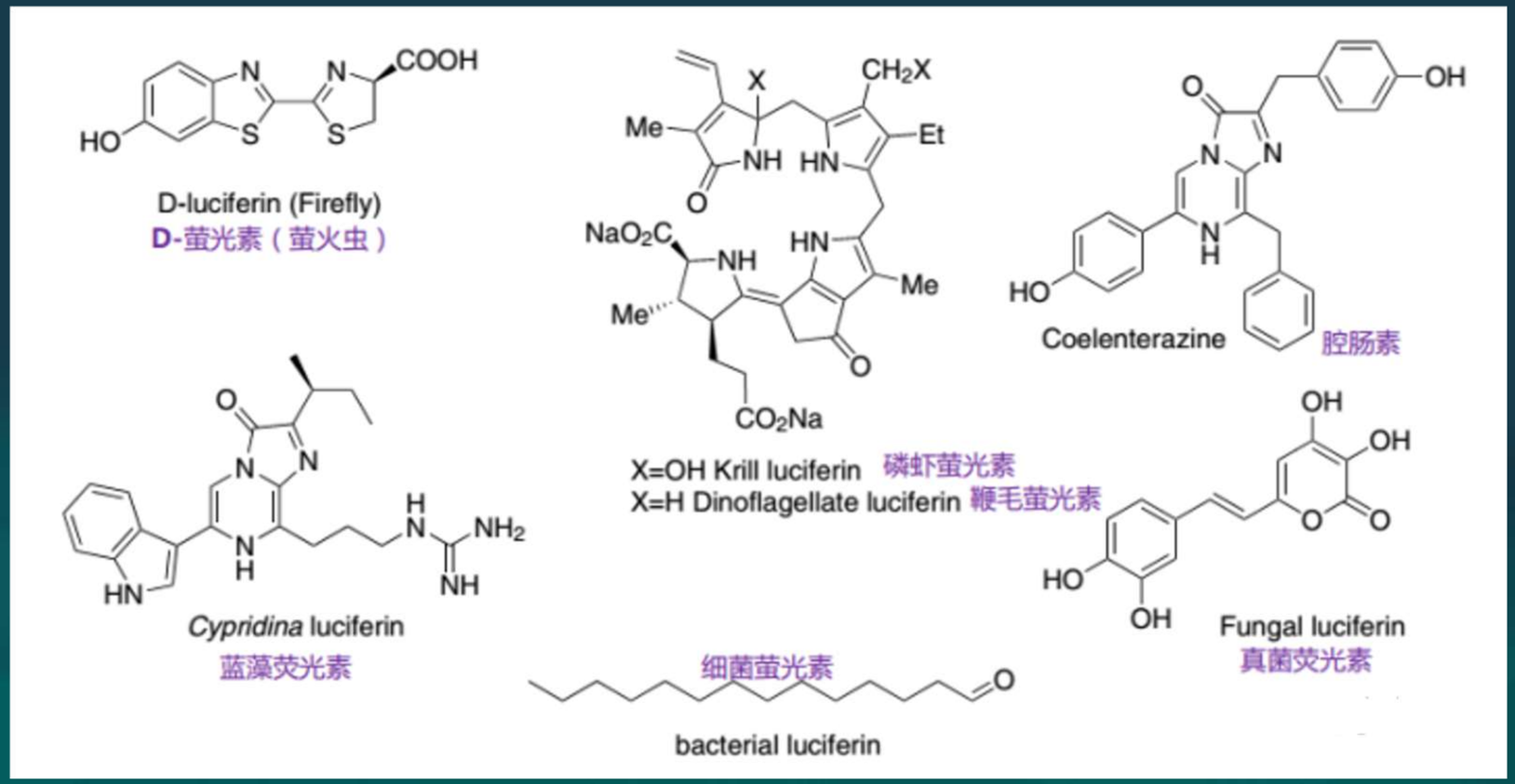
PHOTOLUMINESCENCE


JELLYFISH FLAVOUR
WATERS

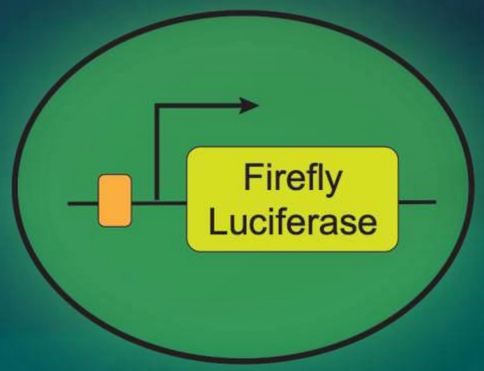
There are more than 40 different bioluminescent systems in nature, but only the seven luminescent reactions in the figure are known.



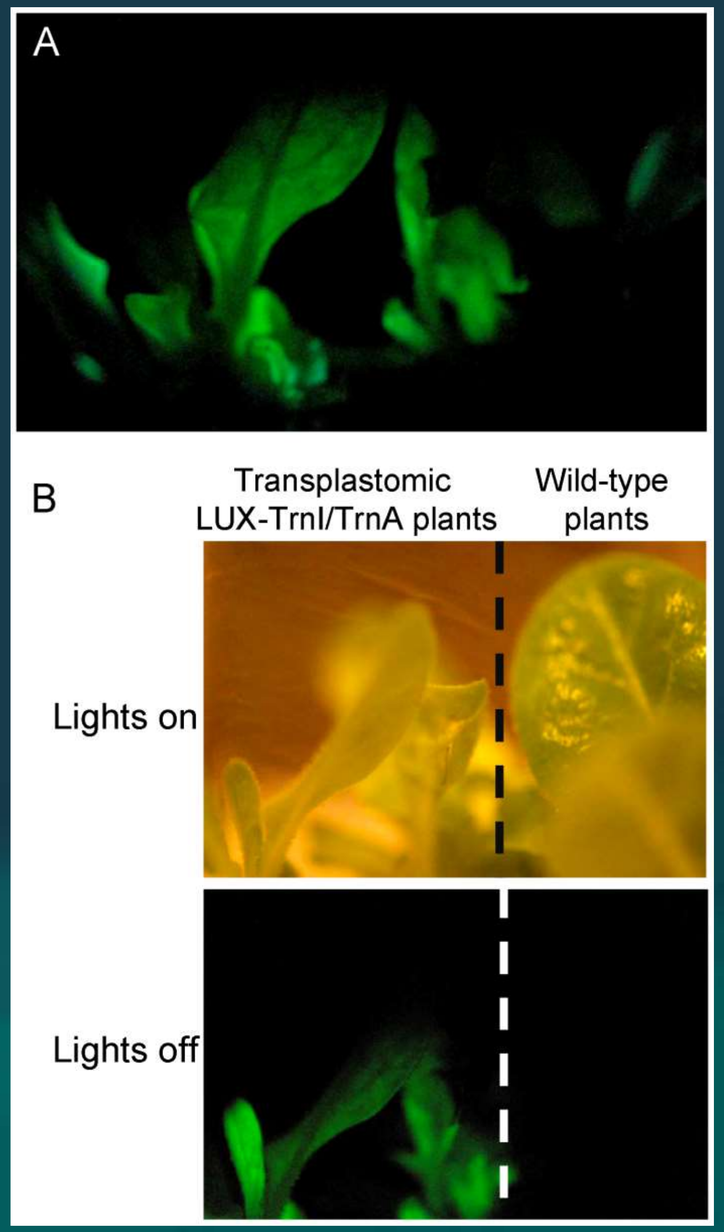
Transient and Stable Expression of the Firefly Luciferase Gene in Plant Cells and Transgenic Plants

Ow, Howell, Science (1986)

Luciferin

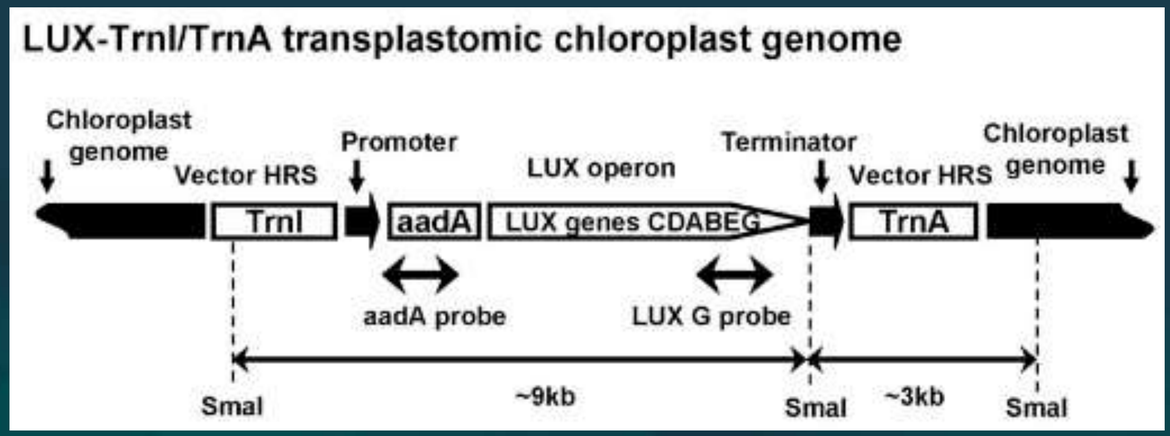


*1.44*10^{12} photons/s*



Autoluminescent Plants

Krichevsky, Citovsky, PLoS One (2010)

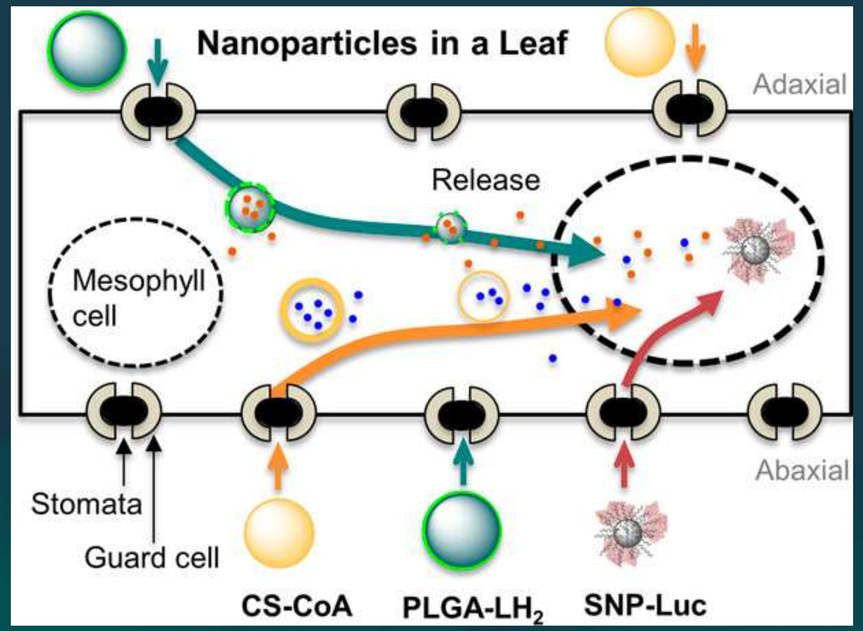


- Luciferase enzyme subunits (luxA and luxB)
- Proteins responsible for synthesizing and recycling the luciferase substrate (luxC, luxD, luxE, and luxG)

$1.3*10^6$ photons/s

A Nanobionic Light-Emitting Plant

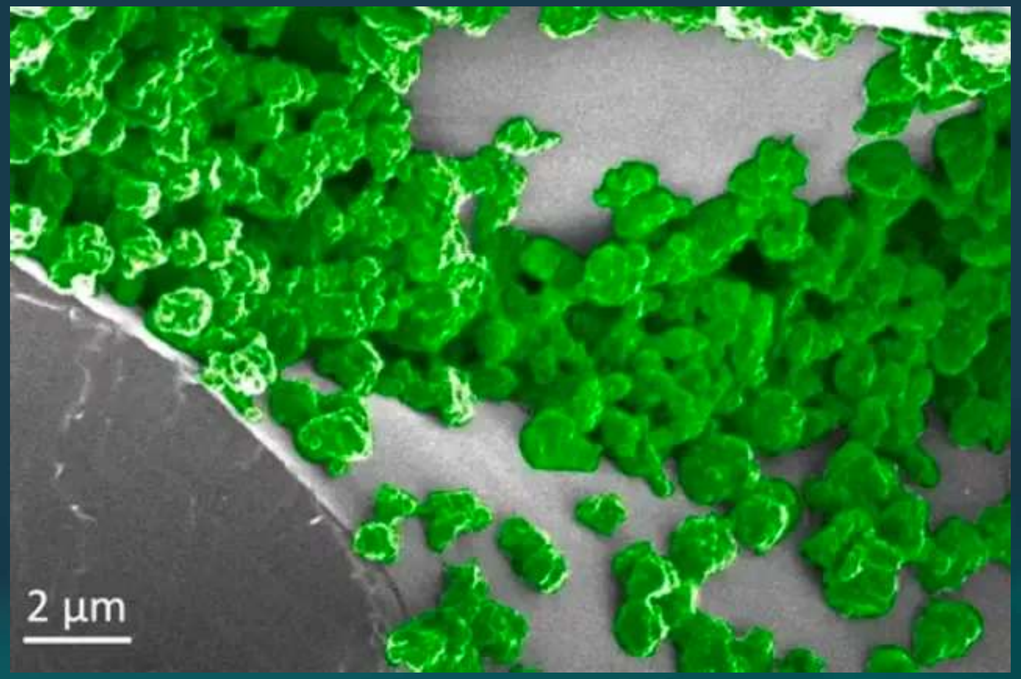
Kwak, Strano, Nano Lett (2017)

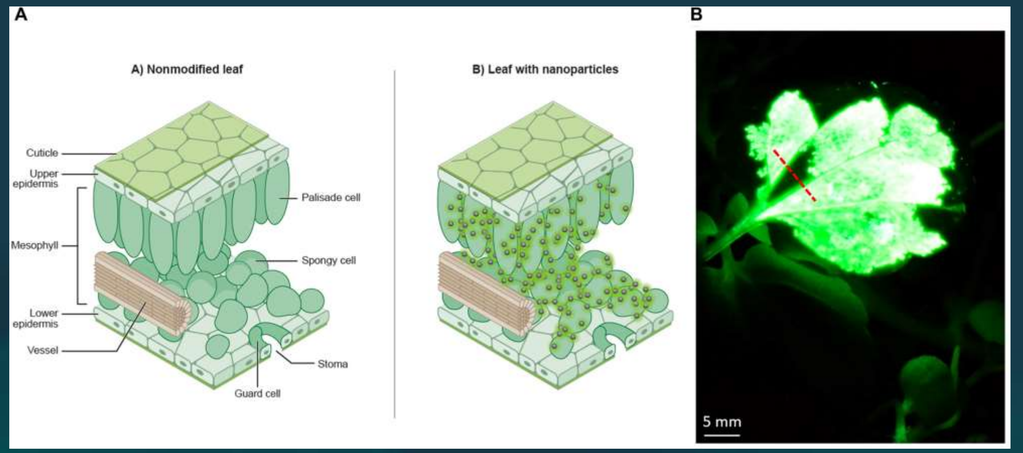


- SNP-Luc, PLGA-LH2, and CS-CoA are separately prepared and infiltrated into the plant as a mixture to enter the leaf tissues through the stomatal pores on the abaxial and adaxial sides. The smaller SNP-Luc can enter the stomatal guard cells and the mesophyll cells, wherease the larger PLGA-LH2 and CS-CoA stay in the mesophyll and release LH2 (orange dots) and CoA (blue dots) as the polymer nanoparticles are swollen and biodegraded.

Augmenting the Living Plant Mesophyll into a Photonic Capacitor

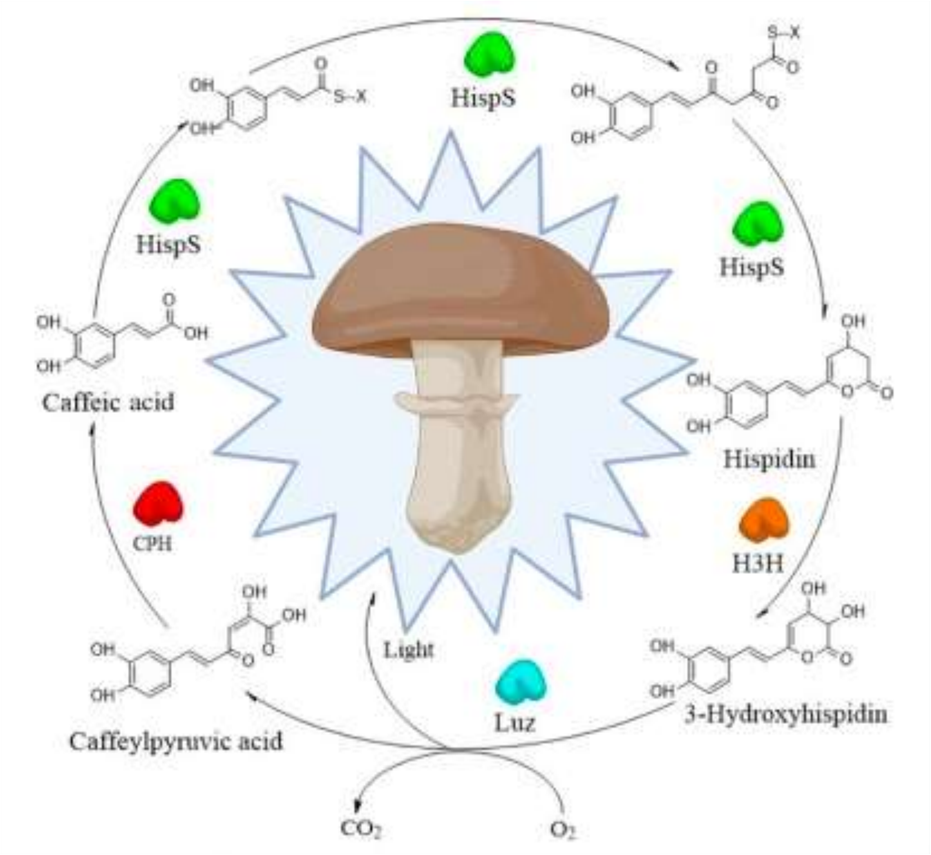
Gordiichuk, Strano, Sci. Adv. (2021)

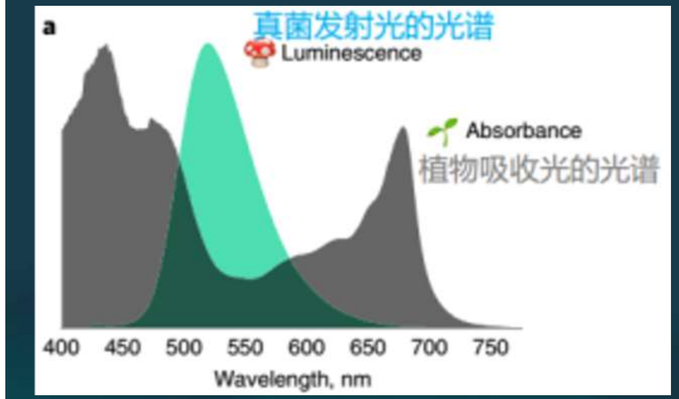




- (**A**) (Left) Schematic image of the mesophyll region of a plant leaf. The image shows cuticle, upper epidermis, mesophyll region, lower epidermis, vessel, palisade cells, spongy cells, guard cells, and stomata. (Right) Schematic image of the modified leaf with the SA NPs.
- (**B**) Light emission (after charging for 10 s with 400 mW/cm2 400-nm light source) infused in 3-week-old watercress leaf with solution of 650 ± 290 nm SA NP (25 mg/ml). The image was captured on camera set on 30-s exposure time.
- (**C**) Cryo-SEM image of nonmodified freeze-fractured watercress leaf. Scale bar, 10 µm.

Fungal bioluminescent pathway





Translation into plants

Mitiouchkina, Sarkisyan, Nat Biotechnol (2020)

Reuter, Lenaghan, Trends in Plant Science (2022)

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Metabolic engineering and mechanical investigation of enhanced plant autoluminescence

Peng Zheng, Jieyu Ge, Jiayi Ji, Jingling Zhong, Hongyu Chen, Daren Luo, Wei Li, Bo Bi, Yongjun Ma, Wanghui Tong, Leiqin Han, Siqi Ma, Yuqi Zhang, Jianping Wu, Yanqiu Zhao ... See all authors

First published: 08 May 2023 | https://doi.org/10.1111/pbi.14068

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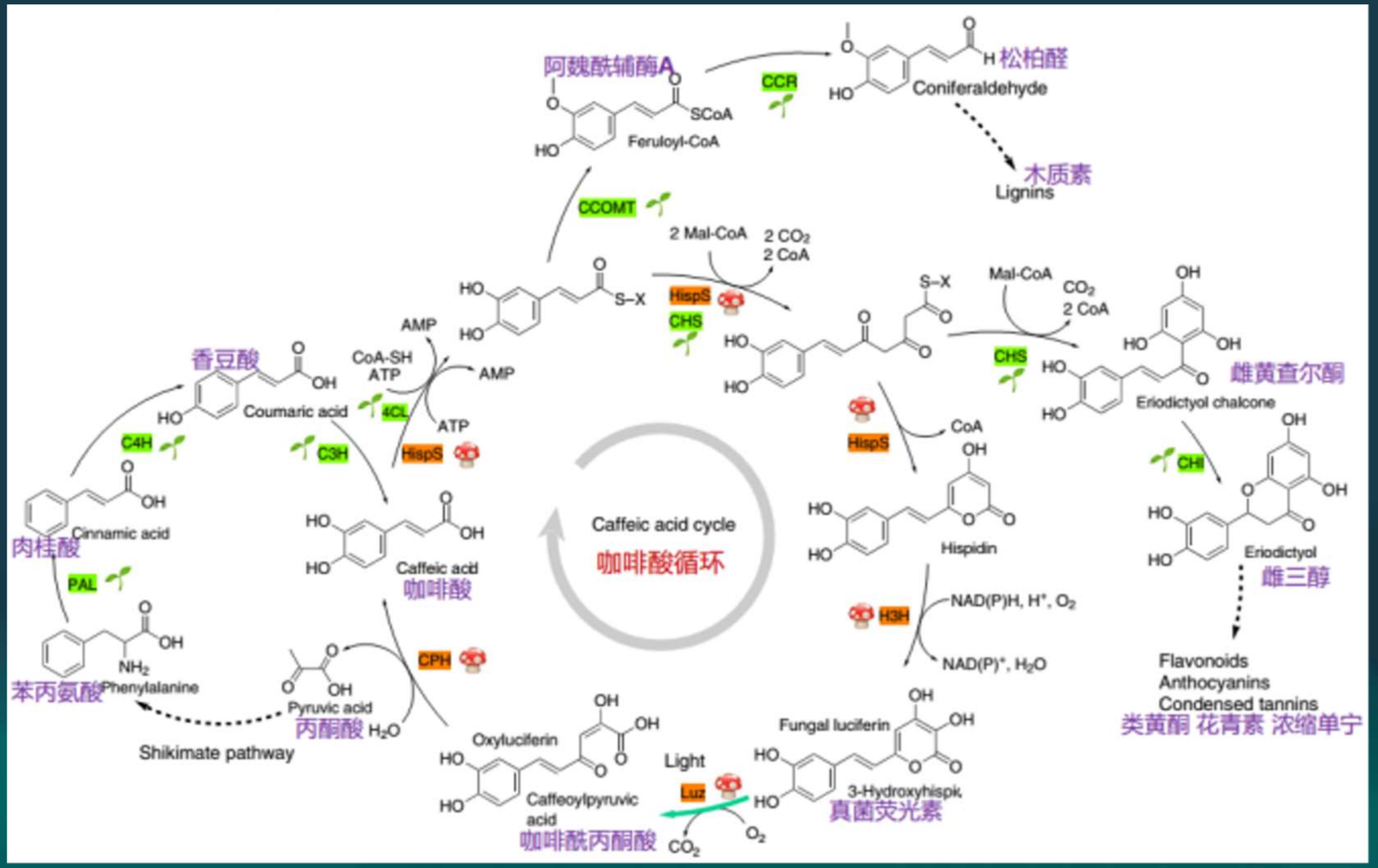
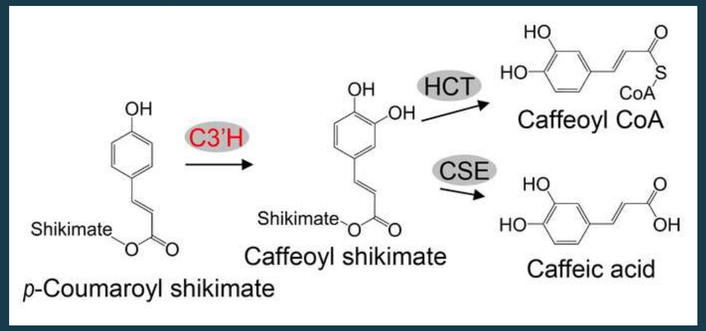
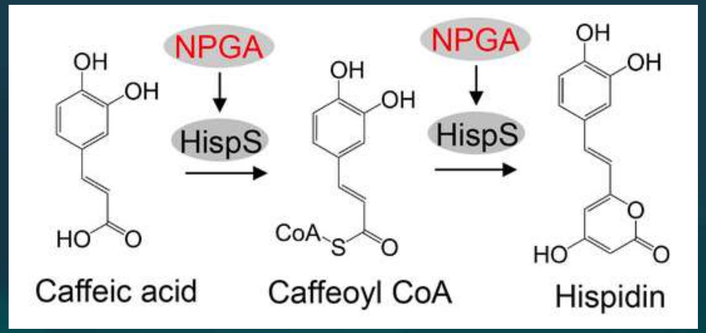
Adviser: Prof. Jen Sheen.

They supposed that C30H facilitates the biosynthesis of caffeic acid and hispidin.





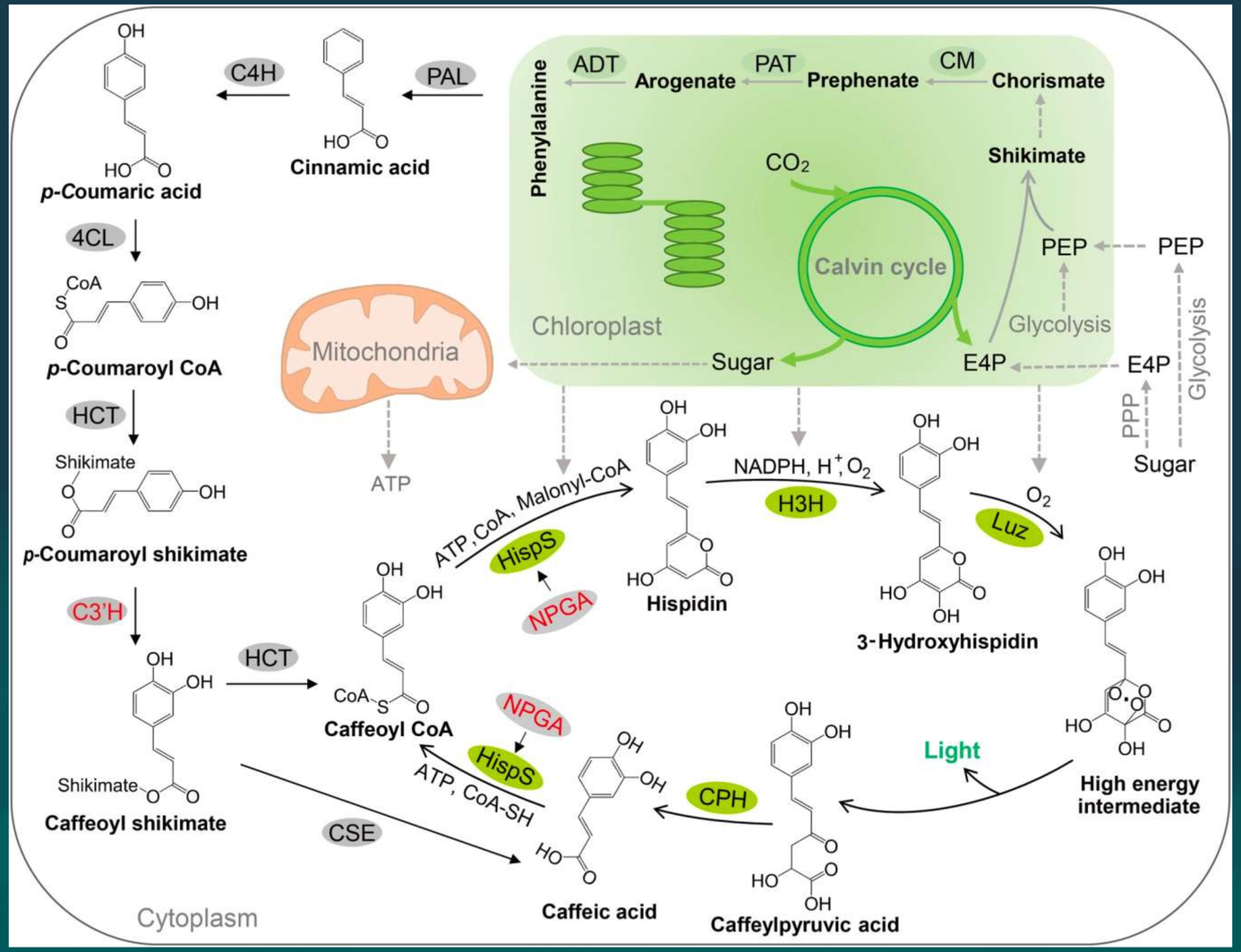
C30H1 gene from Brassica napus



NPGA gene from A. nidulans

*3*10^11 photons/min/cm^2*

Integration of the FBP into plants' metabolic pathways



THANKS