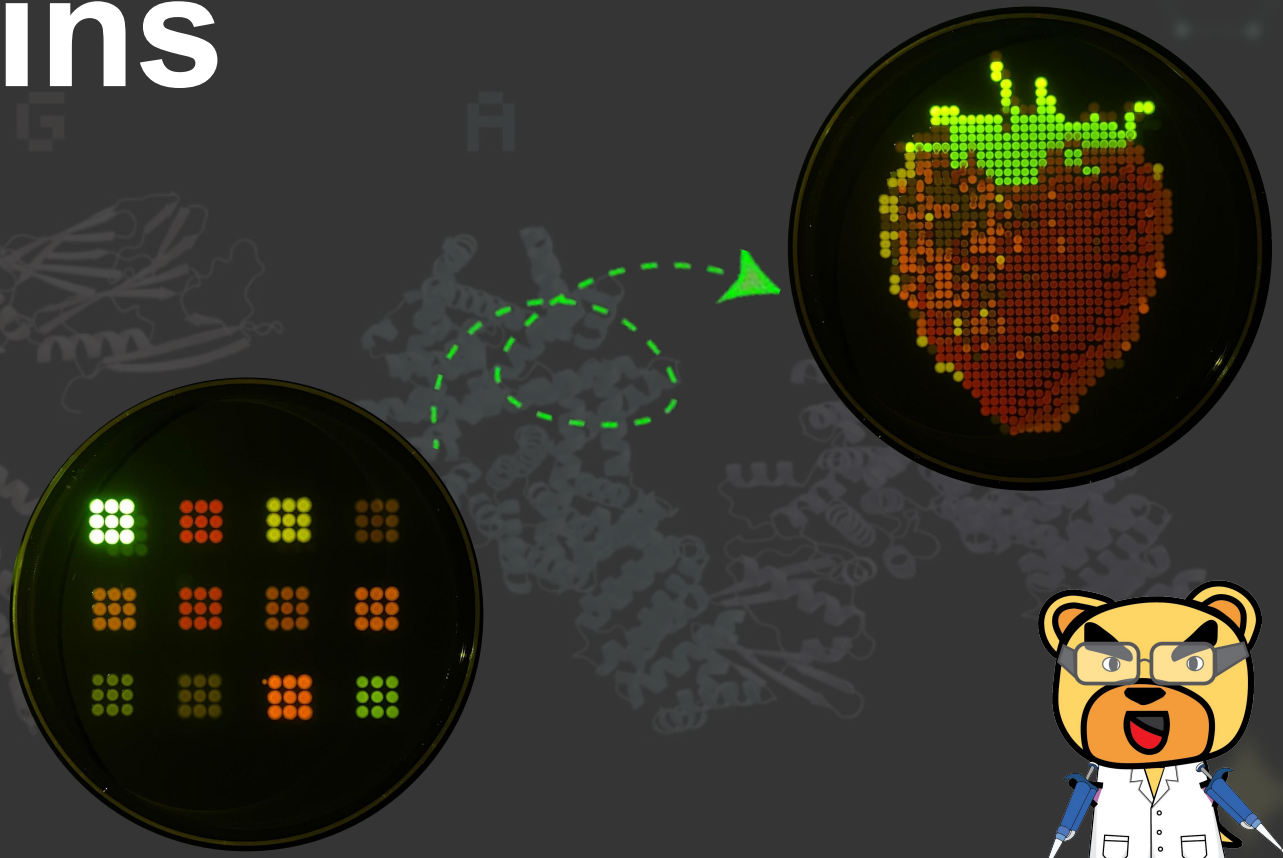
Colored Proteins for BIOART



Cholpisit (**Ice**) Kiattisewee
HTGAA Bootcamp
January 19th, 2026

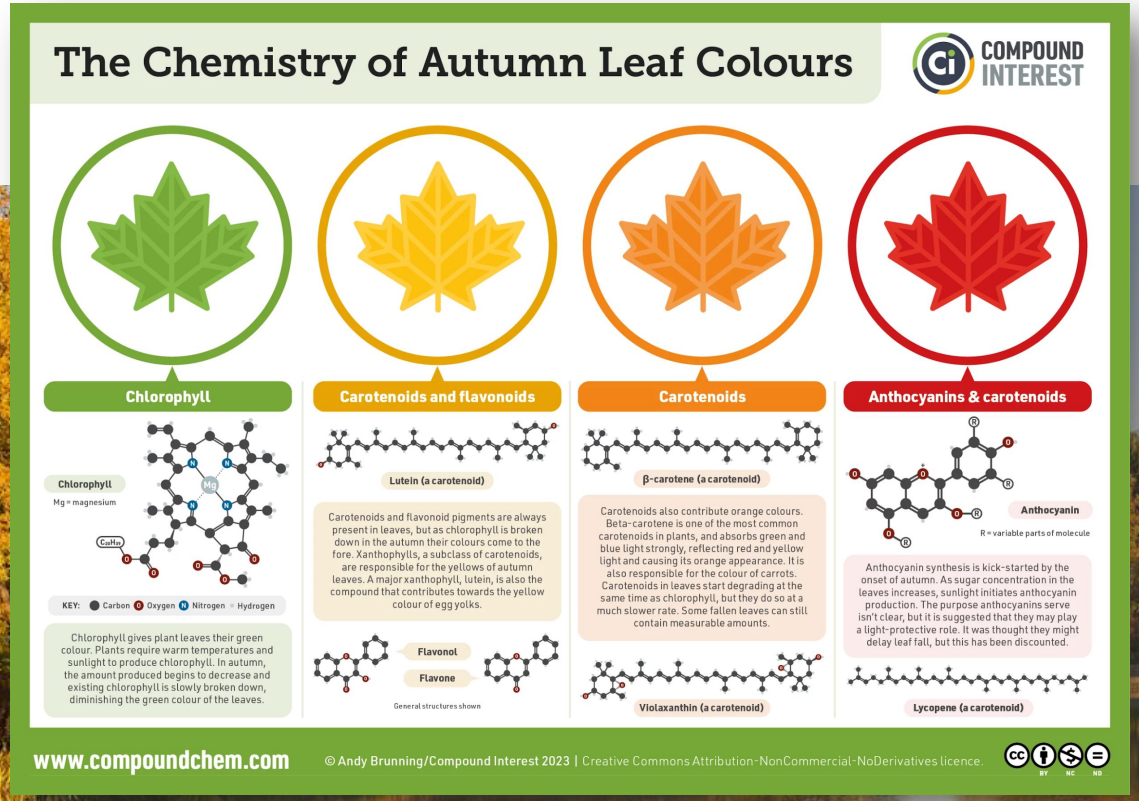
Colors in Nature

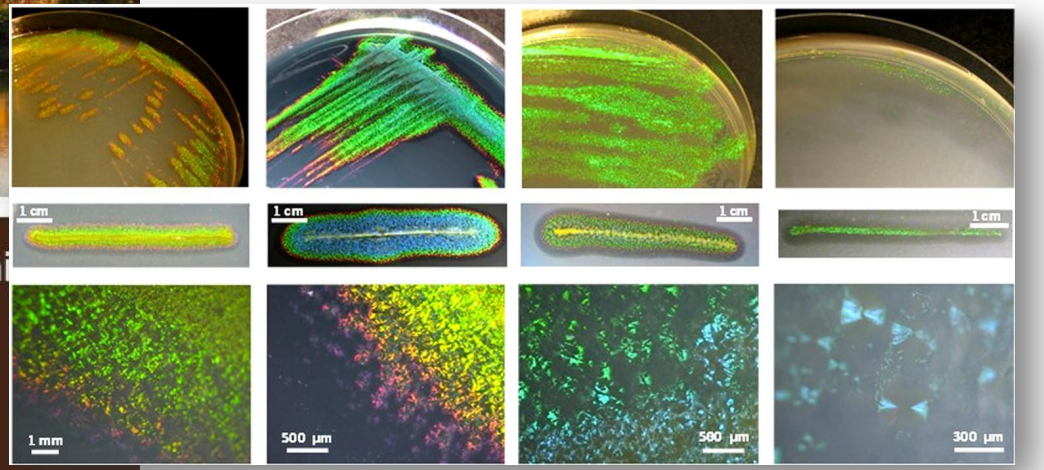
Colors in Nature - Albatros Books

Compounds or Structural

Chlorophyll	Xanthophyll	Carotene	Anthocyanin	Tannins

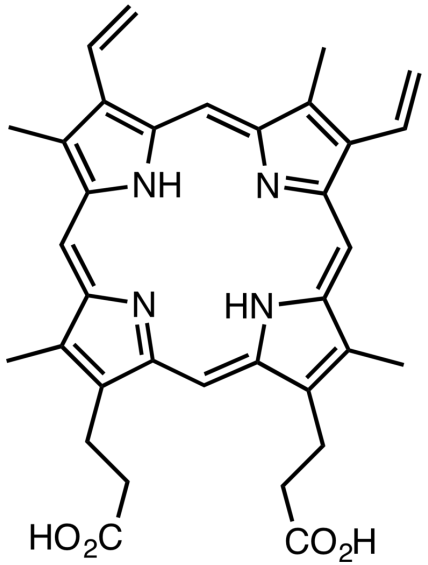
Compounds or Structural





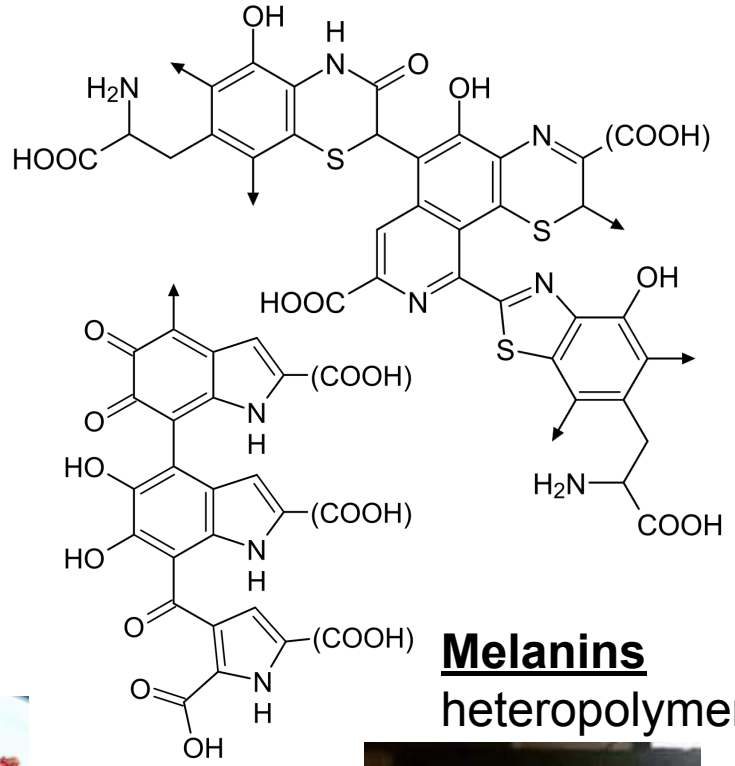
Chlorophyll | Xanthophyll | Carotene | Anthocyanin | Tanni

Pigments in Nature 1

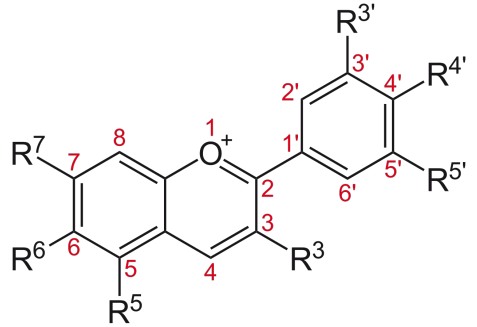


Porphyrin core

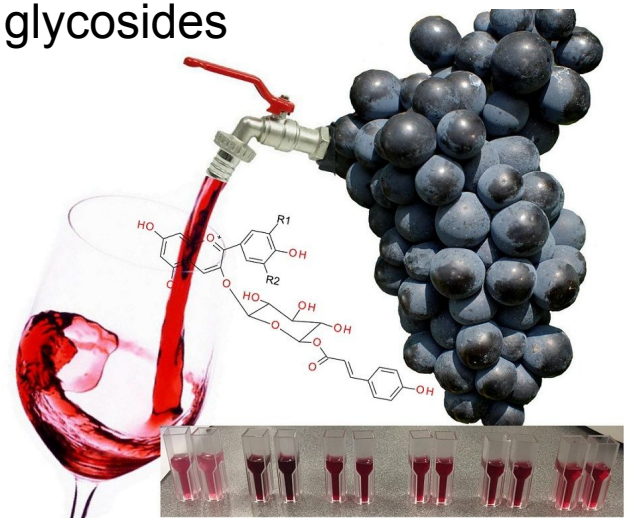
Mg^{2+} Fe^{2+}



Melanins
heteropolymers

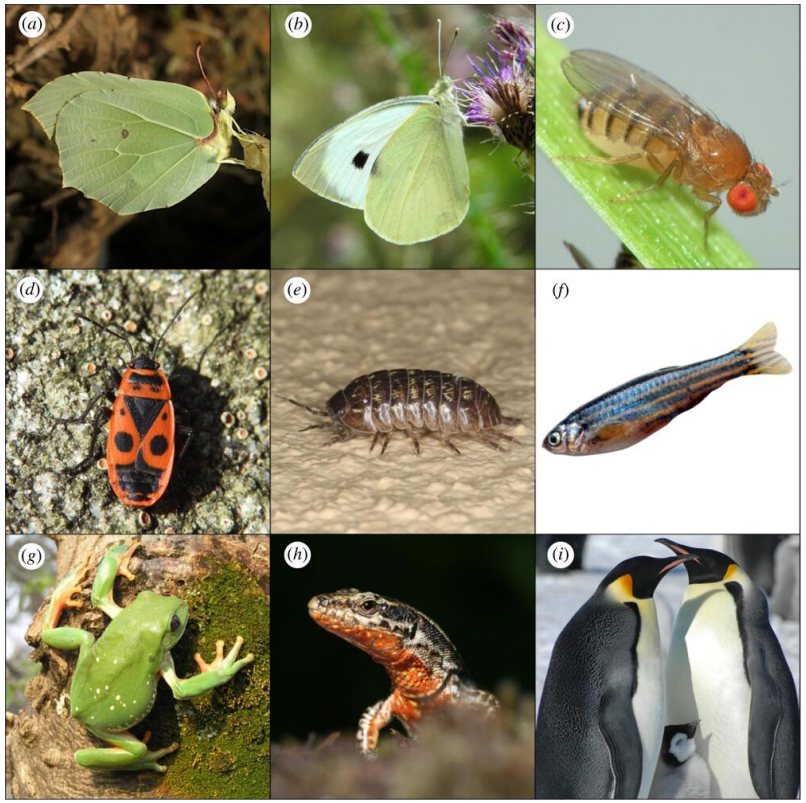


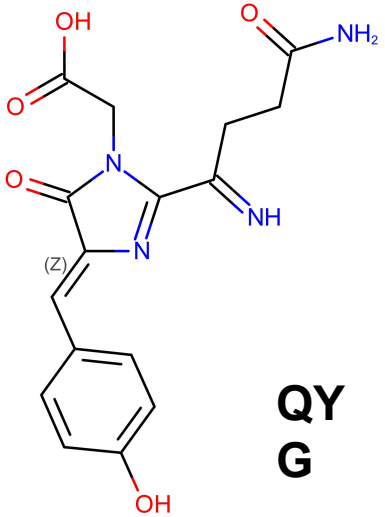
Anthocyanins
Flavonoids glycosides



Porphyrins : the Colors of Life – PhysicsOpenLab

Pigments in Nature 2

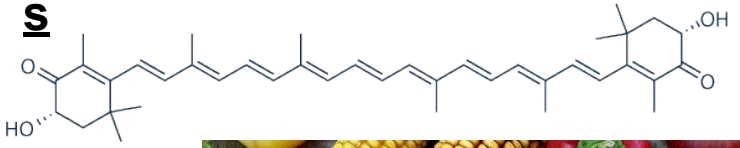




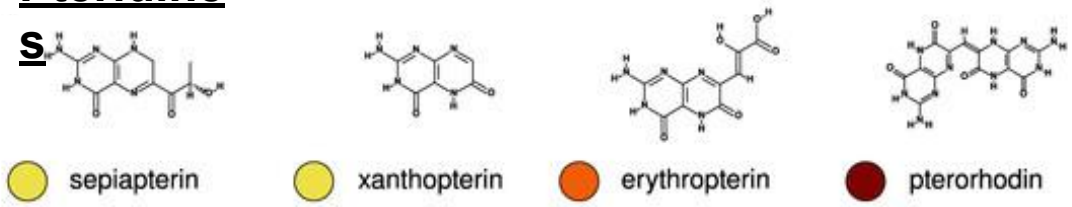
QY
G

Stony coral *Acropora millepora*

Carotenoids



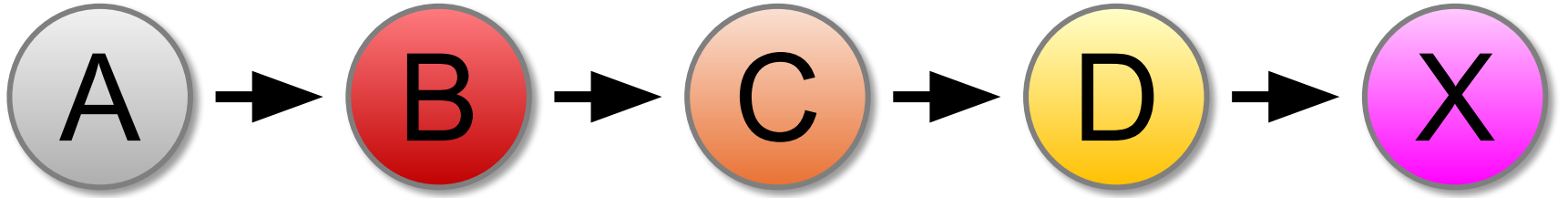
Pteridines

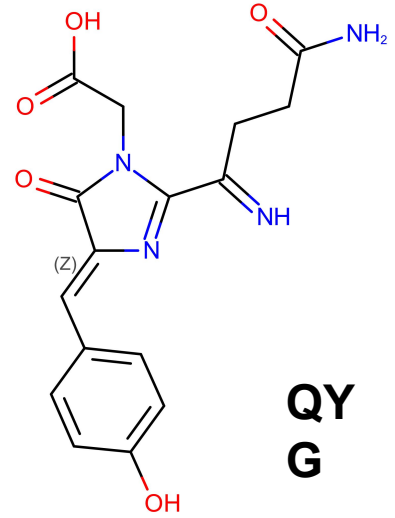


Pterin-based pigmentation in animals | Biology Letters

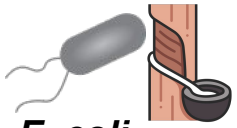
RCSB PDB - CRQ

How Pigments were Synthesize

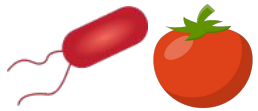




QY
G



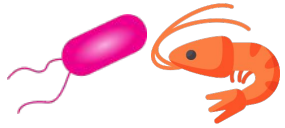
E. coli
+ crtEB
=
carotenoids



+ crtL
=
Lycopene

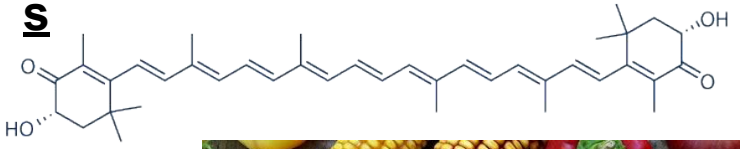
+ crtY
=
beta-Carotene

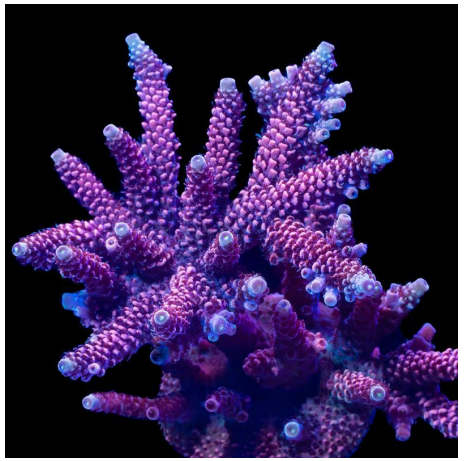
+ crtZ
=
Zeaxanthin



+ crtW
=
Astaxanthin

Carotenoids





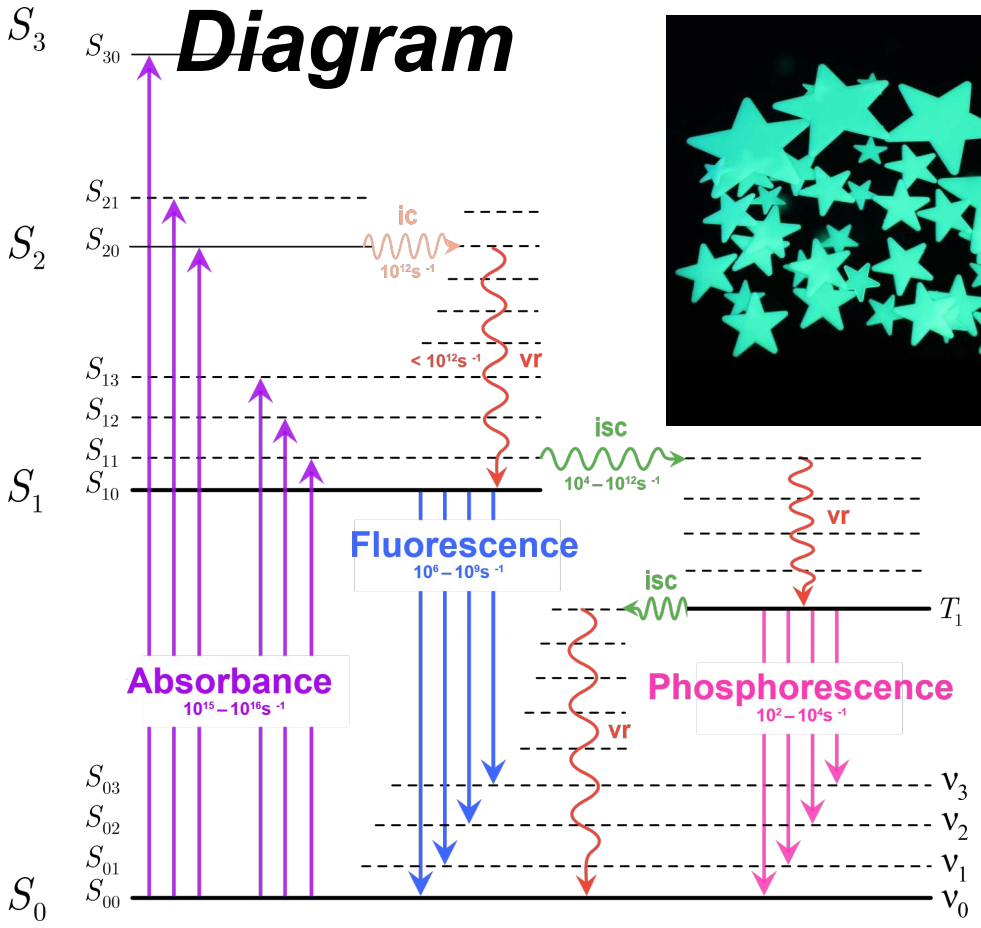
Stony coral
Acropora millepora

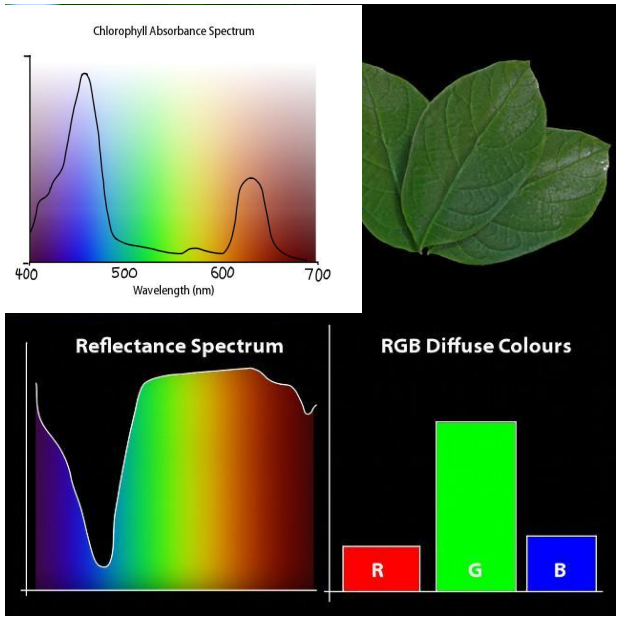
amilCP

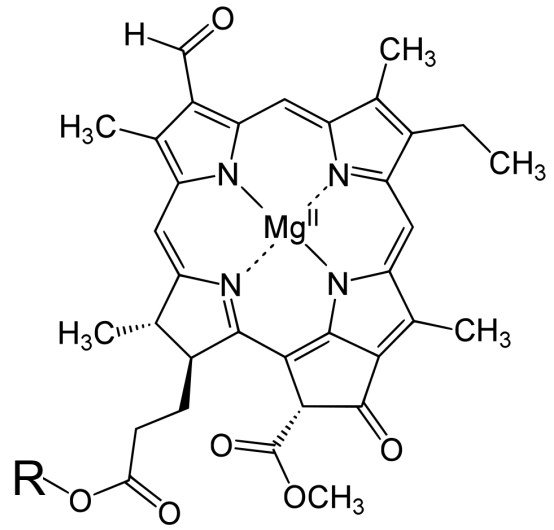
RCSB PDB - CRQ

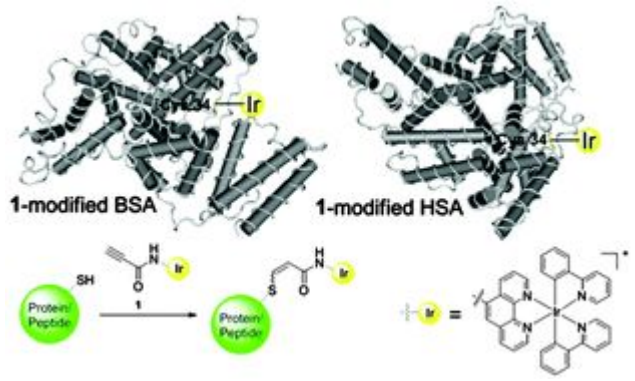
Photochemistry and Colors

Jablonski Diagram



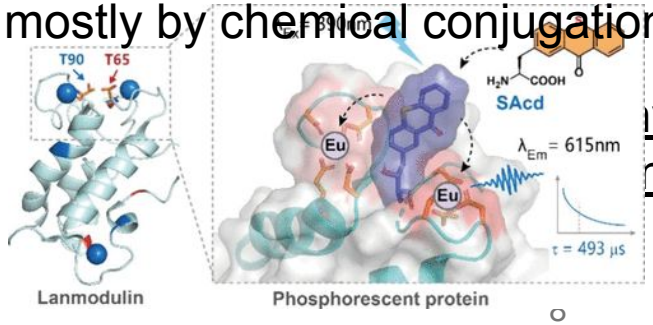






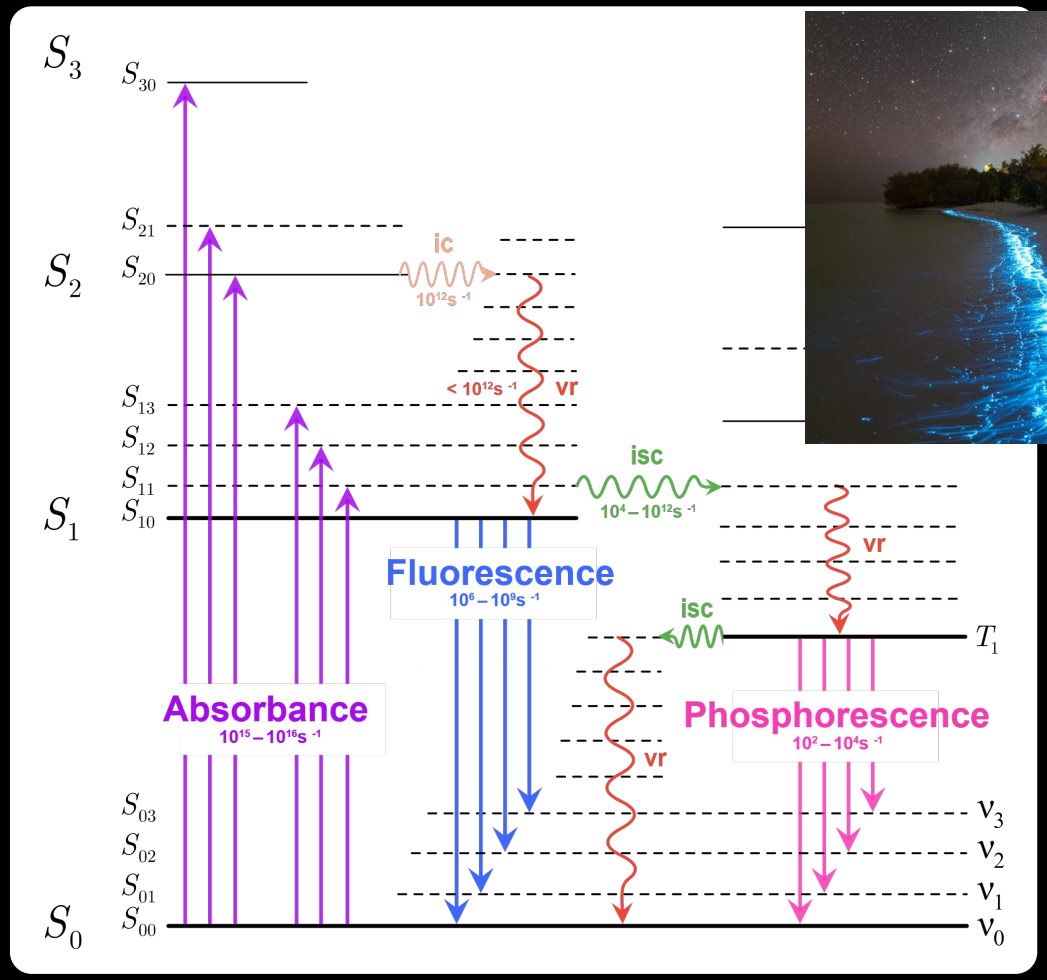
Reported Phosphorescent Proteins

mostly by chemical conjugation



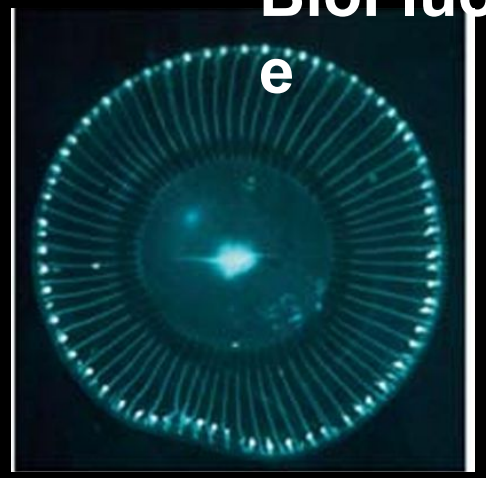
Photochemistry and Colors

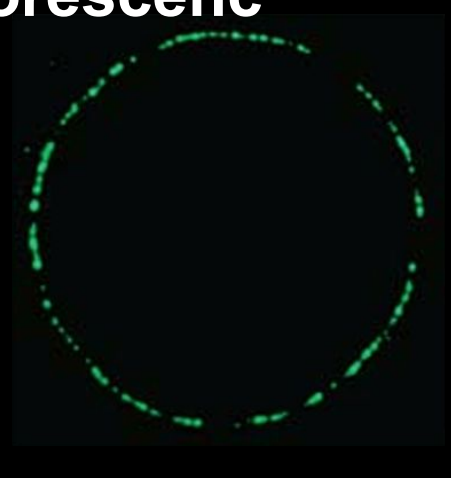
Jablonski



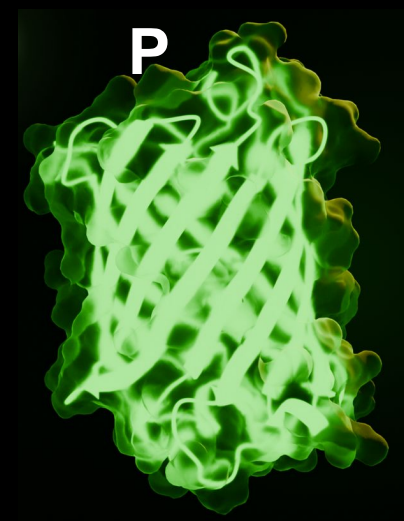
Bioluminescence

BioFluorescence



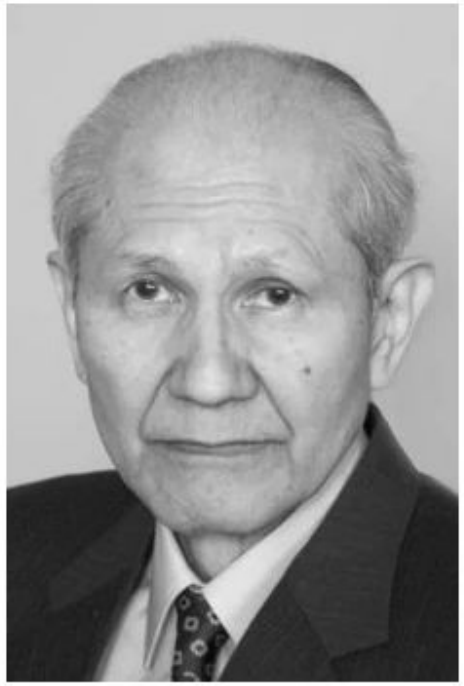


avGFP



[Nobel Lecture by Osamu Shimomura]

Nobel Prize in Chemistry 2008



© The Nobel Foundation. Photo: U. Montan

Osamu Shimomura

Prize share: 1/3

© The Nobel Foundation. Photo: U. Montan

Martin Chalfie

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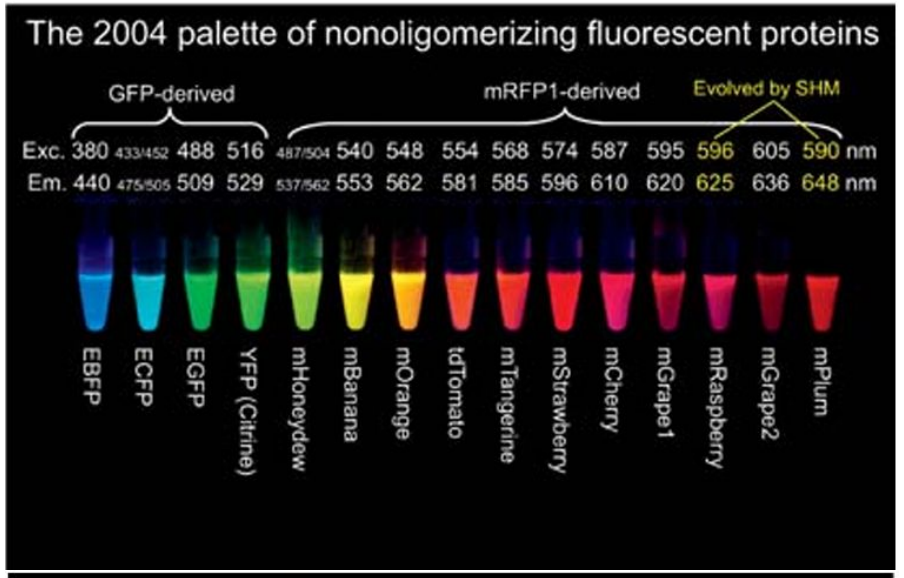
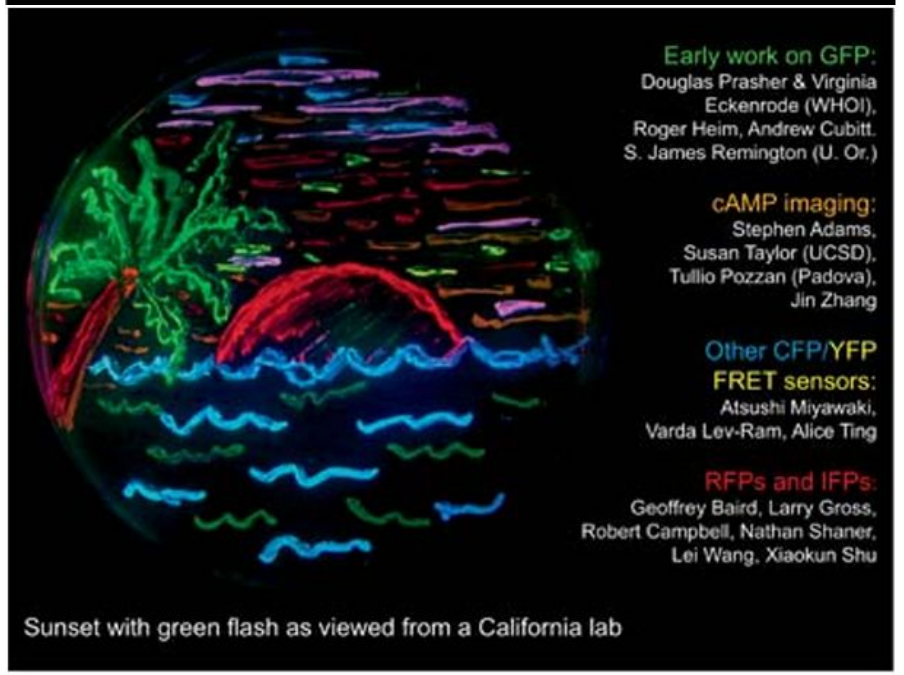
Roger Y. Tsien

Prize share: 1/3





Nobel Lecture by Roger Y. Tsien

Structure of Green Fluorescent Protein

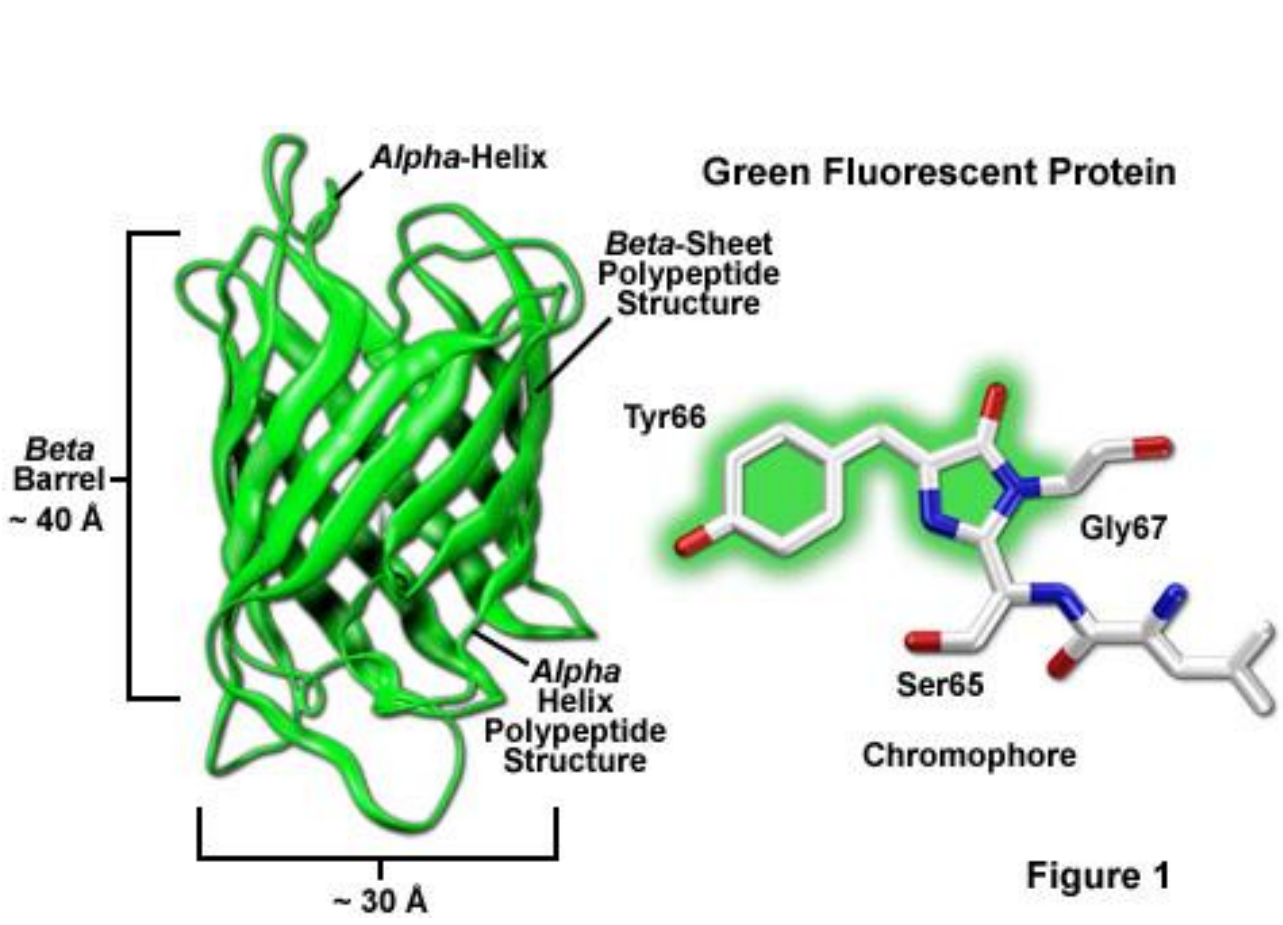


Figure 1

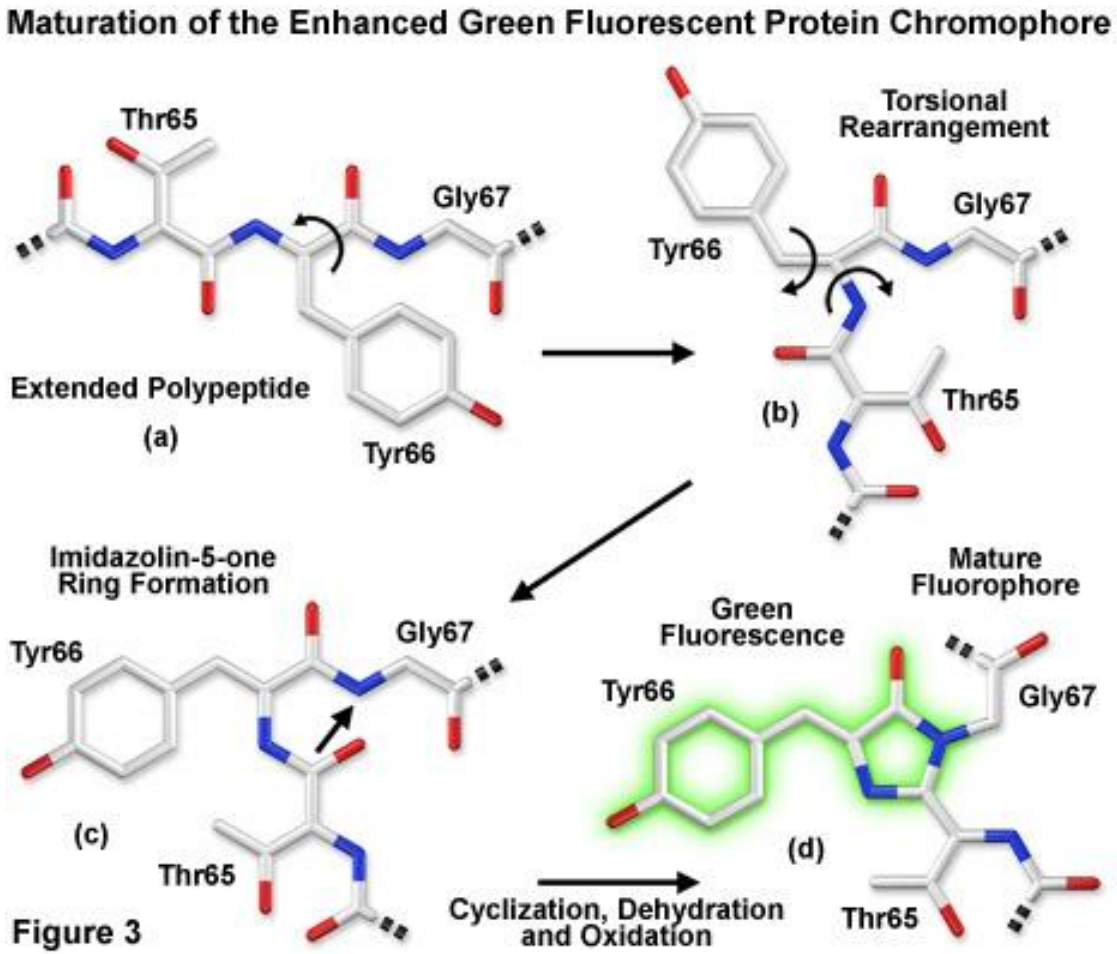
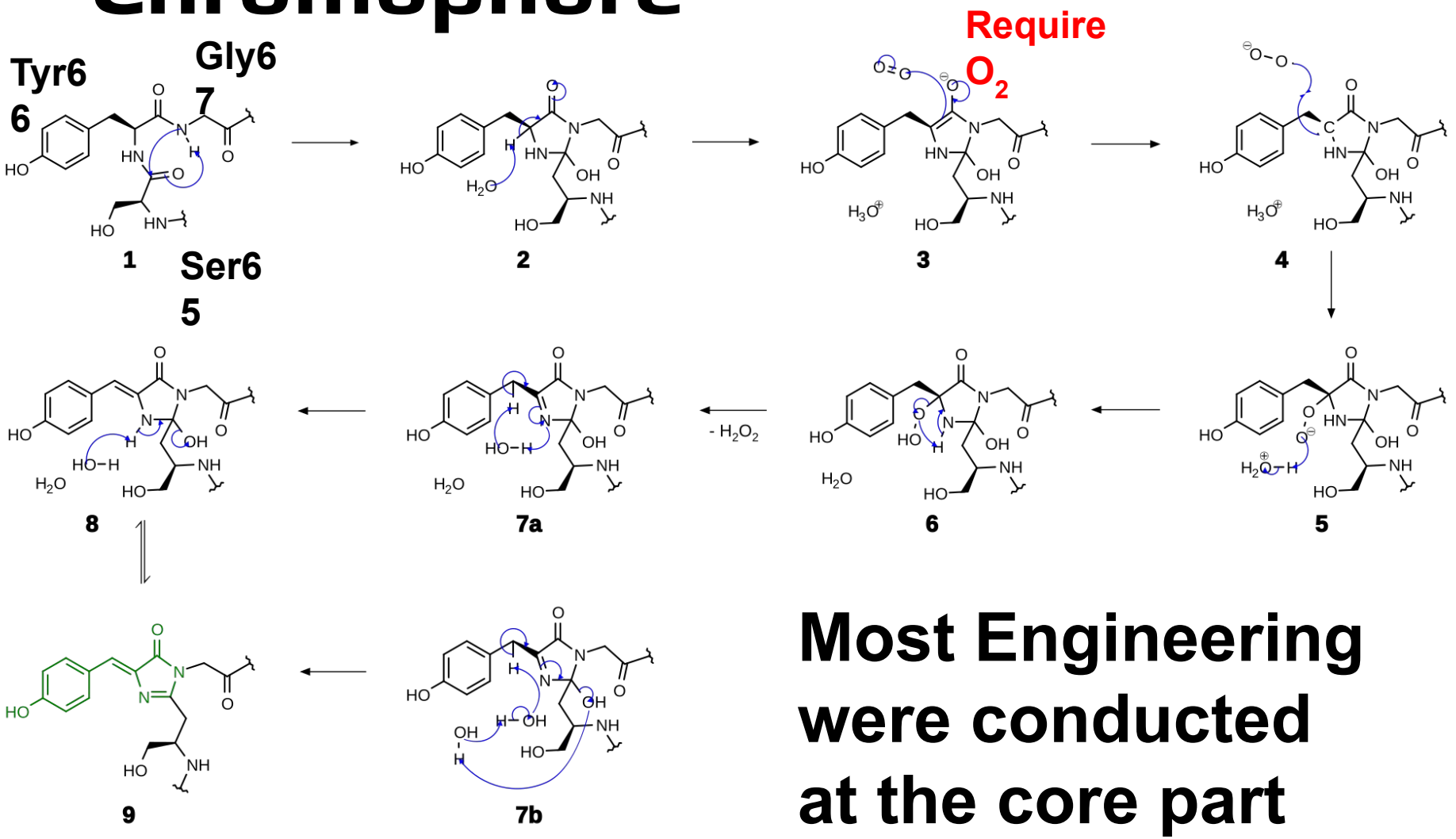
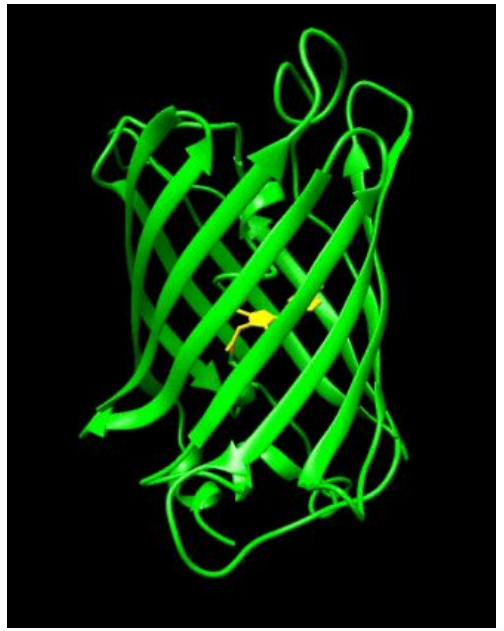


Figure 3

ZEISS Microscopy Online Campus | Introduction to Fluorescent Proteins

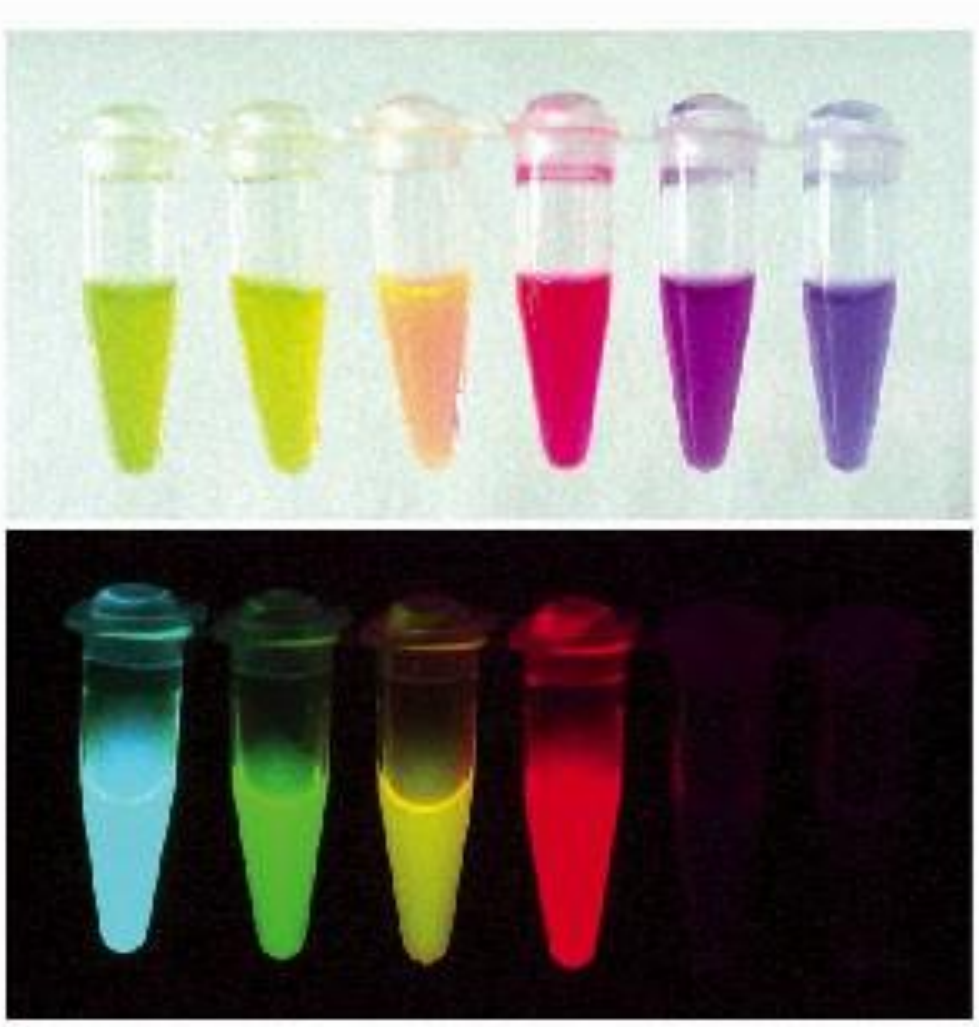
Autocatalysis to Generate Chromophore



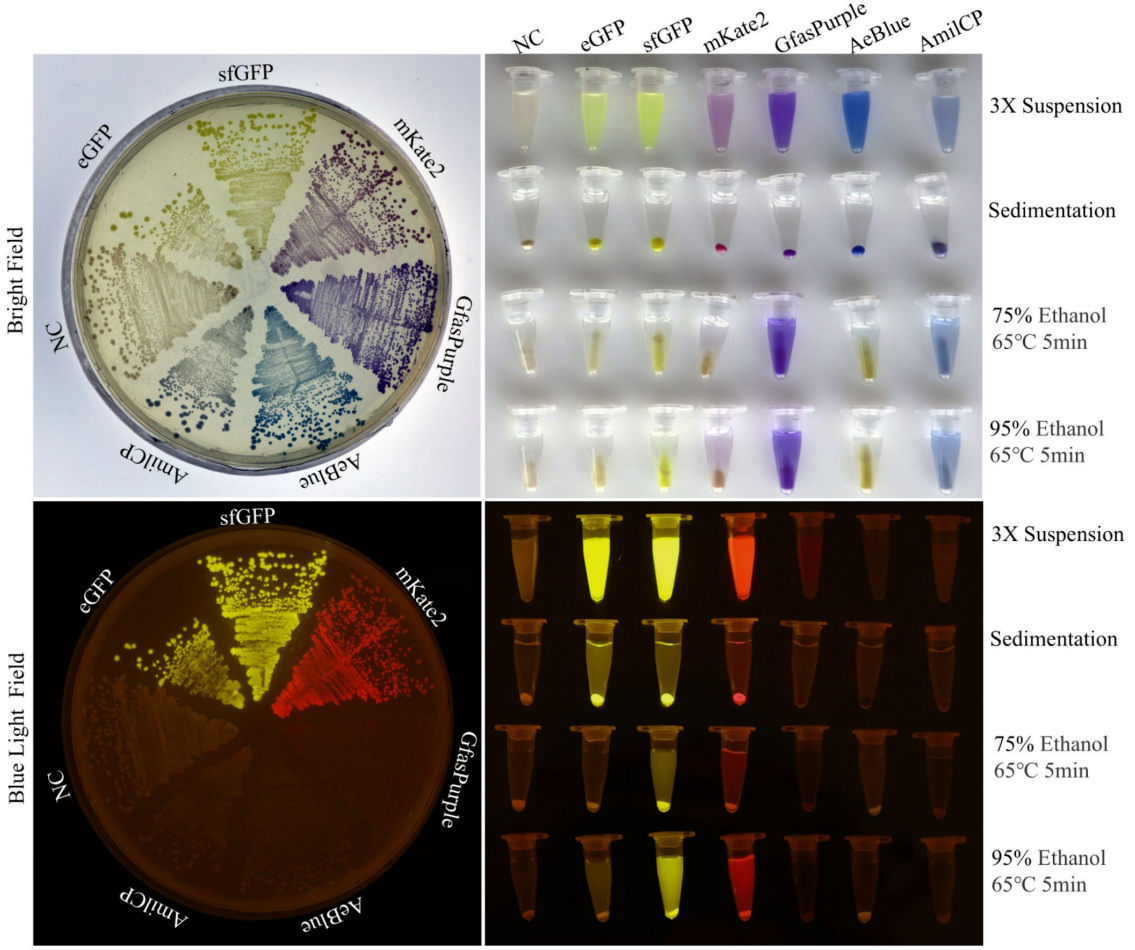


Most Engineering were conducted at the core part

FluorescentProteins



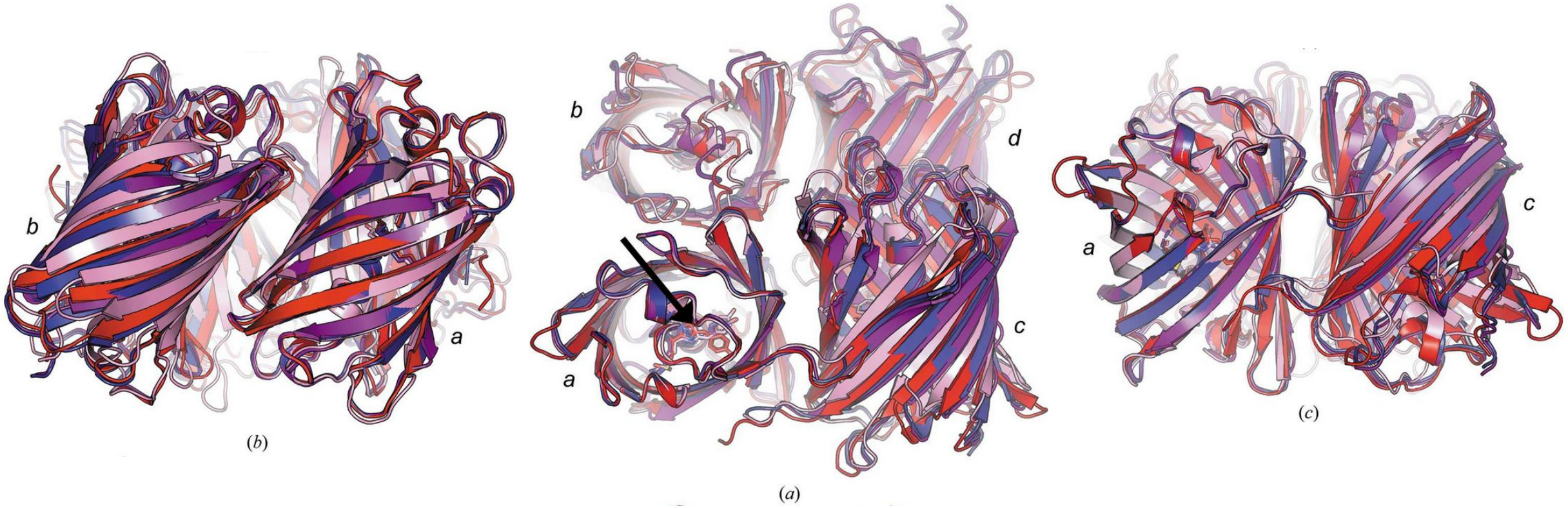
ChromoProteins



The molecular properties and applications of Anthozoa fluorescent proteins and chromoproteins | Nature Biotechnology

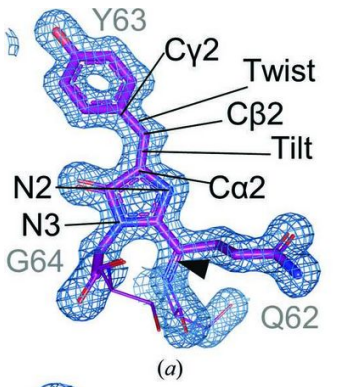
Colored Proteins Act as Biocolorants in Escherichia coli

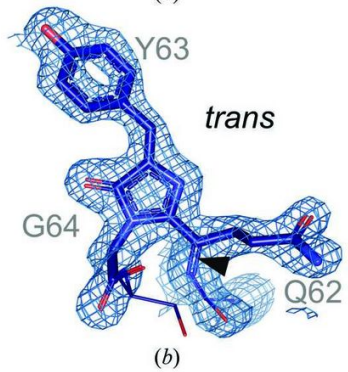
Structure Similarity | Overall Structure



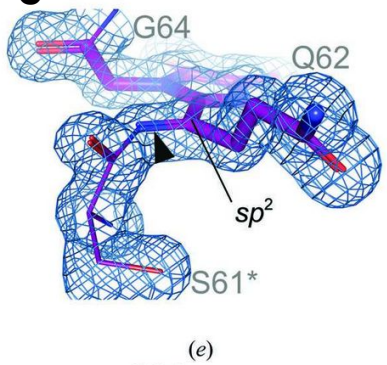
(IUCr) Over the rainbow: structural characterization of the chromoproteins gfasPurple, amilCP, spisPink and eforRed

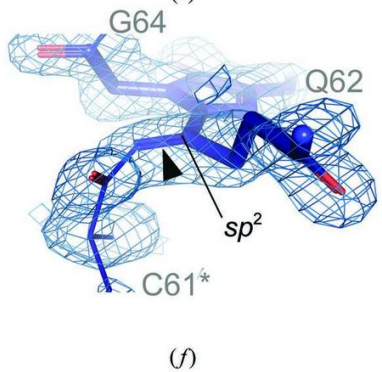
Structure Similarity | Core Chromophore





gfasPurple





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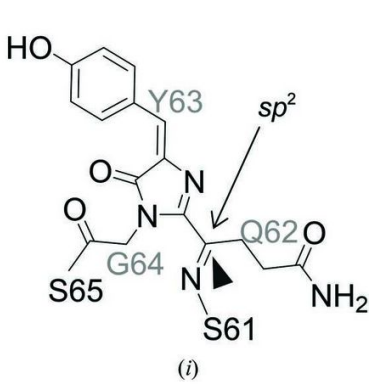
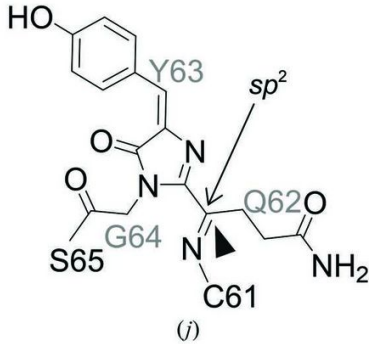
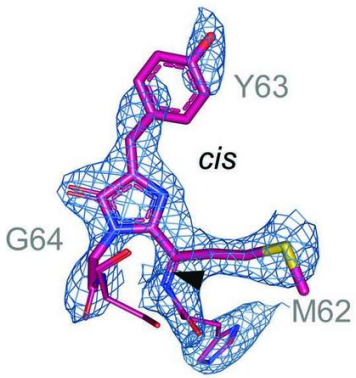
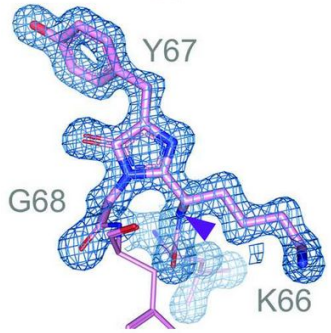
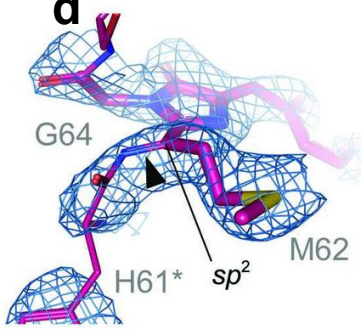


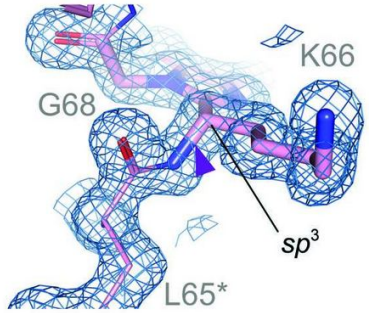




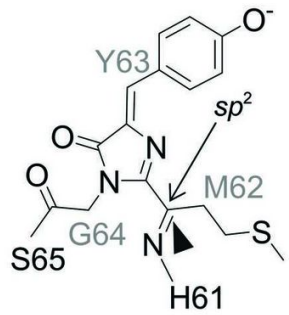


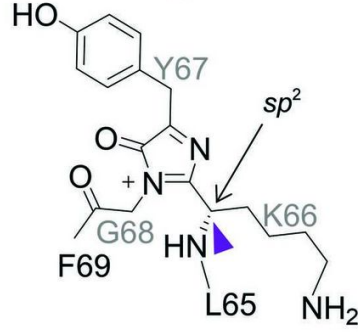
eforRed



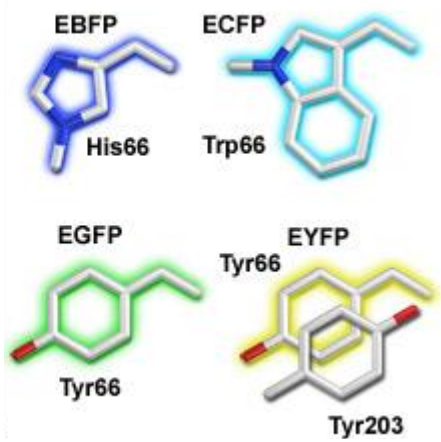


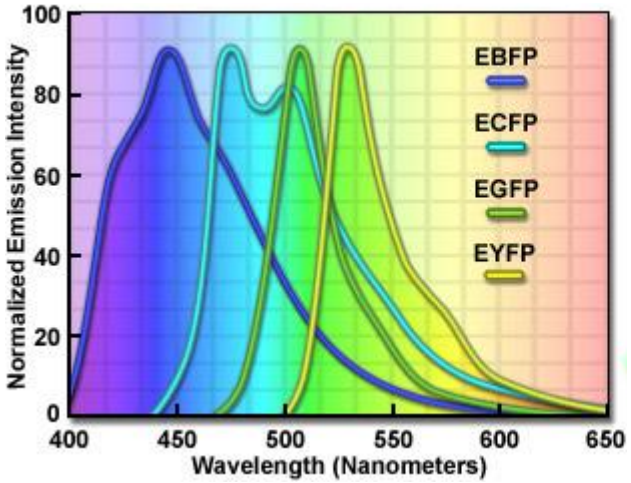
spilPink

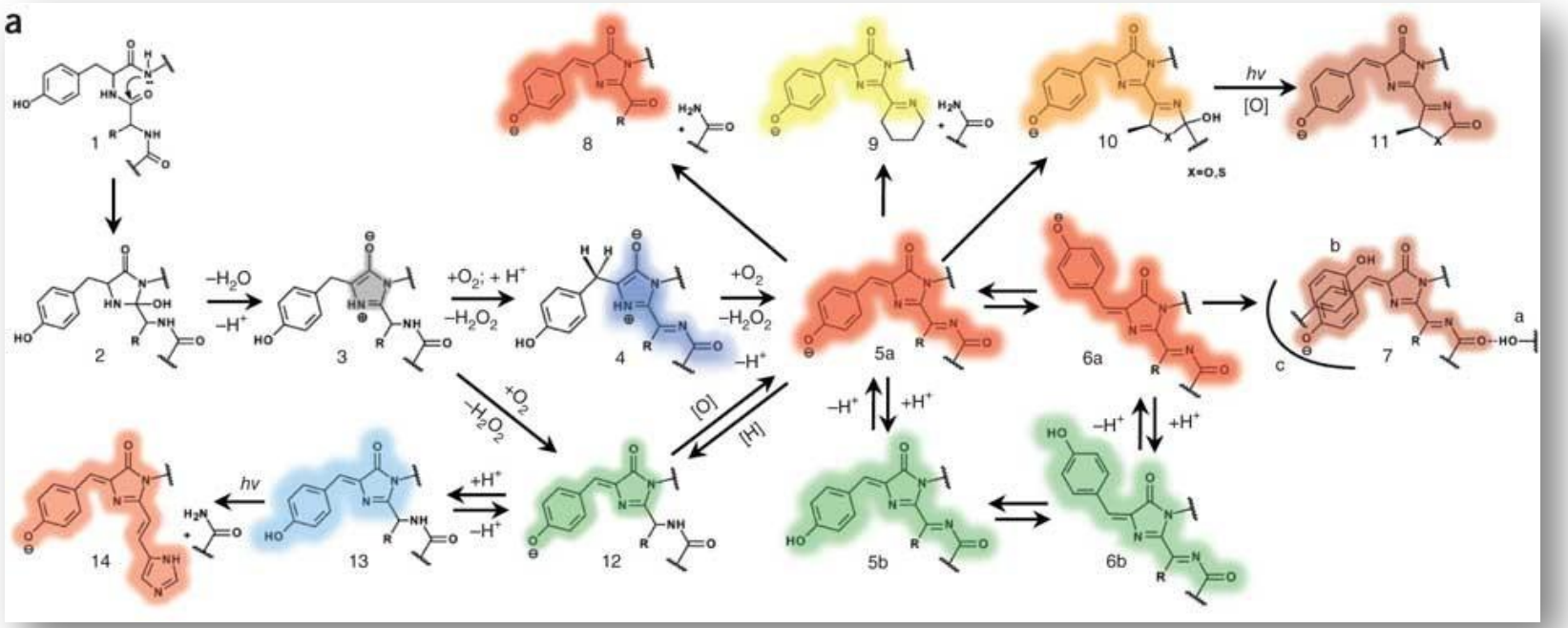




Core chromophore engineering

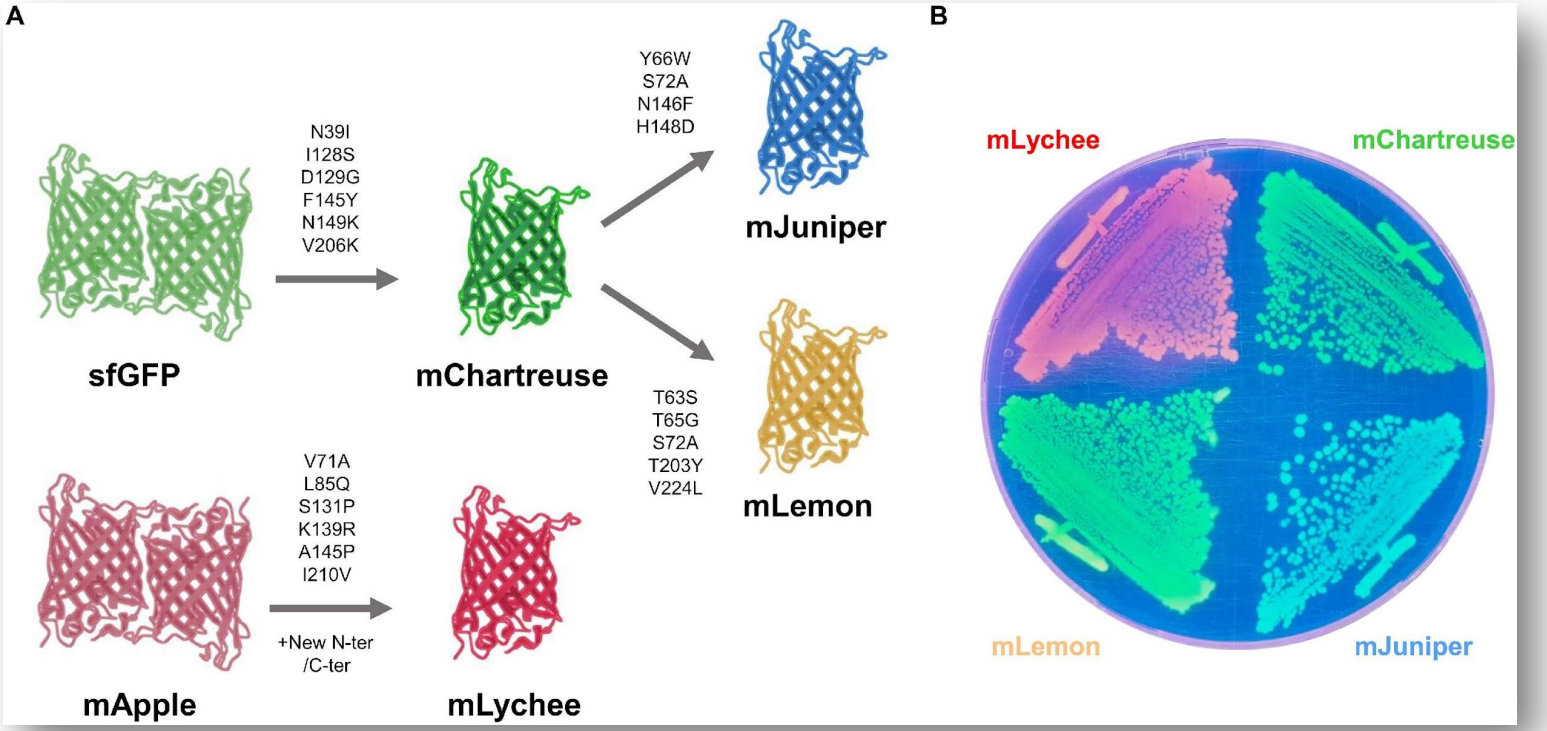


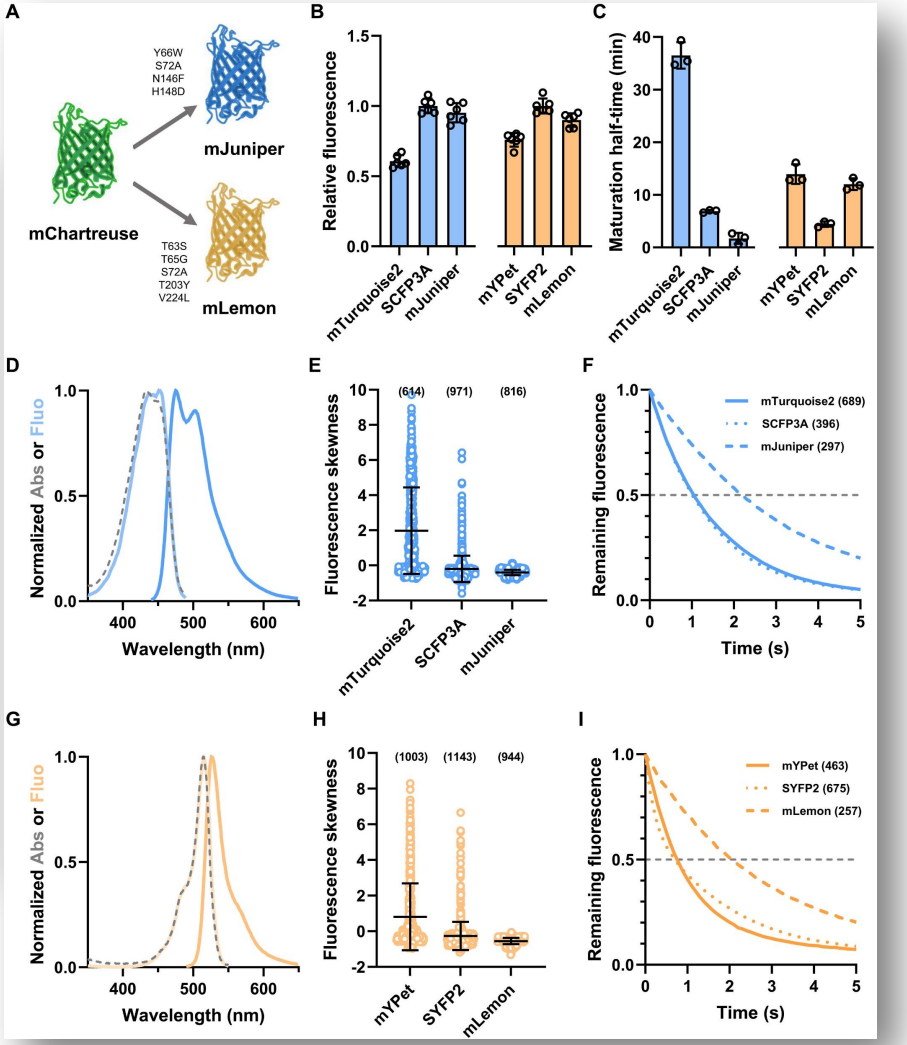




Directed molecular evolution to design advanced red fluorescent proteins | Nature Methods

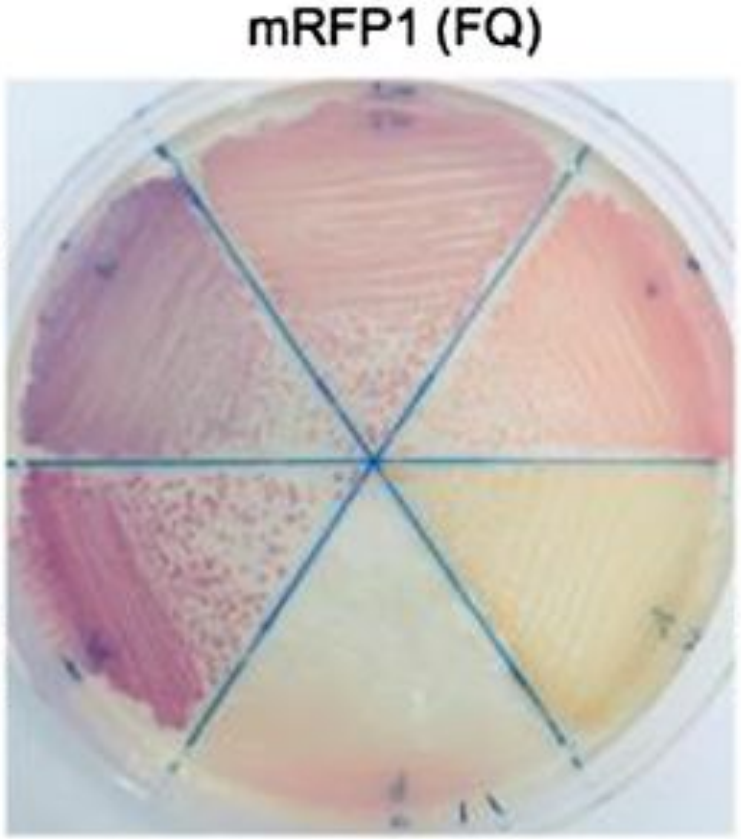
Engineering core protein structure beyond chromophore

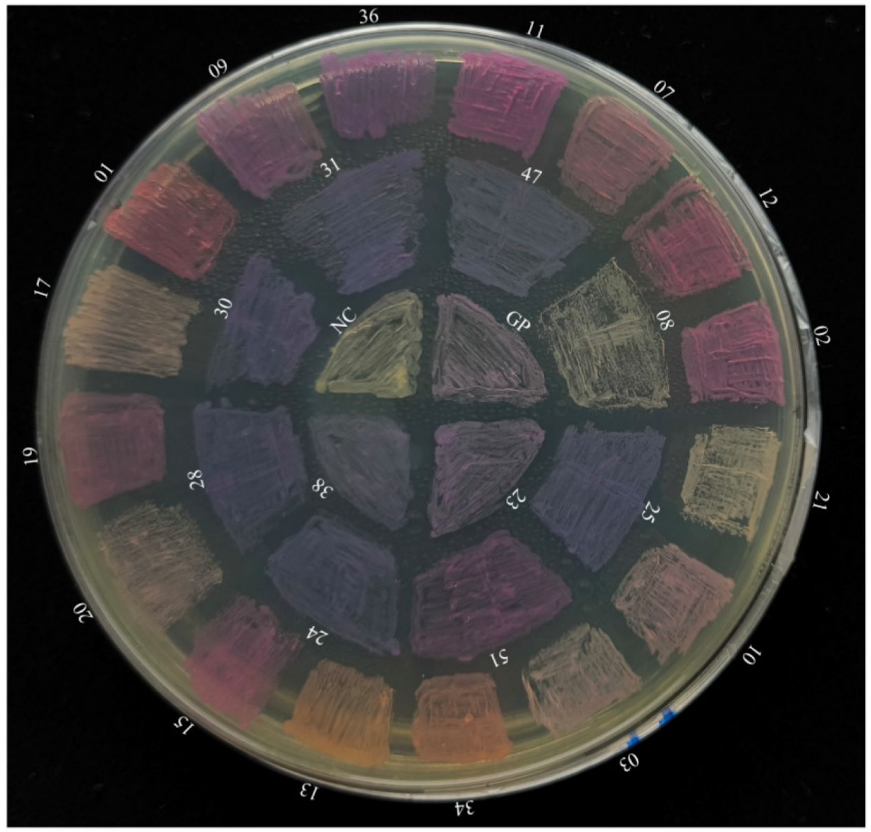


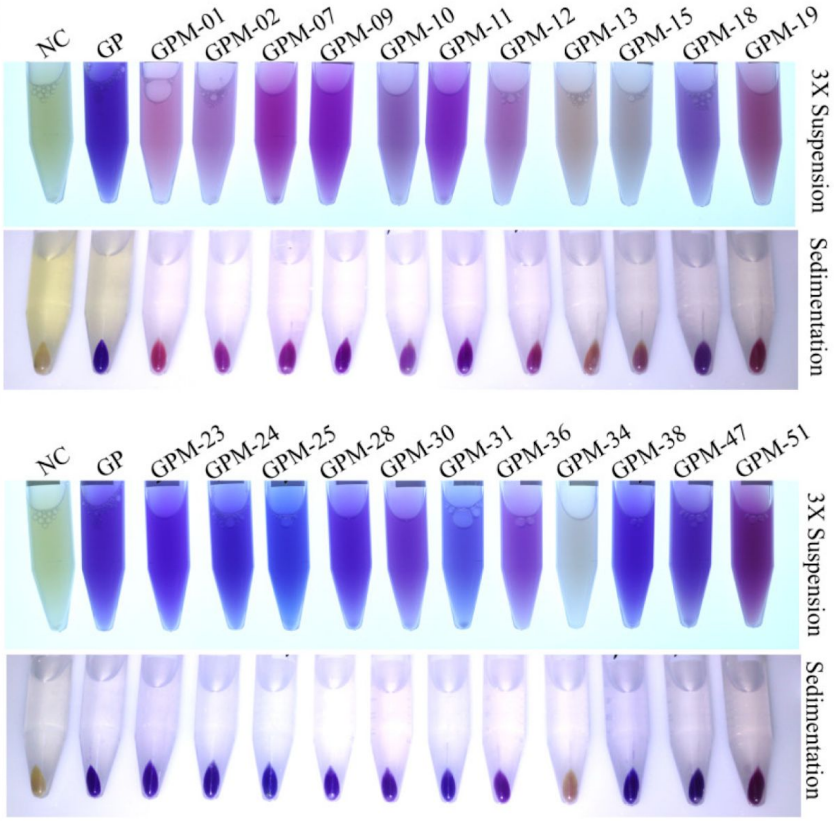


A palette of bright and photostable monomeric fluorescent proteins for bacterial time-lapse imaging | Science Advances

ChromoProteins Engineering



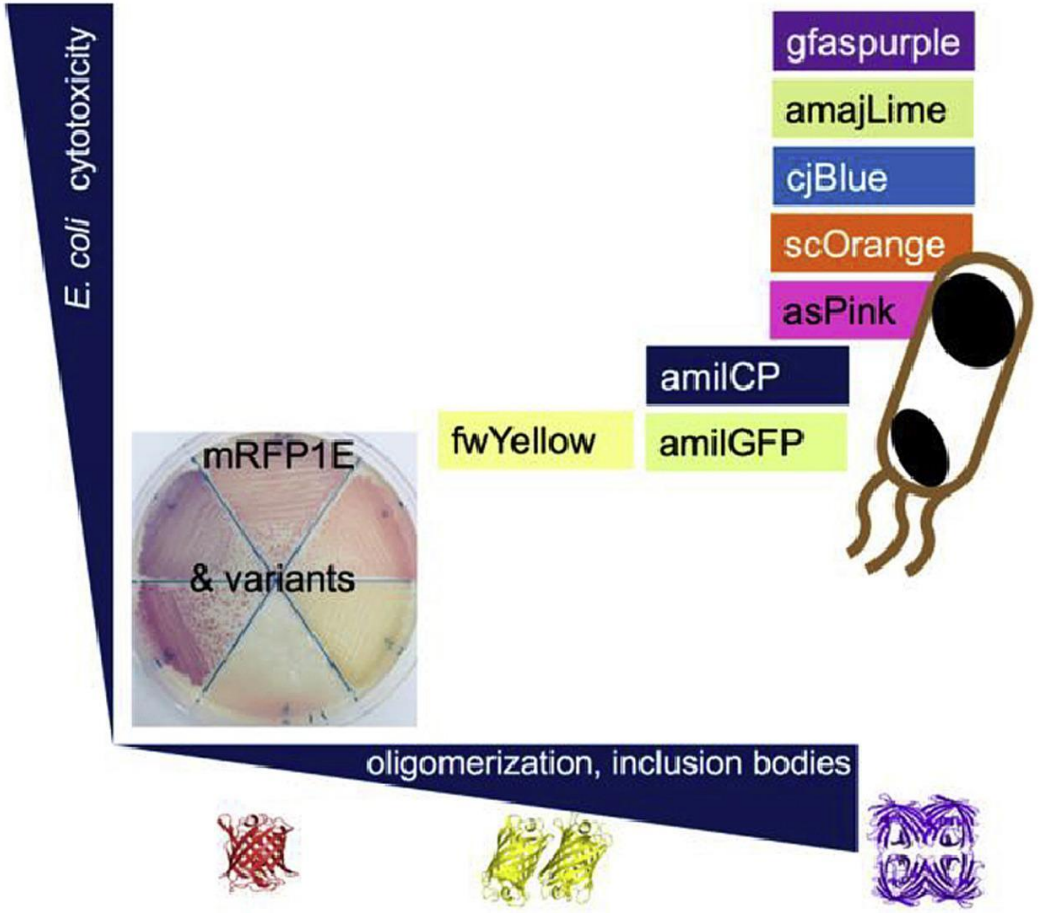


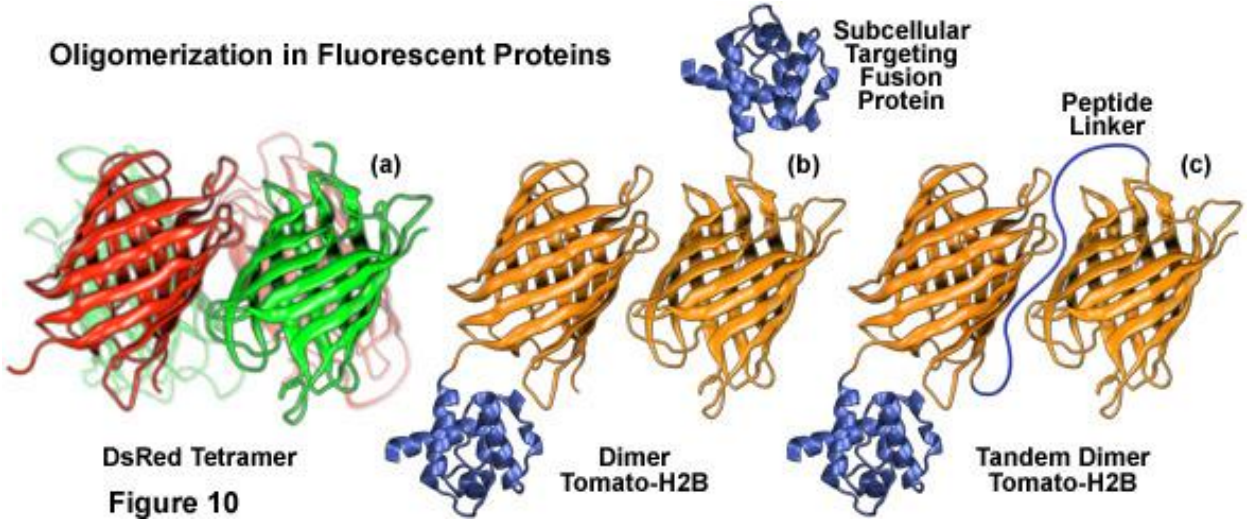


Overcoming chromoprotein limitations by engineering a red fluorescent protein - ScienceDirect

Colored Proteins Act as Biocolorants in Escherichia coli

Engineering at Oligomerizability

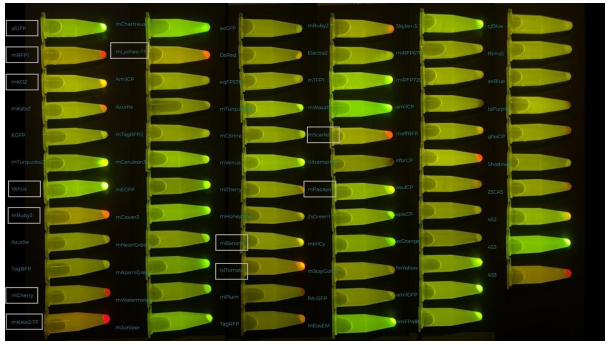


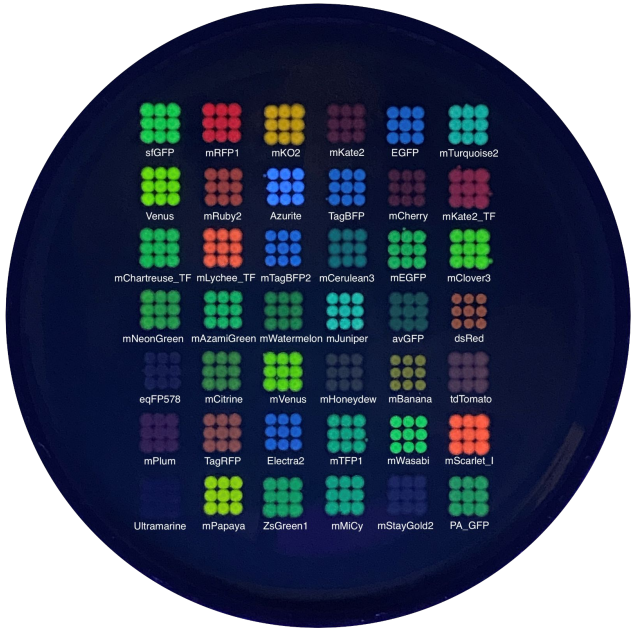


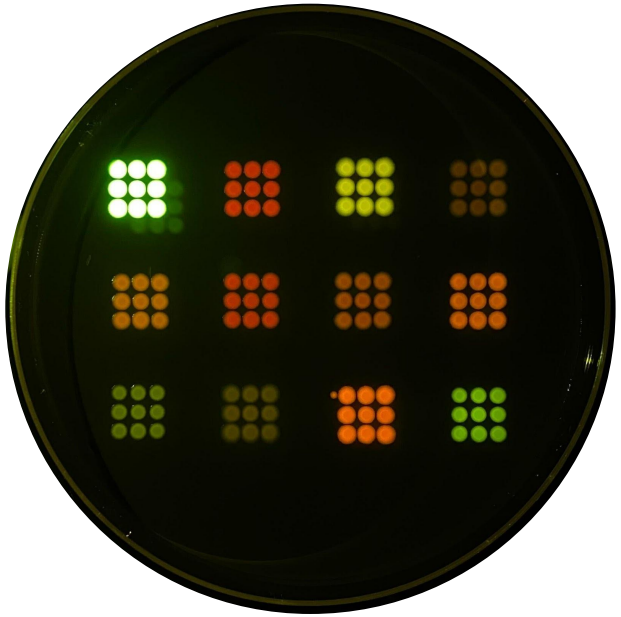
- Toxicity Reduction
- Appropriate Localization

Overcoming chromoprotein limitations by engineering a red fluorescent protein - ScienceDirect

A collection of fluorescent and chromoproteins curated by the HTGAA team







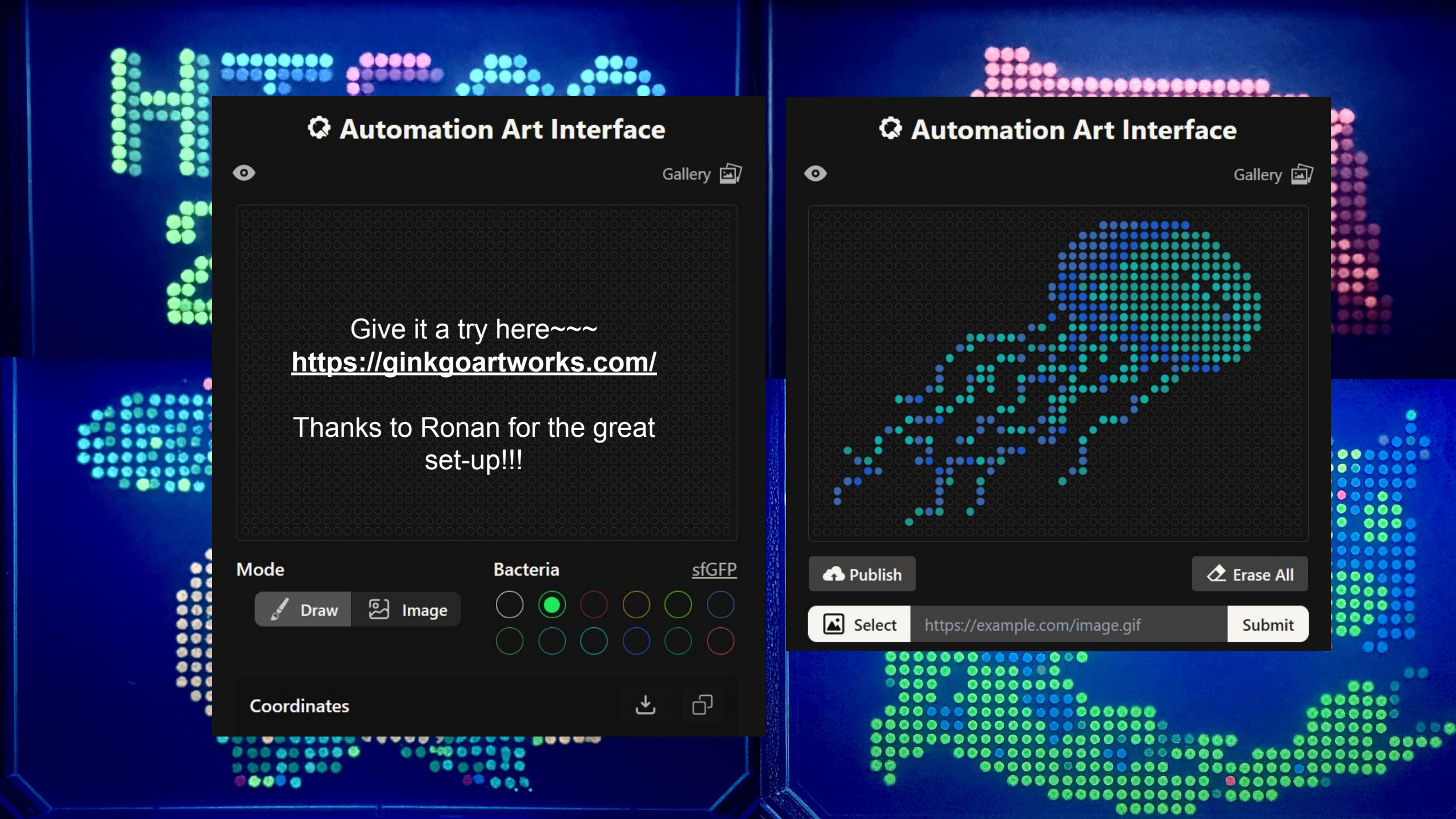
Mixing Colors

You can try mixing colors on your own; just follow these advanced recipes:

	× 7 +	× 1 +	× 1 =	almond white
× 2 +	× 2 +		× 1 =	straw brown
× 3 +	× 2 +	× 2 =		apricot orange
× 3 +	× 2 +	× 1 =		lavender
× 6 +	× 3 +	× 2 =		turquoise
× 3 +	× 3 +	× 1 =		lime green
× 7 +	× 5 +	× 2 =		chestnut brown

Color Mixing


HTBAA
2026


Automation Art Interface
Gallery
Give it a try here~~~
https://ginkgoartworks.com/
Thanks to Ronan for the great set-up!!!
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