

2016 Science English Presentation Abstracts

GROUP 1

Improving power output and efficiency of micro wind turbines

There are fewer studies on micro wind turbines than on normal ones. Normal turbines need a lot of space to operate in, but micro turbines need only a little space and, for example, they can be set up on a building in a city. In order to study better designs of micro wind turbines, a polystyrene foam wind turbine was constructed and various designs tested. From experiments into the angle at which the blade is attached to the turbine, it was found that 25° is the angle which generates the most electrical power. In another experiment, the twist of the blade was investigated, as was the idea of changing the shape of the blade using ideas based on a bird's wing. It was determined that the bird's-wing design gave the best result.

GROUP 2

Mathematical examination of a slime mold colony

Slime molds are organisms consisting of a single massive cell with many nuclei and are known for their ability to connect food sources by the shortest possible route. Models of them using this ability are used to find the shortest route between two points. One use of these models is in car navigation systems. In order to make a model like this, we first observed the number of distinct branches and the change in surface area over time. From the experimental data, we made fundamental models of a slime mold using differential equations. The model was then analyzed and graphed using BASIC.

GROUP 3

Relation between removing metal ions by charcoal and kinds of ions

We wanted to use charcoal, which has the ability to clean water, to solve the problem of water pollution, and we tried to clean metal ions from solutions with known concentrations. We did experiments to find which metal ions are effectively removed by charcoal and whether this effectiveness is related to a metal's position on the periodic table. We attempted to clean ten kinds of solutions of metal ions with charcoal, and measured the effectiveness of cleaning by chelatometric titration. This experiment's results showed that all of the types of metal ions were adsorbed by charcoal to some degree. Also, the relative effectiveness of charcoal in removing various ions was calculated. We are going to try to remove pollutants from water using this result.

GROUP 4

Making a portable breath analyzer to detect aldehydes which are cancer markers

Detection of diseases takes a long time today. We thought that the presence of aldehyde during exhalation when you have cancer means that we can find this disease earlier by measuring the concentration of aldehyde in a breath. We aimed at establishing an easy method which anybody can use at home. We detected the concentration of aldehyde by analyzing the color balance of photos taken by an iPhone5S; colorimetric analysis. Even in low concentrations, we found that there is a relationship between the RGB balance of a breath and the concentration of aldehyde it contains. By using a chromatographic LOC, it should be possible to extract gases even at low concentrations.

GROUP 5

Relationship between asexual division and population density of planaria

The number of animals in a population generally remains the same. How do they control this phenomenon? We decided to study the method of population density control used by planaria. We made two comparative studies using two species of planaria. The first study was a confirmation of a study done last year which showed that American planaria sense their environment and form stable populations. This was repeated using Japanese planaria. Results showed that planaria either divide or do not depending on the size of their habitat. From this result, we formed a hypothesis that planaria detect chemical signals with earlike organs. Then, this hypothesis was checked using the two species of planaria. Planaria with and without ears were put one by one into a chopstick case containing food pellets of varying concentrations, and their movements were tracked. This experiment showed that planaria depend on their ears to sense chemical signals. However, the relative difference in the sensitivity of the earlike organs of Japanese and American planaria could not be clearly determined.

GROUP 6

Using hydraulic modeling to advance proposed greening activities of the Kakogawa Riverside

The greening of the Kakogawa riverside must be appropriate from both a scientific perspective and a social perspective. Currently, there are few trees at the Kakogawa riverside, although the results from a public questionnaire by the city office says many citizens regard the riverside as a green zone. We researched the effects of the presence and absence of trees and taught the advantages of planting trees to primary school children through interaction with them. Beyond a doubt, there are some risks, such as driftwood, to planting trees along the riverside, but we propose a greening plan in which those risks have been minimized by using hydraulic modeling and computer graphics.

GROUP 7A

A study into rainbow angle

Rainbows are fascinating natural phenomena formed when drops of water refract and reflect the sun's rays, focusing different colors in different directions. The angle between the sun's rays and the reflected beams is called the "rainbow angle." Being interested in rainbows, we investigated their optical structure by simulating the formation of a rainbow using a laser and a clear acrylic disk in order to learn how rainbows are formed. By measuring the intensity of reflected light, we discovered that the rainbow angle relates to the intensity of light. We also calculated the behavior of the light using geometric optics. Through these experiments, the behavior of rainbows was examined.

GROUP 7B

Improving the acoustics of the Kakogawa Higashi SHS gymnasium

Currently, the acoustics of Kakogawa Higashi High School gymnasium are poor. We set the purpose of our research as improving the acoustics by using reflecting plates. We measured the sound levels at various points in the gymnasium using white noise. According to our measurements, the attenuation of the sound level is almost the same as outdoors. Based on collected data, we designed reflecting plates and measured the sound level again with the reflecting plates in place. After installing the plates, we were able to verify that the acoustics of our gymnasium have been improved.

GROUP 8

The relationship between the heat island effect and land and sea breezes in Akashi City

Recently, the heat island effect has become a serious problem in big cities. We can see the effect in Akashi City near Okubo Station, which is by the sea. Sea breezes and land breezes are present here. Wind has a great effect on temperature, so we researched the relationship between the heat island in Akashi City and the wind by conducting a field survey to measure the temperature and its relation to surrounding environment on a day when the wind was blowing. In conclusion, we found that wind is weak where buildings are close together, which makes the temperature higher in such locations.