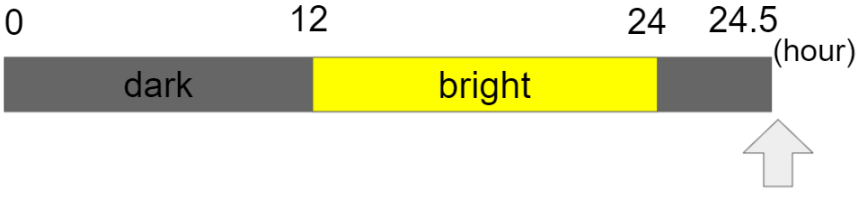
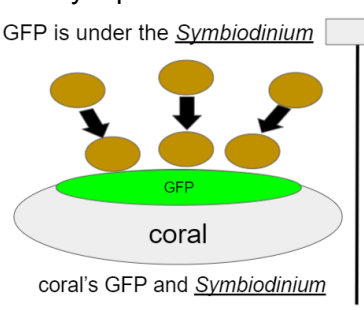
What do jellyfish shine for?

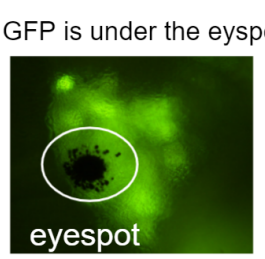
Abstract
In the seas around Japan, *Cladonema pacificum* can be found from spring to autumn. The spawning of this kind of jellyfish is caused by a cycle of light. First 12 hours, we gave jellyfish a dark stimulus,next 12 hours, we gave jellyfish bright stimulus, next half hour, we gave jellyfish dark stimulus. After this method, the jellyfish lays eggs. GFP(Green fluorescent protein) is a protein that emits green fluorescence when excited by ultraviolet to blue light. GFP was isolated by Osamu Shimomura and has become an essential part of life science research. However, it is not known why jellyfish have GFP in the first place.



the cycle

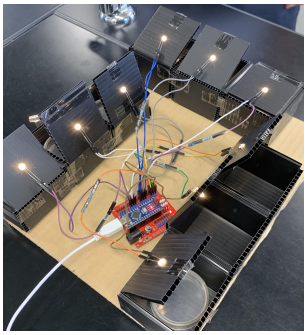
previous work and hypothesis
We did previous work to check the place of the GFP. We found that jellyfish have GFP around the eye spot. From previous research, coral also has GFP. Coral collects *Symbiodinium* which is necessary for life with GFP. *Symbiodinium* is phytoplankton. So, coral has GFP under the *Symbiodinium*. In the situation *Cladonema pacificum*, *Cladonema pacificum* has GFP under the eyespot like a coral. So, we think that *Cladonema pacificum* collects more light into the eyespot with GFP.



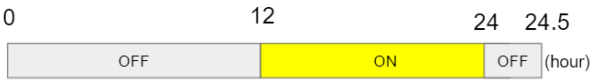


Cladonema pacificum GFP of coral and *Cladonema pacificum*

Method (Experiment)
From this hypothesis, we did an experiment to check the difference of laying eggs in some kinds of light intensity and color. First, we make an “automatic irradiation machine” which makes jellyfish to lay eggs. This machine shines the light following the program. The program is the first 12 hours, this machine doesn't shine, next 12 hours, this machine shines into the jellyfish. Second, we put three female Cladonema pacificums, which laid eggs before experiment in the machine and put this machine in the incubator. After that we shone light into the jellyfish. Next we check if the jellyfish laid eggs . We did an experiment with different types of light.




automatic irradiation machine

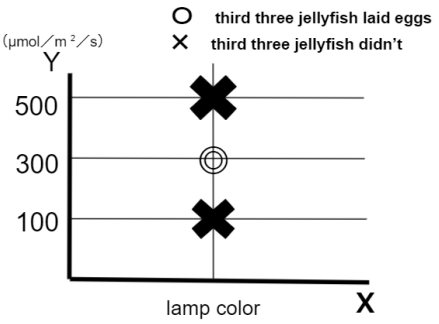


the program

Experiment1 and Result

In the first experiment we used lamp color for light to reproduce sunlight. Light intensity was 100,300 and 500. Light intensity is a unit about the power of light, and jellyfish can catch those light intensities in nature. Sunlight's light intensity is around 500. As a result, all jellyfish laid eggs under only 300 light intensity and, all jellyfish didn't. So, we can know the action of laying eggs is changed from light intensity. Also, high light intensity may have a bad effect on jellyfish.

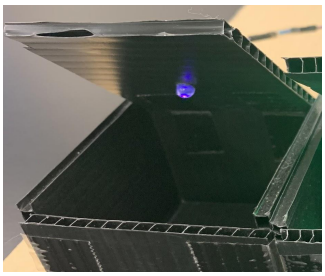
lamp color



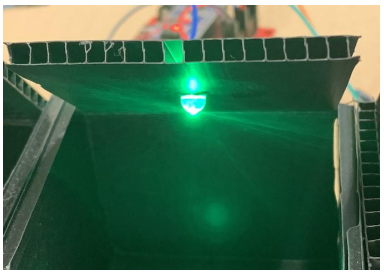
the result (experiment 1)

Experiment2 and result

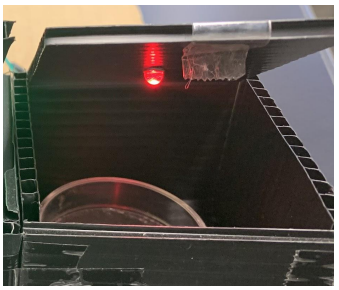
Second experiment, we used some different types of light and light intensity. We used green, red and blue light and light intensity was 100, 300 and 500. Under the red light, jellyfish could not shine and under the blue light, jellyfish can shine. Green is GFP's fluorescent color. As a result,in 300 light intensity, all of the jellyfish laid eggs and in 100 light intensity, all jellyfish laid eggs under the green light and blue light. In 100 light intensity, all jellyfish didn't lay eggs in red light.



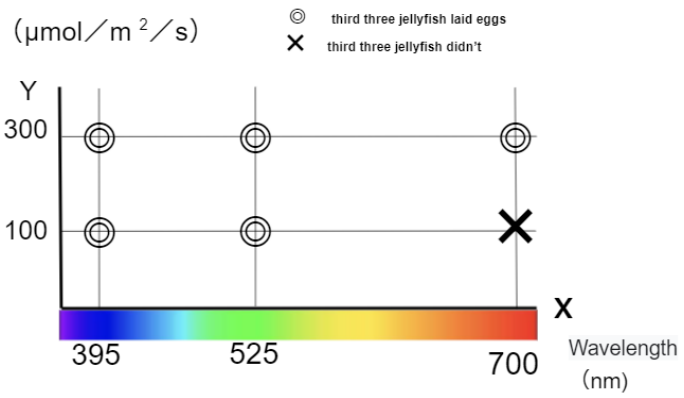
blue



green



red



the result (experiment 2)

Consideration (Discussion)

Spawning could not be observed under strong light (light intensity of 500);too high light intensity or temperature may have an inhibitory effect on including spawning. As it is temporarily difficult to collect C. pacificum around August.Blue and green light induced spawn even at lower intensities than red light.This result indicates that C. pacificus is sensitive to blue and green light,and furthermore, GFP may make blue light more acceptable as green light. In water, blue light passes through more easily. These facts may indicate that jellyfish adapted to their actual environment in this way.

Future work

From these researches,we made a graph about the image of light sensitivity of jellyfish.We found that green light is more sensitive than red light.However,we could not identify the light sensitivity of jellyfish to blue light strictly because GFP changes blue light into green light. So, we will confirm the light sensitivity to do the same experiment with more types of light intensity and wavelength.

In addition, jellyfish mainly have GFP around the eyespot,mouth and genital areas.*Gonionemus vertens* have GFP around eyespot,mouth and genital areas.
But in the case of *Cladonema pacificum*, only has it around the eyespot. It is different where GFP exits depends on jellyfish. So, we construct a hypothesis that the roles of GFP are different to each kind of jellyfish. We will identify that too.

References

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