UNDERWATER COLORIMETRY

INTRODUCTION

COLOR (RE)PRODUCTION

Dr. Derya Akkaynak | dakkaynak@univ.haifa.ac.il

WHAT WILL I LEARN IN UNDERWATER COLORIMETRY?

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- What is a color space?
- What makes it difficult to measure colors underwater?
- How can we use ordinary cameras to capture colors objectively and repeatably?

WHAT WILL I LEARN IN THIS LECTURE?

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- A PopSci introduction to color: Bluest Blue, Pinkest Pink, Blackest Black!

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- Where in science(s) is color relevant
- Different aspects of color we will not talk about in this course

Public Law 104–294
104th Congress

An Act

Oct. 11, 1996
[H.R. 3723]

To amend title 18, United States Code, to protect proprietary economic information, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Economic Espionage Act of 1996.
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"(1) steals, or without authorization appropriates, takes, carries away, or conceals, or by fraud, artifice, or deception obtains a trade secret;

"(2) without authorization copies, duplicates, sketches, draws, photographs, downloads, uploads, alters, destroys, photocopies, replicates, transmits, delivers, sends, mails, communicates, or conveys a trade secret;

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Walter Liew

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Crime: Conspiracy to commit trade secret theft

Court: US District Court

State: CA

Result: Convicted

Sentence: 180 months

Fine: $511,667

Year of Conviction: 2014

Age at conviction: 56

Employee Type: Industry Employee

Military: n/a

Job: Independent Consultant

Country of Concern: China

Targeted Technology: Industrial Chemical Manufacturing Process

Indicators: Criminal Conduct, Financial Considerations, Foreign Considerations

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- Forfeit ~$28 million in profits

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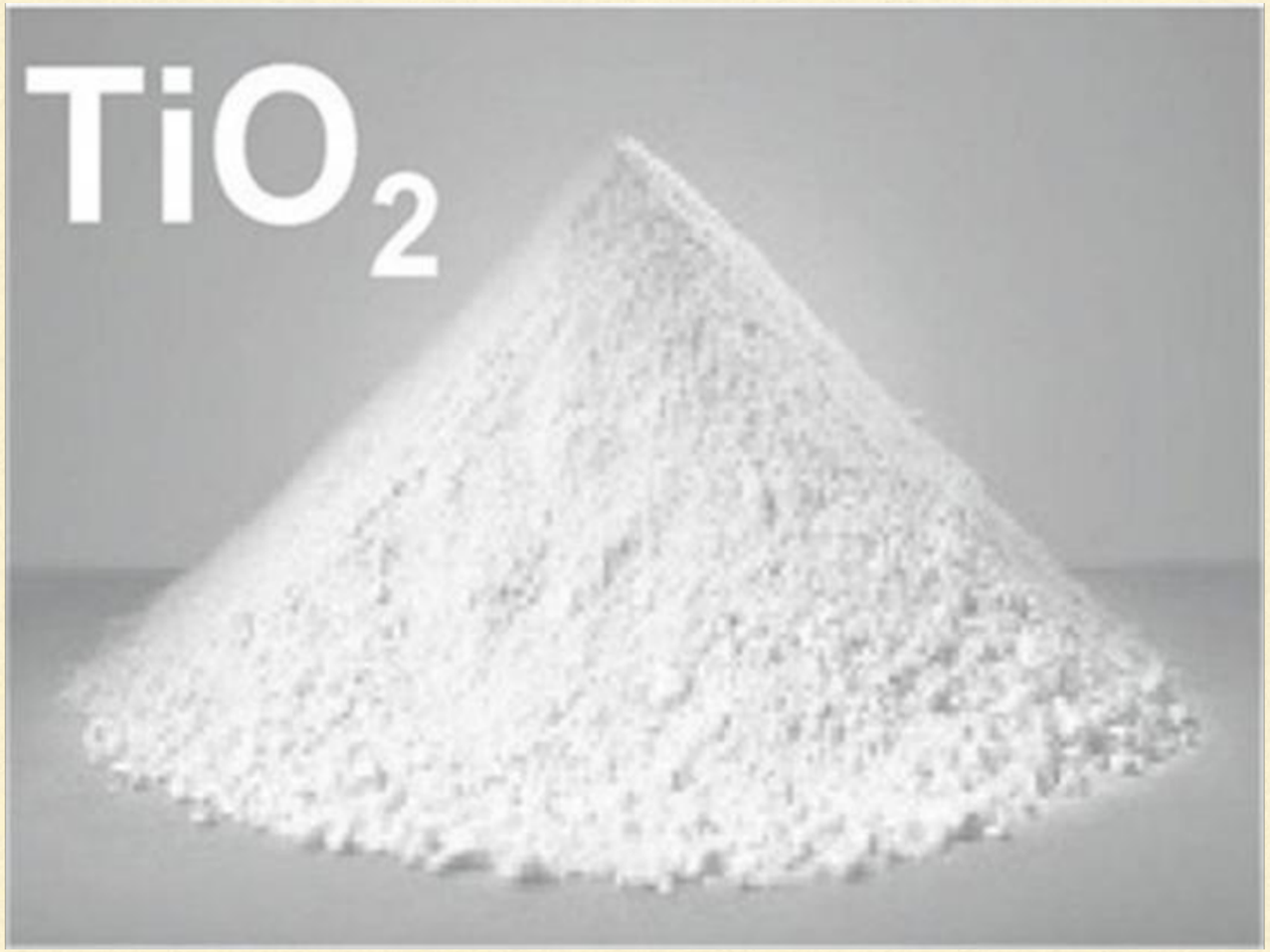
EVERY PAINT ON EVERY WALL!



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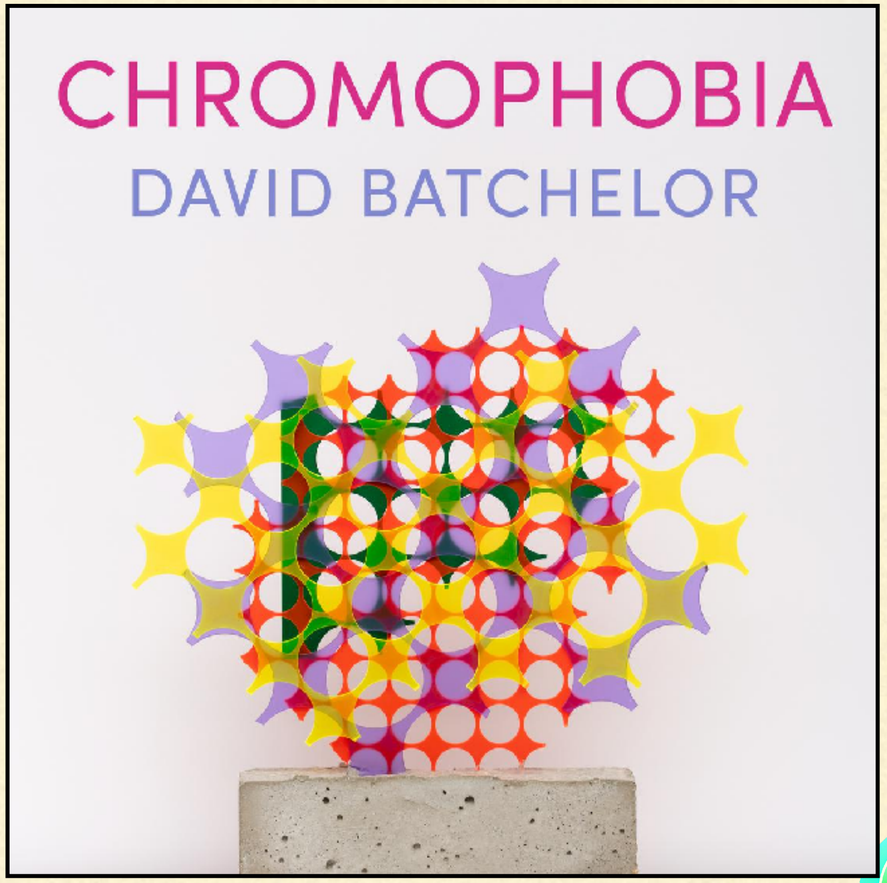
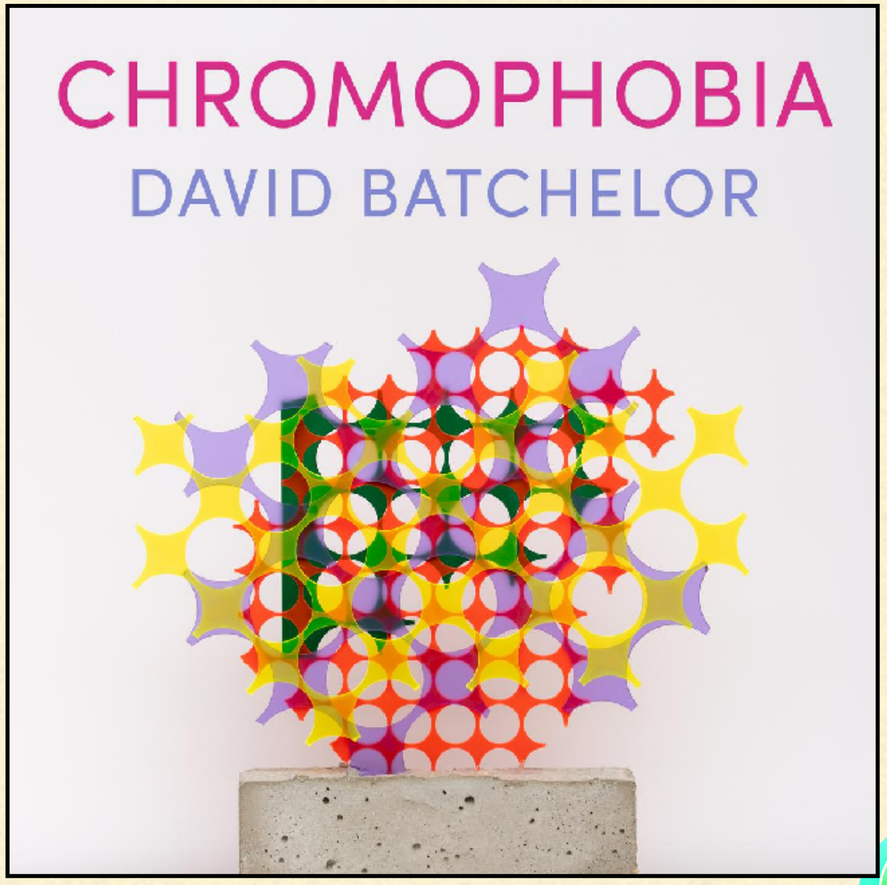
Chromophobia:



Chromophobia:

a bias or distrust of bright or vivid colors, often linked to Western aesthetics that favor minimalism, neutrality, or "seriousness."



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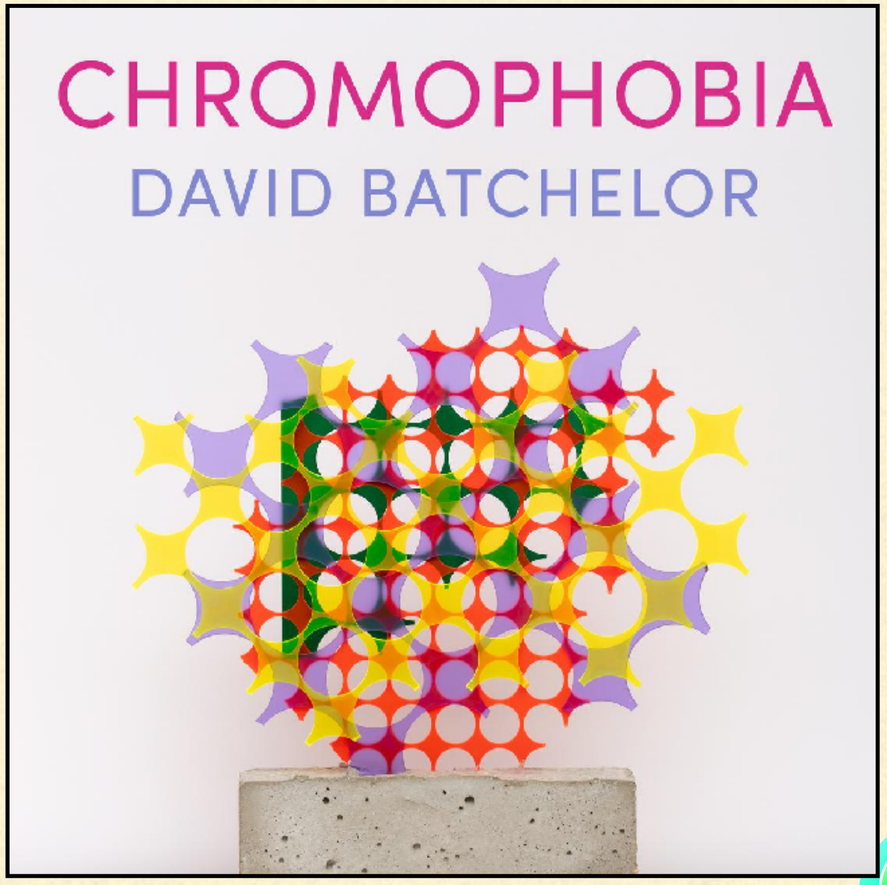
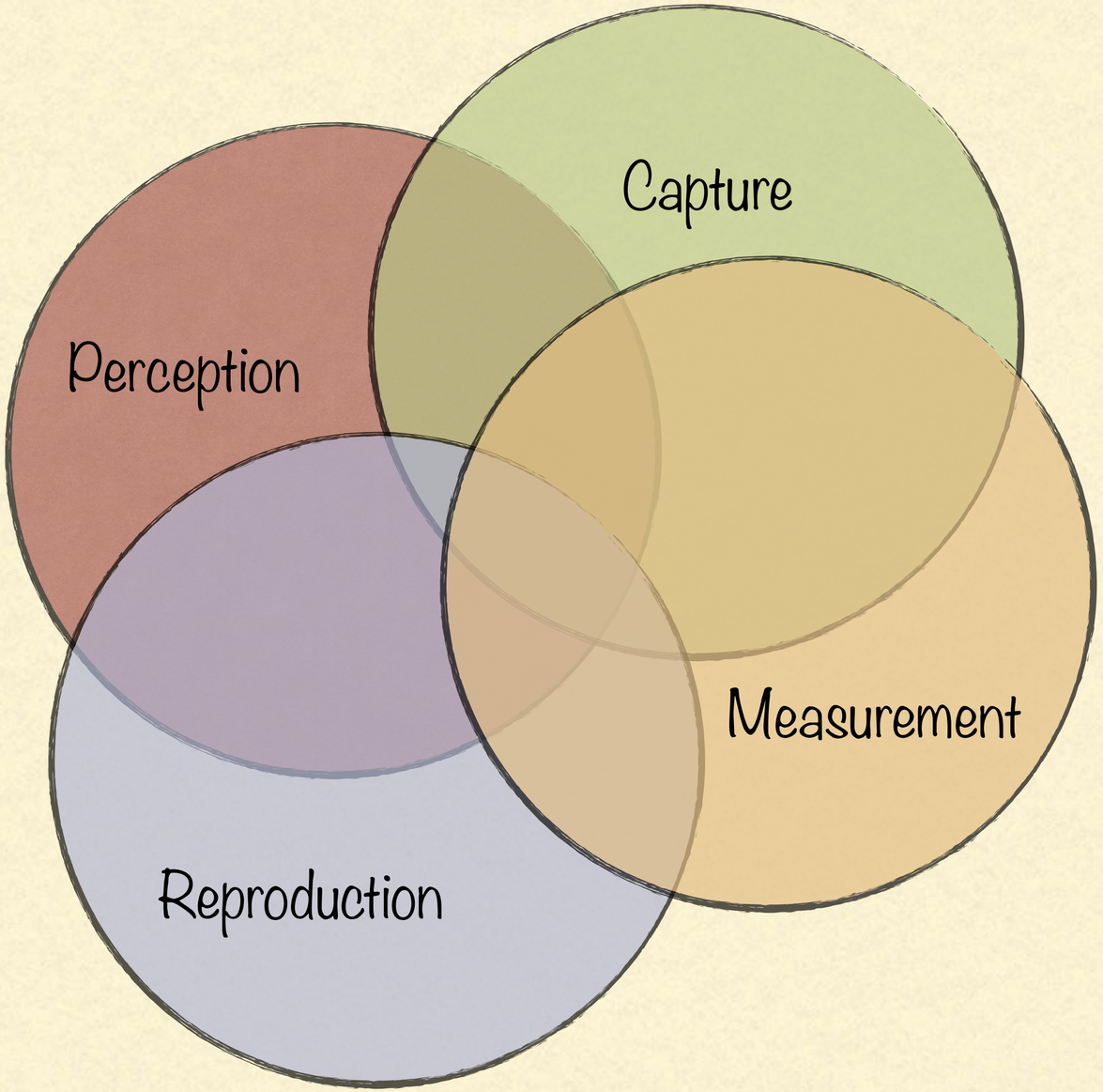
In Western colonialism, Chromophobia manifests itself in the many and varied attempts to purge colour from culture, to devalue colour, to diminish its significance, to deny its complexity.

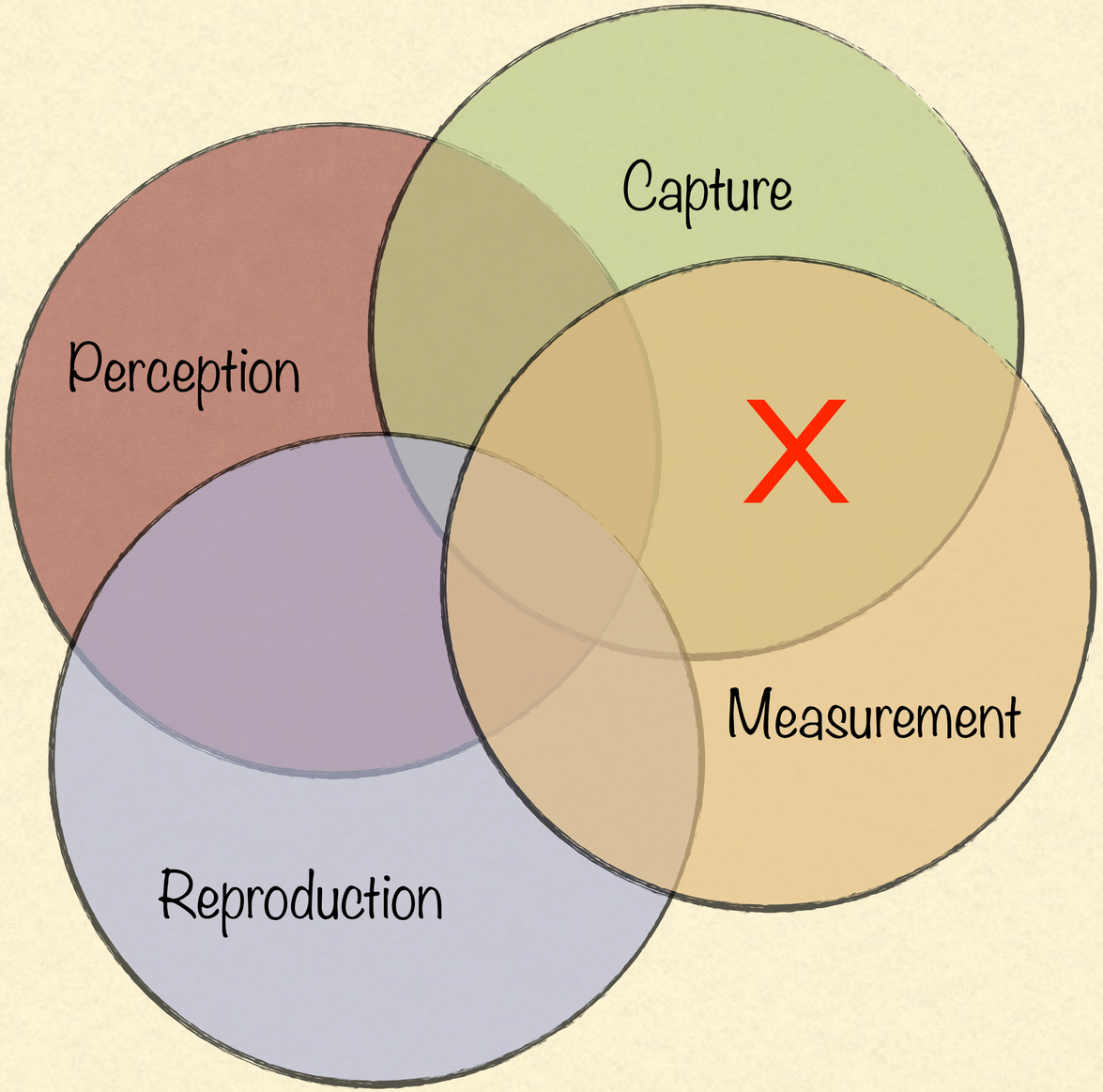
*1) color is made out to be the property of some 'foreign' body - usually the **feminine**, the **oriental**, the **primitive**, the **infantile**, the **vulgar**, the **queer** or the **pathological**.*

*2) color is relegated to the realm of the **superficial**, the **supplementary**, the **inessential** or the **cosmetic**.*





Color Is Complex

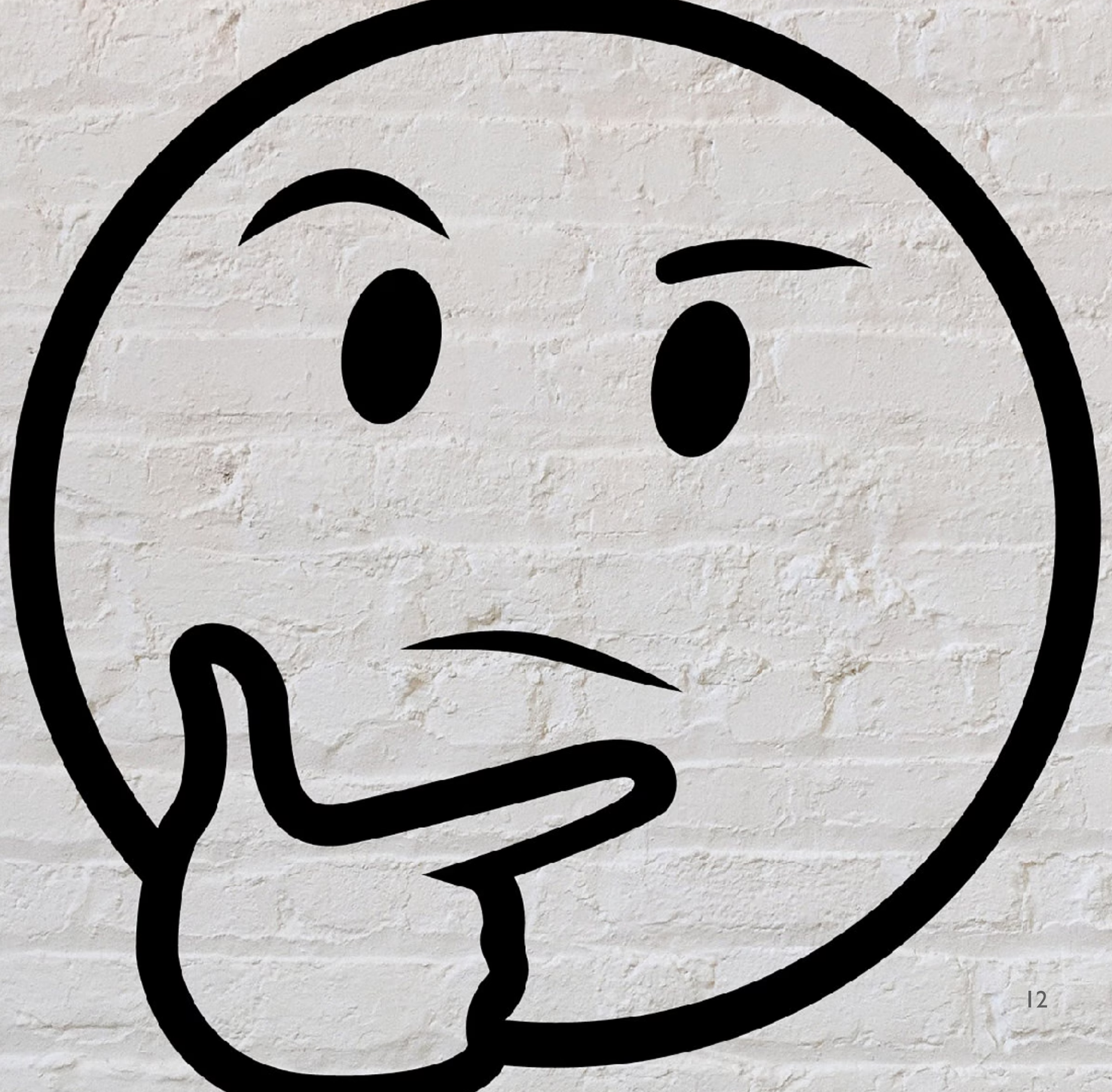


Color Is Complex

Lascaux Cave Paintings (France) 18,000-15,000 B.C.E

Cuevas de las Manos (Argentina) 11,000-7,000 B.C.E

WHERE DOES COLOR COME FROM?



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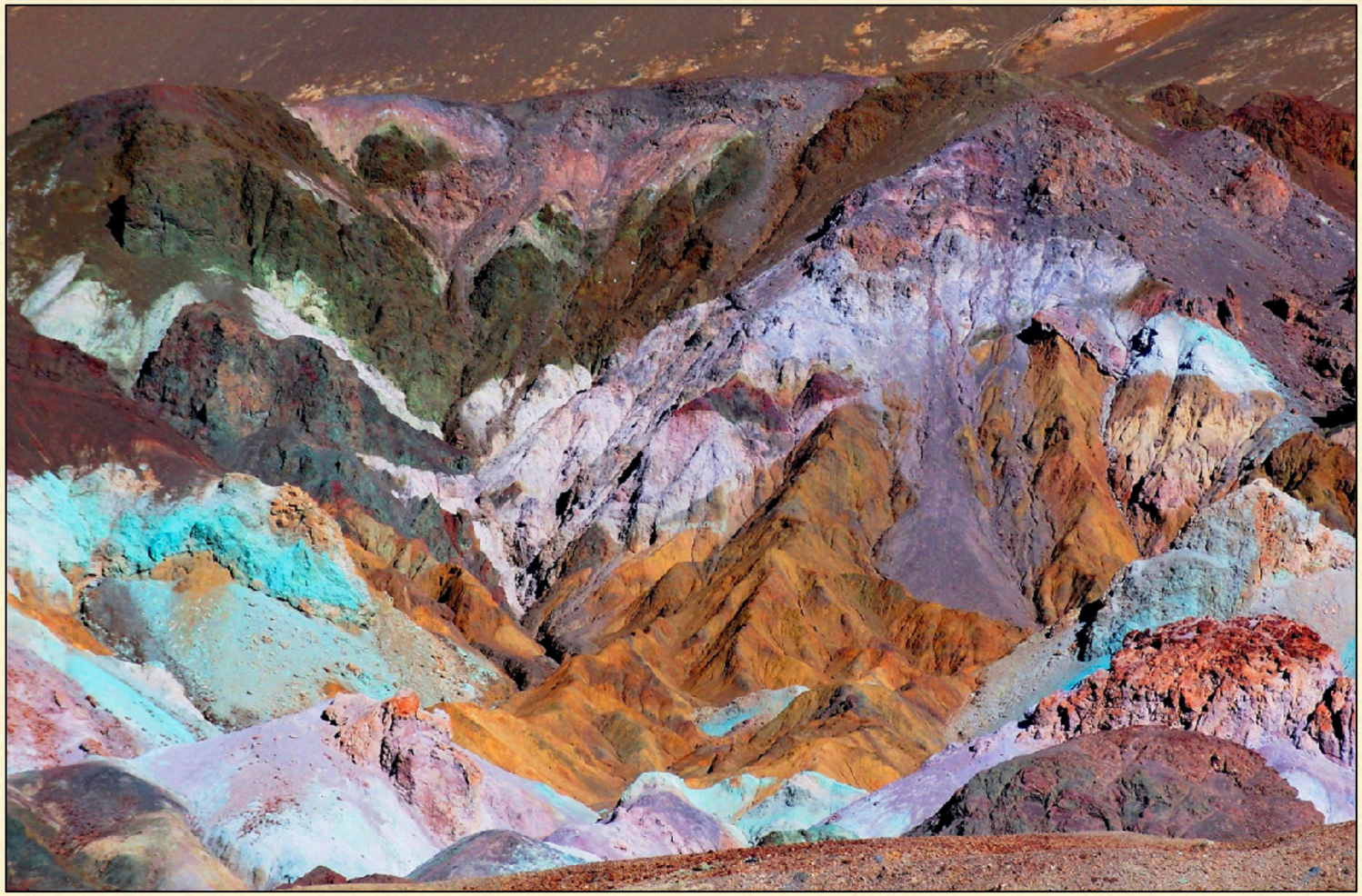

Rocks ✓

Death Valley, CA USA

Where Does Color Come From?

Rocks ✓

Nallıhan, Ankara Turkey

Where Does Color Come From?

Photo credit: https://www.biblewalks.com/

Timna Valley, Eilat Mountains

Rocks ✓

Photo credit: Yaakov Shkolnik

Where Does Color Come From?

Rocks ✓

Bugs

Where Does Color Come From?

Rocks ✓

Bugs

Side Note

CNN Health | Life, But Better | Fitness | Food | Sleep | Mindfulness | Relationships

FDA bans red dye No. 3 from food, drinks and ingested drugs in the US

By Kristen Rogers, CNN

7 minute read · Updated 10:50 AM EST, Wed January 15, 2025

The Most Expensive Dye of the Ancient World

Photo: Israel antiquities authority

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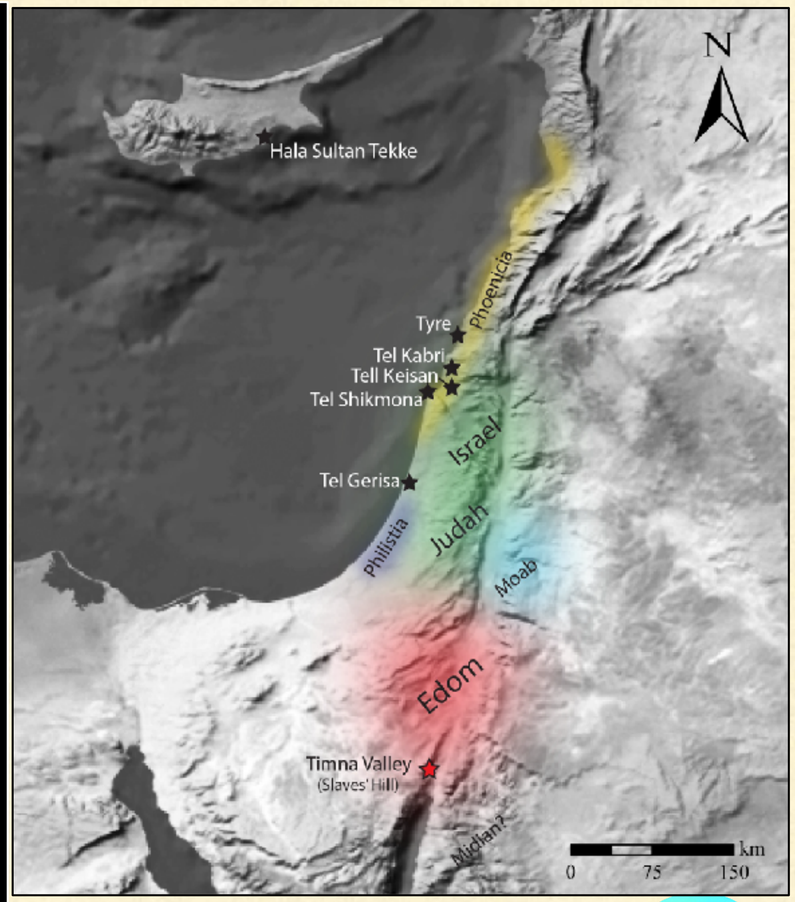

Early evidence of royal purple dyed textile from Timna Valley (Israel)
Sukenik, Iluz, Amar et al. PLOS One (2021)

The Most Expensive Dye of the Ancient World

https://youtu.be/IVXqisH6VeM?

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The Most Expensive Dye/Pigment *Today?*

Rocks ✓

Bugs ✓

Marine snails ✓

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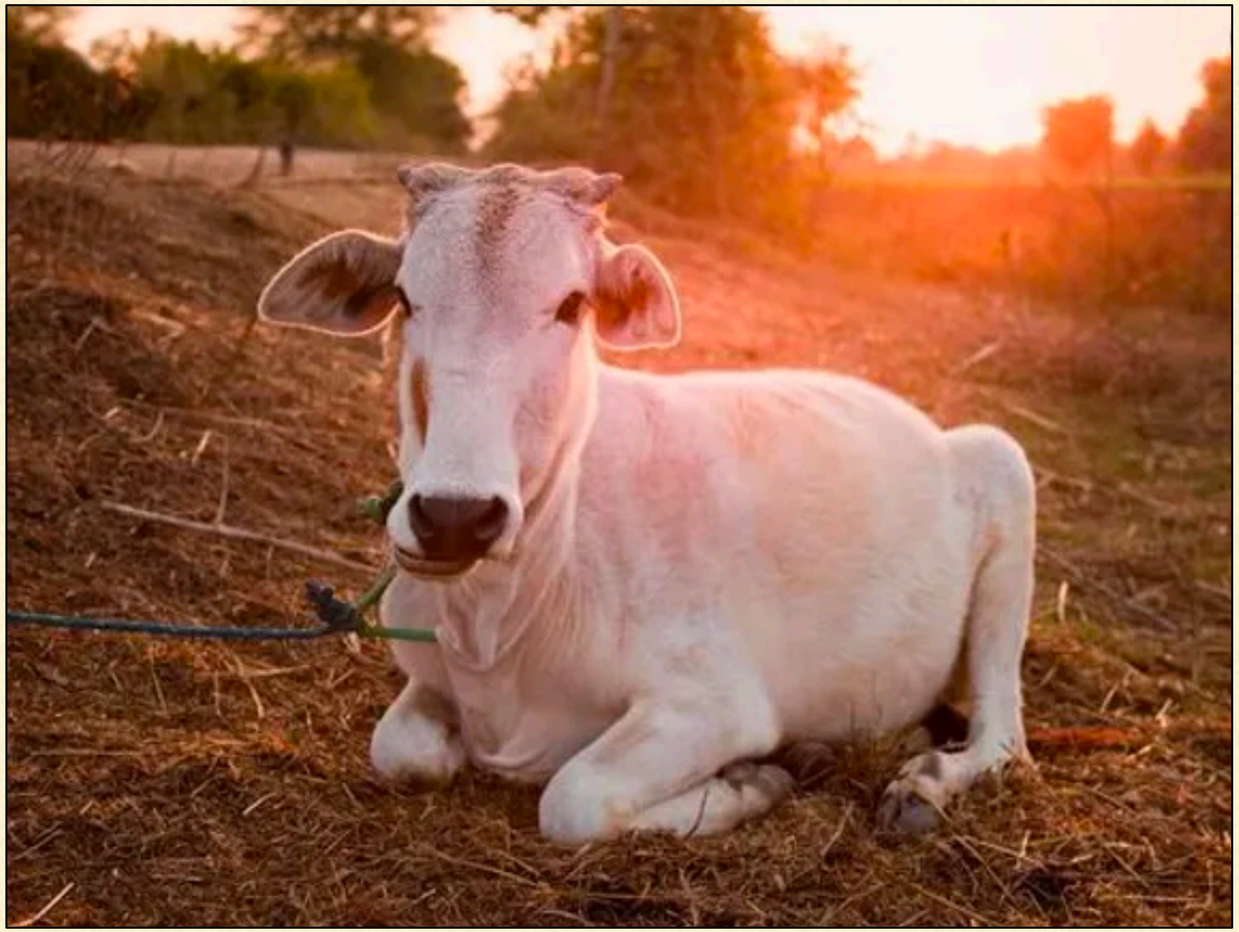

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Where Does Color Come From?

Rocks 

Bugs 

Marine snails 

Plants

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Dried urine of cows feeding on mango leaves

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Oak trees attacked by parasitic wasps

Where Does Color Come From?

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Egyptian mummies

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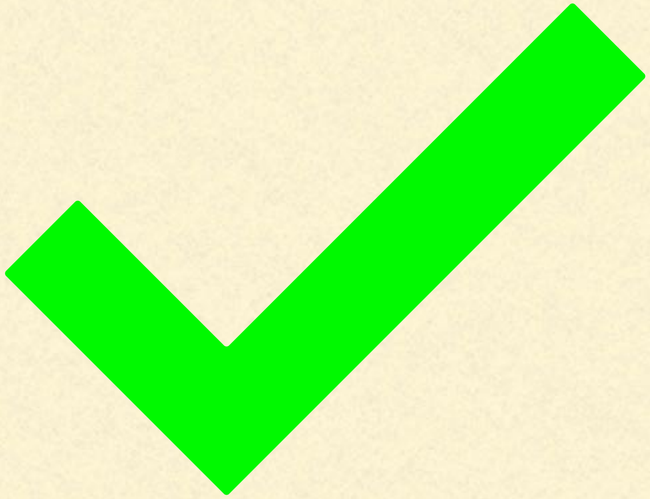
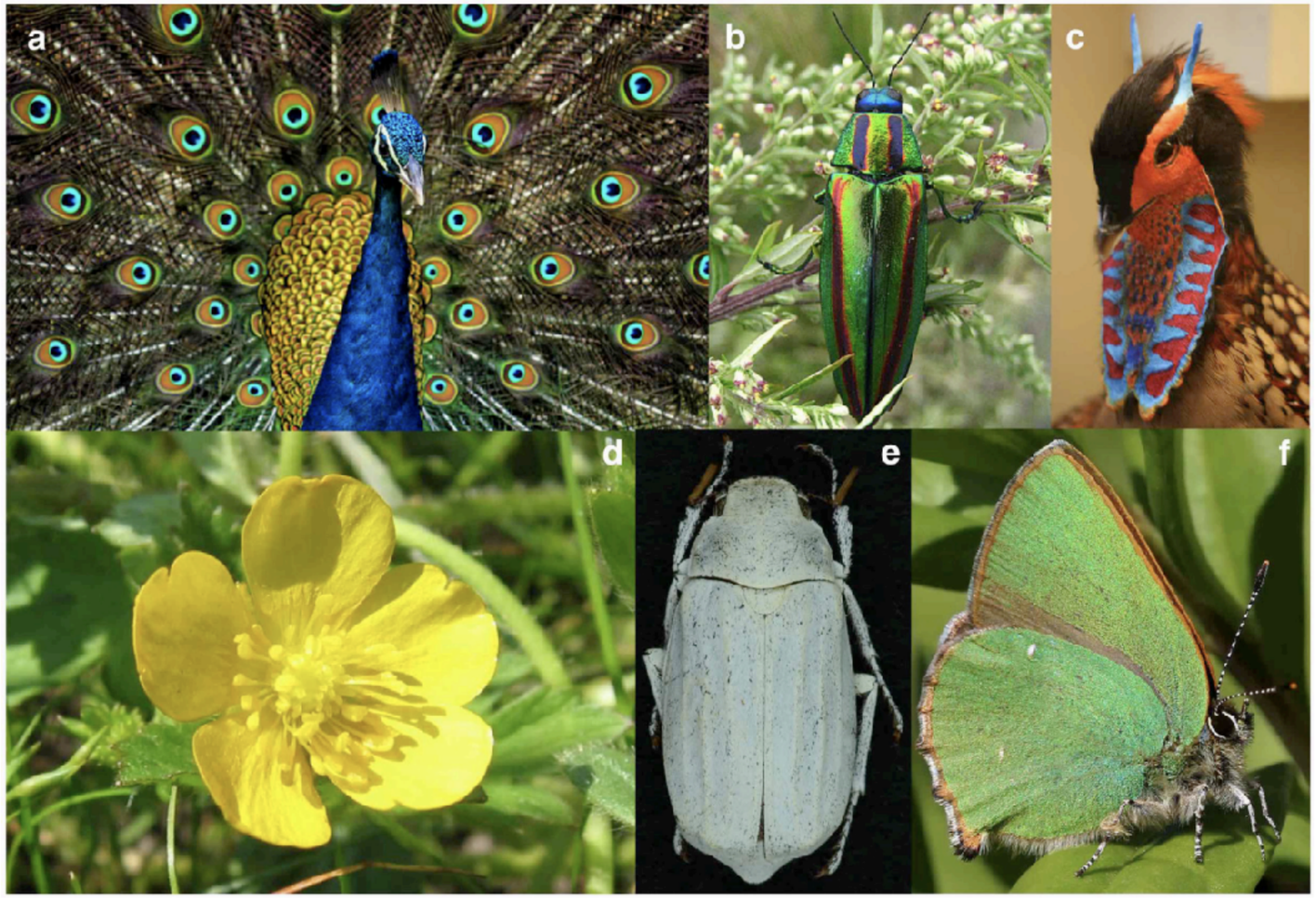


STRUCTURAL COLORATION:
A Physical Way To Make Color



Burg, Stephanie L., and Andrew J. Parnell. "Self-assembling structural colour in nature." *Journal of Physics: Condensed Matter* 30.41 (2018)

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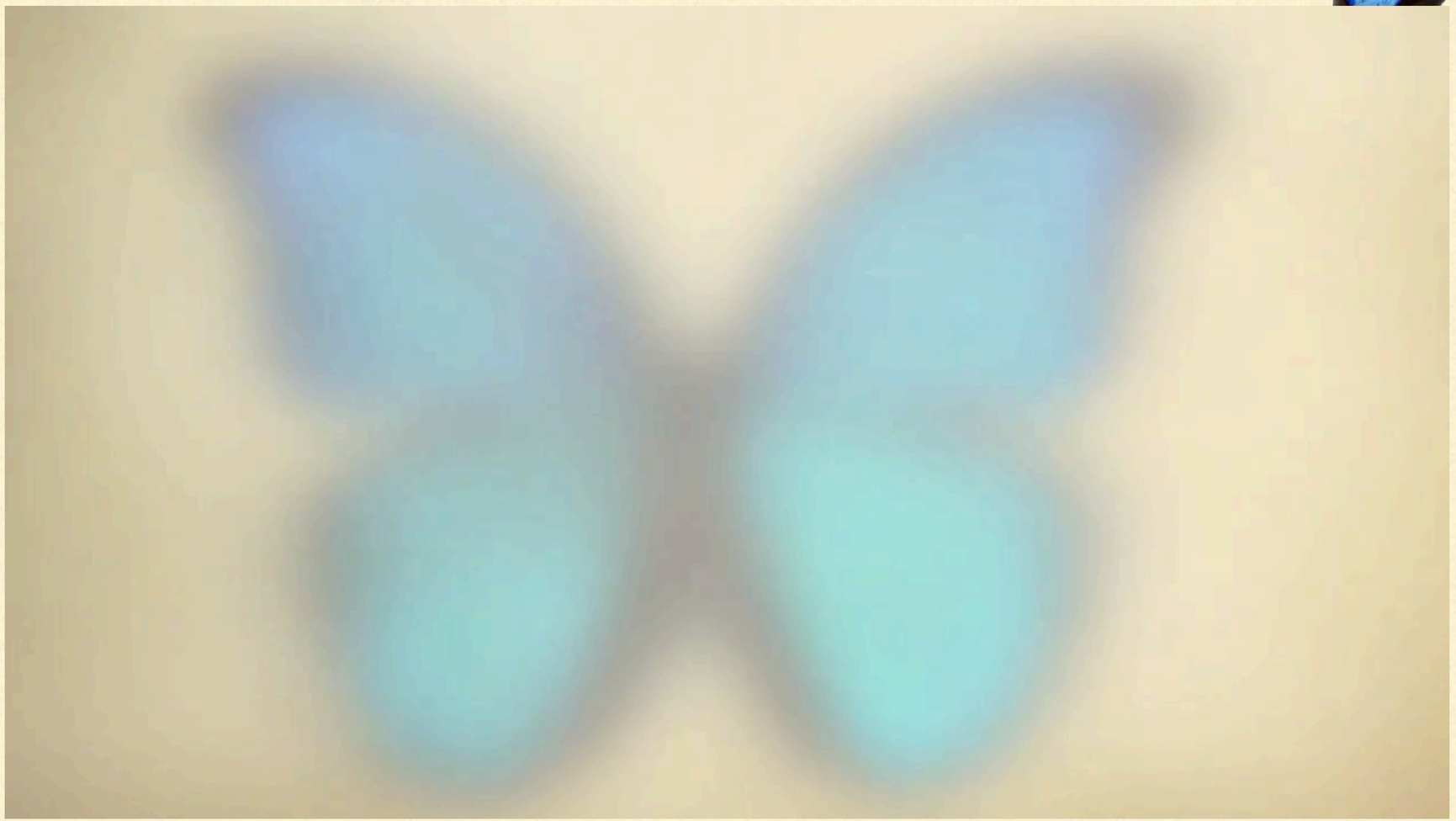

https://www.youtube.com/watch?v=AQ3IRXH1OvI

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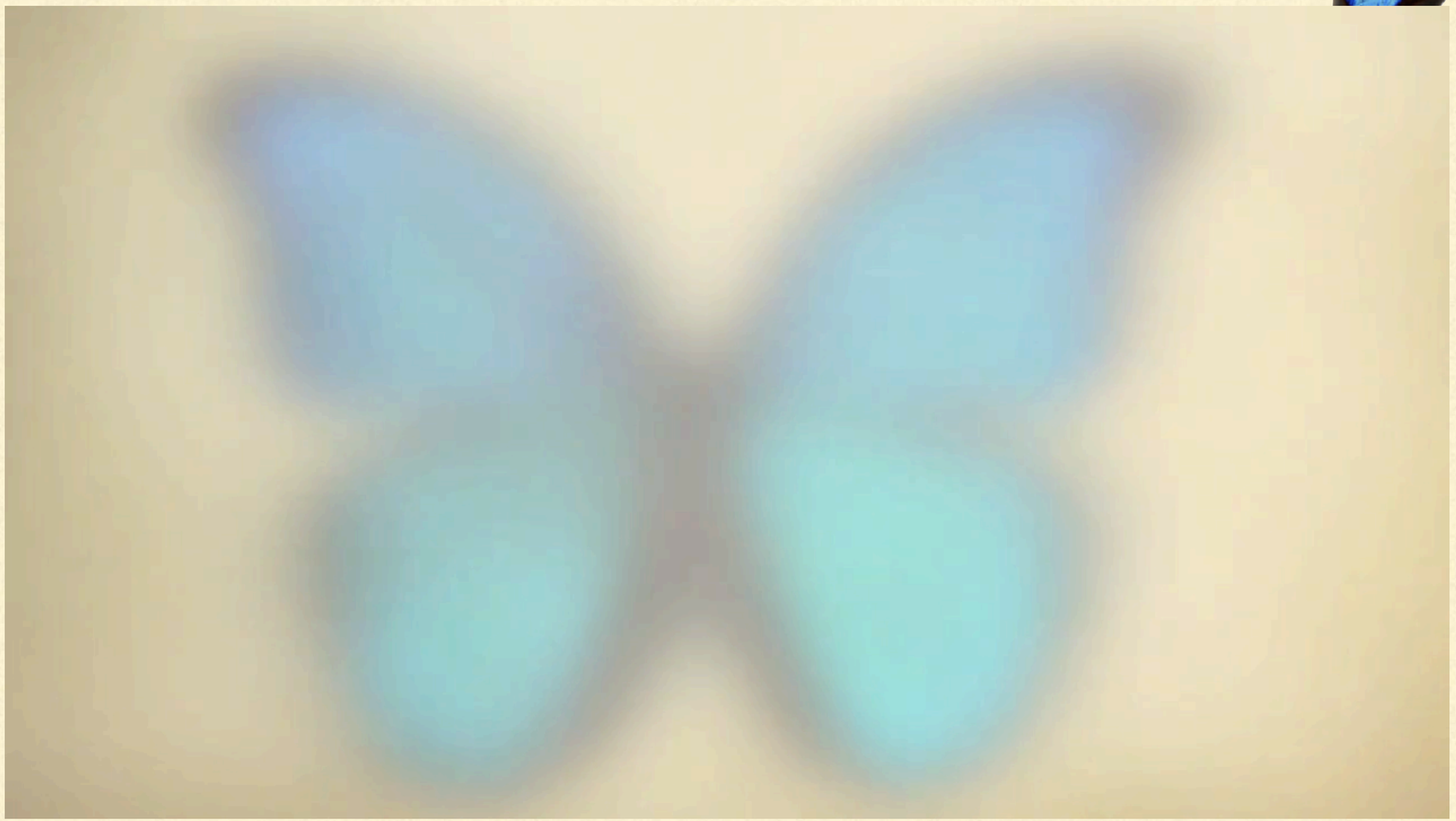

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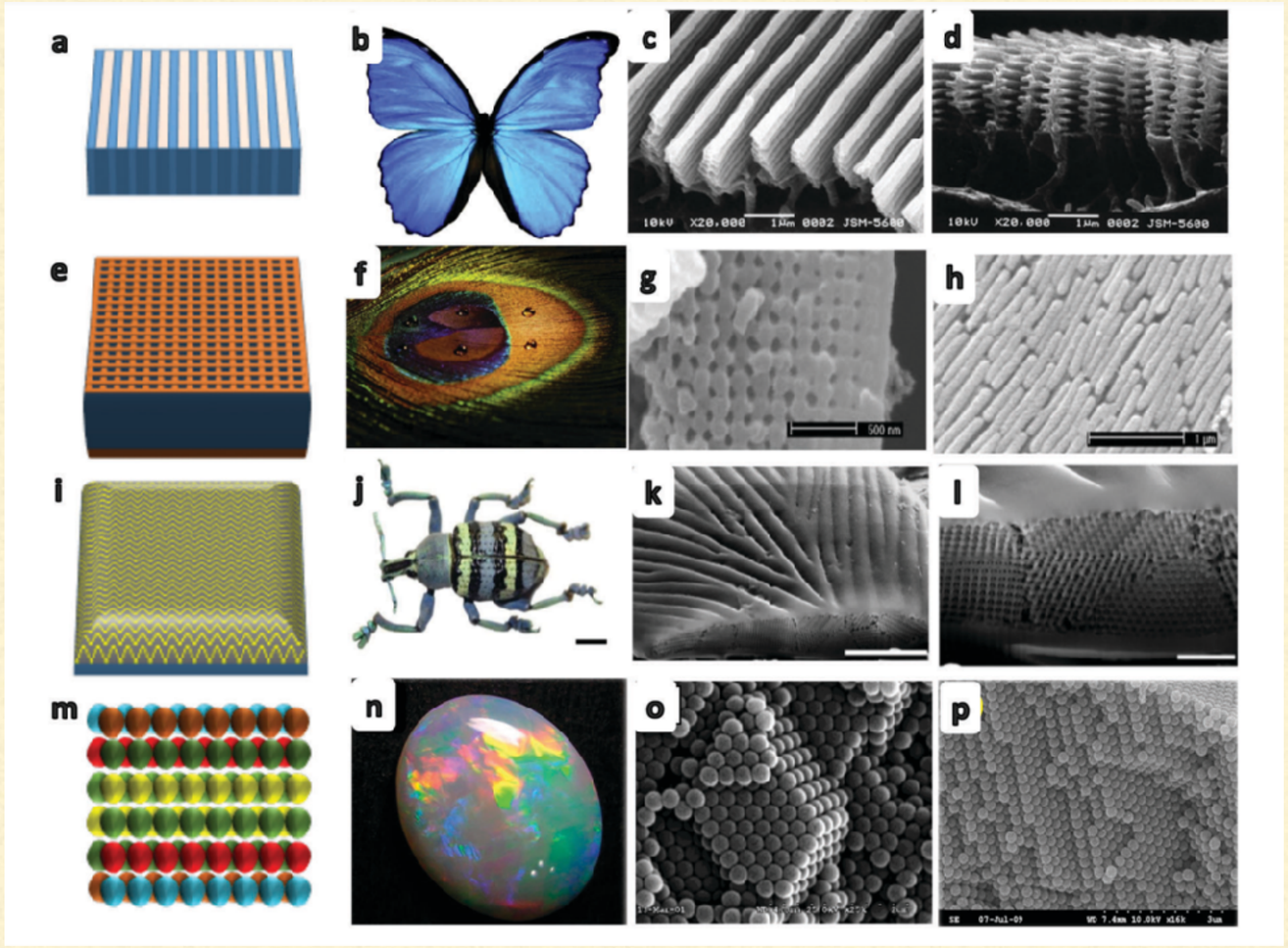

Inan, Hakan, et al. "Photonic crystals: emerging biosensors and their promise for point-of-care applications." *Chemical Society Reviews* 46.2 (2017): 366-388.

What Is the Rarest Color in Nature?

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"The meaning of a word - to me - is not as exact as the meaning of a color."

- Georgia O'Keeffe

https://www.youtube.com/watch?v=yRwoReHd7XU&t=20s

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Back to TiO_2

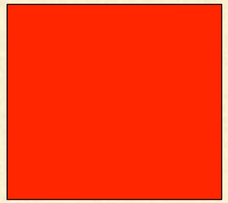
Color is a subjective phenomenon

What is white?

What Is Color?

Color is a subjective phenomenon

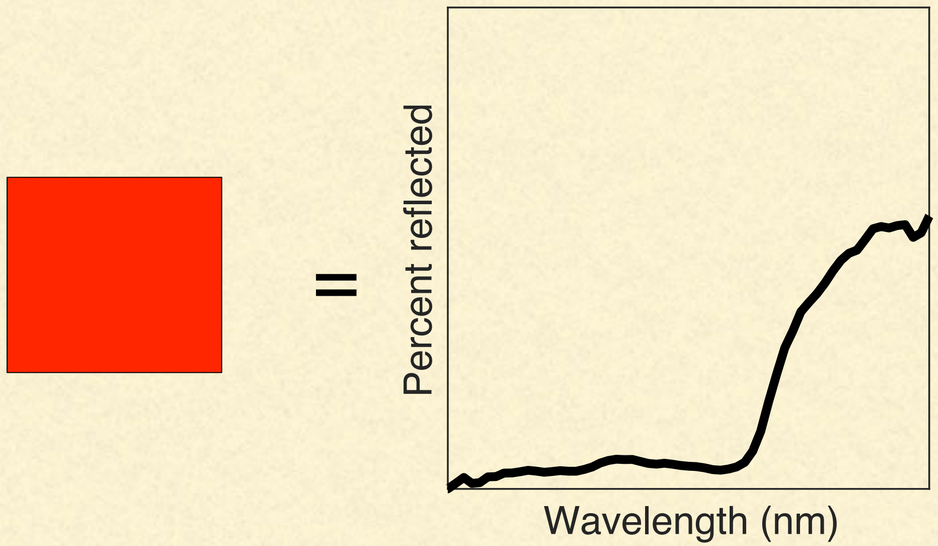
Color



What Is Color?

Color is a subjective phenomenon

Color = Reflectance



What Is Color?

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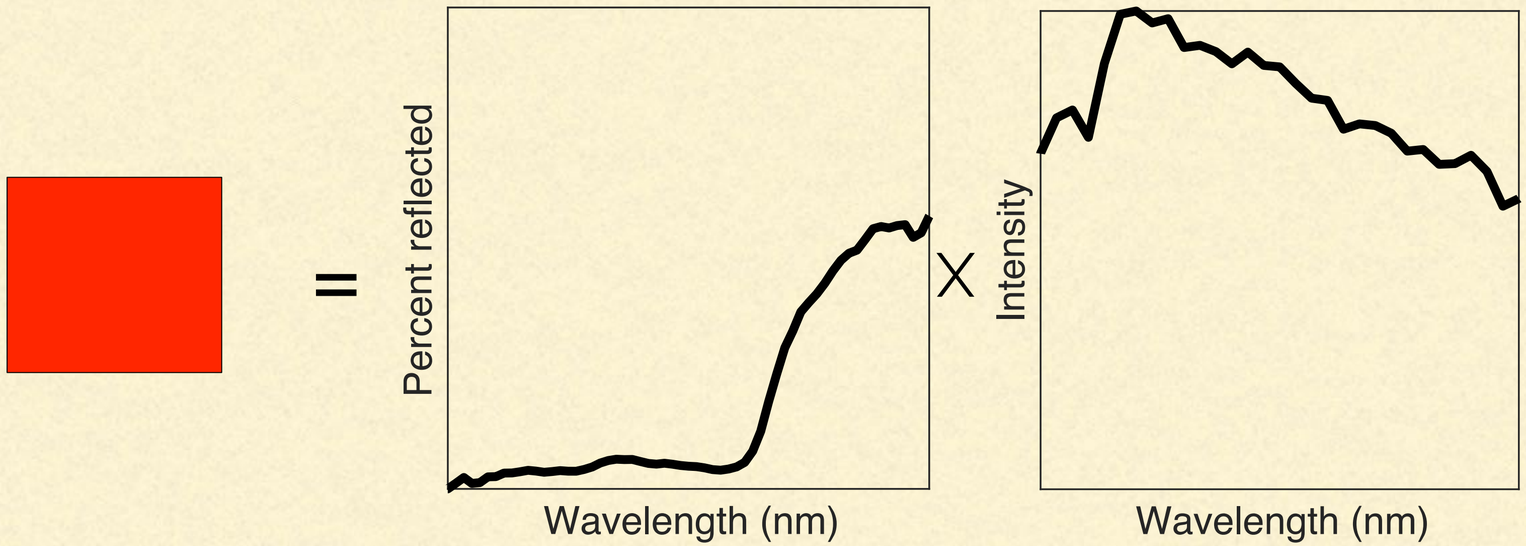
Color = Reflectance X Light



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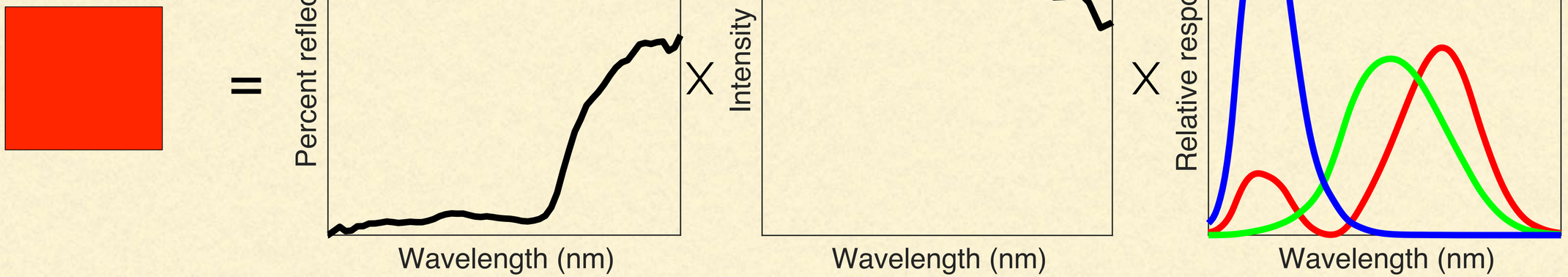
Color = Reflectance X Light X Observer



TiO_2: Every Pain on Every Wall

Color is a subjective phenomenon

https://www.youtube.com/watch?v=zxGJBfnQLWM

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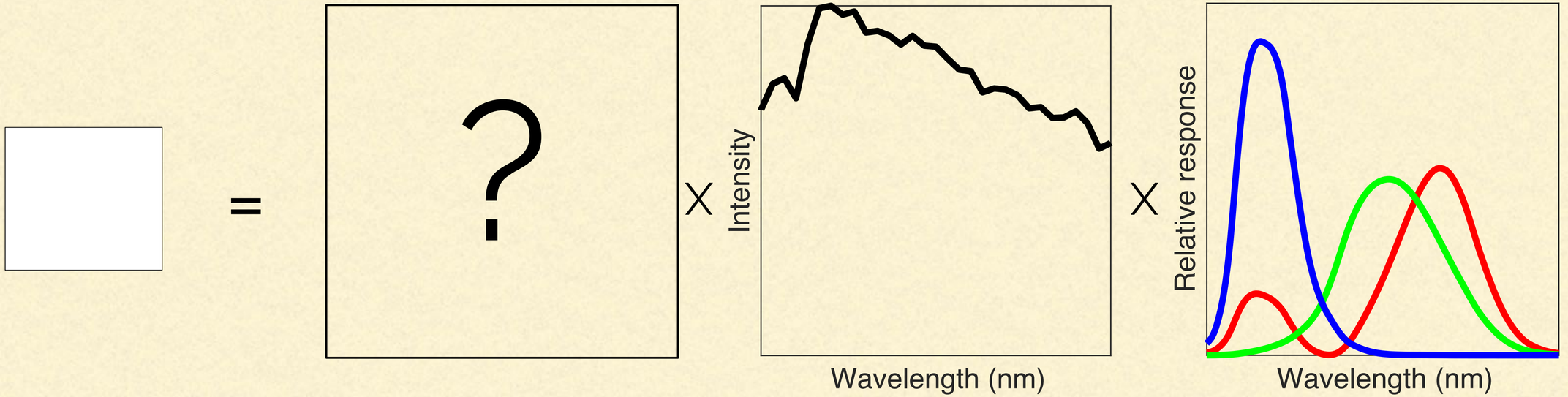

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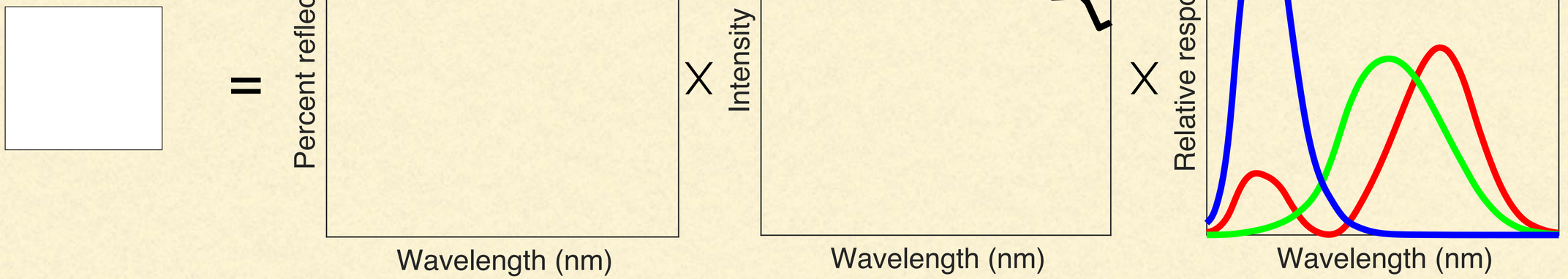
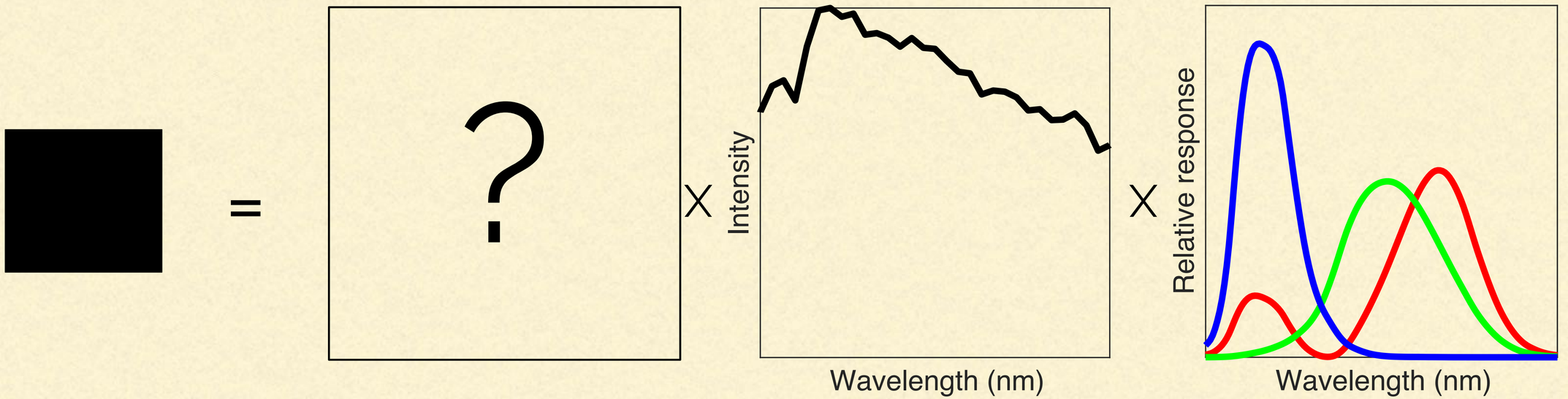


What About **Black**?

Black is very important for underwater colorimetry.

Color = Reflectance X Light X Observer



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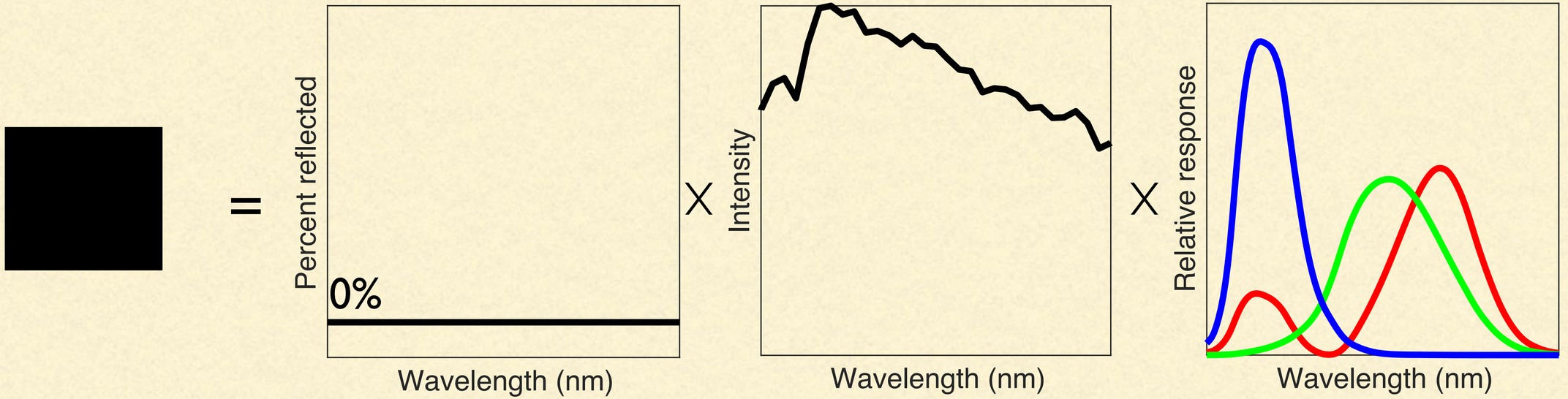

Blackest **Black**

Black is very important for underwater colorimetry.

The superb bird-of-paradise (*Lophorina superba*)

Blackest **Black**
"Structural Absorption"

Black is very important for underwater colorimetry.

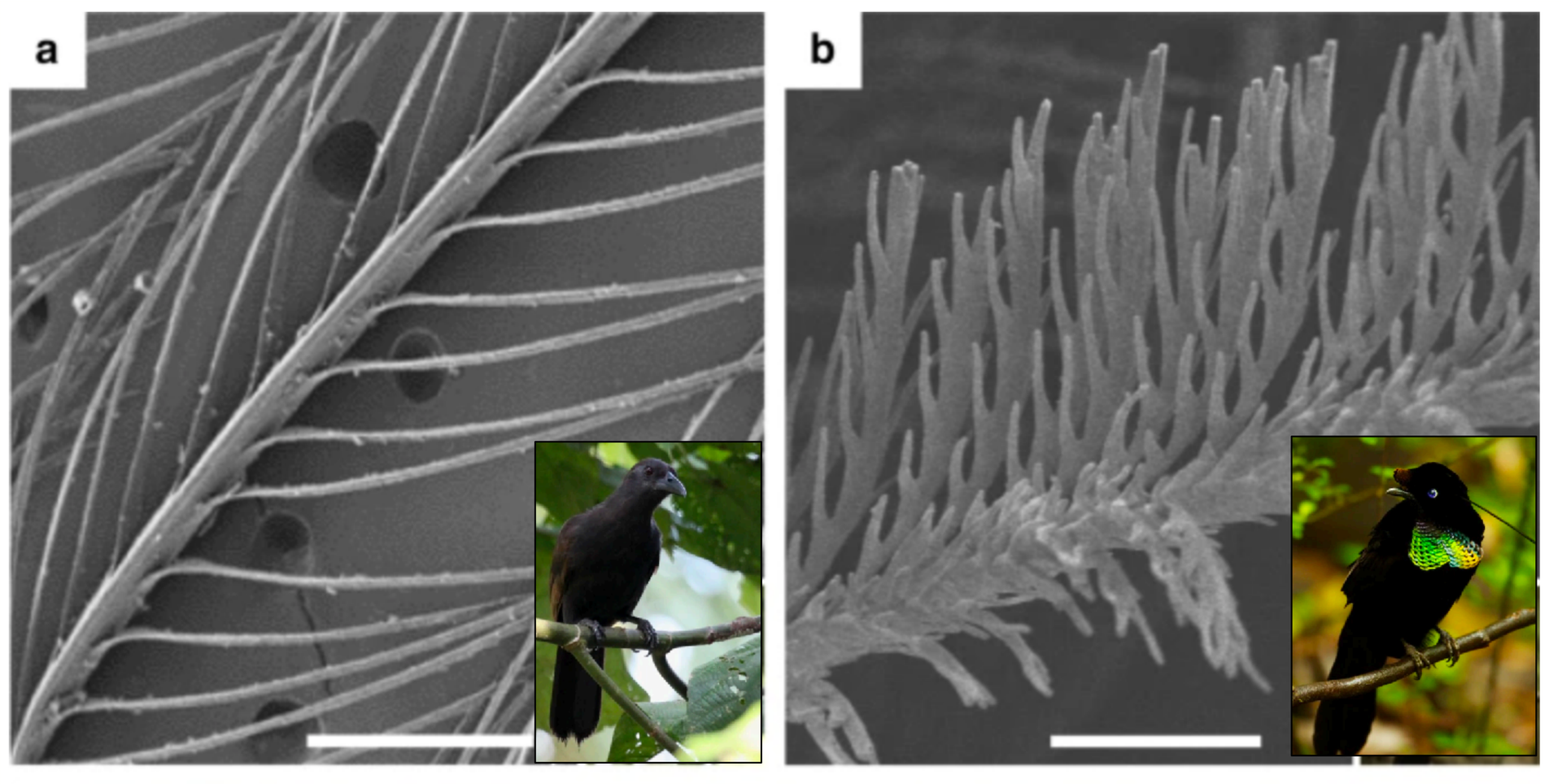

Image from: McCoy, Dakota E., et al. "Structural absorption by barbule microstructures of super black bird of paradise feathers." *Nature communications*, 2018

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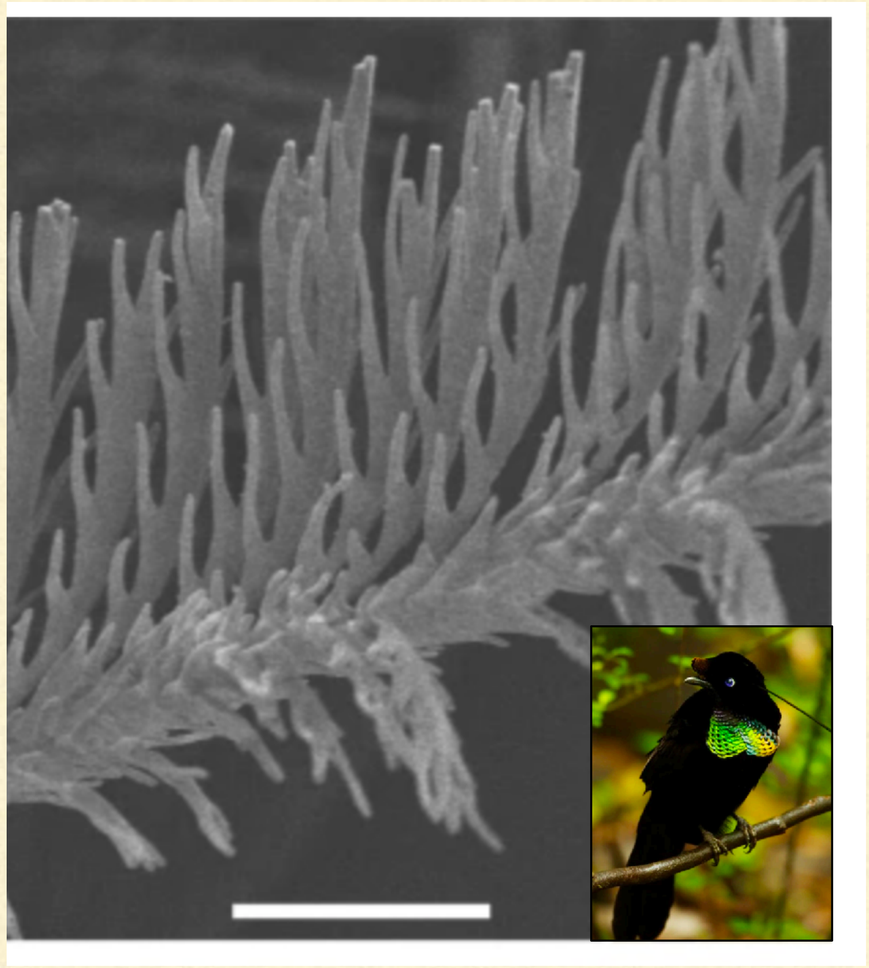
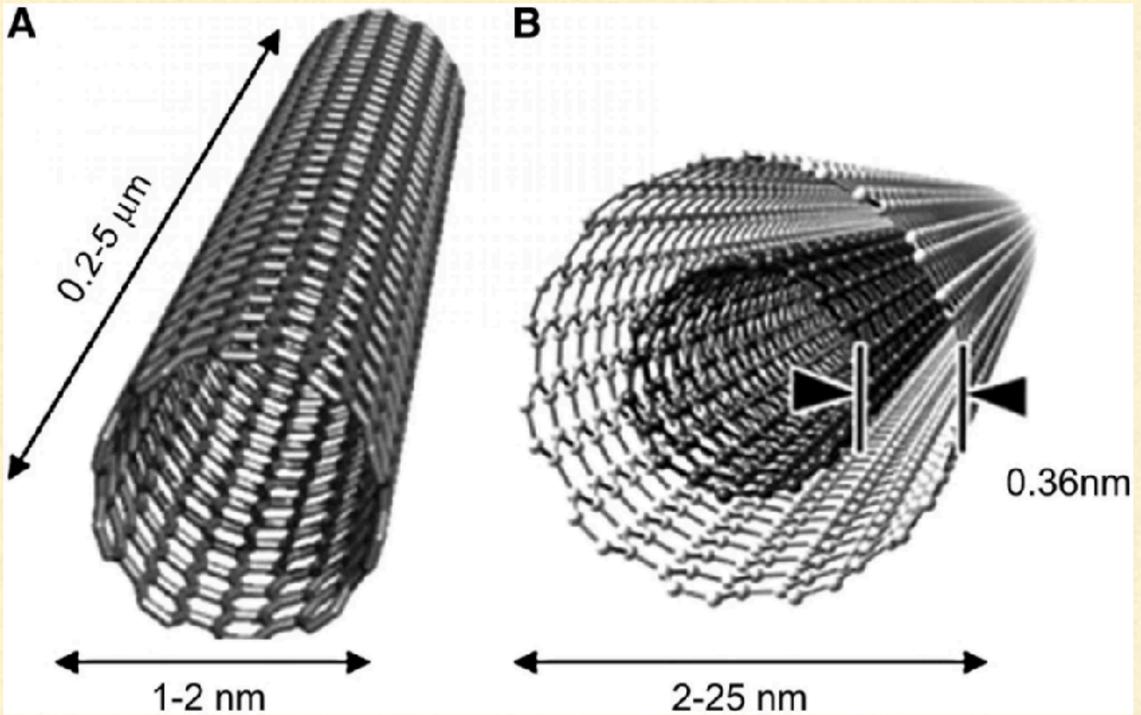


Carbon nanotubes



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NOT

WITHOUT

CONTROVERSY

Not Without Controversy

Cloud gate @Chicago, Anish Kapoor

Anish Kapoor, (selfish) sculptor

Exclusively licensed the *artistic* use of the VANTABLACK

Not Without Controversy

#ShareTheBlack

Stuart Semple, (champion) artist

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Pinkest pink

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Stuart Semple, (champion) artist

Pinkest pink

WE SHIP WORLDWIDE FROM OUR USA WAREHOUSE - Shipping costs will be calculated during checkout :)

*Note: By adding this product to your cart you confirm that you are not Anish Kapoor, you are in no way affiliated to Anish Kapoor, you are not purchasing this item on behalf of Anish Kapoor or an associate of Anish Kapoor. To the best of your knowledge, information and belief this paint will not make its way into the hands of Anish Kapoor.

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*disclaimer: we're not actually sure if this is the worlds pinkest pink ever, it could well be! It's the pinkest we could come up with, and we've not seen anything pinker.

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ACT 2

THE COLOUR WAR

https://www.youtube.com/watch?v=CgXQdbnYj84

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How To Please the Artists?

https://www.youtube.com/watch?v=ozq9dl1aZ94

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Color Drama Is all Around You!

BUSINESS

T-Mobile Has A Trademark On Magenta, Demands An Insurance Company Stop Using It

Trademark Encyclopedia
http://www.trademarkencyclopedia.com › barbie-pink

BARBIE PINK - trademark information

The **"BARBIE PINK" trademark**, serial number 77442813 , was filed on 8th of April 2008 with a mark drawing code of 4000 and its transaction date is 77442813. The ...

Stuart Semple
https://stuartsemple.com › barbiest-pink-out-now

Barbiest Pink Out Now

Stuart Semple has released Pinkie – the **Barbiest Pink** and is sharing it with artists all over the world as long as they are not associated with Mattel, the ...

Break

- Thank you for not using your cell phones during the lectures.
- PRO TIP: Organize your apps by color to find them faster.