

Bioluminiscenca - živa svetloba

Maja Berden Zrimec







Nastanek svetlobe

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- Kemijska reakcija:
luciferaza katalizira
oksidacijo luciferina

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reakcija sproži kalcij



Luciferini si niso sorodni

- Bioluminiscenca se je tekom evolucije razvila vsaj 40-krat, morda celo 50-krat



A chart of selected bioluminescent species, including all known luciferin, luciferase, and photoprotein structures. Based on the textbook *Bioluminescence: Chemical Principles and Methods* (Revised Edition) by Nobel Laureate Professor Osamu Shimomura. © 2014 ELEANOR LUTZ

Konstantno svetenje ali bliskanje

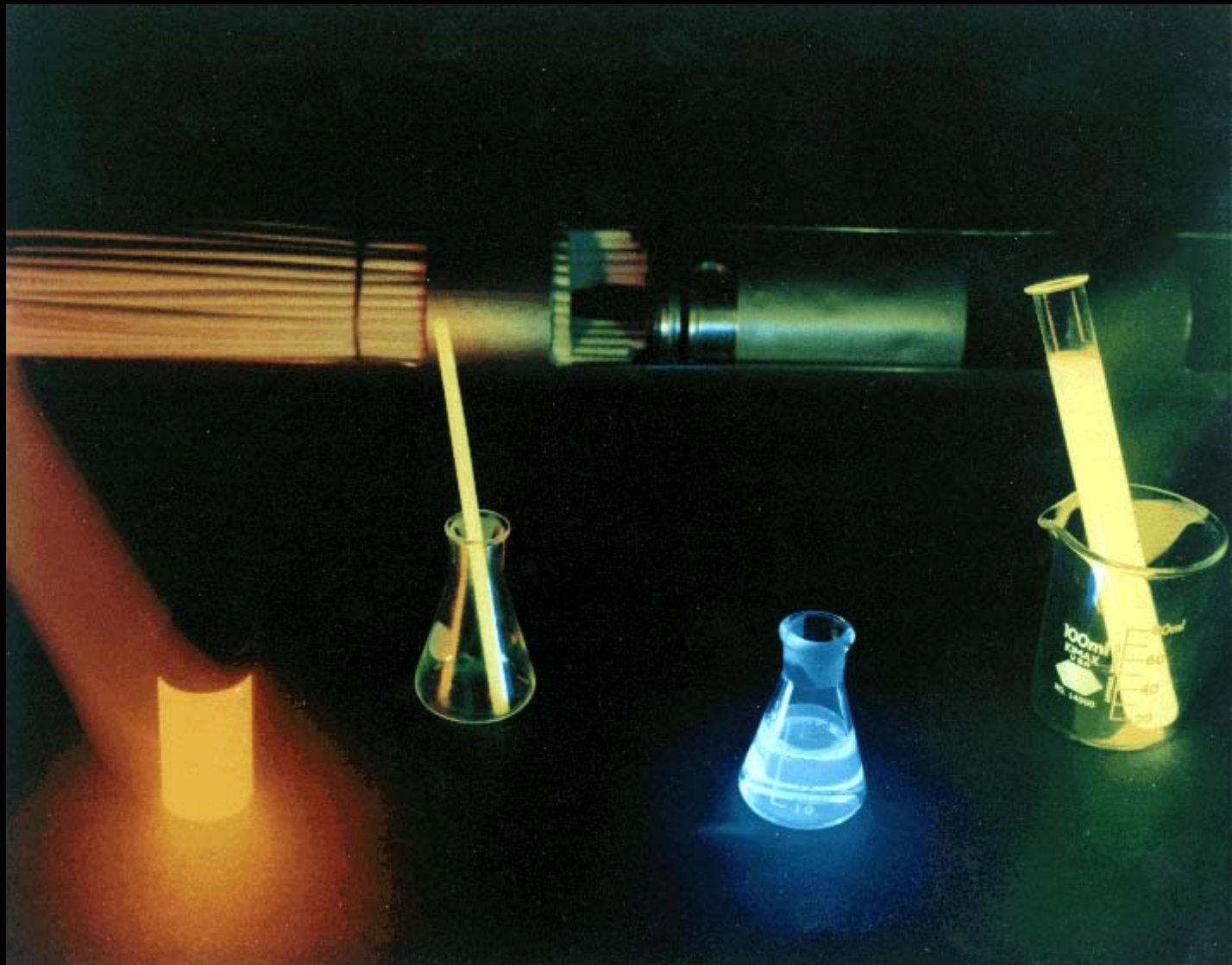


Bioluminiscenca

- Večinoma **modra svetloba**
 - Nekateri klobučnjaki jo pretvorijo v **zeleno**
 - Črna zmajevska riba jo pretvori v **rdečo**
- Večinoma gre za **bliske svetlobe 0.1 – 10 s**
 - Nekateri organizmi oddajajo svetlobo konstantno (bakterije)
- **Zavestna kontrola**: bliskanje sproži kakšen pomemben dogodek – osvajanje samičk pri kresničkah in morskih planktonskih rakcih
- Pri enoceličnih organizmih: bliskanje sprožijo **mehanski dražljaji**

Barve svetlobe

- Barvo oddane svetlobe so določili pri okoli 170 od 670 vrst organizmov, ki bioluminiscirajo
- Barve najpogosteje **modre**, **zelene** in **oranžne**, nekatere pa tudi **temno vijoločne** ali **temno rdeče**
- Barva svetlobe pogosto povezana z okoljem, v katerem organizmi živijo:
 - Prostoplavajoče in globokomorske živali: **modra**
 - Obalni morski organizmi: **zelena**
 - Kopenske in sladkovodne živali: **rumena**



Zakaj bioluminiscenca?

- parjenje (ognjeni črvi, planktonski rakci, kresničke)
- plenjenje (kresničke, sijoči črvi, globokomorske ribe)
- Izogibanje plenilcem:
 - zasenčenje (globokomorski rakci in lignji)
 - izbrizganje bioluminiscentne tekočine (lignji, mehkužci - prilepki)
 - obramba (planktonski rakci, dinoflagelati)
- sporazumevanje (lignji)
- pomoč pri vidu (hrošči, globokomorske ribe)
- bakterije

Parjenje





Just about 100% of a firefly's light is given off as light.

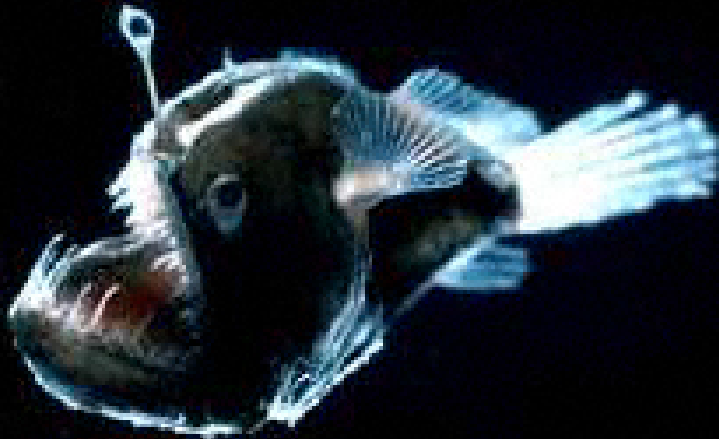
By comparison, a normal electric light bulb gives off only 10% of its energy as light, while 90% is wasted as heat.



Iskanje partnerjev v temnih globinah



Iskanje partnerjev v temnih globinah



Iskanje partnerjev v temnih globinah



© E. Widder

Iskanje partnerjev v morskih globinah



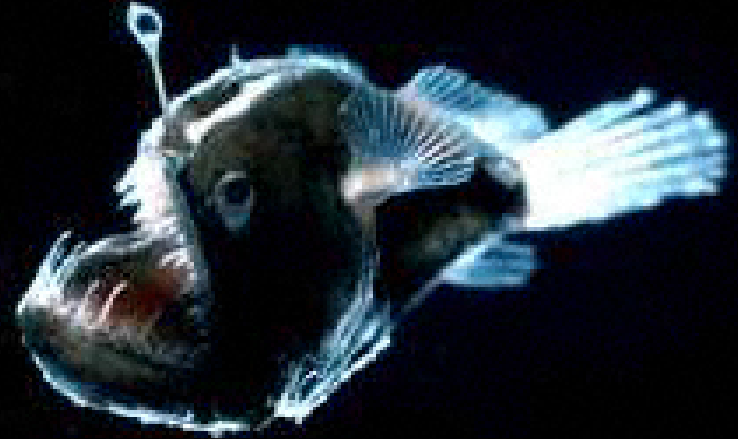
Optical Lure



Nevarnosti pri iskanju partnerjev



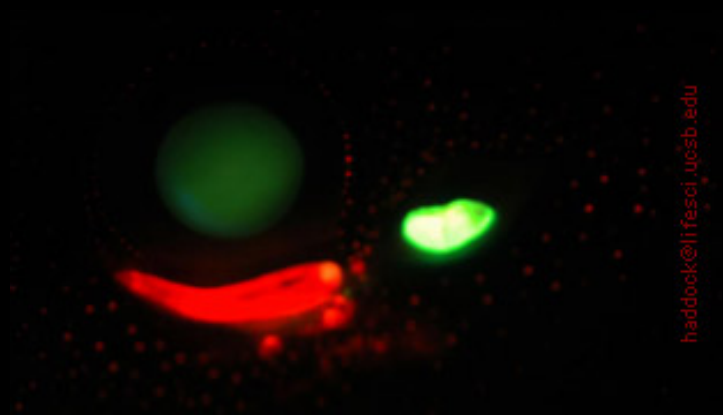
Plenilci



Nevidna baterija – črna zmajevska riba



Nevidna baterija – črna zmajevska riba



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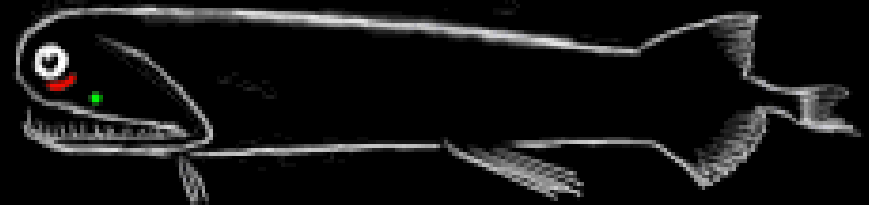


Fluorescence image of an *Aristostomias* eye and photophores.

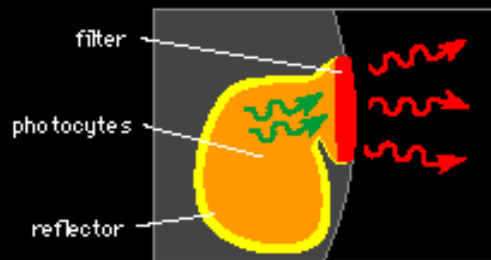
Nevidna baterija – črna zmajevska riba



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Fluorescence image of an *Aristostomias* eye and photophores.



After Denton, et al. (1985)

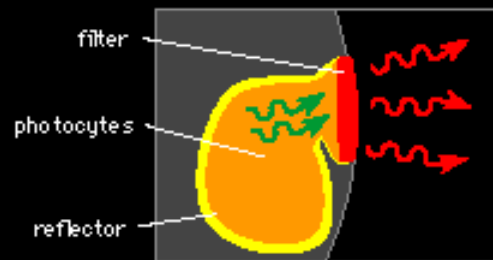
Nevidna baterija – črna zmajevska riba



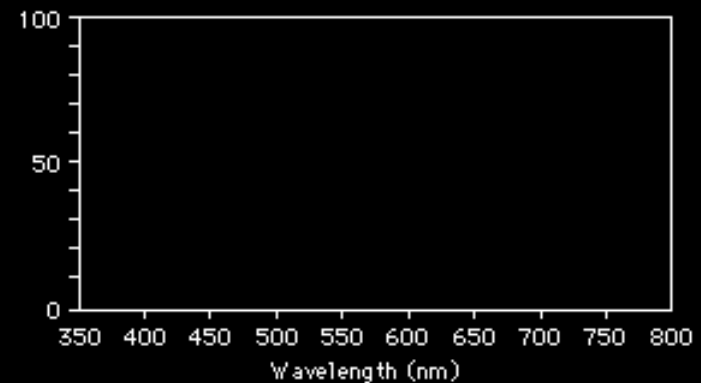
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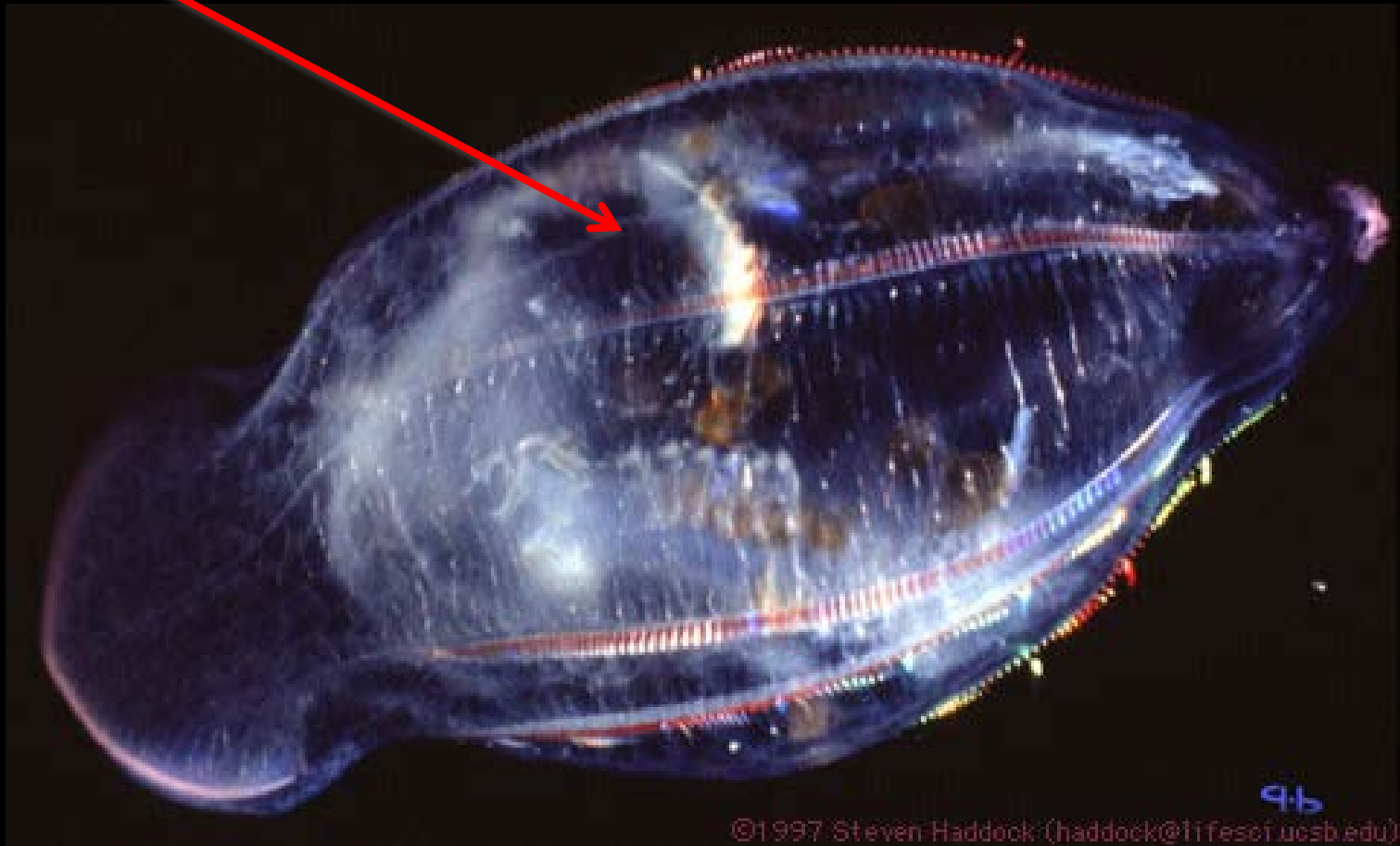
Fluorescence image of an *Aristostomias* eye and photophores.



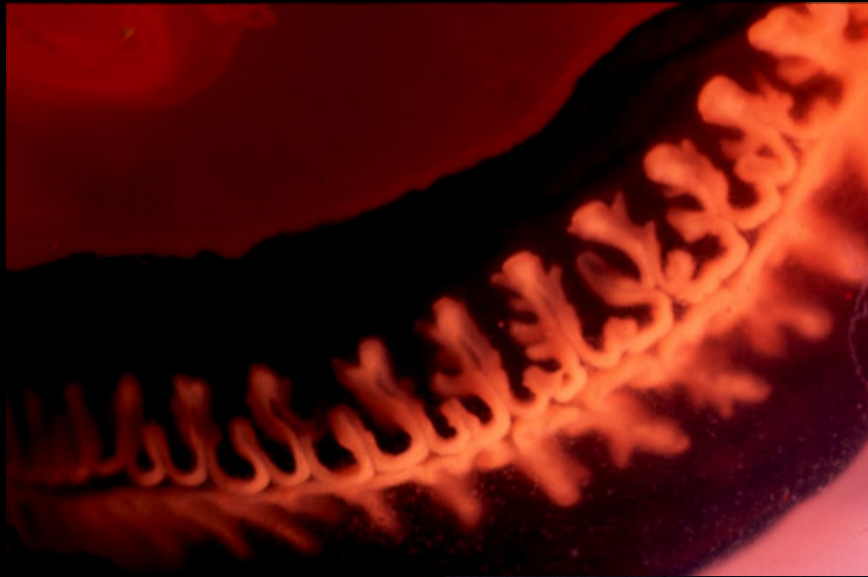
After Denton, et al. (1985)



Skrivanje pojedinih BL organizmov



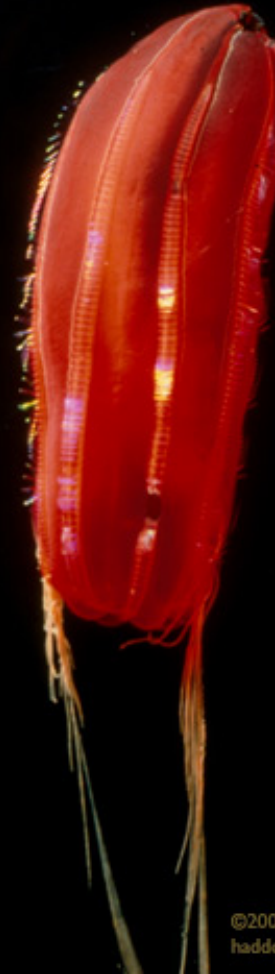
Skrivanje pojedениh BL organizmov



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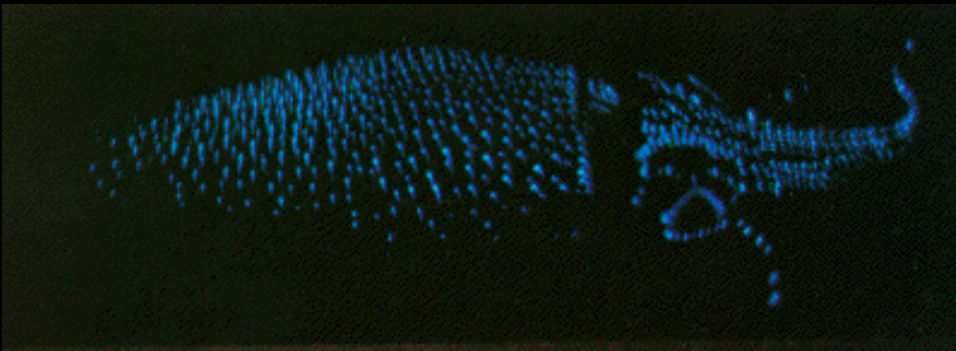


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Izogibanje plenilcem – senčenje telesa



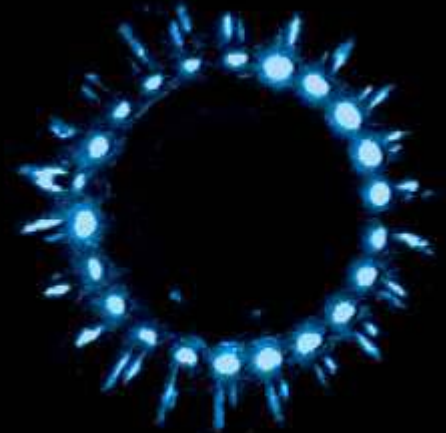
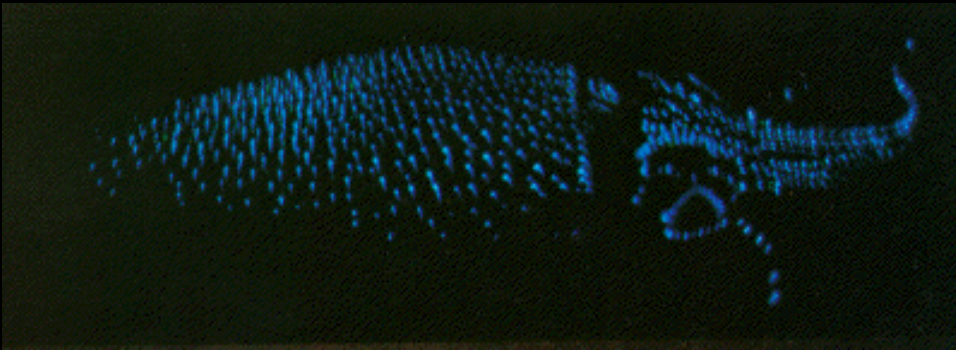
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Izogibanje plenilcem – senčenje telesa



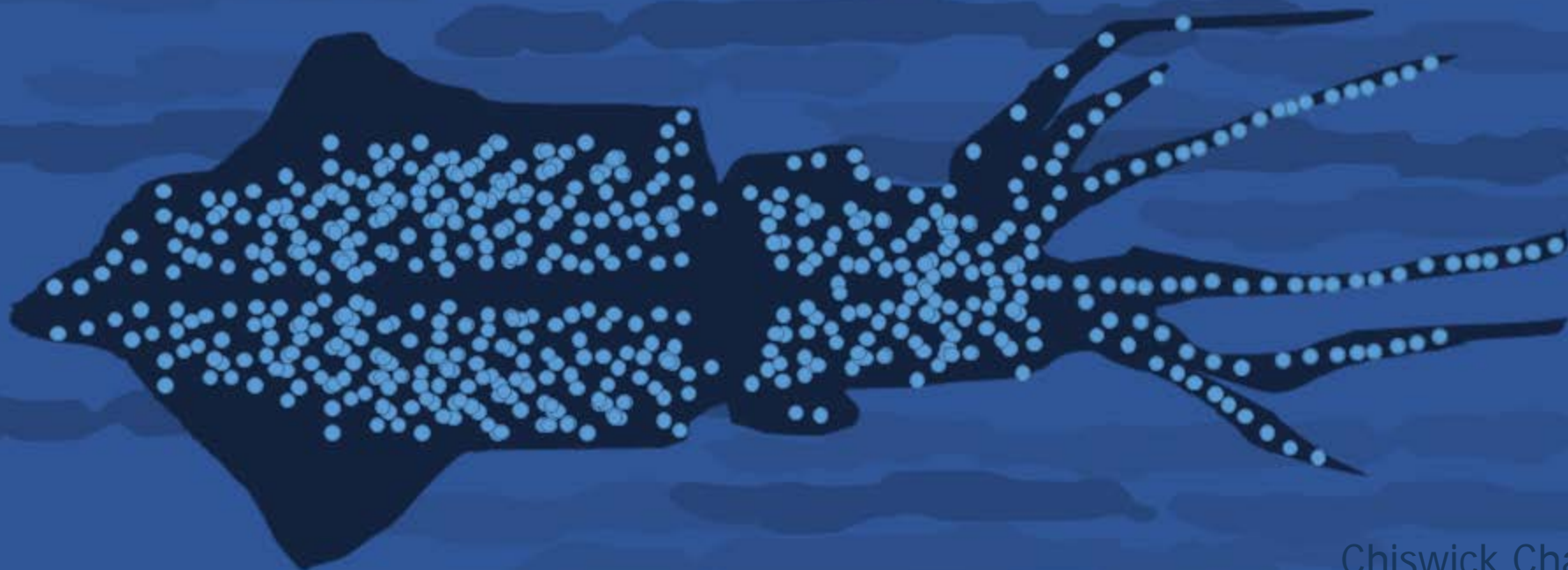
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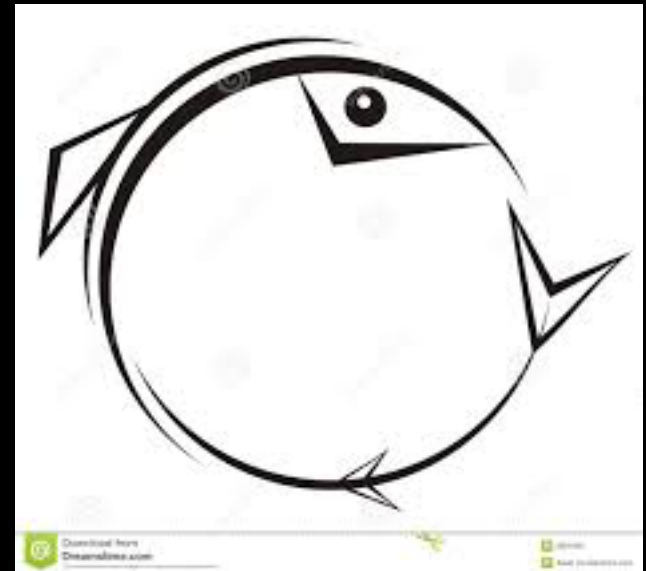
Izogibanje plenilcem – senčenje telesa

Counterillumination in *Porichthys notatus*

In this ventral view of two midshipman fish under dim downwelling light, the fish near the center uses its bioluminescence to obscure its silhouette, while the other does not. When the light is turned off suddenly, the glowing fish is caught in the act.

Robert Harper and James Case
Univ. of Calif., Santa Barbara

Izogibanje plenilcem – mimikrija



Izogibanje plenilcem - bioluminiscentno “črnilo”



Izogibanje plenilcem - bioluminiscentno “črnilo”

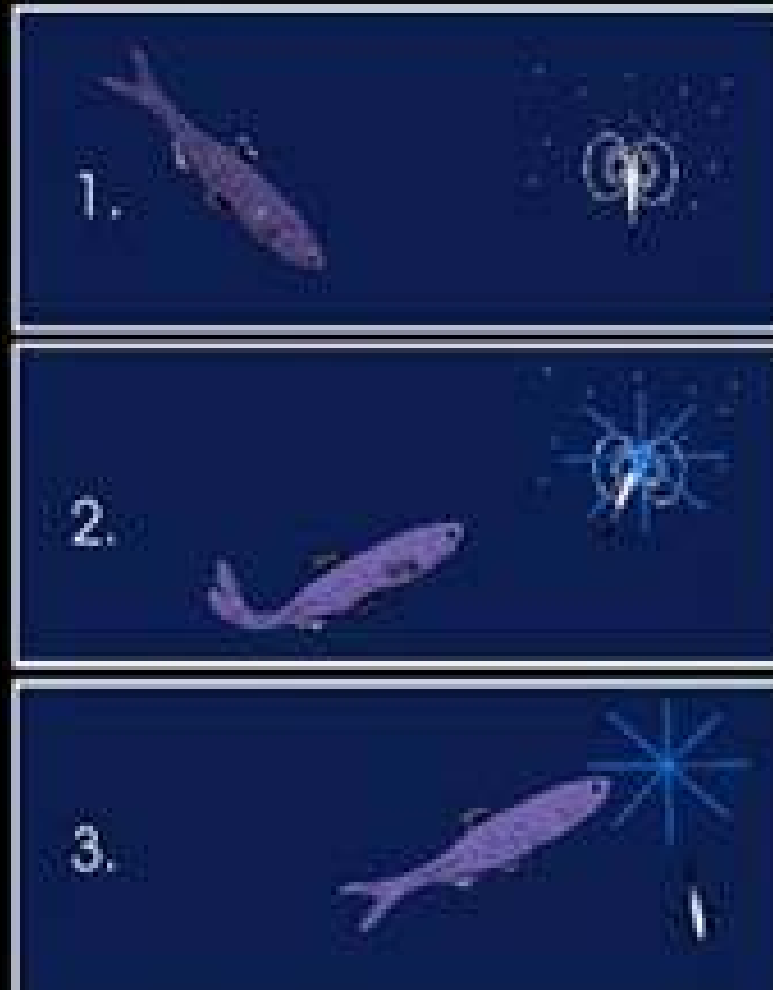
Izogibanje plenilcem - bioluminiscentno “črnilo”



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Izogibanje plenilcem – “vlomilski alarm”



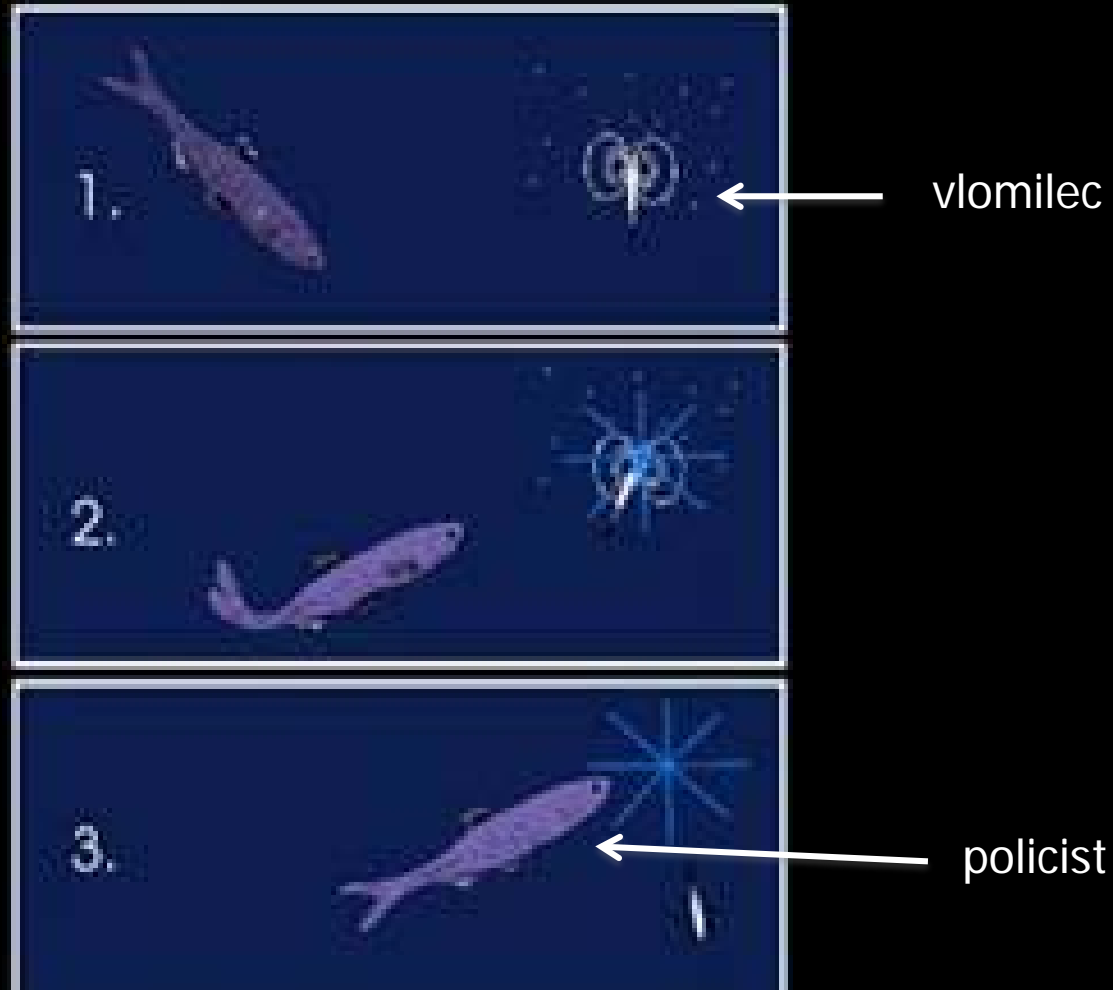
Izogibanje plenilcem – “vlomilski alarm”



← vlomilec



Izogibanje plenilcem – “vlomilski alarm”



Izogibanje plenilcem – “vlomilski alarm”



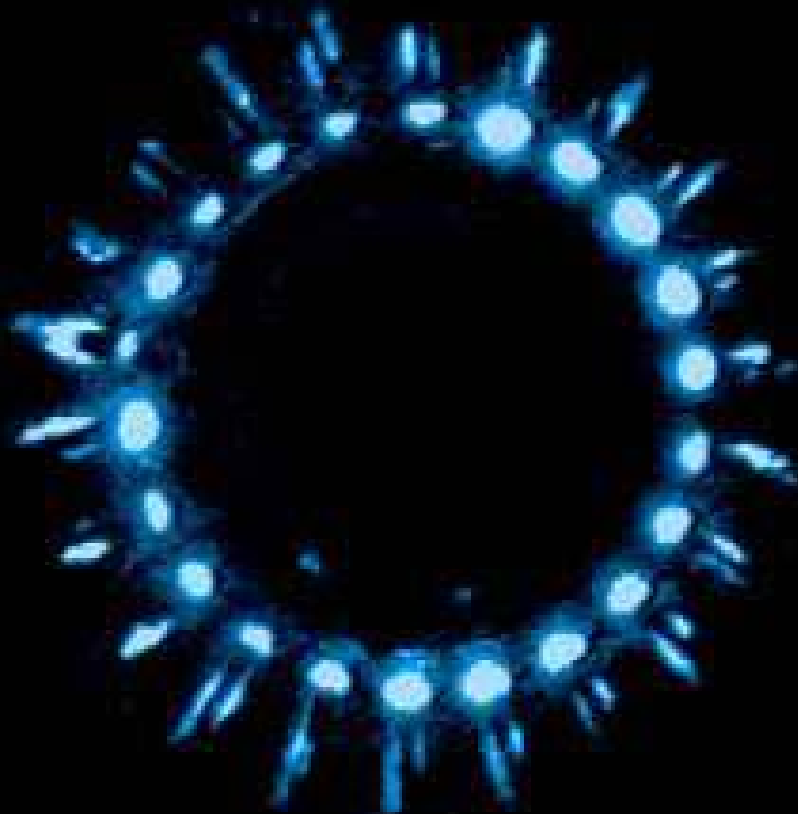
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Izogibanje plenilcem – “vlomilski alarm”



Deep-sea jellyfish: *Atolla wyvillei*



Optical Lure



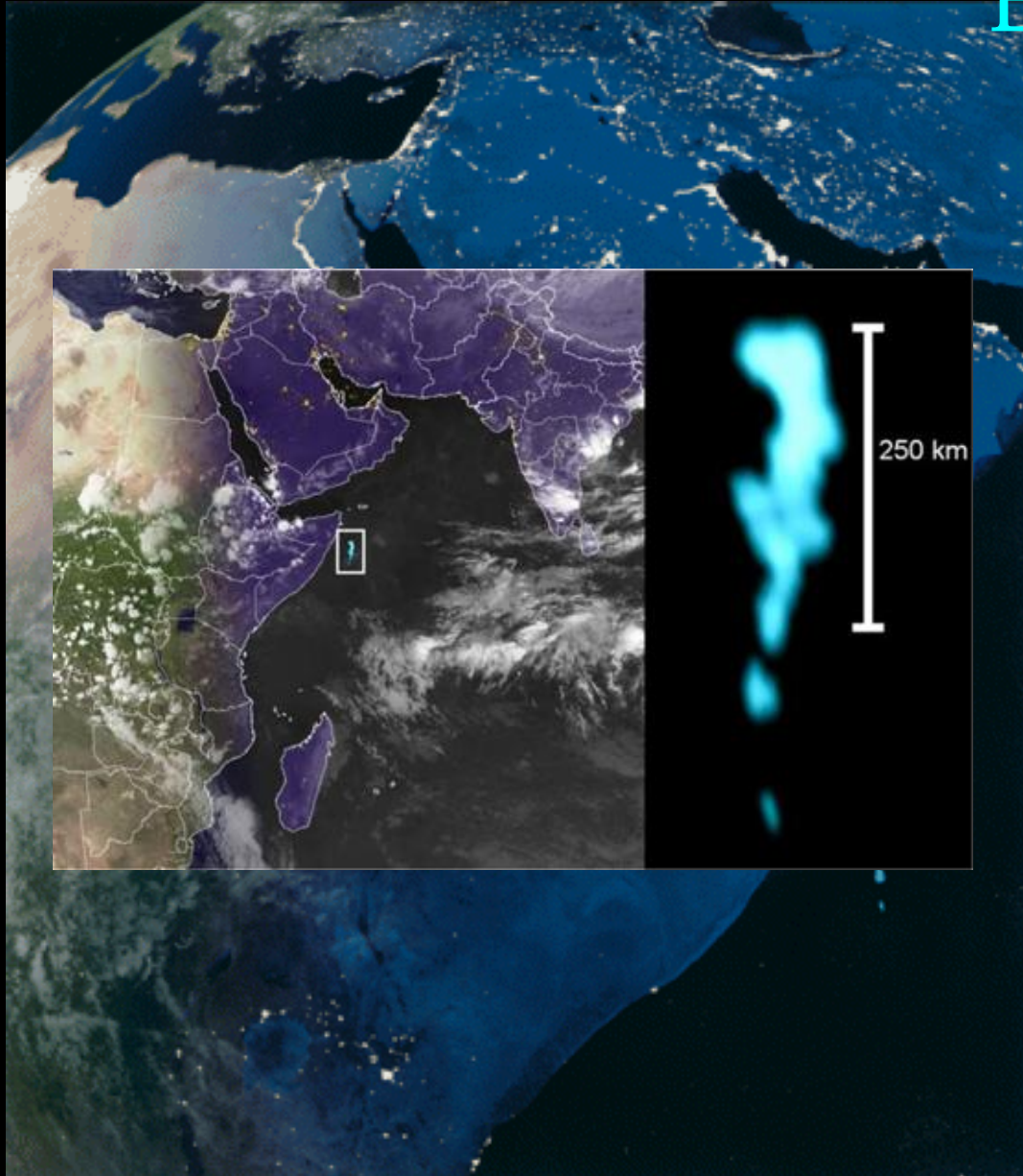




Bakterije

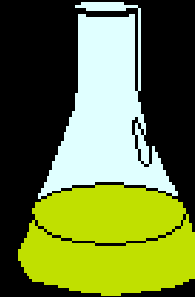
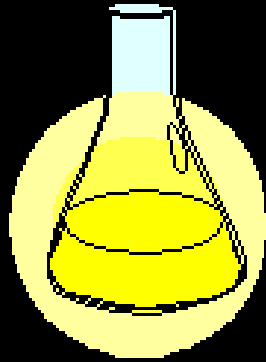


Bakterije



Bioluminiscenca bakterij za ekotoksikološke analize okolja

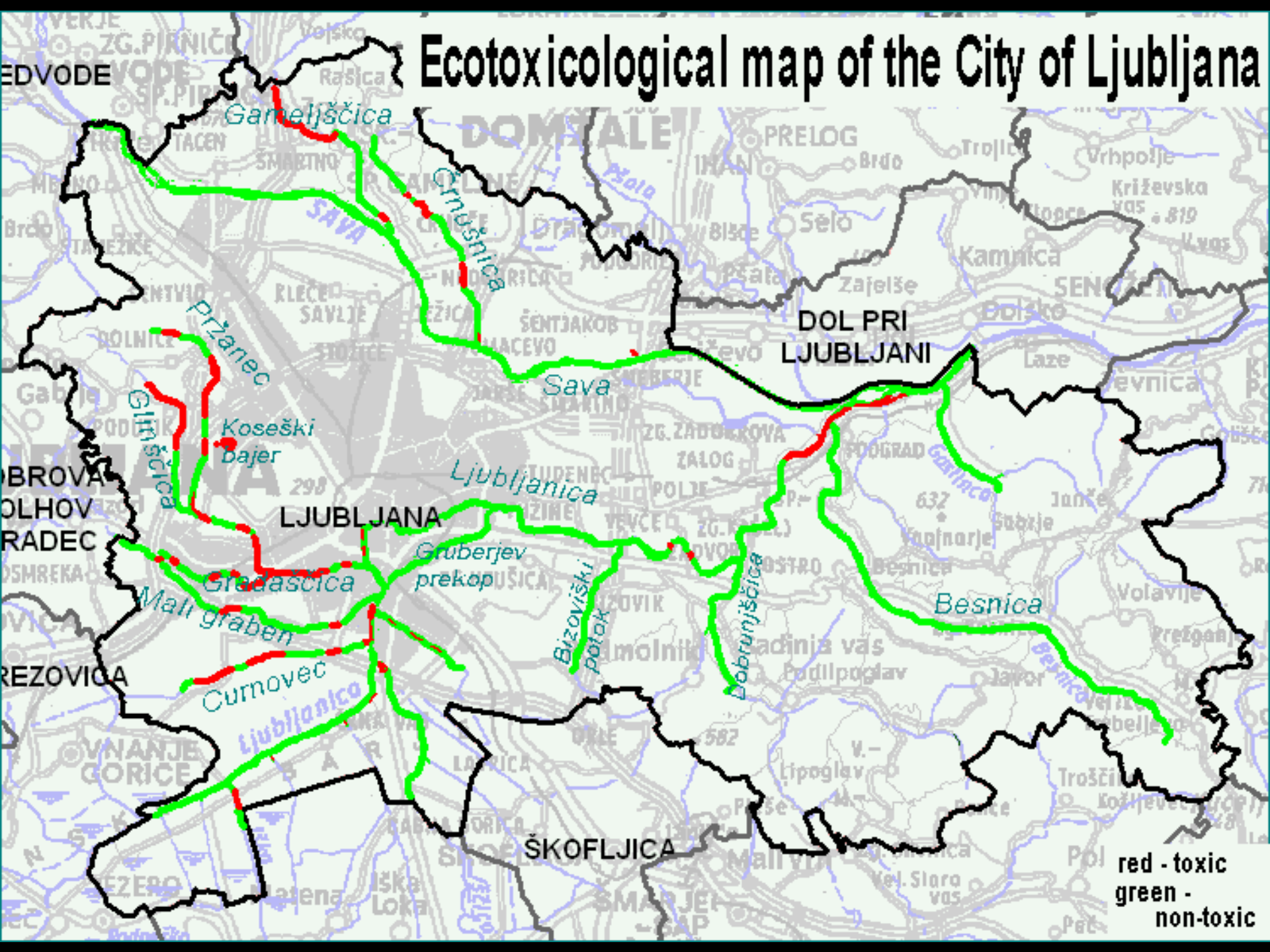
onesnažena
voda



**Močno
svetenje
dobro počutje**

**Šibko svetenje
slabo počutje**

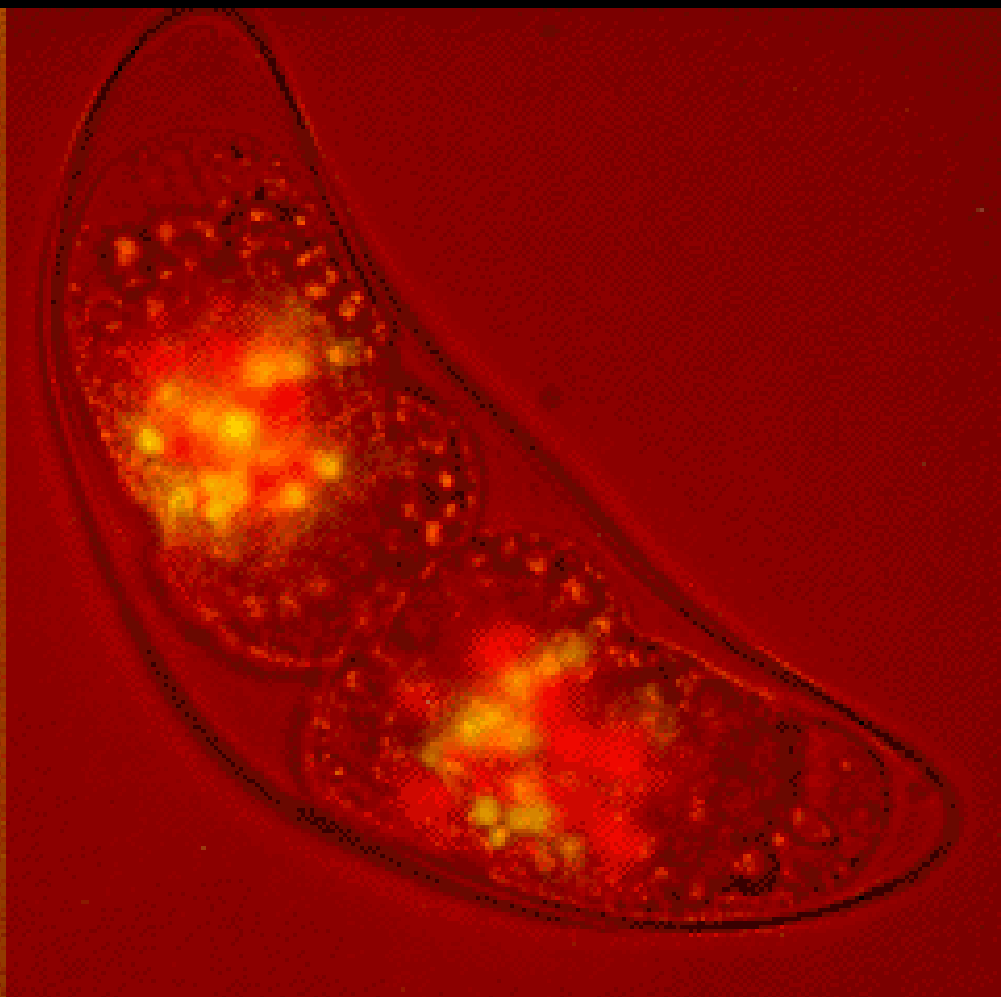
Ecotoxicological map of the City of Ljubljana



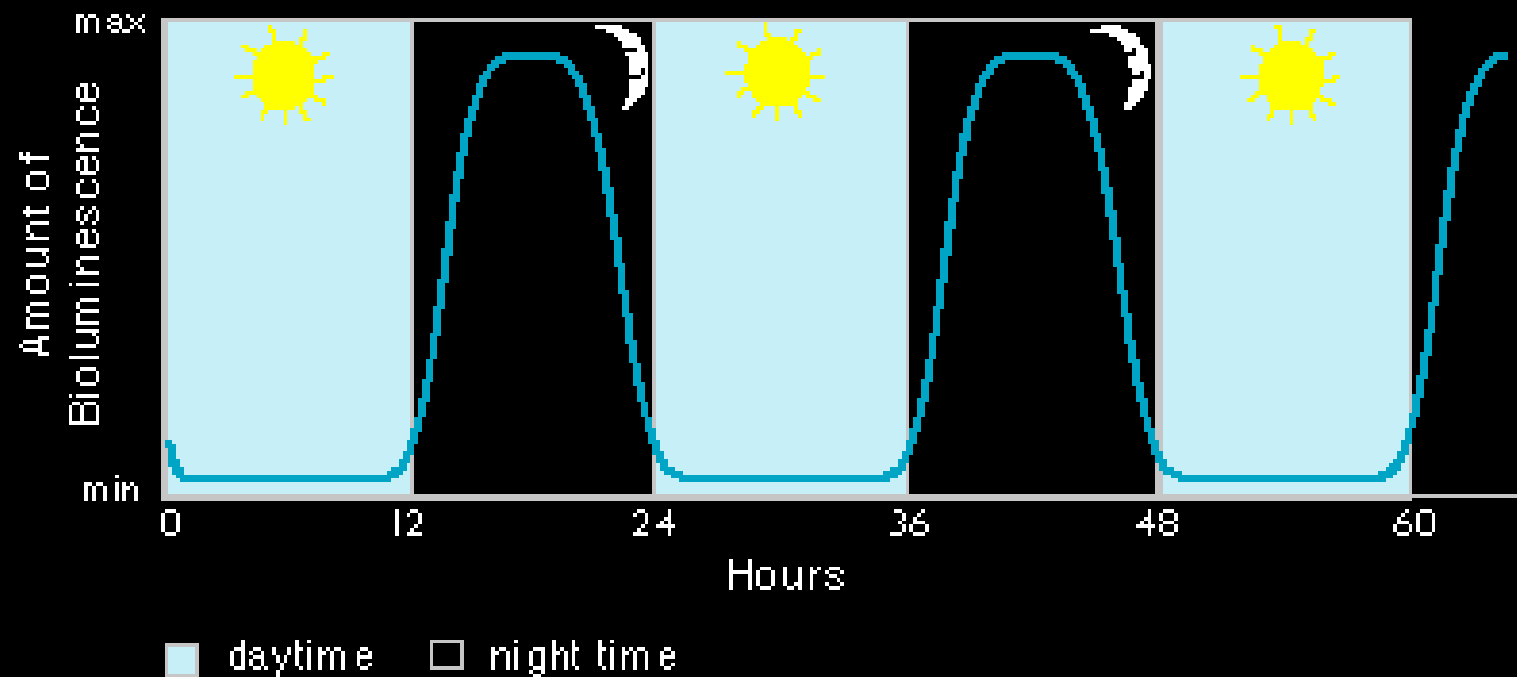
Alge



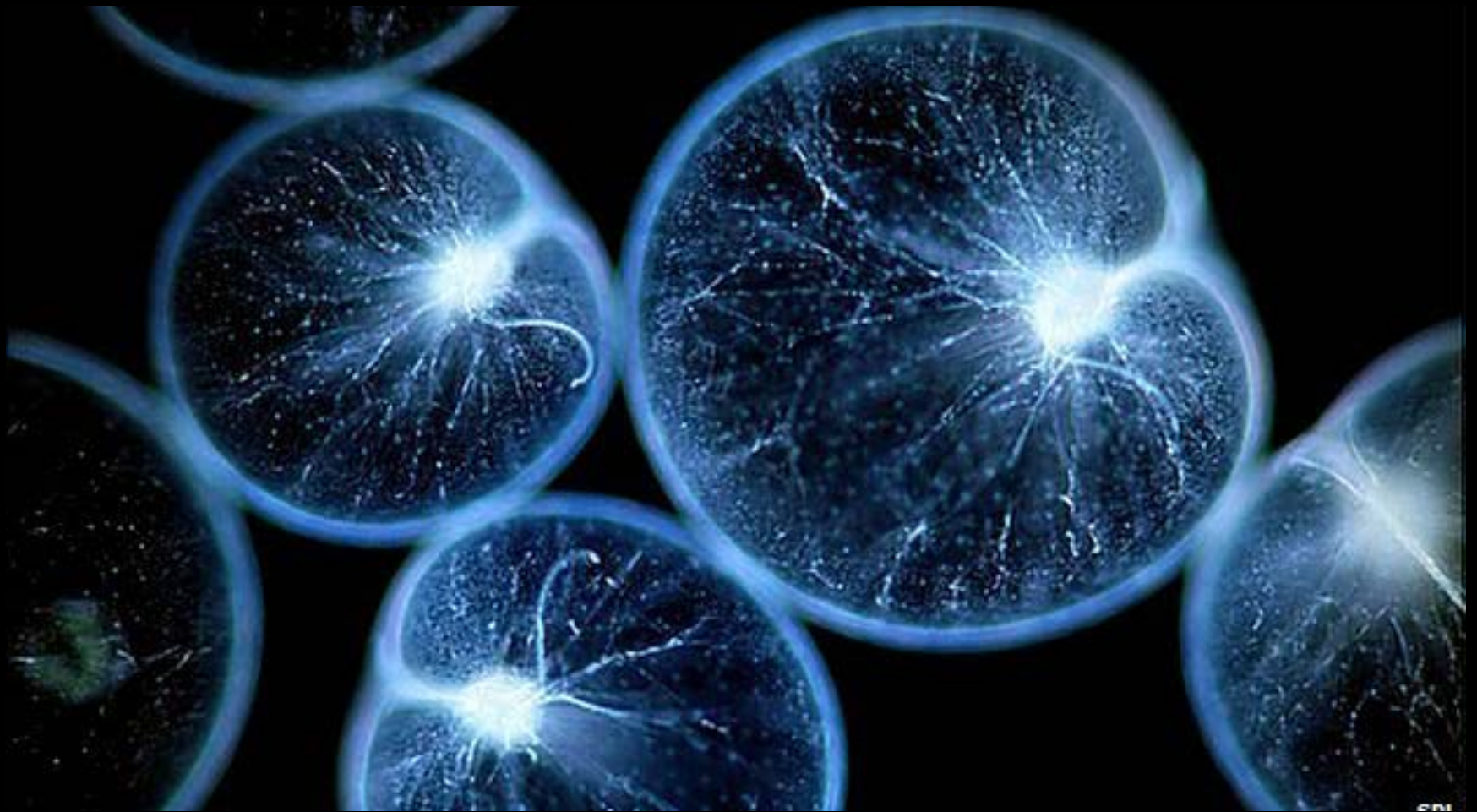
Alge



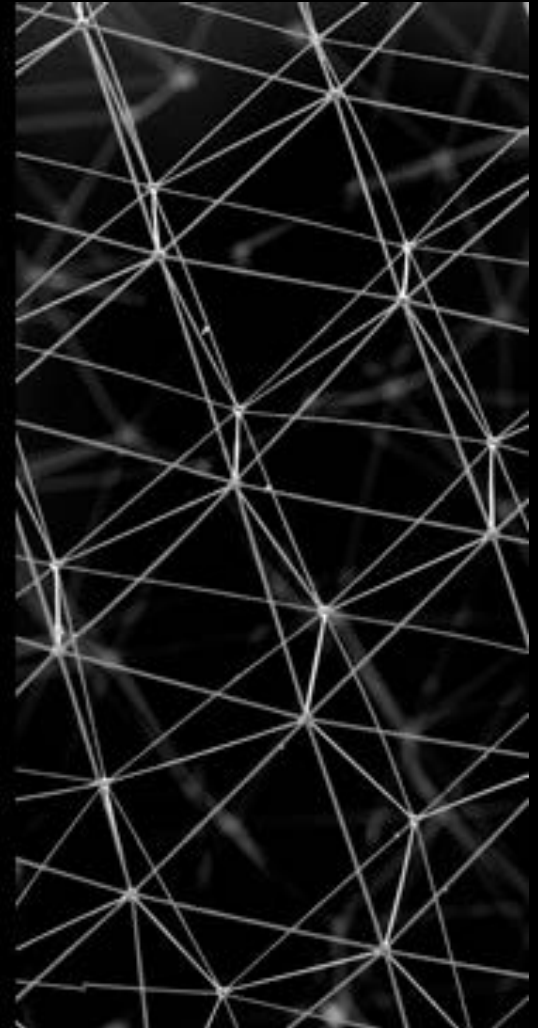
Alge – razlika med močjo svetlenja ponoči in podnevi



Zooplankton



Radiolariji



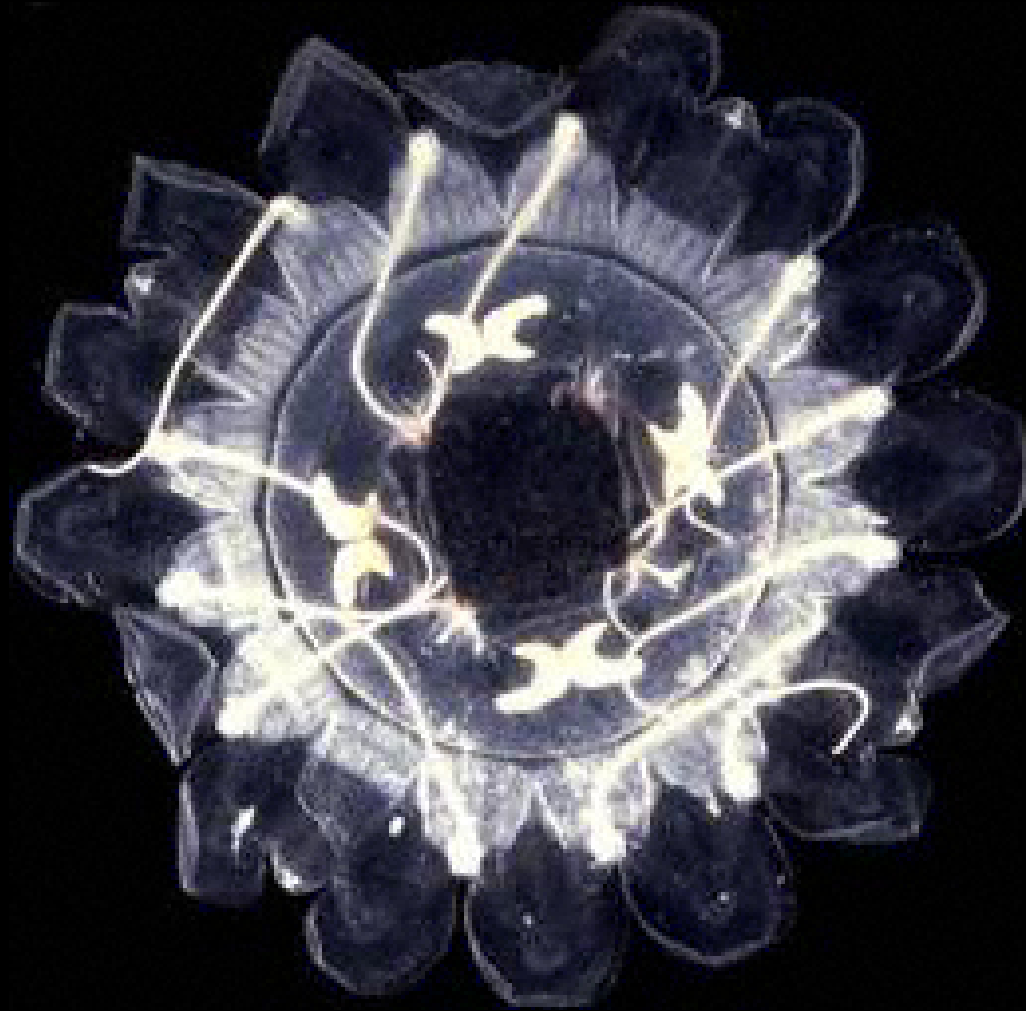
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Glive

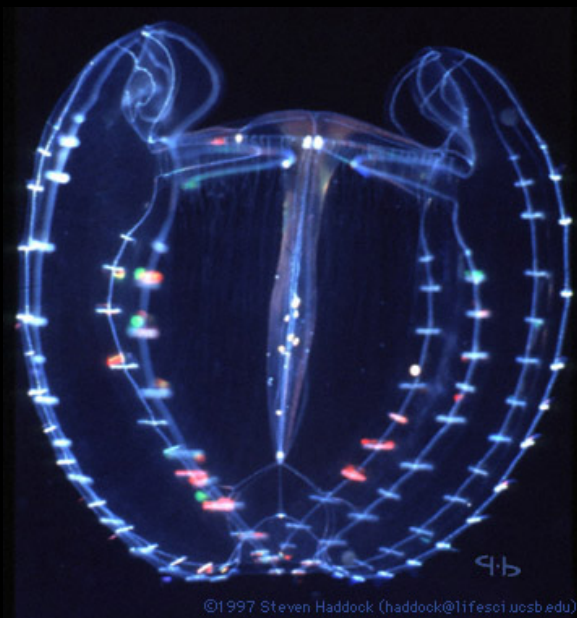
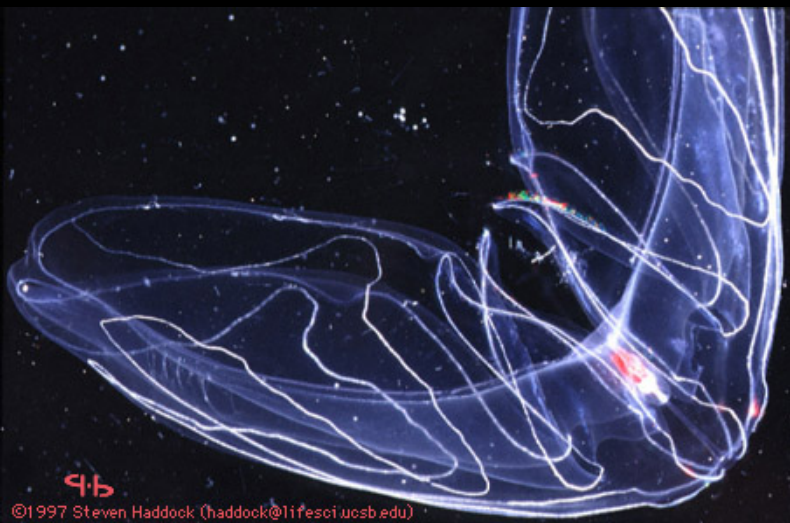


Photographie par Joel Fourcard

Meduze



Rebrače



Goli polži



Glavonožci



4b

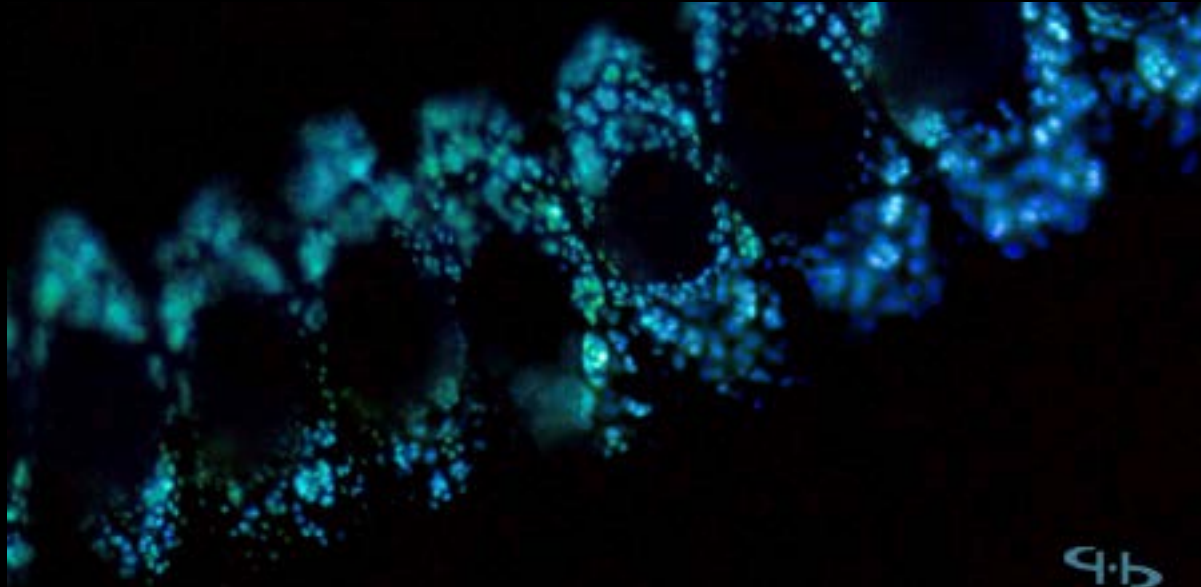
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Glavonožci



Glavonožci

Glavonožci



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Glavonožci



Planktonski rakci



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Mnogoščetinci



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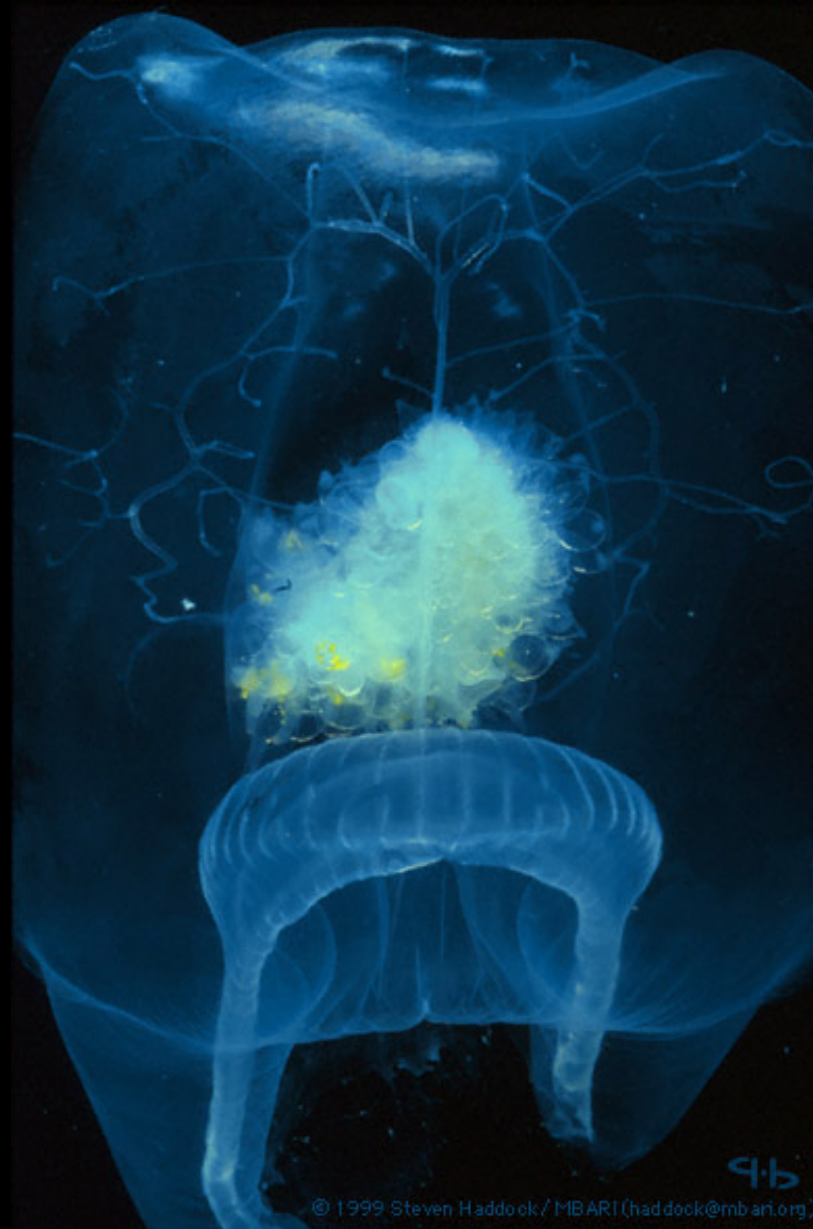
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Sifonofore

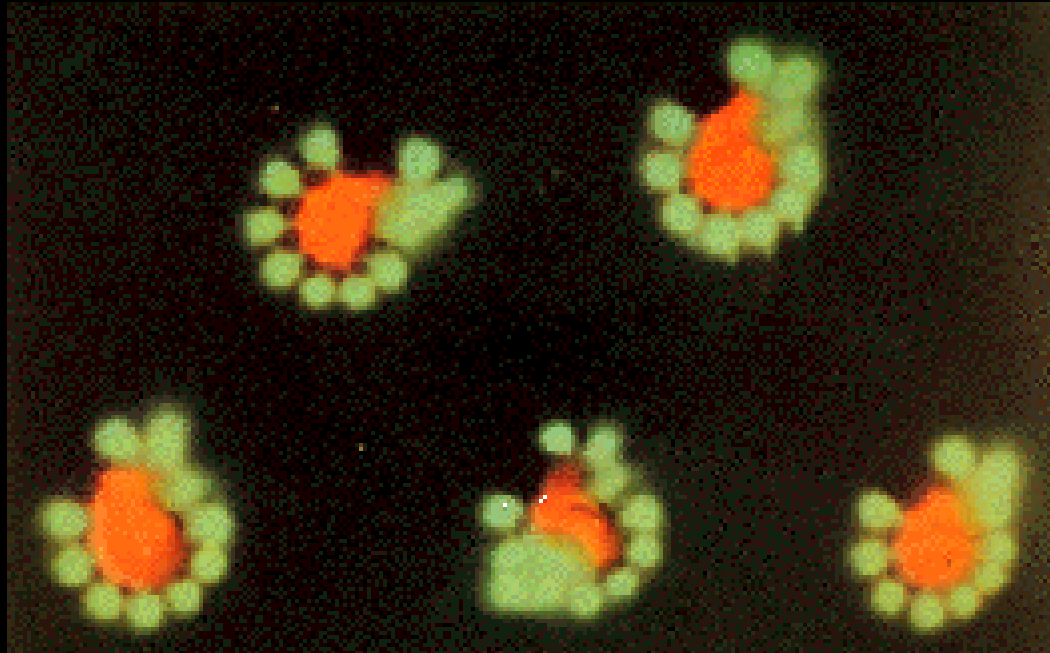


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Sifonofore



Žuželke



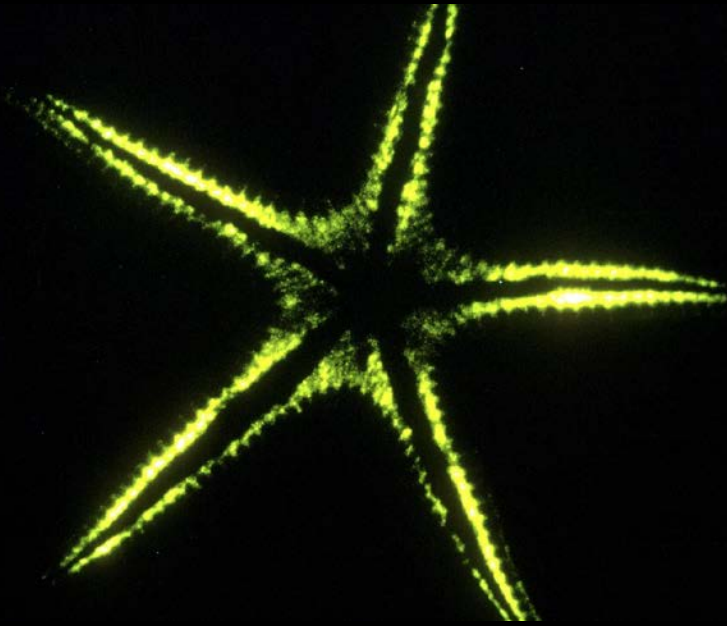
Žuželke



Žuželke



Iglokožci



Many marine organisms, such as this large species of brittle star, are bioluminescent.



Ščetinočeljustnica



Ribe



Ribe



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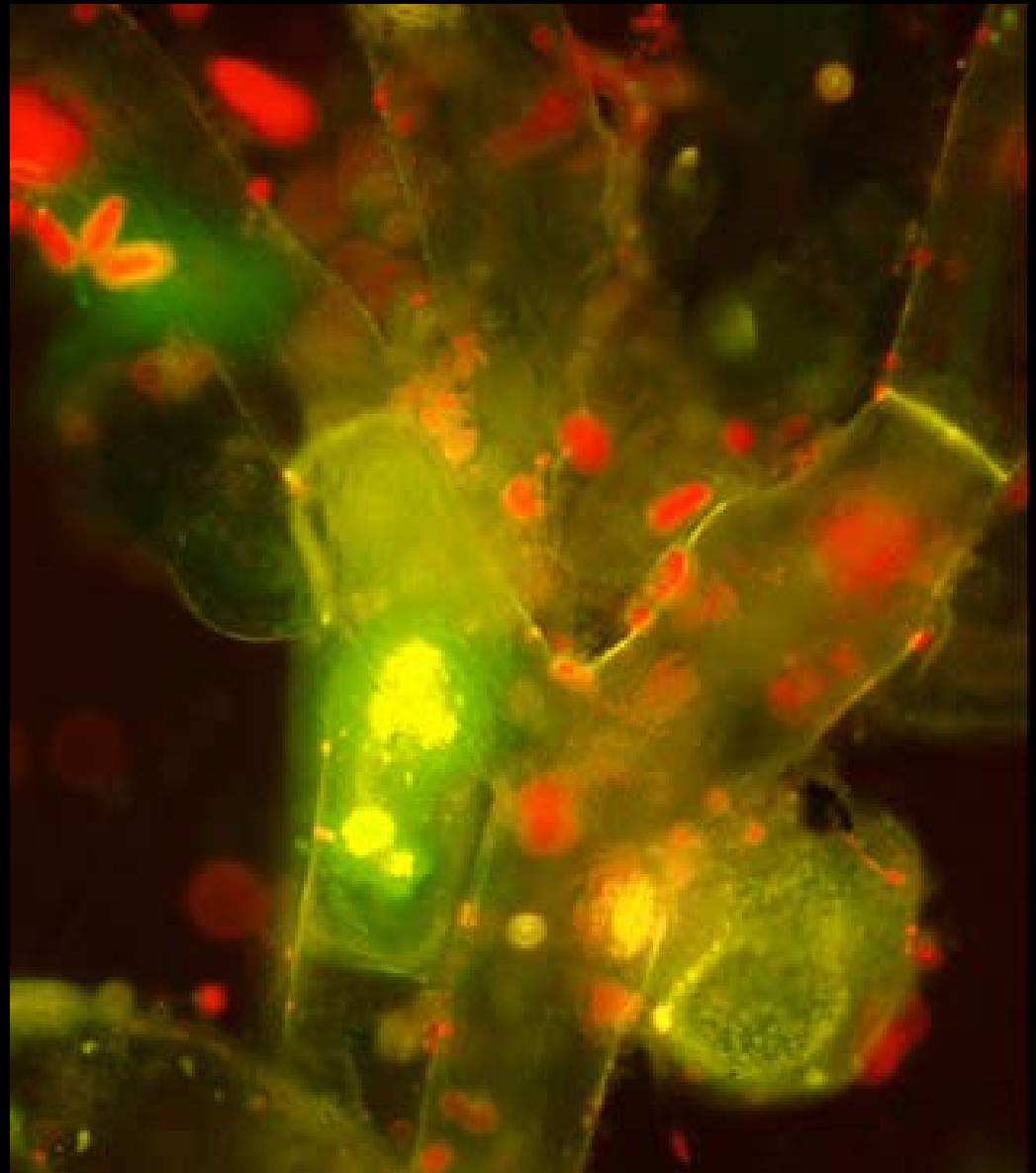
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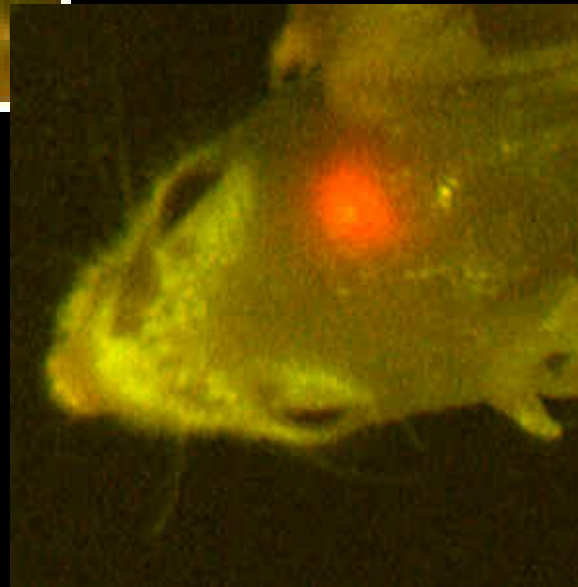
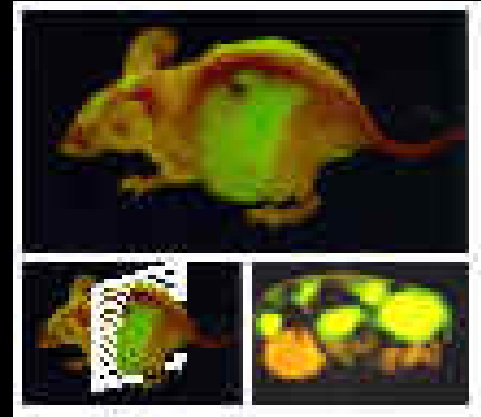
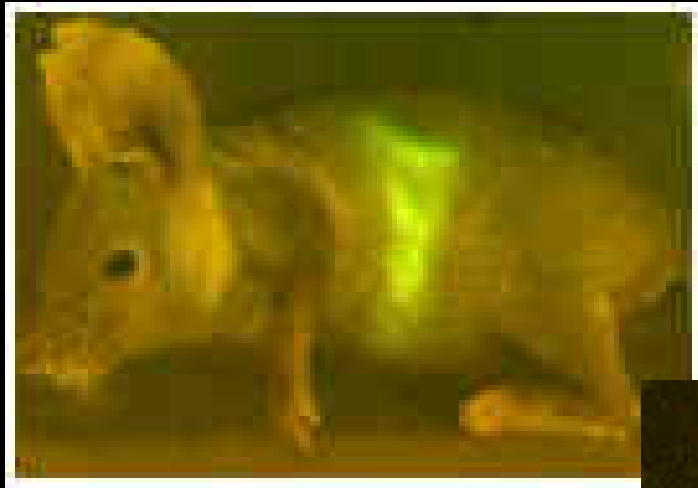
Uporabnost bioluminiscence



Green fluorescent protein GFP



Bioluminescencia v medicini



Bioluminescencia v kmetijstvu



