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Research Paper

Use of a Blind to Observe the Breeding Behaviour of the Asian Paradise Flycatcher (*Terpsiphone paradisi* L.)

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In the study of animal behaviour it is critical to observe animals with as little disturbance as possible in order to get valid information. A blind is essential equipment for observing bird behaviour where the observer can gather data without affecting the observed bird, especially during the breeding season. From 2005 to 2008, 38 pairs of Asian Paradise Flycatchers (*Terpsiphone paradisi* L.) were observed during the breeding season (March to July) at Chiang Dao Wildlife Research Station, Chiang Mai Province, Thailand. Fifteen nests were studied from observation blinds on the ground, 10 m away from the nesting trees, using a 15x–45x telescope and video camera to record parental behaviour for 12 hours per day. Observation blinds were made from bamboo and the foliage of the herb *Etligeria littoralis* (Kon.) Gise. (Zingiberaceae), which grows in abundance in the study area. In order to minimize disturbance to the birds' activities, blinds were built when nest-building was almost finished, and were placed parallel to the birds' regular flight approach pathways to the nests. None of the nesting pairs displayed anxiety when the observer was inside the blind and none of the nests were subsequently abandoned, so observations of the breeding cycle were possible. Of the 15 nests observed, eight nests had breeding success, the eggs in one nest were broken by a tree fall, and in the other 6 nests eggs or nestlings disappeared probably as a result of predators. Successful breeding cycles lasted 26–34 days, including 2–4 days of egg-laying, 14–18 days of incubation, and 10–12 days of parental care of nestlings. Blinds, made of natural materials, are effective in allowing observations of this bird and may also be useful for studying other birds.

Keywords: *blind, breeding biology, parental care, Terpsiphone paradisi*

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Introduction

Techniques for studying animal behaviour in natural habitats are not well-known in Thailand. Students who do research on birds in their natural environment are often limited to observational studies. In order to collect objective data firsthand, the observer must ensure that there is no impact on the birds' activities when

the observer is collecting data. In ornithological studies, constructing small camouflaged areas called blinds allows researchers to unobtrusively study bird behaviour. Blinds can be constructed out of natural or artificial materials that conceal an observer inside hollows, holes, rock fissures, hollowed-out trees, etc. Blinds are designed to blend in with the natural habitat as closely as

possible (Lehner, 1996). When constructing a blind, the kind of animal, its behaviour, and its habitat should all be considered. For example, the Great Cormorant breeds mainly on coastal cliffs, and effective blinds can be concealed in rock fissures surrounding the nesting area (Wikipedia, 2008).

The Asian Paradise Flycatcher (*Terpsiphone paradisi* L.) is a wild bird species. It is distributed throughout Asia in evergreen, deciduous, and secondary growth forests at elevations ranging from sea level to 1,500 meters (Lekagul and Round, 1991). Males are distinguished by their conspicuously broad blue eye-rings and greatly elongated central pair of tail feathers, extending up to 25 cm beyond the rest of the tail. Males have two colour morphs, rufous and white, while females have only one morph, dull rufous-brown with grey eye-rings and a short tail (Sibley and Monroe, 1990; Lekagul and Round, 1991; Mizuta, 1998; Mizuta and Yamagishi, 1998; Khobkhet, 2004; Robson, 2004).

Blinds can be made out many of materials, but there is little information on blind design. In this study, the breeding behaviour of the Asian Paradise Flycatcher was observed from a blind made from natural materials. The blind was in the general shape of a small hut in order to camouflage the observer inside. The aim of this study was to report on the effectiveness of a natural kind of blind structure as well as to observe the birds' overall behaviour. This included reporting on the breeding stages of the Asian Paradise Flycatcher in northern Thailand. Males of this species in northern Thailand consist only of the rufous morph, while those in southern Thailand are of both the rufous and white morphs (Mizuta, 1998). This study can be used to develop and modify new blind designs for other bird species, while also contributing to the overall understanding of the Asian Paradise

Flycatcher's environment and ecology. This information will be useful for assisting future students interested in acquiring techniques for studying bird behaviour.

Study Area and Methods

Study Area

This study was conducted at Chiang Dao Wildlife Research Station, Chiang Mai Province, northern Thailand (19°21'N, 98°55'E) (Fig. 1) at an elevation of 500 meters above sea level from 2005 to 2008.



Figure 1 Map of Thailand showing the location of Chiang Dao, Chiang Mai Province.

The main vegetation types are bamboo + deciduous, hardwood seasonal forest characterized by many woody climbers, and abundant seedlings and saplings of both evergreen and deciduous tree species, as well as several species of bamboos. The herbaceous ground flora was dense and diverse with many creepers, vines, and numerous gingers, e.g. *Etilingera littoralis* (Kon.) Gise. (Zingiberaceae), *Costus speciosus* J.

E. Sm. (Zingiberaceae) (Maxwell, 1992).

Nest Searching

The nests were searched for along existing footpaths in the forest from 08:00 to 12:00 and from 14:00 to 18:00 hrs almost every day during the breeding season. Once a bird was sighted or heard, it was followed to the nest. Nests were hidden amongst dense shrubs and treelets in dark areas. The nest building period was determined by field observations of nests under construction.

Blind Construction

The blinds were built when the nests were near completion in order to minimize disturbance. They were constructed on the ground from bamboo and the foliage of the herb, *E. littoralis* and had dimensions of 1.5 m x 1.5 m x 1.5 m. Bamboo poles were driven into the ground and tied with thin bamboo strips to make a square shape. The foliage of *E. littoralis* was used as roofing material and to densely cover the walls, excluding a small hole for the entrance (Figs. 2, 3). The inside of the roof was lined with a plastic sheet to prevent rain from entering. The blind floor was covered with a plastic sheet. In the wall opposite the nest a small hole was created for a telescope and video camera.

The observation blinds could be built within a short time and be used for several weeks during observation periods. They also withstood wind and rain. Once the leaves of the plant dried, extra fresh foliage of *E. littoralis* was put on the blind.

Blind Positions

The position of observation blinds was adapted from Mizuta (1998). In this study, the blinds were located 10 m away from the nest trees. The blinds were built on the ground parallel to the birds' regular flight approach pathways to the nests. To give the best possible view blinds were placed at locations higher than the



Figure 2 A blind built from natural materials.



Figure 3 The completed blind blends in well with the birds' habitat.

nest sites and with light behind them.

Nest Observations

Observation of the nest was started 1-2 days after the blind construction was finished in order to habituate the bird. Fifteen nests were selected at random to observe from these blinds, using a 15x–45x telescope or a pair of binoculars (7x) and a video camera. The data were collected every five minutes by the focal-scan sampling method in the morning (06:00–10:00 hrs.), around mid-day (10:00–14:00 hrs.) and in the evening (14:00–18:00 hrs.). Each day, parental behaviour, including the date of egg-laying, hatching, and fledging were recorded. Additional observations included the reactions of the birds to the observer inside the blind. Other nests found were observed every day to confirm the dates of egg-laying, hatching, and fledging; and to determine whether breeding

was successful by using a telescope or binoculars without using a blind.

Results

Nesting Habitats

Thirty-eight nests of the Asian Paradise Flycatcher were found from 2005 to 2008, including abandoned or predated ones. Nests were located in a fork of small saplings near small, seasonally-dry streams, usually hidden in dense shrubs and treelets, such as *Mallotus pelletatus* Mull. Arg. (Euphorbiaceae), *Mitrophora vandaeflora* Kurz (Annonaceae), and *Knema tenuinervis* Wilde (Myristicaceae) in bamboo+deciduous, hardwood seasonal forest. The nest trees were less than 3 m tall.

General Breeding Information

In the study area were both male and female Asian Paradise Flycatchers take parts in nest-building, incubating, brooding, and feeding the nestlings. They started breeding in early March and ended it in July. Nests were open, deep, bowl-shaped, and 1-2 m above the ground. A successful breeding cycle lasted 26–34 days, including 2–4 days of egg-laying, 14–18 days of incubation, and 10–12 days of parental care of nestlings in the nest.

Reaction of the birds to the blinds

Fifteen of 38 nests were selected at random for study from 15 observation blinds on the ground. The parents did not show any uneasiness when the observer was inside a blind. They continued incubating the eggs, feeding, and brooding the nestlings. When the observer was outside the blind, the parents flew out and came back when they did not see the observer. None of the observed parent birds abandoned their nest, so allowing observations of the breeding cycle to be made. Among the 15 nests, eight had breeding success, in one eggs were broken by a tree fall, and in the others eggs disappeared in three nests and nestlings in three others,

probably as a result of predators. However, both parents came back to their nests on the same day that they lost their eggs or nestlings. The other 23 nests that were found were checked every day not using blinds to determine whether breeding was successful. Only three of these nests had a successful breeding cycle. Six nests were abandoned before nest-building was completed. Eggs disappeared in nine nests and the nestlings in the five others.

Discussion

Several studies of the breeding biology of birds have used artificial blinds for careful observation but there are some characteristics that should be considered when choosing a blind position, such as the behaviour of the birds being studied and nest habitat surroundings. For example, Kauth *et al.* (1998) studied the breeding biology of Wreathed-billed Hornbills (*Aceros waldeni* Sharpe) in the Philippines. These birds breed in evergreen forest and whose nests are located in living trees at about 10–20 m above the ground. Observation blinds were placed 25 m away from the nest trees but located to give a distinct view. Sciborska (2004) studied breeding biology of the Citrine Wagtail (*Motacilla citreola* Pallas), which breed in wet meadows, marshes and lakesides in Poland. The observations were made from a blind situated 6 m from the nest. A similar technique was used by Jakubas (2005) studied factors affecting the breeding success of the Grey Heron (*Ardea cinerea* L.) in northern Poland, where they live and breed in colonies on grassy plains on inland and coastal marshes, mangroves, mudflats, lakes, and paddies, exposed to strong winds. The blinds were placed on mounds a little farther away from the nests at distances of 10–50 m. Observations were made by one or two people in the blinds.

A few publications have dealt with blind design. Woodin (1983) described the construc-

tion of a portable umbrella blind. Rodenhouse and Best (1983) described the construction of a portable tower-blind. These blinds were made from artificial materials as nylon or canvas, which have some advantages. For example, small, lightweight tents can easily be moved between observation sites. However, these can have some disadvantages, such as the high temperature inside a blind making observations uncomfortable. Furthermore they might not be able to withstand severe wind and rain. In addition, they are also obtrusive, and so likely to disturb the observed animal, in contrast to blinds made from natural materials. The atmosphere inside the blinds used in this study was comfortable with good ventilation. The observer was able to stay inside for a long period at a time. In addition, the ceiling lined with a plastic sheet could protect against rain. They withstood wind and precipitation in the rainy season for several weeks. There is no earlier information on the construction of blinds from natural materials. In this paper we propose that an observation blind made from natural material may be more effective and of sufficient quality making it better than one of nylon or canvas.

In the present study, the position of observation blinds was adapted from Mizuta (1998). The observation blinds were situated 10 m away from nest trees in order to minimize any disturbance caused by the observer's presence. The blinds were placed on higher ground, above the nest site, with the light behind them in order to get the best possible view. A successful breeding cycle lasted 26–34 days, similar to that reported by Mizuta (1998) and Mizuta and Yamagishi (1998) who studied breeding biology of the Asian Paradise Flycatchers in Khao Pra-Bang Khram Wildlife Sanctuary, southern Thailand. They reported that the nest habitat surroundings were small remnant patches of lowland evergreen forest. The breeding cycles were

25–31 days.

In this study, the Asian Paradise Flycatcher became habituated to the blind and did not show any uneasiness when the observer was inside the blind. None of the parent birds observed from the blind abandoned their nests, and eight nests had breeding success. Although in some nests the eggs and nestlings disappeared, we were able to collect data from these parents until they lost their eggs and nestlings. The results indicate that the blinds made from natural materials were effective in allowing observations of this bird species and may also be useful for studying other bird species and other animals in order to generate results that contribute towards conservation and long term survival of the species.

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References

Jakubas, D. (2005) Factors affecting the breed-

- ing success of Grey Heron (*Ardea cinerea*) in northern Poland. *Journal of Ornithology* **146**: 27-33.
- Kauth, M., Engel, S., Lastimoza, L. L. and Curio, E. (1998) Observation on the breeding biology of the Wreathed – billed Hornbill (*Aceros waldeni*) in the Philippines. *Journal of Ornithology* **139**: 475-483.
- Khobkhet, O. (2004) *The Birds of Thailand*. pp.141-144. Sarakadee, Bangkok.
- Lehner, P. N. (1996) *Handbook of Ethology Methods*. pp.54-68. Cambridge University Press, Cambridge.
- Lekagul, B. and Round, P. D. (1991) *A Guide to the Birds of Thailand*. Saha Karn Bhaet, Bangkok.
- Maxwell, J. F. (1992) Lowland vegetation (450 – 800 m) of Doi Chiang Dao Wildlife Sanctuary, Chiang Mai Province, Thailand. *Tiger Paper* **19**: 21-25.
- Mizuta, T. (1998) Breeding biology of monogamous Asian Paradise Flycatcher *Terpsiphone paradisi* (Aves: Monarchinae): a special reference to colour dimorphism and exaggerated long tails in male. *The Raffles Bulletin of Zoology* **46**: 101-112.
- Mizuta, T. and Yamagishi, S. (1998) The breeding biology of the Asian Paradise Flycatcher *Terpsiphone paradisi* in Khao Pra – Bang Khram Wildlife Sanctuary, Southern Thailand. *Natural History Bulletin Siam Society* **46**: 27-42.
- Robson, C. (2004) *A Field Guide to the Birds of Thailand*. pp.172-173. Asia Books, Bangkok.
- Rodenhous, N. L. and Best, L. B. (1983) A portable observation tower-blind. *Wildlife Society Bulletin* **11**: 292-297.
- Sciborska, M. (2004) Breeding biology of the Citrine Wagtail (*Motacilla citreola*). *Journal of Ornithology* **145**: 41-47.
- Sibley, C. G. and Monroe, B. L. (1990) *Distribution and Taxonomy of Birds of the World*. pp.491-492. Yale University Press, New Haven & London.
- Wikipedia, http://www.en.wikipedia.org/wiki/Great_Cormorant, accessed 20/ 12/ 2008
- Woodin, M. C. (1983) A portable umbrella blind for observing wildlife. *Wildlife Society Bulletin* **11**: 72-73.

Research Paper

**A Comparative Study on the Blood Osmolality of the Mud Crab
(*Scylla serrata*) and the Blue Swimming Crab (*Portunus pelagicus*)
Exposed to Different Salinities: A Case Study for
the Topic “Osmotic Regulation” in High School Biology**

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(Received: 30 March 2009; accepted: 25 November 2009)

Blood osmolality of the mud crab (*Scylla serrata*) and blue swimming crab (*Portunus pelagicus*) was examined 0, 1, 3, 6, 9, 12, 24, 48, 72 and 96 hrs after transferred from seawater of salinity of 30 ppt to salinities of 5, 10, 15, 20, 25, 30 (control), 35 and 40 ppt at 25°C. Blood osmolality of both crab species reached to constant levels within 72 hrs. *S. serrata* survived for 96 hrs in all salinities tested whereas *P. pelagicus* survived for 96 hrs in salinities of 15, 20, 25, 30, 35 and 40 ppt but died 12 hrs after transferred into salinities of 5 and 10 ppt. Thus, the salinity ranges over which osmoregulation was performed efficiently were 5 - 40 ppt for *S. serrata* and 15 - 40 ppt for *P. pelagicus*. The results showed that *S. serrata* is a strong hyperosmotic regulator whereas *P. pelagicus* is an ordinary osmoconformer. This study could probably provide a laboratory model for teaching of osmotic regulation system for high school biology.

Keywords: blood osmolality, blue swimming crab, laboratory model, mud crab, Portunus pelagicus, Scylla serrata

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Introduction

“Osmotic regulation” or “Osmoregulation” is the regulation of water amount and ion concentrations in the body. Keeping this regulation precise is critical in maintaining life. Animals in marine environment can survive in media of different salinities and may be good osmoregulators depending on the salinity range. Most marine crustaceans have body fluids that are isosmotic with the medium in which they live. When the concentration of the medium changes, an animal may respond to the changes in one of the following two ways: One is simply allow the

osmotic concentration of its body fluids to correspond to that of the medium, thus remaining isosmotic with the medium; such an animal is called an “osmoconformer”. The other is to maintain or regulate its osmotic concentration at a certain level in spite of external concentration changes, such an animal is called an “osmoregulator”.

Changes in salinity may disrupt the osmotic balance of decapod crustaceans (Lignot *et al.*, 2000). In readjusting the osmotic concentration, they may have to expend considerable quantities of energy. Several studies have shown that vari-

ous species of the shore crabs have remarkably well developed abilities of osmotic regulation, allowing them to withstand exposure to media ranging from 10 to 200% seawater (SW) (Graszynski and Bigalke, 1986). Some crabs can keep their blood composition appreciably hyperosmotic relative to the medium when acclimated to low salinities (De Vries *et al.*, 1994). Exposure of crabs to low salinity is clearly detrimental to osmoregulatory ability (Bamber and Depledge, 1997), for example, *Callinectes sapidus* and *C. similis* exhibit a decline in hemolymph osmolality at low salinities (Guerin and Stickle, 1997) and *Rhithropanopeus harrisi* is a hyperosmotic regulator at salinities below 24 ppt and become hypoosmotic at higher salinities (Diamond *et al.*, 1989). Mud fiddler crabs were shown to be hyperosmoregulator in 10% SW and 50% SW and to be hypoosmoregulator in 150% SW and 200% SW (Holliday, 1985). *Hemigrapsus sanguineus* exhibit strong hyperosmoregulation in the range of 50% SW - 75% SW (Watanabe, 1982).

The mud crab (*Scylla serrata*) and the blue crab (*Portunus pelagicus*) are native throughout the Indo-West Pacific region (Xiao and Kumar, 2004), however their natural habitats are different. *S. serrata* is an estuarine-adapted crab found in mangrove swamps, whereas *P. pelagicus*, also known as sand crabs inhabits in shallow coastal water area. Due to the differences in the natural habitats of *S. serrata* and *P. pelagicus*, both species are thus likely to encounter different salinities. Since salinity is one of the important environmental factors used to test physiological response of aquatic animals. The response of both species of crab to fluctuations in salinity may be described by determining those species' ability to regulate their osmotic concentration.

The purpose of the present study is to determine the capability of *S. serrata* and *P. pelagicus* to regulate osmotic concentrations in

the blood, when they are transferred from 30 ppt to 5, 10, 15, 20, 25, 30 (control), 35 and 40 ppt in the laboratory. This will provide an understanding of the problem of how these species responds osmotically to variable salinities.

Materials and Methods

Maintenance of Crabs

Adult males of the mud crab *S. serrata* (with average weight of 83 ± 5 g and carapace length of 116 ± 18 mm) and the blue crab *P. pelagicus* (with average weight of 56 ± 7 g and carapace length of 106 ± 13 mm) were obtained from a private farm, Chantaburi province and from fishermen at Bangsaen, Chonburi province, Thailand, respectively. The crabs were transported to the laboratory in Department of Aquatic Science, Faculty of Science, Burapha University, and maintained in fiberglass tanks with a circulating seawater system at temperature of 25°C and salinity of 30 ppt under natural dark-light cycle. Seawater was changed every a few days for duration of the experimental period. The crabs were acclimated for at least one week prior using in the experiments and fed every day with pieces of mussel. But they were not fed 48 hrs before and during the experimental periods. Only crabs in the intermolt stage were selected for the study.

Experimental media

Seawaters of different salinities were used as test media for osmotic regulation studies. The normal seawater was 30 ppt in salinity which equivalent to 943 mOsm kg^{-1} . Concentrated seawaters (35 and 40 ppt) were obtained by evaporating the natural seawater. Diluted seawaters (5, 10, 15, 20 and 25 ppt) were prepared by dilution of natural seawater with distilled water. Osmolalities of experimental media are shown in Table 1.

Table 1 Osmolalities of experimental media

Salinity (ppt)	5	10	15	20	25	30	35	40
Osmolality (mOsm kg ⁻¹)	157	314	471	629	786	943	1100	1257

Measurement of blood osmolality

Forty-eight crabs of each species (*S. serrata* and *P. pelagicus*) were transferred individually from the holding tanks to a glass chamber containing 2 liter of each test medium. Individual chamber was aerated throughout the experiment. There were eight treatments (salinity levels of 5, 10, 15, 20, 25, 30, 35 and 40 ppt) and each treatment was conducted in six replicates with one crab in each chamber.

The osmolality of seawater and the blood osmolality of *S. serrata* and *P. pelagicus* were measured at 1, 3, 6, 9, 12, 24, 48 and 96 hrs after transferring the crabs into each experimental salinity. A 10 µl of blood sample was drawn from each crab by puncturing the membrane at the base of the fifth walking leg with a 26g needle. The osmolality of blood sample was read in an osmometer (Wescor Vapor Pressure Osmometer model 5520) which had been calibrated with standard solutions of 100, 290 and 1000 mOsm kg⁻¹.

Data analysis

Blood osmolalities of crabs were expressed as mean ± S.D. Data were analyzed by using SPSS (Statistical Package for the Social Sciences) computer program. Differences in blood osmolality after abrupt salinity changes were compared using a one-way analysis of variance to estimate the time when steady-state values were reached. If statistically significant differences were indicated at 0.05 level, then subsequent multiple comparisons of means among treatments were performed using the Scheffe pairwise comparisons method. If the blood osmolality value at a certain point in time was the same as that at later times, then the blood con-

sidered to have reached a steady state at that point (in time). The relationships between mean blood osmolality and medium osmolality were plotted to estimate the isosmotic crossover values, where blood osmolality = medium osmolality.

Results**Blood osmolality of *Scylla serrata***

Changes in blood osmolality were observed in the crabs immediately after transferred from 30 ppt to different salinities. The blood osmolalities of *S. serrata* in relation to time are depicted in Figure 1. *S. serrata* survived and their blood osmolalities reached constant levels within 72 hrs in all test salinities. At 72 hr, the mean blood osmolality in the control crabs (30 ppt) was 958±23 mOsm kg⁻¹. For crabs, 72 hrs after transferred from 30 ppt to 5, 10, 15, 20, 25, 35 and 40 ppt, blood osmolalities stabilized at 743±54, 762±27, 777±28, 803±13, 849±24, 1077±10 and 1221±42 mOsm.kg⁻¹, respectively. The blood osmolality of *S. serrata* as a function of medium osmolality is given in Figure 2. The isosmotic point was approximately 1000 mOsm kg⁻¹ which is equivalent to the salinity of 31.8 ppt.

Blood osmolality of *Portunus pelagicus*

Changes in blood osmolality were observed in the crabs immediately after transferred from 30 ppt to different salinities. The blood osmolalities of *P. pelagicus* in relation to time are depicted in Figure 3. *P. pelagicus* survived in media ranging from 15 ppt – 40 ppt. At 5 and 10 ppt, the blood osmolalities of crabs rapidly decreased and the crabs could not survive after 12 hrs of exposure. At 15, 20 and 25 ppt, the blood

osmolalities of crabs decreased slowly and then became constant after 72 hrs. The blood osmolalities of crabs at 72 hrs in 15, 20 and 25 ppt seawater were 627 ± 24 , 757 ± 24 and 841 ± 23 mOsm kg^{-1} in 15, 20 and 25 ppt at 72 h, respectively. In the salinity of 30 ppt, the blood osmolality of the crab was 969 ± 28 mOsm kg^{-1} at 72 hr of exposure time. In 35 and 40 ppt, blood osmo-

lalties increased slowly and became constant at 1105 ± 19 and 1252 ± 32 mOsm kg^{-1} after 72 hrs respectively. The blood osmolality of *P. pelagicus* as a function of medium osmolality is given in Figure 4. The isoosmotic point was approximately 1100 mOsm kg^{-1} which is equivalent to the salinity of 35 ppt.

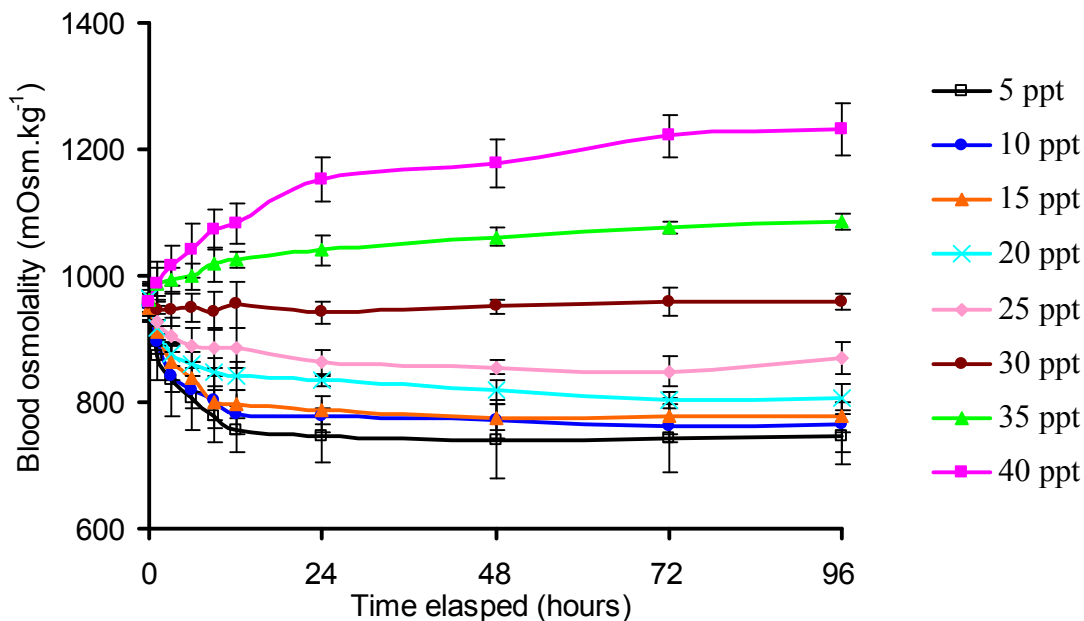


Figure 1 Changes in the blood osmolality of *Scylla serrata* when the crabs were subjected to different salinity levels for different time period at 25°C (n=6)

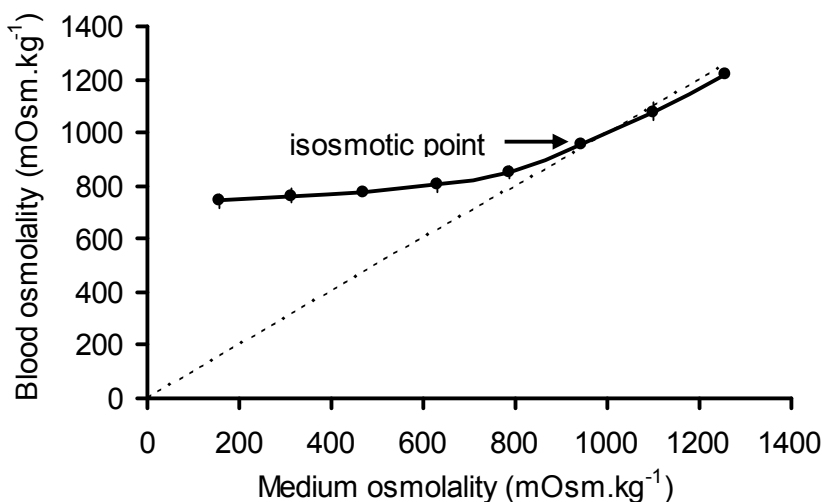


Figure 2 The relationships between the blood osmolality of *Scylla serrata* and the medium osmolality

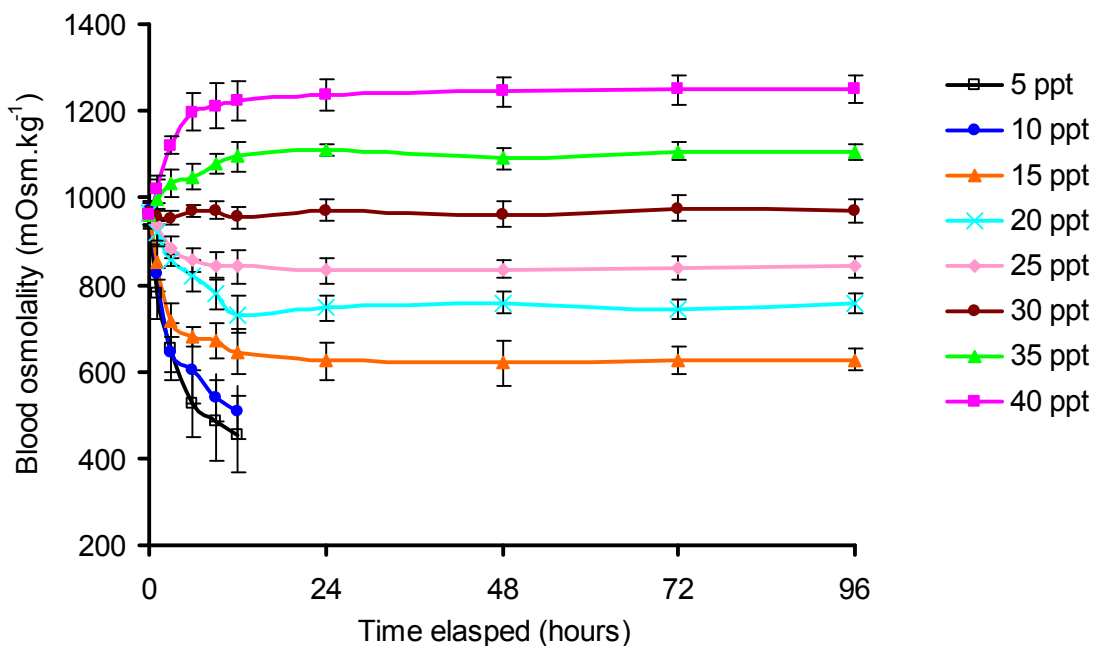


Figure 3 Changes in the blood osmolality of *Portunus pelagicus* when the crabs were subjected to different salinity levels for different time period at 25°C (n=6)

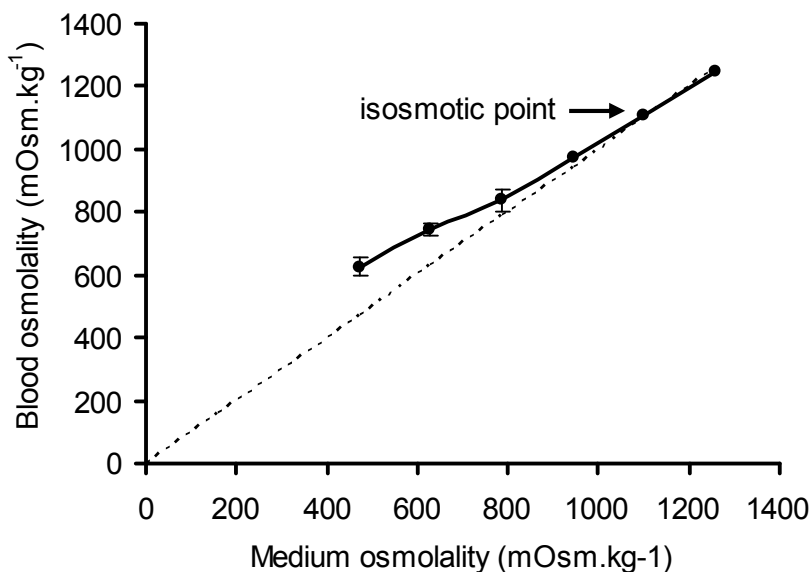


Figure 4 The relationships between the blood osmolality of *Portunus pelagicus* and the medium osmolality

Discussion

The osmoregulatory ability of aquatic animals can be determined by measuring the blood osmolality under various salinity conditions (Lignot *et al.*, 2000) and comparing with the osmolality of the medium. The present study

showed that *S. serrata* is hyperosmoregulator in a medium below 1000 mOsm kg⁻¹ and become an osmoconformer in a medium above that level. The similar finding was obtained by Davenport and Wong (1987) who reported that *S. serrata* is a hyperosmoregulator in salinities lower than

those of the open sea, and becomes an osmoconformer at a medium osmolality greater than 900 mOsm kg⁻¹ at 28-30°C. The blue crab *C. sapidus* (Tagatz, 1971) and the mud crab *Panopeus herbstii* (Blasco and Forward, 1988) also regulate their blood osmolalities hyperosmotically at salinities lower than 28 ppt and become osmoconformers at salinities higher than 28 ppt. *S. serrata* is a large portunid crab, which matures and spawns in seawater, spends post-larval and juvenile phases in brackish water, and then returns to the sea as a pre-adult. Thus, this species is likely to encounter fluctuation of salinity in natural habitat.

Comparing with the *S. serrata*, blood osmolality of *P. pelagicus* decreased with the reduction of salinity and exhibited positive linear relationship with the medium osmolality. *P. pelagicus* was observed to be osmoconformer. Similar results have been reported for some penaeid prawns (Chen and Lin, 1994; Sang and Fotedar, 2004; Setiarto *et al.*, 2004) and other portunid crabs (Guerin and Stickle, 1997). *P. pelagicus* is found in coastal marine and estuarine waters throughout the Indo-West Pacific (Kailola *et al.*, 1993), China, Japan, Philippines, Australia, Thailand and East Africa. In Thailand, *P. pelagicus* is mainly found along the Gulf of Thailand, in the estuary areas and the Andaman Sea. This crab species lives in a wide range of inshore and continental shelf areas, including sandy, muddy, algal and seagrass habitats, from the intertidal zone to a depth of at least 50 m (Edgar, 1990). It usually lives under stones and seaweeds in rock pools. However, in some areas it is found living on sandy bottoms, using the swimming paddles to excavate a burrow to hide.

The results of this study demonstrated that *P. pelagicus* is a stenohaline species and sufficiently sensitive to environmental changes such as salinity. *P. pelagicus* can tolerate only a narrow salinity range which makes difference from

S. serrata, being euryhaline crabs that can by definition tolerate a wide range of salinities. In laboratory, *P. pelagicus* showed to be an osmoconformer or a poor osmoregulator, which does not enable them to cope with a low salinity level less than 15 ppt. This characteristic stands in contrast with *S. serrata* which is a good osmoregulator and can survive in media of salinity range from 5 to 40 ppt. Salinity can have an immediate and significant effect on survival and growth of *P. pelagicus*. It has been suggested that salinities closer to the isosmotic point result in decreased metabolic demands and, therefore, increased growth, since the crab would be expending the least energy in doing osmotic work (Panikkar, 1968). The suitable salinity range has significant implications for aquaculture.

This study could also probably be used as laboratory model for teaching of osmotic regulation system for high school biology project or laboratory on the topic "Osmotic regulation," since there are several practical benefits of using crustaceans in teaching lab: 1) they are less expensive than vertebrates, 2) their use does not require approval of animal-care communities.

References

- Bamber, S. D. and Depledge, M. H. (1997) Responses of shore crabs to physiological challenges following exposure to selected environmental contaminants. *Aquatic Toxicology* **40**: 79-92.
- Blasco, E. and Forward, R. B., Jr (1988) Osmoregulation of the Xanthid crab, *Panopeus herbstii*. *Comparative Biochemistry and Physiology* **90A**: 135-139.
- Chen, J. C. and Lin, C. Y. (1994) Osmolality and chloride concentration in the haemolymph of subadult *Penaeus chinensis* subjected to different salinity levels. *Aquaculture* **125**: 167-174.
- Davenport, J. and Wong, T. M. (1987) Re-

- sponses of adult mud crabs (*Scylla serrata*) (Forsk.) to salinity and low oxygen tension. *Comparative Biochemistry and Physiology* **86A**: 43-47.
- De Vries, M. C., Wolcott, D. L. and Holliday, C. W. (1994) High ammonia and low pH in the urine of the ghost crab, *Ocypode quadrata*. *Biological Bulletin* **186**: 342-348.
- Diamond, D. W., Scott, L. K. and Forward, R. B. (1989) Respiration and osmoregulation of the estuarine crab, *Rhithropanopeus harrisi* (Gould): effects of the herbicide, alachlor. *Comparative Biochemistry and Physiology* **93A**: 313-318
- Edgar, G. J. (1990) Predator-prey interactions in seagrass beds. II. Distribution and diet of the blue manna crab *P. pelagicus* Linnaeus at Cliff Head, Western Australia. *Journal of Experimental Marine Biology and Ecology* **139**: 23-32.
- Graszynski, K. and Bigalke, T. (1986) Osmoregulation and ion transport in the extremely euryhaline fiddler crabs *Uca pugilator* and *Uca tangeri* (Ocypodidae). *Zoologische Beiträge (NF)* **30**: 339-358.
- Guerin, J. L. and Stickle, W. B. (1997) A comparative study of two sympatric species within the genus *Callinectes*: Osmoregulation, long-term acclimation to salinity and the effect of salinity on growth and moulting. *Journal of Experimental Marine Biology and Ecology* **218**: 165-186.
- Holliday, C. W. (1985). Salinity induced changes in gill Na⁺ K⁺ ATPase activity in the mud fiddler crab *Uca pugnax*. *Journal of Experimental Zoology* **233**: 199-208.
- Kailola, P. J., Williams, M. J., Stewart, P. C., Reichelt, R. E., McNee, A. and Grieve, C. (1993) *Australian Fisheries Resources*. Bureau of Resource Sciences, Department of Primary Industries and Energy, and the Fisheries Research and development Corporation, Canberra, Australia.
- Lignot, J. H., Spanings-Pierrot, C. and Charman-tier, G. (2000) Osmoregulatory capacity as a tool in monitoring the physio-logical condition and the effect of stress in crustaceans. *Aquaculture* **191**: 209-245.
- Panikkar, N. K. (1968) Osmotic behavior of shrimps and prawns in relation to their biology and culture. *FAO Fishery Report* **57**: 527-538.
- Sang, H. M., Fotedar, R. (2004) Growth, survival, haemolymph osmolality and organo-osmotic indices of the western king prawn (*Penaeus latisulcatus* Kishinouye, 1896) reared at different salinities. *Aquaculture*, **234**: 601-614.
- Setiarto, A., Strussmann, C.A., Takashima, F., Watanabe, S., Yokota, M. (2004) Short-term responses of adult kuruma shrimp *Marsupenaeus japonicus* to environmental salinity: osmotic regulation, oxygen consumption and ammonia excretion. *Aquaculture Research*, **35**: 669-677.
- Tagatz, M. E. (1971) Osmoregulatory ability of the blue crabs, in different temperature-salinity combinations. *Chesapeake Science* **12**: 14-17.
- Watanabe, K. (1982). Osmotic and ionic regulation and the gill Na⁺ + K⁺-ATPase activity in the Japanese shore crab *Hemigrapsus sanguineus*. *Bulletin of Japanese Society and Scientific fishery* **48**: 917-920.
- Xiao, Y. and Kumar, M. (2004) Sex ratio, and probability of sexual maturity of females at size, of the blue swimmer crab *Portunus pelagicus*, off southern Australia. *Fishery Research* **68**: 271-282.

Practical Report

A Support to the “Integrated Study” at a Junior High School in the Local Community

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As a guest lecturer, I have been supporting the “Integrated Study” for the first grade students in Kawaguchi Junior High School for several years. The titles of my lectures in the recent three years are as follows: “Let’s walk the promenades on the map of fantastic village, Kawaguchi” in 2008, “Let’s explore the unexplored areas in Kawaguchi Village” in 2007, and “Let’s make your nature trails in Kawaguchi Village” in 2006. At first, I gave my lecture on the culture and history of our home village Kawaguchi and its nature such as the low mountains, woods, rice fields, and rivers in the rural district of Kawaguchi. Furthermore, I taught students about wild birds, wild animals, and wild flowers in the nature of Kawaguchi Village. And then, students carried out research activities on various subjects in their community and reported their results by the end of second term.

Keywords: Integrated study, junior high school, Home Village Kawaguchi

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As an example of environmental preservation activities in the local community, let me introduce my lectures related to my hometown Kawaguchi Village. The lectures have been given to support the Integrated Study for the first grade students in Kawaguchi Junior High School in the village.

About Kawaguchi Village

Where is Kawaguchi Village?

Kawaguchi Village is in Hachioji city which is located in the western part of Tokyo Metropolis, Japan. Kawaguchi Village is far

from the center of Tokyo. The latitude of the village is 35°39’N and the longitude is 139°07’E.

Tokyo Metropolis is located in the center of Kanto region which is in the large Kanto plain, and is surrounded by four prefectures: Saitama, Kanagawa, Chiba and Yamanashi.

The city hall of Tokyo Metropolis, which is one of the high-rise buildings in Japan, is in Shinjuku Ward in the downtown of Tokyo Metropolis. The governor of Tokyo Metropolis is Mr. Shintaro Ishihara, a famous novelist of Japan. He is an elder brother of the popular and famous movie star, the late Mr. Yujiro Ishi-

hara.

Aerial View of Kawaguchi Village

The aerial view of Kawaguchi Village shows many golf courses in the forests of the Minami-Kasumi Hill region particularly in the northern part of it. And it shows the forests of Kawaguchi Hill region in the southern part of the village. The Kawaguchi River runs between Minami-Kasumi Hill region and Kawaguchi Hill region. The local community of Kawaguchi Village spreads along the river.

Kawaguchi Village is well-known in Japan

Kawaguchi Village is well-known among Japanese students because the geographical topics of Kawaguchi Village have been taken up in a textbook of geography for junior high school students which is published by Teikoku-shoin Co., Ltd. (Fig. 1). Many Japanese junior high school students learn geography through this textbook today.

The Imakuma Shrine

The Imakuma Shrine (Fig. 2) is one of the representative historical buildings in Kawaguchi Village. It was said that in the old time Mt. Imakuma, which is a low mountain behind the shrine, was haunted such as bogies, monsters and ghosts, like the famous Totoro who is

a hero in an animated film made by the very famous Japanese animated movie director, Mr. Hayao Miyazaki, and lives in the forests in the Sayama Hill region of Tokorozawa city, Saitama Prefecture.



Figure 2 The Imakuma Shrine

Kawaguchi River

The Kawaguchi River (Fig. 3), which runs through the center of Kawaguchi Village, is a branch of the Asakawa River, a tributary of the Tamagawa River which is a main river of Tokyo. Once, the Kawaguchi River had much clean water and many wild birds like a Japanese kingfisher named “Kawasemi,” and many fish. We saw many rich forests and green fields along the river in the nature of Kawaguchi Village.

Princess Norinomiya, who married Mr. Yoshiki Kuroda, does research on the Kawasemi, and she wrote a book on the bird. However, recently I am sorry that we see less water and fewer living things in the Kawaguchi River because of certain developments in Kawaguchi Village, such as river improvements, road constructions and turning the land into housing lots.



Figure 1 (Left) A junior high school geography textbook published by Teikoku-shoin Co., Ltd. which take up the geographical topics of Kawaguchi Village



Figure 3 Kawaguchi River

History of Kawaguchi

In the Jomon period, five thousand years ago, people lived on the plateaus of Kawaguchi Village, their habitation sites with so many pieces of Jomon earthenware, which have vivid fire flame patterns, were found in the fields of Kawaguchi Village. The name of Kawaguchi Village is found in an old book from the Nara period, more than one thousand years ago. During the age of civil wars in the 15th century, a feudal lord ruled Kawaguchi Village. The ruins of Lord Castle are in the village. From the age of civil wars to the Edo period, many Buddhist temples were built in Kawaguchi Village. The representative one, Hourenji Temple, was built in the 15th century in the center of the village.

The Woods called "Satoyama"

"Satoyama" is the woods which is close to a farming area. For farmers in Kawaguchi Village, their Satoyama used to be very useful forests. Once, they used trees in Satoyama as firewood and for making charcoals everyday. They used fallen leaves for fertilizer for the rice fields. However, farmers came to use oil and chemical fertilizers gradually, so they do not use trees and fallen leaves in Satoyama. As a result, Satoyama in Kawaguchi Village is abandoned today. In our Satoyama, we can see many pretty flowers which are called Spring Ephemerals, such as beautiful "Kata-

kuri," *Erythronium japonicum*, and various violets during the spring season. We also can see the flowers of "Higanbana," *Lycoris radiata*, in autumn. We can see various dandelions from spring to autumn.

A View of Fantastic Village, "Kawaguchi"

Kawaguchi Village has beautiful scenery because it has beautiful nature such as green hills, clean rivers and fertile fields. The landscape of Kawaguchi Village in a rainy day during the rainy season of the Japanese islands is particularly beautiful and heartwarming (Fig. 4). In early spring, we can enjoy many beautiful plum blossoms and cherry blossoms. The cherry trees are the representative plant of Japan. One hundred years ago, a famous Japanese poet, Toukoku Kitamura, visited Kawaguchi Village and stayed there for a short time. He wrote the novel entitled, *Mikka-Genkyo*, which means "the stay for three days in Fantastic village Kawaguchi."



Figure 4 A rainy scene of Kawaguchi Village

One of Japanese Hawks, "Otaka"

One of the Japanese hawks, Otaka (Fig. 5), lived in the forest named Tengu-mine of Kawaguchi Village before. Once, we found Otaka's nest and heard the birds cry in it. However, we have not found Otaka anywhere in Kawaguchi Village since the tunnel construction of the highway named Ken-o-do was started. We hope we will find Otaka in the forests of Kawaguchi Village someday in the

future because the bird is one of the endangered species in Japan.



Figure 5 A Japanese hawk, Otaka, in Tengo-mine Forest

A Support to the “Integrated Study” at Kawaguchi Junior High School

Kawaguchi Junior High School

Kawaguchi Junior High School was established by Kawaguchi Village 60 years ago. In the year of 2008, there were 368 students and 11 classrooms, a broad school yard, a rooftop swimming pool, and in particular, a duplicated old room of farmer’s house in Kawaguchi Village. The Japanese farmer’s family lives at the sunken hearth end in their house made of wood, straw and paper in the old time.

Lectures of Integrated Study for the First Grade Students

I have had my lectures of Integrated Study for all first grade students in Kawaguchi Junior High School in the auditorium before their fieldwork for three years continuously. The titles of my lecture were “Let’s make your nature trails in Kawaguchi Village” in 2006, “Let’s explore the unexplored areas in Kawaguchi Village” in 2007, and “Let’s walk the promenades on the map of fantastic village, Kawaguchi” in 2008.

FieldWork of Integrated Study

One day on July 2008, I had fieldwork with some first grade students around their school for two hours. They studied the history of Buddhist temples, Shinto shrines and old farmer’s houses. And they investigated and watched many wild flowers, insects and birds in the fields, woods and mountain streams. After their fieldwork, they chose the topics of their research thesis by themselves. They presented their reports in which they wrote the result of their research by the end of the second term.

Practical Report

Educational Significance of “Fish dissection” in Elementary School Science for Realizing the Preciousness of Life

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In this paper, we analyzed the educational significance of “fish dissection” in elementary school science of Japan. Description of fish dissection has been decreasing in elementary school science textbooks in recent years, though the importance of “natural experience,” “experiential learning,” and the necessity of guidance to understand the “preciousness of life” has been proposed in science education in Japan. For the method of analysis, we investigated mainly the changes in teaching materials for “fish dissection” in the postwar textbooks, and also the notions of dissection and scientific concepts of sixth graders as well as their view of life through classes of “fish dissection.” We examined science textbooks published by four different textbook publishers on the basis of the Course of Study (CS) for Elementary Schools in Japan, which were revised in 1958, 1968, 1977, 1989 and 1998. The results of the study were as follows: Crucian carp (*Carassius cuvieri*) was described as one of the teaching materials for observations and experiments in all textbooks published based on the 1958 and 1968 revisions of the CS. There were, however, no teaching materials on “fish dissection” in any textbooks published by any companies based on the 1977 revision of the CS. “Fish dissection” was described as a reference in a unit in the textbooks published based on the 1989 and 1998 revisions of the CS by some of the four publishers. A questionnaire to the children after the class on “fish dissection” revealed the following facts: First, almost all of the children answered that the practice of fish dissection was good. Secondly, they had a variety of impressions or notions on life and seemed to realize the “preciousness of life”. The facts show the effectiveness of introducing “fish dissection” in elementary school science to let children realize the “preciousness of life”.

Keywords: biology education, elementary school science, fish dissection, preciousness of life, teaching material.

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Introduction

It is often said “The dissection may be against the preciousness of life.” In Japan, fish dissection had been practiced in almost all elementary school science classes from the 1960’s to 1970’s (Iwama *et al.*, 2008). However, there is a report that the ratio of enforced animal dissection in elementary school science is about 10% in recent years (Nishikawa and Tsuruoka, 2007). The low ratio might be attributed to the loathsomeness of dissection itself, difficulty in teaching classes by teachers who have had no experiences of animal dissection, some pressure to stop animal dissection from animal protection groups, and so on.

In this study, we analyze the educational significance of fish dissection in elementary school science. Description of fish dissection has been decreasing in elementary school science textbooks, though the importance of natural experience, experiential learning and the necessity of guidance in understanding the preciousness of life have been proposed in Japanese science education in recent years. We studied the changes in teaching materials for fish dissection in the postwar textbooks. We also examined the notions on dissection and scientific concepts of children as well as their view of the preciousness of life through classes of fish dissection, and analyzed whether fish dissection is really against the preciousness of life, and whether it gives certain negative influence to the children.

Methods of Investigation

1. Survey of science textbooks

We investigated the changes in descriptions of fish dissection in science textbooks to know how the teaching materials for this topic have been treated in elementary school science in Japan. The textbooks were published by four different textbook publishers on the basis of the

Course of Study (CS) for Elementary Schools in Japan, which was revised in 1958, 1968, 1977, 1989, and 1998. We analyzed the units on fish dissection in the textbooks for fifth and sixth graders.

2. Practice of “fish dissection” in classes

We conducted science lessons including a practice of fish dissection in two classes of sixth graders in an elementary school in Tokyo in February, 2008 to know the educational effectiveness of the practice. The class sizes were as follows: Class A was composed of 39 children (19 boys and 20 girls) and Class B was composed of 37 children (18 boys and 19 girls). The total number of children was 76 (37 boys and 39 girls)

The practice was composed of the following three parts.

Part 1. Introduction to fish dissection practice

We allotted one school hour (45 minutes) to an introductory class prior to the fish dissection practice for each class in order to let children realize the preciousness of life.

Part 2. Fish dissection practice

We allotted two continuous school hours (90 minutes) to the fish dissection practice, and we gave the same lesson for each class. We prepared two teachers in each class; that is, one of them was an assistant teacher.

The teaching material for fish dissection was crucian carp (*Carassius cuvieri*). We used live fish in order to show the pulsation of the heart. We put them in a 0.1% Tricain (Tricane) solution for 15 minutes for anesthesia.

Children used a science textbook published in 2005 by [DN]¹⁾ (Fig. 1)²⁾. As the anatomical figure of a fish in the textbook described only five organs, we distributed a copy of an anatomical figure of a fish describing nine organs, which was obtained from a science textbook published in 1974, to each group as supple-

mentary material (Fig. 2).

We divided the students of one class into 12 groups. Each group which was composed of three or four children used one crucian carp.

Part 3. A questionnaire to children on fish dissection

After the classes on fish dissection we asked the children to answer the following questions about fish dissection in a questionnaire to know their responses to the practice.

- 1) Did you wish to do “fish dissection?”
- 2) What did you think about “fish dissection?”
- 3) Which fish organs could you notice?

We analyzed their answers to the questions from several aspects such as “experiential learning,” “scientific knowledge,” “biodiversity” and “preciousness of life.”

Results and Discussion

1. Results of the survey of science textbooks (Table 1)

We analyzed the changes in teaching materials for fish dissection in the following elementary school science textbooks published from four textbook publishers from several viewpoints concerning descriptive modes and

names of fish organs: the textbooks published in 1968 were based on the CS revised in 1958, those published in 1974 were based on the CS revised in 1968, those published in 1986 were based on the CS revised in 1977, those published in 1995 were based on the CS revised in 1989, and those published in 2005 were based on the CS revised in 1998.

Also, the abbreviations [DN] [TS] [KR] and [KS] stand for publishers of elementary school science textbooks in Japan¹⁾.

a. On the science textbooks published in 1968

Fish dissection was described in the textbooks published for the fifth graders (Item No. 3). The total number of pages for the topic in each textbook varied from two to three (Item No. 6) and were 2.4 pages on average.

Crucian carp was described as the teaching material for observations and experiments in all textbooks (Item No.7). The total number of fish organs was eight in [DN], four in [TS], five in [KR] and four in [KS] (Item No. 8). The structure of the body skeleton of fish was described in textbooks by all four publishers, but the muscle construction was described in textbooks by two publishers among four (Item No. 9).

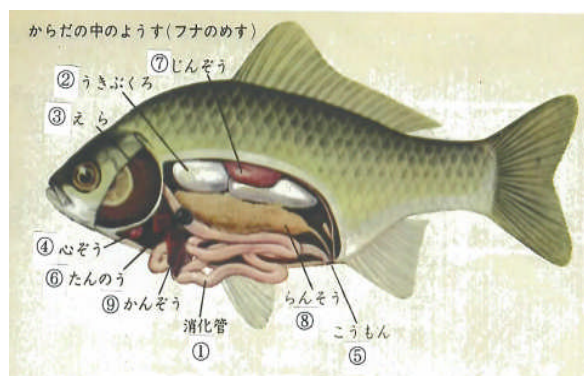
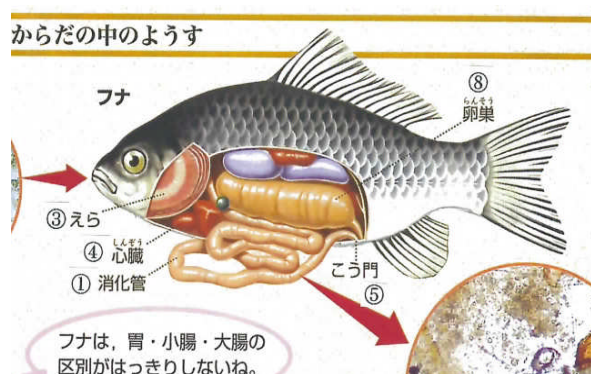


Figure 1 (left) A figure of fish organs in a science textbook published by Dainippon-tosho Co., Ltd. in 2005. Five organs (1: Alimentary canal, 2: Gills, 3: Heart, 4: Anus and 5: Ovary) were described.

Figure 2 (right) A figure of fish organs in a science textbook published by Dainippon-tosho Co., Ltd. in 1986. Nine organs (1: Alimentary canal, 2: Swim bladder, 3: Gills, 4: Heart, 5: Anus, 6: Gall bladder, 7: Kidney, 8: Ovary, and 9: Liver) were described.

Table 1-(1) Changes of the contents related to “Fish dissection” in elementary school science textbooks in Japan

No	Item	DN*					TS*				
		1968	1974	1986	1995	2005	1968	1974	1986	1995	2005
1	Year of publication of textbooks	1968	1974	1986	1995	2005	1968	1974	1986	1995	2005
2	Year of revision of the Course of Study	1958	1968	1977	1989	1998	1958	1968	1977	1989	1998
3	Grade	5th	5th	6th	6th	6th	5th	5th	6th	6th	6th
4	Name of the unit	Life of fish	Structure and function of body	Structure and function of body	Structure and function of body	Structure and function of body	Life of fish	Fish and human bodies	Human bodies	Human and animal bodies	Function of animal bodies
5	Pages of the unit	8	19	18	14	16	8	16	19	16	16
6	Pages of fish dissection	2.2**	3	—	1	0.7	2	3.5	—	—	—
7	Kind of fish	Crucian carp	Crucian carp		Crucian carp	Crucian carp	Crucian carp (Carp)	Crucian carp			
8	Name of organ										
	Gills	+	+		+	+	+	+			
	Heart	+	+		+	+	+	+			
	Alimentary canal	+	+		+	+	+	+			
	Gall bladder	+	+		—	—	—	—			
	Liver	+	+		—	—	—	—			
	Kidney	—	+		—	—	—	—			
	Ovary	+	+		+	+	—	—			
	Swim bladder	+	+		—	—	+	+			
	Anus	+	+		+	+	—	+			
	Total number of organs	8	9		5	5	4	5			
9	Structure of body skeleton	+	+		—	—	+	+			
	Muscle construction	+	+		—	—	—	+			
10	Page of science textbook	168	154	146	122	138	184	184	152	108	124

+: described in the textbook; —: not described in the textbook.

*DN: Dainippon-tosho Co., Ltd.; TS: Tokyo Shoseki Co., Ltd.; KR: Shinko Shuppansha Keirinkan Co., Ltd.; KS: Kyoiku-shuppan Co., Ltd.

**The textbooks published in 1968 and 1974 are A5 (14.8-by21-centimeter) size and those in 1995 and 2005 are B5 (18.2-by15.7-centimeter) size. The calculation for less than one page is determined by (percentage of page) area.

Source: Journal of Science Education in Japan, Vol.33 No. 2, 2009 (in Japanese)

<To be continued to the next page>

b. On the science textbooks published in 1974

Fish dissection was described in the textbooks published for the fifth graders (Item No. 3). The total number of pages for the topic in each textbook varied from three to five (Item No. 6) and was 3.9 pages on average.

Crucian carp was described as the teaching material for observations and experiments in all textbooks (Item No. 7). The total number of fish organs described was nine in [DN], five in [TS], six in [KR] and five in [KS] (Item No. 8).

Table 1-(2) Changes of the contents related to “Fish dissection” in elementary school science textbooks in Japan

No	Item	KR*					KS*				
		1968	1974	1986	1995	2005	1968	1974	1986	1995	2005
1	Year of publication of textbooks	1968	1974	1986	1995	2005	1968	1974	1986	1995	2005
2	Year of revision of the Course of Study	1958	1968	1977	1989	1998	1958	1968	1977	1989	1998
3	Grade	5th	5th	6th	6th	6th	5th	5th	6th	6th	6th
4	Name of the unit	Life of fish	Body of fish, breeding of fish	Our bodies	Human and animal bodies	Human and animal bodies	Life of fish	Body of fish	Structure and function of body	Structure of human bodies and other animals	Structure of body for living animals
5	Pages of the unit	8	12	19	12	14	14	8	17	16	22
6	Pages of fish dissection	2.5	5	—	—	—	3	4	—	1	1
7	Kind of fish	Crucian carp	Crucian carp				Crucian carp	Crucian carp		Crucian carp (Carp, Mackerel)	Crucian carp (Carp, Mackerel)
8	Name of organ										
	Gills	+	+				—	+		+	+
	Heart	+	+				+	+		+	—
	Alimentary canal	+	+				+	+		+	+
	Gall bladder	—	—				—	—		—	—
	Liver	—	+				—	—		—	—
	Kidney	—	—				—	—		—	—
	Ovary	+	+				—	—		+	+
	Swim bladder	+	+				+	+		—	+
	Anus	—	—				+	+		—	+
	Total number of organs	5	6				4	5		4	5
9	Structure of body skeleton	+	+				+	+		—	—
	Muscle construction	+	+				—	+		—	—
10	Page of science textbook	176	176	148	104	124	184	184	138	124	148

+: described in the textbook; —: not described in the textbook.

*DN: Dainippon-tosho Co., Ltd.; TS: Tokyo Shoseki Co., Ltd.; KR: Shinko Shuppansha Keirinkan Co., Ltd.; KS: Kyoiku-shuppan Co., Ltd.

**The textbooks published in 1968 and 1974 are A5 (14.8-by21-centimeter) size and those in 1995 and 2005 are B5 (18.2-by15.7-centimeter) size. The calculation for less than one page is determined by (percentage of page) area.

Source: Journal of Science Education in Japan, Vol.33 No. 2, 2009 (in Japanese)

The structure of the body skeleton and the muscle construction of fish were described in all textbooks by four publishers (Item No. 9).

c. On the science textbooks published in 1986

At that time, the fifth graders learned about the breeding of fish, and the sixth graders did

human bodies, but there were no teaching materials on fish dissection in any textbooks³⁾.

d. On the science textbooks published in 1995

Fish dissection was included as reference material in the unit on “Structure of Human Bodies and Other Animals” in the textbooks for

the sixth graders published by two publishers among four. The total number of pages on “fish dissection” was one in both [DN] and [KS] (Item No. 6).

Crucian carp was described as the teaching material for observations and experiments in these two textbooks (Item No. 7). The total number of fish organs described was five in [DN] and four in [KS] (Item No. 8). The structure of the body skeleton and the muscle construction of fish were not described in any textbooks (Item No. 9).

e. On the science textbooks published in 2005

Fish dissection was included as reference material in the unit on “Structure of Human Bodies and Other Animals” in the textbooks for the sixth graders published by two publishers among four publishers. The total number of pages on “fish dissection” was 0.7 and one in [DN] and in [KS], respectively (Item No. 6).

Crucian carp was described as the teaching material for observations and experiments in these two textbooks (Item No. 7). The total numbers of fish organs described were five in both [DN] and [KS] (Item No. 8). The structure of the body skeleton and the muscle construction of fish were not described in any textbooks (Item No. 9).

2. Results of practice of fish dissection

a. Introductory classes on “fish dissection”

Prior to the classes on “fish dissection,” we asked children, “Why do we need to dissect fish?” and “Why do we need the experiment even though it takes the life of fish?”

The aim of the class was to let children realize the “preciousness of life.” When we asked children, “Do you not want to dissect fish?” about a quarter of children answered, “No, I do not want to do it.” As for the reasons for it, they said, “I don’t want to kill fish,” and “I am sorry for killing the fish.” So, we told them, “Fish dissection is important to understand our

bodies and learn about animal lives.”

b. Classes on “fish dissection”

At the beginning of the class on “fish dissection,” we asked the children, “Why do we need an experiment even though it takes the life of fish?” again.

Some children still hesitated to carry out the fish dissection at the beginning; however, they soon came to observe it more eagerly. The other children took part in the dissection with excitement from the beginning. During the class, all children could observe the internal organs of crucian carp and could check nine organs with the anatomical figure of a fish which was distributed to each child previously. The pulsation of the heart could be confirmed by all groups. After the experiment, we buried the dissected fish in the ground all together with the feeling of “many thanks.”

3. Children’s recognition of fish organs

After the class on “dissection of fish,” we distributed a questionnaire to the children to know their recognition of fish organs. The results are shown in Table 2. According to the answers about fish organs, the children recognized the nine organs at a high ratio.

The alimentary canal and swim bladder were recognized by all children. Gills and the heart were recognized about 99%, the anus was recognized about 96%, and the gall bladder was recognized by about 91% of them. The kidney, ovary, and liver were recognized by more than 60% of them⁴⁾.

4. Children’s views of “fish dissection”

Another questionnaire to children was distributed after the classes on “fish dissection” to know their view of the dissection. Table 3 shows the children’s answers, and they reveal the following facts.

Prior to the class on “fish dissection,” 20 children out of 76 answered, “I do not want to dissect fish.” The following three reasons for

the answer were presented by them: (1) I will be sick (nine children), (2) I am sorry for killing the fish (five children), and (3) I do not want to kill fish (four children). Six children out of 76 answered, “I have no idea.”

However, after the class on “fish dissection,” a big change occurred; 74 children out of 76 children answered that it was good to practice fish dissection.

5. Children’s notions after “fish dissection”

It became clear from the children’s answers

that from the practice, they had a lot of notions, such as an impression of experiential learning, recognition of scientific concepts, and awareness of biodiversity as well as the preciousness of life.

Table 4 shows the classification of the description of children’s notions in their responses to the questionnaire after the completion of “fish dissection.” All children described something related to experiential learning. Examples are as follows: “I observed real fish, then I understood the structure of a fish body” and “I was

Table 2 Fish organs recognized by children after “fish dissection”

(N=76)

Name of Organ	Boys (37)		Girls (39)		Total (76)		Ratio (%)
	Rec*	Non**	Rec*	Non**	Rec*	Non**	
1. Alimentary canal	37	0	39	0	76	0	100
2. Swim bladder	37	0	39	0	76	0	100
3. Gills	37	0	38	1	75	1	99
4. Heart	36	1	39	0	75	1	99
5. Anus	36	1	37	2	73	3	96
6. Gall bladder	32	5	37	2	69	7	91
7. Kidney	27	10	29	10	56	20	74
8. Ovary	25	12	29	10	54	22	71
9. Liver	20	17	28	11	48	28	63

*Rec: recognition. **Non: non-recognition.

Source: Iwama *et al.* (2009) *Journal of Science Education in Japan*, **33** (2).

Table 3 Children’s views of “fish dissection”

(N=76)

Did you wish to do “Fish dissection”?		What did you think about “fish dissection”?		
		Good	Not good, No idea	Total
Yes	Number	50	0	50
	Ratio (%)	66	0	66
No	Number	18	2	20
	Ratio (%)	23	3	26
No idea	Number	6	0	6
	Ratio (%)	8	0	8
Total	Number	74	2	76
	Ratio (%)	97	3	100

Source: Iwama *et al.* (2009) *Journal of Science Education in Japan*, **33** (2).

impressed that the body of a fish was very delicate.”

Almost all the children described something related to scientific knowledge. Examples of them are as follows: “The alimentary canal is 60cm long,” “The fish has a two-chambered heart,” and “The heart plays the role of the blood pump.”

Descriptions related to biodiversity were given by about 70% of the children. Examples are as follows: “A fish has gills and a swim bladder” and “The heart of a fish is small.”

Descriptions related to the preciousness of life were given by about 60% of the children. Examples are as follows: “I realized the preciousness of life when I watched the pulsation of the heart of the fish,” “I realized that the body was not usable if it was injured,” and “Although the heart of the fish was very small, it moved very strongly. I realized the vitality of the fish.”

Conclusions

Description of animal dissection has been decreased in elementary school science textbooks in Japan. Crucian carp was described as a teaching material for observations and experiments in all elementary school science textbooks published based on the 1958 and 1968 revisions of the CS in Japan. There was, however, no teaching material on fish dissection in any textbooks which were published based on the CS

revised in 1977. Fish dissection was described only as a reference in a unit in the textbooks for the sixth graders published based in the CS revised in 1989 and in 1998 by two publishers among four. It will be the same status due to the most recent revision of the CS for Elementary Schools in Japan in March, 2008, although science textbooks based on it have not been published yet.

However, fish dissection is very impressive for elementary school children, and it has a high educational effect as shown by our implementation. The results of the questionnaire to children after the class on “fish dissection” revealed the following facts: First, almost all the children answered that it was good to practice the fish dissection. Secondly, through the activity, children gained notions of experiential learning and scientific concepts and impressions of the delicacy of the structure of a body, and they seemed to realize the preciousness of life. Moreover, we got no answer to show that the practice of “fish dissection” was against the preciousness of life or that it gave any negative influence to children.

Although the above facts showed the educational significance of fish dissection in elementary school science, many problems are left unsolved to enforce it in elementary school science. For example, some teachers do not want to do dissection and some children do not want to kill fish or are sorry for killing fish by dissection.

Table 4 Contents of description of children’s notions after “fish dissection” (N=76)

Categories	Boys (37)	Girls (39)	Total (76)	Ratio (%)
Experiential Learning	37	39	76	100
Scientific Knowledge	36	39	75	99
Biodiversity	21	33	54	71
Preciousness of Life	18	28	46	61

Numbers in the table show numbers of answers classified by aspects (multiple answers).

Source: Iwama *et al.* (2009) *Journal of Science Education in Japan*, 33 (2).

It seems that fish dissection is important for experiential learning in order for children to have some notions about the structure and function of human bodies and other animals and to notice the delicacy of the structure of the body that will lead to realization of the “preciousness of life.” It must be worthwhile to reconsider the adoption of “fish dissection” in elementary school science.

Acknowledgements

We thank Prof. Kunio Umeno (Fukuoka University of Health and Social Welfare) for his detailed comments and suggestions and some attendants of the 22nd Biennial Conference of the AABE.

Notes

- ¹⁾ Abbreviations: DN, Dainippon-tosho Co., Ltd.; TS, Tokyo Shoseki Co., Ltd.; KR, Shinkoshuppansha Keirinkan Co., Ltd.; KS, Kyoiku-shuppan Co., Ltd.
- ²⁾ The number within a circle for each fish organ in Figure 1 and Figure 2 was inserted by us corresponding to that in Table 2.
- ³⁾ According to one of the members of the committee that produced the CS at that time, it was difficult even to use the term “dissection” in the CS for Elementary Schools in Japan and its commentary.
- ⁴⁾ The spermary testis has not been described in the CS of Elementary Schools in Japan.

References

- Iwama, J., Hatogai, T., Matsubara, S., Yamagishi, R. and Shimojo, T. (2008) Study on Educational Significance of “Dissection of fish?” — Biology Education for Realizing the Preciousness of Life —. *Japanese Journal of Biological Education* **48** (1-2): 46. (in Japanese)
- Iwama, J., Hatogai, T., Matsubara, S. and Shimojo, T. (2009) Study of Teaching Materials of Living Things to Form Scientific Concepts and to Foster an Esteem for Life in Elementary School Science: The Case of “Fish Dissection.” *Journal of Science Education in Japan* **33**(2): 118-130. (in Japanese)
- Ministry of Education, Science, Sports and Culture, Japan (1998) The Course of Study for Elementary Schools in Japan. Printing Bureau, Ministry of Finance, Japan. (in Japanese)
- Ministry of Education, Culture, Sports, Science and Technology, Japan (2003) The Course of Study for Elementary Schools in Japan. National Printing Bureau, Tokyo. (in Japanese)
- Ministry of Education, Culture, Sports, Science and Technology, Japan (2008) The Course of Study for Elementary Schools in Japan, Tokyo Shoseki Co., Ltd., Tokyo. (in Japanese)
- Nishikawa, K. and Tsuruoka, Y. (2007) The actual situation of animal dissection in the elementary and junior high school science classes. *Japanese Journal of Biological Education* **47**: 146-156. (in Japanese)
- Japanese Elementary School Science Textbooks**
- Dainippon-tosho, 5th grade, 1968, 1974, 1986
- Dainippon-tosho, 6th grade, 1950, 1953, 1986, 1995, 2005
- Kyoiku-shuppan, 5th grade, 1968, 1974, 1986
- Kyoiku-shuppan, 6th grade, 1986, 1995, 2005
- Shinko Shuppansha Keirinkan, 5th grade, 1968, 1974, 1986
- Shinko Shuppansha Keirinkan, 6th grade, 1986, 1995, 2005
- Tokyo Shoseki, 5th grade, 1968, 1974, 1986
- Tokyo Shoseki, 6th grade, 1950, 1953, 1986, 1995, 2005

Country Report

**Indigenous Protected Areas in Australia
– A Role to Play in the UN’s Decade for Sustainable Development –**

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Indigenous Protected Areas (IPAs) are lands provided to and managed by Indigenous groups to promote biodiversity and cultural resource conservation in Australia. In November 1999 Victoria’s first IPA was declared. Deen Maar occupies 453 ha in the State’s south-west and was previously seriously degraded pastoral land that had been over-grazed and had many weeds and pests. However, Deen Maar also has extensive wetlands and saltmarshes that are of international conservation significance. The land also has deep cultural significance for local Indigenous peoples. Deen Maar is undergoing extensive revegetation. A biodiversity audit of the property has been conducted; this showed the property’s importance for conservation of many threatened species. Bird hides have been built and accommodation for visitors established. IPAs must generate income; accordingly 12 wind turbines have been erected. As well, cropping occurs and cattle are grazed on improved pasture that has been fenced. The Indigenous owners of the land are keen for Deen Maar to be an educational resource and will be encouraging student visits and research projects. It thus represents a resource for environmental education within a culturally significant context. The United Nations Decade of Education for Sustainable Development aims to “encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations.” Deen Maar’ goals are certainly in line with these sentiments.

Keywords: Indigenous Protected Area, environmental education.

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The UNDESD aims to “encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations” (UNESCO, 2009). Thus the focus is on education that will bring about behavioral change that will, in turn, produce effective environmental outcomes, economic certainty and adjust society.

In this paper I describe UNDESD’s relevance to Australia’s Indigenous population and a scheme that aims to provide Indigenous communities – who are regarded as disadvantaged in many respects – with the opportunity to contribute significantly to biodiversity conservation, environmental improvement, cultural conservation while at the same time, generating valuable income.

Indigenous Protected Areas in Australia

Europeans settled in Australia relatively recently; it is widely held that the first European contact with Aborigines was by Englishman William Dampier in 1688 (Flannery, 1994). Settlement occurred in Sydney Cove in 1788. However, Aborigines have lived in Australia for around 50,000 years with some estimates suggesting 60-70,000 (Flannery, 1994). While conventional view has it that Aborigines lived in harmony with their environment, carefully managing its natural resources through fire management and migratory activities (e.g. DEWHA, 2008), there is a growing view that Indigenous peoples had a significant effect on the megafauna and habitats through hunting and fire that changed landscapes significantly (e.g. Flannery, 1994).

There is strong recognition that Aboriginal communities are some of the most disadvantaged in Australia, especially in terms of health (their life expectancy is far below that of other groups), employment and living conditions. In the 1990s there was a strong push to acknowledge not only Aboriginal's great understanding of natural lands and biodiversity, but also acknowledgement that they were entitled to ownership of crown lands in which they had experienced a long and continuous association. There thus emerged pressure to provide Indigenous Australians with lands they could manage in their own way to 'care for their country' and thus protect the natural and cultural assets. In the late 1990s a new category of protected lands was thus established by the Australian Government, called *Indigenous Protected Areas (IPAs)* which became an important addition to Australia's National Reserve System (see <http://www.environment.gov.au/parks/nrs/index.html>).

The goals of the Indigenous Protected Areas element of the Caring for our Country initiative are to:

1. Support Indigenous land owners to develop,

declare and manage IPAs on their lands as part of Australia's National Reserve System.

2. Support Indigenous interests to develop cooperative management arrangements with Government agencies managing protected areas.
3. Support the integration of Indigenous ecological and cultural knowledge with contemporary protected area management practices (DEWHA, 2008).

In 1997 a conference of Indigenous people described IPAs as follows:

- An Indigenous Protected Area is governed by the continuing responsibilities of Aboriginal and Torres Strait Islander peoples to care for and protect lands and waters for present and future generations.
- Indigenous Protected Areas may include areas of land and waters over which Aboriginal and Torres Strait Islanders are custodians, and which shall be managed for cultural biodiversity and conservation, permitting customary sustainable resource use and sharing of benefit.
- This definition includes land that is within the existing conservation estate, that is or has the ability to be cooperatively managed by the current management agency and the traditional owners (DEWHA, 2009).

A 2006 review of the IPA program by the Director of New South Wales National Parks & Wildlife Service, Brian Gilligan, described the IPA program as the nation's "most successful innovation in Indigenous conservation" (Gilligan, 2006). To celebrate the decade of achievements of the IPA program, the Commonwealth's Department of Environment & Water Resources published *Growing Up Strong*, which includes discussion of Victoria's first IPA, Deen Maar (DEWR, 2006).

Deen Maar – a Case Study of an IPA

Deen Maar is a 453 ha property in south west Victoria that was purchased by the Framlingham Aboriginal Trust in 1993. The land has

deep cultural significance for the local Indigenous people (the Gunditjmara). Firstly, it is believed that when Bunjil, the Creator, had completed his tasks in making the world, he ascended from Deen Maar Island (Lady Julia Percy is) nearby. Secondary, on Deen Maar mainland, it is also possible to have direct visual contact with many important sites – the Island, as well as volcanic mountains/ hills such as Mt Eccles, Gariwerd and Tower Hill. Such high spots were important for communication between Aboriginal groups who would signal to each other using smoke from fires. Thirdly, Deen Maar is the site of the infamous Eumerella wars in which many Aboriginals were killed by white settlers. Finally, there is evidence that local Aboriginals spent much time on the coast at Deen Maar, collecting and eating shellfish, birds and fish from the productive shoreline and estuary.

There is a diversity of habitats at Deen Maar, including sand dune communities, limestone ridges, a river, lakes and extensive wetlands and saltmarshes.

From the mid 1800s the property was used for grazing. The wetlands were drained and native vegetation cleared. Overgrazing by stock was exacerbated by rabbit grazing and weeds became abundant. Productivity was very low.

Since its purchase by the Framlingham Aboriginal Trust, the land has slowly undergone an amazing transformation. There has been extensive weed removal and planting of native vegetation to recreate original habitats.

In 2008 I conducted an audit of flora and fauna at Deen Maar. The site contains species of conservation significance, such as the Orange-bellied Parrot *Neophyma chrysogaster* which is critically endangered at both a state and national level. It also has numerous species of waterbirds of conservation significance, especially Magpie Geese (*Anseranas semipalmata*) and Egrets (3 species). One frog and several fish species are also of conservation significance.

Over 110 species of birds have been recorded at the site.

Even though the property is not large, Murphy (1999) described 10 vegetation communities at the site. Importantly, a native shrub is expanding rapidly and has been declared an ‘environmental weed’.

The declaration of Deen Maar IPA in July 1999 was made under World Conservation Union (IUCN) Category VI – Managed Resource Protected Areas: Protected Area managed mainly for the sustainable use of natural ecosystems (see <http://www.environment.gov.au/parks/ucn.html> for a description of the categories). Murphy (1999) noted that the IUCN defines such a category as an “area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs” (HORSCERA, 1993). Objectives of management for these areas outlined by the IUCN are to:

- protect and maintain the biological diversity and other natural values of the area in the long term,
- promote sound management practices for sustainable production purposes,
- protect the natural resource base from being alienated for other land-use purposes that would be detrimental to the area’s biodiversity; and contribute to regional and national development (HORSCERA, 1993, p26).

Such a categorization enables the land owners to undertake activities that can generate income which, in turn, can be used to finance the conservation management actions that are required. There are three main ways the owners currently generate income:

- i) cropping on improved pasture and some cattle grazing,
- ii) leasing land for wind-turbines to generate electricity,
- iii) ecotourism and cultural tourism.

Deen Maar represents an excellent educational resource. The Framlingham Aboriginal Trust recently purchased a former primary school in nearby Yambuck and have converted the building to a 'backpackers' hostel. Students and community members can enjoy kayak trips along the Eumerella River and bird watching (using hides built by the Trust), learn about Aboriginal history and culture, study the effects of weed and pest removal, study succession, and enjoy beach activities. In terms of the UN-DESD, Deen Maar meets the requirements as a venture that aims to improve environmental quality while at the same time generating sufficient income for the property's objectives to be realized in the long-term. Certainly, by supporting economic independence of a severely disadvantaged part of the community and helping preserve their cultural heritage, Deen Maar is making a positive contribution toward achieving a just society for present and future generations.

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References

- DEWHA (2008) Indigenous Protected Areas. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia.
<http://www.environment.gov.au/indigenous/ipa/index.html> [viewed 1 May 2009].
- DEWR (2006) *Growing Up Strong. The first ten years of Indigenous Protected Areas in Australia*. Australian Government Department of Environment & Water Resources, Canberra. Also at
<http://www.environment.gov.au/indigenous/publications/pubs/ipa-growing-up-strong.pdf>
- Flannery, T. (1994) *The Future Eaters: An Ecological History of the Australasian Lands and People*. Reed Books Australia, Chatswood.
- Gilligan, B. (2006) *The Indigenous Protected Areas Program – 2006 Evaluation*. Australian Government Department of Environment & Heritage, Canberra. Also at
<http://www.environment.gov.au/indigenous/publications/ipa-evaluation.html>
- House of Representatives Standing Committee on Environment, Recreation and the Arts (HORSCERA) (1993) *Biodiversity: The Role of Protected Areas*. (Australian Government Publishing Service: Canberra).
- Murphy, A. (1999) Ecological and Cultural Significance of an Indigenous Protected Area at Deen Maar, Yambuk, Southwest Victoria. B. Nat. Res. Man. (Hons) thesis, Deakin University.
- Wallis, R. (2008). *Deen Maar Indigenous Protected Area – BIOAUDIT*. Framlingham Aboriginal Trust. Warrnambool.

<Figures are on the next page>



Figure 1 View of Deen Maar looking south towards coastal secondary dunes bearing wind turbines. Between the foreground of tussocks and grasses and the dunes is a dried out wetland that fills during winter.



Figure 2 Magpie Geese at Deen Maar. These birds had been lost from southern Australia because of overhunting and habitat loss, but have been successfully re-introduced into areas such as Deen Maar.



Figure 3 Wetland view from one of the recently constructed bird hides.



Figure 4 Extensive erosion caused by introduced European Rabbits.



Figure 5 Successful revegetation with plants that are indigenous to the area. This site was once overgrazed, cleared pasture.



Figure 6 A group of university students studying Environmental Planning at Deen Maar, being addressed by Framlingham Aboriginal Community members, including distinguished Elder, Lionel Harradine, second from left.

Abstracts of the Papers Presented at the 21st Biennial Conference of the AABE

The 21st Biennial Conference of the AABE was held at Kongju National University, Gongju, South Korea from 25 to 28 October, 2006. The themes of the Conference were “Biology Education through Field Excursion: Bird Watching” and “Recent Trends in Biology Education.” There were two plenary lectures, 13 oral presentations and 24 poster presentations. On 27 October, a school visiting program to Seoryeong High School and a fieldtrip to Seosan for bird watching were carried out.

<Plenary Lectures>

Bird Watching in South Korea

Sam-Rae Cho

Kongju National University

Although about 400 species of birds have been recorded in Korea, so far identifying a particular bird usually is not too difficult. As in developing any skill, however, a bit of pleasant effort is required. Ultimately, proficiency is achieved only through practice looking at birds in the field. But field observations must be supplemented with study of a field guide. Here are a few pointers to help the beginning birder learn to identify birds more quickly.

Determining the correct identify of a bird is essentially a process of elimination. First you must be able to recognize the family to which a bird belongs, for example if it is a seagull, a woodpecker, or heron. To do this you must pay close attention to the size and shape of the bird and in many cases to its bill. Study the field guide, including the pictures on the book, to become familiar with the bird families which occur in Korea. Then look through the pictures to see the birds you might en-

counter in the field. Pay special attention to the pictures which point to the field marks so you will learn the kinds of things to look for when you see a new bird. You will see that the yellow tip of the bill of Spot-billed Duck, the blue back of the Common Kingfisher, and the crest of the Lapwing are field marks which will help you to identify these birds at a glance. Some will be more difficult because there are species which look almost alike, but the distinguishing characteristics can be learned with study and practice.

In the field, train yourself to observe birds in flight, carefully looking for colors and pattern, silhouette, the way the wings are held, and the manner of flight. The behavior of a bird can also give important clues to its identify. Pay attention to such things as how it files, how it swims, how it moves the tail, whether it walks or hops, and if it occurs in flocks. From the beginning take note of calls and songs. Most species have distinctive voices. Knowing them can be an invaluable aid in identification.

Additional factors which will be helpful in narrowing your options are season, habitat, and location. For example, the Common Cuckoo cannot be found in Korea during the winter, seagulls cannot be found in the mountains, and often similar species do not occur in the same parts of Korea. In most cases there is little exciting to find a bird where it doesn't belong or at a time of year when it does not belong or at a time of year when it does not normally occur in Korea, but until you have become more proficient it is best to assume you have selected the wrong species. For this information please refer to the status and the distribution map for each species.

Don't expect to be able to identify every bird you see. You should, however, soon learn to know

within two or three possibilities what bird you have seen. There will always be birds on any day in the field which you will not see well enough to identify.

Good birders recognize this and avoid guessing when they have not seen a bird well enough to make a positive identification.

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“AABE with New Era” and Science Curriculum Innovation in Japan

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In my speech, I will give you two sorts of information; one is about the history of the AABE and the other is on the current movement of curriculum improvement in Japan.

I. The history of the AABE

The Asian Association for Biology Education was established in 1966 by joining many leading biology teachers, educators and researchers among Asian countries. The first conference was held in Manila. So far, we have had conferences biennially in not only at cities in Asian countries, but also in Israel and Australia (Table 1).

In past 40 years, biological research has made remarkable progress. This makes us review the study contents of biology and biology curriculum frequently. The biennial conference of the AABE is good opportunity for us to exchange information, ideas, teaching materials, etc. (Table 1: on the next page). I keenly hope the activity of the AABE will be continued and enhanced more in this millennium.

II. The current movement of curriculum improvement in Japan

The Section for Investigation of Curriculum Framework of the Central Council for Education,

organized by Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan, has been investigating the present situation of science education at the primary and secondary levels in Japan and found some issues to be resolved. Based on the investigation, the section members prepared a proposal which suggested some ways of improving science education in Japan. The contents of the proposal are as follows:

1. Reconsidering the science objectives while keeping the major objectives of “Science” in the present CS.
2. Allowing students to acquire basic, fundamental scientific knowledge and skills such as understanding of scientific key concepts
3. Developing students’ abilities to think and to explain scientifically
From the viewpoint of developing students’ abilities of thinking and explaining scientifically, the following learning activities should be encouraged while taking into account the age and developmental stage of students and the contents of study.
4. Encouraging observation, experimentation, scientific experiences and experiences in nature
5. Enhancing the motivation for studying science to deal with the development of science and technology
6. Elementary school science: arranging study contents into two disciplines
7. Junior high school science: reconsidering the learning sequence of contents
8. Senior high school science: reconsidering subject composition
9. Enriching teaching resources

Based on this proposal and further discussion at the Curriculum Council, which is related to the Central Council for Education, the revised Course of Study will be made by the end of 2007.

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Table 1 The History of the Asian Association for Biology Education

	Date	City (Country)	Director and Convener	Conference Theme(s)	No. of Participants [No. of Countries]
1	Dec. 1966	Manila (Philippines)	Liceria B. Soriano Dolores F. Hernandez	School Biology in Asia: A New Orientation	100 [14]
2	August 1968	Tokyo (Japan)	Yoshito Shinoto Kazuhiko Nakayama	Enrichment of School Biology: Content and Techniques	107 [15]
3	Dec. 1970	Manila (Philippines)	Hilary Cruz Dolores F. Hernandez	The Utilization of Investigative Research Projects in School Biology Teaching: Reflect the Peculiarities of the Region	45 [13]
4	Dec. 1972	Jerusalem (Israel)	Alexandra Poljakoff- Mayber R. Bitman	1. Evaluation in Science Education 2. The Uses of Educational Technology in Science Educa- tion	101 [15]
5	June 1974	Singapore	Wee Heng Tin John Yip	Biology Education for Rural and Urban Areas in Asia	116 [9]
6	July-Aug. 1976	Bangkok (Thailand)	Twee Hormchong Sanga Sappasri	Preparation of Teachers for Biology Teaching	101 [13]
7	Dec. 1978	Kuala Lum- pur (Malaysia)	Cheong Siew Yoong S. Kanagasabai	Multidisciplinary Biology Education Relevant to Commu- nity Development	157 [12]
8	Oct.-Nov. 1980	Osaka & Gifu (Japan)	Kozo Imahori Yutaka Koshida	Biology Education for the Next Decade - Linking Biology to Social Studies - Using Living Organisms for Field Study and Laboratory Work	80 [21]
9	Dec. 1982	Melbourne (Australia)	David M. Stakes Robert L. Wallis	The Role of Biology Education in Enhancing the Quality of Life	39 [6]
10	Dec. 1984	Chiang Mai (Thailand)	Panee Chiowanich Morakot Sukchotiratana	Biology Education and Technology	50 [5]
11	Dec. 1986	Quezon City (Philippines)	Dolores F. Hernandez Vincenta F. Reyes	Research and Evaluation in Biology Education and Its Implication for the Teachers	120 [12]
12	Dec. 1988	New Delhi (India)	R. K. Mohta B. G. Pitre	Explosion of Biological Knowledge and the Challenges for Secondary Education and Teacher Preparation	21 [5]
13	August 1990	Seoul (Korea)	Yong Jai Chung Yung Chil Hah	Environmental Education in the Curriculum of Biological Education	Ca.65 [7]
14	Dec. 1992	Melbourne (Australia)	Robert L. Wallis Peter Brown	Environmental management in Asia	53 [7]
15	August 1994	Tokyo (Japan)	Yutaka Koshida Hideo Kitano	Biology Education for Non-biology Majors	107 [7]
16	Dec. 1996	Chiang Mai (Thailand)	Morakot Sukchotiratana	Excellence in Biology Education: Research, Practice and Experience	ca.120 [10]
17	Dec. 1998	Pasai City (Philippines)	Carmen G. Kanapi Salvasion P. Angtuaco	Biology Education in the Third Millennium: Focus on Information Technology and Environmental Education	ca.150 [6]
18	August 2000	Hong Kong	Park L. Tang	Biology Education in the New Millennium	ca 60 [9]
19	Nov. 2002	Warrnambool (Australia)	Robert L. Wallis	Ecological Sustainable Development in Education	38 [6]
20	Dec. 2004	Chiang Mai (Thailand)	Morakot Sukchotiratana	Roles of Modern Technologies in Biology Education	ca.45[4]
21	Oct. 2006	Gongju (Korea)	Kyoung Ho Kim Kew Cheol Shim	Biology Education through Field Excursion: Bird Watch- ing Recent Trends in Biology Education	

<Oral Presentations>

**Use of Marine Food Chain as
an Educational Model for
Biological Magnification of Mercury**

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Three hundred and ninety samples of marine organisms were collected from the East Coast of Thailand for total mercury analysis. The results indicated that mercury levels of fish and other marine organisms from the East Coast of Thailand are within the safety limit. However, biological

magnification of mercury residue in the marine food chain was observed. Organisms of higher trophic levels have higher mercury residue than those in the lower trophic levels. Statistical analysis showed positive linear regression between the size of the marine organisms and mercury contents of some species of marine organisms. Results of investigation reveal that marine food chain could be used as an effective model for biological magnification study of pollutants such as mercury residue in the environment.

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**The Practice of Environmental Education
in Japanese Junior High School Science
– Introducing the Environmental Education
Program “Project WILD” and “Project
WET” –**

**Kiyoyuki Ohshika, Orié Ohshika, Takayuki Sato,
Heiwa Muko**

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As for practicing environmental education in Japanese junior high school, Science is an important subject with two units emphasizing on environmental learning. However, there are few activities and experiments allow students to link their basic knowledge to real life situation in their unit. Therefore, students have difficulty to develop environmental ability and attitude in their science study.

Project WILD (PW) and project WET (PWET) are widely-used environmental education programs in several countries. They are packaged program based on the experimental learning cycle. There are several types of PW and PWET activities, e.g., role-play card game, outdoor exercise, debate, etc. In this study, we have practiced the environmental study using the activities of PW and PWET in science class, and discussed the validity of teaching

materials and the effectiveness to the students learning. We had chosen some of the activities, and modified and applied them to the junior high school science in Japan. Based from the results of practice on the unit “nature and human” in science II using these materials, our findings are as follows:

- Students could participate positively using the adapted activities from PW and PWET in their science class.
- Students have not only been able to learn the knowledge about nature ecology, but raise their interest about neighborhood environment and environmental issues.
- Students were able to simulate the long-term change of ecosystem through some activities, and they were able to understand the science process through the results of their activities.
- Students could develop the scientific thinking skills and the decision making for environmental sustainability and conservation.

The findings mentioned above indicate the positive effect to students the practicing of environmental education in science class using the activities from PW and PWET. Therefore, these programs were able to carry out environmental education in science class.

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**Application of the Environmental
Education Program “Project WET” to
Japanese Biology Curriculum**

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In Japanese schools, students have less chance to study about the environment. Environmental education has not established its framework in a

subject or teaching unit clearly. Therefore, it is a problem that students are not aware of their surrounding environment through the subjects.

“Project WET (PWET)” is a program developed in the USA for environmental education, which focuses on water and water environment. PWET has issued the curriculum and activity guide that includes 91 activities: research, simulation, puzzle game, and so on. It was imported and spread into Japan since 2004.

In this study, we compared both the contents of PWET and Japanese science curriculum particularly biology from elementary school to high school. Then, we discussed the application of PWET to these curricula.

As the results, we found out that some activities of PWET are possible to be used in each biology curriculum at all school levels, and they are expected to be used as teaching materials for hands-on study. For example, their simulations and puzzle games are possible to be used instead of the observation or experiments that are difficult to be performed as class activity.

We concluded that students develop their skills and abilities in environmental education by experiencing these activities. In addition, we think that students can deepen their understanding of the environment and apply their basic science knowledge to their surrounding environment. Therefore, we believe that PWET is a good teaching material for studying the environment in the subject of science including biology.

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**The Principles of Phylogenetics:
An Example in the Tribe Mussaendeae
(Rubiaceae)**

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Traditional plant systematics has in the past char-

acters from morphology, anatomy, embryology, chromosome, palynology, secondary plant compounds and protein. More recently, DNA sequence information has provided an important source of characters and has led to the rapidly developing field of molecular systematics (also called phylogenetics). There are undeniable advantages of molecular data because their interpretation is simpler and that there are simply more molecular characters available. Molecular data have often resolved systematic questions where morphological evidence is inconclusive and revealed relationships that are not suspected in the basis of traditional morphological characters. As a result, it is now widely used for generating phylogenetic hypotheses.

In this lecture, a practical introduction to the study of molecular systematics will be presented. The theory, fundamental terms, approaches, methodologies, and genomic markers useful in phylogenetics will be outlined. The value of molecular data, inferred from chloroplast (*trnT-F*) and nuclear (ITS) DNA data, will be discussed using the genetic conflicts in the tribe Mussaendeae (Family Rubiaceae) as an example.

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**The More Experience Teachers Have with
Laboratories and Field Activities,
the More Laboratories They Include in
Their Lessons!
— From the Results of a Survey of Upper
Secondary School Biology Teachers
in Japan —**

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In November 2005, we conducted a survey on upper secondary school biology education in Japan.

We sent a questionnaire to biology teachers at 1,000 upper secondary schools selected randomly among approximately 5,000 upper secondary schools in Japan and received answers from 654 teachers. Though the questionnaire covered a broad range of topics, we will report the results pertinent to one of the themes of this conference, "Biology Education through Field Excursions."

The vast majority of biology teachers at upper secondary schools have had the experience of collecting, growing or raising plants or insects when they were elementary school children. Only one third have had relatively abundant experience in biology laboratories (observations and experiments) during upper secondary school. However, two thirds have had relatively abundant experience of field activities in university.

From the results of this survey, it appears that the more experience they have had with biology laboratories in upper secondary school, and the more field activities they have experienced in university, the more likely upper secondary school biology teachers are to include student laboratories in their lessons.

Taking the importance of observations and experiments in biology education into account, it is desirable that biology teachers be provided with as much experience in field activities as possible during their training in addition to experience in laboratory activities.

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Pigmented Actinomycetes from Coastal Areas and Their Bioactive Secondary Metabolites

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Forty soil samples collected along the coastal areas

of Chonburi, Rayong and Chantaburi Provinces were isolated for Actinomycetes having some bioactive secondary metabolites. Pre-treated soil samples were 10 fold-diluted and incubated to starch casein agar plates. Various colorful actinomycetes were picked up after 7 – 14 d incubation at 32°C and purified and 147 isolates were screened. Out of 147 isolates, 92 were active against gram positive and/or gram negative bacteria, including yeasts. Bacterial test strains were: *Micrococcus luteus* TISTR 884, *Staphylococcus aureus* TISTR 885 and *Pseudomonas aeruginosa* TISTR 781. Yeast test strains were: *Candida albicans* TISTR 5239, *Candida tropicalis* TISTR 5045, *Debaryomyces hansenii* TISTR 5265, *Pichia kluyveri* TISTR 5150 and a *Candida* sp. hospital strain. All of them, both antimicrobial producers and non-antimicrobial producers were able to produce pigments both in spore mass and at colony reverse in various colors: gray, white, yellow, pink, light orange, red, brown, yellow-brown and purple. Furthermore, some isolates could produce soluble pigments into the agar medium. The present study showed that coastal soils can be one of the interesting sources of actinomycetes isolation for these worth useful bioactive secondary metabolites.

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Comparative Studies on Blood Osmolalities of the Mud Crab (*Scylla serrata*) and the Blue Swimming Crab (*Portunus pelagicus*) Exposed to Different Salinity Levels

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Blood osmolalities of the mud crab (*Scylla serrata*) and the blue swimming crab (*Portunus pelagicus*) were examined after 0, 1, 3, 6, 9, 12, 24,

48, 72 and 96 hr transferred from seawater at salinity of 30 ppt to salinities of 5, 10, 15, 20, 25, 30 (control), 35 and 40 ppt at 25°C. Blood osmolality of both crab species reached constant levels within 72 hr. *S. serrata* survived in all test salinities within 95 hr whereas *P. pelagicus* survived in salinities of 15, 20, 25, 30, 35 and 40 ppt within 96 hr but died 24 hr after being transferred to seawater at salinities of 5 and 10 ppt. Thus, the salinity ranges over which osmoregulations were performed efficiently were 5 – 40 ppt for *S. serrata* and 15 – 40 ppt for *P. pelagicus*. The result on value of blood osmolalities showed that *S. serrata* is a strong hyper-osmotic regulator whereas *P. pelagicus* is an osmoconformer.

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Introduction of Diatoms for Studying River Environment

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Diatoms are microalgae distributed in almost all aquatic environment and take major role in global ecosystem, because 20 – 25% of photosynthesis in the world is contributed by them. Diatoms are one of useful bio-indicators and water quality evaluation methods using diatoms are applied in many countries. In spite of these facts, diatoms are less informed in biology education. Using video movies and simulation software, we tried to introduce the diatoms to biology education for understanding relationship between human activities and river water quality. Because of their small size, observation of diatoms is usually not easy for many students. In addition, identification of diatoms is difficult for beginners, as over 300 species occur in Japanese rivers. To solve these problems,

we developed the simulation software “SimRiver.” We have had several classes using these learning materials since 2002. In some classes, field learning was also combined with indoor learning. In conclusion, it was indicated that students enjoyed the learning with SimRiver and understood the change of species diversity according to water pollution, and their thinking to environment was promoted.

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Analysis of Secondary School Science Teachers’ Perceptions of and Practice in Microcomputer-based Laboratories

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Recently, secondary school science laboratories and the experimental tools in them are improving and developing due to the science laboratory modernization policy to activate and reform science education in Korea. Related to this, the Microcomputer-based Laboratory (hereafter, MBL) has become one of the technologies attracting the attention of science teachers and science educators.

In this research, secondary school science teacher’s perception of MBL and its usage in schools were investigated using survey methods. One thousand secondary school science teachers across the country were surveyed through online for one month in May 2006, and their responses were analyzed. Through this research, the ways to improve the effectiveness and efficacy of scientific inquiry or experiments by implementing MBL in science education were expected to find out.

The survey results showed that only 53.3% of science teachers have even heard of MBL and 31.7% of teachers have experienced MBL directly or in-

directly, usually through teacher training programs. Also, a very small percentage of secondary schools (6.1%) were equipped with MBL tools and used them mainly for demonstration by teachers because of the low quantity of MBL tools. Thus, it was found that only a small percentage of secondary school science teachers understood the meaning and value of MBL in terms of improving science experiments.

Meanwhile, 70 – 80% of teachers had a positive opinion about the effectiveness and practicability in using MBL in science experiments, and 80.8% of teachers intend to participate in teacher training program on MBL in the future. Moreover, they requested MBL tools in schools and teaching materials about MBL experiments for activating the usage of MBL in science education.

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Philippine Science High School (Main Campus) Biology Unit: Gearing Secondary Level Gifted Students towards Careers in Biology through Field Biology

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Philippine Science High School – Main Campus

The– Main Campus Biology Unit, true to its vision and mission of contributing to nation-building by increasing the number of biological science oriented students at the secondary level, re-organized a field biology course offered to incoming 4th year high school Filipino students. The program aimed to promote learning in the ecology of terrestrial and aquatic environments and in ecological field techniques, develop conservation-minded students, and improve inter-cultural interaction. Linkages both local and foreign were forged with conservation project institutions, university field

laboratories and local government units to achieve the minimum level of competency required of in a multidisciplinary field of nature conservation, awareness, and preservation.

The Philippines is a mega diverse country, but it has much natural resources still waiting to be discovered. Its current condition as a “hotspot country” prompted the authors to intensify the campaign of field discovery and field education.

Bird watching, as part of the Field Biology program, offered students the opportunity to patiently wait and to identify birds of different species using the current literatures published on Philippine Birds and aided with the expertise of a research station staff.

The Philippine Science High School Biology Unit is continuously looking for opportunities for an active cooperation of external scientific bodies and institutions, both local and foreign, to reshape once again the interest of students in fieldwork and exploration amidst financial, equipment, and expertise constraints.

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Myxomycetes in Hokkaido, Northern Japan, and Introduction to a Simple Method to Collect Myxomycetes

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Myxomycetes (also called “slime molds”) are fungus-like organisms commonly found in forests throughout the world. They are very interesting organisms because of their life cycle. At one stage, they produce mold-like masses that give rise to spores, and at the other stages they move and feed on bacteria in an animal-like fashion. Although myxomycetes occur in any kinds of wood-

land, most people overlook because of a lack of knowledge of them. In the course of this study, we have devised a simple method to collect myxomycetes for teachers and students.

Asahikawa is located at the central part of Hokkaido, and is climatically situated in the cool-temperate zone. Five hundreds and thirty specimens were recorded as field collections during 2004 – 2006, and 93 taxa of myxomycetes were recognized. Seasonal development of fructification was observed at the research area. In spring (April and May), abundant fructification of peculiar “snow bank myxomycetes” were found near melting snow and 14 taxa of this group could be enumerated. In summer (June to August), 46 taxa were recognized, and most of these were known as cosmopolitan species which widely range from tropical to temperate zones. In autumn (September to December), 44 taxa were recorded, including 14 species which are regarded as typical autumn species and which have been recorded also from mountain regions of the central part of Honshu Isl., Central Japan.

We have devised a simple method to collect myxomycetes which is convenient for teachers and students to easily find and collect myxomycetes in forests and schoolyards.

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Development of Inventing Future Animal for Students of Elementary School

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“The Future is Wild” is a TV program made by Animal Planet and BBC. In this program, there are many future animals like “Megasquid.” Many famous scientists create these animals with scientific prediction. Scientists believe that, 200

million years in the future, the eight-ton “Megasquid” may roam Earth. According to experts of this program, it is not difficult to imagine that squids may one day live on land, since all land-living animals are descendants of marine organisms.

In Korean Elementary Science 4th Grade, there is a lesson for creating students’ own animal of conjecture. But, more imagination of students’ own animal is not appropriate to nurture scientific thinking. Before drawing or developing students’ own animal introducing the animals of “The Future is Wild” would be a good guide to elementary students for making scientific animal and would be a good material to explain evolution.

Before making students own animal of imagination, the surrounding environment and many variables of nature should be explained thoroughly to make animals of scientific imagination.

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Biodiversity of Birds in Wiang Kosai National Park, Thailand

Surakan Payakkhabut

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Wiang Kosai National Park was designated as the 35th national park of Thailand on October 9, 1981. It covers an area of 410 km² in Phrae Province and Lampang Province. The landscape of the national park is high steep mountains covered with dry evergreen forest and mixed deciduous forest. The highest peak reaches a height of 1,267 m m.s.l. The forests are important water source of Yom River. In the past, the forests were the living place of various kinds of wild animals, i.e. tiger, elephant, and deer. However, poaching and illegal cultivation, past to present, has regrettably destroyed the rich natural forests much. The pur-

pose of this research was to study biodiversity of birds in Wiang Kosai National Park. Since the natural forests are habitats and food sources of birds, therefore, we can use information about biodiversity of birds as a factor to indicate the fertility of natural forests. The more species of bird we can find, the more fertile the forest is. The research had been conducted from July, 2005 to June, 2006. In this study, 51 species of birds are found in Wiang Kosai National Park. There have been both common residents and winter visitors. The number of birds increases in winter. The dominant species is Black-crested Bulbul. It shows that Wiang Kosai National Park is still a beautiful fertile forest and very suitable for nature study. We must not allow anybody to take further advantages or damage it again.

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<Poster presentations>

The New Circumscription and Biogeography of *Mussaenda* (Rubiaceae) Inferred from Chloroplast (*trn*T-F) and Nuclear (ITS) DNA Data

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Although recognition of *Mussaenda* as a separate genus has been widely accepted, its generic circumscriptions have always been controversial. In this first molecular phylogenetic study focused specifically on *Mussaenda* sensu lato (s.l.) and its allied genera, parsimony analyses were based on both ITS and *trn* T-F sequence data to (1) test the monophyly of *Mussaenda* s.l. as presently circumscribed and (2) make inferences on the bio-

geographical origin of *Mussaenda*. Results highly support the polyphyly of *Mussaenda* s.l. as currently delimited. The Malagasy *Mussaenda* are more closely related to *Landiopsis* than they are to the African and Asian *Mussaenda*. As a result, *Mussaenda* is now restricted to include only the African and Asian *Mussaenda* representatives. A new genus *Bremeria* is described to accommodate all Indian Ocean (Madagascar and the Mascarenes) *Mussaenda* species. The newly delimited *Mussaenda* is diagnosed by reduplicate-valvate aestivation and glabrous styles, whereas *Bremeria* can be distinguished from the remaining *Mussaendeae* genera by having both reduplicate- and induplicate-valvate aestivation and densely pubescent styles. This study strongly suggests an African origin of the newly delimited *Mussaenda*.

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The Learning of Plant Diversity, Adaptation and Evolution by Inquiring into the Vascular Bundle

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The aims of learning of vascular bundle system are to understand the structure and function of vascular bundle that consists of phloem and xylem, to classify the angiosperms into two large groups – the monocotyledons and dicotyledons – based on the form and arrangement of vascular bundle, and to appreciate that the acquisition of vascular system is one of the major factors in plant evolution and adaptation to dry land environment. To develop the suitable materials and method for learning, we observed the hand sections of stem and analyzed the morphological

features of vascular bundle in 85 species. We used 70 common wild plants, 10 garden plants, and 5 aquatic plants that can be gotten easily in surroundings of school. The aquatic plants are useful to inquire the plant evolution and adaptation because the vascular system degenerated in water. The results of our study are below:

- 1) Dicotyledonous *Mirabilis jalapa* has an exceptional vascular system which is similar to monocotyledonous type.
- 2) The number and position of vascular bundle were related to that of sclerenchyma in some species, such as *Lamium amplexicaule*, *Clinopodium micranthum*, and *Vicia angustifolia*.
- 3) The proportion of vascular bundle area to stem cross section was high in climbing plants, such as *Pueraria lobata* and *Dioscorea batatas*.
- 4) The aquatic plants, such as *Egeria densa*, *Ceratophyllum demersum*, had degenerate vascular system and developed inter cellular space.

Students should find out plant diversity, structure and function, adaptation, and evolution through comparative observation using stem cross sections of some species mentioned above.

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SimRiver – Simulation Software to Study Relationship between Human Activity and River-water Quality Using Diatoms

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SimRiver is a sort of simulation software and provides an opportunity for students to understand relationship between human activities in river wa-

tershed and water quality using diatoms. Operation of SimRiver is game-like and all students over junior high school age can use it without difficulty. At first, students create environment along a river in monitor by choices of environmental factors, namely land use, population and sewage treatment plant, then decide season. At this point in operation, water quality is estimated in five collecting sites as COD, though the value is not shown to students. After students choose a site for collecting diatoms, microscopic view of permanent slide of diatom is synthesized in the monitor. Students can easily identify each specimen by electronic diatom guide, and mark them for counting. Counting sheet is also automatically prepared with diatom names, which are correspond to the specimen in the permanent slide view. Saprobic index, which shows degree of water pollution, is calculated by student using this counting sheet. The operation procedure of SimRiver will be demonstrated in poster session.

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Unraveling the Genus *Villaria* Rolfe: Endemic Philippine Rubiaceae

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The genus *Villaria* is one of the endemic Philippine Rubiaceae (coffee family) which is imperfectly known to the present day. To this data, there is no published exact account in terms of its species number, comprehensive vegetative and reproductive descriptions, and distribution of the genus. Herbarium materials of *Villaria* in major herbaria are likewise limited. Although *Villaria* is widely accepted as a separate genus, its tribal circumscription has been controversial because of its one-celled ovary. Accordingly, the present

study is a contribution to the understanding of the Philippine's endemic genus. A preliminary investigation of the genus morphological structure is represented by the *Villaria odorata* collected from General Nakar, Quezon. It is typically shrub; leaves opposite, coriaceous; stipules intrapetiolar, persistent; inflorescences axillary, cyme, few-many flowered; bracts basally connate; flowers small; calyx tube infundibular, the lobes 5, dentate; corolla hypocrateriform, the throat with villous indumentums, the lobes 5, white, spreading, contorted; stamens 5, exerted, the filaments extremely short; anthers subsessile, dorsally fixed, linear, acute at apex; ovary unilocular; style slender at base, the apex fusiform; ovule 4-8, embedded in 2, parietal placenta; fruits green, fleshy, with persistent calyx lobes.

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Students' Conceptions of Decomposition and Circulation of Materials in Ecosystems

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This study is to identify students' conceptions about decomposition and circulation of materials in ecosystems. The conceptualized tendencies were analyzed and connected with contents of science textbooks through kindergarteners to 10th graders. Students' ideas of the concepts categorized through the series of written tasks and individual interviews were nature of growth, nature of substance in ecosystem, role of plants as producers, fate of organisms, and cause and process of decomposition and circulation of materials in ecosystems. One hundred and eighty subjects from a preschool, a kindergarten and 3rd, 5th, 8th, and 10th grades were responded to each question.

Qualitative data was collected, transcribed and analyzed to investigate their conceptual differentiation. Many students who are below the 3rd grade did not understand decomposition concept biologically; however, they had experienced sometimes the decay phenomenon at their everyday life. Most of pre-3rd grade students did not understand decomposition conceptions, however, they understood decay phenomenon. Some of the 5th and 8th graders understood the cause and process of decomposition conceptions and 10th grade students began to understand the phenomenon of circulation of materials in ecosystem. Because science textbooks for only the 6th graders contained the contents, the 3rd and 5th graders could not find any chance to meet the concepts through their formal school programs. Therefore, the 8th graders develop the concept of the decomposition process and cause of materials. Students' scientific conceptions of circulation of materials in ecosystems at last were found from the 10th graders after they had learned with the chapters for "metabolism" in high school textbooks.

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Association between Students' Attitude toward Science and Students' Age, Gender and Learning Environment

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Attitude toward science is one of important motivation factors for science learning and it influence satisfaction of science subjects and learning quality. Therefore, it is necessary to investigate where students' attitude toward science is influenced. Students' age, gender and learning environment in

which they influence science work were considered in this study. TOSRA (Test of Science-Related Attitudes) was used for measuring students' attitude toward science, and questionnaire was developed for investigate students' science learning environment. Questionnaire was administered to 666 elementary, middle and high school students and the data collected was analyzed. Among the research factors, positive association was appeared both students' environmental factors and students' science-related attitudes ($P < 0.01$). Specially, positive association was appeared relatively highly at the both factors of parents' concern about science and friends' concern about science. As students' school age was more greatly associated from low grade to high than the students' learning environmental factor and attitude toward science. It was turn out that there was generally no difference between students' gender and attitude toward science by t-test.

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Students' Conceptions of Evolution and Their conceptualizing Traits in Terms of the Subjects: Human, Animals and Plants

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The purpose of this study was to identify students' conceptions and perceptions of evolution in terms of their explanation subjects: human, animals, and plants. Questionnaire was specially developed to make sure students' conceptions and perceptions of evolution and students' explanation patterns with the five evolutionary explanations: creationism, internal will explanation, teleological explanations, use and disuse explanation, and mutation and then

natural selection, and the perceived ideas of evolution in terms of the subject characters of human, animals and plants. It was administered to 1,540 elementary, middle and high school students. The data was collected and analyzed longitudinally by their ages. Results showed that there was difference between the students' evolutionary explanations in terms of human, animals and plants. Students had more "teleological explanations" than "internal will explanation" and "Use and disuse explanation" about plant evolution. "Mutation and then natural selection explanation" was less explained about human. This result showed that the anthropocentric thoughts had influenced students' evolution conceptions. According as student's age was increasing, "teleological explanation" and internal will explanation" were getting less and "use and disuse explanation" was more. Many students recognized that evolution was a kind of scientific hypothesis with small evidence. They have had little interest in evolution and conceptualized it through informal educational sources. This study mentioned that teaching evolution make effectively, first of all, teachers should make "use and disuse explanation" adhered strongly to students' cognitive structure eliminate.

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Biology Teachers' Perception of Inquiry-Based Instruction

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Korean science education researchers were concerned with science inquiry and laboratory activities over the past two decades. With this effort, it has been influenced on improving Korean students' inquiry ability and science teachers' teach-

ing methods in terms of inquiry-based instruction. Because a teacher variable specially has great influence on inquiry instruction, teacher factors need to be verified. In this study, 110 biology teachers teaching at the Korean secondary schools have participated. To figure out how well biology teachers perceive the inquiry-based instruction, a questionnaire was specially designed and administered to them. The questionnaire included the definition of inquiry and its relation with experiment through selected-response. Also teachers' perception on inquiry instruction and students who are invited in inquiry and the inquiry environment had been asked through five levels Likert scale. The major results of the study are as follows. Firstly, the higher teachers evaluate their inquiry instruction, the more frequently they teach using the strategy while the lower teachers evaluate their inquiry, the more they make it conceive difficulty. Secondly, biology teachers perceived what they could not be overlooked would be their own capabilities. Many biology teachers have been misunderstood about characteristics of inquiry learning and experiment learning. The results mean that biology teachers have conceptualized their own notion about inquiry learning and it has great influence on their instructions.

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Phytotoxic Effect of Phenolic Compounds from *Erigeron canadensis* and *Artemisia princeps* var. *orientalis* on the Seed Germination and Seedling Growth

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Phytotoxic effects of the aqueous extracts from *Erigeron canadensis* and *Artemisia princeps* var. *orientalis* were studied. *Digitaria sanguinalis*, *Rumex acetocella* and *Cirsium pendulum* were used as test materials. Quantitative identification of chemical compounds from plant species analyzed benzoic acid, caffeic acid, coumaric acid, ferulic acid, gentistic acid, protocatechuic acid, salicylic acid, sulfosalicylic acid, vanillic acid, and scopoletin by HPLC. Three phenolic compounds (ferulic acid, sulfosalicylic acid and vanillic acid) accelerated the germination of *Rumex acetocella*. The seed of *Cirsium pendulum* was inhibited significantly both germination and seedling growth by the extracts of five plants. In case of leaf extracts, the magnitude of inhibition was as follows: *Artemisia princeps* var. *orientalis* > *Erigeron canadensis*.

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A study of Appropriateness Concerning Photosynthetic Products' Experiments Presented in Science Textbooks

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Science textbooks at elementary and secondary school present biology experiments with methods which were mostly like a cook-book recipe in order to confirm the theoretical results. Students may develop the inquiring ability while practicing experiments presented in the textbooks. However, there are some cases for teachers and students to experience many difficulties in the process of practicing biological experiments because of inappropriate experimental tools or methods presented in science textbooks. Therefore, some problems occur where students may not understand the bio-

logical concepts in relation to the experiments and this may decrease their interests and hopes for biological experiments. This study analyzed the appropriateness of experimental methods to confirm the material (starch) and gas (oxygen) production by photosynthesis. We selected Korean science textbooks which present the experiments of the photosynthesis for this study. There are 19 different science textbooks (one textbook in grade-5, nine textbooks in grade-7, eleven textbooks in grade-10) published according to the 7th National Education Curriculum of Korea, which was instituted by the government in 1997. In addition to textbooks' analyses, we investigated the practical difficulties in the process of those experiments to confirm photosynthetic production, we were able to improve the experimental methods and suggested new methods in photosynthetic products' experiments. We show that it is necessary to present the experimental methods correctly on the basis of the practice of experiments by the biology textbook's authors.

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Examination of the Best Balance of Hormones for Dedifferentiation, Multiplication of Callus Cells of *Daucus carota* and a Method for Inducing Plant Growth from Adventitious Embryos

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Among the authorized textbooks for senior high school Biology I and II published in 1994 or 1998, some textbooks did not give sufficient attention to hormone balance for plant morphogenesis. So, we re-examined the best medium and hormone

balance for dedifferentiation and multiplication of the callus cells of *Daucus carota*, and best method to grow the plants from adventitious embryos.

The best medium for the dedifferentiation of explants of *D. carota* was Murashige and Skoog (MS) solid medium supplemented with 8.75 mg/l Indole-3-acetic acid (IAA), and 0.2 - 0.4 mg/l kinetin, and 0.5 mg/l 2,4-dichlorophenoxyacetic acid (2,4-D). Three weeks after placing callus cells on the MS solid medium, those callus cells were then placed on the White solid medium supplemented with the 10% coconut water and left for three weeks.

Many adventitious embryos grew into small plants. Then, the small plants were placed on the 0.3% Hyponex solid medium. The small plants grew up vigorously. The conditions of the room were 25°C, 5000Lux, 16hr light - 8hr dark, 50% humidity.

The importance of inquiry laboratory experiments was approved by many Japanese upper secondary school biology teachers. The new curriculum for senior high schools was started in 2003. Although several inquiry laboratory experiments are included in new biology textbooks, biology teachers expect many more inquiry laboratory experiments to be developed. Many students of upper secondary schools prefer laboratory experiments. They want to carry out special technical experiments such as plant tissue culture. Thus, new techniques in science education may enhance their interest in learning. The motivation is likewise very important in studying science. If they can derive satisfaction in their inquisitive mind from the successful completion of laboratory experiments, they will come to study science harder.

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The Development of Web-Based Biological Learning Program for Middle School Students – Human Heredity –

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The purpose of this study is to develop effective Web-based instruction data for assisting the learning, which was difficult to achieve by experiments and practices, in secondary school biology. To do this purpose, learning cycle model was applied about the “human heredity” part of a “heredity & evolution” unit in a middle school science textbook. The developed instruction data were reconstructed to HTML web pages and flash data according to a curriculum and the entire formation were as follows:

- Learning contents: Inquiry activity was dealt essentially with in 7th curriculum and presented in exploration phase. Inquiry activity mentioned all the contents of seven textbooks. Flash data were applied to induce the student’s interest. Seven authorized textbooks were analyzed and summarized in concept introduction phase. In concept application phase, the similar data to contents performed in exploration phase were presented for fixing the concepts introduced in exploration phase and concept introduction phase.
- The science in a living: In the science in a living, it was presented to data not only recorded in the textbook but also quoted from newspapers and science journals.
- Reference data: The reference data about polygenic inheritance were shown to avoid a misconception, e.g. “One inherited character was operated by only one gene.”
- Evaluation: For evaluating achievement of lessoned students, several questions related with “human heredity” unit were presented.
- Arrangement of terms: To help students learning, essential terms for comprehending the concepts of “human heredity” unit were recorded. The terms were arranged in the Korean alphabetical

order for ease access of students.

- Related sites: Students may have a question about not only in human heredity unite but also in other units in learning. For this case, easily available sites were categorized and presented according to the universities, organizations, personal home- pages, and textbook publishes.

Web-based instruction data developed in this study were considered to be a great assist for students’ expansion of inquiry ability and improvements of learning achievement of “human heredity” unit at a school and home study scene.

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Research Trends in Science Education

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The trends of researches are reflected in that it is about the strong-and weak points of previous researches but also a guideline for future research. This study explored the trend in the topic of science education research. The articles in 1982 – 2006 of the *Journal of Korean Association for Research in Science Education* and 1973 – 2006 of the *Korean Journal of Biological Education* were analyzed and categorized by the research aims, methods, strands, subjects and contents. The frameworks of research strands were borrowed from that of the 2006 NARST (National Association for Research in Science Teaching) conference. The use of the NARST strands makes it possible to compare the science education research trends in Korea with the international ones. As the results of this study, three domains of research were found to be predominant; the understanding of the conceptual status of students using questionnaires, developing teaching materials and analyzing their

effects through implementation, and exploring the affectional elements such as motivation and attitudes toward science with questionnaires and interviews. In addition, efforts to enhance students' scientific literacy and understanding the Nature of Science have been increased. Implications from analyzing research trends on science education will be discussed.

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Developing of Biology Inquiry Field-Trip Program for Elementary Pre-service Teachers: at Woopo, the Greatest Swamp in Korea

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This study aimed to develop an inquiry program of biology fieldtrip for elementary pre-service teachers and to implement it. Learning inquiry skills are as important as concept learning on elementary biology education. Biology inquiry field work needs some different teaching-learning techniques from those of biology classroom work, because of open space, various inquiry materials, many choice of themes wanted by students, self-inquiry to self-choosing theme, and above all self-learning of knowledge making ability as an essential character of science work as well as basic inquiry skills and higher thinking for science inquiry. Therefore, it will make a significant contribution to administer biology inquiry field trip program as a curriculum for elementary pre-service teachers to improve the quality of elementary biology education. In our research, 120 Korean elementary pre-service teachers participated in the program, they each acted in a team with 3 or 4 members. The program had three parts, which were pre-work at school, fieldwork at the location, and post-work at school. In pre-work, they had learnt science in-

quiry process, investigated the location by the Internet of books, discussed their inquiry with team members, and written temporary inquiry plan. It took 3 days to inquiry at the location. During fieldtrip, they inspected Woopo, explored the possibility of their plan, inquired the plan or new theme which they decided better at the location, performed it, and presented it. In post-work, they submitted a final report which included the conclusion of research and the added examination and information.

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Development and Application of Bioethics Course Program Using Norm Cards

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The important goal of science education is to develop scientific literacy for solving everyday problems. As biotechnology develops rapidly, value judgments about bioethics issues is becoming prominent. In this study, we developed asset of norm cards to make a reference in dealing with bioethics issues, in high school context. The norm cards were drawn from a various category of philosophy, ethics, laws, medical science, etc. Bioethics course program was implemented during 4 class periods: One for understanding relevant science concepts and the others for decision making about three issues including abortion, human embryonic reproduction, and an organ transplant. To investigate the effectiveness of the classes, both of value judgments test and scientific concept test were carried out through the preliminary and post inspection. This study has found that the students which used the norm cards made moral decisions with more various norms and there were associations among students' attitude, achieved scores,

and value judged ability. This study included discussion for the revitalization of bioethics education.

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A Suggestion of Performance Assessment Developing Model to Assess Science Creative Problem Solving for the Science Gifted

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The Science Gifted has been recognized the leading group which will improve the country and serve it as well as their outstanding scientific achievement. Creative Problem Solving has been considered absolutely essential way through which people could solve various problems the most valuable. It would raise the quality of personal life, too. Therefore, it is very important to develop science creative problem solving assessing tools with high validity and reliability. However, creative problem solving is the one which is constructed with several unknown factors so that it is uneasy that we assess it valid. Performance assessment has been known as a useful tool capable of assessing various abilities in teaching-learning situation. This study suggested a performance assessment developing model to assess various abilities in science creative problem solving process. Firstly, the assessment framework was made up. It had a 3 dimensional structure which was composed of scientific components, creative components, and problem solving process components. The tools must have three essential parts such as performance task, students' format, and assessors' scoring system. The performance task had to be in situation which demanded

scientific knowledge. The students' format must be made through a selected problem solving process, and one or more components of creative thinking must be able to assess at each step in the process. There must be the rubrics about creative components at each step in assessors' scoring system. And there must be also the rubrics about the level of scientific knowledge, cognitive thinking, and problem solving components.

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Ideal Education with Synthetic Horizons: Need for the Establishment of the New Subject "Culture" in the Curriculum

Takeshi Tate

The Japan Culture Biology Society

Science and technology have made a remarkable progress in the last half century. It is because of many scientific fields formed through the natural science studies. For instance, the discovery of DNA is the result of a combined effort of biology and chemistry together, and furthermore the physical technology.

In early years, the studies of physics, chemistry, biology and earth science were done within its own category. But lately, it is getting more and more important to put the stress on the studies in the interdisciplinary fields. Moreover, the investigation also from the social and human-and cultural sciences cannot be ignored.

I want to bring out a part of educational problems now in Japan, and advocate the better way to bring up youth who shall carry and support Japan in future. It is desirable and necessary that the young people should be encouraged to learn and study the culture and tradition of their own country. People who study their own culture well, will be able to

esteem the culture of other countries and the people behind. That can be a step to create the better mutual understanding between the nations. With such a horizon for the education, I think, it is necessary to establish "Culture" as the new subject in the curriculum, and put it into practice.

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The Effect of Project Learning about "Organism and Environment" in Biological Class

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The purpose of this study was to find out educational effect of project learning about "organism and Environment" in biological class. For this study, we designed students-centered project learning materials. These materials were made of 3 steps; introduction, small group activity, presentation of their own products. Students had to do a mission for 4 weeks. That was so called "create creature." Two students made a group and each group selected its own ecosystem. The groups created their own creature in various ecosystems. At first week, teacher introduced the relation of organism and environment. At second week, each group aggregated some information about its own ecosystem and animals in textbook, science magazine, the Internet, etc. At third week, each group had made its own creature that well adapted themselves to its own ecosystem. At the last week, each group presented their products. In this study, 154 students in the 10th grade of the Science High School were implemented. The results of this study was as follows: first, most of students showed great interests and enjoyed the class of this style, and they thought it was a good

chance for creative thinking; second, it was easy to understand about the animals in each ecosystem. From these, we concluded that project learning facilitated meaningful learning and scientific attitude.

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The Qualitative Change of Students' Attitude through Student-Centered Guided Discovery Learning in Biology Classroom

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Students can understand everything by themselves in studying biology in the classroom. That means the fact that teachers do not teach the knowledge, but do the principle. From this educational viewpoint, we can find out the qualitative change in the student behavior's aspect through the discovery learning organized and guided, studying by themselves, expressing, discussing things together. This just is the purpose of this study.

As the way and subject of study, we selected and experimented three equivalent groups of girl students of the second year in Kongju Girls High School in small and medium city.

As the result of study, we did compare the scores between when the students did not finish the discovery learning and when they did it: the score in the mid term exam, the score in the final exam.

In class "A," 63% (17 students) of the class increased the score, 4% (1 student) were the same level and 41% (11 students) decreased the score. In class "B," 54% (14 students) increased the score, 15% (4 student) were the same level and 35% (9 students) decreased the score. In class

“C,” 70% (19 students) increased the score and 30% (9 students) decreased the score. The class “C,” grouped by the relationship between the students, showed more increase than the class “A,” grouped by the school record and the class “B,” grouped by the name code.

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An Analysis of the Editorial Design on Science Textbook of High School and the Cognition of Students

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The purpose of this research was to suggest improved plans for a development of the next textbook through analysis of the external format and the editorial design further various opinions against the editorial design between the present textbook and the new generation one.

The method of the study was to analyse the design of seven different kinds of the 7th science textbooks at high school and to investigate satisfaction and requests on the science textbook's design of 319 high school students.

The major findings of this study were as follows:

First, the size of the textbooks used at present was unified to 4.6-size in all step schools. Such a restriction for the external format of textbooks may hinder various editorial designs. Only 34.6% of high school students were satisfied with the science textbook's size. And 66.4% of high school students think that its thickness and quality was not appropriate.

Second, although 68.2% of students think that color of science textbook was clear, some did not answer affirmatively about harmony (21.5%).

Third, only 22.5% of students answered pictures

and drawings of science textbook had a realistic description and only 19.7% answered it because of the students' curiosity.

Fourth, the space of science textbook was too small to ensure proper learning.

Fifth, only 13% of students recognized that textbook induced interest. It was judged that a change of design contribute to improvement of learning effect.

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The Effect of Using Animal Dissection of Science Achievement and Attitude toward Dissection Experiments in “Structure and Function of Visual Organs” for Middle School Students

Hye-Lynn Hwang, Sung-Hee Yeau
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The aim of this study was to find out how the students were influenced by the cow-eye dissection experiment when learning about the structure and function of visual organs in unit “Stimulus and Reaction” of middle second grade. The participants of this study were 138 students from “K” Middle School in the province of Gyeonggi. Two classes were an experiment group and the other two classes were a control group. Science achievement and attitude test were carried out before and after classes and the results revealed the cow-eye dissection experiment was more effective in improving science achievement and the attitude toward dissection experiments.

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Learning Ability and Color Remembering of Great Hornbill in Captivity at Chiang Mai Zoo

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The learning and color-remembering abilities of 6 (3 couples of male and female) Great Hornbills (*Buceros bicornis*), in Chiang Mai Zoo, were studied from June 2005 to May 2006. The study used 2 models: color-remembering model and mechanical food box. The first set of model consisted of 4 plastic bowls, which were yellow, red, green, and blue in color. The bowls were covered with paper sheets having the same colors as the bowls, but only the red bowl contained some food. The second model was the mechanical food box, with a lid, containing food. The result of the model testing showed that the Great Hornbills had a good learning ability, and could recognize colors.

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The Development of Science History - CPS Teaching Model for Improvement of the Gifted-in Science Students' Creative Problem Solving Ability

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A new teaching program is needed to improve the creative problem solving ability of the gifted-in science students, which includes the creative strategies in general and specific field such as science. Therefore, CPS (Creative Problem Solving) model that is the general creative problem solving strategy was integrated with the scientists' creative problem solving strategies based on sci-

ence history to produce science history – CPS teaching program. The scientists' problem solving strategy appeared in the science history include both the scientific content which corresponds to propositional knowledge, and the scientific research process, which is procedural knowledge. According to this teaching model, heredity teaching program was developed and applied with the forty-eight first grade students of the science high school.

The results showed that the students achieved a significant improvement in fluency, flexibility, and originality, which are the sub-elements of the general creativity. Also, they showed meaningful development in understanding of the problem, generating of an idea, planning and practice, the sub-elements of the problem solving ability which corresponds with procedural knowledge of the science specific strategy. The achievement level of heredity concepts was also improved more significantly after class, which corresponds to the proportional knowledge of the specific strategy in the field.

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***Haematococcus*, Unicellular Green Alga, Is Useful for a Student Laboratory Experiment on "The Response of Organisms to Environmental Changes"**

Nobuyasu Katayama, Koichi Abe
Tokyo Gakugei University

Haematococcus is a motile unicellular green alga common in small pools. The cell comes to be an immobile resting cell called akinete when the environmental conditions, such as nutrients, pH and temperature, become worse. During akinete formation, the color of the cell turns red because it

accumulates a large amount of the red carotenoid, astaxanthin. The akinete again comes to be motile and green when it is transferred to the conditions appropriate for its growth. Since such color changes seem to be detected easily by the naked eye, we thought that this alga could be used for a laboratory experiment on the response of organisms to environmental changes.

Green motile *Haematococcus* cells were obtained from a subculture inoculated into liquid "C medium" every two weeks. Red immobile akinetes were prepared by leaving the green cells in liquid C medium for five to six months without changing the medium. The cells were cultured at 20°C under a light intensity of $40 \pm 5 \mu\text{mol/m}^2/\text{s}$ with a 12 hr photoperiod. Carotenoid (Car) and chlorophyll (Chl) were extracted by 90% acetone. Their concentrations were determined photometrically and the Car/Chl ratio was calculated. The ratio can be used as an indicator of cell color, e.g., 0.5 = green, 1.2 = brown, 2.7 = red.

The Car/Chl ratio of green motile cells rose from 0.23 to 1.6 three weeks after the cells were transferred into a nitrogen-deficient liquid C medium. The Car/Chl ratio of red akinetes fell from 2.50 to

0.95 during the same period after they were transferred into liquid C medium. However, the color changes in both cases were hard to detect by the naked eye. On the other hand, when the red immobile cells were cultured on the solid C medium (C medium with agar), the cells quickly changed their color to green and the Car/Chl ratio fell from 2.80 to 0.61 within three days. This color change could be detected easily by the naked eye. In contrast, the change in cell color was considerably slower when the green mobile cells were cultured on the water-agar medium (with no nutrient).

Thus, it is easy to carry out a student laboratory experiment to confirm that *Haematococcus* akinete quickly responds to nutrient supply, but it takes a longer time to confirm that its motile cells respond to nutrient shortage. As *Haematococcus* is obtainable anywhere and cultured easily, the alga can be used more often in biology teaching.

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Abstracts of the Papers Presented at the 22nd Biennial Conference of the AABE

The 22nd Biennial Conference of the AABE was held at the ANA Gate Tower Hotel, Osaka, Japan from 21 to 24 November, 2008. The theme of the Conference was “The Role of Biology Education in Society Today.” There were sessions devoted to the following sub-themes: “Biology Education for Realizing the Preciousness of Life” and “Biology Education in “The UN Decade of Education for Sustainable Development (UNDESD).” There were two plenary lectures, 19 oral presentations and 19 poster presentations. Six country reports from Australia, Japan, Korea, Philippines, Singapore and Thailand were also presented.

<Plenary Lectures>

Biology Education for Realizing the Preciousness of Life

Kunio Umeno

Former Professor of Nakamura Gakuen University

One of the two sub-themes of this biennial conference is “Biology Education for Realizing the Preciousness of Life.” I would like to discuss the meaning of this sub-theme, drawing on the results of our research and some case studies.

1. In general, the objects of science education, including biology education, are the transmission of the scientific cultural heritage and the acquisition of scientific method.
However, biology education has another important object that is different from the objects of the other fields in science education. Biology education allows students to realize the preciousness of life, thus fostering the spirit and attitude related to the preciousness of life.
2. In Japanese educational laws, there are statements about “fostering the spirit and attitude of the pre-

ciusness of life.”

3. According to the results of our nationwide questionnaire survey of secondary school science teachers, most teachers recognize the significance of “biology education for realizing the preciousness of life.” On the other hand, few teachers think education for the preciousness of life is rather an issue for moral education or ethics education.
4. In Japanese elementary schools, cultivation of plants and breeding of small animals are performed as a part of science teaching. Needless to say, such activities are useful for students to understand the structure and the function of organisms. These activities also have an important role in realizing the preciousness of life
5. Dissection of animals, such as fishes, frogs/ toads, mice/ rats is very effective, not only for recognizing on the structure of animals, but also to foster the spirit of the preciousness of life. However, careful guidance before and after dissection is required.
6. Recently, cellular and molecular level experiments have been increasing in biology laboratories in upper secondary schools and colleges. However, from the point of view of “fostering the spirit/ attitude of the preciousness of life,” there should be more frequent use of lab activities with intact organisms at the upper secondary school.
Similarly, teacher training courses in colleges should adopt more activities using organisms as individuals, be it for the culture of plants, the breeding and dissection of animals, nature observations and so on. Otherwise, after graduates from these courses become teachers in elementary and secondary schools, they cannot carry out the educational object of “fostering the spirit / attitude

of the preciousness of life.”

7. “Fostering the spirit/ attitude of the preciousness of life” is a very important educational issue. It is one that is common among all human beings. It is clear that we cannot address this big issue solely through biology education. However, students have no chance to touch organisms directly and realize the preciousness of life except during their biology lessons. Therefore, the role of biology education for “fostering the spirit/ attitude of the preciousness of life” is extremely important.

Keywords: activities using intact organisms, animal dissection, plant and animal breeding, preciousness of life.

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Meeting the Challenges of the Decade of Education for Sustainable Development through Quality Science Education

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This presentation starts with a description of what quality science education is because it is a means by which we can meet the challenges of education for sustainable development (ESD). It shows briefly how the concept of ESD has evolved. It describes the eight ESD content topics and themes: Ecological principles and concepts; Economy, lifestyle, and sustainable consumption; Food and agriculture; Society, peace, and human rights; Governance and citizenship; Human health and the environment; Sustainable urbanization and transportation; and, Indigenous and local knowledge. It also outlines the skills essential to ESD: 1) being able to know where we want to go and work out how to get there (envisioning); 2) learning to question our current belief systems and being able to examine the economic, environmental, social, and cultural structures

in the context of SD (critical thinking and reflection); 3) acknowledging complexities and looking for links and synergies to find solution to problems (systemic thinking); 4) promoting dialogue and learning to work together (building partnerships); and 5) participation in decision making (empowering people).

These ESD themes are covered in the Science-Technology-Society program being implemented in many parts of the world. It is emphasized that these themes and skills are to be applied and developed in the cultural contexts of different groups and stakeholders.

Both ESD and Science Education are based on our current understanding of the ways in which students learn best. This paper presents some pedagogical methods relevant to ESD and Science Education as well as some strategies for long-term impact and sustainability. It also explains some environmental biotechnology breakthroughs which are important for the success of ESD programs. Finally, it describes the Think Green, Act Green Program implemented at UP NISMED focusing on the Green Audit and what other institutions and organizations can learn from these activities.

ESD suggests changing paradigms about the environment and of education. In particular, it calls for changing the way we promote Science Education because it has a strong potential in addressing complex environmental problems/issues related to sustainable development. It also provides a platform for developing critical and analytical skills, systemic thinking, problem solving, evidence-based decision-making as well as the spirit of inquiry, openness, and collaboration needed for our survival.

Keywords: environmental education, ESD, science education, STS program, Think Green - Act Green Project.

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<Oral presentations>

Indigenous Protected Areas in Australia – Opportunities for Environmental Education

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Indigenous Protected Areas (IPAs) are lands provided to and managed by Indigenous groups to promote biodiversity and cultural resource conservation in Australia. In November 1999 Victoria's first IPA was declared. Deen Maar occupies 453 ha in the State's south-west and was previously seriously degraded pastoral land that had been over-grazed and had many weeds and pests. However, Deen Maar also has extensive wetlands and saltmarshes that are of international conservation significance. The land also has deep cultural significance for local Indigenous peoples.

Deen Maar is undergoing extensive re-vegetation. A biodiversity audit of the property has been conducted; this showed the property's importance for conservation of many threatened species. Bird hides have been built and accommodation for visitors established. IPAs must generate income; accordingly 12 wind turbines have been erected by Pacific Hydro. As well, cattle are grazed on improved pasture that has been fenced.

The Indigenous owners of the land are keen for Deen Maar to be an educational resource and will be encouraging student visits and research projects. It thus represents a resource for environmental education within a culturally significant context. The United Nations Decade of Education for Sustainable Development aims to "encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations". Deen Maar' goals are certainly in line with these sentiments.

Keywords: Australia, biodiversity conservation,

culturally significant lands, environmental education, Indigenous Protected Area.

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Understanding Evolution Is Essential in Education of Life

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"Nothing in Biology Makes Sense Except in the Light of Evolution" was written by Theodosius Dobzhansky (American Biology Teacher **35**: 125-129, 1973). This famous phrase is more delight and meaningful at today, in the 21st century, even if the methods of teaching biological facts are improved and the devices are developed, for example the digital tools. Nowadays, it is possible to say that the boundaries between nations do not present as the Internet and the many traffic systems are developed. The Evolutionary view has important value for understanding diversity of organisms and/or human being. In the present study, such evolutionary view was introduced to students' thinking about humanity and their Life in the classes of biology from elementary school to senior high school, and its effectiveness was verified by case studies. We also made a program in which the Evolution can be learnt systematically. In this program, students are able to understand the modern Evolutionary thought that thinking about the historical causes of Evolution is Science. Understanding historical causes of Evolution relates to students understanding about themselves and their origin. Because of this matter, students are able to have a framework of thought that is meaning about the existence of their own selves, other organisms including human being, and the earth. In practice, this learning program was done at a senior high school. The results indicate that the students understood the Evolution itself and also they could

hold the precious value of the Life. The education about the Evolution is effective and essential for the students to understand the meaning of Life.

Keywords: biodiversity, evolution, historical causes, learning program, precious value of life, science, self-understanding.

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Study on Educational Significance of “Dissection of Fish” —Biology Education for Realizing the Preciousness of Life—

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“The dissection may be against the preciousness of life,” they often say. In this study, we carried out “dissection of fish” in school science in order to analyze whether “dissection of fish” is really against preciousness of life, and whether it gives some bad influence to children. We had two classes of “dissection of Crucian carp (*Carassius cuvieri*)” for sixth graders in an elementary school in Tokyo.

A questionnaire to children after the class of “dissection of fish” leads to the following facts: First, 74 children out of 76 answered that “it was good experience to do dissection of fish.” Secondly, a lot of things cleared out from the answers such as children’s idea on “view of life,” “experiential learning,” “scientific concept,” “biodiversity,” and impressed by “delicacy of structure of body.”

However, three out of six textbooks for the sixth graders published in 2005 do not describe “dissection of fish.” Although many problems are left unsolved in enforcement of “dissection of fish” in elementary school science, it seems that “dissection of fish” will be important for “experiential learning” in order for children to have “notion about structure

and function of human bodies and other animals,” and notice “delicacy of structure of body” that will lead to realization of “the preciousness of life.”

Keywords: biology education, dissection of fish, experiential learning, preciousness of life, teaching material.

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Environmental Advocacy and the Internet: How Do Philippine Science High School Students Build Connectivity?

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Philippine Science High School-Main Campus

Internet advocacy in the early 2000’s hardly went beyond emails and websites. These limitations were largely due to the obvious unavailability then of social networking sites (*e.g.* Friendster.com, Facebook.com, *etc.*), video sharing sites (*e.g.* YouTube.com), and personal publishing systems (*e.g.* Wordpress.com, Freewebs.com, *etc.*). Over the recent years, the flourishing Internet community has made it easier for individuals or groups to maintain non-stop, informative, and highly graphical means of communication.

At the Philippine Science High School-Main Campus, we put to good use the popular online video streaming site YouTube.com to promote environmentalism among high school students. The 2008 Youth, Math, Science, and Technology (YMSAT) Integrated Project committee decided that students produce a music video promoting environmental awareness using original songs or songs adapted from local or international artists. Another objective of the project was to demonstrate scientific concepts in the music video and to integrate topics from the humanities into the storyline. The target audience was the Philippine Science High School

community and ultimately the world, since the videos were posted on YouTube.com. We also present here HumanIT, an YMSAT integrated project proposal of one of our co-authors, Mr. Martin Benedict S. Perez of the Social Science Unit. HumanIT is an advocacy project utilizing Internet tools. Through this project, our students will be able to focus and make a stand on certain issues, develop a message for the masses, and design an information campaign on the web and on the ground.

Keywords: environmental advocacy, environmentalism, internet, Philippine Science High School.

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Science Reading Material Development on Famous Scientists – Robert Hooke vs Chang Yongsil

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Teaching from science texts can promote important general literacy skills. In addition to providing an excellent opportunity for acquiring information about the world, reading science texts provides students the chance to learn specific academic language. Robert Hooke is famous for his microscope and his first book *Micrographia*. But his life with brilliant scientific works and depute with Isaac Newton are rarely known to students. Nowadays in United Kingdom many books were published about his works and life. His achievement in science and architecture in London could be contrasted with famous Korean scientist Yongsil Chang in Yi Dynasty. Many Korean elementary students read science reading material on Yongsil Chang. In the present study, reading material on Robert Hooke

and Yongsil Chang was developed with the contrast of the two famous scientists.

Keywords: Literacy, Robert Hooke, science reading, Yongsil Chang.

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Biology Education Attaching Great Importance to Life: The Method of How to Feel Man's Internal Organs Lie in Reality

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At present time, the research based on the biology shows epoch-making progress. Also people pay more attention to the life environment in general. But generally accepted idea of school curriculum puts stress for the necessary subjects for the entrance exams for the upper schools, therefore it is difficult to bring up the general view of natural science. *"To learn and know the importance of living creatures in the global environment"* has been my principle of teaching. I believe it is important "to know his or her own physical body" in their primary days. Therefore I have tried the special "Scientific Class for Junior Pupils" for about 30 years in summer vacation until now. Last summer I taught them to make a stethoscope with materials at hand, and helped them to find the heart and listen to the beat. A child went home, and tried to listen to the heart-beat of the mother and shouted, "I listened to this sound all the time while I was in your tummy!" The mother reported this so happily to me. For this summer program I had the theme, *"Why should the chief article of food be carbohydrate? How is the route in the body?"* I wanted to advocate the way that everybody can understand how to feel in reality the location of the internal organs.

Keywords: carbohydrate, chief article of food, cur-

riculum, global environment, heart, heart-beat, life, living creatures, location of internal organs, science class, stethoscope.

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A Design of ESD Program That Aims the Maintenance of the Global Diversity of Species – Not Re-creatable and Extremely Elaborate Beings

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The Earth is the sole celestial body in the universe that bears life. It supports tens of million of species that have been diversified as the result of four billions of years of evolution. Natural and semi-annual ecosystems on the Earth are increasingly deteriorated and fractionalized by land exploitation by human being, resulting in the acceleration of species extinction. The most popular definition of "sustainable development" is the development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." The sustainable development so defined has so strong bias toward anthropocentrism that the maintenance of the global diversity of species, most of which are of no value as resource for humans, will not be guaranteed. So, I developed an ESD program that facilitates decision-making and actions toward the maintenance of biodiversity. In this program, I first give the students impression of the extreme elaborateness of biological species by showing some examples, and then lead them to understand that those species have evolved in integral and diversified ecosystems in the course of long earth's history and that they can never be made up again by humankind once they have been lost from the world. Next, I make the students grasp the present situations of land exploitation in several parts of the world by showing satellite images as

well as the pictures/documents of habitat destruction on the earth surface. And then, I make them to become aware that there need brakes on the world development which, though, is necessary for human existence to certain limit. Finally I encourage them to think what actions are effective to maintain the diversity of species.

Keywords: biodiversity, ESD program, sustainable development.

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Embedding Academic Skills Development in Course Delivery

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Recent policy development at national and institutional levels confirms that there is significant interest in innovative approaches to teaching and learning within higher education. This applies not only to the theories and practices of the discipline studied but also to the generic skills required by graduates for their future professional pursuits. Quite often the emphasis for learning is place on the skills and knowledge of the discipline while the generic skills rather than being taught are expected to be acquired at some time during the course of study. This has much to do with the fact the teacher is trained in the discipline and not in the area of academic skills development. What innovative approaches can be adopted to meet the challenge of ensuring that graduates at the end of their course of study are not only strong in their discipline but also have the required generic skills to give them a good standing within their selected professions? This paper reports on a study that has examined how well academic skills are embedded into the undergraduate Environmental Science curriculum at Deakin University in Australia. It reports on students' self

evaluation of their essay writing skills and looks at a case study that involves a discipline specialist working with an academic skills advisor to enhance student generic skills. It analyses the use of student self-assessment to enhance student engagement in the learning of generic skills.

Keywords: environmental education, generic skills, graduate attributes, student self evaluation.

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Construction of International Network on River Environmental Education with Special Reference to Diatoms

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Water is one of the most important resources, utilized for every human life, agriculture and industry in every country. However, various problems of water have never disappeared and rather grow into serious affairs in proper areas of the world. Water pollution is one of such problems to be solved. Domestic sewage is a heavy load for river in areas with high population density, especially eastern Asia, whereas outflow of fertilizer induces eutrophication of river water in agricultural areas of continents. For sustainable development better understanding of relationships between human activities and water quality is important and biology education takes an essential role to achieve this aim. We produced educational program featuring diatoms accompanied by multi lingual video movies and simulation software "SimRiver", and are developing a web site

(<http://www.u-gakugei.ac.jp/~diatom>) for sharing these tools and information. By using the same educational tools and comparing learning outcomes it will be expected that students deepen their understanding and cooperation among countries under different circumstances.

Keywords: diatom, simulation software, video movie.

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Environmental Education for Kindergarten: A Hands-on Approach Using Worms

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The Curriculum Standards for Kindergartens stipulates that "the area of "Environment" concerns childrens' surroundings, and the relationship with them," is connected to Environmental Education. The purpose of this study was to examine how children sorted garbage into things worms can eat or cannot eat from records that children discussed. The target group were 17 five year-old children and 17 four year-old children. Newspaper material, pencil waste, a can lid, and a plastic spoon were put into a box containing worms, and children reflected on how worms ate the items. One month later, the newspaper material and pencil waste had disappeared but the can lid and plastic spoon remained. Elder children considered why the worms could eat them and provided reasons, e.g., "because they are hard", "because worms have no teeth", "because their mouths are too small". Their use of logical analysis evolved independent of adults. As well, they talked about how the garbage the worms had eaten had changed, e.g., "something came out" "stool and urine" "it has turned into soil" and so on. These utterances seem to show the

childrens' ability to distinguish the things that worms can eat or cannot eat, and that the garbage worms can eat had been excreted.

Keywords: environmental education, excretion, keeping worms, kindergarten.

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Development of Biology Audiovisual (CD) Teaching Material for Developing Experimental Basic Skills of Science Teacher on Developing Country

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It is important to improve the status in developing countries, such as science teachers cannot instruct the practical work in school science because they almost have not had any laboratory experience, and there is absolutely lack of experimental instruments in schools. Purpose of this study is to develop, try and assess the audiovisual (CD) biology teaching materials based on a survey of the status of school science and science teachers in developing countries. We surveyed the status in Cambodia, Philippines and Indonesia, and then tried to use and assess these materials at in-service science teacher training in the former two countries. Then, we made three versions in English, Khmer and Bahasa Indonesia, in addition to selecting experimental materials available in each country. We developed two kinds of "Biology" audiovisual materials: one was on basic scientific skills, such as how to use alcohol, how to make and observe cross sections of a leaf, etc., the other was on teaching biology concepts, such as photosynthesis, marine life, etc. The basic idea of these teaching materials were to develop adequate basic scientific skills based by comparing the correct skill with wrong skill, and to develop inquiry

skills based on inquiry learning. The in-service training using these CD teaching materials was highly evaluated by the attending science teachers. This research was supported by the MEXT Japan (2003-2006).

Keywords: basic experimental skills, biology audiovisual (CD) teaching material, Cambodia, developing country, Indonesia, inquiring learning, Philippines.

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Standards for the Development of Certification Examinations for Secondary School Biology Teachers in Korea

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In this paper, standards in the context of the current reforms in science teacher certification process are developed from the perspective of secondary school biology teachers' knowledge for their professionalism. For development of standards, first, literatures related to general teachers', science teachers', and biology teachers' professional knowledge were reviewed and analyzed. Second, various existing cases of the standards for biology teacher education programs were examined. Third, the tentative standards for the development of certification examination for secondary school biology teachers in Korea were proposed based on literature review and examination of the standards. Fourth, the tentative standards were repeatedly criticized and revised by experts and resource personnel. Finally, the final version of standards was completed after two public hearings. The final version of standards includes ten standards in categories of teachers' belief, subject matter content, pedagogical, and contextual knowledge.

Keywords: professional knowledge, standards for

biology teacher, teacher certification.

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Examining Practices in an Inquiry-based, Work-oriented Science and Technology Classroom: Implications on Biology Education

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This paper presents a case study of Filipino secondary students' and teachers' practices and experiences in an inquiry-based, work-oriented course that aims to enhance learners' interest and participation in science and technology-based careers. Educators argue that contextual pedagogy through inquiry and work-oriented learning helps develop communication, collaboration, critical thinking and problem-solving skills deemed important for students to become lifelong learners. My research study looked into substantiating these claims for non-Western classrooms where traditional sociocultural norms are more prevalent and the teacher's authoritarian role impinges on student-centred learning practices. The context for my study is a science-technology course where high school students work in teams as they address a local problem in the community or workplace. Through an inquiry approach, students outline a proposal, design a scientific experiment or technological gadget, and implement their design to answer the problem. Findings from the study have important implications on the design of a biology curriculum that addresses learners' diversity, and equips students with critical thinking and lifelong learning skills necessary to prepare them for their future roles in the 21st century.

Keywords: contextual learning, inquiry in biology education, secondary biology curriculum.

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Multimedia Presentations on the Human Genome "Implementation and Assessment of a Teaching Program for the Introduction to Genome Science Using a Poster and Animations"

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Genome science is now an established part of our daily lives; thus we need to learn genome science to better equip ourselves for the present day. Learning from topics directly related to the human has been suggested to be more effective than learning from Mendel's peas. Therefore, we have developed a teaching program for the introduction to genome science whose subjects are focused on the human genome. This program consists of mixed multimedia presentations: a large poster on the human genome (a human genome map for every home), and animations on the basics of genome science. We implemented this program at four high schools. We found that students felt that they learned about the human genome from the program and some increases in students' understanding were observed with longer exposure to the mixed multimedia presentations. English versions of the poster* and the animations** are now available on the Web. We hope they will be used by teachers around the world.

* <http://stw.mext.go.jp/20080714/>

** http://www.lif.kyoto-u.ac.jp/labs/biosoc/7animations/animation_list.html

Keywords: animation, genome science, high school, human genome, illustration, multimedia presentation, poster, teaching program.

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Examination Method of Teaching Materials Development of “Ferns”

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The current Japanese national curriculum for elementary school and junior high school does not include the content on *ferns*. However, there is a necessity for such content for the junior high school to have better understanding of concept of plants. Hence, the revised curriculum which will be enforced by 2010 has again incorporated the topic on *ferns*. Before the exclusion of *ferns* in the current curriculum, new teaching materials were relentlessly developed through different ways such as textbook analysis. Exercises involving *ferns* and examples used in the different grade level textbooks were analyzed. With the re-inclusion of the content, this method is recommended to be re-employed. Therefore, this study analyzed the basis of using a fern species as an example used in the textbook in order to obtain insights in the development of new teaching materials. It was found out that species of *ferns* that are commonly discussed in textbooks are of those which are famous and widely available. Among these are *Equisetum arvense*, *Pteridium aquilinum*, and *Osmunda japonica*. Moreover, these *ferns* are easily identified, collected and cultured. They exhibit typical characteristics of prothallium. Another fern species, *Asplenium antiquum*, was discussed due to its substantial function as food even if such species grows in few areas only. Based on these insights, locally-growing *Adiantum monochlamys* and *Lygodium japonicum* are recommended to be used as the fern species involved in the teaching materials to be developed. Furthermore, originality of the ma-

terials that will be developed is assured for the reason that these fern species are rarely discussed in textbooks of elementary and junior high school not only in Japan but other countries as well.

Keywords: biology education, fern, teaching material.

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Using *Fissidens* Hedw. (Bryales, Bryophyta) in Thailand as a Model for an Electronic Learning Key

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The moss genus *Fissidens* Hedw. is the only genus in the family Fissidentaceae (Bryophyta). *Fissidens* is one of the most diversified moss genera and includes 900 species in temperate and tropical areas throughout the world. The genus has an unique characteristic leaf arrangement of two rows in one plane (distichous), which makes it easy to identify at the generic level in the field. Identification at species level can only be done in the laboratory under a microscope. The second author is revising *Fissidens* in Thailand, which has 39 species (3 new) and 4 varieties.

Since detailed information on Thai *Fissidens* is known, it was chosen as a model on how to construct an electronic learning key. This key was constructed by using the programme “Macromedia Dreamweaver 8”. It is a suitable programme for beginners using computers, since it only requires a background in Word and PowerPoint. The key contains photographs, line drawings, diagnostic descriptions, and a glossary. It allows the users step by step to identify species of *Fissidens* along with supporting information. This electronic learning

key is appropriate for using in bryophyte laboratory classes and for those who are interested in bryophyte taxonomy. It will help students to understand the classification, identification, and technical terms of *Fissidens*. This will make the topic more interesting and effective. The methodology used for this work can also be applied to other plant groups.

Keywords: electronic key construction, electronic learning key, *Fissidens*, teaching model.

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Use of a Blind to Observe the Breeding Biology of the Asian Paradise Flycatcher (*Terpsiphone paradisi*)

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In the study of animal behaviour, it is critical to observe animals with as little disturbance as possible, in order to get valid information. A blind is essential equipment to observe bird behaviour that is unaffected by the observer, especially in breeding season. From 2005 to 2008, 38 pairs of Asian Paradise Flycatchers (*Terpsiphone paradisi*) were observed in the breeding season (March to July) at Chiang Dao Wildlife Research Station, Chiang Mai Province. Fifteen nests were studied from observation blinds on the ground, 10 m away from nest trees, using a 15x – 45x telescope and video camera to record parental behaviour for 12 hours per day. Observation blinds were made from bamboo and the foliage of a herb, *Etlintera* sp., which grew in abundance on the study area. Blinds were built when nest-building was almost finished in order to minimize disturbing the bird's activities, and they were placed parallel to bird's regular flight approach pathway to the nest. Both parents did not show any uneasiness when the observer was inside a blind.

None of the observed parent birds abandoned their nests, allowing for complete observations of the breeding cycle. A successful breeding cycle lasted 26 – 34 days and included 2 – 4 days of egg-laying, 14 – 18 days of incubation, and 10 – 12 days of parental care of nestlings in the nest. Natural blinds are, therefore, effective in allowing observations of this bird species and may also be useful for studying other bird species.

Keywords: blind, breeding biology, observation, parental care, *Terpsiphone paradisi*.

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Teaching Materials on “How Can Water Striders Float on Water Surface?” and Their Using in the Science Classes of Elementary and Junior High School

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Teaching materials were newly produced on “How can water striders float and stride on water surface?” and used in science classes of an elementary school and a junior high school. Three major answers are possible to the question. (1) Water striders are very light and have long part of middle and hind legs to attach to water surface; (2) They have numerous fine hairs on their legs; (3) They extract oil from tarsus of their legs and put it onto numerous hairs of leg surface. All factors reduce body pressure per unit of the leg attachment to water surface. Putting washing agent onto water on which water striders are striding make them sink into the water. The science class using the new teaching materials which include these contents was significantly effective ($P < 0.001$) for the increased ratio of both

elementary (to 33.3%) and junior high (to 40.5%) school students to understand that oils onto the fine hairs on legs are critical to keep surface tension of water around legs.

Keywords: elementary and junior high school students, floating on water surface, science education, surface tension, teaching materials, water striders.

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An Analysis of Skills for Use of Scientific Ability in the University Entrance Qualification Examination Biology Test

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It was examined what types of skills for use of scientific ability were contained in the University Entrance Qualification Examination Biology Test, which assured successful applicants over the same as scholastic level as senior high school graduate. In this study, 10 tests (2001-2004) were used. At first, units of questions which are associated with scientific inquiry were selected. Next, the character of questions to composed unit was specified by the method of coding. The questions which were characterized as scientific knowledge were excluded and the characters of remainders were analyzed. As the result, from the point of view of science process skill (SPS), some questions were related with a SPS and the others were two SPSs or more. Furthermore, some questions were associated with knowledge to perform experiences or observations. In addition, there were some differences, as compared among fields. For example, in the field of cell, several SPSs were required. In contrast, in the field of genetics, the SPS of using number was main.

Keywords: science process skills, scientific ability, senior high school biology, the contents of questions in the University of Entrance Qualification Exami-

nation.

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An Example of Support to the Integrated Study of a Junior High School of Japan in the Local Community

Mitsuo Saitoh

The Society of Practical Education in Biology

I have been supporting the integrated study of the 1st grade students in Kawaguchi Junior High School for several years. At first I had my lecture on the culture and history of Home Village Kawaguchi and the nature such as low mountains, woods, rice fields, and rivers in rural district Kawaguchi. Furthermore, I taught wild birds, wild animals and wild flowers in the nature of Kawaguchi Village. The titles of my lecture for recent 3 years are as follows: Let's Walk the Promenades in the Map of Fantastic Village, "Kawaguchi" (2008), Let's Explore the Unexplored Areas in Kawaguchi Village (2007), Let's Make Your Nature Trails in Kawaguchi Village (2006).

And then, students have to research their themes on various subjects of their community and report their results by the end of 2nd term.

Keywords: Home Village Kawaguchi, integrated study, junior high school.

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<Poster presentations>

Study on Actinomycetes Soluble Pigments for Suitable Application

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Actinomycetes are gram positive bacteria belonging to the class Actinobacteria which is notably a rich source of biologically active metabolites. Apart

from antibiotics for pharmaceutical and agricultural uses, low molecular weight enzyme inhibitors, immunomodifier and enzymes for use in industrial applications, actinomycetes can produce various kinds of pigments and soluble pigments. In our study, 284 actinomycetes were isolated from coastal areas in Rayong and Chonburi Provinces, Thailand. Most of 284 actinomycete isolates could produce spore mass in various colors: white, grey, brown, red, pink, yellow, light yellow, yellow brown, grayish green, and some produced soluble pigments in yellow, violet, red, brown, green, light brown, grayish green. Nine samples of crude pigment extracts were taken to test for toxicity by using Brine Shrimp Bioassay, the results revealed that one crude sample was toxic to the brine shrimp. For suitable application, all the pigments could be used for different purposes, more toxic pigments can be used for fine fabric dyes and non toxic pigments could be investigated further if can used for food dye.

Keywords: actinomycetes, pigments.

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Effects of Handling Processes on the Quality and Biochemical Changes in Tissue of Mud Crab, *Scylla serrata*, (Forsk., 1755) during Emersion Storage

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The handling processes were investigated in the mud crab, *Scylla serrata*, using pre-cooling and chelae tying methods during emersion storage. Muscle glycogen, muscle lactate, muscle yield, muscle pH, volatile basic nitrogen (VBN), and proximate compositions were analyzed. More than 90% of the glycogen in muscle of non pre-cooling without chelae tying and non

pre-cooling with chelae tying disappeared within 3 days of emersion storage while the concentration of glycogen of non pre-cooling with chelae tying and pre-cooling with chelae tying disappeared only about 70% within the same period of time. The content of lactate increased from the initial level (1.20 mmol.kg⁻¹) to 14.81±0.28 mmol.kg⁻¹ in non pre-cooling without chelae tying while it increased to 11.34±0.58 mmol.kg⁻¹, 11.12 ±0.27 mmol.kg⁻¹ and 10.08±0.62 mmol.kg⁻¹ in treatment of non pre-cooling with chelae tying, pre-cooling without chelae tying and pre-cooling with chelae tying respectively. The muscle pH of all treatments decreased slightly from 6.90 to 6.85, 6.95, 6.90, and 6.94 in non pre-cooling without chelae tying, non pre-cooling with chelae tying, pre-cooling without chelae tying and pre-cooling with chelae tying, respectively. Percentages loss of muscle yield increased to 30.10±1.20 %, 20.95±3.90 %, 22.32±4.26 % and 17.29±4.93 % in non pre-cooling without chelae tying, non pre-cooling with chelae tying, pre-cooling without chelae tying and pre-cooling with chelae tying, respectively. The VBN levels of the non pre-cooling without tying was 60.12±3.36 mgN/100g which is significantly different from the levels of the pre-cooling with chelae tying treatment (48.00±4.38 mgN/100g). There were no significant changes in mean of moisture, protein, fat, and ash content in all treatments. The results indicated that the handling process by pre-cooling with chelae tying could reduce metabolic activity and metabolic stress, which could delay loss of quality and physiological changes of mud crab during emersion storage.

Keywords: biochemical, emersion storage, freshness, glycogen, handling process, lactate, mud crab, *Scylla serrata*.

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The Study of Biosurfactant as a Cleaning Agent for Insecticide Residue in Leafy Vegetable

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Pesticides are used as the main tool for agricultural pest control. Many pesticides are, however, toxic substances and persistent in character. Concern over the pesticide residues in fruits and vegetables have led to the development of many clean up and analysis methods.

Biosurfactant was used in this study to explore the possible potential for cleaning up cypermethrin residue. Lettuce was chosen as a representative for leafy vegetables. Amounts of biosurfactant and the contact times needed to reduce cypermethrin residue in lettuce to below maximum residue limit of 2 ppm to make it safe for consumers were determined. Salt, vinegar and potassium permanganate are also tested for comparing the cypermethrin neutralizing effect on lettuce with biosurfactant. A simple method to determine cypermethrin residue is developed based on Ninhydrin test which is the reaction of Ninhydrin reagent with free Nitrogen to form a color product which can be detected by spectrophotometer.

With the initial pesticide concentration of 100 ppm the amount of biosurfactant that need to be used is 10 ppm of biosurfactant for 25 minutes, 15 ppm of biosurfactant for 15 minutes and 20 ppm of biosurfactant for 5 minutes. With the initial pesticide concentration of 10 ppm the amount of biosurfactant that need to be used is 2 ppm for 4 minutes, 3 ppm for 3 minutes, 4 ppm for 2 minutes and 5 ppm for 1 minute. From this study we concluded that biosurfactant can be used as an effective agent to clean up insecticide on leafy vegetable.

Keywords: biosurfactant, cypermethrin, leafy vegetables, persistent pesticides, pesticide clean up.

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Diversity of Birds and Food Plants of Birds at Wiang-Kosai National Park, Thailand

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Wiang-Kosai National Park was designated as the 35th national park of Thailand on October 9, 1981. It covers an area of 410 km² in Phrae Province and Lampang Province. The landscape of the national park is high steep mountains covered with mixed deciduous forest and dry evergreen forest. The highest peak reaches a height of 1,267 m. (mean sea level; m.s.l.). The forests are important water sources of Yom River. In the past, the forests were the living place of various kinds of wild animals i.e. tiger, elephant and deer. However, poaching and illegal cultivation, past to present, has regrettably destroyed the rich natural forest much. The purpose of this research was to study diversity of birds in Wiang-Kosai National Park. Since the natural forests are habitats and food sources of birds, we can use information about diversity of birds as a factor to indicate the fertility of natural forests. The more species of bird we can find, the more fertile the forest is. The research has been conducted from November, 2007 to May, 2008. A line transect method was used at 3 sampling sites: (1) farmland area surrounding the national park (800 m. m.s.l.) (2) mixed deciduous forest (900 m. m.s.l.) (3) dry evergreen forest (1,000 m. m.s.l.). There were 75 species from 23 families, which included 62 residents, 12 winter visitors and 1 passage migrant. The dominant species is black-crested bulbul. Thirty-four species of food plants from 27 families were recorded. Most of birds like to eat fruit of food plants, but sunbirds like to eat nectar. Some birds eat stamens. It shows that Wiang-Kosai National Park is still a beautiful fertile forest and very suitable for nature study.

Keywords: diversity of birds, food plants of birds, natural forest, national park, line transect.

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Cercarial Infections of Freshwater Snails Genus *Bithynia* Leach, 1818 in the Northeast of Thailand

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Cercarial infections of freshwater snails Genus *Bithynia* in the Northeast of Thailand, were studied between December 2005 and January 2007 at twelve water source locations of the water sources in ten provinces. The snails were collected every two months for one year. Counts per unit of time method was used in this study, and the samples of snails were collected every 10 minutes by five collectors. Infected snails were found in eight sampling sites of six provinces. These are Huai Lam Por Daeng, Huai Kliang, Nong Han Swamp, Nong Bua Rai Swamp, Thung Sang Swamp, Huai Ta Kua, Nam Pung Dam and Huai Ho. Three species of *Bithynia* were found; they were *Bithynia siamensis goniomphalos*, *Bithynia siamensis siamensis* and *Bithynia funniculata*. The cercarial infections were investigated using shedding and crushing methods. The infection rate was 0.032 % (53:1635). The cercariae from the collected snails were categorized into eight species: *Acanthatrium hitaense*, *Stictodora tridactyl*, *Gastrothylax crumifer*, *Cardicola alseae*, *Centrocestus formosanus*, *Loxogenoides bicolor*, *Haematoloechus similis* and *Cercaria senoi*.

Keywords: Cercariae, Freshwater snails, Genus *Bithynia*, Infection, Trematode.

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Trematode Infections Obtained from Freshwater Snail *Melanoides tuberculata* in the North Thailand

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Trematode infections of freshwater snail *Melanoides tuberculata* were studied by using cercaria emergence. The snails were investigated from fifteen locations in the North Thailand between December 2004 and July 2006; they were collected every two months for one year. Counts per unit of time method was used in this study, and the samples of snails were collected every 10 minutes by five collectors. The cercarial infections were examined using shedding and crushing methods. Cercarial infections were found of the snails collected from thirteen sites; these were Sakunotayan waterfall, Kaeng-sopha waterfall, Pha-lath waterfall, Si Satchanalai National Park stream, Maepool waterfall, Cherg Thong waterfall, Huay Ton Peung waterfall, Tarnsawan waterfall and Mae Mai waterway. Eight species of cercariae were categorized; they were *Haplorchis pumilio*, *Haplorchis taichui*, *Centrocestus formosanus*, *Acanthatrium hitaense*, *Loxogenoides bicolor*, *Haematoloechus similis*, *Cloacitrema philippinum* and *Transversotrema laruei*. The infection rates were 1.76% (23/1,309), 0.08% (1/1,309), 4.20% (55/1,309), 0.69% (9/1,309), 2.22% (29/1,309), 4.05% (53/1,309), 0.08% (1/1,309) and 0.61% (8/1,309), respectively.

Keywords: Trematode, Cercariae, Infection, Freshwater snail, *Melanoides tuberculata*.

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Sensitivity to Chemical Attractant of Diacetyl after Pre-exposure to Diacetyl Is Inversely Related to Life-span of the Nematode *Caenorhabditis elegans*

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The duration of attenuated chemotactic response to continuous presentation of odorant diacetyl was measured in the nematode *Caenorhabditis elegans*. The level of chemotactic response of the nematodes which were pre-exposed to diacetyl for 90 min was significantly smaller than that of the non-exposed control nematodes. The wild-type nematodes were maintained at three temperatures (15°C, 20°C and 25°C) after pre-exposure to diacetyl. At 20°C, the decrease in response to diacetyl continued 6 h after pre-exposure to the chemical, but not up to 12 h. Interestingly, the decrease in response of diacetyl did not continue up to 2 h in the nematodes bred at 15°C, although that continued beyond 12 h in the nematodes bred at 25°C. These results indicate that the duration of decrease in response to diacetyl is dependent on the environmental breeding temperature of nematodes, and suggest that a higher aging speed prolongs the duration of attenuated chemotactic response to diacetyl after pre-exposure to the chemical. In the long-lived *daf-2*, *age-1*, *isp-1* and *clk-1* mutants, the effect of diacetyl did not continue up to 2 h. On the other hand, the short-lived *daf-16*, *daf-18*, *mev-1* and *gas-1* mutants showed a longer duration of decrease in response to diacetyl, that is, the duration of attenuated chemotactic response to diacetyl continued beyond 12 h after pre-exposure to diacetyl. These results suggest that the sensitivity to diacetyl after pre-exposure to diacetyl was inversely related to life-span of nematode. It is known that the insulin transmission and activity of oxygen intermediates affect aging speed. So, there is a possibility that insulin and/or oxygen intermediates are associated with the extension of the duration of decrease in

response to diacetyl after pre-exposure to diacetyl.

Keywords: aging speed, *Caenorhabditis elegans*, chemotaxis, diacetyl, memory, nematode, life-span.

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A Proposal of Recycling Club Model for Environmental Education in Malaysia

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Environmental Education (EE) was formally introduced to Malaysian school in 1986. The concept and components of EE were integrated across curriculum, particularly in subjects such as Science, Geography, Local Studies and so on. The Ministry of Education developed EE curriculum guideline in 1998. Samples for activities of EE were provided with some support materials. But the implementation of EE was not so successful in Malaysian school. The environmental awareness is still in its preliminary level among students, teachers and public. Accordingly there is a demand for new approach of EE fitting to school situation.

The purpose of this study is to develop a recycling club model as co-curricular activities for secondary school students. This model includes a set of instructions for EE that emphasizes cooperative learning, critical thinking and discussion, hands-on activity. Each instruction is designed to suit 90 minutes meeting of school's club. Student-centered activities provide some experience for students to understand relationship between human activities and the environment. This model is expected to help students to gain knowledge, skills and attitudes that need to cope with environmental problems in a responsible manner and serve to improve environment in their community.

Keywords: environmental education, Malaysian secondary school, recycling club.

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Variability in Acetylcholinesterase upon Exposure to Chlorpyrifos and Carbaryl in Hybrid Catfish

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Acetylcholinesterase (AChE) was measured in brain, liver, muscle and gill tissues of hybrid catfish (*Clarias macrocephalus* x *Clarias gariepinus*) exposed to a sublethal concentration of an organophosphate, chlorpyrifos and a carbamate, carbaryl, for 4 days. AChE inhibition increased rapidly with insecticide concentration. Relative inhibition of AChE was higher in larger fish but did not differ significantly with sex. Relative inhibition of AChE accompanying insecticide exposure was highest in brain tissues and progressively less in liver, muscle and gill tissues. Insecticide concentrations and AChE inhibition in the brain increased over the 4-days sublethal exposure. After transfer to insecticide-free water, AChE inhibition and insecticide residue in the brain decreased but remained above control values over the 4-days recovery period.

Keywords: acetylcholinesterase, carbaryl, cholinergic insecticide, chlorpyrifos, hybrid catfish.

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Effect of *IGF-2* Gene on Litter Size and Reproductive Performance in Pigs

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Insulin like growth factor (*IGF-2*) gene, produces

IGF-2 protein which is a member of Insulin-relaxin growth factor, shows an effect on reproductive traits in pigs. The aim of this study is to find out the association of *IGF-2* gene polymorphism on reproductive traits in pigs. Blood samples of 99 sows and their phenotypes (total number of new born, number of new born alive, number of weaned piglets and weight of weaned piglets) were collected. A Polymerase Chain Reaction-Restriction Fragment Length Polymorphisms (PCR-RFLP) technique was used for detection genotypes. The 336 bp of *IGF-2* gene in intron 7, occurred mutation (G→C) at 208 locus which is the polymorphic site of restriction enzyme, *BcnI*, were amplified. The association between genotypes and reproductive traits was evaluated by General Linear Model. The genotype frequencies of *GG*, *GC* and *CC* were 27.27%, 58.59% and 14.14%, respectively. The effect of the *IGF-2* gene was not significant ($P \geq 0.05$) in total number of new born, number of new born alive, number of weaned piglets and weight of weaned piglets.

Keywords: PCR-RFLP, total number of new born, number of new born alive, number of weaned piglets, weight of weaned piglets.

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***In vitro* Effects of Some Thai Antihelminthic Plants on Tegument Surface and Mortality of *Stellantchasmus falcatus* (Trematoda:Heterophyidae)**

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The prevalence of *Stellantchasmus falcatus* (Trematoda: Heterophyidae) was investigated in Chiang Mai and Lumphun provinces, Thailand. The activities of aqueous extracts from the two species of

Thai antihelminthic plants, *Carica papaya* Linn. and *Momornica charantia* Linn., were also examined in this study which treat with 30 flukes and vary of concentration as 12.5%, 50% and 100%. The effective concentrations of the aqueous extracts from *C. papaya* 100% (3.67 mg/ml) and *M. charantia* 100% (60 mg/ml) were totally killed (100%) the flukes at 55 minutes and 80 minutes, respectively. Scanning electron microscope (SEM) observation on the tegumental surface of the death helminthes treated with the aqueous extracts from two herbals found difference of tegument surface and destroy not same. A lot of damage and lose of scales around oral sucker and posterior were found group's flukes incubated in the concentration of aqueous extracts from seed of *C. papaya* 100% (3.67 mg/ml). The result of the aqueous extracts from fruit of *M. charantia* concentrate 100% (60 mg/ml) that were lose of outer layer tegument and have a break violent tegument on anterior of flukes.

Keywords: electron microscope, herbal, parasite, *Stellantchasmus falcatus*.

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Sound Quality of Salor's Bow from Different Horsehair Species

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Salor is a Thai-Northern style music instrument, which is consisted of a body and a bow stringed with horse hair. Each Salor has different sound quality, which is likely depended on the horse hair used. This research was aimed to examine effects of different species of horse hair on the sound quality of the Salor. Phenotypic data of 3 horse species (Lipizzaner, Thoroughbred, and New Zealand Pony) were collected. Sounds made by the different bows of the different horse hair were recorded and

analyzed by Fast Fourier Transfer (FFT) to examine their sound qualities. Atomic Force Microscope (AFM) was used to perform roughness analysis (Ra), which might determine the sound quality. It was found that the Palomino Mare New Zealand Pony's hair gives the most satisfied sound quality with the Ra of 11.6585 nm/ 4 nm². However, the Ra was not clearly related to the sound quality. Future research may include studies on endurance, longevity, maintenance, and storage of the horse hair to add value and provide musicians with high-quality Salor.

Keywords: horse hair, horse race, Salor, sound quality.

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Microsatellite Primers in *Ficus hirta* and *Erythrina subumbrans* for Applications in Tropical Forest Restoration

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Forest restoration plots by the framework species method have been established in areas of northern Thailand since 1997 by the Forest Restoration Research Unit (FORRU), Chiang Mai University, Thailand. The forest restoration plots are monitored for their success, e.g. biodiversity recovery. One of the methods is using microsatellite markers to genetically identify plants and track plant dispersal. This work was done to develop microsatellite markers for *Ficus hirta* and *Erythrina subumbrans* to find specific microsatellite primers. Ten individual samples of *F. hirta* (3 maternal and 7 seedling plants) and 15 samples of *E. subumbrans* (3 maternal and 12 seedling plants) in the forest restoration plots at Ban Mae Sa Mai, Mae Rim district, Chiang Mai, were collected. The samples were

extracted for DNA and amplified by Polymerase Chain Reaction (PCR) in touch down PCR program with three pairs of primer: FM1-27, FM3-64 and FM4-15. Then, the products were detected in 10% polyacrylamide gel electrophoresis. The results showed that the primer FM3-64 could amplify the products for 3 sizes of DNA: 300, 400 and 800 base pairs in *F. hirta*, and provide 4 sizes of DNA: 300, 400, 700 and 800 base pairs in *E. subumbrans*. The results of every sample were similar. Therefore, it was shown that the primer FM3-64 could identify the specific characters of *F. hirta* and *E. subumbrans* but could not distinguish individual differences.

Keywords: Chiang Mai, Dispersal, *Erythrina subumbrans*, *Ficus hirta*.

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The Effects of Earthworm-formulated and Commercial Feeds on the Growth and Development of Nile Tilapia (*O. niloticus*)

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Cultivation of fishes like *Oreochromis niloticus* is extensive throughout the world, leading to an ongoing endeavor to improve food production by formulating cheaper and nutritionally comparable feed. This study aims to compare the effect(s) of the earthworm-formulated feed and commercial feed in terms of growth and development of *O. niloticus* fingerlings. Two set-ups of glass aquaria, each containing 20 *O. niloticus* (approximately 3 months old) fish, were prepared. One was exclusively fed with earthworm-formulated feed while the other fed with commercial feed. The weight, total length, fork length, caudal length and body depth were measured every week for 8 weeks and the mean values of the two set-ups were compared. The

survival and general/feeding behavior of the fish were also observed up to 8 weeks. Statistical analysis showed no significant differences in all morphometric variables between the fish in the two set-ups during 8 weeks. A higher survival rate was observed in the set-up fed with earthworm-formulated feed. As to the feeding behavior, approaching, consuming and stalking of feed were observed in the fish fed with earthworm-formulated feed and commercial feed; the fish fed with commercial feed showed more aggression and loss of interest toward their feed. On the contrary, in the set-up fed with earthworm-formulated feed, there was more incidence of feeding on glass panel of the aquarium exhibited by the fish during the 4th to 6th week. With these, it can be concluded that the earthworm-formulated feed is comparable to the commercial feed in terms of its effects on the growth and development of *O. niloticus*.

Keywords: earthworm, feeding behavior, morphometric measurements, Nile tilapia, survival rates, tilapia feed.

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Environmental Education with Reference to Biological Aspects for Non-science Majors in Pre-service Teacher Training Courses

Nobuyasu Katayama
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We have prepared a unique subject called "Project Study Subject" for sophomores in pre-service teacher training in Tokyo Gakugei University. The subject is compulsory not only for students in teacher training courses, but also for those in non-teacher training courses who wish to get a teacher's license. This year, we provide 24 courses in this subject. A pair of teachers has

charge of each course which consists of two classes a week in the spring semester and one class a week in the autumn semester. A professor of natural geography and I offer a course named "Outdoor Practice in Environmental Education." Most of the students attending our course are non-science majors. At first, I gave each attendant two major assignments. One of them was to set up a nature trail in our university campus and to write a guide to the trail. The other was to select a tree in the campus, to get information about the tree, and to observe and record how the tree and its environment change with the seasons. In the first 10 weeks of the spring semester, I taught students methods of getting information about trees, herbs, birds, insects, etc, from books and through the Internet. I brought students out and taught them how to observe plants and animals and how to use illustrated guide books to plants and animals. During that period, each student decided the tree to be observed periodically and carried out the assignment to create a unique nature trail. In the last 5 weeks, some students were appointed as guides of their nature trails and could accomplish their missions. The contents of my classes seemed to be suitable for non-science majors to learn outdoor biological activities in environmental education.

Keywords: Environmental Education, nature observation, nature trails, non-science majors, outdoor activities, pre-service teacher training.

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Investigation of Japanese Biology Curriculum in Primary School Which Is Regarded Nature Observation as Important

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Aomori Prefecture has rich natural environment. Nevertheless, primary school students have little

chance to study nature when they learn biology, for the reason that students and teachers are not well aware of methods of nature observation. On the other hand, out of school, many activities of nature observation are given for children and adults; they treat plants, birds, water creatures, etc.

Thereupon, we considered methods and viewpoints which were used at these activities; we investigated the possibility of Japanese biology curriculum in primary school to connect with nature observation strongly.

We compared these activities in Aomori prefecture with the learning contents of Japanese biology curriculum in primary school. There were many activities which had the viewpoints to grasp changing of four seasons and they connected to the learning contents of 4th grade directly. There were many activities of treating plants which were especially watched in each local area.

We analyzed the questionnaire which had been answered by students attended each activity. Students became to desire wide knowledge of the name and the phenomenon about living things.

On the basis of the result, we proposed a biology curriculum in primary school. It was introduced advantages of nature observation which were acquiring wide knowledge and understanding specific characteristics of local nature environment.

Keywords: Aomori Prefecture, curriculum, nature observation, primary school.

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Creating a Field Biology Program for Your School: Lessons from the PSHS-Main Campus Experience

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Any scholastic program envisioned by a unit of an

institution needs administrative support. The field biology program in the Philippine Science High School-Main Campus is no exception. In this paper, we describe how to plan and implement a field biology program, how to choose field biology sites, how to prepare the pre-departure and activity module schedules, and how to draft the line item budget. The activity modules were designed and implemented in a way that integrates topics of biosystematics, evolution, and ecology. Moreover, the field biology program provides a venue for experiential learning through outdoor activities and social constructivism. Field biology Class 2006 responses, feedback, and evaluation were also presented and other measures of success planned for future implementation were also tackled.

Keywords: field biology program, Philippine Science High School – Main Campus.

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Effects of Fish Breeding Activity for College Students Who Aim to Become an Elementary School Teacher

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In elementary schools in Japan, activities of raising living things are essential for the life environmental study and the science study. For years, the author has lectured and instructed how to grow plants and breed fish non-biology majors in the required class for the elementary school teacher-training course in Tokyo Gakugei University. There, the students raised plants and fish on their own responsibility and learn with the raised living things at home. At the first term of 2008, about 120 students subjected to the fish breeding activity. Before starting the activity, likes and dislikes about plants and animals and experiences and knowledge of fish breeding

that the students had were surveyed. Around the finishing time of the study course, the students' knowledge of fish breeding was again surveyed. Also, at the end of the curriculum, students' consciousness how they were changed before and after the breeding activity was examined by self-evaluating method. Based on the data of above-mentioned study and also the students' opinions and views posted to the college website bulletin board for the class, the influence of the fish breeding activity upon the proficiency of fish breeding and outlook on living things of the students is discussed.

Keywords: breeding activity, elementary school teacher training course, fish, outlook on life.

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Animal-assisted Education at Japanese Schools with Support from Veterinarians

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Traditionally but not compulsorily, Japanese kindergartens and elementary schools have had animals such as rabbits and bantams (chickens) for animal-assisted education (AAE) with the goal that children learn how to take care of animals and that life is irreplaceable. Japanese AAE is unique on the following two points. First, the ratio of schools keeping animals is as high as approximately 90% of elementary schools. The second is the nationwide support of veterinarians for school teachers. Veterinarians provide medical care for school animals, advise teachers how to rear animals, and help children cultivate humane attitude toward animals. An empirical study has proved positive impact of Japa-

nese AAE on children's emotional development. Nakajima and her colleagues found that the group of fourth-grade elementary school students who engaged in a one-year animal rearing activity showed significantly less decrease in school adaptation such as willingness to go to school compared to the students in the control group. Nakajima *et al.* also found highly positive correlation between sympathy for animals and warmth toward other people.

Keywords: animal-assisted education, animal rearing at school, high prevalence rate of animal keeping at Japanese schools, support from veterinarians, school adaptation.

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**Conservation Medical Education
Performed by
the Wild Animal Medical Center (WAMC)
in Rakuno Gakuen University**

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Rakuno Gakuen University

The Wild Animal Medical Center (WAMC) was established in April 2004 as part of Rakuno Gakuen University and serves as a teaching animal hospital. It is funded by the High Technological Project by the Ministry of Education and Culture, Japan. WAMC is not only a core facility for encouraging and supporting progress of wildlife research and educational activities, but it also co-ordinates research among related societies, government departments and other universities/institutes (*J. Rakuno Gakuen Univ.*, **29**: 145-153, 2005). Conservation medicine is defined as an interpretation of the relationship between natural ecosystems and living body mechanisms (*Ibid.*, **32**: 169-178, 2008). There are several specialized educational systems for studying zoo and wild animal medicine in Europe, Africa, the USA and Australia (*Zoo Wildl. News*, **(26)**: 10-13, 2008). The present author

holds a Master of Science in Wild Animal Health from the Royal Veterinary College, UK (*J. Vet. Med.*, **54**: 801-812, 2001), and his experience of taking part in this course has helped provide similar educational activities in the WAMC. Especially, the educational activities on field epidemiology with special reference to the host-parasite relationships between wild avian/mammalian species and their helminths as the Student Short Course (SSC) organized by Japanese Society of Zoo and Wildlife Medicine since 2004 is prominent (*J. Rakuno Gakuen Univ.*, **32**: 25-42, 2007), because his research activities are focused on parasitic or infectious diseases/pathogens of zoo and wild animals, and are connected to host ecology and zoogeography. This research background may help educational activities of conservation medicine provide information from micro to macro levels.

Keywords: conservation medicine, the Wild Animal Medical Center (WAMC), host-parasite relationships, host ecology, zoogeography.

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**Usefulness of Small Scale Biotores in
Kindergarten Education in the Urban
Area of Japan**

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This study focuses on small-scale biotores, which we have found useful for kindergarten education in the urban area of Japan through the examination of current conditions of biotores at kindergartens in the urban area. Thereupon, we studied on two types of biotope, namely, "Paddy-Field Biotope", where rice is grown in its water environment, and "Compound Biotope (pond, paddy-field, flower bed, green field, and bush)". In this study, we examined the practical activities with "Paddy-Field Bio-

tope” at a Kindergarten and analyzed their educational benefits. Activities with “Compound Biotope” were also examined at another Kindergarten and analyzed their educational benefits. We suggest desirable ways to utilize such biotopes in kindergarten education in the urban area.

Keywords: kindergarten education in Japan, small-scale biotope, urban area.

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The Effectiveness of Using Data Which Have Been Obtained by Students for Learning about the Human Environment in Junior High School Science

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Under the supervision of one of the authors (Y.K.), some students of Ochiai Junior High School have been carrying out environmental research as one of their science club activities since 2003. Every month, they have examined the water quality of an artificial pond in the school and a natural pond in the Otomeyama Natural Park which is located very close to the school. For examining the water quality, *i.e.*, pH, ClO, COD, NH₄, NO₂, NO₃ and PO₄, they use Pack-Tests which are water quality examination kits sold on the market. At the same time, they investigate microorganisms with reference to diatoms living in these ponds. They identify diatoms at the order level, count them and measure their sizes.

There are significant difference in the pH and NO₃ concentration between the two ponds; the pH range of water is 8.0 – 8.5 in the school pond while it is 7.0 – 7.5 in the natural pond. The concentration of NO₃ is 10 – 20 in the school pond and 45 in the natural pond. The diversity of diatoms in the natural pond is greater than that in the artificial

pond: the number of orders appearing is around 15 for the former and around 10 for the latter. Larger size diatoms are more abundant in the natural pond. These phenomena have been observed throughout the investigation period.

These results are used in 3rd year Science classes as a material for learning about the human environment. Students attending the classes seem to be very much interested in the material, because the places are very familiar to them and the data were obtained by their fellows.

Keywords: diatom, environmental study, junior high school science, Pack-Test, water analysis.

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The Practice of the Environmental Education in Japanese Elementary and Junior High School Science Using Natural Resource in Hokkaido Area

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The UN Decade of Education for Sustainable Development was started from 2005. In 2007, the teacher’s guide for environmental education (EE) was revised after an interval of 15 years. The EE for a sustainable society has been promoted in Japan. In addition, the Japanese national curriculum for elementary and junior high school was revised in March, 2008. It is emphasized the promotion and application of experiential activity and environmental education as same as science education. It is thought that it will do the environmental education in the science class, especially biology class rather than the integrated study in the future school. It is important to introduce the objective and ability of environmental education in the science class as a school curriculum. In addition, teacher needs the cases of practical study environmental education in the science class.

In this study, I practiced some science lessons of elementary and junior high school in Hokkaido, which were including the teaching environmental education in a science class and using local nature and resource in surroundings. I practiced the importance of natural environment for the migration of the bird as an example in Nagayama Shinkawa in elementary school, the importance of water quality and examination followed the water investigation in Ishikari River in junior high school. Both students experienced through the some activities and they could deepened the knowledge and understandings about environment

Keywords: environmental education, experiential activity, migration, water investigation.

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The Current State of Myxomycete Collections in Museums and Future Prospects of the Utilization on Biological Education

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The application of the public educational institution like a science museum and zoo is strongly promoted on science class by new course of study revised on March 2008. The collections in the museum are good materials on biological education.

Myxomycetes (Slime molds) are very unique and quite common organisms. Because of their peculiar lifecycle and their position in classification systems of organisms, myxomycetes are a good example of Biodiversity. Although the presentation of myxomycetes on biological education may improve student's interest in Biodiversity, it is difficult to find myxomycetes in field if you have not observed them once. Therefore, it is one of the effective ways for students to observe myxomycete collec-

tions in museum for getting knowledge of myxomycetes.

In this study, research of currents state of myxomycete collections in museums was carried out in Europe and Japan, and future prospects of the utilization of the collections on biological education was discussed.

Keywords: biological education, museum collection, myxomycetes.

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Teaching-Materials of the "Rice Plant" in Biology Education

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About 500 million "rice" per year is produced in the world. Among those, it is produced about 90% in Asia, and is the grain supporting many people as the staple food. The quantity of production of Japan is the 10th place in the world (FAO Statistics 2004). A self-sufficiency rate is food with the highest self-sufficiency rate at 95% at home. However, the amount of consumption of the "rice" in Japan is decreasing, and surplus rice has been a problem. The opportunity of eating bread and noodles as a staple food has been increasing, and it is welcomed that the meals are diversified. But the tendency for what is eaten easily to be liked is seen. In Japan, it is hardly troubled by acquisition of food, and "eating" is made light of. Extensive abandonment of food, not to mention it, has been a problem. We tend to forget for food to be insufficient in the world. It is important to raise the concern about "a meal" by learning anew at such time about the "rice" which is the staple food. "Rice" can be utilizable as teaching materials since it is various if even from cultivation of the "rice" as a plant to the "rice" as

grain and the "meal" as food are let pass and seen. Teaching-materials of "the rice as a plant", "the ecosystem and scene of the paddy field where rice plants is grown", "meal culture", etc., can be considered. Then, teaching-materials of "cultivation and observation of rice, ", and "the ecosystem of a paddy field" was tried in biology education of a basic subject of college.

Keywords: rice plant, rice, meal, basic subject of college, various teaching material.

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The Antioxidant Potential of Crude Leaf Extracts from Selected Endemic Plant Species of the Philippines

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The antioxidant property of ethanolic crude leaf extracts of *Ardisia pyramidalis* Roth, *Chisocheton pentandrus* (Blanco) Merr., *Uncaria perrottetti* (A. Rich) Merr., *Voacanga globosa* (Blanco) Merr., *Ficus septica*, *Parameria laevigata*, *Parartocarpus venenosus*, *Streptocaulon baumii*, and *Bacaurea tentandra* was determined using diphenyl picryl hydrazyl (DPPH) assay which evaluates ability of the extracts to scavenge free radicals. Crude leaf extracts of *Uncaria perrottetti* and *Bacaurea tentandra* were observed to possess high free radical scavenging ability with values beyond 90% inhibition indicating that they contain potential chemopreventive agents against many diseases such as cancer, cardiovascular disorders and aging. Free radical inhibition demonstrated by leaf extracts of *Ardisia pyramidalis* and *Chisocheton pentandrus* did not go beyond 60%. All the rest of the plant extracts did not show any free radical scavenging activity.

Keywords: antioxidant, chemopreventive agent,

diphenyl picryl hydrazyl, free radical inhibition.

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Evaluation of Hypoglycemic Activity of *Ardisia* sp. (Myrsinaceae): Mouse Model

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Diabetes, a metabolic disorder on glucose metabolism has become a global epidemic. In the Philippines, 3 million Filipinos are diabetics and the figure is said to double in the next twenty years. Of late, the use of antidiabetic herbal medicines has significantly increased. People perceived these as effective substitutes to drugs or as complement to western medicines in diabetes management.

The Institute of Biology is actively engaged in researches on the evaluation of plant extracts as potential nutraceuticals for health and wellness. This research investigated the hypoglycemic activity of an endemic Philippine plant, *Ardisia* sp. (Myrsinaceae) on alloxan-induced diabetic adult male ICR mice.

Twenty diabetic and twenty normoglycemic mice were given low dose (1.1 mg/g body weight) and high dose (4.4 mg/g body weight) of the plant extract. Fasting blood glucose (FBS) was measured at 0 hr, 1 hr, 2 hr, 3 hr and 24 hr after intraperitoneal administration of the aqueous extract. Results showed that both low and high doses reduced FBS to 50.2-58.1% after 2 hr. Reduction in glucose level continued until 24 h after treatment. Data show that *Ardisia* sp has potent hypoglycemic property. Identification of its bioactive component, its structural identification is important to assess further its potential.

This protocol is being used by senior high school students in special investigatory projects as well as by graduate students in their study on plant biodi-

versity in Baranggay Kanawan in Morong, Bataan.

Keywords: fasting blood glucose, hypoglycemic, nutraceuticals.

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Evaluation of the Glycemic Effect of *Telosma* (Asclepiadaceae) in Normal and Alloxan-induced Diabetic Juvenile Mice (*Mus musculus*)

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The incidence of diabetes is alarmingly fast in both developed and developing countries. In Third World countries medicinal plants have always played a significant role in the maintenance of health and management of diseases. In the Philippines, there are many plants with reported antidiabetic property but these are not scientifically tested. The Institute of Biology is actively engaged in researches on the medicinal properties of plant extracts. This research is a study on the glycemic activity of *Telosma* sp., a plant that is popularly used as vegetable. Using the male mice model, ethanolic leaf extract of *Telosma* was tested for hypoglycemic activity in both normoglycemic and alloxan-induced diabetic mice. Results showed that the blood glucose reducing effect of the extract is dose-dependent. Ethanolic extract of *Telosma* when given at a dose of 100mg/kg body weight produced a significant fall in blood glucose, both in normal ($P<0.001$) and diabetic ($P<0.001$) mice. In alloxan-induced diabetic mice, the maximum decrease in blood glucose level was obtained 1 hr (59%) after treatment which is close to the reduction effect of insulin (65%). Significant reduction in blood glucose was also observed at 2 hrs ($P<0.01$) and 3 hrs ($P<0.05$) after treatment at a lower dose of 50 mg/kg body weight was administered. These

findings show that ethanolic leaf extract of *Telosma* especially at a dose of 100 mg/kg body weight had hypoglycemic activity. Identification and characterizations of the active components of the plant are necessary to understand the mechanism of its hypoglycemic action.

Keywords: alloxan, blood glucose, hypoglycemia, normoglycemic, *Telosma*.

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Male sterile *Oxalis corniculata* as teaching material for pollination and fructification

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Pollination and fructification of angiosperms have been taught in the 5th grade of the elementary school in Japan. Plants of Cucurbitaceae have been recommended as teaching materials in the Direction of the National Curriculum of the primary sciences, because of their diclinism. However, plants of *Cucurbita pepo* or *Luffa cylindrical* set female flowers less frequently than the male flowers. Therefore, it's difficult to prepare enough numbers of the female flowers for classes. Furthermore, these plants grow into a large size to bring into classrooms.

Male sterile flowers are equivalent to female flowers of Cucurbitaceae, as castration is not need before crossing (pollination), whereas isolation of male sterile flowers with bags is needed to control the pollination. We found male sterile strains of *O. corniculata* from Kumamoto Pref. of the Kyusyu Isl. and Ishikawa Pref. of the Honshu Isl. These strains never set seeds without the artificial or insect pollination. As the flowers bloom one after another, it is easy to prepare many flowers for classes. The plants are smaller than 20cm in height, and easy to handle. The flowers will be in bloom with sun-

shine until midafternoon without pollination. It takes 11 days for seeds of *O. corniculata* to mature. Therefore, the plants suit the teaching material for pollination and fructification.

We propose to replace the traditional Cucurbitaceae plants with the male sterile *O. corniculata* in the studies of pollination and fructification of angiosperms.

Keywords: angiosperms, fructification, male sterile, *Oxalis corniculata*, pollination, sexual reproduction.

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Genotoxicity of Cadmium to Coelomocytes of Earthworms, *Pheretima peguana* and *Pheretima posthuma*

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The aim of this study was to assess the genotoxicity of cadmium to non-specific immunity of the mature earthworms, *Pheretima peguana* and *Pheretima posthuma*. We studied the nuclear anomalies of coelomocytes, immune cells in the coelomic cavity, by a micronucleus test and a cytokinesis inhibition analysis. The individual earthworms were exposed to different times and concentrations of Cd on filter papers. Using extrusion buffer stimulation allowed us to investigate the appearances of micronucleus, binucleate, necrosis and apoptosis of coelomocytes under 1000 magnification. Results revealed that the exposure times and concentrations of Cd showed significant differences ($P < 0.05$) in the changes in micronuclei and binucleates frequencies of coelomocytes of *P. peguana*. Compared to the control, the appearances of micronuclei and binucleates of *P. peguana* increased with the increased Cd concentrations but the effects in *P. posthuma* were not significant. The $0.085 \mu\text{g Cd/cm}^2$ of filter paper induced the highest micronucleus changes and

binucleate frequencies at 72 h. Micronucleus assay for the assessment of genotoxicity of Cd can be applied for coelomocytes in Micronucleus assay for the earthworm species, *P. peguana*.

Keywords: binucleate, cadmium, earthworms, coelomocytes, micronucleus, *Pheretima peguana*, *Pheretima posthuma*.

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Factors Affecting Cadmium Adsorption of *Kirchneriella lunaris*

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Factors affecting cadmium adsorption of *Kirchneriella lunaris* were investigated. *K. lunaris* was cultured in modified complete culture medium (MCM) under fluorescent intensity 1,300 lux, light:dark 12:12 h and temperature $26 \pm 2^\circ\text{C}$. The results showed that the EC_{50} of Cd after 24, 48 and 72 hours were 0.117, 0.039 and 0.010 mg/L, respectively. Equilibrium time of Cd adsorption was 80 min when initial Cd concentrations were 1 and 50 mg/L. The number of inoculation cells affected the percent of adsorption and the adsorption capacity. The highest adsorption was 88.51% at 10^8 cell/ml inoculum size. The optimum pH of cadmium adsorption was 6.0 and caused the highest adsorption, 95.50%. The initial concentrations of Cd affected the percent adsorption and adsorption capacity. The highest adsorption capacity of 23.95 mg Cd /g biosorbent was found when initial Cd concentration was 100 mg/L.

Keywords: adsorption, cadmium, EC_{50} , equilibrium time, *Kirchneriella lunaris*.

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Screening Plant Species for Assessing Cd and Neem Extract Contamination

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The phytotoxic effects of cadmium and azadirachtin (Aza), a most active component present in commercial available neem seed extract, were assessed singly in five plant species. Ninety-six hours after being exposed to 100 ppm CdCl₂ or 1.0, 2.5, 5.0, 7.5, and 10 ppm of Aza containing neem extract, the percentages of seed germination and root length were evaluated in all plant species. The screening trials using Cd did not reveal any differences in germination percentage between the treated plants and the control (at 80%) in yard long bean (*Vigna unguiculata* var *sesquipedalis* L.) and tomato (*Lycopersicon esculentum* Mill). The percentages of germination were 6.67, 14.17 and 31.39 % in lettuce (*Lactuca sativa* L.), sweet basil (*Ocimum basilicum* L.) and minnieroot (*Ruellia tuberosa* L.), respectively, whereas the relative inhibition of root length in Cd-treated plants ranged from 65.35 to 91.62%. The reduction in germination percentage as well as root length increased with an increase in the concentration of Aza. The high levels of relative inhibition on seed germination and root length at 10 ppm Aza in lettuce, tomato and minnieroot were 82.58, 63.96, 44.44% and 79.21, 82.68, 75.76%, respectively. The sensitive plant species were selected and cultured in ½ Hoagland solution for two weeks. It was found that treatment of Cd or 10 ppm Aza caused 100% death in lettuce and likewise for sweet basil treated with Cd. The root length of minnieroot treated with Cd was 51.22 % of the control. In contrast, tomato and minnieroot treated with 10 ppm Aza showed similar results as the control. From this study, it could be concluded that these sensitive plants have potential to be used for assessing the contamination of Cd and Aza.

Keywords: phytotoxicity, cadmium, neem extract, *Ocimum basilicum* L., *Ruellia tuberosa* L.

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Classroom Experiment for Studying the Response of Organisms to Their Environment with the Unicellular Green Alga *Haematococcus pulvialis*

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Haematococcus pulvialis accumulates a red carotenoid, astaxanthin, under certain stress conditions, such as nutrient deficiency. As a result, the color of the cell changes from green to red. This color change is reversible when the cells are transferred back to conditions suitable for their growth. Using this color change as an indicator, a classroom experiment at the high school level for examining the response of *H. pulvialis* to its environment has been developed. Instead of the synthetic medium recommended, a liquid fertilizer, 0.05 – 0.1% of Hyponex, could be used as the culture medium. For the observation of cell color change by the naked eye, agar slant medium is more suitable than liquid medium, but for high school teachers the latter is much easier to prepare. We, therefore, cultured the alga with different cell densities in Hyponex liquid medium and examined how many days were required for detecting the color change in cell suspension. When the initial cell density was 6.75×10^4 cells ml⁻¹, the color change could easily be observed at the sixth day of culture. So, if the initial cell density is high enough, the liquid culture can be used for this experiment, and the response of *H. pulvialis* to environmental changes can be observed as the color changes in cell suspension within a few days.

Keywords: classroom experiment, *Haematococcus pulvialis*, high school biology, response to environment

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New Teaching Materials on “Life of Oceanic Sea skaters and Adaptation to Oceanic Environment”

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Forty-six species of sea skaters, *Halobates* have been described (Andersen and Cheng, 2004). Five are oceanic and, only one species, *Halobates micans* is widely distributed in Pacific, Atlantic and Indian Oceans. Based on the several scientific cruises (KH-06-02-Leg5, MR-06-05-Leg 3, KT-07-19, KH-07-04-Leg1, MR-08-02, KT-08-13, KT-08-23), sampling data from wide latitude area from 0°N to 35°N in the western Pacific Ocean and also tropical Indian Ocean show relationship between life of sea skaters and oceanic dynamics including currents. Experimental data on hardiness to the increasing of ambient temperature exhibit relationship between physiological function and habitat characteristics of sea skaters. For examples, a relative species to oceanic sea skaters, *Metrocoris histrio* living in fresh waters on land, was much more resistant to temperature increasing than oceanic sea skaters, *H. micans*, *H. germanus* and *H. sericeus* (Harada *et al.*, unpublished). This study challenges to create new teaching materials based on these data for the actual scenes of science and environmental education in elementary and junior high school.

Keywords: oceanic sea skaters, distribution and currents, heat tolerance, oceanic dynamics, new teaching materials, science and environmental education.

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Study on Teaching Materials of Creature in Elementary School Science Textbooks —Appropriateness of the Fact that Japanese Schools begin in April—

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Schools begin in August in many European and several other countries. They begin in January in Australia and Singapore. Japanese schools begin in April when spring comes. In this study, we analyze the appropriateness of the time that academic year of Japanese school start from the standpoint of science education. We investigated characteristics of animals and plants which were described for observations and experiments in elementary school science textbooks for third to sixth graders. These textbooks were edited by six different publishers on the basis of the Course of Study in Japan which was revised on 1998, and they were published in 2005.

The results of the study are as follows: Most of creatures are suitable as teaching materials in these textbooks. They are popular species seen in daily lives. They are born in spring and become competent to produce progeny within one year, and thereby suitable for observation from spring. There are “Small White (*Pieris rapae*)”, “Barn Swallow (*Hirundo rustica*)”, “Killifish (*Oryzias latipes*)”, “Rose balsam (*Impatiens balsamina*)”, “Sunflower (*Helianthus annuus*)”, etc. When the children observe growth and characteristics of animals and plants through one year, in order to do “experiential learning” on “scientific concept”, “biodiversity”, “view of life”, etc., it is suitable to observe them from spring in Japan, as many of

creatures are born in spring. It seems to be appropriate to start academic year of elementary schools in April, from the standpoint of science education, as spring comes in April in Japan.

Keywords: observation and experiment, science education, teaching material of creature

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Cytotoxicity of Extracts from Endemic and Indigenous Plants of Protected Forests of Bataan in the Philippines

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A memorandum of agreement between the University of the Philippines and the Aytas, indigenous people of Bataan, enabled faculty researchers and students to study the medicinal properties of endemic and indigenous plants from their ancestral domain. One focus of the study was on anticancer property. Leaves were collected, extracted and assessed for cytotoxicity against two human cancer cell lines. Air dried leaves were homogenized and soaked in 95 % ethanol for at least 48 hours. Cytotoxicity was assessed using MTT assay against two human cell lines, lung carcinoma A549 and colon carcinoma HCT 116. Nineteen plant extracts were assayed. *Ficus septica* Burm., *Voacanga globosa* (Blanco) Merr., and *Aglaia loheri* Blanco showed high toxicity against the two cell lines with IC_{50} below 20 μ g/ml. The crude extracts were partitioned against ethyl acetate and hexane and tested again for toxicity. The ethyl acetate fractions of the three plants were toxic against the 2 cell lines with IC_{50} s below 5 μ g/ml indicating that these are worth pursuing for further purification of active agents.

Keywords: anticancer, carcinoma cell line, cyto-

toxicity, endemic and indigenous plants, extracts, IC_{50} .

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Evaluation of Genotoxic Effects of Residue Aza Containing Neem Extract on Root Tip Cells of *Allium cepa*, *Zephyranthes rosea* and *Eucrosia bicolor*

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To assess the effects of residue azadirachtin (Aza) containing neem extract, which may be an environmental contaminant when used in organic farms, the genotoxic effects of this biopesticide on root tip cells were studied in two steps of an experiment. In laboratory testing, mitotic index (MI) and mitotic aberration (MA) were studied in root tip cells of *Allium cepa* L., *Zephyranthes rosea* (Spreng) L. and *Eucrosia bicolor* Ker. Gawl. treated with 2 ppm of active or degraded Aza containing neem extract for 24 h. The degradation of Aza was induced by exposing the neem extract to sunlight for 3 and 7 days. The MI in root tip cells of *A. cepa* and *E. bicolor* treated with degraded 2 ppm Aza increased significantly from the control (2 ppm Aza), but a contrary result was found in *Z. rosea*. However, the MA decreased significantly in most degraded 2 ppm Aza treated plants compared with the control. After the laboratory testing, a field test was conducted. Root tip cells of three plant species, like those in the first experiment, were treated with water samples which were collected from an organic farm on day 1, 2 and day 3 after spraying with a commercial available neem seed extract. A low genotoxic effect of residue Aza containing neem extract was represented by the root tip cells of most plants treated with water samples having higher MI than in the control. Furthermore, the MAs of *A. cepa* and *Z. rosea* were

lower than that in the control, although it was higher in *E. bicolor* than in the control.

Keywords: azadirachtin, chromosome aberration, degraded azadirachtin, genotoxicity, neem extract.

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Karyotype Studies of Freshwater Snails, *Filopaludina* spp.

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Cytogenetic studies were carried out in two species of freshwater snails in Thailand, namely: *Filopaludina javanica* and *F. sumatrensis polygramma*. Chromosome numbers and karyotypes were analysed from the male portion of the gonad. According to the preliminary studies, it was found that the appropriated method for freshwater snail karyotype analysis was the preparation of well spread chromosomes containing metaphase cells by tissue dissection from 22 ± 2 mm in size of collected snails which were cultured in 0.01% colchicine for 6 h before cell harvesting. To study the chromosome numbers, small pieces of dissected male portion of gonad from those snails were incubated in 0.06 M KCl for 1 h and fixed in Canoy' solution I. Thereafter, slides containing cell samples were made using by air-drying technique followed by conventional Giemsa staining. The chromosome numbers from at least 500 metaphase cells were recorded. The result showed variation of chromosome number which ranged from 7-24 chromosomes in both species. However, the highest frequency of determined cells (63%) showed the chromosome number as 11 chromosomes (n) and also 22 chromosomes (2n). After analysis of karyotypes, it was shown that the somatic chromosome number in these freshwater snail species was $2n=2x=22$, which had the haploid karyotype formulas of $L_2^m + L_3^{sm} + M_3^m$

+ M_3^{sm} and $L_1^m + L_1^{sm} + M_2^m + M_6^{sm} + S_1^{sm}$ for *F. javanica* and *F. sumatrensis polygramma*, respectively.

Keywords: *Filopaludina javanica*, *F. sumatrensis polygramma*, freshwater snails, karyotypes.

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A Validation Study of Shell Porosity Measurements in Eggshells of the Lesser Black-backed Gull (*Larus fuscus*)

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During incubation period, the egg usually loses weight through water loss. The rate of water loss should correlate positively with shell porosity. This study used this relationship to validate two different techniques for counting pores in the eggshells of the lesser black-backed gull (*Larus fuscus*); (A) counting pores directly through a light microscope and (B) counting dyed pores through a light microscope. Technique B seemed to have a problem with counting high pore densities. However, pore densities from technique A showed only a weak relationship with water loss.

Keywords: *Larus fuscus*, shell porosity, water loss.

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Life table of springtail, *Xenylla* sp. (Hexapoda:Collembola)

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A life table of springtail, *Xenylla* sp., extracted from soil in Nakhon Pathom Province area, Thailand and mass-cultured in the laboratory, were constructed. The insects were reared under laboratory conditions

(25 - 28°C) using a mixture of plaster of Paris-charcoal and water in the ratio of 8:4:5.5 by volume as substrate. Fresh Baker's yeasts were supplied as food. From three replicates, the life table statistics demonstrated a very high capability of reproduction and population growth. The population size is increasing and one female could produce an average of 42.18 female offspring ($R_0 = 42.18$) with the rate of increase of 1.17 times per day ($\lambda = 1.17$). The life expectancy (e_x) of an adult averaged at 54.11 ± 4.128 days and the generation time (T) from the birth of a parent to the birth of offspring was 26.32 days. Based on the convenience of culturing and maintaining in the laboratory, its relatively short generation time and high rate of population increase, *Xenylla* sp. is recommended to serve as a model for the practice on the construction of a life table in ecology or related courses.

Keywords: springtails, *Xenylla* sp., life table.

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Changes of High School Students' Explanatory Hypothesis Formation by the Anxiety Types of Cognitive Conflict in Respiration Experiment Task

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The purpose of this study was to investigate the students' cognitive conflict anxiety types, differences of explanatory hypotheses and the changes of anxiety type after test experiment in respiration experiment.

The results showed that high anxiety types were divided into conviction in logical misconception, insisting on additional variables, lack of confidence and conflict with past experience, whereas low anxiety types were reported as only reasonable modification in this study even though they had

been reported as several anxiety types in other study. Also, the results showed that there were differences in explanatory hypotheses before and after the test experiment according to anxiety type of cognitive conflict. Moreover, these anxiety types were variously changed after the test experiment. Especially, students that their anxiety types were changed into reasonable modification showed higher variation of explanatory hypothesis. Therefore, it is concluded that teaching strategy in terms of cognitive conflict should be focused on facilitating students' ability to change their anxiety types into reasonable modification.

Keywords: anxiety type, cognitive conflict, explanatory hypothesis, respiration experiment task.

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The Development and Application of Teaching-learning Program utilizing Scientists' Research Papers for Improvement of the Gifted-in Science Students' Problem Solving Ability

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The purpose of this research is the development and application of the instructional program for the improvement of science-gifted students' problem solving ability. The instructional program is based on scientists' research type and cognitive apprenticeship using scientists' research papers. It is not sure whether R&E (research and education) Program has the instructional effects because the students do not clearly understand the procedures and principles of experiments. It makes students lose interests in science. Using this program, students learn and experience scientists' thoughts and quality. In this research, Mendel's paper entitled 'Experiments on Plant Hybrid' was selected for students to

read. 'Presenting Model' suggested by Kang in 2007 was used as a scientists' research types to develop the instructional program. Instruction method induce the cognitive apprenticeship was introduced for students experience the scientists' thinking process. This instruction was applied to the first grades of 7 students in the science high school. Students proposed the blending hypothesis or particulate hypothesis to explain the heredity of *Drosophila*. Using electrophoresis, they recognized the presence of both allelic DNA band from the heterozygote. This experiment confirms that the parental gene can be transferred to progeny without any change. After class, students have experienced the various genetic experiments from Mendel to modern age. Reading research paper helps students make cultural adaptation in expert society. The instructional materials developed in this study will be used as programs for R&E or just before R&E activities to increase the interests in science.

Keywords: heredity, problem solving ability, science-gifted student teaching-learning program.

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Close Analysis of Reading Inscriptions in Biology Textbooks

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Biology textbooks contain various inscriptions such as photographs, drawings, graphs, tables, diagrams, etc. Such inscriptions can help students' learning, because the inscriptions can represent science contents that cannot be written in language easily. However, the inscriptions itself is sometimes hard to read for students. The process of reading inscrip-

tions consists of three different kinds of works, structuring, transforming, and translating (*Sci. Edu.* **90**: 173-201, 2006). We analyzed the process of reading biology inscriptions in detail with the model suggested in the previous research by Han and Roth (*Sci. Edu.* **90**: 173-201, 2006). We focused on some examples of complex inscription where two or more inscriptions were layered together to represent the biology contents. We will show a lot of works are required in reading biology inscriptions, and some works may cause difficulties for students to understand the inscriptions in learning biology. The biology teachers should provide more and more resources kindly to students for reading biology inscriptions.

Keywords: inscription, textbook, reading process.

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Learning-related Brain Activation Changes in High School Students: An fMRI Study

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The aim of the present study was to investigate the learning-related changes in brain activation that were induced by the training of hypothesis generation skills about biological phenomena. Eighteen high school student participants were scanned twice with functional magnetic resonance imaging (fMRI) before and after training during a four-month interval. The experimental group was trained through thirteen biological hypothesis generation programs, but the control group was given only hypothesis understanding program during the four-month period. The results have shown that the left prefrontal cortex, occipito-parietal route were activated

during hypothesis generation in both groups. In addition, the brain activation of the trained group was increased in the left medial frontal gyrus which was related to working memory load and higher-order inferential processes.

Keywords: brain activation change, fMRI, hypothesis generation skills, learning-related activation, medial frontal gyrus, postcentral gyrus.

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An Exploratory Study on Emotional Factors in the Elementary Science Instruction

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The positive and negative emotional factors in the elementary science instruction were examined. For this study, 261 elementary students from eight classes of the third, fourth, fifth and sixth grades in an elementary school in Seoul were selected. Two questionnaires were developed to find out which situations evoke positive and negative emotions in students. They were administered three times after science instruction periods in life unit, and once after whole units. The responses of students on questionnaires were qualitatively and quantitatively analyzed.

The major results of the study were as follows:

First, the factors associated with positive emotions were instruction and text contents, result of instruction, instruction activity, and teacher's attitude, while those associated with negative emotions were instruction and text contents, instruction activity, instruction materials, students' mutual and personal propensities. The factors evoking positive emotions which the students perceived were instruction activity, instruction materials, instruction and text contents, and student's personal propensities.

Second, the teachers who have a strong belief in science teaching efficacy evoked positive emotions to the students more than those having a weak belief in science teaching efficacy ($p < 0.001$), but the latter evoked negative emotions more than the former ($p < 0.001$).

Third, when the relations between the science achievement and the emotional factors were analyzed, positive emotions were evoked more by the factors of students' propensities, instruction activity and instruction result in higher achievers, and by the instruction and text contents and teacher's attitude in lower achievers.

Fourth, when relations between sex and the emotional factors were analyzed, positive emotions were evoked more by the factors of students' propensities and instruction result in boys, by the factors of teacher's attitude, the instruction and text contents, and instruction activity and in girls.

Keywords: elementary science, emotional factor, science achievement, sexual difference, teaching efficacy.

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Brain-based Differences between Pre-service Science Teachers' Causal Inference and Perception about Biological Phenomena

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An understanding of relations between causes and effects is essential for making sense of the dynamic physical world. Also it is very important to make a scientific explanation. Therefore, to investigate whether creating and understanding causal knowledge rely on common or distinct processes, we in-

vestigated fifteen healthy male subjects' brain activation using 3.0 Tesla fMRI. Although the same causality of inference or perception was administered to participants, the inferential strategy was shown a prominent activation in the left prefrontal cortex area and the perceptual strategy was the right prefrontal cortex area. The result of this study shows that the direct perception of causality and the ability to inference of causality depend on different hemispheres of the divided brain. This finding implies that the creating and understanding causal knowledge is not a unitary process.

Keywords: causal inference, causal perception, fMRI, scientific explanation

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Space Educational Program Implementation of Sample Return Missions

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Currently, construction of the International Space Station (ISS) is advancing at 400 km above the earth's surface. Japan is assembling "KIBO" (Japanese Experiment Module) which is a part of ISS. The STS-123 mission delivered an inboard storage room (March 14, 2008). STS-124 (June 4, 2008) sent up the inboard laboratory and robotic arms. An exterior experiment platform will be part of STS-127 mission's payload (scheduled for May, 2009). Then, KIBO will be completed.

At KIBO, a wide variety of experiments can be done under different conditions than that of earth, from micro-gravity testing to the effects of space radiation. JAXA carries out sample return missions as part of its "Life in the Universe" program. The purpose of this is for youth to study scientific

views about the universe and life, through experiments and observations. In the inboard property room, the dormant eggs of *Daphnia pulex*, and seeds of a *Ipomoea nil* and *Lotus corniculatus* are kept. After about six months, they will be returned to earth, and analyzed. Then, they will be made available to primary, junior, and senior high schools, science museums, etc., who hope to use them for educational activities. Moreover, any experimental ideas about using these samples will be available on the JAXA website.

Keywords: ISS, Japanese Experiment Module "KIBO", sample return mission.

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<Country Reports>

Biology Education in Schools Country Report - Australia

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Each Australian State and Territory is responsible for its own curriculum design and implementation in Australia, for all levels of schooling from Preparatory year through the year 12. However, this is likely to soon change with the new Australian Government committed to introducing a National Curriculum.

In the State of Victoria, Biology is taught in the "compulsory" years of school through the discipline of Science, which constitutes a core study area from Prep to year 10. The Victorian Essential Learning Standards sets the curriculum and standards for the compulsory schooling years. Years 11 and 12 are covered by a range of certificates, the most popular being the Victorian Certificate of Education. Here Biology is taught as a stand alone subject. In Victoria Biology is the most popular of the traditional science subjects but faces challenges from 'newer' sciences such as Psychology and Health and Human

Development. As an example of current content of senior level Biology courses being taught in Australia the following gives details of the Victorian VCE curriculum as prepared by the Victorian Curriculum and Assessment Authority in 2005. This curriculum has been accredited until the end of 2009.

The study is made up of four units: Unit 1: Unity and diversity, Unit 2: Organisms and their environment, Unit 3: Signatures of life, Unit 4: Continuity and change. Each unit deals with specific content and is designed to enable students to achieve a set of outcomes. Each outcome is described in terms of key knowledge and draws on the set of key skills. There are no prerequisites for entry to Units 1, 2 and 3, however, students must undertake Unit 3 prior to undertaking Unit 4. Units 1 to 4 are designed to a standard equivalent to the final two years of secondary education and each unit involves at least 50 hours of scheduled classroom instruction. All VCE studies are benchmarked against comparable national and international curriculum.

Keywords: Australia, biology, VCE, VELs.

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Korean Elementary Science Textbook Development (Grade 3 & 4)

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Korean elementary science textbooks had been developed in 2007. When textbooks were developed, workbooks and teachers' guide were also developed by the same textbook writers. The developed textbooks, workbooks and teachers' guide are now in pilot test. After the pilot test, these textbooks, workbooks and teachers' guide will be revised. Textbooks, workbooks and teachers' guide will be released in 2010. The contents of new elementary

science textbooks are adjusted by renewed 2007 Korean National Science Curriculum. There are some differences between old elementary science textbook and new science textbook. First, inquiry will be emphasized with independent chapter. Second, textbook design is far different from old textbook. Third, integration with reading literacy and mathematic ability will be emphasized.

Keywords: design, inquiry, literacy, science textbook, teachers guide, workbook.

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Life Sciences as a Framework for Biology Education and the Training of Biologists: the Singapore Experience

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Biology is an old young science. The Human Genome Project and the genome sequencing projects of model organisms have begun to unlock the fundamental secrets of life in this 21st biocentury. Life sciences create biobusiness opportunities and vast potential for the health, biotechnology, agricultural, and pharmaceutical industries. Singapore embraced life sciences as the fourth pillar of its economy in year 2000. To support this initiative, school science was transformed at all levels, starting from the primary (age 7 - 12 yrs) to the secondary (age 13 - 16 yrs and pre-university levels (age 17 - 18 yrs) to encompass life sciences as a part of total education. Biology is recognized as the base for life sciences and a two-tiered approach is adopted, one for the general student population to understand the human body, other life forms, and the environment, and, the other to equip students with deep knowledge and skills in life sciences for

post-secondary education and careers in the life science industry. Biological science curricula at the tertiary level are reorganized for the education and training of biologists with life science knowledge, techniques and entrepreneurial skills. Biology has also become an integral part of interdisciplinary programs such as bioengineering and chemical biology. The Economic Development Board and the Agency for Science and Technology Research have several schemes to promote life sciences education and research for economic development as well as life science education in schools. To further support life science education in schools, two DNA Science Learning Centers were established and a MSc in Life Sciences program developed to enable teachers to update themselves for the teaching of biological sciences in schools. A total education framework for life science education can better ensure manpower training for the life science industry, the promotion of bioliteracy among its citizenry in the emerging ethical, social, environmental, and legal issues arising from advances in life sciences research, and an improvement of our understanding of global climate change, food and human health issues and biodiversity conservation for sustainable development.

Keywords: biologist training, life science education, Singapore.

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Transition of Curriculum Guidelines for Biology Education in Japan

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Ever since the first Curriculum Guidelines Draft in 1947, revision has occurred about every 10 years. In 1969, the curriculum requirement for lower secondary school students in grades 7 – 9 (3-year time-

frame) was 420 class periods of science study. The requirement was reduced gradually: it was 350 periods in 1977, 315 – 350 periods in 1989, and 290 periods in 1998. After this decrease in requirements, 2008 has brought a significant increase. The new curriculum guidelines specify 385 class periods of science as necessary.

The new Curriculum Guidelines for science contain the following aims: 'To be actively engaged in nature and natural phenomena,' 'To develop the ability to analyze, explain and express the result of observations and experiments,' and 'To develop the attitude of respect towards life and contribute to the conservation of natural environment.'

The Curriculum Guidelines have been revised as to the following subject matters: In classification, at present, we teach Spermatophyta and Vertebrata only, but the newly revised version includes Cryptogamae and Invertebrata. It also contains the study of evolution and heredity, including mention of DNA. Finally, in the unit 'Nature and Humans', 'the conservation of natural environment and use of scientific technology' is added.

Specifically, the new Curriculum Guidelines call for the following improvements: 'To have substantial experience in nature,' 'To regard the connection between scientific study and human society as important,' and 'To develop environmental education.'

Keywords: class hours of science study; lower secondary school; new aims, new contents and improvements; new Curriculum Guidelines.

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Status of Biology Education in the Philippines

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As the course of civilization has been influenced by chemistry and physics during the past centuries, the

21st century is now for Biology. We currently witness biology-driven technologies that are extensively changing the ways mankind responds towards his needs. This includes, among others the advent of genetically improved crops, mapping of the human genome and the discovery of new drugs and products through genetic engineering. The global food crisis and demand for renewable fuels, our growing pollution problem and the outcrop of exotic diseases compounds the need for progress in biology and its many useful applications.

Realization of this need to keep abreast of these many advances in the life sciences, has made a great challenge in Biology education: to teach the basic, intermediate and advanced concepts in Biology correctly and effectively.

Gearing up towards these goals, many assessment studies, national evaluation and diagnostic tests were administered to Filipino students not only in biology but in the other sciences as well. Sciences educators, heads of professional science teachers organizations, scientist teachers and education specialists have held conferences and summits identifying the gaps, issues and concerns in Biology education.

There are four key areas of concern that were found common to school/students in both public and private institutions across all levels: (1) curriculum, (2) basic teaching/learning tools among teachers/students, (3) teaching infrastructure, (4) administrative support.

There have been many efforts of various stakeholders in science education to address these concerns. To mention a few, the Science Education Institute of the DOST, the Department of Education, and the UP National Institute for Science and Mathematics Education Development which has three major functions: curriculum development, training and research. The Commission of Higher Education is likewise in the battlefield focusing on biology, chemistry, geology, mathematics, physics and the marine sciences. The Biology Teachers

Association of the Philippines, Inc. (BIOTA-Philippines) as a nationwide professional organization of biology teachers on its 43rd year has been involved in the quest as well.

Activities of the BIOTA-Philippines through the years towards enhancing biology education will be presented.

Keywords: biology education, BIOTA-Philippines.

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Development of Biodiversity Body of Knowledge in Thailand

Morakot Sukchotiratana, Narit Sitasuwan
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Thailand is rich in natural resources with high biodiversity of living organisms: plants, animals and microorganisms. There have been local wisdoms on biodiversity in parallel with Thai way of life for a long time. The harmony of scientific knowledge and Thai way of life as well as local wisdoms leads to the conservation and management of biodiversity resources.

In Thailand there are 302 species of mammals, 982 species of birds, 350 species of reptiles, 137 species of amphibians, 2,820 species of fishes, and more than 83,000 species of invertebrates but only 14,000 species are identified; most of them are insects. There are 12,000 species of vascular plants including 600 species of ferns, 25 species of gymnosperms, 10,000 species of angiosperms, over 1,000 species of orchids and 2,154 species of non-vascular plants. It is estimated that various living organisms in Thailand constitutes 6 – 10% of the world population of living things comparing with its 0.34% world area.

Thailand is located in the biodiversity hotspot region, the first 8 most important area in the world. However, the biodiversity in Thailand is badly and

rapidly damaged particularly the habitat.

In the meantime there is a shortage of expertise in biodiversity of different groups of living organisms. Considering the manpower in science and technology, there are only 6.7:10,000, incompatible with the developed countries. As far as the researcher in biodiversity is concerned, it is even much less. Therefore, expertise in biodiversity is urgently needed.

The Office of the Tertiary Education (OTE), Ministry of Education in collaboration with many universities in Thailand is developing the body of knowledge in biodiversity in accordance with the national strategy of the tenth National Economic and Social Development Plan (BE 2550 – 2554). It is also to support the international commitment on the Convention on Biological Diversity (CBD) to decrease the rate of loss in biodiversity, to conserve the balance of ecosystem and to protect the local wisdom by AD 2010.

The OTE and universities have agreed to establish the Center of Excellence in Biodiversity (CoEB) in the form of tertiary institute coalition according to the groups of living organisms, i.e. plants, animals and those neither plants nor animals.

Objectives of CoEB

1. to turn out expertise in biodiversity at the M.S. and Ph. D. levels,
2. to form collaborative networks among the Thai and foreign universities,
3. to create various innovations relating to biodiversity and local wisdoms beneficial to the Thai and global societies.

Expectation from BE 2553 - 2557 (AD 2010 – 2014)

1. the number of postgraduates not less than 100 within 5 years depending on the capacity of each university,
2. international research papers,
3. books and media information on biodiversity,
4. academic collaboration with foreign institutes,
5. cooperation with private sectors and local communities.

Research protocol

1. investigate the biodiversity of local living organisms: plants, animals and others,
2. examine the organisms in the important fragile ecosystem or particular ecosystem,
3. study the economically or medically important organisms and those concerning the health of community,
4. study the organisms in the specific area, e.g. protected area.

The collaboration at the tertiary level in the region and other areas with common interest will be beneficial to the conservation of biodiversity resources in Thailand and in the region as well as creating further innovation from the body of knowledge studies.

Keywords: biodiversity, body of knowledge in biodiversity, Center of Excellence in Biodiversity, conservation.

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<Workshop>

A Simple and Useful Method for the Observation of Somatic Cell Divisions Using Acetic Dahlia Solution As a Stain Solution for Biology Class at the Secondary School Level

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For biology class at secondary school level (junior and senior high schools), a simple and useful method for the observation of somatic cell divisions in root tip cells of germinating onion seeds was developed using an acetic dahlia solution as a staining solution. The treatment with a mixture of 7 parts of acetic dahlia solution and 3 parts of 1 mol/L HCl at 35°C for only 5 minutes enables the three steps of

fixation, maceration and staining at the same time. Therefore, this developed method enables students not only to prepare the slides but also to observe them under a microscope within the limited lesson time. Furthermore, the use of 50% glycerol as a mounting fluid maintains the good condition of slides over three weeks without any cement. In this work shop, we demonstrate this simple and useful method and will provide assorted samples of acetic

dahlia solution, 1 mol/L HCl and 50% glycerol with small packages of onion seeds.

Keywords: acetic dahlia solution, biology class, germinating seeds of onion, observation of cell division, secondary school.

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The Asian Journal of Biology Education

Instructions to Contributors for the *Asian Journal of Biology Education*

The **Asian Journal of Biology Education (Asian J. Biol. Educ.)** is published electronically by the Asian Association for Biology Education (AABE). The Journal will be on the AABE web site:

<http://www.aabe.sakura.ne.jp/>

Objectives of the *Asian J. Biol. Educ.*

The main objectives of the Journal are as follows:

- To publish proceedings of AABE conferences;
- To promulgate results of research into the teaching, learning and assessment of biology;
- To present investigatory, experimental, and novel teaching/learning techniques suitable for use in teaching biology;
- To update educators on the advances in biology;
- To review resources for teaching biology;
- To comment on the current policy developments affecting the biology education, especially in the Asian-Pacific region.

The Journal attaches considerable importance to research that is applicable to educational practice. Articles relevant to primary, secondary, tertiary, vocational, adult, and continuing education will be considered. Authors should remember that the Journal has a wide-ranging and international readership hence all papers should contain a clear description of the settings to which they relate.

The Journal seeks to publish

1. Papers presented at the biennial conference of AABE.
2. Papers submitted by authors.

Papers can be in five categories:

1. Reviews: this category aims to provide a link between scientific research findings and the classroom. The aim is to provide teachers with up to date information on key areas. The reviews should give a clear and concise summary of a biological or educational

topic. Articles for this section are intended to review educational topics relevant to a biology curriculum. Articles based on biological topics or those of relevance to the management and design of curricula are also of interest. Theoretical or discussion papers which are intended to deal with key points relevant to biology education may be suitable for this section.

2. Research reports: these will form the main body of the Journal and may be case studies into any aspect of education practice. Their importance will be introduced against the background of a critical review of the relevant literature. The methods and results will be described along with both conclusions and implications for future research and teaching practice. In addition to full research papers, research notes will be acceptable. Research notes are intended to be a short paper which report novel findings worthy of urgent publication. Research notes do not require an abstract and the demarcation between sections may not be clear.
3. Practical reports: this section aims to give practical advice. Papers should clearly describe a laboratory or classroom-based exercise or fieldwork which can be related to biological curriculum. The exercise described should have been trialed within an educational setting. This section may also include descriptions of other innovations and developments, such as the use of teaching aids and the implementation of software packages. The emphasis will be on the nature of the practice, a clear description of the implementation procedure, and an evaluation of its success. The full papers are desirable to contain an abstract, introduction, methodology (materials and methods), results, discussion, and references. Authors are recommended to present details of the suppliers listed in the materials section. Short articles (Practical notes) which describe a novel teaching/learning aid are of interest. Such manuscripts do not require an abstract, and the demarcation between sections may not be clear.
4. Country reports: this section aims to give readers the latest information about science/ biology education in the Asian and neighboring countries.
5. Biological resources: this section aims to give information about biological science research whose results are considered to be useful for resources of biology education at a certain level of education. The author(s) should refer to how the results or the research itself are useful for biology education at that level.

Other articles giving some information about biology education, teaching aids, printed and electronic references, etc. will also be accepted. These will generally not be refereed. Abstracts of the papers presented by oral or poster at the latest AABE conference will automatically be published.

Editorial organization and reviewing process

The Editor-in-Chief is appointed by the Executive Committee of the AABE and has final responsibility for all editorial decisions. The Editorial Board processes all manuscripts that are received.

When a manuscript is received the Editor-in-Chief will first judge whether its content falls

within the scope of the AABE Journal. Manuscripts that are simply to confirm previous work, are too highly specialized, or are felt not to be of interest to the general readership of the Journal will be returned without review. At least two members of the Editorial Board will be involved in these decisions.

After this preliminary review, the manuscript of a full paper categorized as “Reviews,” “Research reports,” “Practical reports” or “Biological resources” will be sent to two referees to ensure that the paper is applicable to biology education and that the science and/or educational research is sound. The review process is completely anonymous. Referees are selected based on their competence in specialized areas of biology and education. If referees disagree, or if in the opinion of the Editor the paper has not been sufficiently considered, it will be sent to a member of the Editorial Board to aid in arbitration.

If the manuscript is returned for revision the author should reply to the specific recommendations in a covering letter stating how each point has been addressed. If any recommendations have been disregarded the reasons should be given. The revised manuscript should be returned to the Editor-in-Chief within 3 months, after which it will be considered a new submission and will undergo the full review process.

Submission of manuscripts

Sending files

Only electronic submission is acceptable. Manuscripts should be sent by e-mail to Dr. Nobuyasu Katayama (nobukei@oregano.ocn.ne.jp), the Editor-in-Chief, *Asian Journal of Biology Education*.

Formats

We can accept:

- MS Word document files
- MS Excel spreadsheet documents files
- Acrobat files

Authors should ensure that the paper meets the guidelines listed below for the preparation of manuscripts. Manuscripts including Tables and Figures should not exceed the number of pages given below:

Review: 12 pages, Research report: 12 pages, Research note: 4 pages, Practical report: 12 pages, Country report: 8 pages, Biological resources: 8 pages, other articles: 2 pages.

Presentation of manuscripts

All contributions must be in English and be as succinct as possible. They should not be under consideration by any other journal. Authors should emphasize the educational setting and the relevance to biology education in the Asian-Pacific region. Papers should contain a clear description of the context to which they relate, and should show the relevance of the results and insights in both their specific setting and in any general setting to which they may also relate.

The manuscript should be typed on A4-sized papers using single line spacing (ca. 36 lines/page) throughout. The recommended font is 12 point, Times New Roman. The

margins should be 3 cm wide and pages numbered consecutively.

Cover page layout

The first page will be a cover sheet and should include:

- (1) A title which clearly describes the content of the manuscript;
- (2) The name(s) and affiliation(s) of the author(s) – the author for correspondence with his/her address and e-mail address should be clearly indicated;
- (3) A running title of no more than 50 characters including spaces;
- (4) Up to seven key words;
- (5) A brief description of the article (less than 200 characters).

The second page

The second page should contain the title of the paper, and an abstract (no more than 200 words). In order to ensure anonymous and fair refereeing, the name(s) or affiliation(s) of the author(s) should not be indicated on the second and following pages.

General notes

Footnotes and appendices

Footnotes are discouraged except the cover page, and all material should be placed in the main body of the text. If notes are required they should be numbered sequentially and placed at the end of the paper. Appendices may be used if they are essential to understand the manuscript.

Units, symbols, abbreviations and nomenclature

The International System of Units (SI) should be used throughout. All symbols or abbreviations should be defined when first used. Full stops are not used after unit symbols. For biological nomenclature the use of scientific names is recommended. If desired, the common name of the organism should be shown in parentheses after the recommended name. For chemical nomenclature the rules of the International Union of Pure and Applied Chemistry (IUPAC) should be followed.

Tables

Tables should be numbered consecutively. Each table with its number, heading and any footnotes should be embedded in the text where it should most naturally occur. The table caption or heading should be self-explanatory.

Figures

Graphs, line drawings and photographs should be numbered consecutively. Each figure with its number and caption should be embedded in the text where it should most naturally occur. The journal will accept color pictures. If you have any queries, please consult with the Editor-in-Chief.

Line illustrations

Graphs and drawings must be presented to a high professional standard. It is desirable to prepare these figures in the same scale to be printed. Full-size A4 figures may be accepted, but the size will normally be reduced to one quarter or one half A4, depending on the level of detail present. Because of the requirements of such editorial treatment, every figure should be prepared to be edited easily by the MS Word software.

Photographs

Photographs must be clear, good quality black and white or color pictures, and JPEG-formatted. Any lettering required should be printed directly on the photograph by the author. The insertion of a scale on the photograph is preferable to a statement of magnification in the caption.

References

It is expected that the majority of the references will be easily accessible to a wide range of educators. References in the text should be given as follows:

Pell and Wörman (2009) or **(Pell and Wörman, 2009)**. Papers with three or more authors should be cited as **Hedde et al., 2010**. When an author has published two or more papers in one year, the references should be distinguished by referring to **Hedde et al. (2007a)** and **Hedde et al. (2007b)**, etc. Where more than one reference is given at the same point in the text, they should be listed chronologically.

References at the end of the paper should be listed alphabetical order by the family names of the first authors and should include the author's initials and the full title of the paper. Titles of journals must be given in full, followed by the volume number, and the first and last page numbers in full:

Hedde, M., Bureau, F., Chauvat, M. and Decaëns, T. (2010) Patterns and mechanisms responsible for the relationship between the diversity of litter macro-invertebrates and leaf degradation. *Basic and Applied Ecology* 11: 35-44.

References to books and monographs should include in the order as follows: author or editor, year of publication, title of book, edition, chapter, and/or page reference (if desired), publisher and town of publication. For example:

Futuyma, D. J. (2009) *Evolution*, 2nd ed. Sinauer Associates, Inc., Sunderland, MA, USA.

Pell, M. and Wörman, A. (2009) Biological wastewater treatment systems. In: Jørgensen, S. E. (ed.) *Ecosystem Ecology*, pp. 166-180. Elsevier, Amsterdam.

Electronic/web-based resources should be included in the reference list. These should include web name, address and date of access:

Science and Plants for Schools (SAPS), <http://www-saps.plantsci.cam.ac.uk/> accessed 20/10/2010.

Copyright

When papers are accepted, authors are asked to assign copyright, in print or electronic form, to AABE. The association is then responsible for dealing with requests for printing or copying, and for protecting authors' right.

Authors must obtain written permission to use any material, which has been published elsewhere, in their articles. They must also include in their manuscripts any credits requested to the source. Photocopies of letters granting permission should be presented with submitted manuscripts.

It should be noted that where potential authors feel they may have a topic which would be suitable for *Asian J. Biol. Educ.*, advice and guidance is freely available from the Editor-in-Chief and the members of Editorial Board.

Editorial Board (2008-2010)

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[From the Editor]

First of all, I apologize for the delay in publishing the fourth volume of the *Asian Journal of Biology Education (Asian J. Biol. Educ.)*.

This volume contains two research reports and two practical reports as well as one country report. The abstracts of the papers presented at the 21st and the 22nd Biennial Conferences of the AABE are also included. The former conference was held at Kongju National University, Gongju, South Korea, from 25 to 28 October, 2006, and the latter was held at the ANA Gate Tower Hotel, Osaka, Japan, from 21 to 24 November, 2008.

Regarding the practical report by Iwama, *et al.*, I'd like to make a comment on it. As mentioned at the bottom of the first page of the article, the major parts of the contents of the paper have already been published in a Japanese journal on science education. However, the Editorial Board decided to publish this paper in the *Asian Journal of Biology Education* because the subject matter in the manuscript reflected trends in the teaching and learning of biology in schools in Japan, and seemed to be interesting and informative for the journal readers outside of Japan. As mentioned by the authors, the study showed that fish dissection is a meaningful form of experiential learning that promotes active learning and student engagement in exploring biological concepts.

Still, we have some papers and reports submitted from the AABE members and other contributors. In addition, we have the abstracts of papers presented at the 23rd Biennial Conference of the AABE which was held at the

National Institute of Education, Singapore, from 18 to 20 October, 2010. Those papers and abstracts may be in the next issue which will be published soon. The Editorial Board, however, would like to ask the AABE members and the readers to submit their research reports and practical reports to this journal. For preparing the manuscript, please refer to "**Instructions to Contributors for the Asian Journal of Biology Education**" which has revised recently and is included in this volume.

As mentioned in the cover page, Dr. C. H. Diong, Dr. Churdchai Cheowtirakul, Professor Jae Young Kim, Professor Rosie S. Madulid and Professor Koichi Morimoto became new members of the Editorial Board in 2008. With the transfer of the AABE Website from Australia to Japan, Dr. Laurie Laurenson, the former production editor of this journal, has finished his job. I deeply appreciate his effort to establish the AABE Website and his contribution to the publication of three volumes of the *Asian J. Biol. Educ.*

I am very thankful to the following persons for their effort to review some of the articles which are included in this volume: Dr. Hideo Kitano, Professor Masahiko Nakamura (Joetsu University of Education), Dr. Kiyoyuki Oshika (Aichi University of Education), Dr. Takayuki Sato, (Hiroshima University), Professor Hidenori Ubukata (Hokkaido University of Education), and Dr. Robert Wallis (University of Ballarat). I am also grateful to Mr. John R. Cantillon for his help to prepare the final draft of the volume.

Dr. Nobuyasu Katayama