The Physics of Sunlight, Vitamin D and Circadian Rhythms

How one photon can unleash the activation of over 200 genes in our DNA!

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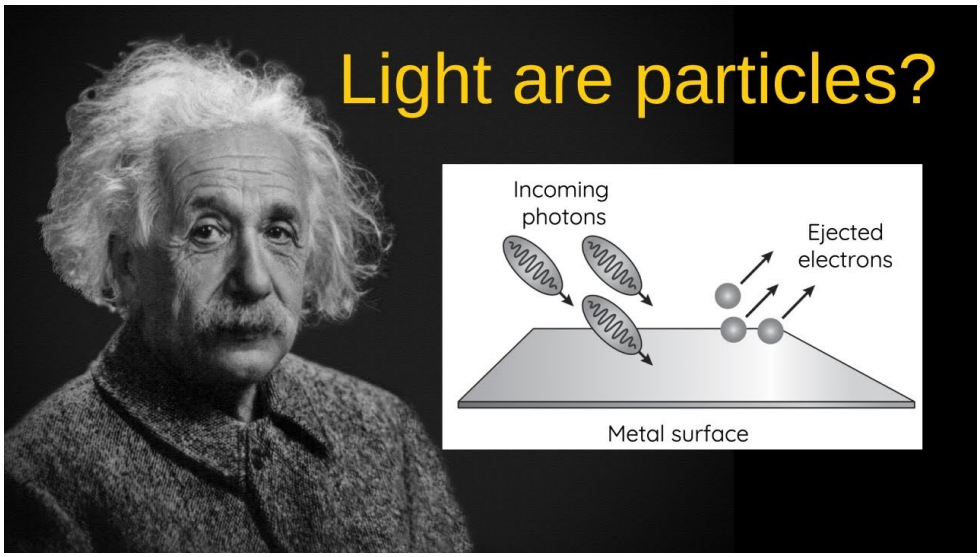
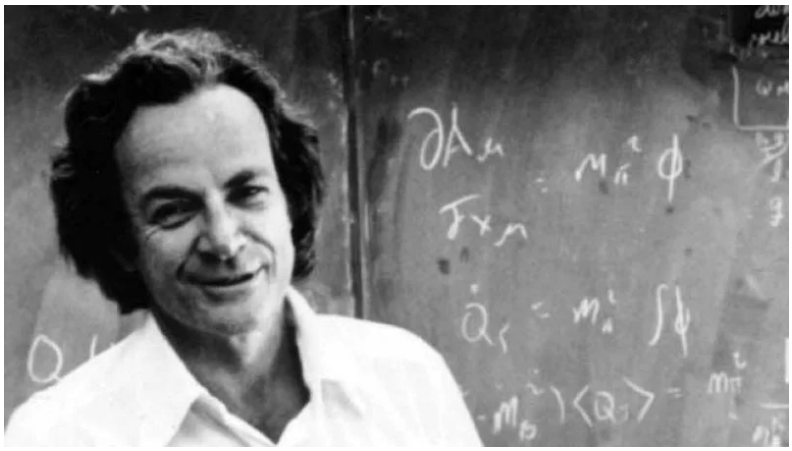


Albert Einstein's Photoelectirc Effect: Nobel Prize in 1927

2

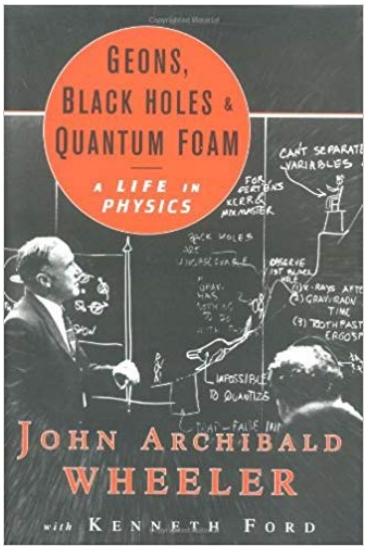


Richard Feynman

"Sunlight is captured in all matter."

https://www.youtube.com/@The_Feynman_Way

3

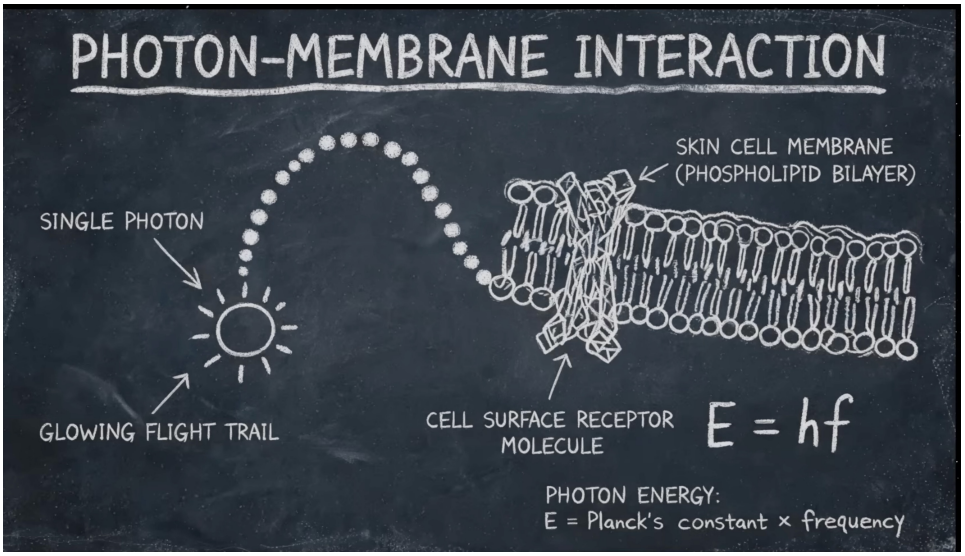


"*It from bit* symbolizes the idea that every item of the physical world has at bottom…an immaterial source and explanation…that all things physical are information-theoretic in origin and that this is a participatory universe"

John Archibald Wheeler

…from particles to energy to information

4



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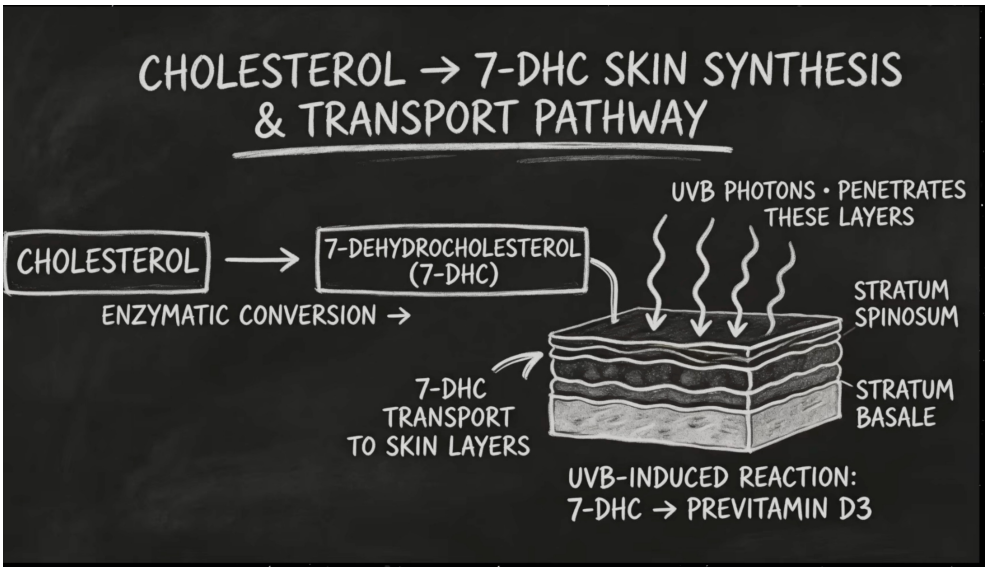

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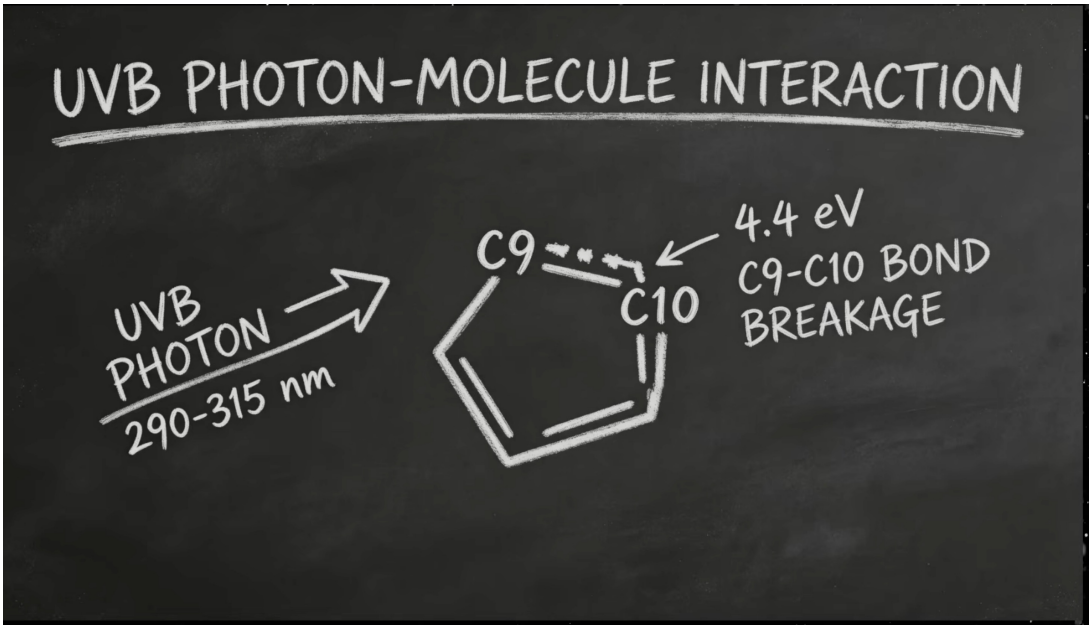

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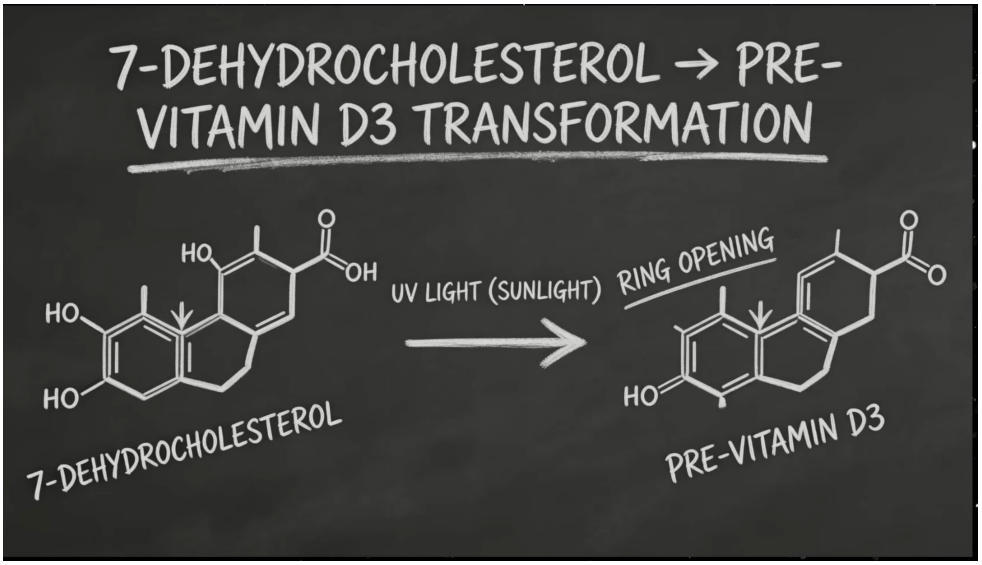

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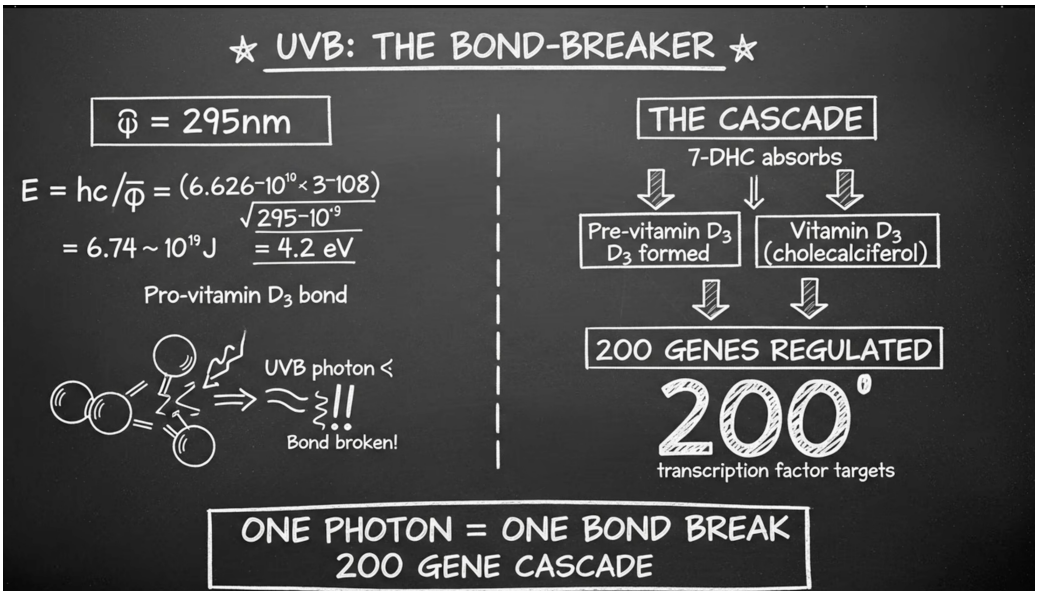

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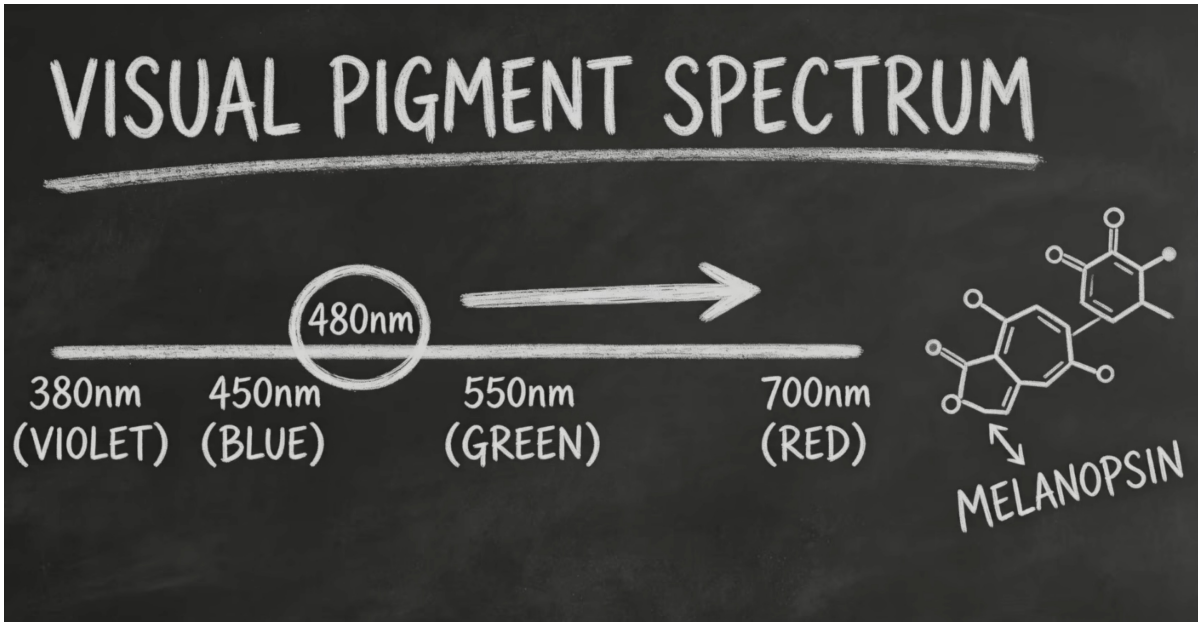

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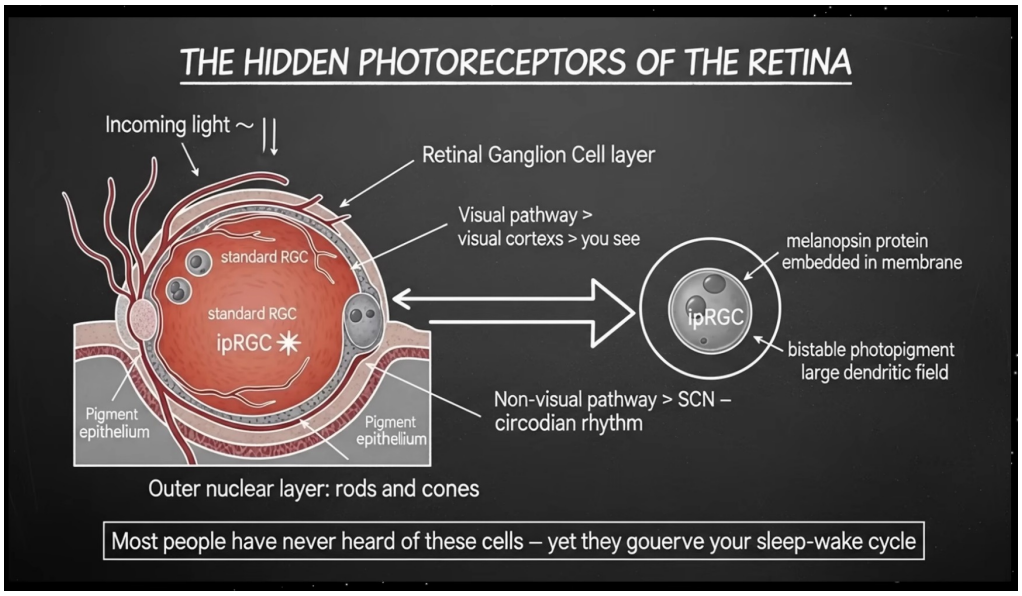

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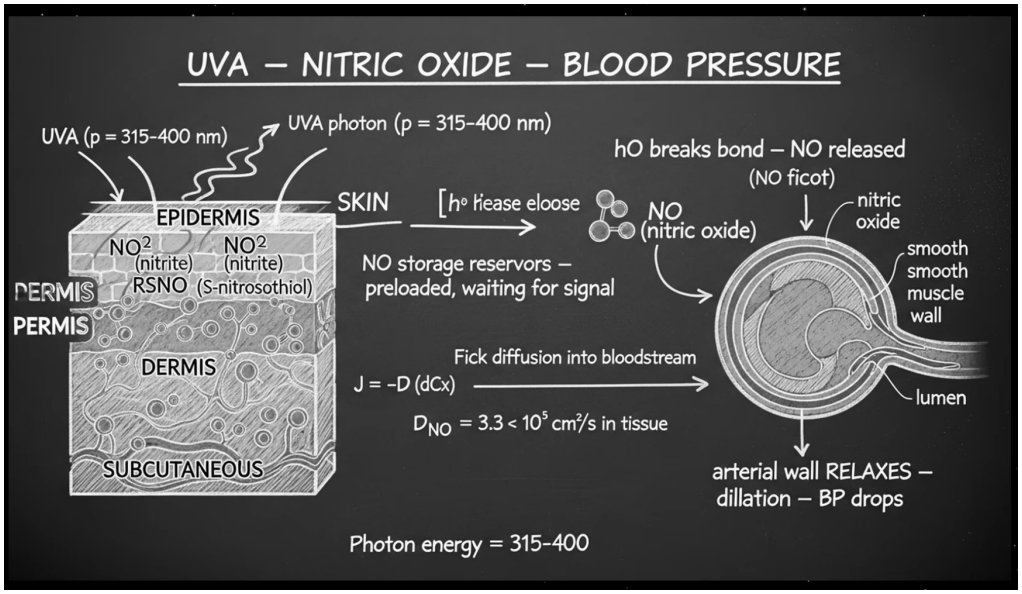

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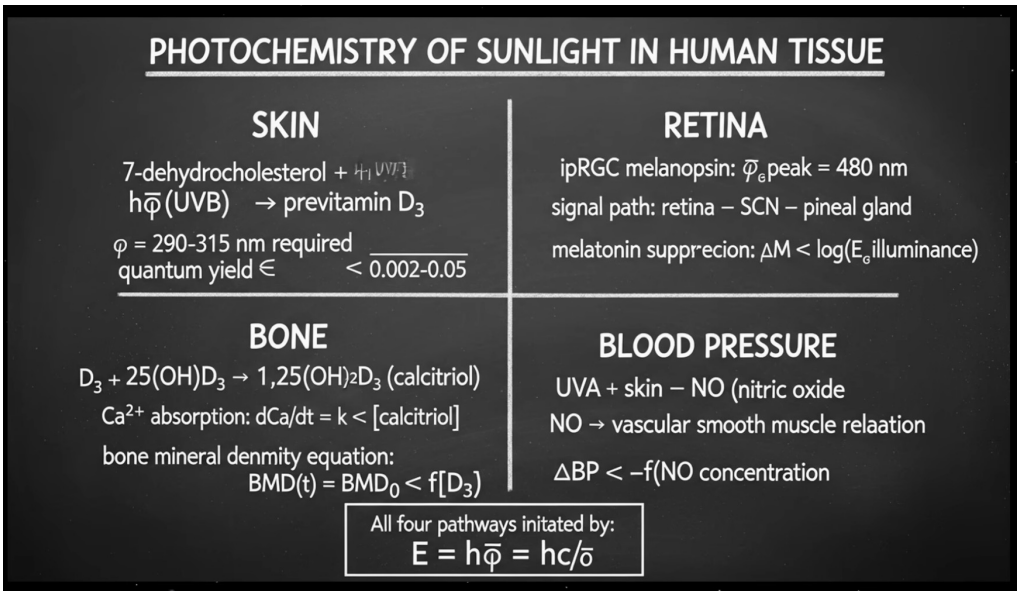

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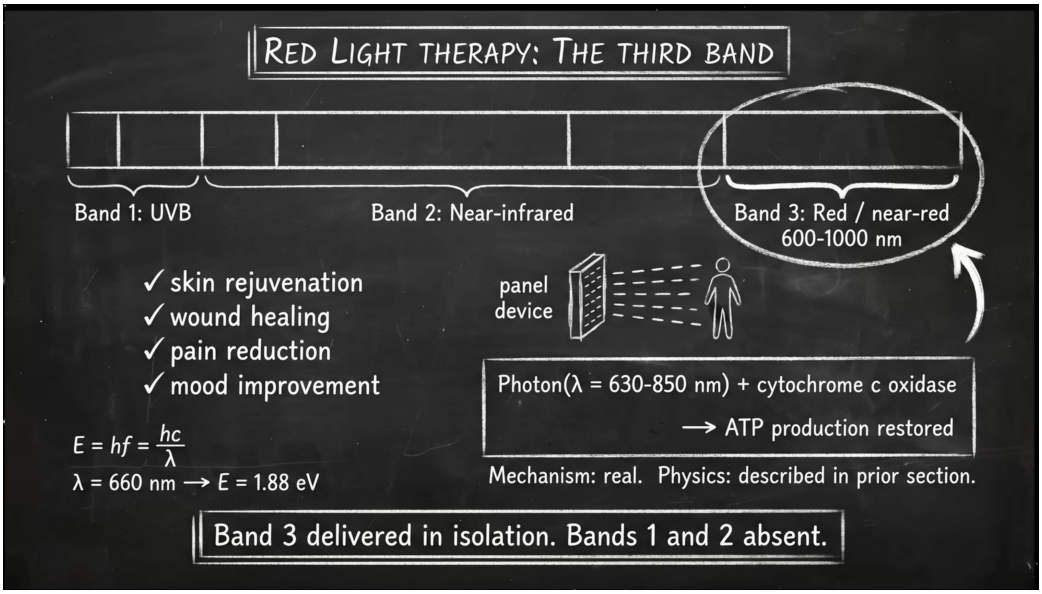

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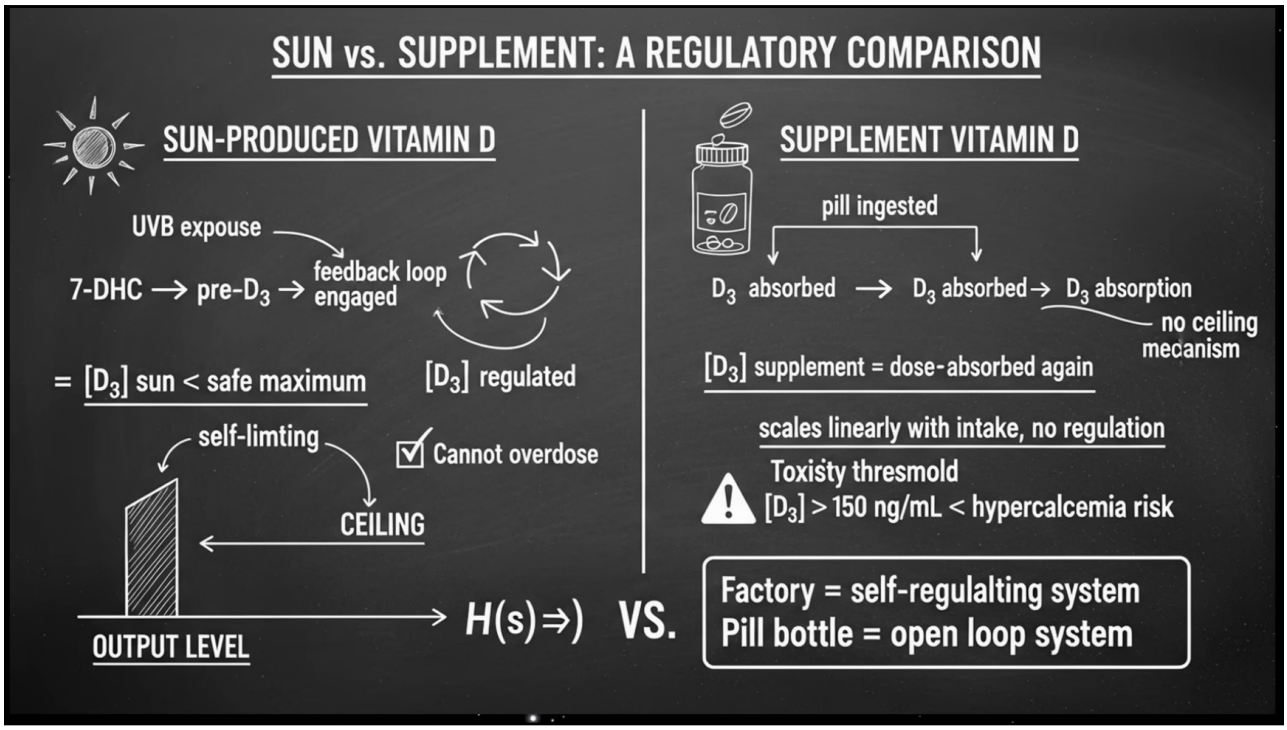

15

Courtesy Michael Holick MD, PhD

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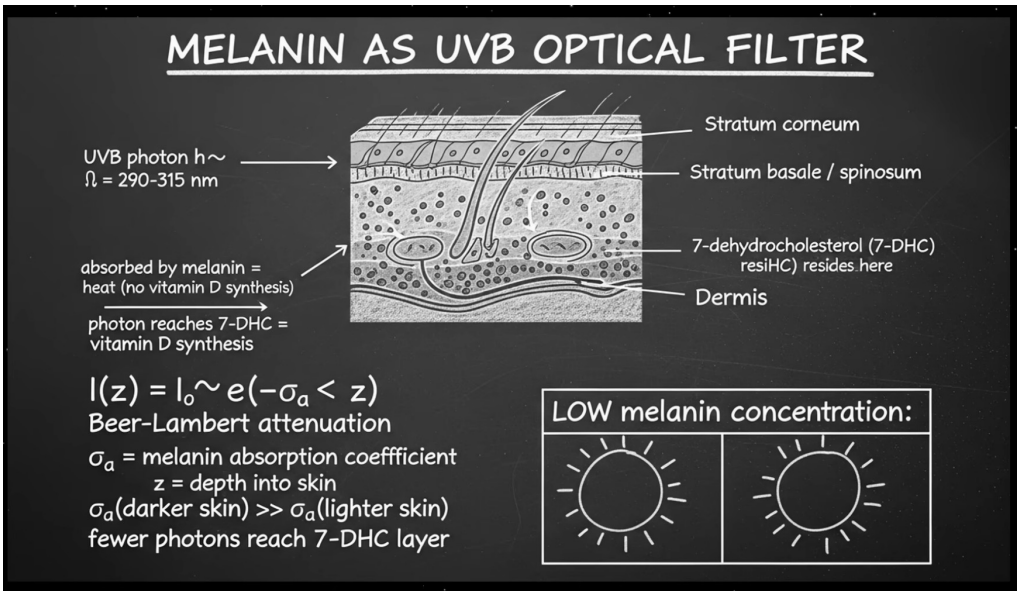

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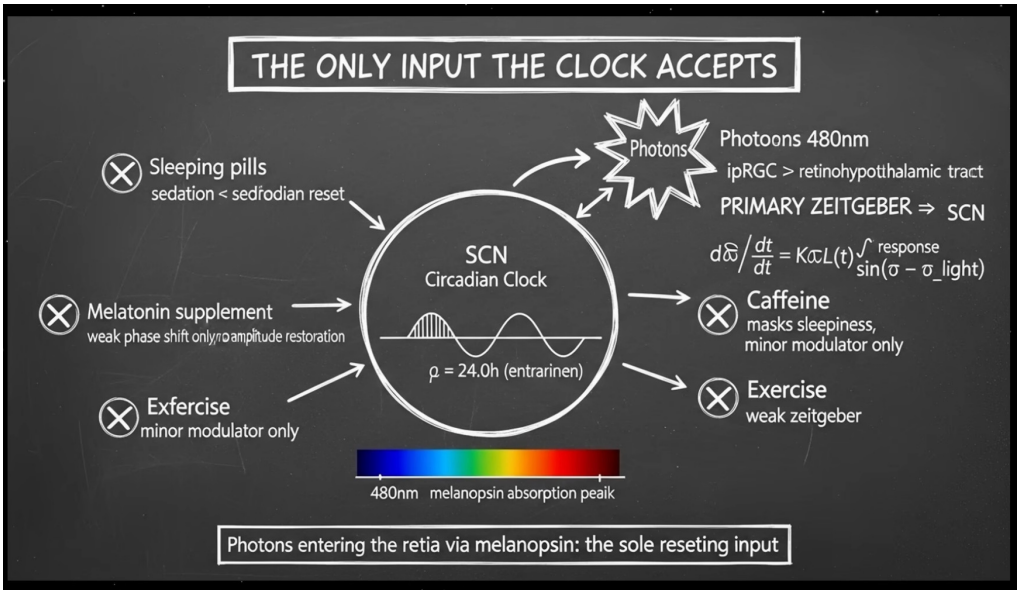

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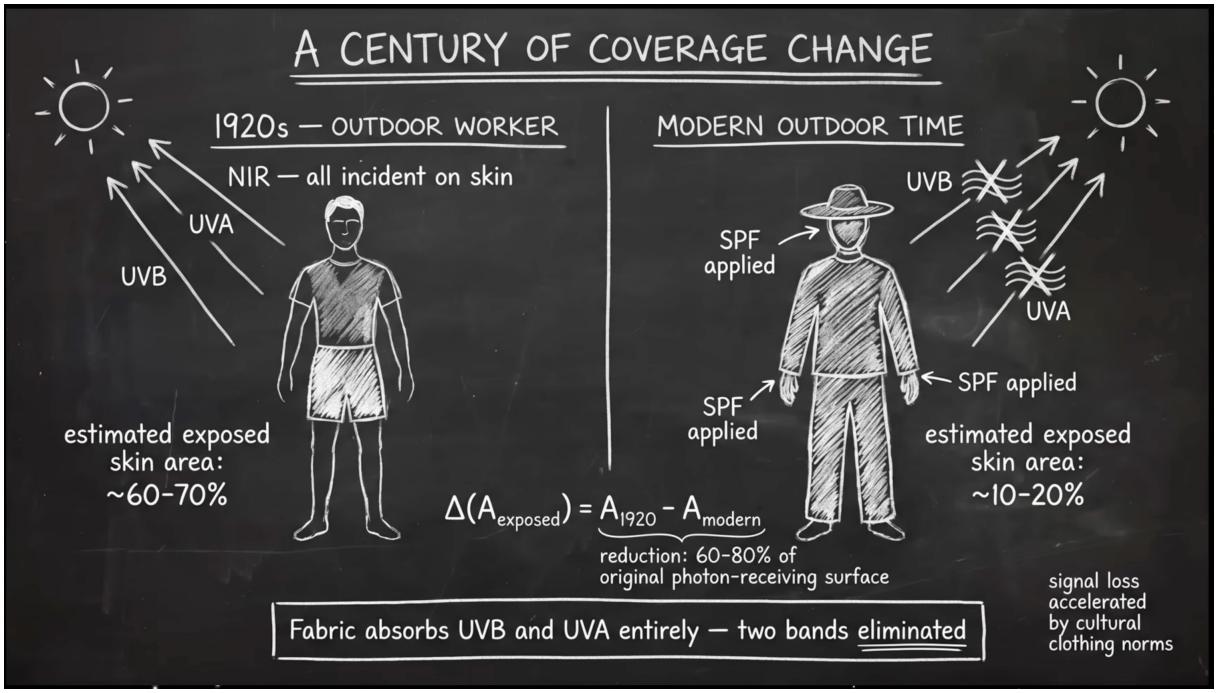

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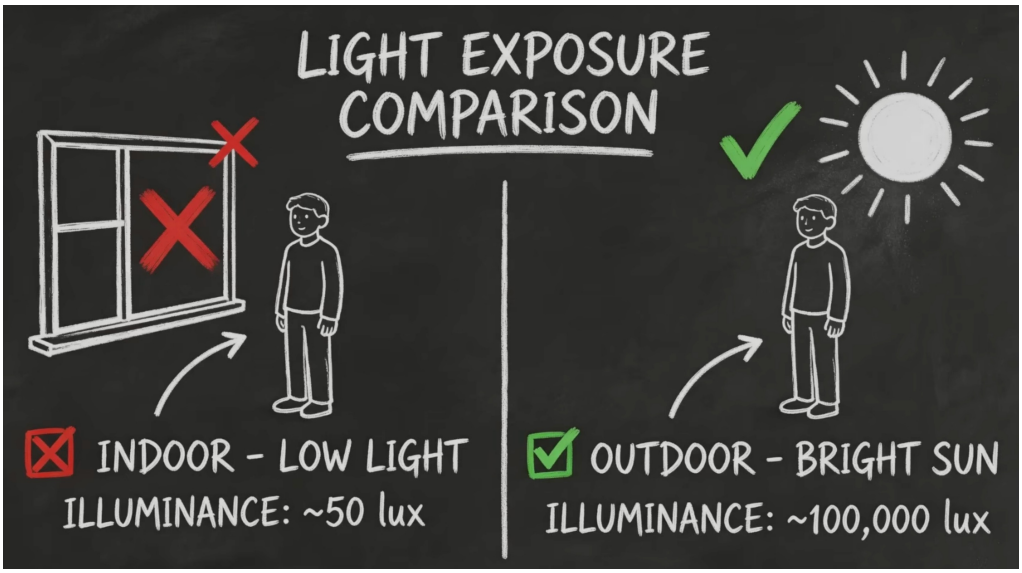

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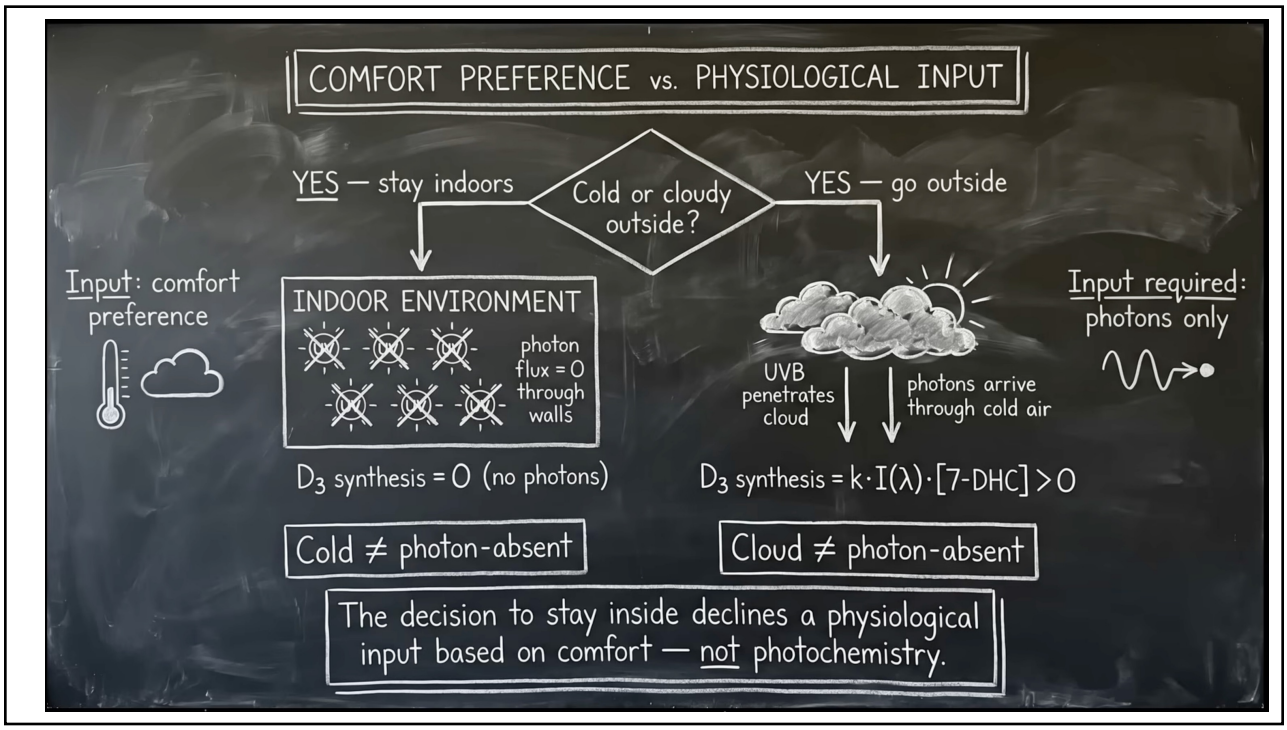
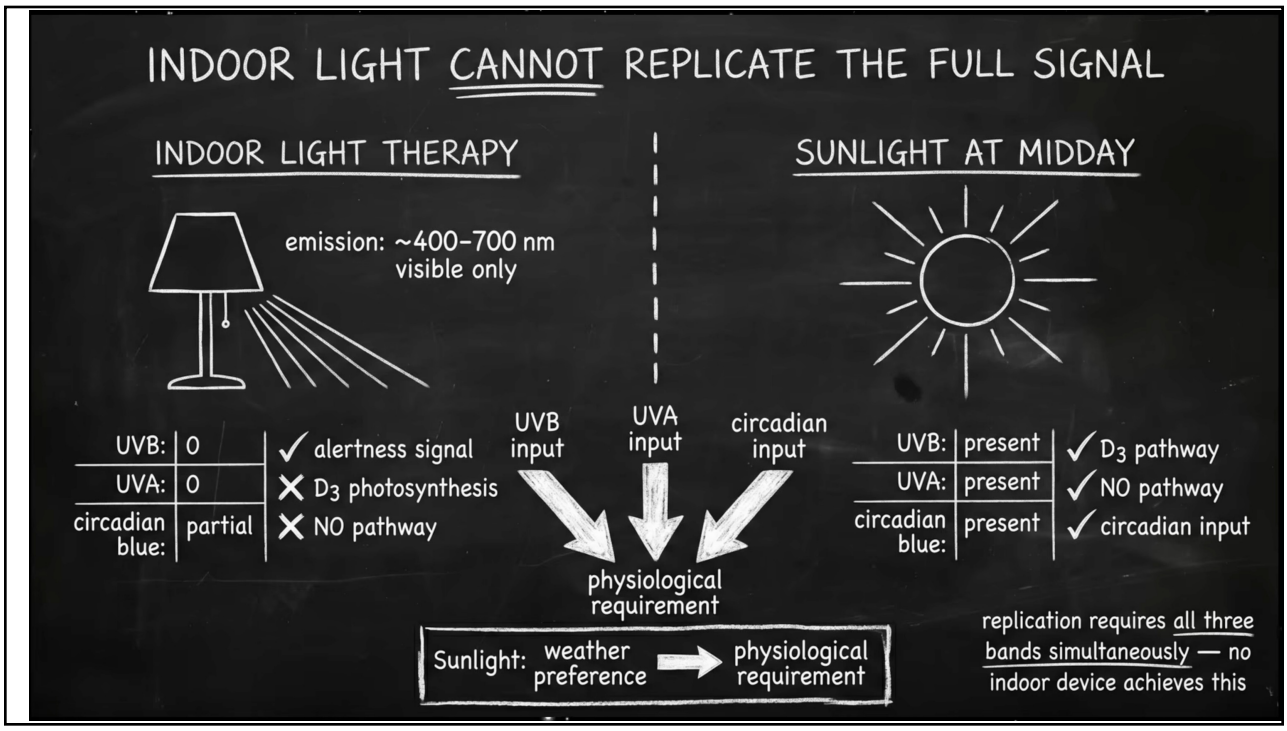
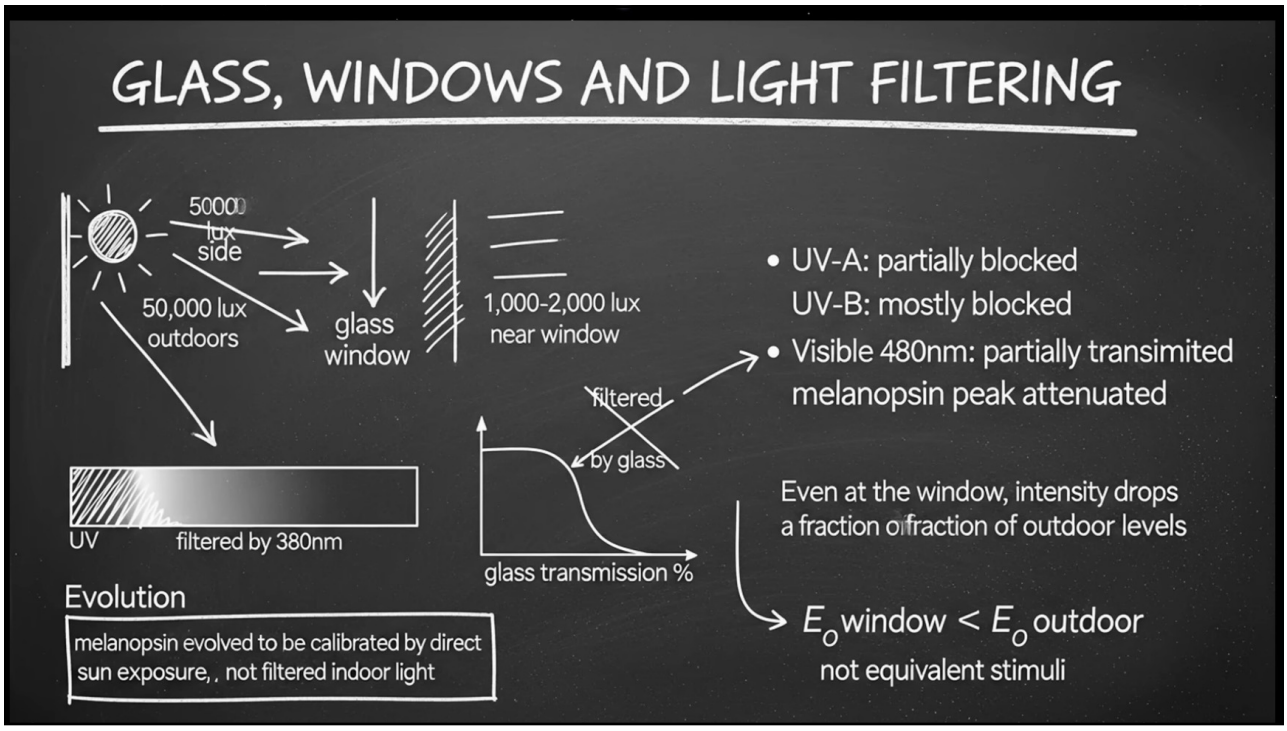

COMFORT PREFERENCE vs. PHYSIOLOGICAL INPUT
Cold or cloudy outside?
YES — stay indoors
YES — go outside
Input: comfort preference
INDOOR ENVIRONMENT
photon flux = 0 through walls
UVB penetrates cloud
photons arrive through cold air
Input required: photons only
D3 synthesis = 0 (no photons)
D3 synthesis = k·I(λ)·[7-DHC] > 0
Cold ≠ photon-absent
Cloud ≠ photon-absent
The decision to stay inside declines a physiological input based on comfort — not photochemistry.

21


INDOOR LIGHT CANNOT REPLICATE THE FULL SIGNAL
INDOOR LIGHT THERAPY
emission: ~400–700 nm visible only
UVB: 0
UVA: 0
circadian blue: partial
✓ alertness signal
✗ D3 photosynthesis
✗ NO pathway
SUNLIGHT AT MIDDAY
UVB: present
UVA: present
circadian blue: present
✓ D3 pathway
✓ NO pathway
✓ circadian input
UVB input
UVA input
circadian input
physiological requirement
Sunlight: weather preference → physiological requirement
replication requires all three bands simultaneously — no indoor device achieves this

22



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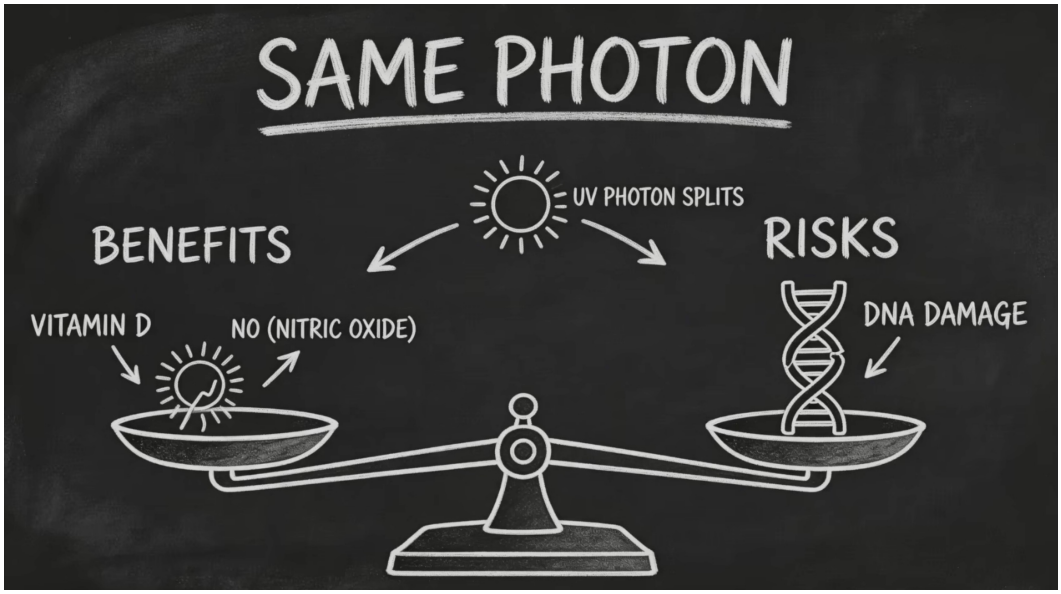

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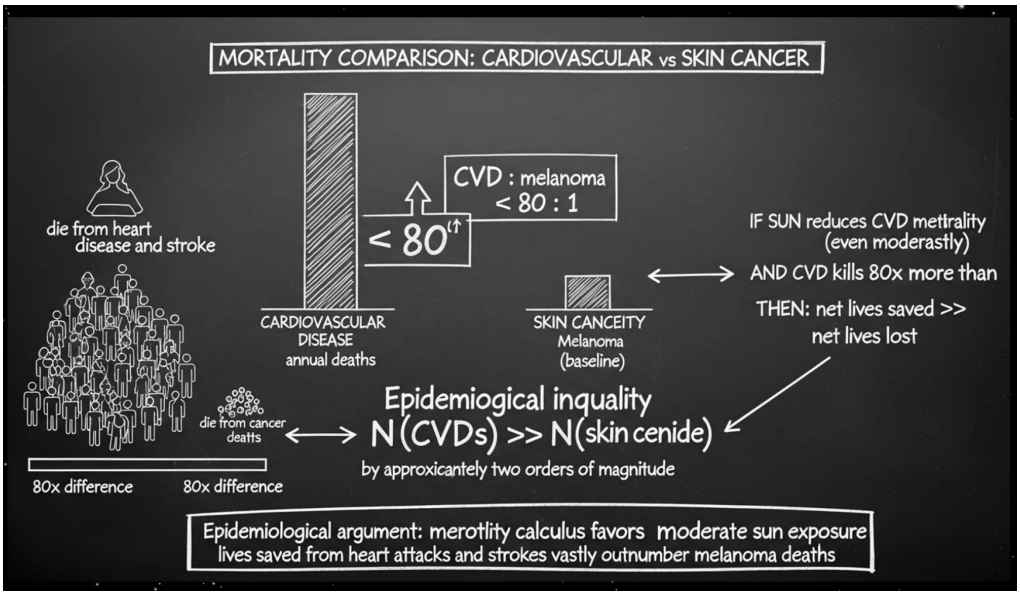

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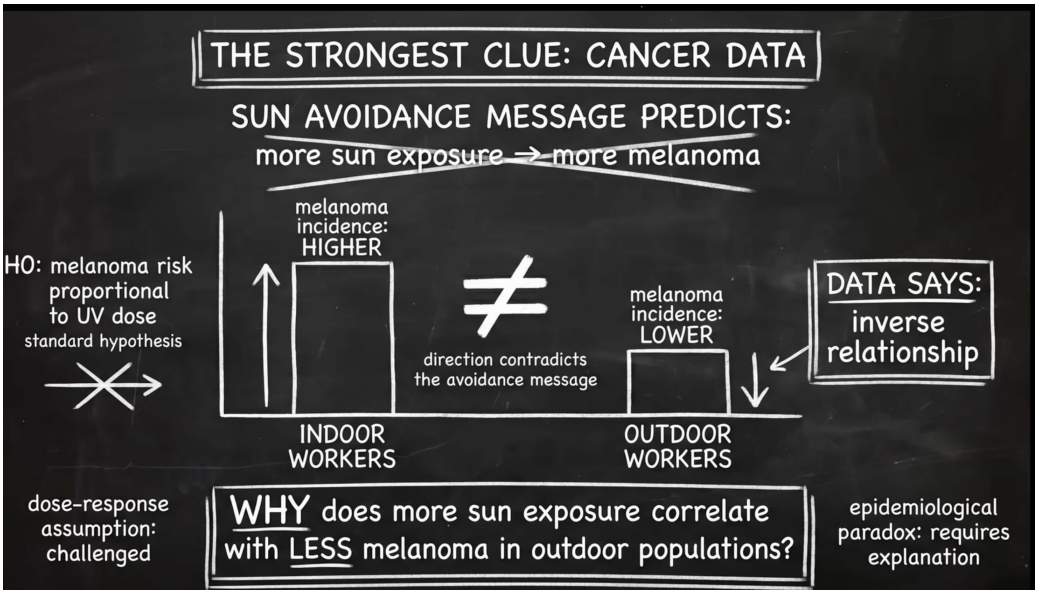

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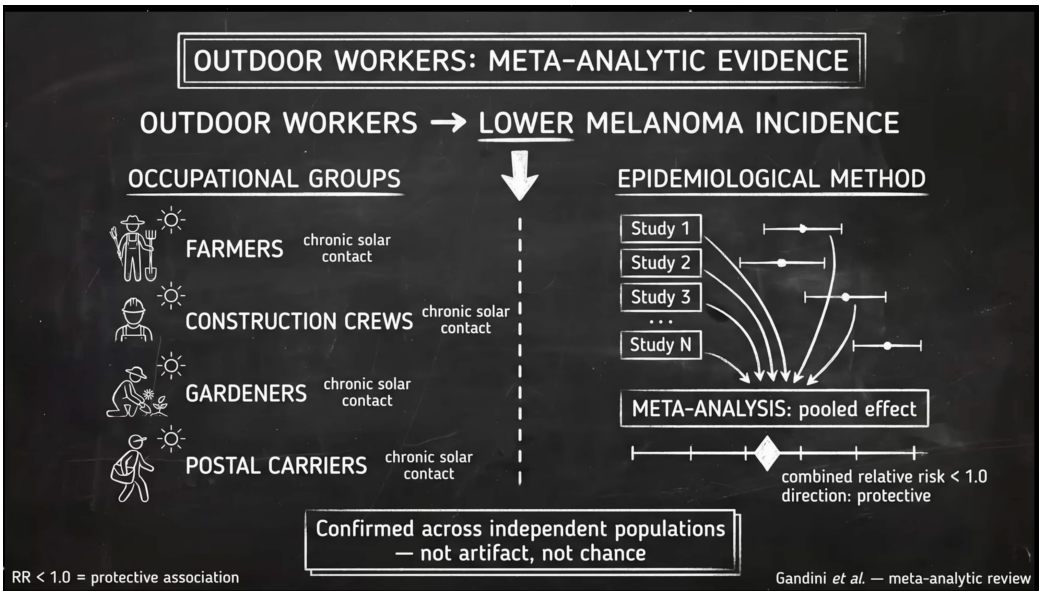

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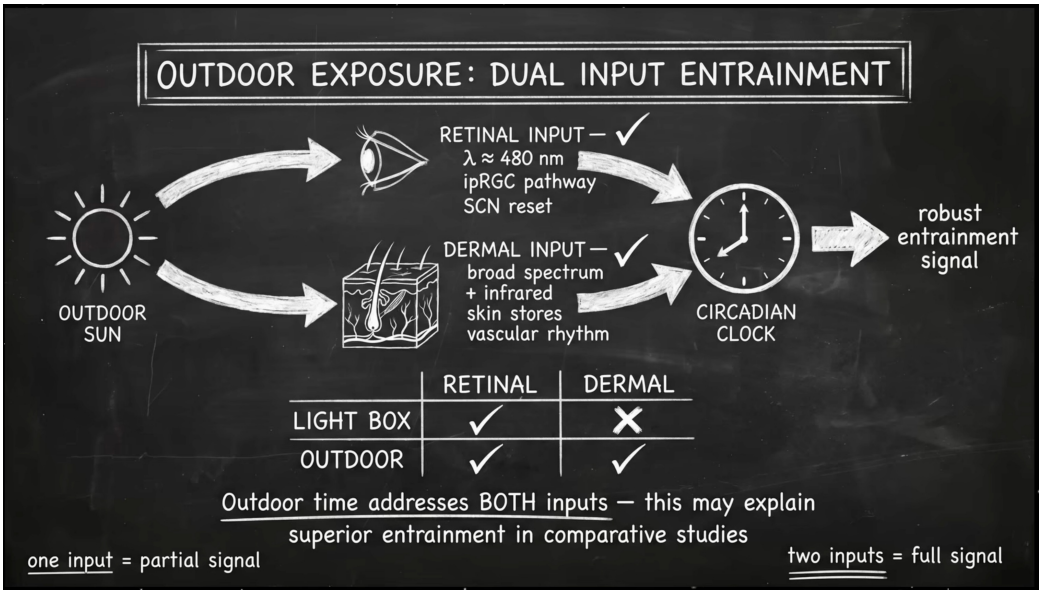

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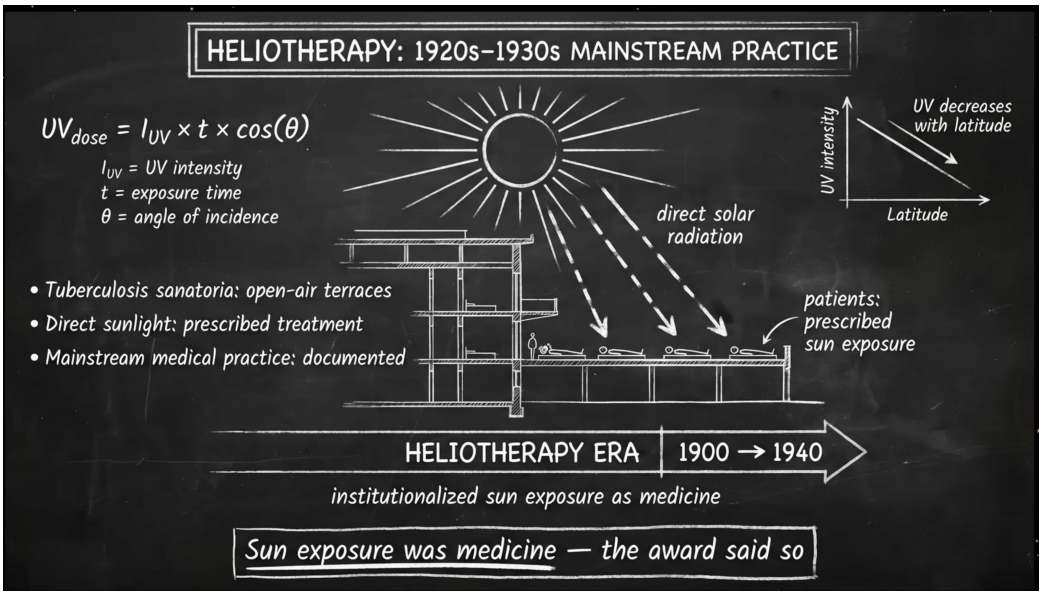

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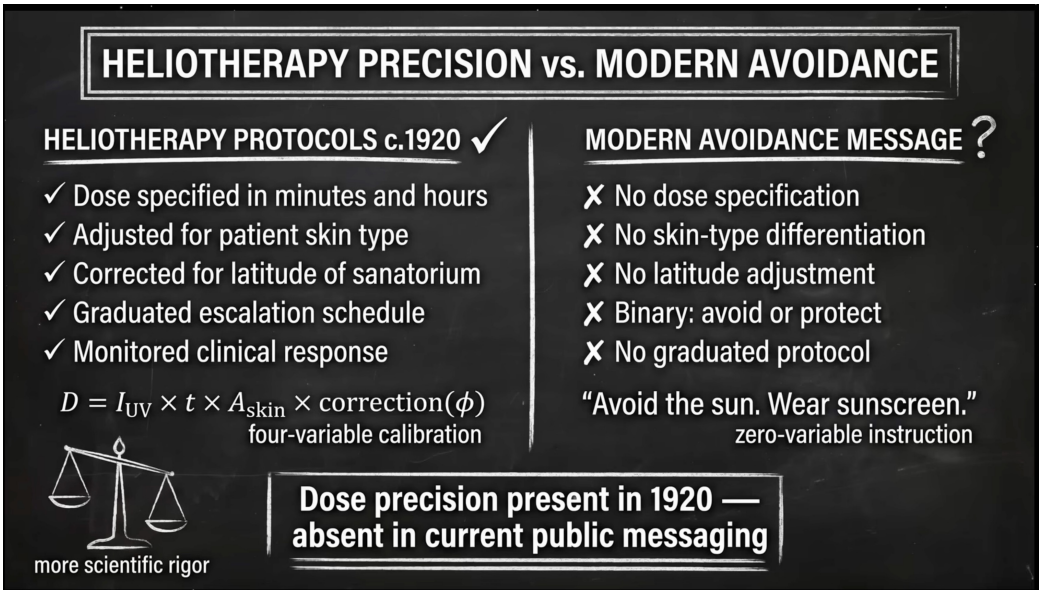

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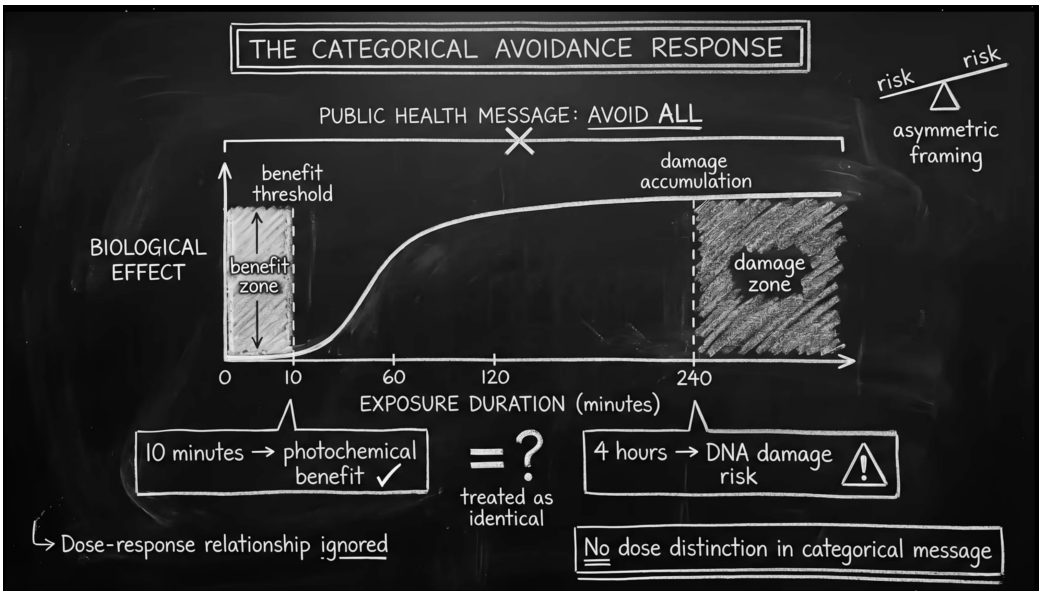

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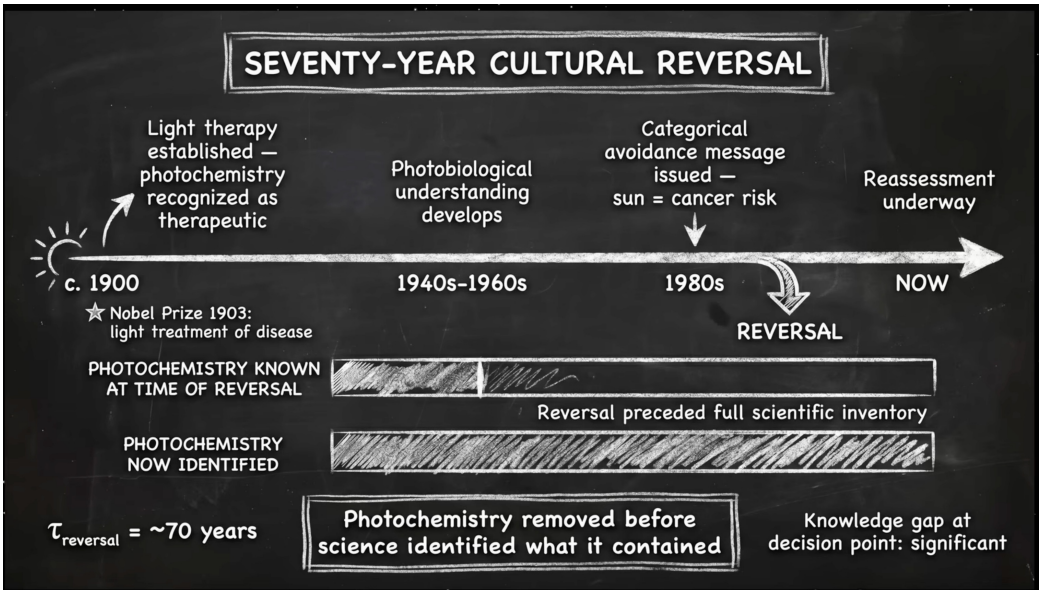

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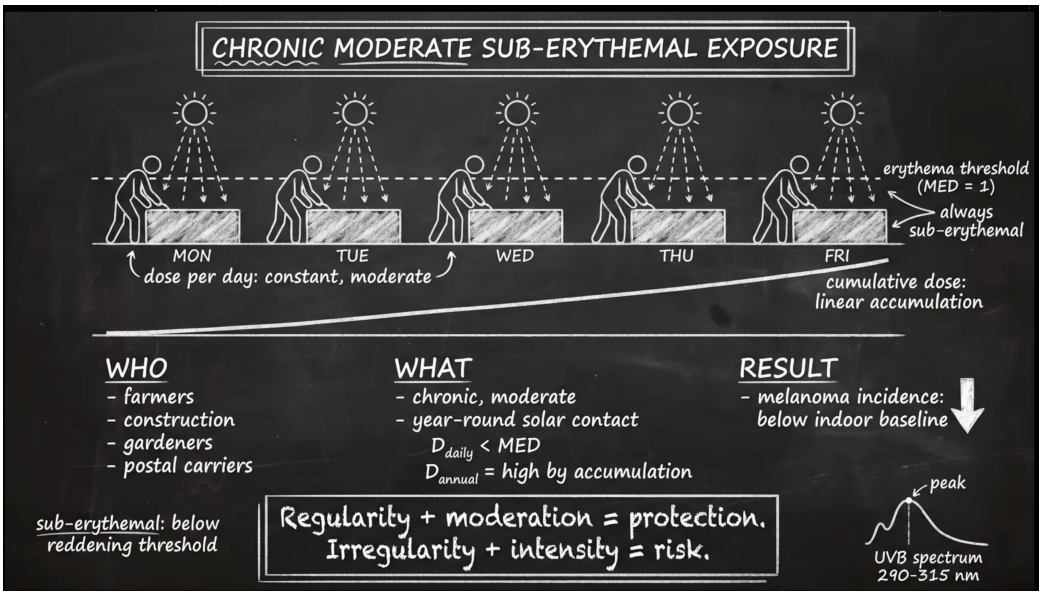

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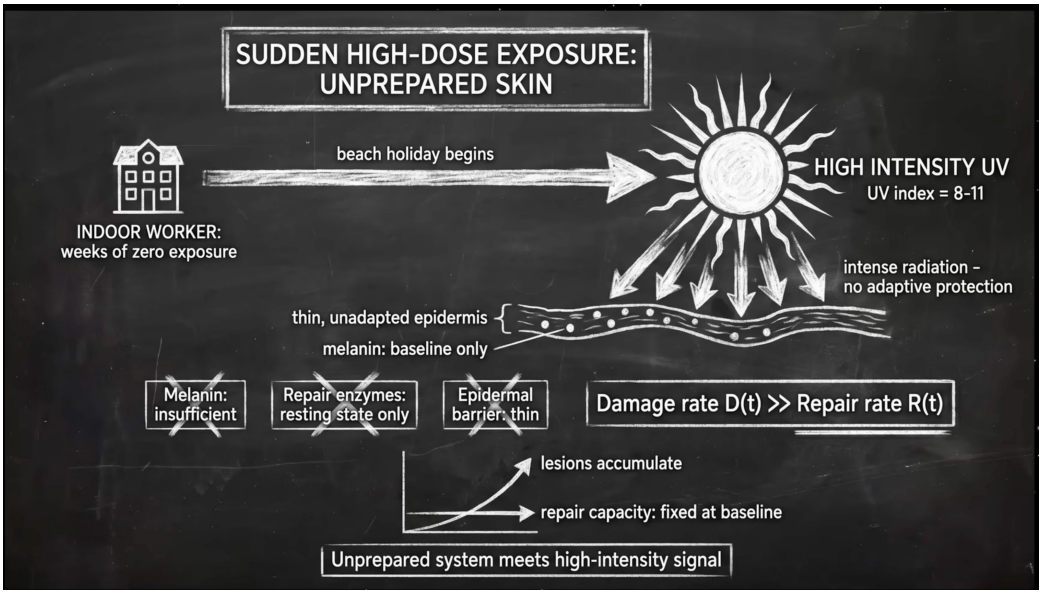

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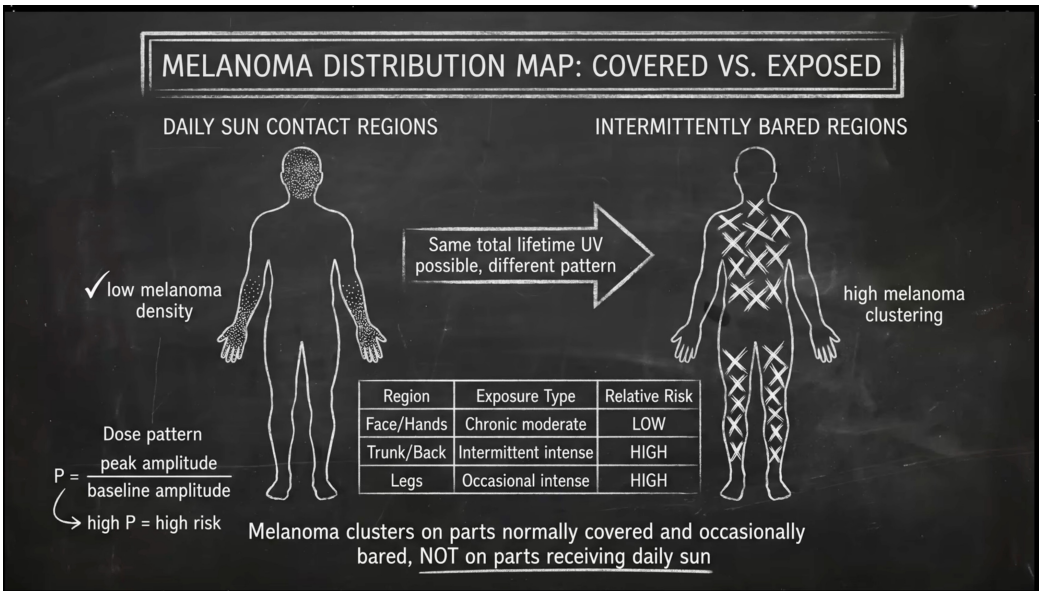

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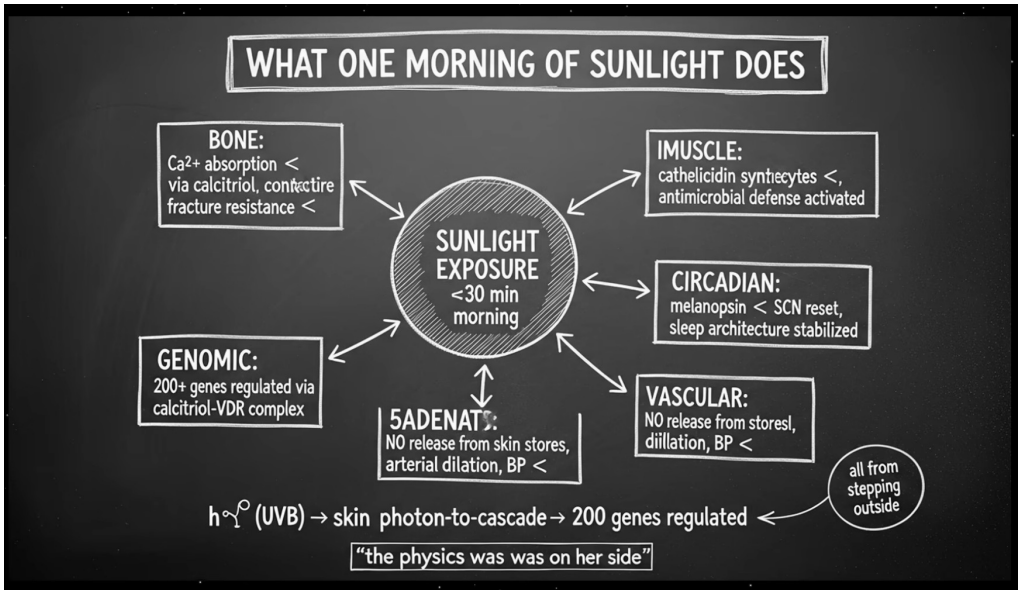

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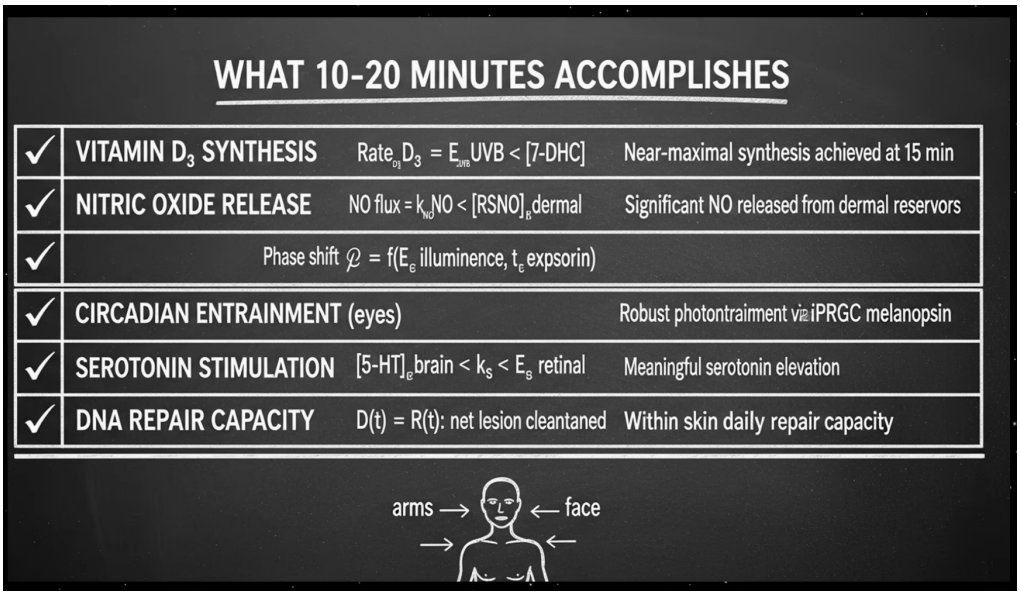

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