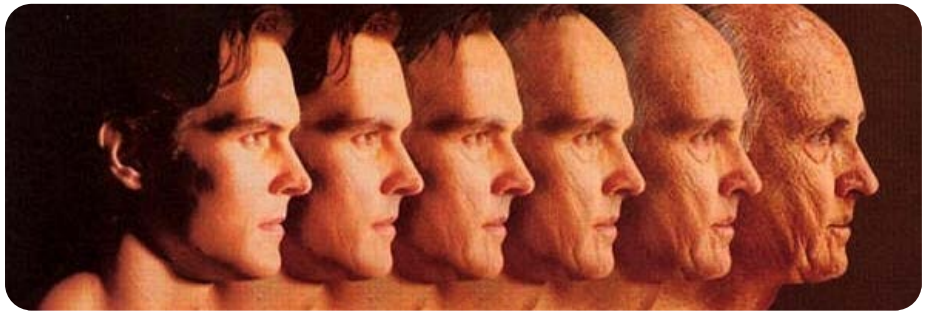
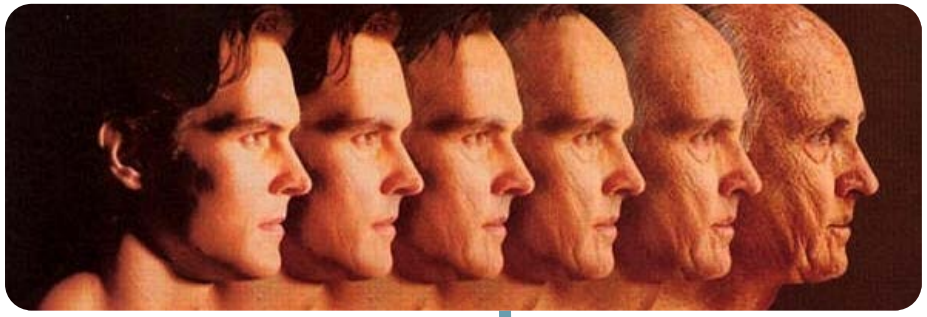


Donner et al., Jiménez et al., Krishnaswamy & Baranoski

RENDER



Input

Age,
gender,
skin type,
body location
…

Biophysically-Based Model

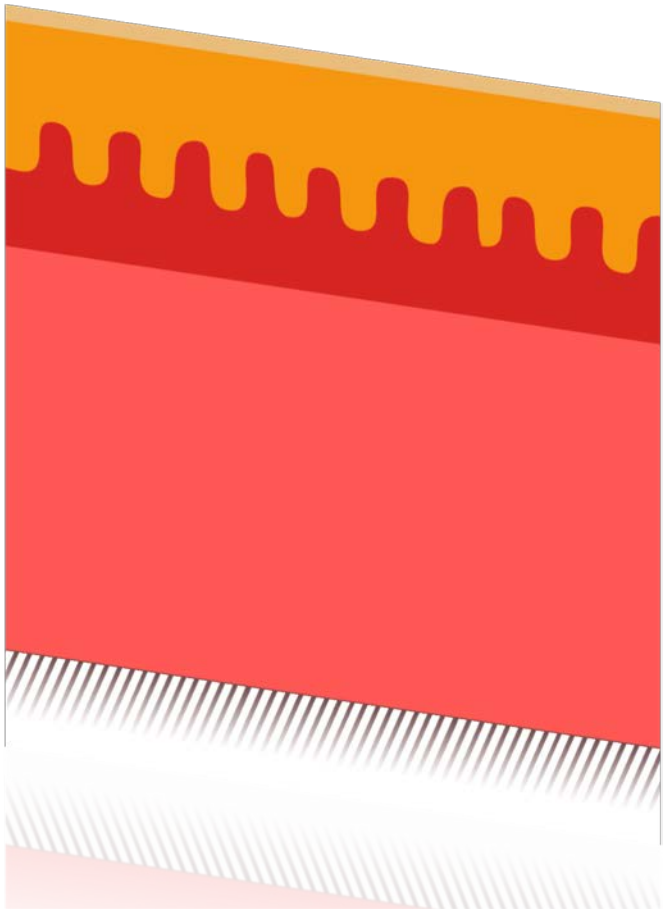
Literature - medicine, tissue optics

Optical Parameters

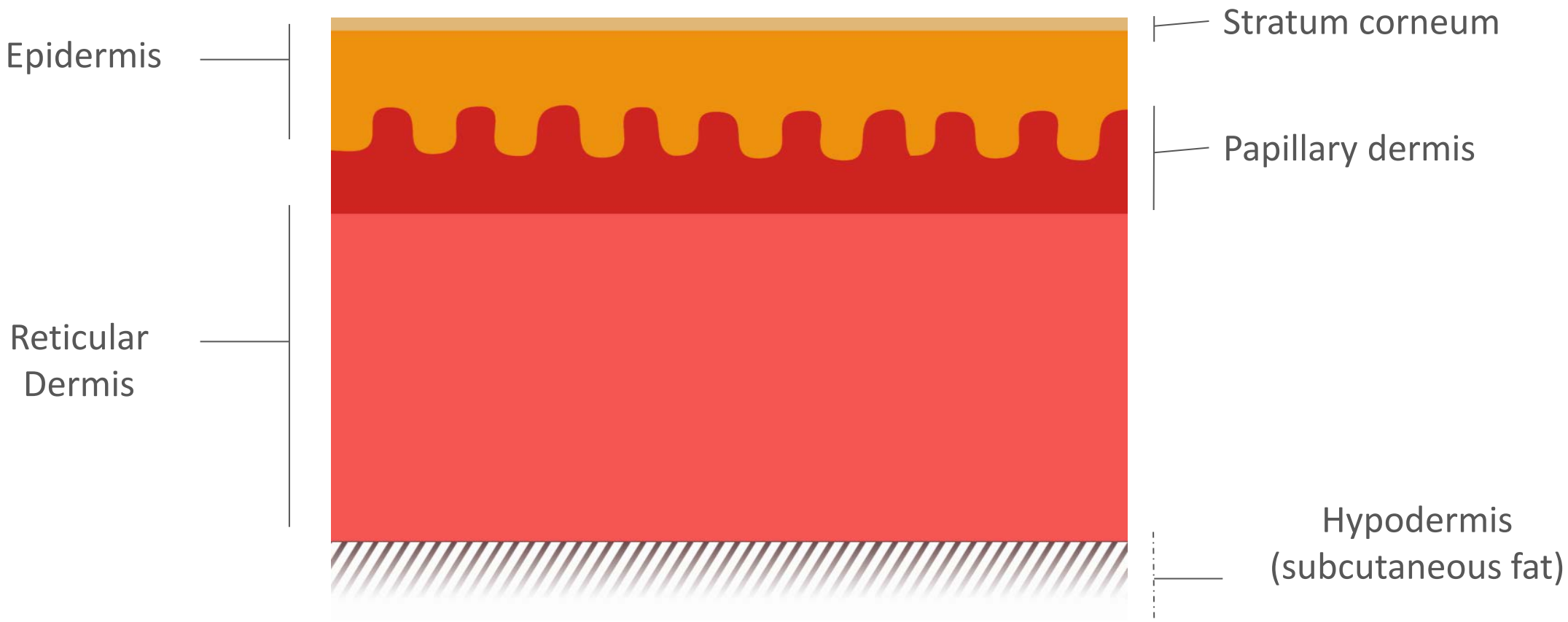
Chromophore concentrations, sublayer thicknesses, surface roughness, …

Skin Optics

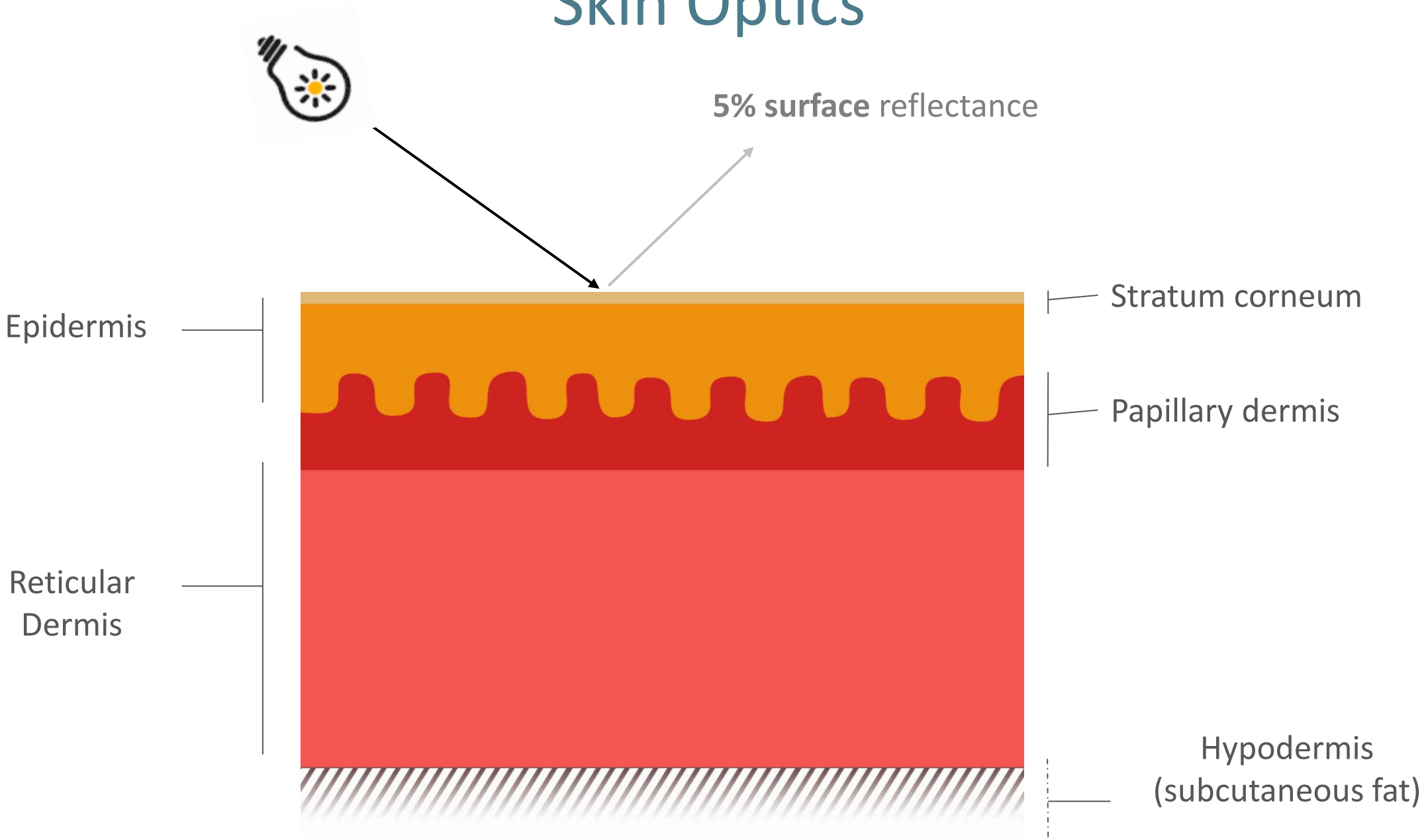
Skin Optics



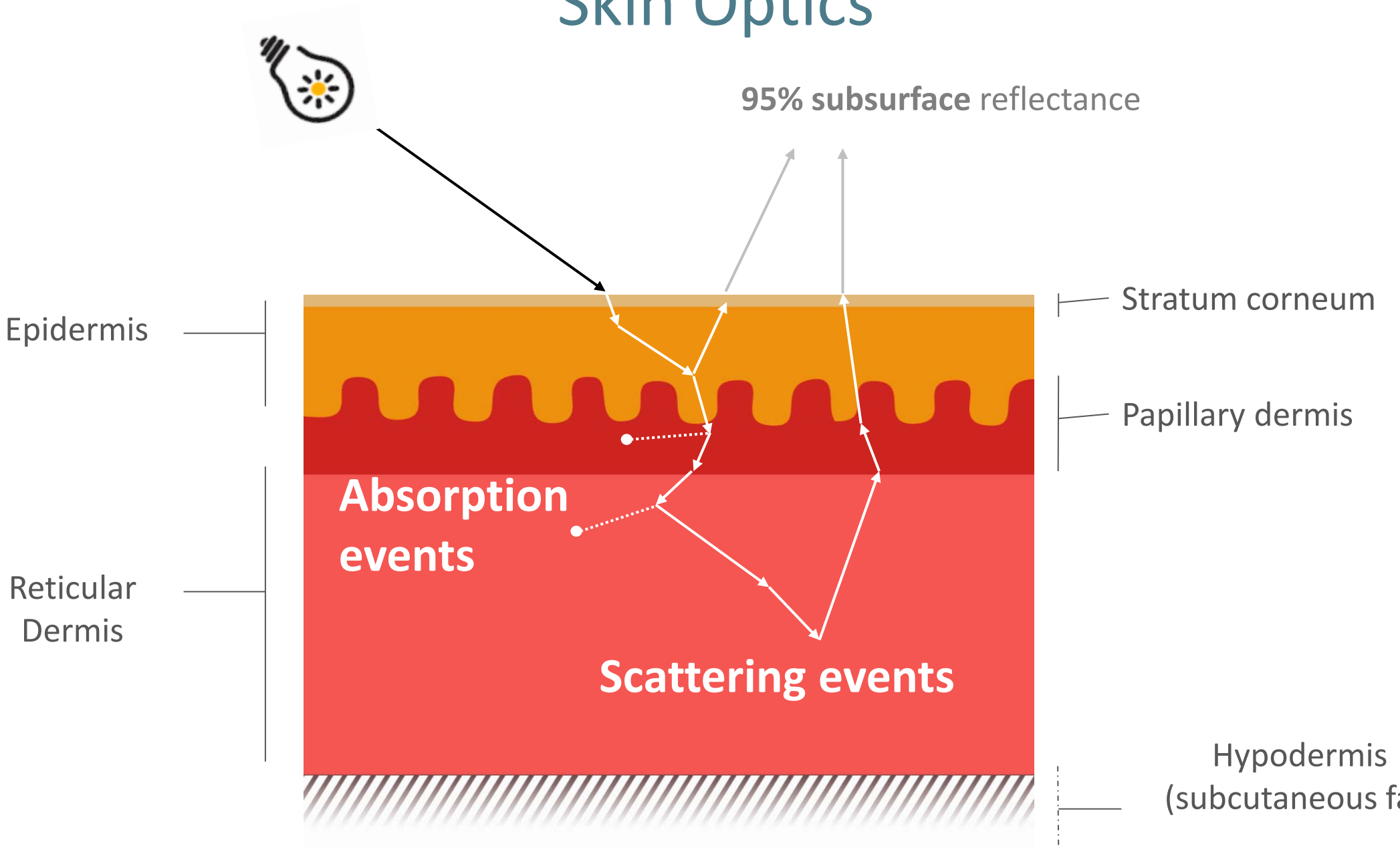
Skin Optics


Epidermis
Reticular Dermis
Stratum corneum
Papillary dermis
Hypodermis (subcutaneous fat)

Skin Optics

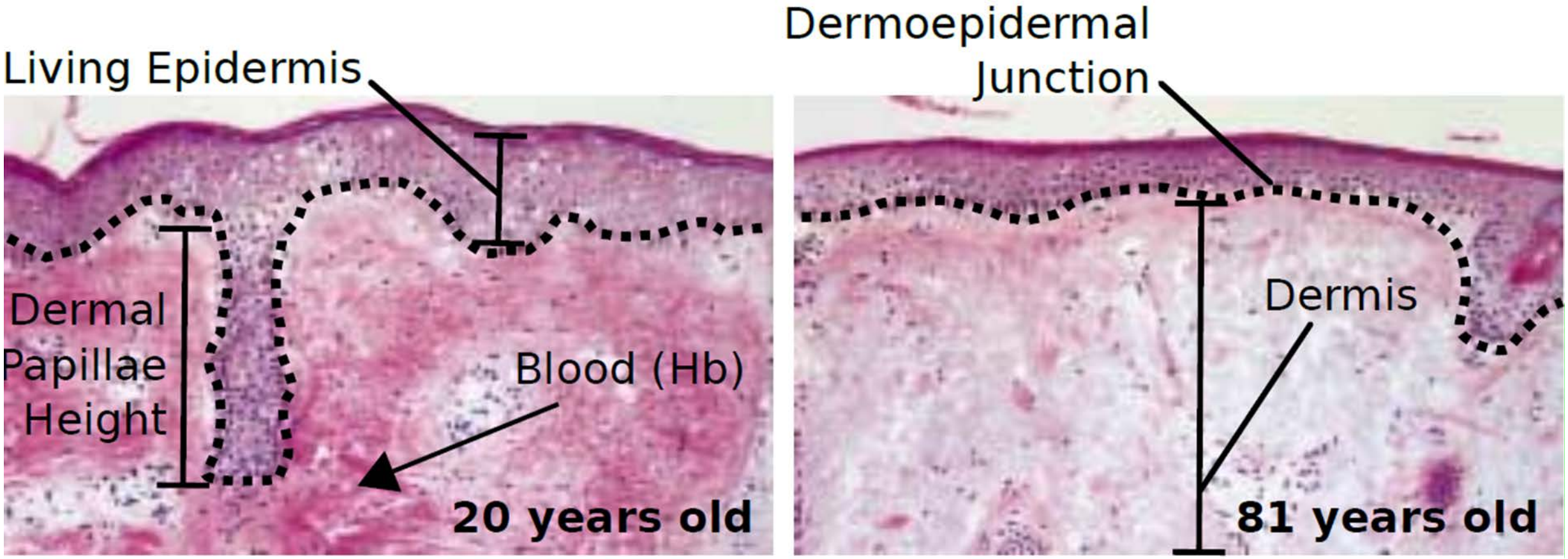

5% surface reflectance
Epidermis
Stratum corneum
Papillary dermis
Reticular Dermis
Hypodermis (subcutaneous fat)

Skin Optics

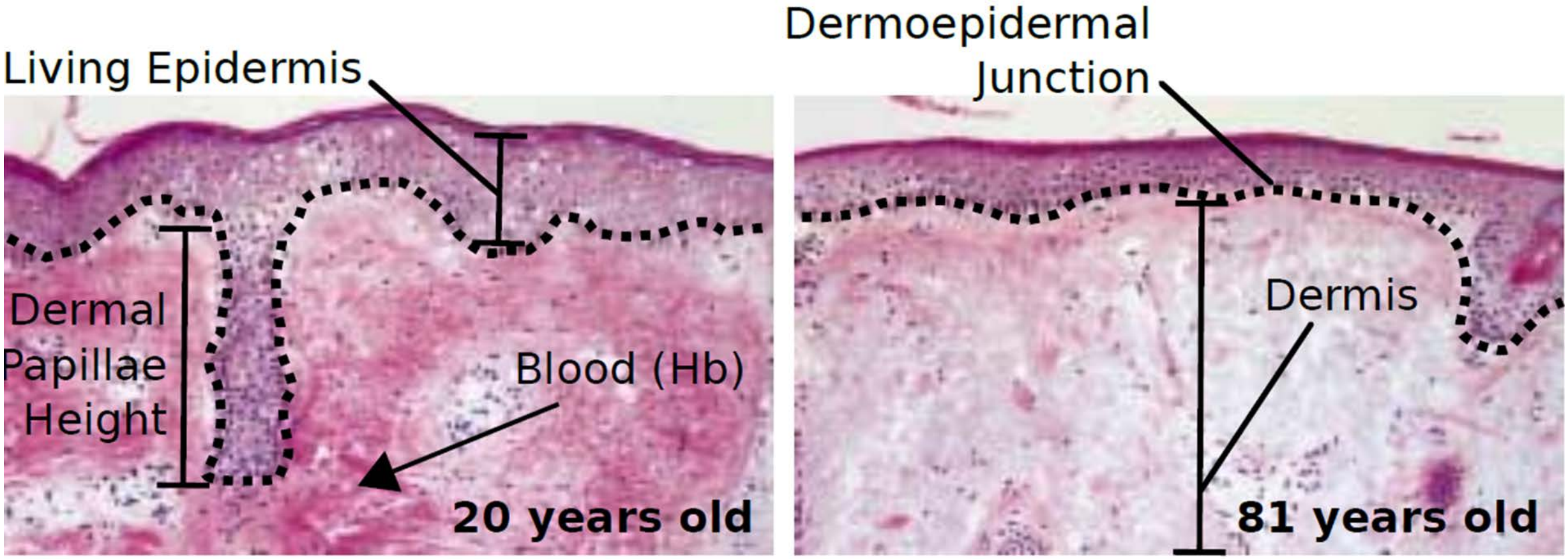

95% subsurface reflectance
Epidermis
Stratum corneum
Papillary dermis
Absorption events
Reticular Dermis
Scattering events
Hypodermis (subcutaneous fat)

Skin Aging. Changes in the Optical Properties.

Skin Aging


Living Epidermis
Dermal Papillae Height
Blood (Hb)
20 years old
Dermoepidermal Junction
Dermis
81 years old

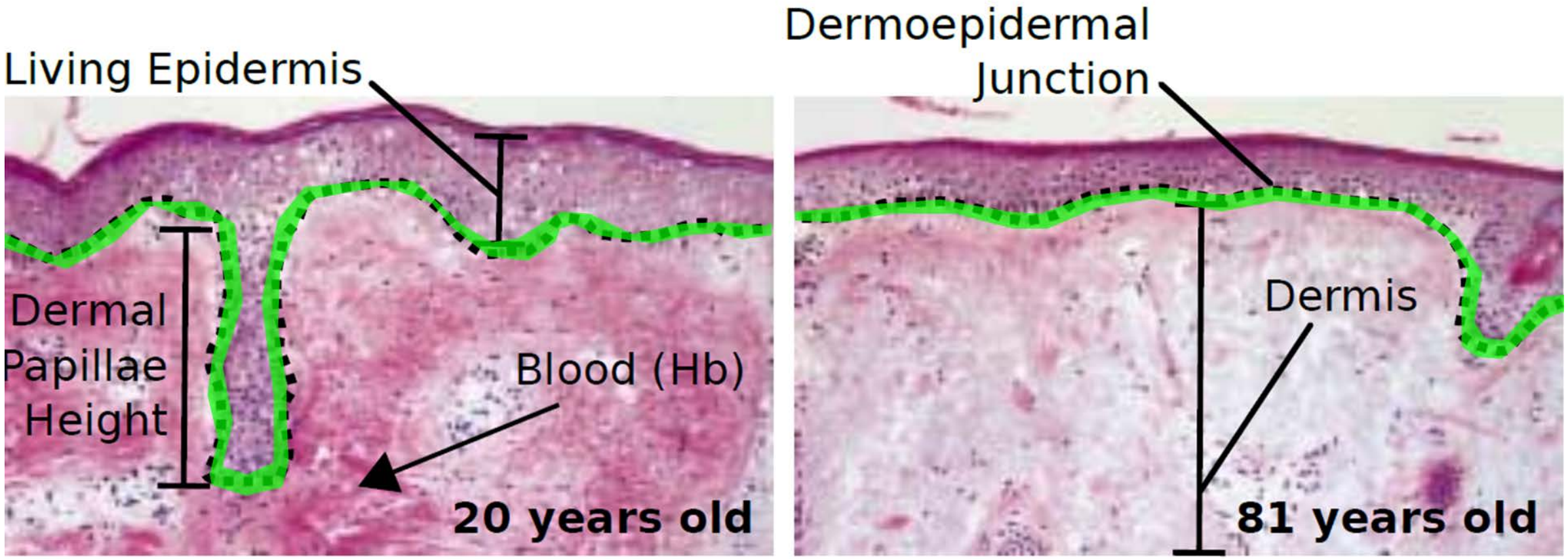
Skin Aging


Living Epidermis
Dermal Papillae Height
Blood (Hb)
20 years old
Dermoepidermal Junction
Dermis
81 years old

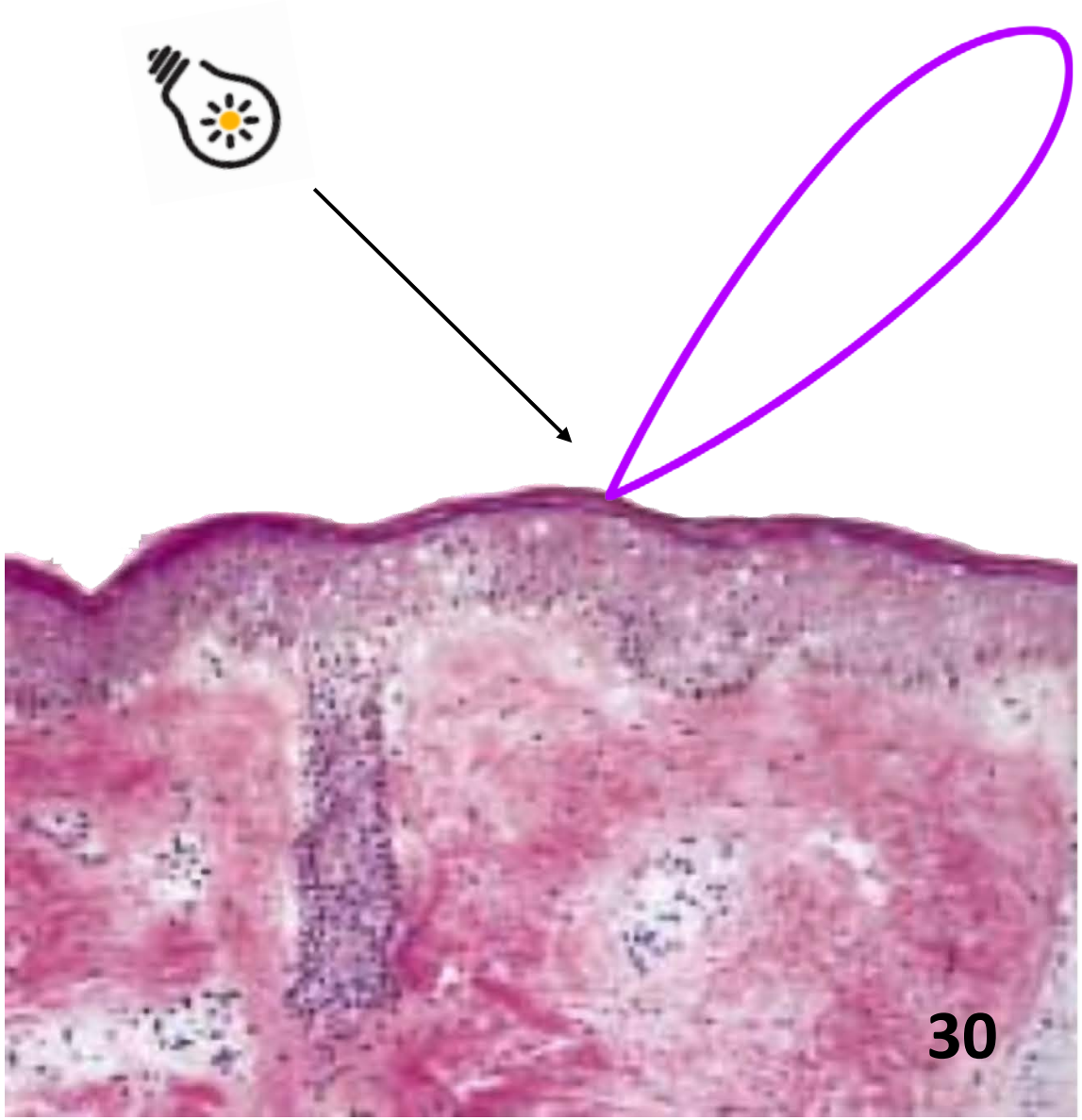
Skin Aging. Changes in the Structure.

Skin Aging. Changes in the Structure

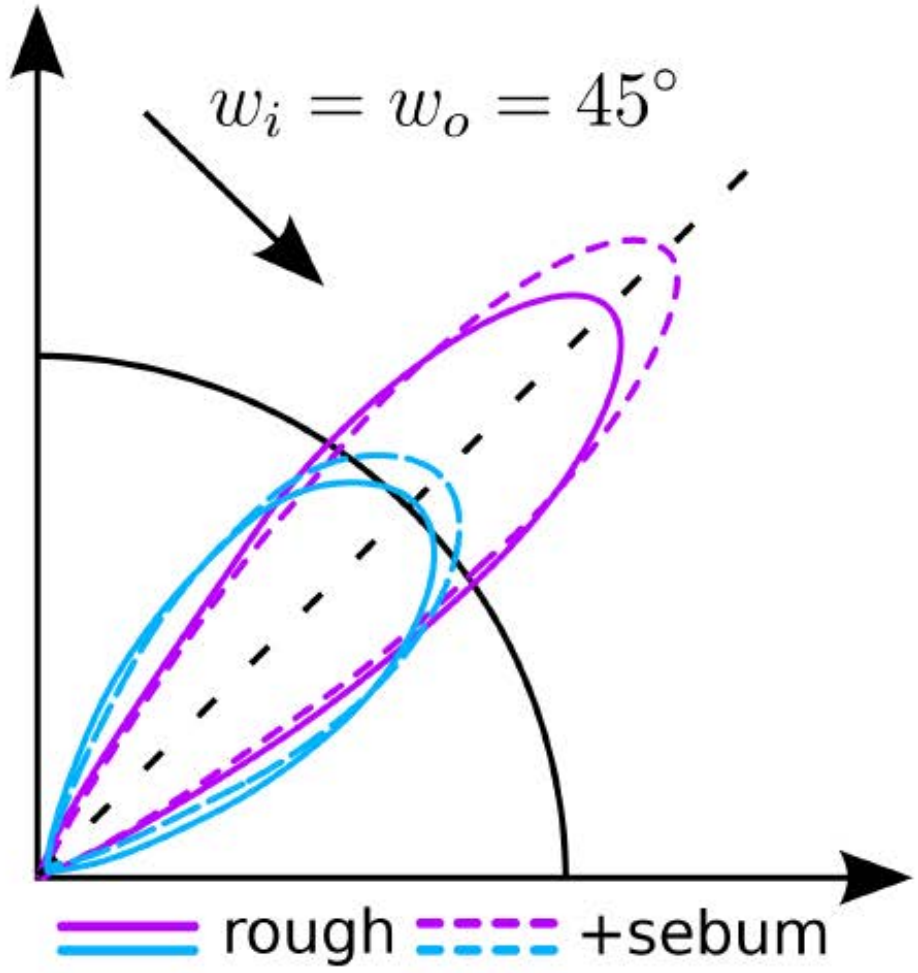
$$z_{(x,y)} = \bar{z} + A_x sin(\omega_x x + \phi_x) \cdot A_y sin(\omega_y y + \phi_y)$$



Skin Aging. Changes in the Structure



Skin Aging. Changes in the Structure



Skin Aging. Changes in the Composition.

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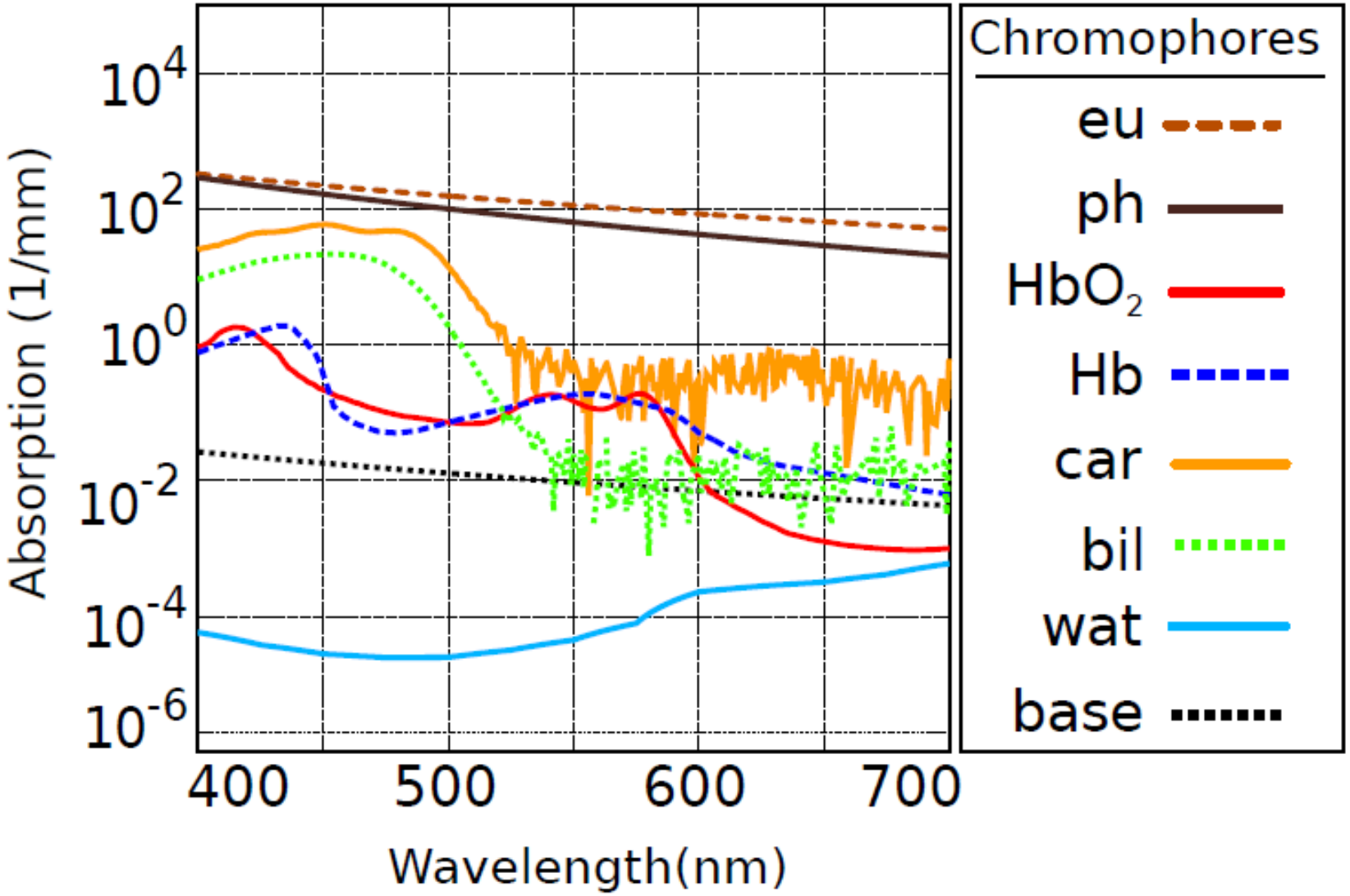
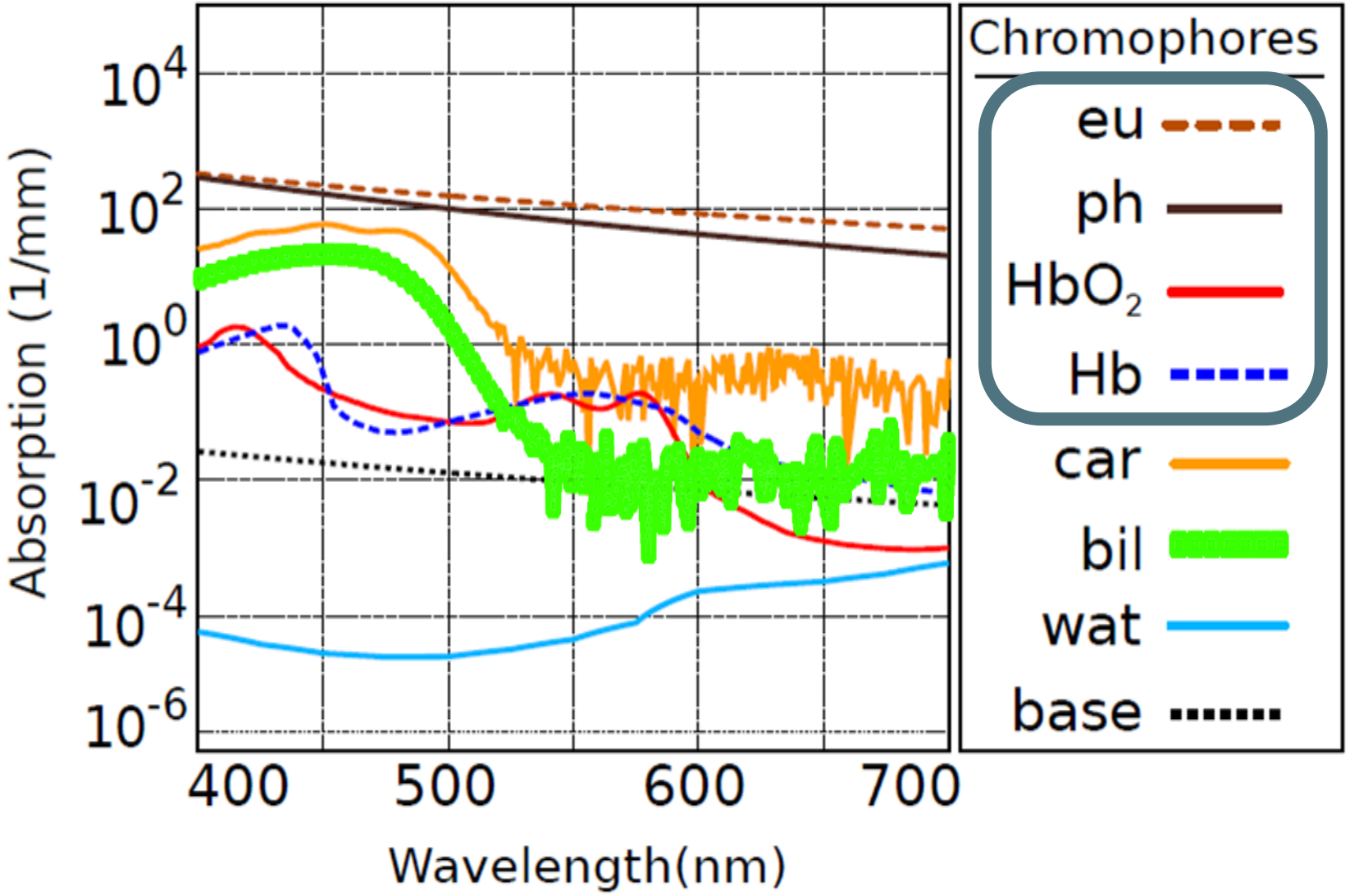
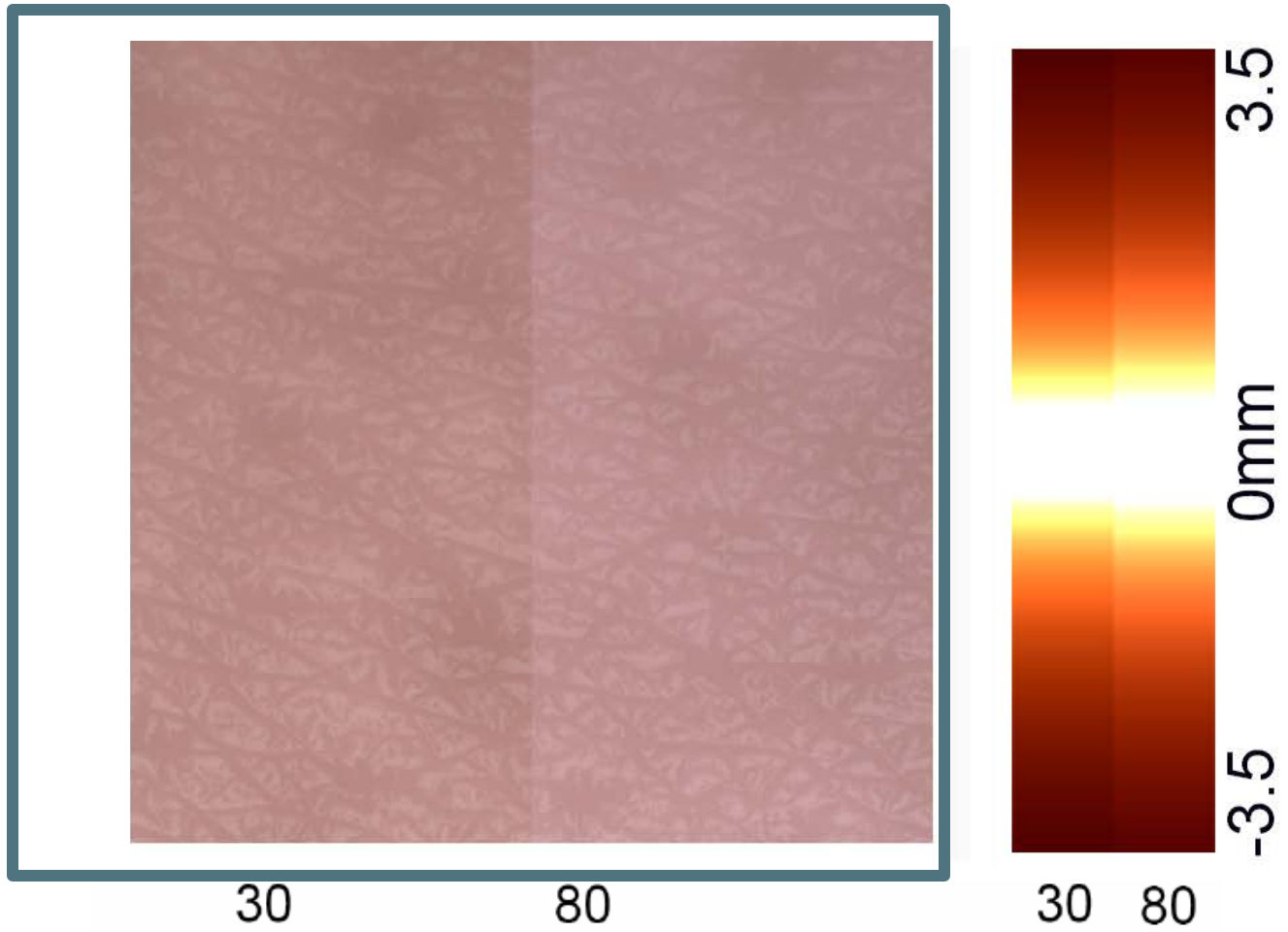
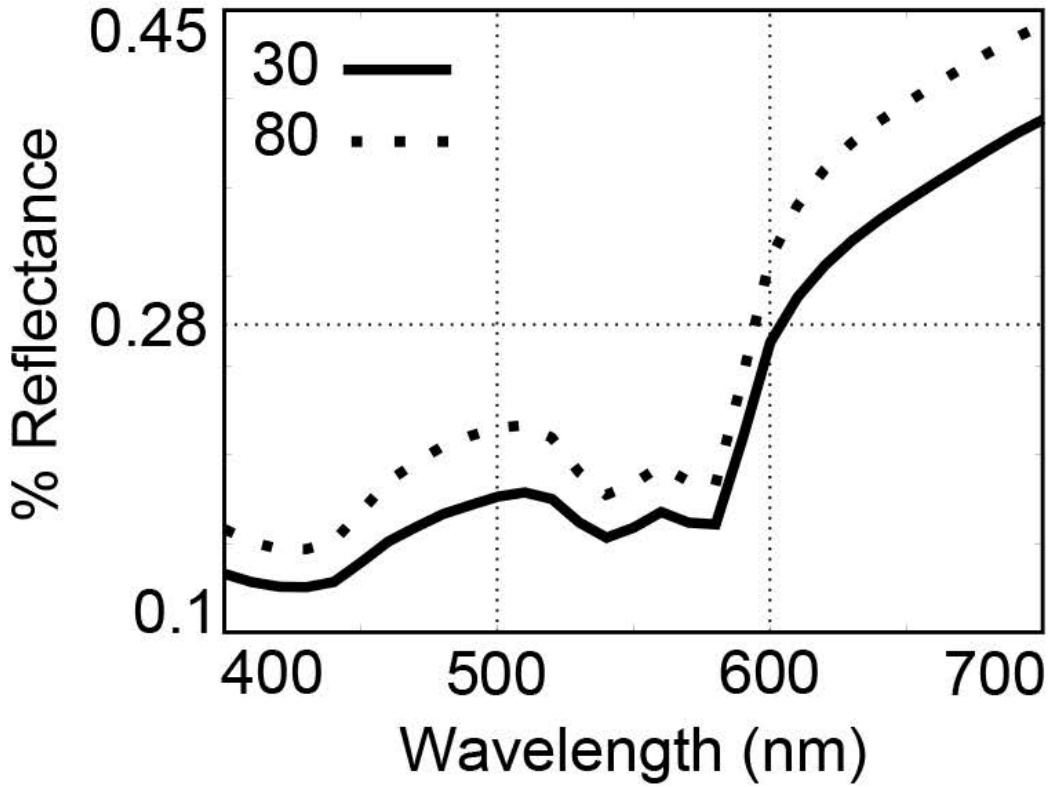


Skin Aging. Changes in the Composition



Skin Aging. Changes in the Composition





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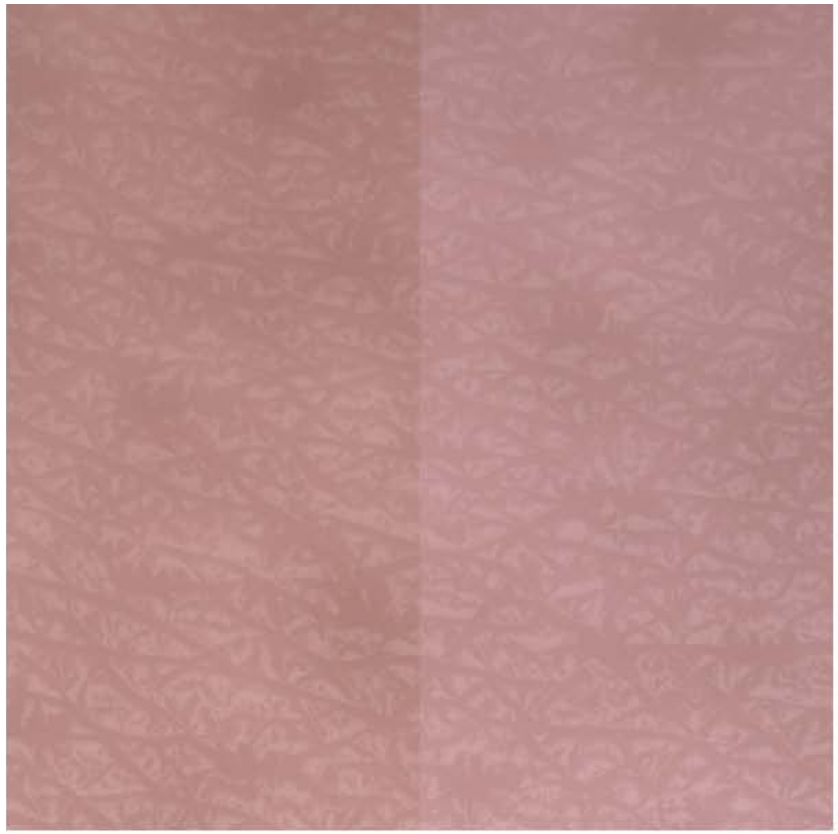

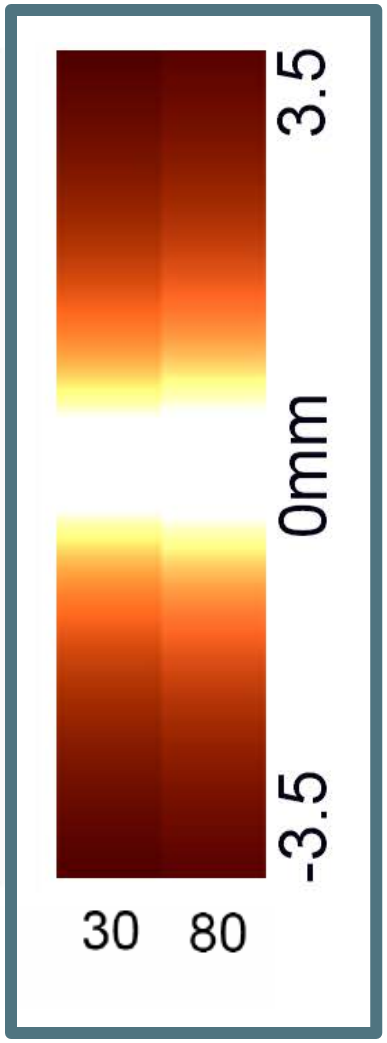

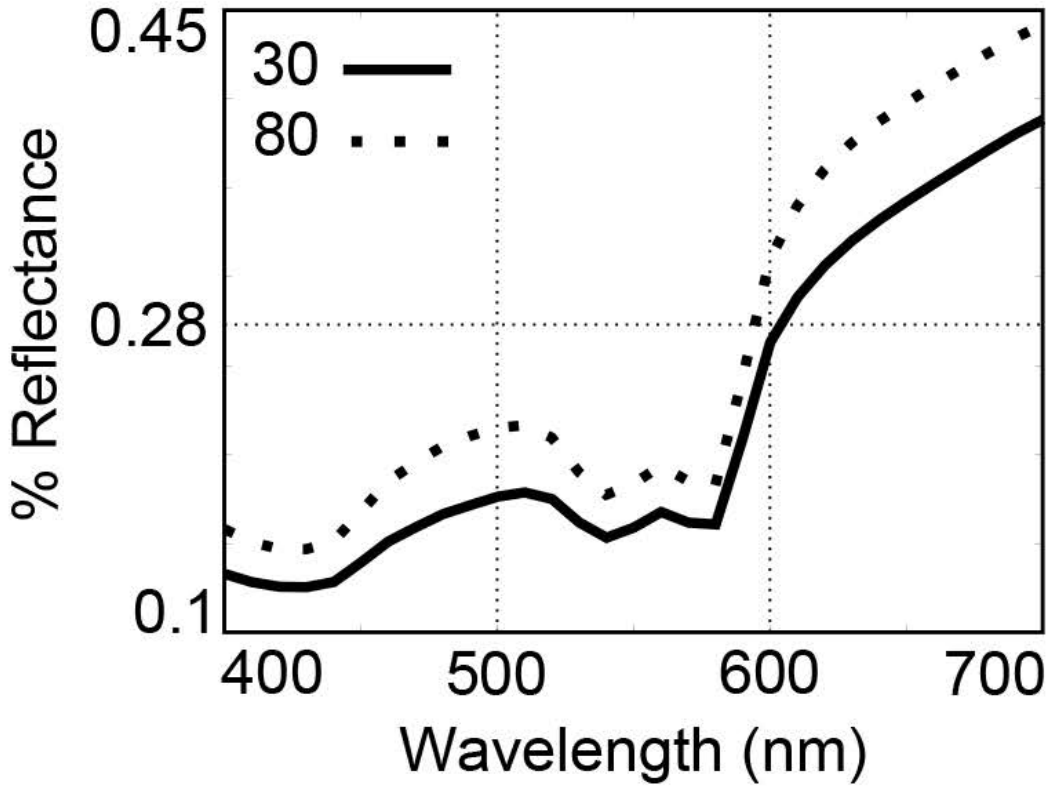

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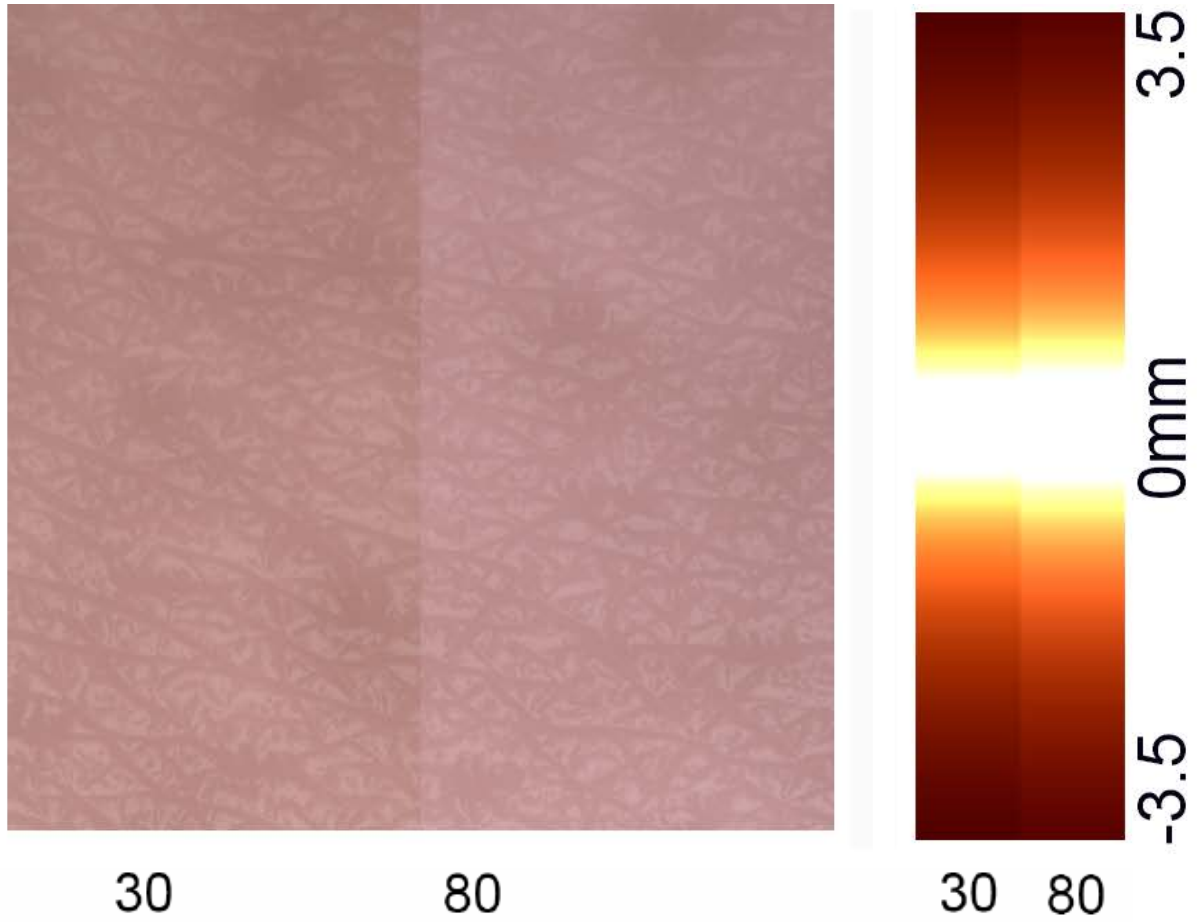

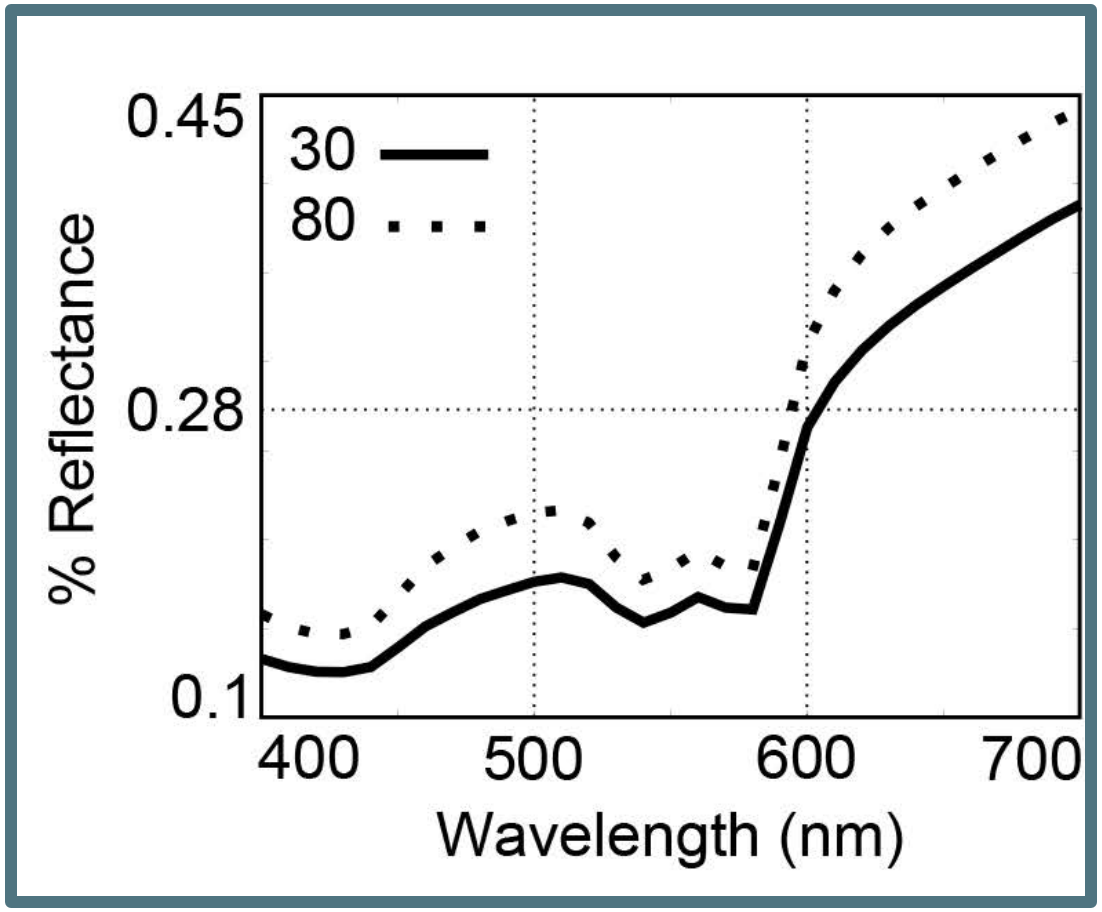

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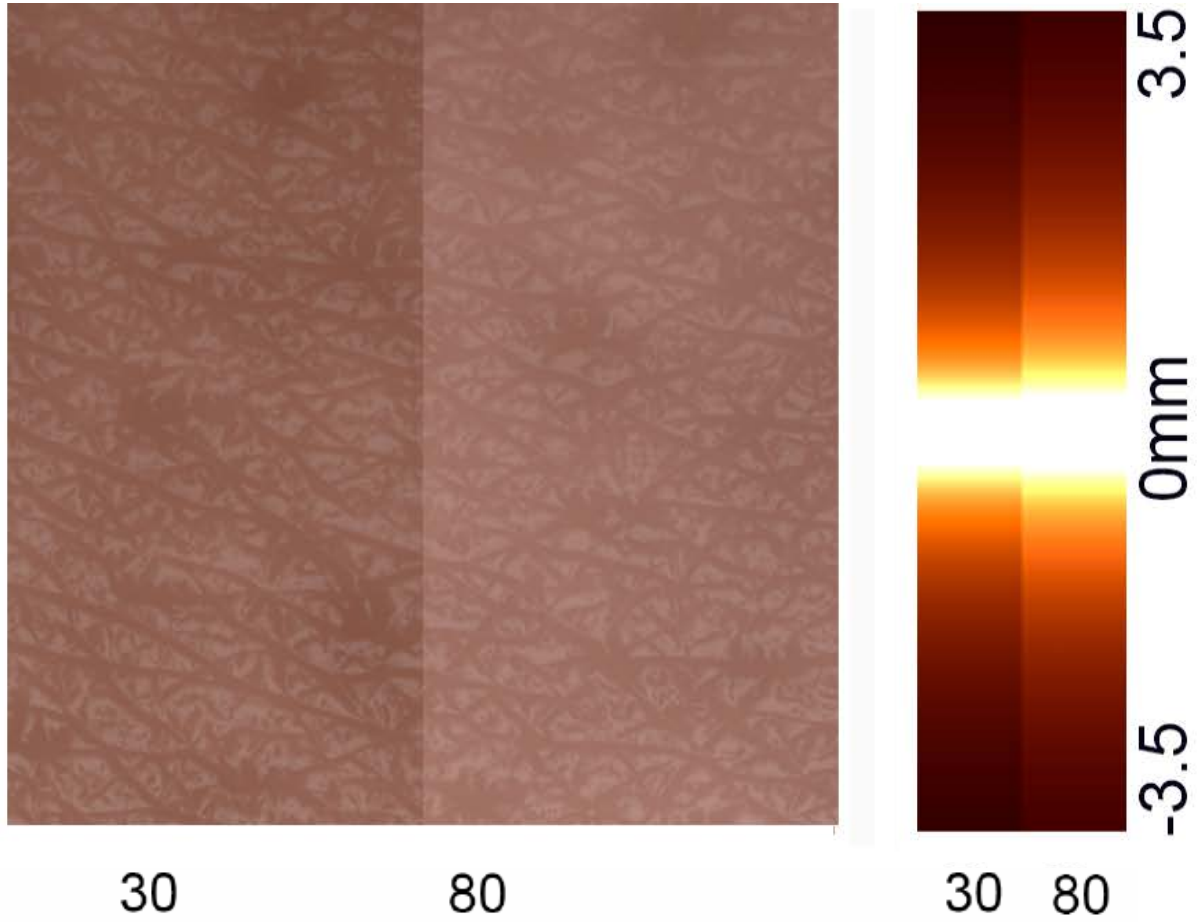

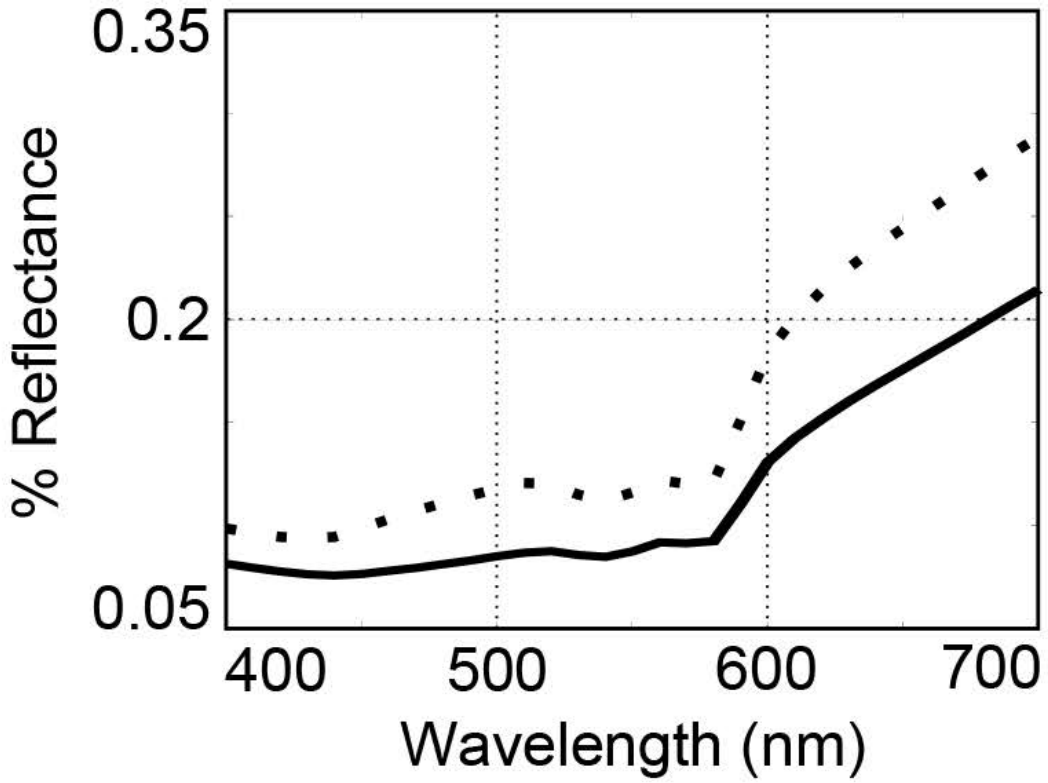

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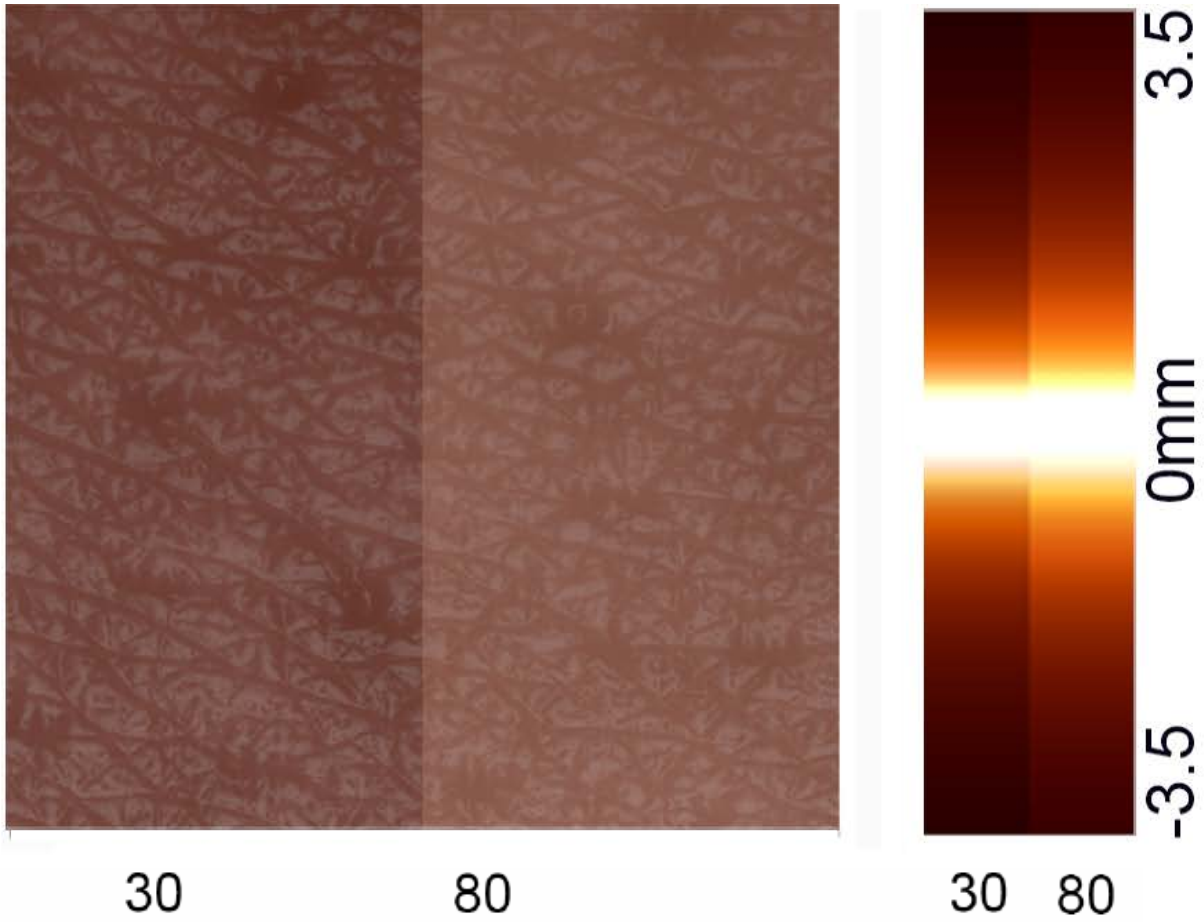

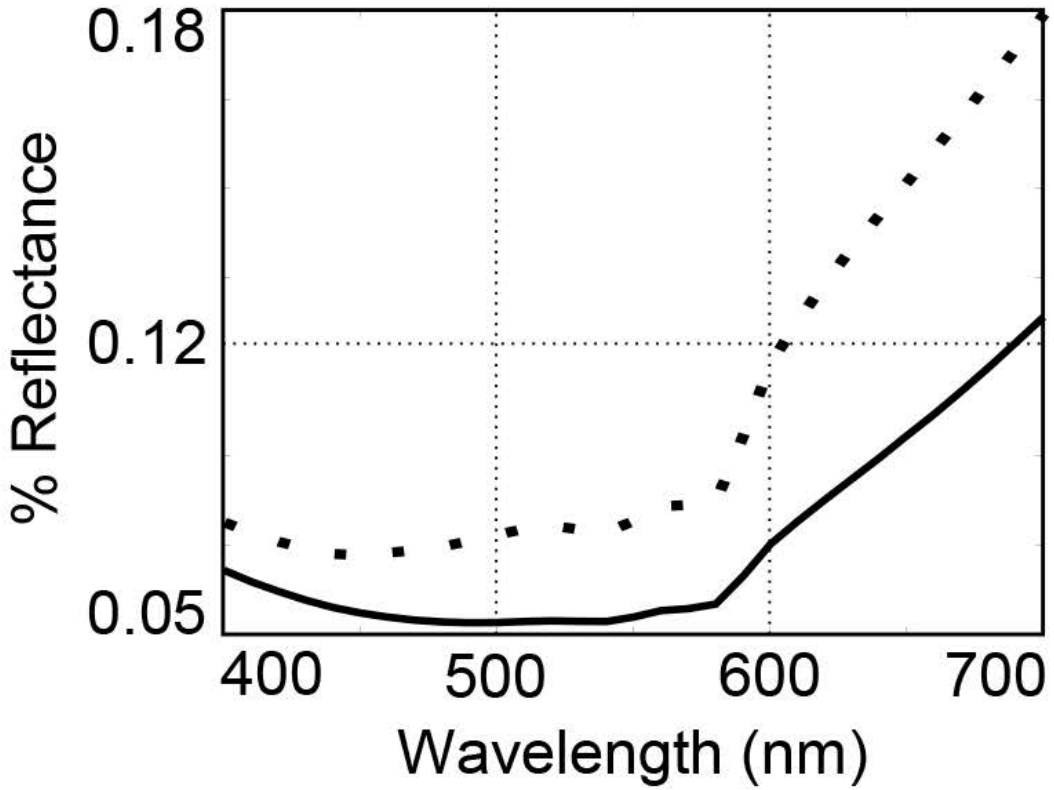

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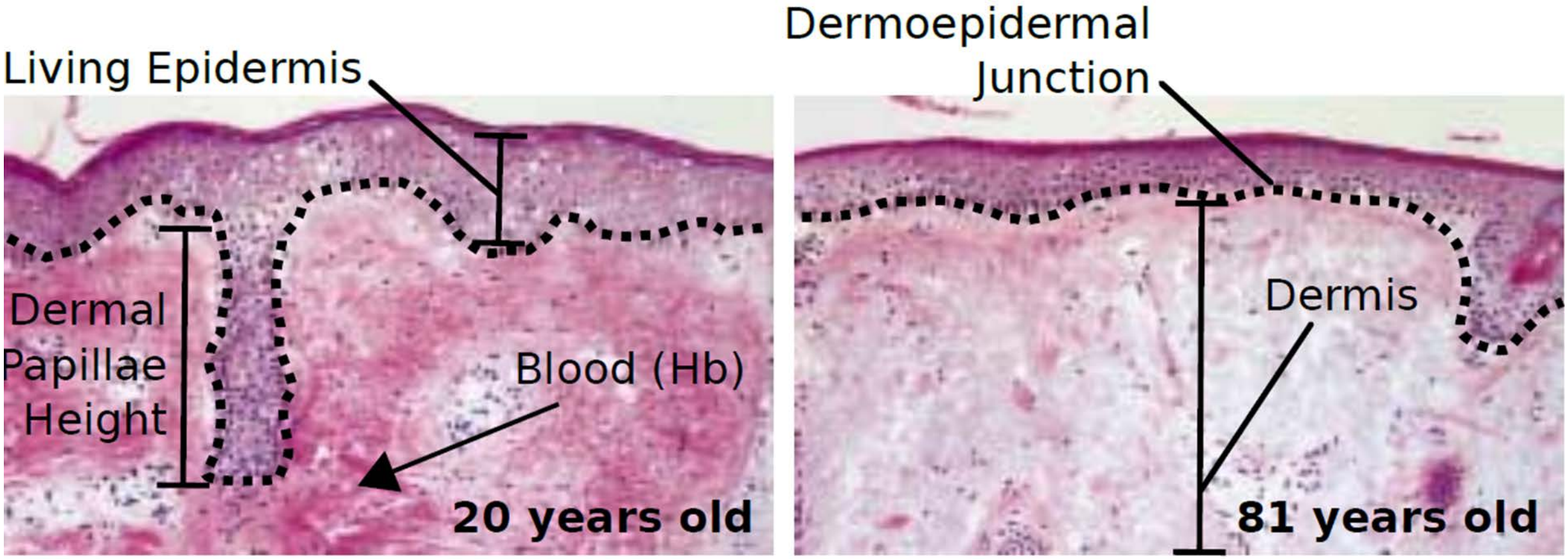

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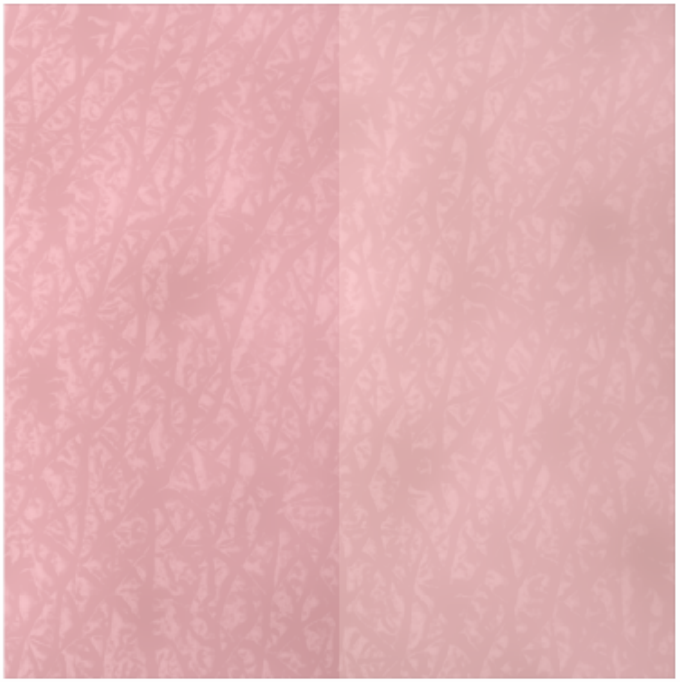
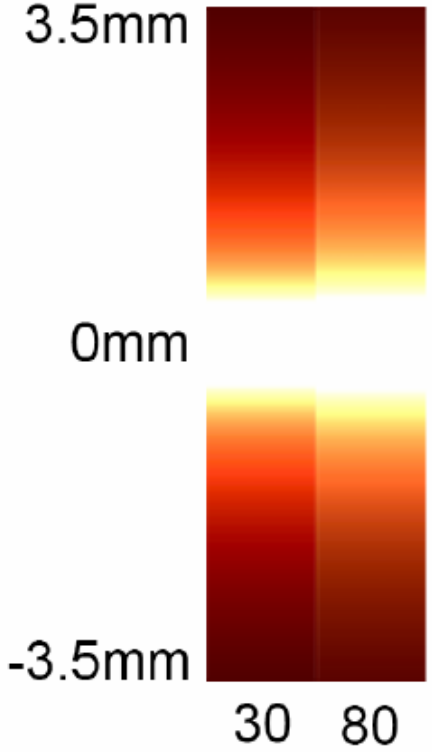
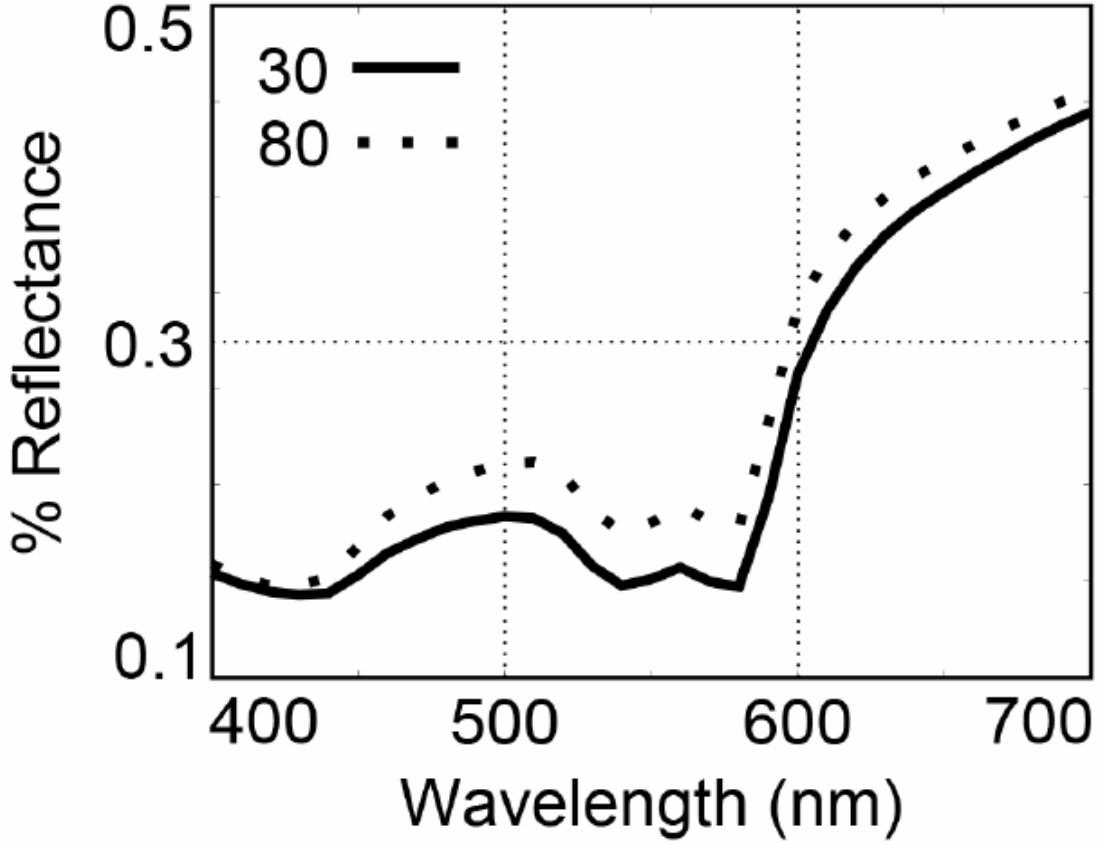
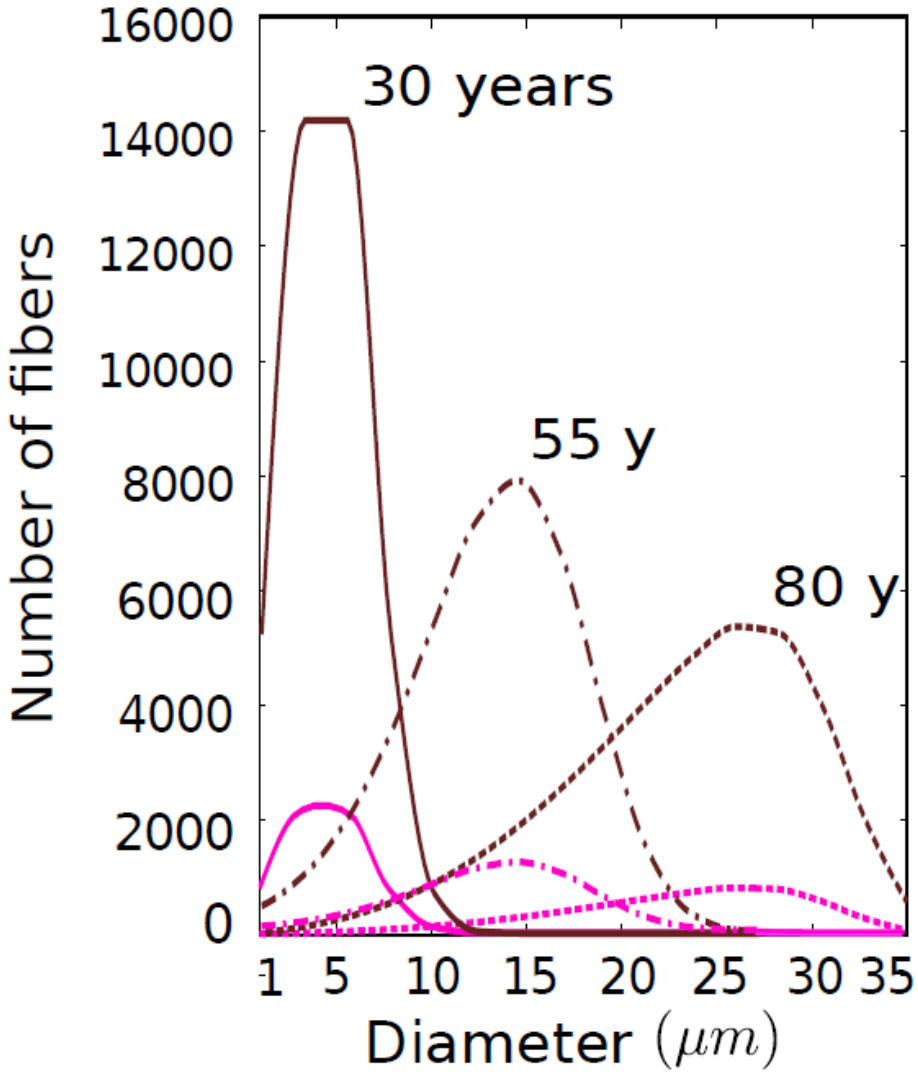






Skin Aging. Changes in the Structure



Results

Results

Skin Types Scale [Fitzpatrick]

I

II

III

30 years old

Results

Skin Types Scale [Fitzpatrick]

I

II

III

30 years old

Results

Skin Types Scale [Fitzpatrick]

I

II

III

80 years old

Results

Skin Types Scale [Fitzpatrick]

IV

V

VI

30 years old

Results

Skin Types Scale [Fitzpatrick]

IV

V

VI

30 years old

Results

Skin Types Scale [Fitzpatrick]

IV

V

VI

80 years old

Results

30 years old

Back of the hand

Skin type III
5% melanin
5% haemoglobin

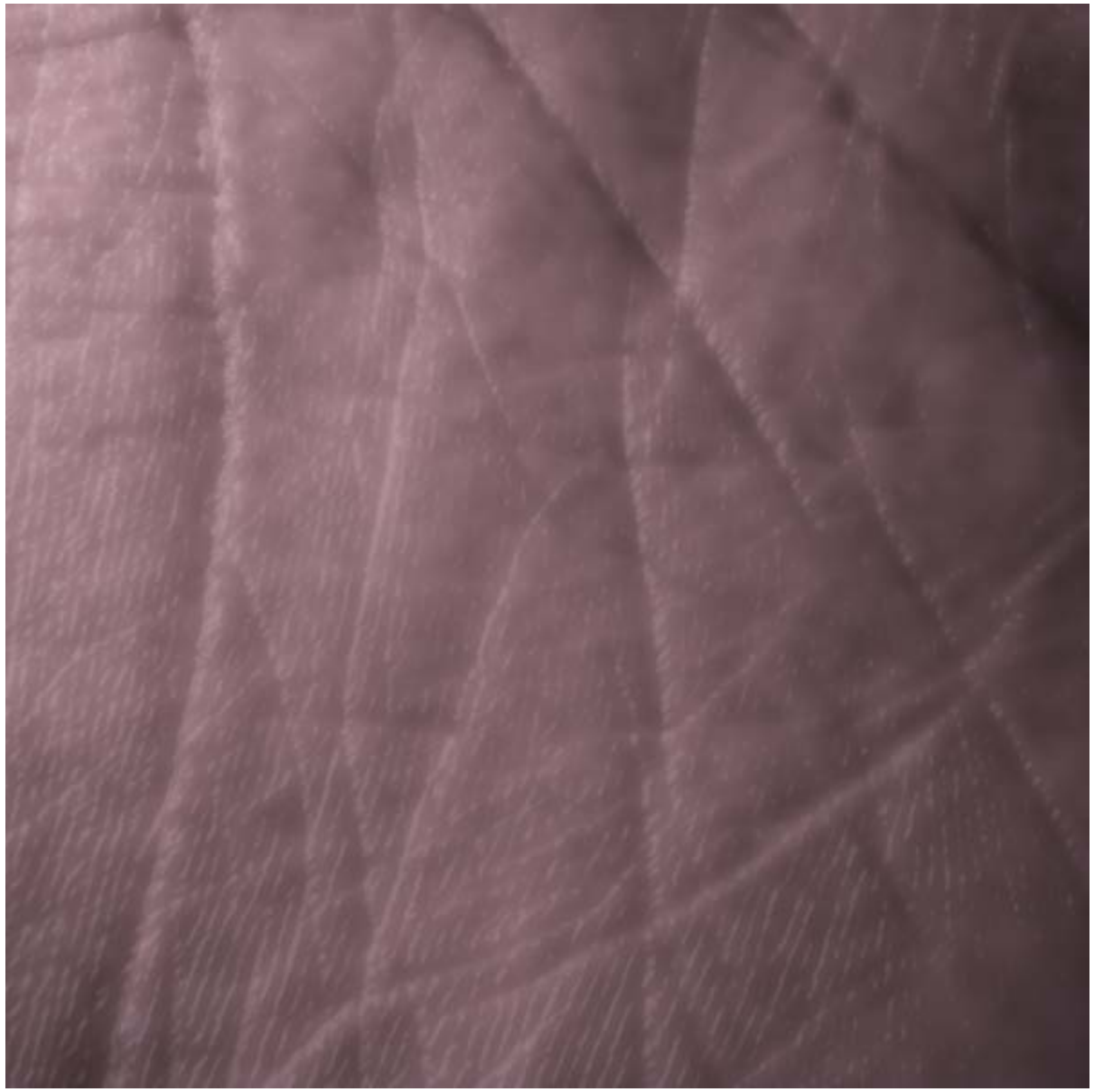
Results

80 years old

Back of the hand

Skin type III
5% melanin
5% haemoglobin

Results

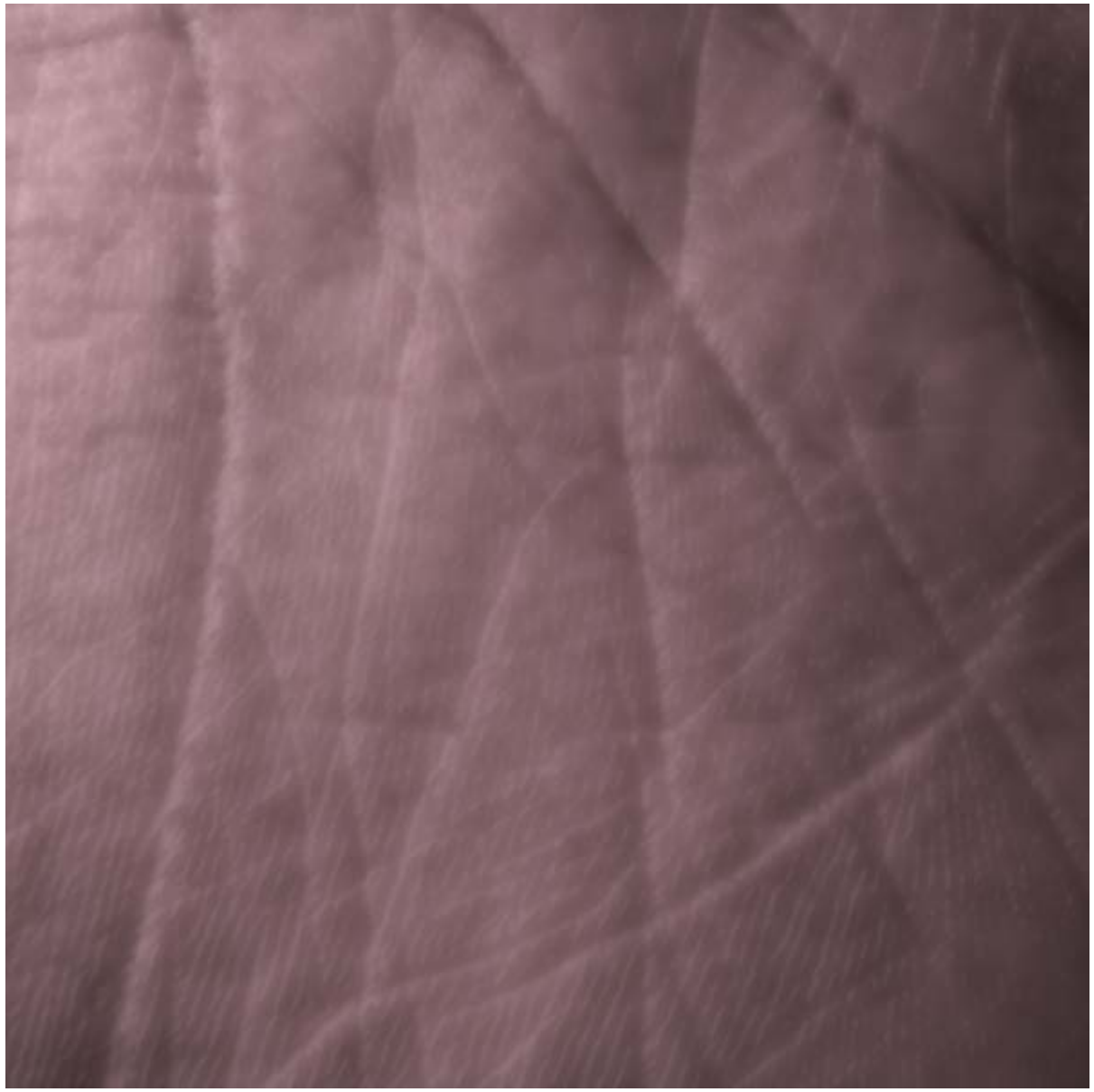


30 years old

Palm

Skin type III
5% melanin
5% haemoglobin

Results



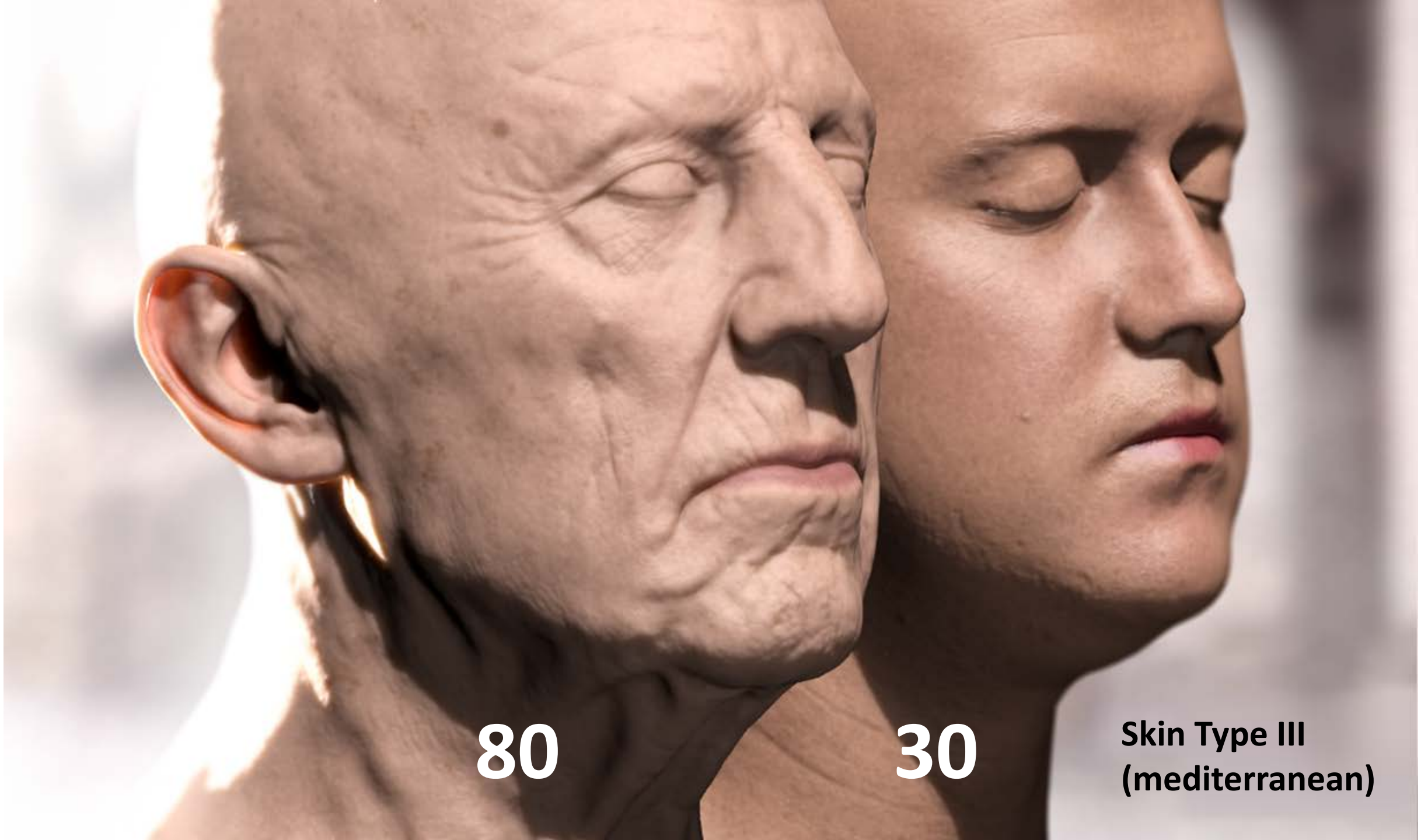
80 years old

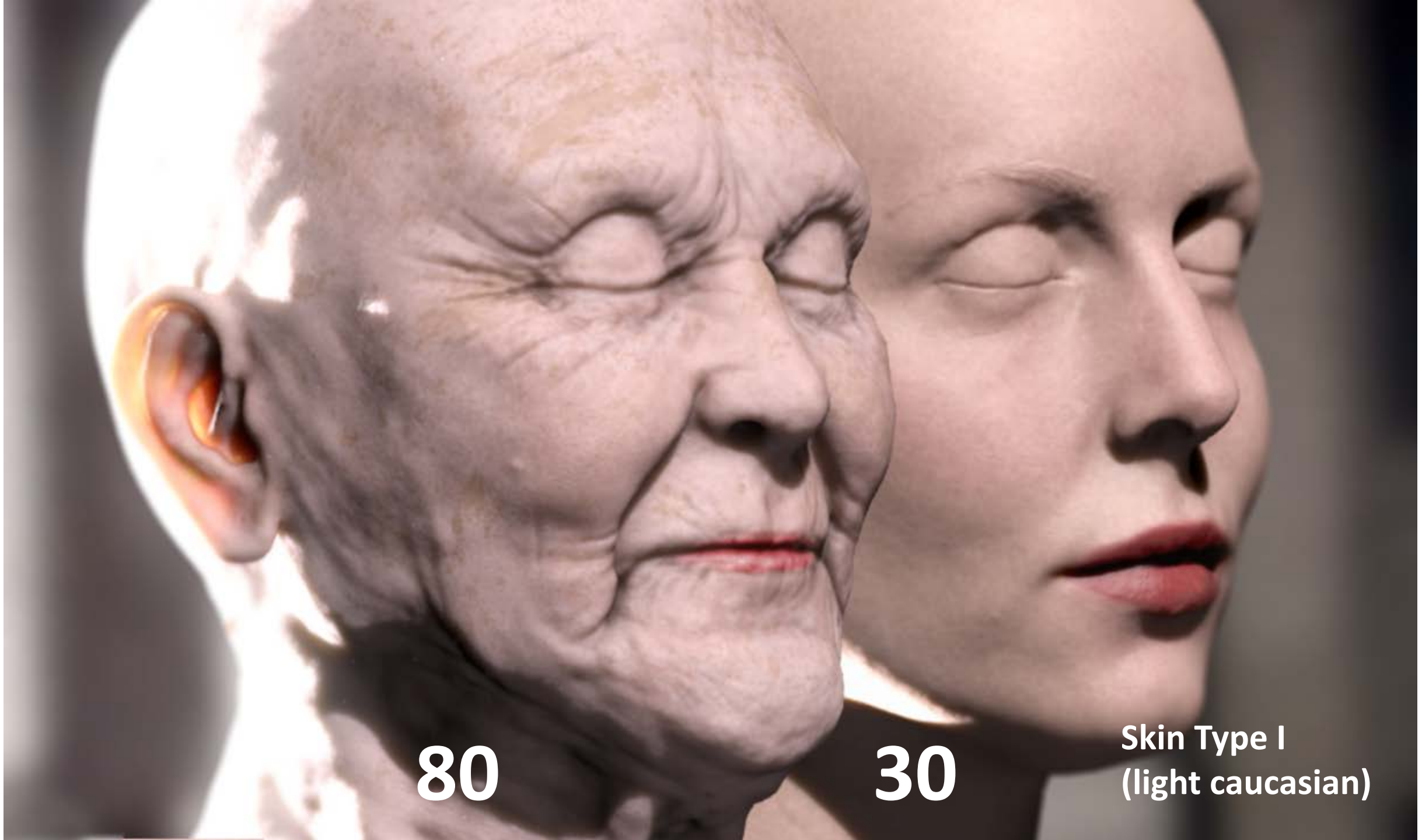
Palm

Skin type III
5% melanin
5% haemoglobin

Results

Results


80
30
Skin Type III
(mediterranean)


80
30
Skin Type I
(light caucasian)


A
B
C
D

Conclusions

Biophysically based model for simulating aging

Conclusions

Biophysically based model for simulating aging

Exhaustive compilation of medical and tissue optics data of skin measurements.

Conclusions

Intuitive input parameters such us age, gender, skin type and skin care.

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Off the shelf model suitable for any rendering framework, even real-time.

Conclusions

Intuitive input parameters: age, gender, skin type, body location, skin care…

Off the shelf model suitable for any rendering framework, even real-time.

All gathered data is available on the web.

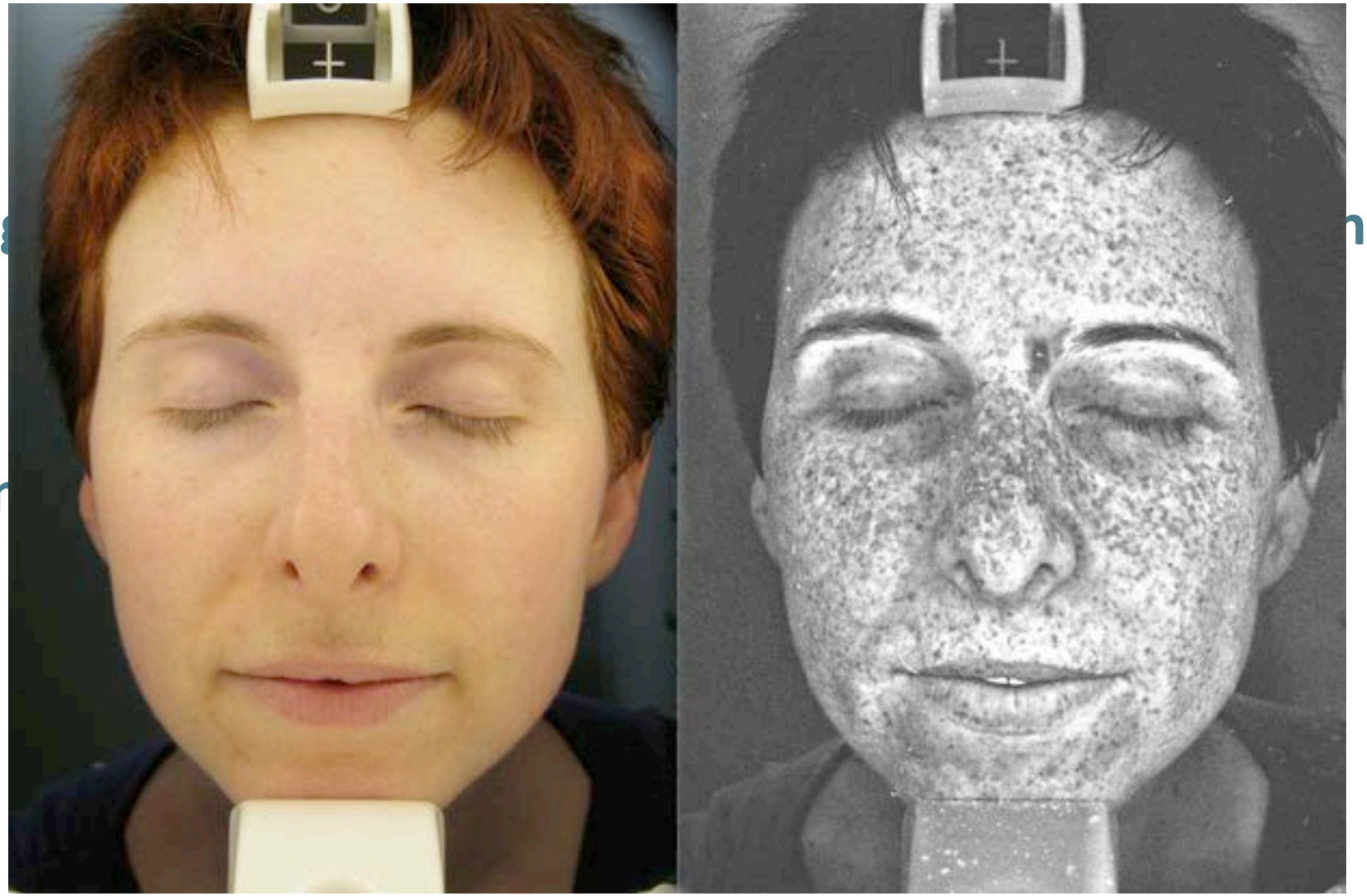
Discussion and Future Work

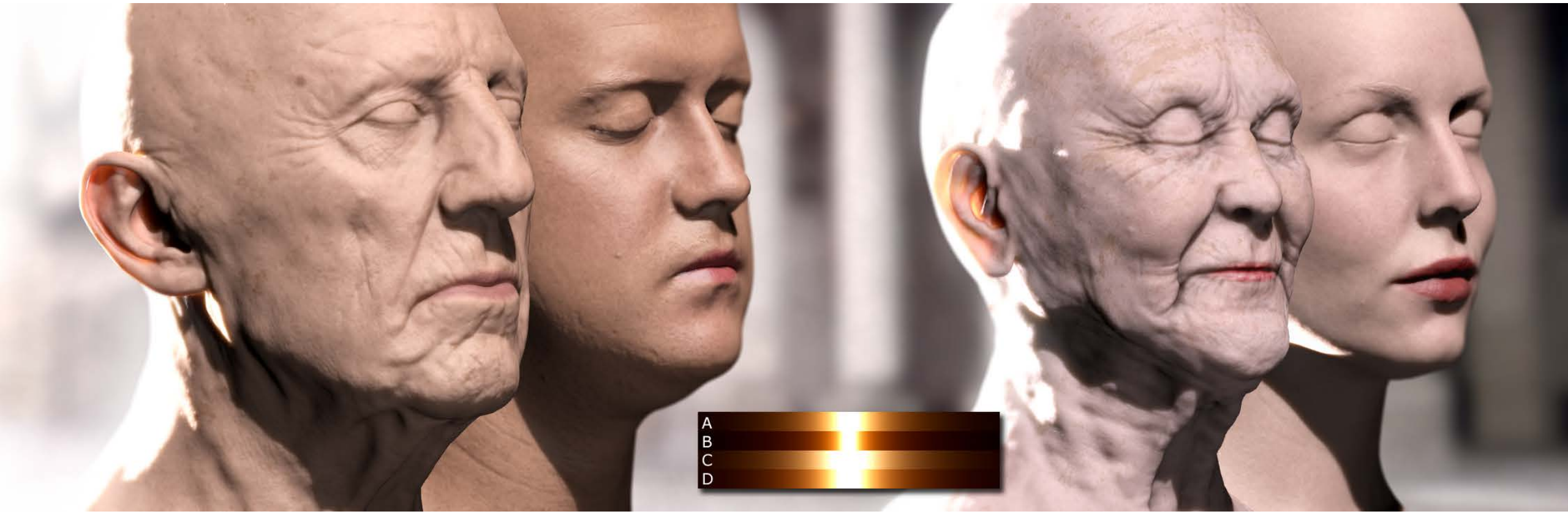
Interesting for other fields like cosmetics or medical simulation.

Discussion and Future Work

Interesting

Heteroger





http://giga.cps.unizar.es/~ajarabo/pubs/skinAgingEG15/