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# The Asian Journal of Biology Education

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**Research Paper**

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## Progress toward the Construction of an International Web-based Educational System Featuring an Improved “SimRiver” for the Understanding of River Environments

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The United Nations has designated water sanitation and safety as one of millennium goals and has emphasized the role of international cooperative efforts in achieving this goal. Promoting awareness to the nations about riverine environments is one approach to this goal and science education has the potential to actualize it. “SimRiver,” a program simulator that uses diatoms to enhance the understanding of the relationship between human activity and water quality, is a useful tool for achieving this aim. While previous studies have indicated the advantages of using SimRiver in classroom activities, these studies also revealed the necessity for bringing about improvements in several areas. Revisions were made in both the software itself and in the lesson plans incorporating the use of software, and the effectiveness of these revisions was assessed via a questionnaire study. The results suggest that classroom activities incorporating both the improved version of SimRiver and the enhanced lesson plans succeed in promoting the awareness of river environments more effectively than the previous ones, and in motivating students to conduct additional independent study. In addition, a multilingual version of SimRiver has currently been developed for international use based on the original Japanese version. Web-based multilingual educational teaching aides composed of a Web-based SimRiver simulator, streaming movies, visual tools and a reporting system for classes using these tools are also being prepared in order to encourage international communication in the spirit of the United Nations’ millennium development goal.

Keywords: *diatoms, river environment, SimRiver, video movie, web-based system*

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## Introduction

The United Nations has designated water sanitation and safety as one of its millennium development goals and has emphasized the role of international cooperative efforts in achieving this goal (United Nations, Web-based resource). The proportion of the population that is able to continuously access purified water is one of the indices for evaluating progress toward this goal. The introduction of both water purification and sewage systems can effectively increase this index. However, promoting national awareness of aquatic environments is also a necessary step in accomplishing this United Nations' goal. Science education has the potential to help accomplish this objective.

"SimRiver" is a useful software application that can provide an enhanced understanding of the relationship between human activity and water quality (Katoh *et al.*, 2004; Mayama, 2006). However, previous trials of the software in classroom settings demonstrated the need for improving some of its components as well as the lesson plans associated with its implementation (Mayama *et al.*, 2008).

In this study, we address these issues and further present a multilingual Web-based educational system for promoting the development of a collaborative international network focused on aquatic environmental education.

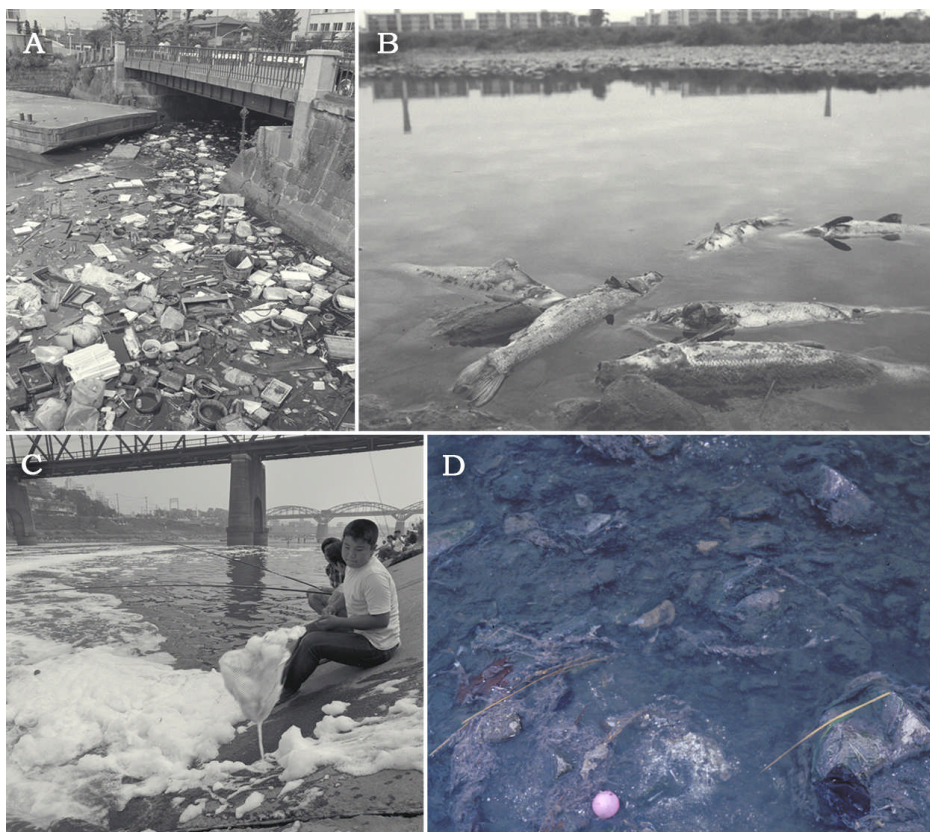
## River Pollution

The relationship between river systems and human activity varies both regionally and nationally. Today, in Asian countries with high population densities, sanitary conditions of river systems are often diminished due to an inflow of domestic sewage. In North American and European countries, however, water quality is often diminished through an inflow

of fertilizer from agricultural activities.

Over time, water quality in these regions has both worsened and improved based on human interactions. The Japanese economy developed rapidly from the mid-1950s to mid-1970s, resulting in the severe pollution of many of the nation's rivers (Fig. 1). Following this development period, the amount of dumped garbage decreased, but the water quality still suffered due to a direct inflow of domestic sewage that continued until the 1980s. Similar aquatic conditions occurred in North American and European countries during this period. In the late 1960s, environmental pollution was a growing concern in the United States and Canada. In the early 1970s, Lake Erie, a part of the St. Lawrence River, was declared "dead" due to extreme levels of chemicals and other pollutants (Environment Canada, Web-based resource). In Europe during the late 1970s, the Main River was in a grave condition due to heavy sewage from German industrial plants (Lange-Bertalot, 1978, 1979). In Korea, which has seen an economic boom since the middle of the 1960s, the Han River became heavily polluted until the end of the 1980s due to the city's dense population and industrial activities in its catchment area (Environmental Information Network in North East Asian Region, Web-based resource).

While these countries have attempted to overcome their serious water problems by enacting protective legislation, expanding their sewage systems, and developing treatment technologies, these efforts have not fully resolved their water contamination issues. Japan, for example, has achieved substantial improvement in its urban areas, e.g., in Tokyo sewer coverage is at 99%, but in 13 of its 47 prefectures, coverage remains under 50% because of mountainous landscapes (Ministry of



**Figure 1** Polluted rivers in Tokyo, 1960-1970's. **A.** Much strewn garbage. **B.** Dead fish caused by  $O_2$  deficiency. **C.** Huge amount of foam caused by domestic detergent. **D.** Gunmetal-grey water and riverbed covered with slime. A-C. ©Tokyo Metropolitan Government Bureau of Environment.

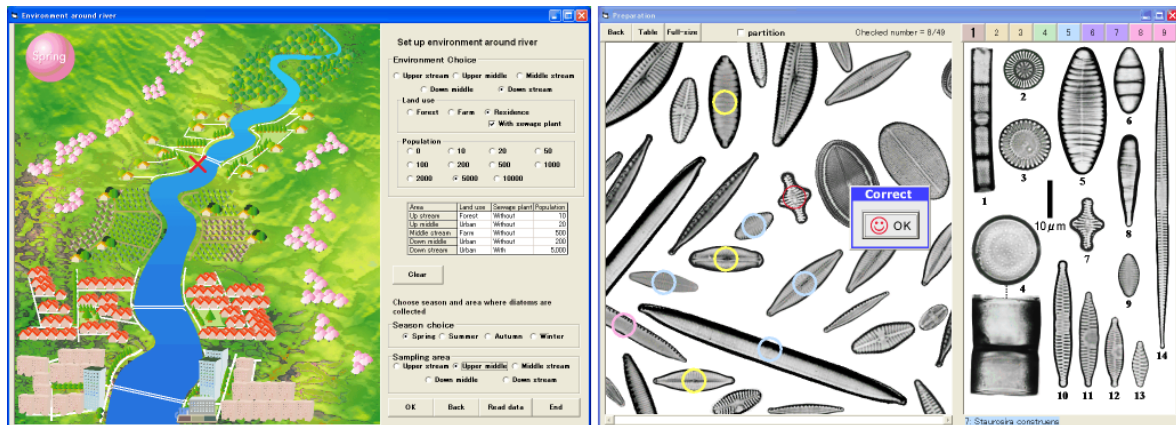
Land, Infrastructure, Transport and Tourism, Web-based resource). Moreover, outside these nations, there are regions around the world where water protection and sanitation have barely improved. This situation is particularly prevalent in parts of Asia, South America and Africa.

### Difficulty in Using Science Education to Solve Environmental Problems

Because alterations in river environments usually take place over an extended period of time, it can be difficult for students to understand the actual process of environmental change within short-term classroom settings. Therefore, students tend to accept information regarding environmental degradation of rivers as mere knowledge, with a lack of meaningful

context. As experience-based exercises are often most effective in science learning, we developed SimRiver, a software simulation package. In the program, land use, population, the presence of sewage treatment plants, and the seasons can be manipulated, allowing students to create a variety of river environments. Students can evaluate the impact of environmental manipulation through the use of computer-generated diatom communities reflecting the water quality in electronic river systems (Katoh *et al.*, 2004; Mayama, 2006) (Fig. 2). Students utilizing the SimRiver package can therefore better understand the relationships between human activity, river water quality, and diatom communities.

Although the term “diatom” is found in every science textbook in Japanese junior high



**Figure 2** SimRiver ver. 3, English version. Set up window for environment along a river (left). A view of a computer-synthesized diatom slide equipped with a built-in identification support system (right).

schools (Katayama, 2010), the word is often inset with only a small photograph or drawing identifying them as aquatic microorganisms, with no further explanation. Consequently, despite their great potential for science education, diatoms are organisms that are not well known by students or teachers (Mayama, 2005). To promote the awareness of diatoms and their utility in science education, we developed additional educational tools that can support lessons utilizing the SimRiver program. These additional resources include a three-part streaming video series (see Mayama et al., 1996, for the original scenario) and a

Flash video collection of diatoms, “Visual knowledge” and “Encyclopedia.” These resources are available at the following site (Fig. 3):

<http://lhm.ab.a.u-tokyo.ac.jp/%7Ekeiso/diatom4/>

**SimRiver**

Brief Review of the Software Development

The release of SimRiver dates back to the beginning of this decade. The archetype of SimRiver was not a simulator but simple HTML Web pages supporting diatom identifications. These Web pages were composed of a dry lab utilizing diatoms, which came from



**Figure 3** The top page of the comprehensive website “Let’s learn about river environments from microorganisms, Diatoms” available in Japanese.

the paper-based version of the lab (Ueyama and Kobayasi, 1986). Junior high and high school students carried out the exercise using the dry lab favorably in an extracurricular setting (Mayama, 2001). The development of the simulator version, SimRiver ver. 1, began in 2002, when a program for water quality estimation and a display program for the diatom community were combined.

Once together, the reliability of the computer-generated data was tested. Moreover, since they had been used for 17 years by some local governments (e.g., Tokyo Metropolitan Government Bureau of Environment, 2003), three categories of diatom pollution tolerance (Kobayasi *et al.*, 1985; Kobayasi and Mayama, 1989; Mayama, 1999) were employed as parameters for a saprobic index within the simulator. These categories were as follows: Group A, the most tolerant diatoms; Group B, moderately tolerant diatoms; and Group C, sensitive diatoms (for further details, see Kobayasi and Mayama, 1989).

SimRiver ver. 2 was created based on the results of various tests of ver. 1 (Katoh *et al.*, 2004). The use of this tool was welcomed by many students and motivated some of these students to learn more about river environments and seemed to increase their understanding of water resource issues (Mayama *et al.*, 2008). However, a detailed TWINSpan analysis of the students' own written descriptions of the subject indicated that nearly 40% of them did not hold an interest in water resource issues, but were merely interested in manipulating the simulator and testing overall performance (Mayama *et al.*, 2008).

#### Software and Lesson Plan Improvement

In this study, we improved not only SimRiver ver. 2, but also the lesson plan designed for classes using the software (Table 1).

The previous lesson plan focused on let-

ting students understand the relationships between human activities, water quality, and diatom communities, by only using a saprobic index. However, as this index was difficult for students with poor math skills to calculate, the use of this index resulted in the potential loss of students' interest. In the revised lesson plan, we intended to focus the students' attention on species richness as well as the ratio of species, which were classified into three categories of diatom pollution tolerance. In biology education, learning the relationship between a species and its environment is critical in understanding the concept of bioindicators. To support students understanding of the principle of bioindicators, the improved version, SimRiver ver. 3, generates a graph in each simulation, demonstrating the ratio of species in three pollution tolerance categories. In the same window, a map of a river reflecting the environmental parameters that have been modified by the user on the initial setup screen, is displayed (Fig. 4).

Additionally, the operation of the built-in identification support system was changed to simplify its use and save time, i.e., all operations requiring a right-click were omitted. In the revised lesson plans, we also included time for watching the part 1 of the video "Diatom." *Assessment of SimRiver ver. 3 through a Class Survey*

To assess the operability of SimRiver ver. 3 and to understand students' interest in the activities, a questionnaire survey was conducted in the classes to which the revised lesson plan including the use of above-mentioned educational tools had been applied. The classes surveyed included junior high school A (public, coeducation), junior high school B (private girl's school), high schools A and C (public, coeducation, almost all students intend to go on to university), high school B (public,

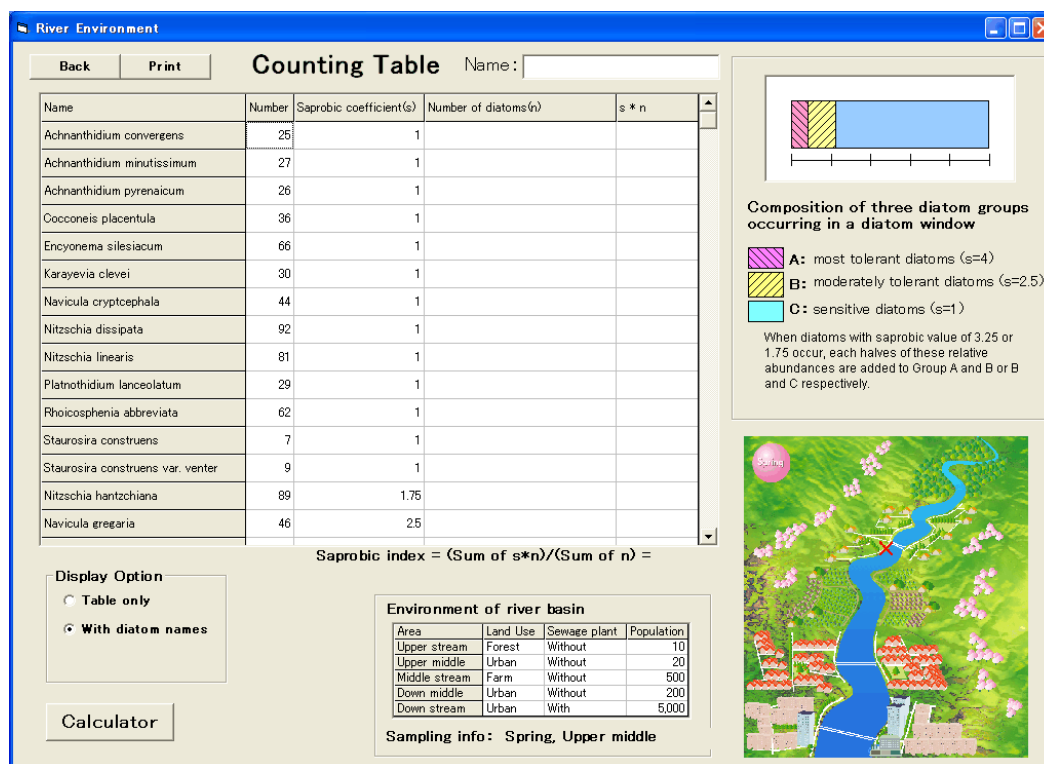
**Table 1 Improved lesson plan. The basic plan is shown below, the details of which were slightly changed when implemented in classes depending on the student levels.**

Time	Activity
0 (min)	<p>Introduction</p> <p>* Teacher shows a bottle of mineral water to the students and asks "Has anyone tasted water like this?""**</p> <p>Students: "yes."</p> <p>* Teacher: "Why did you drink it?"</p> <p>Students: "Tap water doesn't taste good."</p> <p>* Teacher: "Do you know why tap water doesn't taste good?"</p> <p>Students: "No I don't."</p> <p>* Teacher: "Chemicals are added to tap water at water purification plants. Why are chemicals added?"</p> <p>Students: "The water is polluted."</p> <p>* Teacher: "Heavily polluted water is not used for tap water, but the addition of chemicals is necessary for making sure it is safe to drink."</p> <p>Teacher: "Do you know how people can know the level of water pollution?"</p> <p>Students: "Maybe we can use a chemical or electric sensor."</p> <p>Teacher: "Yes. But there is another method, in which people employ organisms as a bioindicator to assess a river environment. In this lesson I will introduce diatoms as an example of a bioindicator."</p>
8	<p>Video</p> <p>* Watch part 1 of the video "Diatoms"***</p>
13	Teacher answers students' questions
16	Teacher questions the students
18	<p>Explanation of the activity using SimRiver.</p> <p>* Level 1 is used for easy understanding of the software operation.</p>
35	<p>Student group activity</p> <p>* In each group, composed of 5 students, the members discuss what environments they will create along two different rivers in the software and decide who will handle which area.</p>
45	<p>Student personal activity using SimRiver at level 3</p> <p>Each member sets up his or her environment, which is shared with the other members of the same group, and then works on an assigned area.</p> <p>* After obtaining their results, the data will be exchanged among the members in order to give them an understanding of the changes of species richness, the ratio between species classified into the three categories of diatom pollution tolerances, and a saprobic index corresponding to the river environment from upstream to downstream.</p>
100	Discussion
110	End

\* Newly added activity in the improved lesson plan.

\*\*Japanese were not accustomed to drinking bottled water on a regular basis until about 25 years ago. In the past 20 years, the consumption of bottled water has increased.

\*\*\* We produced parts 1 to 3 of the video. The contents of part 1 are an easy introduction of diatoms and a method of diatom collection in a river system.



**Figure 4 SimRiver ver. 3, English version. Window of counting table with a newly added environment map and a graph which shows the ratio of the counted diatoms classified into three categories.**

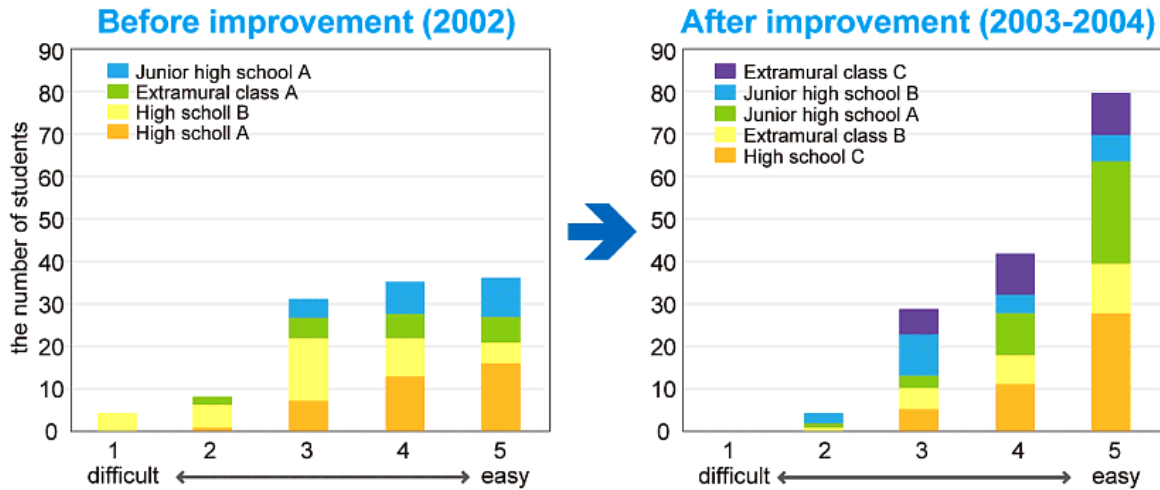
coeducation, almost all students intend to go on to vocational college), and extramural classes A, B, and C (composed of junior high and high school students who attended the classes voluntarily). The survey questions used for these evaluations were identical to those used in a previous study (Mayama *et al.*, 2008). For each question, students were asked to choose one number from a one-to-five attitude scale, corresponding with their opinion. Although the learners were different between the present and previous classes, the results indicated a significant shift in the students’ response, suggesting a substantially successful improvement (Figs. 5, 6). In fact, poor scores (one to three on a five scale) were recorded less frequently in the present survey compared to the previous one despite an increment of the total number of students. Differences in scoring patterns for high school B

and junior high school B, when compared to other classes, may be related to the specific profiles of these schools and students above mentioned in parentheses.

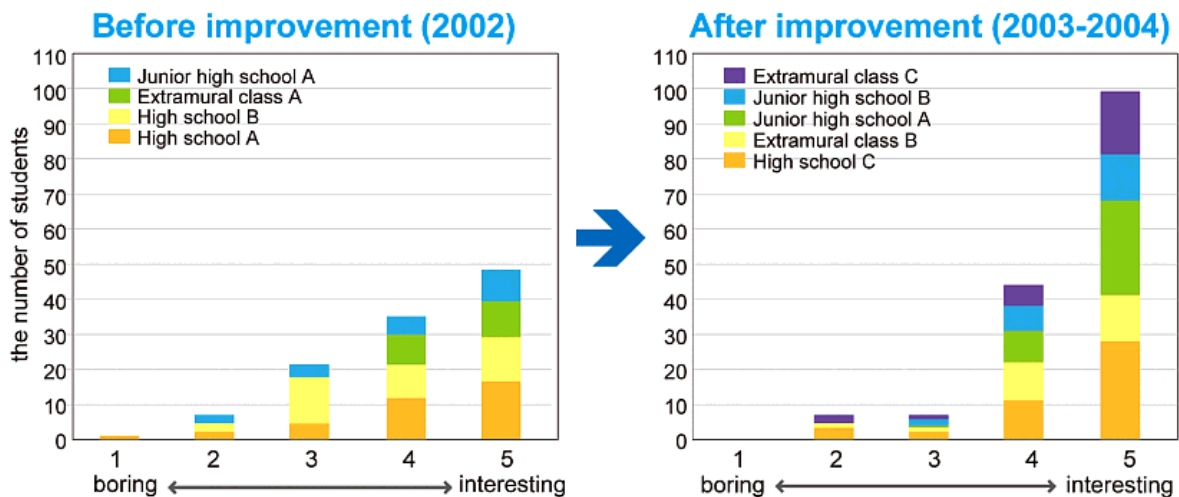
The questionnaire survey also showed a qualitative difference in the written descriptions between previously surveyed classes (Mayama *et al.*, 2008) and classes that had applied the revised lesson plans developed in this study. Examples of typical descriptions in the previously surveyed classes include the following:

- “Creating an environment on my own was a good experience.”
- “The game-like learning was easy and fun.”
- “I felt the lesson period to be shorter than usually.”
- “If such classes increase, I will have more fun in school.”

Remarkably, descriptions reflecting a



**Figure 5** Comparison of operability between the ver. 2 and ver. 3 of SimRiver software assessed by students. N=114 (2002) and N=156 (2003-2004). Left graph: after Mayama *et al.* (2008).



**Figure 6** Comparison of students' interest in the lesson between the classes using the former lesson plan with SimRiver ver. 2 and those using the revised lesson plan with SimRiver ver. 3 and the video movie. N=114 (2002) and N=156 (2003-2004). Left graph: after Mayama *et al.* (2008).

concern for environmental protection and an attitude toward taking care of the environment in daily life were written by students who had been given a set of the improved program and lesson plan. Such descriptions include the following remarks:

- "If the environment becomes good, water quality will be better and organisms, which cannot live in polluted water, can increase. This means the conservation of the envi-

ronment is linked to the conservation of organisms."

- "I learned that thinking about the global environment where we live is very important. I think of the importance of attitude to seeking what I can do for making environment better."
- "It is important that each person thinks about something good to do for our environment and does not depend solely on the

self-purification of rivers or on solutions made by limited specialists.

In the previous survey, 43.8% of the respondents did not show any interest in river environments in their written descriptions (Mayama *et al.*, 2008), and thus a resolution of this problem was expected in the use of the new program and lesson plan. In the present survey, the descriptions showing an interest only in the use of the computer or software decreased to 7.7–13.6% in 5 different classes (10.8% in total descriptions), and the ratio of descriptions referring to river environments increased to 88.6% (Table 2).

The question for the written descriptions was “What thoughts do you have after this lesson?” and did not try to elicit any specific answers, allowing the students to write a description reflecting their own personal and

spontaneous awareness. Therefore, the results indicate that the improvements in the software and lesson plan were effective for the promotion of student awareness of river environments.

In the survey for students at high school C, we added additional questions concerning their understanding of bioindicators and their motivation for further study. The students were again asked to select one number from a one-to-five attitude scale, corresponding with their opinion. This self-assessment indicated a possible effect of the lesson plan incorporating SimRiver on promoting student understanding of bioindicators (Fig. 7) although it should be confirmed by additional quantitative testing. The survey also indicated an increased motivation for further study in many students (Fig. 8).

**Table 2 Comparison of student concerns regarding river environments between the previous and present surveys. In the present survey, the improved software and lesson plans were used in the class activities.**

Group*	Previous survey** (%)	Present survey					
		Junior high school B (%)	High school C (%)	Extramural class B (%)	Extramural class C (%)	Junior high school A (%)	Total (%)
A	43.8	13.6	12.8	12.5	7.7	7.7	10.8
B1	21.4	36.4	23.4	33.3	34.6	43.6	33.5
B2	12.5	36.4	51.1	45.9	53.9	43.6	46.9
C	21.4	13.6	10.6	8.3	3.8	5.1	8.2
D	0.9	0	2.1	0	0	0	0.6
Sum	100	100	100	100	100	100	100
n	112	22	47	24	26	39	158

\* Groups recognized in past written descriptions (Mayama *et al.* 2008).

A: composed of students who described only an interest in the use of either the computer or software.

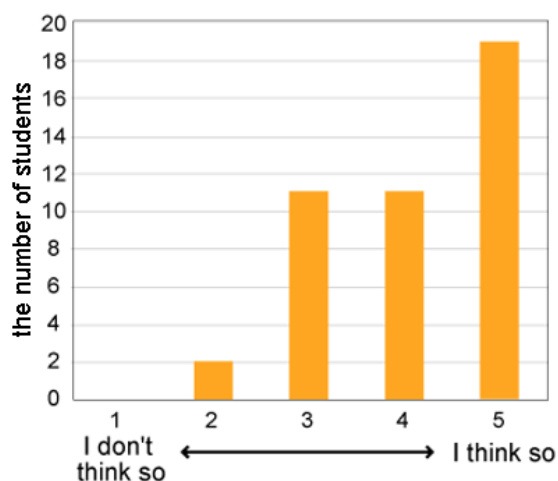
B1: composed of students who described an interest in the use of either the computer or software, and referred to rivers, the environment, and/or diatoms.

B2: composed of students who described an interest in the self-creation of an environment in the software operation and referred to rivers, the environment, and/or diatoms.

C: composed of students who did not show an interest in the computer and software, but referred to diatoms and the entire lesson.

D: composed of students who showed no interest in the lesson.

\*\* Mayama *et al.* (2008)

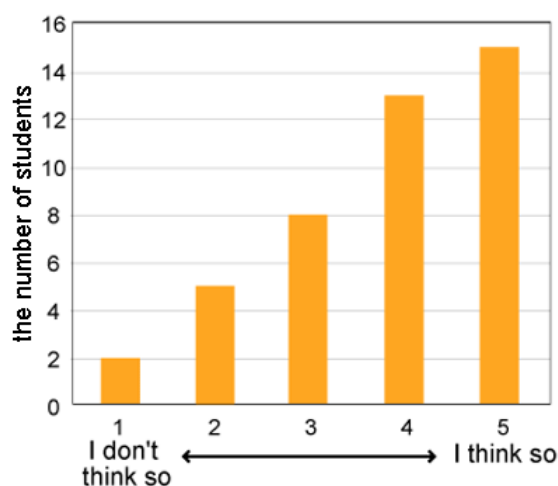


**Figure 7** Students' self-assessment on promotion of the understanding of bioindicators. N=43. [Question: Do you think that your understanding of bioindicator was promoted?]

After the implementation of the new lesson plan used in this study, we introduced our project in many other situations, thus exposing more than 1,700 students to the lesson. We have also analyzed the effectiveness of the lesson in these cases and have partially reported on the results of these implementations (Mayama *et al.*, 2007, 2009; Nakamura *et al.*, 2008). Despite the fact that diatoms were not familiar organisms to the students prior to the implementation of the lesson, these results also indicate a promotion of student awareness on aquatic environments.

### Production of Multilingual Educational Tools

SimRiver and its related educational tools were originally produced in Japanese, and it became necessary to prepare versions in other languages for international use. We believe the use of native languages is important in the promotion of a nation's awareness of river environments, as most classes in every country are taught in their native tongue. Therefore, we have begun producing multilingual editions of the SimRiver and its support tools based on



**Figure 8** Students' self-assessment on motivation for further studies. N=43. [Question: Do you want to collect and observe diatoms?]

the original Japanese version. At present, we have completed video programs on diatoms in English, Korean, Portuguese, Polish, Thai, German, French, Spanish, Russian and Chinese, and the SimRiver software has been packaged in English, Korean, Portuguese, Thai, German, Spanish, Chinese and French. Additionally, Russian and Indonesian versions of the software and an Indonesian version of the video program are currently in production. As students tend to be familiar with only their own present river environments, we also offer multilingual visual tools at a Website to introduce the circumstances of various water environments in different areas and in different time frames in order to enhance student insight on aquatic issues worldwide. Completed products are available on the website "Diatom Project." (Fig. 9):

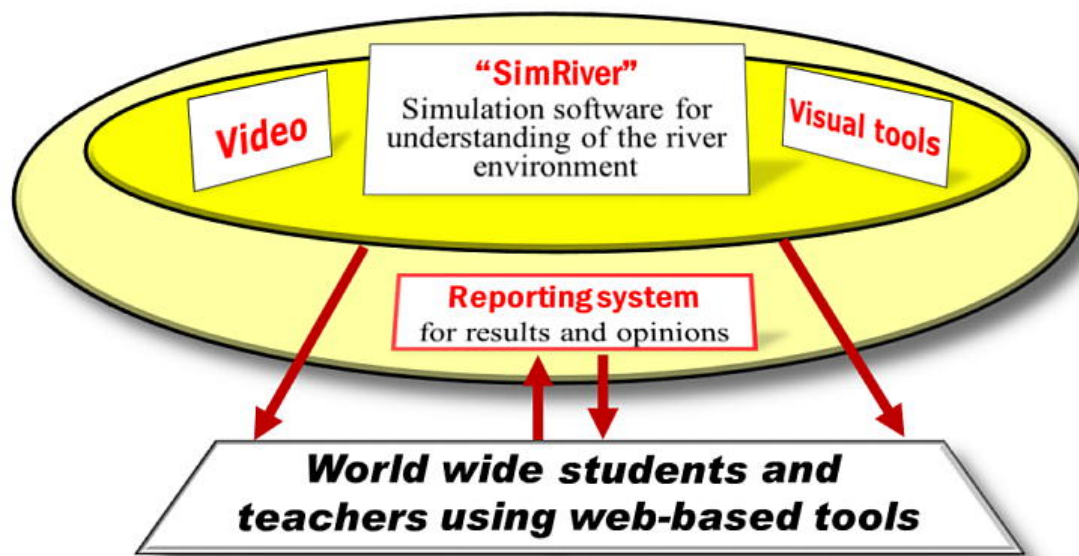
<http://www.u-gakugei.ac.jp/~diatom/>

### Construction of an International Educational System

To achieve the objective of our project, we are developing an advanced Website system (Fig. 10). In this system, we have



**Figure 9** Top page of the website “Diatom Project” from which users can access the multilingual educational tools. (accessed 01/10/2010)



**Figure 10** Diagram of a web-based educational system for international understanding through river environment.

produced SimRiver ver. 4 in Japanese, programmed using Java Script and HTML, which can be used directly on a Web browser. SimRiver ver. 3 needs to be downloaded and installed on a computer before use, as it was originally written in Visual Basic. However,

school computers often have security protocols limiting software installations, and therefore teachers have to spend a great deal of time preparing the classroom computers before using ver. 3 of the software. The SimRiver ver. 4 is being improved based on the results of

preliminary trials conducted at two junior high schools (unpublished data). After the modifications are complete in the Japanese version, various language versions of SimRiver ver. 4 will gradually be produced; very recently, an English version was released (Hoffer *et al.*, 2011). The downloadable versions will still remain on the Website, "Diatom Project," for schools in the regions where Internet access is inconvenient.

The combination of video program, the SimRiver program itself, and other visual tools creates a unique system that allows students to learn about changes in river environments from the past to the future during a class course.

The use of the same educational tools will be able to promote students' ability to compare thoughts about river water issues from a shared perspective. To facilitate this opportunity, we are preparing a reporting system that will be located on a Website for gathering classroom results based on their use of these tools. The system will be composed of a form for gathering their thoughts and opinions, a table showing their reports, a map indicating the areas where the reporters live, and simple automatic translators. Using this system, students will be able to share and compare their experiences with others around the world. This system will also allow students to communicate easily and internationally, resulting in the promotion of global friendships.

Various results, impressions, and opinions reported on the Website from classes around the world will lead students to discover not only the differences in river environments, but also the different thoughts of people spreading across the globe. This is meaningful for students to understand variations in national circumstances, allowing them to contemplate worldwide cooperation. Thus, the effective execution of this system will be a significant

event for sustainable development, and will allow us to invite people from any country to join the project in order to help in accomplishing this goal.

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### References

- Hoffer, J., Mayama, S., Lingle, K., Conroy, K. and Julius, M. (2011) SimRiver, environmental modeling software for the secondary science classroom. *Science Scope* **34**(5): 29-33.
- Katayama, N. (2010) How algae have been treated in compulsory science in Japan, with special reference to diatoms. *Diatom* **26**: 47-50. (in Japanese)
- Kato, K., Mayama, S., Omori, H. and Seino, S. (2004) Construction of "SimRiver": a simulation program for river epilithic diatom assemblage composition. *Japan Journal of Educational Technology* **28**: 217-226. (in Japanese)
- Kobayasi, H., Mayama, S., Asai, K. and Nakamura, S. (1985) Occurrence of diatoms collected from variously polluted rivers in Tokyo and its vicinity, with special reference to the correlation between relative frequency and BOD<sub>5</sub>. *Bulletin of Tokyo Gakugei University, Sect. 4* **37**: 21-46. (in Japanese)
- Kobayasi, H. and Mayama, S. (1989) Evaluation of river water quality by diatoms. *Korean Journal of Phycology* **4**: 121-133.
- Lange-Bertalot, H. (1978) Diatomeen-Differentialarten anstelle von Leitformen: ein geeigneteres Kriterium der Gewässerbelastung. *Archiv für Hydrobiologie Suppl.* **51**, *Algological Studies* **21**: 393-427.

- Lange-Bertalot, H. (1979) Toleranzgrenzen und Populationsdynamik benthischer Diatomeen bei unterschiedlich starker Abwasserbelastung. *Archiv für Hydrobiologie Suppl.* **56**, *Algological Studies* **23**: 184-219.
- Mayama, S. (1999) Taxonomic revisions to the differentiating diatom groups for water quality evaluation and some comments for taxa with new designations. *Diatom* **15**: 1-9.
- Mayama, S. (2001) An educational tool for learning water environment using diatoms on Internet. *Sorui* **49**: 219-220. (in Japanese)
- Mayama, S. (2005) A novel approach to the popularization of diatomology: An exhibition of diatoms, presented as a fusion of science and art (4). *Diatom* **21**: 61-70.
- Mayama, S. (2006) Study of water quality in river and lake with diatoms – Water environment elucidated by microorganisms. In: Okazaki, M. and Fujisawa, K. (eds.) *Scientific subjects leading improvement of scholastic ability: Promotion of a motivation to study focusing on power to utilize knowledge in biology education*. pp. 70-73. Tokyo Hourei, Tokyo. (in Japanese)
- Mayama, S., Katoh, K., Omori, H., Seino, S., Kokubuda, K. and Oshikata, K. (2008) Trial and evaluation of "SimRiver": Educational simulation software for assessment of river water quality using diatoms. *Japanese Journal of Biological Education* **48**: 10-20. (in Japanese)
- Mayama, S., Takahashi, O. and Yuasa, T. (2007) A case study of training students as science communicators in a teaching training college under the college system. *Journal of Science Education in Japan* **31**(4): 380-390. (in Japanese)
- Mayama, S., Ueyama, S., Mayama, N. and Kobayashi, H. (1996) A video program showing the procedure for collection and observation of diatoms used for evaluation of river water quality. In: Kitano, H. et al. (eds.) *Biology Education to Nonbiology Majors. Proceedings of the 15th Biennial Conference of the Asian Association for Biology Education*. pp. 184-189. AABE, Tokyo.
- Mayama, S., Watanabe, T., Katoh, H. and Omori, H. (2009) The application of SimRiver as a data resource for the study of biodiversity in higher education. *Environmental Education Studies, Tokyo Gakugei University* **18**: 23-37. (in Japanese)
- Nakamura, M., Mayama, S. and Katoh, H. (2008) A program to promote students' awareness to river environment at a junior high school: A case study of environmental education featuring a simulation-software "SimRiver". *Environmental Education Studies, Tokyo Gakugei University* **17**: 61-78. (in Japanese)
- Tokyo Metropolitan Government Bureau of Environment (2003) *Report of survey on aquatic organisms 2003*. Department of Environmental Assessment of Tokyo Metropolitan Government, Tokyo. (in Japanese)
- Ueyama, S. and Kobayashi, H. (1986) A dry laboratory set of the water quality estimation method using diatoms in high school biology. *Bulletin of Tokyo Gakugei University, Sect. 4*, **38**: 55-77. (in Japanese)

### Websites

- Environment Canada. *A short history of the Great Lakes water quality agreement*. <http://www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=F9B3C836-1> <accessed 05/07/2009>
- Environmental Information Network in North East Asian Region. *Environmental status and environmental administration of Korea*. [http://www.npec.or.jp/northeast\\_asia/en/environmental/page03.html](http://www.npec.or.jp/northeast_asia/en/environmental/page03.html) <accessed 05/07/2009>
- Ministry of Land, Infrastructure, Transport and Tourism. *Sewerage*. <http://www.mlit.go.jp/crd/sewerage/policy/pdf/01.pdf> <accessed 05/07/2009>
- United Nations. *Goal 7: Ensure environmental sustainability*. <http://www.un.org/millenniumgoals/environmental.shtml> <accessed 05/07/2009>

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**Research Paper**

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## Embedding Academic Skills Development in Course Delivery

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Innovative approaches need to 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 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 a case study that involves a discipline specialist working with an academic skills advisor to enhance student generic skills. It discusses the patchy nature of current implementation of programs for generic skill education.

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

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### Introduction

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. For some time now there has been recognition of the importance of generic skills in higher education (Clancy and Ballard, 1995; Jolly, 2001; Hager *et al.*, 2002). Most tertiary institutions have adopted a set of generic skills that are considered necessary attributes of students when they graduate. However, to ensure that these attributes are indeed developed by students during their courses, they must be implemented within the curriculum of the discipline that the students are studying.

A problem often encountered in education is that the skills and knowledge of the discipline have been the focus of teaching programs with

the generic skills being overlooked. It is the aim of this paper to present an investigation into the acquisition of generic skills by students studying Environmental Science at the tertiary level. The paper firstly presents a background discussion on the nature and scope of generic skills before presenting the results of the research. Finally some recommendations are made as to how generic skills can be embedded into the Environmental Science curriculum alongside the theory and practice of the discipline.

### Background

Environmental Science is an enormous field of study that incorporates learning knowledge and skills applicable to problems and issues that span from the global through local to ecosystem and chemical scales. Within the discipline it is recognised that just as important as the facts and concepts are the processes through which we can add to our current knowledge. With the use of the *Scientific Method*, we can

add to our current understanding through observation, hypothesis testing, experimental design and analysis, and through publication. To disseminate new knowledge, it is imperative that (along with the theory and practice of Environmental Science) we teach our students a number of important generic skills.

Quite often all the emphasis for learning is placed 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 skill(s) development. Generic skills are defined by Hager *et al.* (2002) as

*the skills, personal attributes and values which should be acquired by all graduates, regardless of their discipline or field of study. In other words, generic skills should represent the central achievements of higher education as a process* (Higher Education Council, Australia, 2002).

Most universities in Australia have adopted in one form or another a set of graduate attributes that include a set of generic skills that all graduating students should have been taught at some time during their studies. For example, at Deakin University skills considered generic include:

- Critical analysis, problem solving and creative thinking;
- Identifying, gathering, evaluating and using information;
- Communicating effectively and appropriately in a range of contexts;
- Developing, planning and managing independent work;
- Working effectively as part of a team;
- Effectively using information and communication technologies; and
- Applying knowledge learnt in the program to new situations (Deakin University, 2008).

There are a number of reasons why generic attributes have been given so much attention by the higher education sector (Hager *et al.*, 2002) including employability and the ability to share the knowledge of the discipline. The Australian Department of Education Training and Youth Affairs (2000) found that employers are looking for communication and interpersonal skills and an ability to problem solve as key attributes in graduates seeking employment. It also found that new graduates generally were lacking in these types of skills. Thus it appears that such skills, which increase the employability of the graduates (Hager *et al.*, 2002), need to be given more attention. A good set of generic skills can help disseminate the knowledge and skills across disciplines. This is particularly important in Environmental Science, which embraces an interdisciplinary approach. Transdisciplinarity, discourse across disciplines, is an essential requirement to tackle some of the complex environmental issues faced by the world today. A set of generic skills offers graduates a starting point for bridging the gap between disciplines enhancing their ability to learn from, as well as, to teach those from other disciplines. This will also enhance their capacity to work in multidisciplinary teams.

Although it is well accepted across Australian tertiary institutions that generic attributes should be integrated with the teaching of disciplinary content, the challenge is to ensure that the generic skills are indeed embedded within the curriculum of the discipline. Sumison and Goodfellow (2004) outlined the difficulties and tensions involved in embedding skills development in course content and bringing about curriculum change. They attributed the limited success of this approach in the main to the fact that generic attribute acquisition has been a managerial-driven agenda, which has failed to bring academic staff on board. They also suggest that

in many Australian universities there has been insufficient resourcing to support curriculum change. Other constraints include the fact that the knowledge and skills of the discipline are often considered paramount by teachers, there is much knowledge to impart, and the teachers have been trained to develop curriculum content rather than teaching the required generic skills. Students also tend to think about their learning in terms of the discipline knowledge rather than skills development (Langer, 1992, pp. 83-84). Again there has been much debate about how transferable generic attributes may be across contexts, and whether or not the generic concept idea is seen as being more relevant to vocational training than higher education (Sumsion and Goodfellow, 2004; Moore & Hough, 2005). There are very few studies which provide evidence to support specific pedagogical approaches to integrating the teaching of generic skills.

With the idea of curriculum reform in mind, we set about conducting a small research project to investigate some of the assumptions outlined above. The focus was the assessment task as a construct for the development of generic skills. The following section presents the results of the project, which aimed to evaluate whether or not generic skills were adequately embedded into our Environmental Science course.

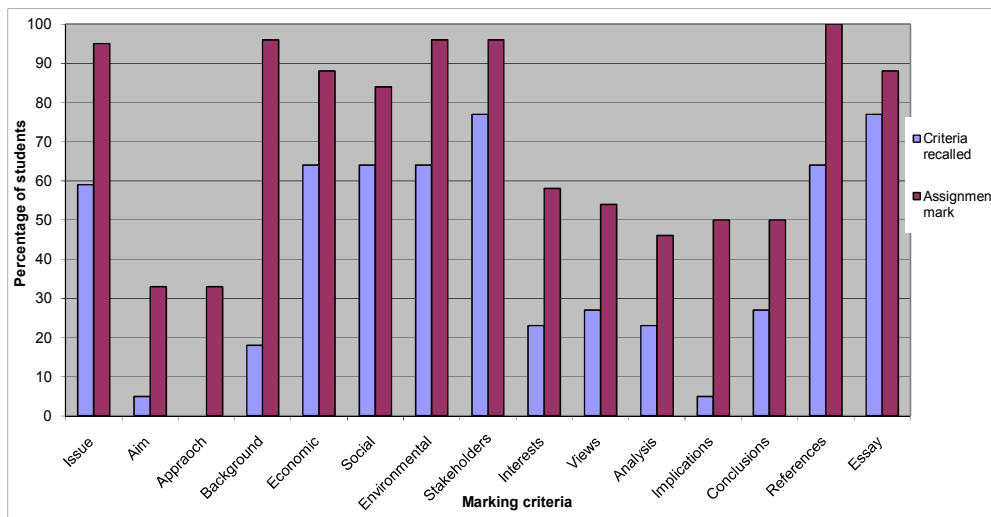
### **Evaluating generic skills**

In this investigation we set out to evaluate how well generic skills are embedded into the Environmental Science degree program at Deakin University, Warrnambool campus. We worked with a select group of students (n=25) completing their third university year and included two generic skills in our evaluation: writing and critical analysis. These two skills were selected as firstly, concern has recently been

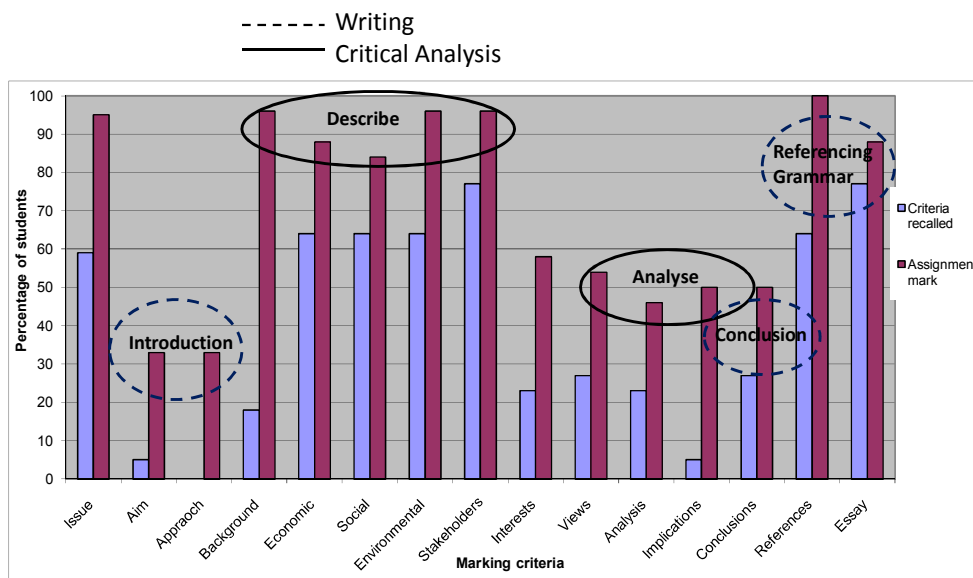
expressed in Australia that students lack basic grammar and writing skills, and that these skills are not being acquired by students during their course of study (Hart and Edwards, 2007). Secondly, critical analysis is considered not only an important generic skill but also a skill important for graduates of the Environmental Science discipline. Our hypothesis was that if these skills were well embedded into the teaching of the course then students should perform well in an assessment task that required them to demonstrate these skills.

Our approach was to set a writing task in the form of an essay that required the students to critically evaluate a current environmental issue. A two hour workshop was conducted by two teaching staff: an academic skills adviser teaching the basic rules of good essay writing and an environmental scientist to discuss the steps involved in a good critical analysis. Toward the end of the session the assessment criteria that would be used to measure how well the students had met the learning objectives was developed, using student input, providing students an opportunity to draw on their current understanding of these tasks and some clarity on what was expected of them. Students were required to record these criteria for later reference. One week prior to the assessment submission date, during class time, students were asked to recall the assessment criteria, so that these were reiterated prior to students submitting their work.

The assessment results, although pleasing demonstrated that in some areas some students had not yet acquired the necessary generic skills. All (100%) students passed the assessment task and one student received full marks. Figure 1 presents on the X-axis an abbreviated list of the marking criteria and shows that student's could recall a number of these one week prior to the submission date. It also shows the student's over-



a)



b)

**Figure 1 Assessment task marking criteria and student performance: a) compares percentage recall of marking criteria one week prior to submission and percentage of students who address each criterion, b) demonstrates where the strength and weakness are in the students' assessment tasks.**

all performance across the different criteria when the essay was marked. In Figure 1a) it can be seen that for those criteria that students could recall one week prior to the submission date their performance was higher than for those they did not recall. In Figure 1b) it can be seen that student writing skills were stronger and critical analysis skills weaker. For the assessment of writing skills all students gained full marks for referencing their work (a skill that is reinforced in every unit that they undertake), however many struggled to write good introductions and conclusions. For the critical analysis students demonstrated good skills at describing and presenting data, but poor skills in critically analysing the data (the information they had gathered). In terms of feedback the students were very positive about the whole evaluation process, and felt that they had learnt much from this exercise.

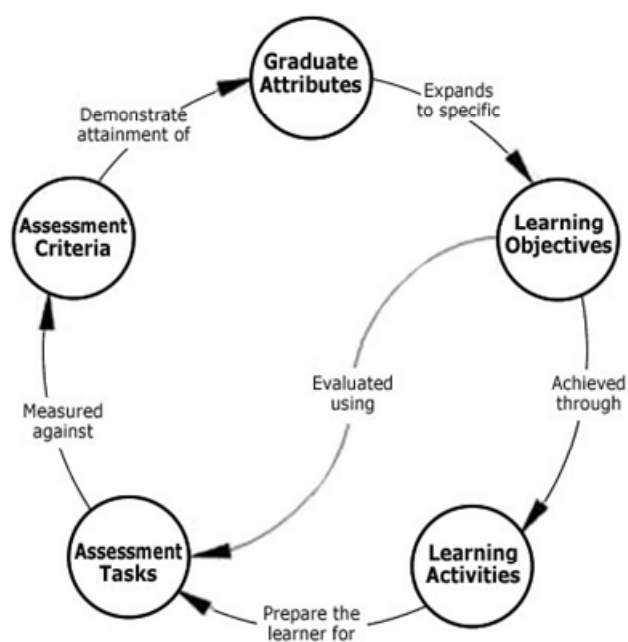
### Discussion

Writing is always included in generic skills as is critical analysis. It is evident from this evaluation project that there is still some way to go to ensure that graduates do possess the generic skills that employers and universities would like them to have as they embark upon their new careers. The evidence presented from this evaluation shows that in Environmental Science, although students demonstrated adequate writing skills, improvements can be made in teaching some of the important components of good writing, such as writing good introductions and conclusions. It also suggests that critical analysis is not a skill well developed by the students in their third year of university studies, and therefore some effort must be made to embed this into the curriculum. Academic staff, who have been trained in the discipline, may need professional development programs to assist them in developing learning activities that help with teaching the students how to critically ana-

lyse data, information and issues. Although the evaluation was conducted in a one-off situation over one teaching semester it has been an informative process that can form the basis for further trials on methods to better incorporate the teaching of generic skills in our course. The evaluation undertaken supports the view that the uptake and implementation of generic skills into higher education curriculum is patchy (Barrie and Jones, 2002).

Environmental Science as with other science disciplines is technical in nature yet environmental scientists spend much of their careers in non-technical work, as do graduates from other disciplines. The curriculum should be shaped not only by the nature of the discipline but also by professional requirements, aspirations and abilities of the students, and the needs of society (Jolly, 2001). Teaching and learning processes that embed generic skills need greater attention. A number of barriers to embedding generic skills in teaching and learning processes exist. These include differences in the understanding academics have of what generic skills are, a lack of funding directed to implementation generic skills programs (Barrie and Jones, 2002), and the lack of adequate training for teaching staff (trained in their discipline) on how to develop courses and programs that embed graduate attributes and generic skills. Jolly (2001) provides some guidance for implementing graduate attributes as shown in Figure 2, and this process includes similar steps to how one would go about preparing courses for units of study within the discipline. However, by making the learning objectives for the generic skills explicit during the course development stage there is a greater possibility that these skills will be embedded into the teaching of the course.

With this project, the assessment task provided a meaningful way of integrating the acquisition of skills with content. Rather than just set-



**Figure 2 A process for implementing graduate attributes (Jolly 2001)**

ting the assessment task, the skills involved were ‘scaffolded’ during the workshop. Students then actively placed themselves in the position of the audience and determined the criteria that would be used to evaluate the quality of the writing. Moore and Hough (2005) suggest that assessment tasks that require students to adopt identities other than that of their own, and to write for different audiences can also promote the acquisition of different generic attributes.

The development of Environmental Science courses which successfully embed skills will be enhanced by collaboration between staff from the discipline (in this case environmental science) and the language and learning staff. For this project, the lecturer in Environmental Science and the learning adviser were working together over a period of time, trialling different approaches and reflecting on how these had helped students to better understand the discipline practices of their discipline. Crosling and Wilson (2005) describe this as the staff with ex-

pertise in the discipline being able to “identify and articulate the goals of the disciplinary community,” while the learning adviser “has the resources to interpret and therefore explain these as writing practices” (p. 7). The pedagogical and professional affiliation described in this project helped to create an environment that not only improved student’s academic performance, but also promoted the development of metacognitive skills. That is students were asked to think about how they might approach an assessment task that required critical thinking. The challenge in planning courses is to integrate skills development in such a way that students develop into successful learners in their discipline, and are also able to transfer core skills into other settings.

### **Conclusion**

There is no doubt that the future prospects for graduates either moving into the work force or heading into research through post graduate

studies are much improved if, as well as a strong knowledge of the theory and practice of the discipline, they have a strong set of generic skills. To ensure this outcome learning objectives, activities and assessment tasks for generic skills must be given consideration at the earliest stages of course development. Collaboration between discipline specialists and learning skills advisers is one way of enhancing the course development. Also academics must be supported in trialling new initiatives to embed generic skills within their teaching programs, better evaluation of the acquisition of generic skills is required, and sharing of these findings will provide the feedback needed to determine the best approaches to teaching these skills.

## References

- Barrie, S. and Jones, J. (1999) Integration of academic writing skills in university courses: A model for generic attributes curriculum development. In: Rust, C. and Gibbs, G. (eds.) *Improving Student Learning*. The Oxford Centre for Staff Development, Oxford. pp. 479-489.
- Clanchy, J. and Ballard, B. (1995) Generic skill in the context of higher education. *Higher Education Research and Development* 14(2): 155-166.
- Department of Training and Youth Affairs (2000) Employer Satisfaction with Graduate Skills, Research Report, *AC Nielson Research Services, Evaluations and Investigations Programme, Higher Education Division, Commonwealth of Australia*.
- Hager, P., Holland, S. and Beckett, D. (2002). *Enhancing the learning and employability of graduates: The role of generic skills*. Business/Higher Education Round Table Position Paper No. 9. Melbourne, Australia.
- Hart, C. and Edwards, V. (2007) More uni English woes tipped. *The Australian*, January 30th 2008.
- Higher Education Council, Australia (1992) *Achieving Quality*. Higher Education Council, National Board of Employment, Education and Training, Canberra: Australian Government Printing Service.
- Jolly, L. (2001) *Graduate attributes Fact Sheet 1.10 Implementing Graduate Attributes*. The Value Added Career Start Program, University of Queensland, Brisbane Australia.
- Langer, J. (1992) Speaking of knowing: Conceptions of understanding in academic disciplines, In: Herrington, A. and Moran, C. (eds). *Writing, teaching and learning in the disciplines*. New York, MLA. pp. 69-85.
- Sumsion, J. and Goodfellow, J. (2004) Identifying generic skills through curriculum mapping: a critical evaluation. *Higher Education Research and Development* 23: 329-346.

## Websites

- Crosling, G. and Wilson, A. (2005) *Creating a Rich Environment: Co-operation between academic support and disciplinary teaching staff*. Paper presented at LAS 2005 conference Critiquing and reflecting.  
[www.aall.org.au/conferences/2005/las/papers](http://www.aall.org.au/conferences/2005/las/papers)  
<accessed 4/12/ 2008>
- Deakin University (2008) *Higher Education Courses – Operation Policy*. Deakin University.  
<http://theguide.deakin.edu.au/TheDeakinGuide.nsf/e1d4531a98f1364aca256e44001a0613/d675c4939d755566ca2573b00000a7dd>  
<accessed 5/30/ 2008>
- Moore, T. and Hough, B. (2005) *The perils of skills: Towards a model of integrating graduate attributes into the discipline*. Paper presented at LAS 2005 Conference, Critiquing and Reflecting.  
[www.aall.org.au/conferences/2005/las/papers](http://www.aall.org.au/conferences/2005/las/papers)  
<accessed 4/12/2008>

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**Practical Report**

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## Determining the Antioxidant Property of Plant Extracts: A Laboratory Exercise

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Vegetables and fruits are good sources of free radical scavengers or antioxidants. To evaluate the free radical scavenging activity of a plant extract, a few simple steps using the 1,1-diphenyl-2-picryl hydrazyl (DPPH) assay can be followed. Any plant part can be processed to produce crude extracts which can be used for testing. Using this technique, a small class of tertiary students determined the antioxidant property of ethanolic crude leaf extracts of some endemic and indigenous plants. The plants used were *Ardisia pyramidalis* Roth (Myrsinaceae), *Baccaurea tetrandra* (Baill.) Mull.Arg. (Phyllanthaceae), *Chisocheton pentandrus* (Blanco) Merr. (Meliaceae), *Ficus septica* Burm. (Moraceae), *Parameria laevigata* (Juss.) Moldenke (Apocynaceae), *Parartocarpus venenosus* (Zoll. & Moritzi) Becc. (Moraceae), *Streptocaulon baumii* Decne. (Asclepiadaceae), *Uncaria perrottetii* (A. Rich) Merr. (Rubiaceae), and *Voacanga globosa* (Blanco) Merr. (Apocynaceae). Crude leaf extracts of *U. perrottetii* and *B. tetrandra* were observed to possess a high free radical scavenging activity with values beyond 90% of that of gallic acid. These were fractionated further, and subsequent assays showed that ethyl acetate fractions for both plants had high free radical scavenging activity indicating that they contain potential chemopreventive agents against many diseases such as cancer, cardiovascular disorders and aging. Free radical scavenging activities demonstrated by leaf extracts of *A. pyramidalis* and *C. pentandrus* did not reach 70% of that of gallic acid. All the rest of the plant extracts showed very low or no free radical scavenging activity.

**Keywords:** *antioxidant, chemopreventive agent, diphenyl picryl-hydrazyl, free radical scavenging activity*

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### Introduction

Production of free radicals takes place as a result of normal metabolic processes in the body especially that which happens during cellular respiration in the mitochondria. Reactive oxygen or nitrogen species are detrimental to biological molecules in the cells, hence destroying cell membranes, nucleic acids and proteins which in turn

lead to aging and other diseases such as cardiovascular diseases and cancer.

The search for free radical scavengers is thus an important component in drug discovery. Most of the antioxidants are part of our diet including the polyphenolic variety such as flavonoids (Haninen *et al.*, 2000).

It is thus important to teach tertiary students

of biology and chemistry some techniques to determine the presence of free radical scavengers in any test samples.

This paper reports the results of undergraduate college students in a small laboratory class who collected test plants and processed them for determination of free radical scavenging activity. The class aimed to find antioxidant-rich plants from the forested mountains in Kanawan, Morong, Bataan, Philippines. As the area is a part of the ancestral domain of a community of indigenous Filipino people, a series of meetings was held between the community, the researchers and the students to come up with the Memorandum of Agreement (MOA) between the researchers and the community elders for this purpose. The preliminary investigations in the present study lead to a number of undergraduate theses.

## Materials and Methods

### Collection, Extraction and Purification

Students collected leaves from nine endemic and indigenous plants from the mountainous forests of Kanawan, Morong, Bataan, Philippines. Identification was authenticated by Mr. Leonard Co and Dr. Daniel Lagunzad, curators of the Jose Vera Santos Herbarium, Institute of Biology, University of the Philippines, Diliman. Voucher specimens were deposited also at Jose Vera Santos Herbarium, Institute of Biology, University of the Philippines, Diliman from 2007 to 2008.

Air dried leaves were homogenized, soaked in 95% ethanol for 48 hours, filtered and concentrated *in vacuo* to yield the crude ethanol extract. Extracts that were found to possess high free radical scavenging activity (as can be computed below) were partitioned in hexane and ethyl acetate. The hexane and ethyl acetate fractions were concentrated by rotary evaporation and air-dried overnight. Thereafter, the air dried samples were dissolved in dimethyl sulfoxide (DMSO) to a concentration of 4 mg/mL for use in the subsequent assays.

### Assay for free radical scavenging activity using 1,1-diphenyl-2-picrylhydrazyl (DPPH)

Following the procedure of Hou *et al.* (2004), a 300  $\mu$ M free-radical solution was prepared by dissolving 1,1-diphenyl-2-picrylhydrazyl (DPPH) in absolute ethanol. Then 95  $\mu$ L of the DPPH solution was dispensed to 96-well plates. From the 4 mg/ml of extracts solutions, 5  $\mu$ L was dispensed to each well to make final volumes of 100  $\mu$ L. A 4 mg/mL gallic acid solution served as the positive control while DMSO served as the negative control for the assay. At least three replicates were made for the controls and extracts. The plate was then incubated at 37°C for 1 hour. After incubation, absorbance was read at 515 nm. From the absorbance, the free radical scavenging activity of each crude leaf extract relative to that of gallic acid was computed using the following formula with slight modification:

$$\text{Percent Free Radical Scavenging Activity} = \left( \frac{Abs_{DMSO} - Abs_{extract}}{Abs_{DMSO} - Abs_{gallic\ acid}} \right) \times 100$$

At least three trials were made for each extract..

## Results and Discussion

As Hou *et al.* (2004) implied, the assay for free radical scavenging activity using the stable free radical DPPH was simple, rapid, and replicable. Similar exercises have been done by tertiary

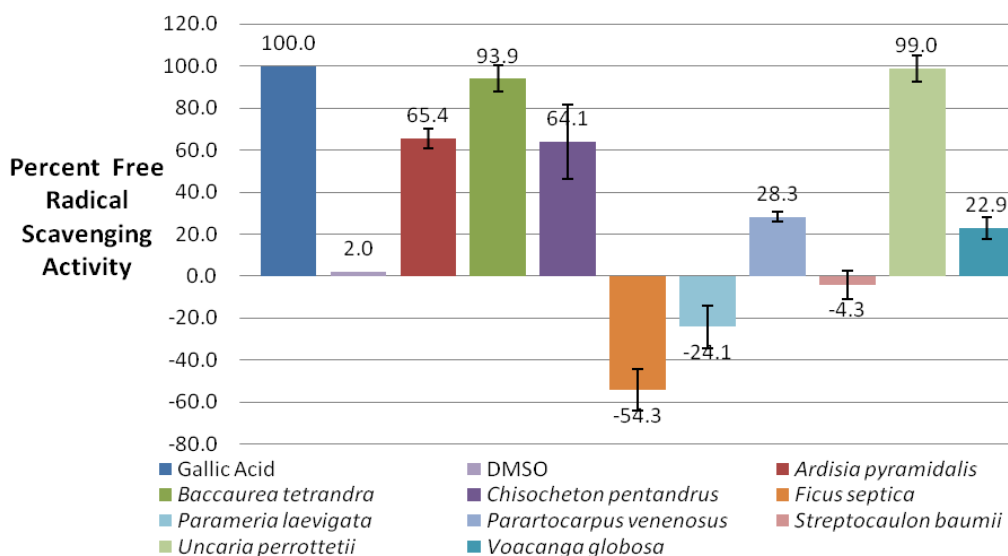
and secondary students using different plants for undergraduate thesis and science investigatory projects.

In this report, DPPH free radical scavenging activity with respect to gallic acid was calculated

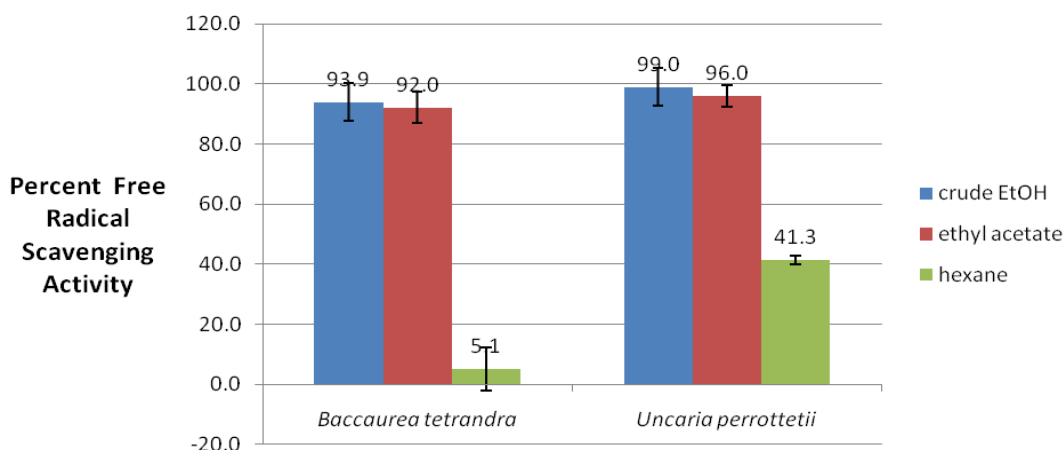
for each of the ethanolic crude leaf extracts (Fig. 1). Two extracts were observed to have a high DPPH free radical scavenging activity (>90%): *B. tetrandra* and *U. perrottetii*. Hence, these were further partitioned in hexane and ethyl acetate fractions and were subsequently tested for the same DPPH free radical scavenging activity.

Results in Figure 2 showed that the ethyl acetate fraction had significantly higher DPPH free radical scavenging activity. This indicated that the active compounds were polar since ethyl acetate can extract more polar compounds compared to hexane.

All the other crude extracts yielded moderate



**Figure 1** Free radical scavenging activities relative to gallic acid assayed using the 1,1-diphenyl -2-picryl hydrazyl in the crude ethanolic extracts of selected plants from Kanawan, Morong Bataan, Philippines. Each value represents the mean of three trials with three replicates per extract per trial. DMSO: dimethyl sulfoxide. Bars represent standard deviations.



**Figure 2** Free radical scavenging activities relative to gallic acid of the ethyl acetate and hexane fractions of the crude ethanolic leaf extracts of *Baccaurea tetrandra* and *Uncaria perrottetii* from Kanawan, Morong Bataan, Philippines using the 1,1-diphenyl -2-picryl hydrazyl assay. Each value represents the mean of three trials with three replicates per fraction per trial. Bars represent standard deviations.

activity, such as *A. pyramidalis* and *C. pentandrus*, or low activity, such as *P. venenosus* and *V. globosa*. *F. septica*, *P. laevigata* and *S. baumii* showed no activity (Fig. 1).

The high percent DPPH free radical scavenging activity indicates that these extracts contain antioxidants. The potent antioxidant nature of the active extracts makes them potential sources of chemopreventive compounds or compounds that can significantly prevent carcinogenesis and other diseases (Tseng *et al.*, 2001; Albert-Baskar and Ignacimuthu, 2010). This suggests that further purification is needed to isolate the active compound or compounds that are antioxidants and are potentially chemopreventive.

It is interesting to note that the most potent free radical scavenging activity was observed from the extract of an endemic plant, *U. perrottetii*, which is used as food by the indigenous tribes of Aytas in Bataan. As *U. perrottetii* has not been studied at all in terms of its medicinal potential, this is the first report of bioactivity coming from this plant. *U. tomentosa*, a related plant, is used as tea by native Peruvians and is believed to possess the following properties: immunomodulation, anti-bacterial, antimutagenic, diuretic, depurative, hypotensive and vermifuge (<http://www.herbalremedies.com/samstren6030.html>). *U. perrottetii* may also confer the same dietary benefits because of its antioxidant property.

Development of tea from *U. perrottetii* is also next in the plans as part of the MOA between the indigenous group of Aytas and the University of the Philippines, Diliman, with the former as the primary beneficiaries of any nutraceuticals that may result from the research project.

### Acknowledgements

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### References

- Albert-Baskar, A. and Ignacimuthu S. 2010. Chemopreventive effect of *Cynodon dactylon* (L.) Pers. extract against DMH-induced colon carcinogenesis in experimental animals. *Experimental and Toxicologic Pathology* **62**: 423-431.
- Hanninen, O., Kaartinen, K., Rauma, A. L., Nenonen, M., Torronen, R., Hakkinen, S., Adlercreutz, H. and Laakso, J. 2000. Antioxidants in vegan diet and rheumatic disorders. *Toxicology* **155** (1-3): 45-53.
- Hou, W. C., Wu, W. C., Yang, C. Y., Chern, H. J., Liu, S. Y. and Lin, Y. H. 2004. Antioxidant activities of methanol and hot-water extracts from leaves of three cultivars of Mai-Men-Dong (*Liriope spicata* L.). *Botanical Bulletin of Academia Sinica* **45**: 285-290.
- Tseng, T. H., Tsheng, Y. M., and Lee, Y. J. 2001. Cytotoxicity effects of di- and tri-hydroxybenzaldehydes as a chemopreventive potential agent on tumor cells. *Toxicology* **161**: 179-187.

### Websites

- <http://www.herbalremedies.com/samstren6030.html>  
<accessed December 15, 2009>

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**Country Report**

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## **Transitions in the Course of Study for Biology Education in Japan Focusing on Lower Secondary Schools**

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Ever since the Course of Study (CS) draft in 1947, revision has been carried out about every 10 years. In 1969, the curriculum requirement for lower secondary school students in grades 7 – 9 (3-year timeframe) was 420 periods of science study. In 1977, the requirement was 350 periods; in 1989, it was 315 – 350 periods; and in 1998, it was 290 periods. After this decrease, 2008 has brought a significant increase in requirements. The CS revised in 2008 specifies 385 periods of science as necessary. The new CS for science emphasizes the following aims: to be actively engaged in nature and natural phenomena; to develop the ability to analyze, explain and express the results of observations and experiments; to develop an attitude of respect towards life and contribute to conservation of the natural environment. The CS for science was revised as to the following subject matters. In classification, according to the former CS, we taught Spermatophyta and Vertebrata only, but the newly revised version includes Cryptogamae and Invertebrata. It also reintroduces the study of heredity and evolution, including mention of DNA. Finally, in the unit 'Nature and Humans,' the topic 'conservation of the natural environment and use of scientific technology' is added. Specifically, the new CS calls 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.

*Key words: Course of Study, lower secondary school biology, periods of science study, science curriculum improvements*

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### **The transitions in the Course of Study in Japan**

Although the transitions in the Course of Study (CS) in Japan from 1947 to 1989 were already reported by Katayama (1993, 1998a), I would like to review them further, and present an update.

In 1947, a new mandate for education in Japan began, and a tentative CS was published. Since then, revision has been carried out about

every 10 years. Since 1958, there has been a short period of 3 or 4 years between the times of notification and enforcement (Table 1).

Table 2 shows school hours allotted to science per year for each grade in compulsory education schools. In the first and second grades, science has been replaced by life environment studies since 1989.

In Table 3 and the attached graph, totals for school hours allotted to science for elementary

and lower secondary schools are shown. As Katayama (1998a, 1998b) pointed out, the curriculum requirements for compulsory education schools had been decreasing since 1977. After

**Table 1 The year of notification and enforcement**

ELEMENTARY		LOWER SECONDARY		UPPER SECONDARY	
notification	enforcement	notification	enforcement	notification	enforcement
1947	1947	1947	1947	1947	1948
1951	1951	1951	1951	1951	1951
				1955	1956
1958	1961	1958	1962	1960	1963
1968	1971	1969	1972	1970	1973
1977	1980	1977	1981	1978	1982
1989	1992	1989	1993	1989	1994
1998	2002	1998	2002	1999	2003
2008	2011	2008	2012	2009	2013

**Table 2 School hours for science per year at each grade level in compulsory education schools**

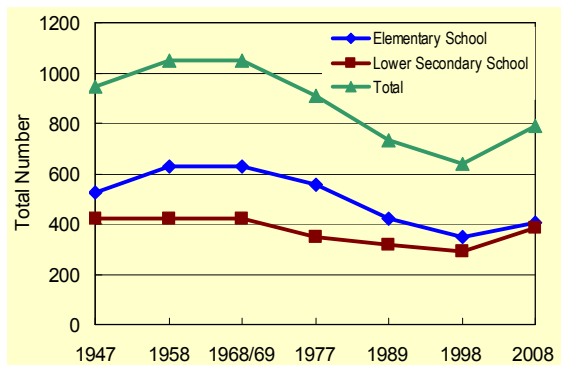
	Elementary School*						Lower Secondary School**		
	1	2	3	4	5	6	1	2	3
1947	70	70	70	105	105~140	105~140	140	140	140
1951							105~175	145~175	140~175
1958	68	70	105	105	140	140	140	140	140
1969	68	70	105	105	140	140	140	140	140
1977	68	70	105	105	105	105	105	105	140
1989	LIFE ENVIRONMENT STUDIES		105	105	105	105	105	105	105~140
1998			70	90	95	95	105	105	80
2008			90	105	105	105	105	140	140

\* Elementary school: One unit school hour is a class period of 45 minutes.

\*\* Secondary school: One unit school hour is a class period of 50 minutes.

**Table 3 Transition of total number of school hours for science per year in compulsory education schools**

	Elementary S.(minimum)	Lower S. S. (minimum)	Total
1947	525	420	945
1958	628	420	1048
1968/69	628	420	1048
1977	558	350	908 ↓
1989	420	315	735 ↓
1998	350	290	640 ↓
2008	405	385	790 ↑



a continuous decrease in the requirements, there was a significant increase in the requirements in 2008.

### The characteristics of each Course of Study

◇ *The 1947 version*: this tentative CS was based on practical matters in daily life. For example:

- What roles do animals play for people, and what is the purpose of breeding animals?
- Investigation of harmful animals. Discussion of ways to protect oneself from harmful animals.
- What is the biological composition of our clothes? (The characteristics of plant fibers, animal fibers, etc.)

◇ *The 1958 version*: much more time was allotted to science subjects, and the Two-field System\* was introduced into lower secondary school science. A systematic approach to biology was adopted. For example:

- Classification of Vertebrata,
- Structure of animal bodies,
- Function of animal organs, etc.

◇ *The 1968 version*: the key characteristic of the revised CS was learning scientific methods through the process of inquiry. Yet, at the same time, emphasis was placed on achieving high levels of technological proficiency. Thus, much additional content was included.

These conflicting pressures and the added study burden resulted in a greater number of students who disliked science. Also, more problems of students' behavior surfaced and came to be recognized as a social issue. Out of that, study for realizing the preciousness of life, and pressure-free education came to be proposed.

◇ *The 1977 version*: the revised CS included a policy of education that was "rich in humanity" and free of pressure. Excess content

which seemed to overly burden students was eliminated by careful selection, and learning through direct experience was emphasized. There was also a reduction in school hours.

◇ *The 1989 version*: the revised CS called for "education to develop students' individual personalities". Thus, many electives were offered to match students' individual interests and abilities (Katayama, 1998a).

For elementary schools, a new subject 'Life Environment Studies' was introduced into the first and second grades, and the study of science started from the third grade.

In addition, a five-day school week system was introduced for every other week in 1995. School hours continued to be reduced.

◇ *The 1998 version*: the new CS extended the five-day school week system to include every week from 2002. Major emphasis was on fostering "zest for living (IKIRU-CHIKARA, in Japanese)" in children (Ministry of Education, Science, Sports and Culture, 1998a, 1998b).

The following description is given on the MEXT (Ministry of Education, Culture, Sports, Science and Technology) website:

<http://www.mext.go.jp/english/org/struct/014.htm>,

"The CS seeks to foster the qualities and abilities necessary to acquire steadily the rudimentary basics of education, such as reading, writing and arithmetic, and to learn, think and act for oneself, as well as, develop problem-solving skills. Specifically, by carefully selecting educational contents, the MEXT is working to ensure that children can actively engage in educational activities that offer individual instruction, review instruction, and hands-on, problem-solving learning, and is making other improvements including the creation of the Periods for Integrated Study and the expansion of elective learning."

Also, in the CS for lower secondary schools,

the content, "heredity and evolution" was deleted, and it was shifted to upper secondary school biology (Katayama *et al.*, 2004).

### The results of some investigations

The academic ability of Japanese children is in a declining trend. Table 4 shows a comparison of the results of PISA 2003 and PISA 2006 by OECD. The results for Japan show that reading performance dropped from the 14th to the 15th place. Science performance dropped from the 2nd to the 6th place, and math performance dropped from the 6th to the 10th place (Table 4).

Analyses of PISA and TIMSS by IEA also show the following difficulties of Japanese students:

- Scientific interpretation and essay test-taking.
- Answering questions related to daily life.
- Learning motivation and study habits.

Another interesting finding was obtained from the school curriculum enforcement situation survey which was conducted by NIER (National Institute for Educational Policy Research) in 2003. This survey showed that there were many more students who like to study science than those who like to study other subjects. But, science was considered less important than the other subjects listed (Fig. 1).

### The characteristics of the new Course of Study

Based on the results of such analyses and survey, the MEXT decided to implement policies to improve school education as a whole. However, the aim of fostering "zest for living" in children has been continued from the previous CS. In addition, the newly revised CS includes the following ideas in order to emphasize "zest for living".

**Table 4 Comparison of the results of PISA 2006 and PISA 2003**

Reading Performance			Science performance			Mathematics Performance		
ranking	2006	2003	ranking	2006	2003	ranking	2006	2003
Korea	1	2	Finland	1	1	Chinese Taipei	1	
Finland	2	1	Hong Kong	2	3	Finland	2	2
Hong Kong	3	10	Canada	3	11	Hong Kong	3	1
Canada	4	3	Chinese Taipei	4		Korea	4	3
New Zealand	5	6	Estonia	5		Netherlands	5	4
Ireland	6	7	Japan	6	2	Switzerland	6	10
Australia	7	4	New Zealand	7	10	Canada	7	7
Liechtenstein	8	5	Australia	8	6	Macao-China	8	9
Poland	9	16	Netherlands	9	8	Liechtenstein	9	5
Sweden	10	8	Liechtenstein	10	5	Japan	10	6
Netherlands	11	9	Korea	11	4	New Zealand	11	12
Belgium	12	11	Slovenia	12		Belgium	12	8
Estonia	13		Germany	13	18	Australia	13	11
Switzerland	14	13	United Kingdom	14		Estonia	14	
Japan	15	14	Czech Republic	15	9	Denmark	15	15

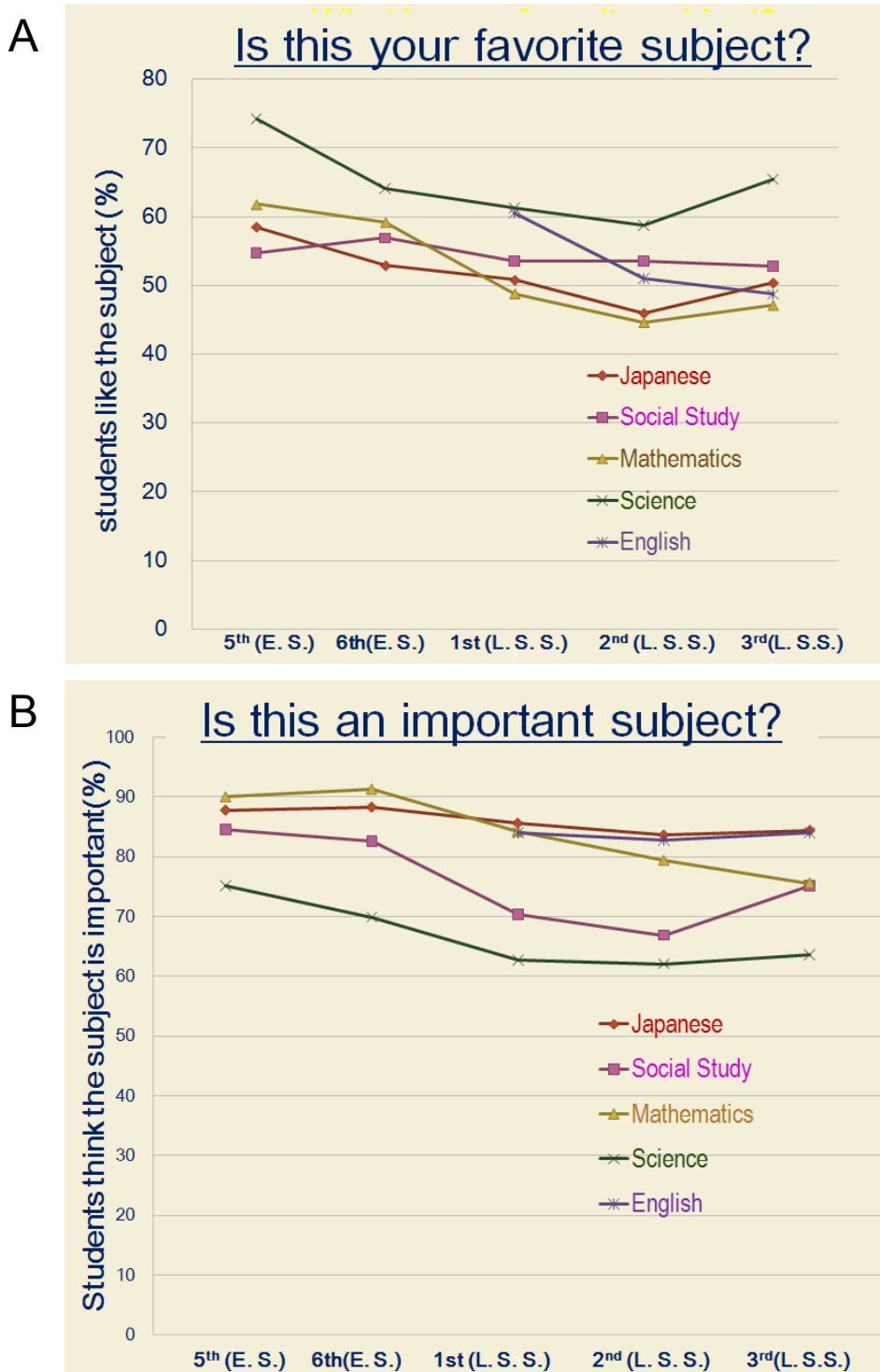
(Source: PISA 2006 Science Competencies for Tomorrow's World)

- Improvement of humanity through cooperation with others and self-control.
- Improvement of health and physical vigor.

The revised CS for elementary schools and lower secondary schools was published in

March, 2008 (Ministry of Education, Culture, Sports, Science and Technology, 2008a, 2008b).

In July, the teacher manuals were published. School hours allotted to science in elementary schools and in lower secondary schools greatly



**Figure 1** A: The trend in students’ favorite subjects; B: The trend in students’ idea on subject importance (right). (Source: The 2003 School Curriculum Enforcement Situation Survey)

increase in the revised CS. The basic concepts of the revised CS for lower secondary schools, the production of which I participated in as an advisor, are:

1. To develop the following key concepts: energy, particles, life, and earth.
2. To foster scientific insight and thinking, and comprehensive viewpoints.
3. To develop the ability to analyze and explain results scientifically.
4. To understand the significance and usefulness of studying science, and to take an active interest in it.
5. To have enriched scientific experiences, including those within the natural environment.

Accordingly, in the revised CS, the following aims for science are emphasized:

- To encourage students to be actively engaged in nature and natural phenomena.
- To develop the students' ability to analyze, explain and express the results of observations and experiments.
- To foster an attitude of respect for life and the desire to contribute to conservation of the natural environment.'

The CS for lower secondary school science has been revised as to the following subject matters:

- On classification, according to the former CS, we taught Spermatophyta and Vertebrata only, but the revised CS includes Cryptogamae and Invertebrata as well.
- The units of heredity and evolution are restored after an interval of two decades since their removal in 1998, but DNA is described only briefly in these units.
- In the unit 'Nature and Humans', the topic 'conservation of the natural environment and use of scientific technology' is added.

In addition, the revised CS calls for the following improvements:

- To have substantial experience in nature.

- To regard the connection between scientific study and human society as important.
- To develop environmental education.

### **Common points between the aims of the new Course of Study and AABE22 themes.**

I would like to stress one of the aims of the 2008 CS, i.e., "To foster an attitude of respect for life and the desire to contribute to conservation of the natural environment," because this aim is related to what we discussed at the AABE22 conference.

The two sub-themes of the AABE22 conference were similarly stated as "Biology Education for Realizing the Preciousness of Life" and "Biology Education in the UN Decade of Education for Sustainable Development (UN-DESD)."

It is very important to make clear the role of biology education in society today. People who are engaged in biology education have the mission of helping others to realize the preciousness of life and to work towards sustainable development. I hope that the fruits of the AABE22 conference will be reflected in future education.

### **Note**

\*Two-field System: This term refers to the grouping of physics and chemistry into Science Field 1, and biology and earth science into Science Field 2.

### **References**

- Katayama, N. (1993) Algae appearing in Japanese science textbooks at the compulsory level for the last 40 years reflecting changes in the Japanese environment. *In: Wallis, R. L. and Shi, G. R. (eds.) Environmental Management in Asia (Proceedings of the 14th Biennial Conference of the Asian Association for Biology Education)* pp. 75-85.
- Katayama, N. (1998a) Current status of biology education at the primary and secondary levels in Japan. *In: Sukchotiratana, M. and Kang-*

- wanpong, D. (eds.) *Excellence in Biology Teaching: Research, Practice and Experience (Proceedings of the 16th Biennial Conference of the Asian Association for Biology Education)* pp. 53-68.
- Katayama, N. (1998b) Biology education and environmental education in the third millennium in Japanese primary and secondary schools. *In: Angtuaco, S. P., Lagunzad, C. G. B., Lagunzad, D. A. and Micalat, E. B. (eds.) Biology Education in the Third Millennium: Focus on Information Technology and Environmental Education (Proceedings of the 17th Biennial Conference of the Asian Association for Biology Education)* pp. 43-49.
- Katayama, N., Takamori, H. and Kanaizuka, Y. (2004) Crisis of Biology Education in Japan. *Asian Journal of Biology Education* **2**: 75-80.
- Ministry of Education, Science, Sports and Culture (1998a) *The Course of Study for Elementary Schools*. Printing Division, Ministry of Finance. (In Japanese)
- Ministry of Education, Science, Sports and Culture (1998b) *The Course of Study for Lower Secondary Schools*. Printing Division, Ministry of Finance. (In Japanese)
- Ministry of Education, Culture, Sports, Science and Technology (2008a) *The Course of Study for Elementary Schools*. (In Japanese)
- Ministry of Education, Culture, Sports, Science and Technology (2008b) *The Course of Study for Lower Secondary Schools*. (In Japanese)
- Websites <accessed 20/09/2008>**
- [http://ibuki.ha.shotoku.ac.jp/~ishihara/shidou/shidou\\_index.html](http://ibuki.ha.shotoku.ac.jp/~ishihara/shidou/shidou_index.html)
- <http://www.mext.go.jp/english/org/struct/014.htm>
- [http://www.mext.go.jp/a\\_menu/shotou/new-cs/youryou/index.htm](http://www.mext.go.jp/a_menu/shotou/new-cs/youryou/index.htm)
- The 2003 School Curriculum Enforcement Situation Survey  
[http://www.nier.go.jp/kaihatsu/katei\\_h15/index.htm](http://www.nier.go.jp/kaihatsu/katei_h15/index.htm)
- PISA 2006 Science Competencies for Tomorrow's World  
[http://www.oecd.org/document/2/0,3343,en\\_32252351\\_32236191\\_39718850\\_1\\_1\\_1\\_1,00.html#Vol\\_1\\_and\\_2](http://www.oecd.org/document/2/0,3343,en_32252351_32236191_39718850_1_1_1_1,00.html#Vol_1_and_2)

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**Archives**

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## **Abstracts of the Papers Presented at the 18th Biennial Conference of the AABE**

The 18th Biennial Conference of the AABE was held from the 1st to 5th of August, 2000, at the Hong Kong Polytechnic University, Hong Kong SRA. The conference was organized by Professor P. L. Tang of the Hong Kong Polytechnic University. The main theme of the conference was "Biology Education in the New Millennium." There were three plenary lectures given by Professor T. P. Leung, Vice President of the Hong Kong Polytechnic University, by Dr. K. C. Pang, Deputy Director of the Hong Kong Institute of Education, and by a representative from WWF Hong Kong SAR. The Forum "Biology Education in Secondary Schools" chaired by Professor Y. S. Wong, Vice President of City University of Hong Kong, was held at the first day of the conference. In addition to 32 oral presentations and 22 poster presentations, two introductory talks for the mid-conference tour entitled "Hong Kong Country Parks and Nature Education" and "Hong Kong Marine Parks and Marine Reserve" were given by the officers (Mr. Y. N. Ngar and Mr. A. Kwok) from the Agriculture, Fisheries and Conservation Department of Hong Kong. The abstracts of the presented papers are as follows:

### <Plenary Lectures>

#### **Challenges of Contemporary Educational Reforms on Teaching Biology in the New Millennium: A Hong Kong Case**

**Pang, K. C.**

*The Hong Kong Institute of Education,  
Hong Kong SAR*

Moving into the new millennium, Hong Kong's education will experience a major reform for quality enhancement, brought about by the Education Commission in a large-scale, comprehensive review of the current system and practices. The Commission recommends new aims for the education system, emphasizing on development of enjoyment in learning, communicative abilities, commitment as well as creativity. A wide range of reform proposals is put forward to achieve the new goals. Apart from recommendations for changing the educational system and structures, recommendations were also made for reforms in the school curriculum, teaching and learning as well as assessment. In the plenary lecture, the speaker will examine the challenges of this reform to biology teaching to illustrate

contemporary developments as a Hong Kong case, by first identifying the aspects of the reform which will affect biology education, followed by an analysis of their implications on biology teaching in Hong Kong in the new millennium. The changing needs of teacher education for biology teachers as a result of these changes will also be discussed.

### <Oral Presentations>

#### **BioEd 2000 Symposium, the Challenge of the Next Century: The Paris Experience**

**Angtuaco, S. P.**

*Ateneo de Manila University, Philippines*

Paris last 15 – 18 May, 2000, served as the perfect setting for the BioEd 2000 International Symposium; and the venue, the Museum National d'Histoire Naturelle Grande Galerie de l'Evolution, really set the stage for a very lively and fruitful symposium. The venue was already reason enough to visit Paris. The museum sat inside a Jardin de Plantes, which was abloom in

May with all kinds of flowers. A menagerie also existed in the grounds of the museum. The museum itself housed all kinds of animals and plants, showcased as a story of evolution. Thus, the venue alone was by itself a total educational feast for the senses and mind. The Paris symposium presented a meeting of people interested in sharing experiences about biology education and in learning from each other. The major activities of the symposium included plenary lectures, plenary sessions, parallel sessions, workshops and posters that covered a wide range of topics. The topics ranged from simple monitoring of children's perceptions of biological situations of biotechnology, web-based learning, and museum displays. The conference truly covered the theme: "The Challenge of the Next Century."

### **A Quantitative Inquiry-based Module in the Investigation of the Growth Parameters and Metabolic Activity of *Saccharomyces cerevisiae* in Aerobic and Anaerobic Conditions**

**Quinto, E. A., Alejandro, G. D., Aimeon, E. C. and De Leon, E. P.**

*University of Santo Tomas, Philippines*

This is a simple and student-friendly modular activity which investigates some of the most basic concepts in biology like growth and metabolism. This laboratory exercise uses the bakers' yeast: *Saccharomyces cerevisiae*, a microbe which is very safe to handle being nonpathogenic and edible, easily seen at HPO due to its large cell size and rapid growth rate which will allow the exercise to be completed in a 3 hour laboratory period. Two cultures of *S. cerevisiae* obtained from active dry yeast granules are cultivated under aerobic and anaerobic conditions. The effect of each condition on the metabolism as either respiratory or fermentative will be determined colorimetrically (Iodoform Test)<sup>1)</sup> by the production of alcohol. The conditions of the two cultures are then immediately reversed to

observe the phenomenon known as the "Pasteur Effect." From each culture, 0.01 ml samples are evaluated for their cell count/ml using the direct microscopic counting (Breed Method)<sup>2)</sup> at specific time intervals. The cell density of each culture is plotted on semi-log paper and the growth rate and slope are computed and compared. The cell count/ml of each culture in future time is calculated using model preparation and experimental results (predictability)<sup>3)</sup>. This concept on growth rate can be extended to other disciplines like ecology and genetics.

1) Vogel, A. I. (1956) *A Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis, 3rd ed.* pp. 1068-1069.

2) Tortora, G. J., Funke, B. and Case, C. (1998) *Microbiology, An Introduction, 6th ed.* Addison Wesley Longman, Inc. pp.175.

3) Cazzador, L. and Mariani, L. (1988) A simulation program based on a structured population model for biotechnological yeast processes. *Journal of Applied Microbiology and Biotechnology* **29**: 198-203.

### **A Module in Protoplast Fusion between Two *Allium* Species**

**Flores, J. G., Lamorena, M. B. and Marbella, R.**  
*University of Santo Tomas, Philippines*

Protoplast technology is still in its stage of infancy in our region but it is slowly gaining ground among biotechnology enthusiasts, despite the tedious and intricate techniques involved; notwithstanding the expensive chemical reagent requirements. To help students develop and gain skills along this area, a module is designed using plant materials to introduce the technique.

The schedule was initially tested by the University of Santo Tomas graduate students enrolled in the Biotechnology II (Protoplast Technology) during the second semester of school year 1999 – 2000. Gleaned from the results of the laboratory work, the students were able to isolate protoplast from *Allium cepa* and *Allium sativum* by using mechanical and enzymatic techniques. Protoplast yield from both techniques were compared. Viable protoplasts were determined,

cultured and subsequent intra- and inter-specific fusion was induced with the application of polyethylene glycol (PEG) to form somatic hybrids.

**The Virtual School of Biodiversity:  
the Development of IT-supported  
Teaching in the Department of Ecology  
and Biodiversity, the University of  
Hong Kong**

**Chan, B. K. K. and Hodgkiss, I. J.**

*The University of Hong Kong, Hong Kong SAR*

The Virtual School of Biodiversity (VSB) is a joint venture between the Department of Ecology and Biodiversity, the University of Hong Kong and the School of Biological Sciences, the University of Nottingham, UK, under the auspices of *Universitas 21*. A 'Virtual School' is a location in the Internet to support resources sharing, distributed learning and collaborative teaching. The VSB, therefore, aims to produce distributed biodiversity learning materials and assess the potential use of the World Wide Web (WWW) in teaching developments. To make use of WWW in teaching developments, On-line Learning Support Centres (LSCs) have been developed to provide student access to existing Web-resources concerning biodiversity news, study skills, jobs and careers and virtual libraries that can provide high quality information and guidance on student learning. An individual module LSC has also been developed for all courses in the environmental Science curriculum to give students on-line assured Web-sites. The 'Chat' function allows students to have Web-based discussion of the academic topics with their classmates and lecturers. Students' responses to LSCs were positive and 60% of them agreed that the learning resources and Web-sites were helpful to their learning and improved their performance. The VSB has also developed a delivery platform 'Scholar's Desktop' for producing CD-based multimedia courseware which enable students to learn in an interactive way including quizzes, scrapbooks, visits to virtual laboratories and

simulations of virtual field trips. More than half of the students responded that the courseware units developed in the 'Scholar's Desktop' were interesting and they had learned a great deal of useful information. Based on the present study, the VSB has enhanced the teaching performance of the Department by making use of WWW and IT in teaching developments. The VSB can further expand this partnership in collaborative university teaching by sharing resources and providing distributed quality assured university education on a global basis. The VSB concept can also be applied to the tertiary – secondary educational interface in the future, thus extending biodiversity education in Hong Kong.

**Flexible Learning Resources and Their  
Effects on Student Learning in the  
Tertiary Life Science Laboratory**

**Chan, T. Y.**

*The University of Hong Kong, Hong Kong SAR*

The use of computer-based learning and web-based instructional resources have gained much popularity in the modern life science laboratory, either as supplement to or replacement for conventional wet laboratory practicals. These two modalities exemplify methods of flexible course delivery, which rest on the theoretical underpinnings of distance education. While much has been written on the educational technology aspect in this area, there is however a dearth of discussion on curriculum philosophy, impact on teaching and learning, and the effects of these two approaches on the learning experience of students. This paper tackles the issues mentioned by relating flexible learning to constructivism and highlights the changes brought about by these new approaches to the teaching and learning scene. The recognized advantages of flexible learning support systems over conventional approaches to teaching and learning are appraised by making comparisons at the level of the actual learning process. An analysis of student learning in different learning situations in

the laboratory is undertaken using the experiential model of learning as a basis for elaboration. While it is appreciated that the merit of flexible learning resources lies with their potential for enhancing learner's experience through active knowledge construction, threats of under-emphasis of the feature or sacrifice to narrow-objectivist information delivery function should be cautioned and avoided.

### **New Initiative in Teaching and Learning in Marine Conservation**

**Cheung, S. G. and Shin, P. K. S.**

*City University of Hong Kong, Hong Kong SAR*

For biology graduates to become successful professionals in the field of marine conservation, they should possess the following generic skills: teamwork, dedication and flexibility. Equally important, they should have a wider knowledge and an appreciation of local marine ecology, and be aware of environmental issues. The present university curriculum in Hong Kong, however, cannot meet the challenge in nurturing such able graduates, owing to inherent problems associated with the current teaching and learning mode. Problems in teaching identified include insufficient inventory of the local fauna and difficulty in accessing to museum specimens. The use of preserved, instead of colourful, live, specimens, also deter students' interest in the subject. The didactic mode of teaching and time constraints in delivery of the course content also reduce the students' motivation in constructing their own knowledge. Moreover, they tend to adopt a rote and passive learning mode, be examination-oriented, and have inadequate background knowledge on animal classification techniques. To improve teaching and learning in marine conservation, a combination of activities is introduced at the City University of Hong Kong. These include the production of a CD-ROM on local marine ecological habitats, design of web pages on common animal groups, introduction of problem-based learning initiatives, participation

of learning in overseas, and co-operation in a group project. The focus of all these activities is to enhance the teaching and learning process proactively. We believe that graduates who are exposed to such a student-centred and self-learning culture will develop the necessary traits to take on future challenges in marine conservation.

### **Field Studies Centres in Hong Kong**

**Kan, K. Y.**

*Sai Kung Field Studies Centre, Hong Kong SAR*

Environmental awareness has long become an issue of common concern. Concerted efforts are necessary in order to maintain a better living environment, hence much importance has been attached to environmental education. With a view to providing better opportunities and facilities for students to gain a first hand information about their own environment, and to impart skills and techniques in field studies, the Sai Kung Field Studies Centre – the first of its kind in Hong Kong – was established in 1979 and began to provide residential ecology and geography field studies courses for sixth form students as well as in-service courses for teachers of these two subjects.

### **Caritas Chan Chun Ha Field Study Centre: Its Service, Its Role in the Education Reform in Hong Kong, and Its Future Development**

**Ng, P. S.**

*Caritas Chan Chun Ha Field Study Centre,  
Hong Kong SAR*

The Centre, established by Caritas Hong Kong in 1996, serves as an educational and resource centre. It aims at providing opportunities and adequate activities to students to gain firsthand information about their environment and to learn the skills and techniques in field studies. What we are doing in the centre materialized certain reform proposals by the Education Commission,

e.g., life-wide learning and project-based learning. Besides, ever since the establishment of the centre we promote environmental awareness through our courses, and in response to Section V - Making Hong Kong an Ideal Home in the Chief Executive's 1999 Policy Address, we will continue our effort. To acquire more resources, we have been successful in the past two years in the bid for Quality Education Fund for the production of two CD-ROMs on field studies, launching the Windmill Project, and sending teaching staff on study visit to Field Study Centres in UK. With the existing staff establishment and resource, we can only serve sixth form students. However, if the Education Department can make appropriate revision, we can extend our service to students of Secondary 5 and below, and even to primary school pupils.

### **Scientific Inquiry, a Teaching That Enhances Critical Thinking for Non-Science Majors in the General Education Curriculum Biology Education**

**Hafalla, J. R.**

*Far Eastern University, Philippines*

In the Scientific Inquiry (SI) teaching strategy, the learners are active creators of problems and hypothesis and are architects of the testing process in seeking information. The students' skills developed in this strategy through group activities include: a) Scientific process: keen sense of observation, problem identification, formulation and testing of hypothesis; b) Critical thinking skills: inquisitiveness, making logical influences, associating and noting relationships of concepts (cognitive); c) Intellectual courage and perseverance, suspension of judgement, enthusiasm in sociocentricity (affective); designing and executing procedures, creating models that test the hypothesis, concept mapping, using graphs and visual tools (creative thinking). Our university have developed and implemented the SI approach in biological sciences for non-science students as

well as in basic biology subjects for majoring students of B. S. Biology, as springboard to essential concepts and as a step to enhance critical thinking. This strategy replaces the traditional method of giving lecture and of the traditional laboratory activities. Initial findings in a research made on the effect of this teaching strategy are available.

### **Development of a Value Inquiry Model in Biology Education**

**Jeong, E. and Kim, Y.**

*Seoul National University, Korea*

There are many bioethical issues in line with the rapid advance of biology. In this situation, it is important for students to make a rational decision on value problem. In this study, value inquiry model in biology education was developed.

To develop the model, value inquiry models were reviewed. Value clarification model is helpful for the formation of the personal value as the process of individual value inquiry, but it is not helpful for clarifying the value conflicts. Value analysis model focuses on the rational solution of value problem through the logical procedure. But it has limitation that overemphasizing the logical and systematic aspects results in devaluating students' affective aspects. So it is necessary to coordinate psychological and logical aspects of value inquiry.

In this regard, the model was developed, including "identifying and clarifying value problem," "understanding biological knowledge related to conflict situation," "considering on the related persons," "searching for alternatives," "predicting the consequences of each alternative," "selecting the alternative," "evaluating the alternative," and "final value judgement and affirming it."

The educational objectives of value inquiry were selected in consideration of the ability to carry out the steps of the developed model. And the selected contents were animal duplication, test-tube baby, genetic engineering, growth hormone

injection problem, brain death, organ transplant and animal to be experimented, and were organized on the basis of the 6th and 7th science curriculum.

The suitable instructional models for the value inquiry education were selected: bioethical value clarification decision-making model, group presentation according to the value analysis model, role play and debate, and discussion through web forum. The interview was considered to be suitable to evaluate the students' value inquiry ability and the rubric was made to evaluate the attainment of the educational objectives of value inquiry.

**Laboratory Exercise Suitable for Teaching the Relationship between Vertical Distribution of Seaweeds and Their Photosynthetic Characteristics in Advanced Science Classes in Japanese Junior High Schools**

**Kanaizuka, Y. and Katayama, N.\***  
*Ochiai Junior High School; \*Tokyo Gakugei University, Japan*

There is only a little subject matter relating to algae and no laboratory exercises for teaching photosynthesis using seaweeds in the present Japanese Science Curriculum Standards for Junior High Schools. In the present study, we developed an experiment for teaching the photosynthetic characteristics of seaweeds in relation to their colors and vertical distributions in advanced science classes in junior high schools. We chose the red alga *Mastocarpus yendoi* Masuda et Yoshida and the green alga *Ulva pertusa* Kjellman because they can easily be collected anywhere at rocky seashores throughout the year. In addition, these seaweeds were cultured easily using filtered seawater at room temperature and maintained their photosynthetic activities for about two weeks. We examined the photosynthetic rates of these seaweeds under the light with different colors (blue, green or red) quantitatively by using the Productmeter, a gas volumeter. In

any light color condition, the photosynthetic rate was measured within 50 minutes that is one class hour of junior high schools. The difference in the photosynthetic responses to the light color conditions was observed between the red alga and the green one. We introduced this experiment into an advanced science class as a laboratory exercise to evaluate its effectiveness. This experiment seems to be effective to allow students to be aware of the difference in the photosynthetic rates of seaweeds under the different light color conditions and to understand the relationship between the vertical distribution of seaweeds and their photosynthetic characteristics.

**Environmental Education for All at the University of Santo Tomas: A Total Approach**

**Kanapi, C. G. and Hilario-Andres, J. T.**  
*University of Santo Tomas, Philippines*

The University of Santo Tomas, a 388-year-old private educational institution situated in the heart of one of Manila's most densely-populated sectors and catering to approximately 34,000 students, has embarked on a massive environmental education development project tagged as EE for All at UST (Environmental Education for All at the University of Santo Tomas). This presentation outlines the goals and objectives of this ongoing project, highlights the step-by-step development of the action plans targeting the entire university community. To date, a volunteer Core Group of committed faculty members representing all academic units has been organized, and baseline data on all non-science curricular offerings (social sciences, languages, mathematics, religion and the humanities) have been collated. A survey of teacher competency has been administered to determine the non-science teachers' capability to integrate basic EE concepts in their course syllabi. The survey results serve as a basis for more than twenty modules which are currently being developed and compiled to aid teachers in integrat-

ing basic EE concepts into the existing syllabi of tertiary level non-science subjects. Upon completion, these modules are to be used in an intensive in-service training session for teachers to be held at the beginning of the first semester of AY2000-2001, and will subsequently be pilot-tested and applied in selected classes throughout the said semester.

### **Teaching First Year Biology at a Rural University Campus**

**Wallis, A. M. and Wallis, R. L.**  
*Deakin University, Australia*

At Deakin University first year Biology is one of the largest units and is taught at four campuses. At Warrnambool Biology A (which runs in Semester 1) is taken by Science students taking three environmentally based courses as well as by Nursing students. This latter group of students takes Biology B in Semester 2. Here we outline some of the features of the program including the website and its associated interactive activities, the problems in teaching disparate groups of students in biology A and teaching students where most are living away from home and many are mature age learners who have not studied science for a long time.

### **Changes in Attitudes towards Nature in University Students**

**Wallis, R. L. and Douglas, L.**  
*Deakin University, Australia*

Development of positive attitudes towards the environment is an important element in environmental education. We investigated whether students at Deakin University who took the first year level unit SQE112 "Ecology and Environment" developed any changes in attitudes to nature. Students completed a questionnaire before and after completing the unit of study. The questions provided information on six categories of attitudes towards wildlife. We found students who had taken SQE112 developed signifi-

cantly more positive attitudes to wildlife in four of these categories (*biocorrect*, *exploitation*, *natural stewardship* and *pest rights*) but not in the categories *controlled breeding* and *animal rights*. In contrast, a control group of year one students showed no significant changes in attitudes to nature. Students who studied SQE112 had higher attitude scores initially than the control group, suggesting they were more positively disposed to the environment and chose a course which reflected this greater interest in environment. There were no significant differences in attitude change for students enrolled in SQE112 at metropolitan and regional campuses, although regionally based students initially had much lower scores on the *exploitation* scale. Our results are very similar to those found for USA students.

### **Bridging the Gap between Secondary and Tertiary Biology Education: Case Study of a Young Scholar Program**

**Lam H.-M.**  
*The Chinese University of Hong Kong,  
Hong Kong SAR*

In Hong Kong, biology education in secondary schools used to adopt a knowledge acquiring and instructor-assisting mode, in contrast to the in depth, knowledge-exploring and self-learning characteristics in tertiary institutes. Supported by the CDI of the Education Department of HKSAR, the Biology Department at the Chinese University of Hong Kong has organized a Young Scholar Program in two consecutive summers serving to bridge the gap between secondary and tertiary biology education. This Young Scholar Program has two integral components. Firstly, a series of "hot" biology topics were covered in a seminar series that was opened to all S.6 teachers and students. The seminar series was designed not only to provide updated information, but also to stimulate follow-up discussions among secondary school teachers and students. A selected group of students were allowed to participate in

hands-on research projects tailored to cope with the seminar series they attended. Besides, they also joined the social activities organized by undergraduate students. Through this summer camp, the participants obtained different levels of exposure to university life and mode of learning. We hope that the participants will share their valuable experience to their fellow schoolmates and thus promote a better understanding of university biology education.

### **Promoting Biotechnology Education to Secondary Schools**

**Lui, C. W. K. and Chan S. L.**

*The Hong Kong Institute of Education,  
Hong Kong SAR*

Due to the importance of biotechnology education, there is a worldwide trend of extending this from college to secondary school level. While many western governments have been planning to bridge the gap, the pace in Hong Kong is comparatively slow. As Hong Kong science educators, we are planning to introduce relevant and updated biotechnology elements, such as DNA fingerprinting, gene therapy and cloning, to the secondary school teachers and students. Besides these advanced techniques, we would also introduce general biotechnological applications in the field of food production, agriculture and environmental protection to the lower form students; activities such as wine production, plant tissue culture and biological washing powder will be included. In doing so, we are developing an interactive CD-ROM as well as homepage on the biotechnology education. These comprise of basic biotechnology theories which are given in more lively presentation, e.g. using animation to explain complicate mechanisms. There are also step-by-step demonstrations on simple biotechnological experiments. These experiments do not require advanced equipment and can easily be carried out in secondary schools. We also include bioethical issues, such as animal and human cloning, genetic modified food and gene

therapy, to stimulate students' controversial debates and discussions. We hope that the materials presented in the CD-ROM and homepage can stimulate students' interest in these scientific advances and products.

### **Digital Library**

**Piriyakul, K. and the others**

*Bodindecha (Sing Singhaseni) School, Thailand*

As a network for Thai schools, <http://oho.ipst.ac.th>, or <http://web.ku.asc.th/schoolnet/index.html>, the Digital Library aims at providing Thai students the way to find out information in order to enhance their knowledge. For the best utilization of Schoolnet network, this program can help reducing the problems about information rarely found for Thai teachers and students, the complexity of foreign language, etc. There are many parts of details involved in this program such as computer, mathematics, chemistry, biology, physics, environment, and basic engineering. For biology, the content includes plants, animals, health, foods, academics, and others. The content of this pilot project was developed in Thailand to persuade the schools to create a variety of academic information in order to form the virtual library on the Internet by emphasis on enhancing the children's education.

### **Evaluation of Physico-chemical Characteristics, Plankton and Fish Communities Survey for Estero De Balete Rehabilitation Project of Adamson University, Philippines**

**Lee, S. J., Laguimun, A. T. and Anes, M. L.**

*Adamson University, Philippines*

Abiotic evaluation of bodies of water such as physico-chemical analysis and biotic survey of population is routinely done to assess quantitatively the characteristics of rivers and their tributaries. Using the Estero De Balete along Adamson University as experimental site, the research project has established baseline data to

serve as diagnostic tool in identifying the degree of severity of water pollution in a river tributary. Several data gathered has been presented to the Department of Environmental and Natural Resources and other government agencies in order for them to initiate plans of action for the rehabilitation of the waterway. As a learning institution, the Adamson University had embarked on a "Sagip Estero" (Save the waterway) Project when it established a network of research of it in different Departments of the University designed to harness the knowledge and skill of the faculty towards the rehabilitation of the highly polluted waterway. Results of these studies had been used to evaluate the physico-chemical characteristics of the "estero" and its plankton and fish population as biologic indicators of pollution. Considering that there are myriads of "dead esteros" crisscrossing the streets of Metro Manila, the results of this research project can serve as a rich source of ideas for government and private institutions intending to conduct rehabilitation programs for river tributaries.

- 1) Needham, J. G. and Needham, P. R. (1990) *A Guide to the Study of Fresh-Water Biology*. Holden-Day, Inc., San Francisco, USA.
- 2) Greisel, I. and Jensch, P. (1991) *Investigating Our Ecosystem*. Houghton Mifflin Co., Boston, USA.

### **Freshwater Pollution Monitoring: Putting Theory into Practice**

**Tilling, S. M., Quynh, N. G.\*, Pinder, C.\*\* and Yen, M. D.\***

*Field Studies Council, UK; \* The National University of Hanoi, Vietnam; \*\* Institute of Freshwater Ecology, UK*

Worldwide, at least 25,000 people die every day through using dirty water. Biological monitoring of freshwaters is becoming increasingly important as a rapid-assessment tool for evaluating water quality<sup>1)</sup>. However, the use of biomonitoring in Asia has been hampered by the lack of baseline data, the absence of easily-used and rigorous bio-assessment protocols and a lack of people with appropriate skills and knowledge<sup>2)</sup>.

Biology education has an important role. This paper describes the results of a project in Vietnam during which standard protocols, pollution indices and non-specialist identification keys were devised and tested. The results demonstrate a clear relationship between water quality and freshwater microinvertebrate communities. The educational potential was illustrated by the development of a number of new teaching modules and post-graduate degrees in Vietnam's colleges. It is likely that similar resources and approaches could be applied in other Asian countries.

- 1) Noris, R. H. and Noris, K. R. (1995) The need for biological assessment of water quality: Australian perspective. *Australian Journal of Ecology* **20**: 201-211.
- 2) Rosenberg, D. M. and Resh, V. H. (eds.) (1993) *Freshwater Biomonitoring and Benthic Microinvertebrates*. Chapman & Hall, New York, USA.

### **Teaching the Constructivist Way to Enhance Critical Thinking among Students of Biology**

**Perez, T. R.**

*Centro Escolar University, Philippines*

Constructivism allows students to become fully involved in putting together knowledge into a structured form. They are made to think carefully in the learning process. They are required to try to generate new ideas, identify and summarize relationships between various ideas and concepts. Students are actively involved mentally, hence critically. The constructivist approach to teaching has been found to be effective in achieving meaningful learning. It is important for the teacher to find out the prior knowledge of the students so that they can construct their own meanings. This approach entails a lot of preparation and requires the knowledge of several strategies on the part of the teacher in order to use what appropriate in their teaching. Constructivism stands in contrast to the more deeply rooted ways of teaching that have long typified our classrooms. Traditionally, learning

has been thought to be a “mimetic” activity, a process that involves students repeating or miming, newly presented information in reports or on quizzes and tests. Constructivist teaching practices, on the other hand, help learners to internalize and reshape or transform new information.

- 1) Fosnot, C. T. (ed.) (1995) *Constructivism: Theory, Perspective, and Practice*. Teachers College Press, New York, USA.
- 2) Constructivist Theory <http://www.gwu.edu/~tip/bruner.html>
- 3) Teacher Education Station, Constructivism: Background Knowledge <http://www.hmco.com/college/educastion/station/concept/construct/conback.html>
- 4) CSCL, Constructivism [http://www.uib.no/People/sinia/CSCL/web\\_struktur-836.htm](http://www.uib.no/People/sinia/CSCL/web_struktur-836.htm)

### **Helping Science Teachers to Understand the Nature of Science**

**Yip, D. Y. and Lai, M. K.\***

*The Chinese University of Hong Kong; \* Education Department, the Government of Hong Kong, Hong Kong SAR*

The ETV (Educational Television) Section of the Education Department of Hong Kong is developing a series of ETV programs for secondary science teachers. This paper outlines the content of a programme to help teachers understand the nature of science. A historical approach is used to illustrate how early scientists used various methods to study nature. From this, the nature of scientific inquiry as a process of problem solving is elicited.

The first example refers to the age-old problem: Is the Earth really flat? By referring to discrepant events and using probing questions, the audience is guided to query the validity of the theory of a flat Earth, and develop an alternative hypothesis to account for observations that are inconsistent with the view of a flat Earth. The importance of hypothesis testing is illustrated by the attempts of early sea explorers to test the prediction that a ship traveling in the same direction on the Earth would finally return to its starting point.

The second example refers to the discovery of vaccination by Jenner in the 18th Century. Through careful observation, hypothesis formulation and testing, he was able to gain a better understanding of the relationship between cowpox and smallpox, and devise a method to develop immunity in the body against smallpox.

As a closure, the program summarizes the main steps of the process of scientific inquiry, while emphasizing the variety of methods employed by scientists in their search for knowledge.

### **Chromosome: Karyotype Game**

**Piriyakul, K.**

*Bodindecha (Sing Singhaseni) School, Thailand*

The Karyotype Game is one of the teaching instruments for grade 12 Biology. It aims at providing the children-center for the teaching activities. So, the students can understand the meaning of karyotype and classify the sex and the characteristics of normal persons and genetics persons in accordance with the abnormal of chromosome. The students will be classified into many groups to compete for the game by making arrangement of respective chromosome. The first group who can finish arranging the karyotype will be the winner. The result of this instrument is that the average post-test scores of the students are more than their pre-test scores. Moreover, the students get the knowledge about chromosome and having fun for biological study.

### **Biology and New Technology: A Small Mammal Community Living in a Powerline Easement**

**Macreadie, J., Wallis, R. and Adams, R.**

*Deakin University, Australia*

Small mammals living in a powerline easement that had been cleared of trees were surveyed in Bunyip State Park in Gippsland. At least five species of small mammals were found, including the rare broad-toothed rat, *Mastacomys fuscus*. The extent to which these species are also living

in the surrounding open forest is unknown. This appears to be the first report of such a rich assembly of small mammals living in such a manipulated corridor. Others elsewhere have reported that cleared powerline easements are invaded by typically grassland species, non-forest or introduced species, which invade along the easement. It is unusual that no introduced rodents were detected at the study site, in what such an obviously modified habitat.

### **Impact of the Internet on Insect Biology Teaching and Research in Thailand**

**Wongsiri, S.**

*Chulalongkorn University, Thailand*

The Internet is affecting insect biology teaching and research. Internet tools help students communicate and easily find access information. Biology instructors who adopt these tools may discover that they are surprisingly about time consuming to implement. Requiring students to use the Internet teaches them to study by themselves from outside classroom of available information and to communicate electronically, both vital skills in today's workplace. The Internet helps meet the growing need for distance education by providing as a medium that allows students to conveniently access course materials and to communicate by e-mail and homepage with the instructors and other students. Researchers benefit from using the Internet for one-to-one and one-to-many communication and from access to large cooperative databases. Perhaps the greatest impact on research will be the migration to the Web of journals and other specialized research literature.

### **Biology Education in Secondary Schools of Indonesia**

**Sudarmi, R. and Katayama, N.**

*Tokyo Gakugei University, Japan*

In the Indonesian secondary school curriculum, the subject of science divided into two parts, bi-

ology and physics, for lower secondary schools, and three parts, biology, chemistry and physics, for upper secondary schools. The number of biology classes is 136-138 in three terms, or three so called "catur wulan," in a year in lower secondary schools and in the first two years in upper secondary schools. In general, they have three biology classes every week. However, in the last year in upper secondary schools, students can choose one of the courses offered by the school, depending on their interests. According to the curriculum, each school has to offer two courses: social science, natural science. In the biology course, students have seven biology classes every week in addition to other subjects, whereas in the other course there is no biology class. The purpose of teaching biology in general is: "Let students understand biological concepts, utilize their biological knowledge in their daily life, understand how to consider and how to solve environmental issues wisely, respect nature as a wonderful gift from God, and understand that we have to preserve nature and take care of it." To achieve these aims, the Directorate of Education and Culture has been offering training courses for teachers to improve their ability. There is a biology teachers' association in every district of the country so that biology teachers can have some opportunities to discuss the best solutions to the problems occurring in the classes where they are teaching.

### **Biology Education in the Philippines: Current Status and Challenges in the Third Millennium**

**Lagunzad, C. G. B.**

*Ateneo de Manila University, Philippines*

In the last few decades of the second millennium, we are witness to the awakening of the human consciousness on the issue of bioethics. With the thrust of basic education to integrate environmental issues in all courses and technology in all the sciences to highlight the need to maintain quality life for human society, the significant role

played by biology education at the turn of the third millennium cannot be over-emphasized. For biology education to effectively assume its key role, it has to meet the challenges of a society that expects and demands a healthy environment, sufficient and good quality food products, adequate medical services and access to information that can significantly affect human well-being whether in this generation or the next.

This paper is focused on basic science and biology education in the Philippines: its current status, problems and accomplishments. In addition, this paper will discuss how the science of biology influences the educational system, government socioeconomic policies and cultural development in the country. There will also be a deliberate attempt to project the potential contribution of biology education in national growth and development in the third millennium.

### **Diversity of Edible Invertebrates Found in Khon Kaen Province, Northeast Thailand**

**Na Nagara, S., Jamjanya, T., Wangsomnuk, P., Tarbsripair, P. and Polsan, Y.**  
*Khon Kaen University, Thailand*

A survey of diversity of edible invertebrates from fresh market in Kohn Kaen Province conducted during January to December 1999. There were 10 sites of study areas: Amphure Muang, A. Namphong, A. Khoasuankwang, A. Bhuviang, A. Chumpare, A. Nhongroua, A. Bhol, A. Bhanbhai, A. Chonnabot and A. Munjakiri. The result showed that seven orders 18 families and 35 species of edible insects were found. Of these beetles were the most abundant sold in market. Silkworm, ant egg and scarab beetle were sold occasionally, and the most rare case found were cicada and metallic beetles. These edible insects were collected by light trap, collected from plants they eat or may be from their own habitat. We also found that insects sold in khon Kaen market were transported from other places such as Nakornswan, Chiangmai and Chiangrai. The

most favorite and make a lot of money were fried grasshopper, fried bamboo caterpillar and ant egg. Popular dishes from edible insects were Koa, Thod, Larb, Koi, Mhok and Kaeng. To collect insects by light trap during February to December 1999, 15 species were found. Mole cricket, predaceous diving beetle, water scavenger beetle, cricket, giant water bug were found all year round. Scarab beetle and dung beetle were found occasionally. The mole cricket showed the highest number of counting (273.14/day) during February. Other edible invertebrates, we found nine species of mollusk, three species were viviparid snail, three species were apple snail and other three species were bivalve. Cooking dishes were Kaengom, Kaeng-koa, Koi, Bhad and Ji. Only one species of freshwater crab and one species of freshwater shrimp were found. Cooking dishes were Larb-phu, Namya-phu, Phu-kem, Ji-phu, and Mun-phu. Dishes from freshwater shrimp were Koi-kung, Jom-kung and Nung-kung.

### **Biodiversity of Rare Actinomycetes in Island Soils and Their Antimicrobial Activities**

**Sriivibool, R.**

*Burapha University, Thailand*

Sample soils were collected from various sites of Raet Island, Chonburi Province, and were prepared at 55°C for 15 min and 100°C for 1hr before making serial 10 fold dilutions. From morphological study together with the analysis of diaminopimelic acid in peptidoglycans and sugar pattern in whole cell hydrolysates, 199 strains of 17 genera were isolated. The identified genera were *Actinomadura*, *Streptomyces*, *Saccharopolyspora*, *Saccharomonospora*, *Pseudonocardia*, *Micromonospora*, *Faenia*, *Kibdelosporangium*, *Promicromonospora*, *Saccharothrix*, *Streptoaloteichus*, *Thermoactinomyces*, *Thermonospora*, *Nocardiosis*, *Nocardioides*, *Kineosporia*, and *Kitasatosporia*. It was found that 21 strains of Actinomycetes showed some level of antibiosis

against either *Bacillus subtilis* ATCC 6633 or *Micrococcus luteus* ATCC 9341, or both of them or against *Candida albicans* DSM 70014 and either one or two of the Gram positive bacteria. Furthermore, two strains of Actinomycetes, R4-20 and R4-21, showing antifungal activity from the isolating plates were also detected.

### **Anticancer Properties of Lectin from the Seeds of *Dolichos lablab* Linn.**

**Jacinto, S. D., Sonico, M. G. I., Quitariano, M. L. V., Cruz, F. M., Lim, R. M. and Gabius, H. J.\***

*University of the Philippines, Diliman, Philippines;*  
*\*Ludwig Maximilians University, Germany*

Mannose specific lectins from seeds of *Dolichos lablab* Linn., a local edible legume was purified from crude extracts by first fractionating with saturated ammonium sulfate and through affinity column chromatography using mannose Sepharose. Through *in vitro* cytotoxicity assay using the method of Mosmann<sup>1)</sup>, the lectin was found to be toxic to human cancer cell lines, A549 (lung non small cell carcinoma) and T47D, a breast cell line, but not cytotoxic to SKBr3, another breast cell line. It was also not toxic to the cell line, HUVECC, which are normal cells from human umbilical vein endothelium. *In vivo* testing was also done for 40 days by injecting T180 mouse sarcoma cells with or without lectin into male ICR white mice strain. Mice injected with sarcoma cells alone died before the 40th day. Dissection yielded profuse ascetic fluid with sarcoma cells indicating that the cells proliferated within the mouse's body. Moreover, histological examination of different organs of the digestive system showed tumorous growths in the stomach, duodenum and descending colon. Those injected with sarcoma cells incubated with different doses of lectin prior to intraperitoneal injection showed no ascites fluid nor sarcoma cells and healthy conditions to the organs of the gastrointestinal tract.

1) Mosmann, T. (1982) Rapid colorimetric assay for cellular growth and survival: Application to

proliferation and cytotoxicity assay. *J. Immunological Methods* **65**: 55-63.

### **The Interactive Effects of Elevated CO<sub>2</sub>, Temperature and Nitrogen Supply on the Growth and Yield of Rice**

**Baysa, M. C., Tremmel, D. C.\*, Reynolds, J. F.\*, Rivero, G. C.\*\* and Tabbada, R. A.\*\***

*University of Santo Tomas, Philippines; \*Duke University, USA; \*\*University of the Philippines, Diliman, Philippines*

Rice (*Oryza sativa* L. cv. IR72) was grown in growth chambers under all combinations of two CO<sub>2</sub> concentrations (375 and 750 µl L<sup>-1</sup>), two air temperatures (29/21 and 34/26°C day/night) and two nitrogen supplements (40 and 80 mg L<sup>-1</sup>) from sowing until grain maturity to examine the interactive effects of CO<sub>2</sub>, temperature and N supply on its growth and yield. Elevated CO<sub>2</sub> enhanced plant biomass in terms of leaf area, tiller and panicle production, especially in high temperature and N treatments. CO<sub>2</sub>-enriched plants grown at high temperatures had lower harvest indices due to reductions in the number of filled grains per panicle and grain mass, and lower grain N content when given high N. Any potential benefit of increased atmospheric CO<sub>2</sub> on rice yield and grain N content under optimal N supply may therefore be offset by higher temperatures associated with future global warming conditions.

### **Identification of Heavy Metals concentration in Kangkong (*Ipomoea aquatica*) Grown in Laguna Lake Area**

**Luber, R. and Laguimum, A. T.**  
*Adamson University, Philippines*

Kangkong (*Ipomoea aquatica*) is commonly known as "poor-man's food" in the Philippines and it is basically used as one of the favorite vegetables for most native dishes. This aquatic plant is also used as animal feeds as well as an essential part of the "food chain" and "food web" in the aquatic ecosystem. The most popular site

in Metro Manila devoted for planting this vegetable is the Laguna de Bay. The proximity of this lake to Metro Manila makes it the best choice for this purpose. Unfortunately, it is a known fact that this lake is one of the biggest “pozo negro” (dumping site) of Metro Manila where industrial and residential effluents are being disposed unabated. Despite this condition the lake is still considered not fully dead due to seasonal flushing of polluted water in and out of Manila Bay which gives it a lease of life. Since “kangkong” is thriving in Laguna Lake, everything dissolved in it could be used and may end up as primary or secondary components of plants and animals raised in this area. Studies shown that heavy metals, *i.e.* Pb, Hg, Cd, As, pesticide and other effluents coming from different sources find their way into this water. Two of the known dissolved compounds are *lead* and *mercury*. With this knowledge there is a relatively high probability that these kangkong are bioconcentrating these metals which may render them hazardous for human consumption. This research project monitored the bioconcentration of these two metals in kangkong in order to establish the safeness of this food item. To achieve these objectives, sites in Laguna de Bay were selected based on a) accessibility; b) abundance of samples; and c) density of human population. Water samples and kangkong plants segregated into parts, *i.e.* root, stem and leaves, were collected for analysis. Spectrophotometer (Perkin-Elmer Atomic Analyst 700) was used for heavy metal analysis. Results showed that Pb was detected in all samples. However, Hg was not detected. The data indicated that Pb measured high in water. The fate of this metal upon bioabsorption showed that root registered the highest, followed by leaves, and stem the least.

- 1) Christman, R. F. (1997) Where might heavy metals in the aquatic environment end up? *Environmental Science and Technology*.
- 2) Paredes, R. (1994) “Heavy Metal Analysis of *Ipomoea bantas* Grown in Lahar” Thesis U. P., Diliman, Quezon City.

#### <Poster Presentations>

### **Environmental Studies on the Ashimori River in Okayama City, Japan**

**Tara, M.**

*Hiroshima Institute of Technology, Japan*

The present study was carried out by 14 members of the Science Club, who were directed by the principal T. Segawa and the director R. Noto of the Municipal Ashimori Junior High School in Okayama City. The Ashimori River locates in the northwest of Okayama City and forms a fine natural environment. Recently, fireflies decrease in number because of water pollution by human activities. This is the reason why we started to investigate aquatic animals and water pollution on the Ashimori River in 1994. Aquatic animals were collected and examined with a naked eye, and counted in number. The number of aquatic lives on the bottom in 25 cm<sup>2</sup> square frame was counted. Water temperature, pH, COD, NO<sub>2</sub><sup>-</sup>, PO<sub>4</sub><sup>-3</sup> and tachometry were measured. The more upper streams, the more species appeared in number. As the result of investigation, *Zacco temmincki*, Ephemeroptera, Trichoptera, *Semisulcospira libertine* (Gould), *Potamon (Geothelphysa) dehaani*, etc. were found in the upper streams. Ephemeropteras decrease in number year by year. Measurements of water quality showed the tendency that higher values on COD, NO<sub>2</sub><sup>-</sup> and PO<sub>4</sub><sup>-3</sup> were recognized in lower streams. On the contrary, the reverse result was recognized on pH. The values on pH, COD, NO<sub>2</sub><sup>-</sup> and PO<sub>4</sub><sup>-3</sup> in the past 3 – 5 years showed that the water pollution in the Ashimori River advanced annually.

### **Analysis of High School Student's Decision-making Processes to Solve a Problem Involving Biological Knowledge**

**Hong, J.-L. and Chang, N.-K.**

*Seoul National University, Korea*

In this study, the cognitive characteristics of students' decision-making processes centered on

phases, difficulties, and strategies are analyzed in personal daily life context involved in biological knowledge. The subjects were first year science and general high school students in Seoul, Korea; six female students and seven male students. The students' decision-making processes were analyzed by "think-aloud" and participant observation methods. On the whole, the students' decision-making processes progressed in following order: "recognizing a problem," "searching for alternatives," "evaluating the alternatives," and "decision." During the decision-making processes, the above phases are repeated by trial and error. Students preferred non-compensatory rules that do not allow trade offs among alternatives for decisions, rather than compensatory rules of selection. Students had a tendency to have difficulty analyzing the difference between initial state and desirable state of the problem, organizing biological knowledge-related problems, and clarifying values as selective criteria. Even students who had high achievement and more positive science-related attitudes did not apply biological knowledge to search for alternatives and could not utilize scientific values as selective criteria very well. Finally, we discuss the implications of these results for teaching of decision-making in respect to scientific literacy or biological literacy.

### **Elementary Science Education Majors' Views and Self-confidence Related on Biological Teaching**

**Hong, J.-L. and Kim, J.-Y.\***

*Seoul National University; \* Seoul National University of Education, Korea*

The purposes of this study are to investigate pre-service elementary school teachers' views and self-confidence related on biological teaching, and to find out suggestions for pre-service teachers curriculum. The subjects are 122 students of sophomores, juniors and seniors who have studied elementary science education in Seoul, Korea. The five-point scale of Likert-type

survey instrument, which is consist of 3 subscales of life-view, biological teaching-view, and self-confidence in biological teaching abilities, is used. The results show that students do not have creative life-view ( $m = 2.53$ ) but have evolutionary view about origin of live ( $m = 3.26$ ), and strongly agree on viewpoint of individuality, diversity, adaptativity, complexity, homeostasis, and emergency on properties of living things ( $m > 3.50$ ). They significantly agree on constructive biological teaching view ( $m = 3.88$ ) more than non-constructive view ( $m = 3.53$ ) ( $p < 0.001$ ), but, on the whole, they have both constructive and non-constructive view. Their level of self-confidence in understanding of biological concepts for elementary school is high, but not that of advanced knowledge and concepts. The levels of self-confidence in practical abilities on various science-teaching methods, and technical skills for biological teaching are in middle. Considering the results, programs for constructive teaching are to be more supported, and practical skills for biological teaching are also to be trained enough in curriculum for pre-service elementary teachers.

### **The Effect of a Chromosome Model on the Understanding of Genetic Concepts**

**Kim, H.**

*Wonkwang University, Korea*

Genetic concepts are very difficult for secondary school students to understand. Several studies have revealed that students had misconceptions about genetics because they could not relate generic phenomena with chromosome behavior during the process of gamete formation and fertilization. Therefore, the purpose of this study was to develop a chromosome model with which students can stimulate the independent assortment of alleles during gametogenesis and the allele recombination at fertilization, and to examine the effects of conception learning by using it. For this study 130 tenth graders in four classes were sampled from a high school in the

city of Jeonju in Korea. The students were divided into two groups for implementation of the program, one experimental group and one control group. In the experimental group the chromosome model which was developed in this study was used, while the contents of a science textbook were taught in the control group. The results of this study were very informative. Students in the experimental group showed a higher record, in the test items of genetic concepts that could be solved with relation to chromosomal behavior, than those in the control group, the differences between the two groups being statistically significant. In addition, interviews with students in the experimental group provided evidence that the simulation activity was interesting and helpful in relating chromosome behavior with Mendelian genetics. The use of the model was found to be effective for improving the understanding of the concepts of genetics, particularly the chromosome theory that genes are on the chromosome.

### **Simulation Experiments: Teaching Mammalian Physiology in the Laboratory**

**Tang, P. L., Ho, S. C. F. and Yau, M. Y. C.**  
*The Hong Kong Polytechnic University,  
Hong Kong SAR*

Since the introduction of "Adam-the-Visible Man" in the mid-nineties, there has been lots of changes in the teaching/learning strategies on the subject "Anatomy." Thereafter nearly all disciplines in life sciences have been equipped with computer-aided learning materials. A virtual physiology laboratory can be set up if one can afford the price and the time to choose the appropriate software from the suppliers.

We ran a pilot scheme in virtual physiology laboratory for students and compared the training outcome with those going through the classical hands-on experience. The evaluation parameter used included a written assessment on understanding certain principles in physiology, prob-

lem solving and applications. In addition, a questionnaire was also employed to collect feedback from students in both groups.

It is interesting to note that the virtual physiology group picked up the basic principles much faster including solving problems but they easily got tired after a few simulating experiments. They also showed a shallow perception in applying the physiology principles in real life situations. The reverse is true for the other group. Further investigation is needed to bring out the intrinsic value of virtual real learning/teaching activities.

Work was supported by Hong Kong Polytechnic University Research Grant: Acct No. 4855.

### **Computer and Multimedia Resources in Molecular Biology Teaching**

**Lee, K. L. D.**  
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Hong Kong SAR*

Multimedia, computer-aided, or web-based teaching seems to be catching on very fast these days. Just one academic year ago, PowerPoint presentations were rarely used in lectures in our university. Now, all teaching rooms and lecture halls in our university are equipped with multimedia projectors. PowerPoint presentations are commonly used in lectures of all disciplines. In molecular biology lectures, we have started using PowerPoint presentations two years ago and it was welcome by students with enthusiasm and excitement. This year, students are much less enthusiastic about these PowerPoint presentations. Some students are even complaining about lecturers using PowerPoint presentations too frequently. For the past two years, we have also been developing multimedia packages with animations and interactive components to aid students' learning in DNA technology. A package on polymerase chain reaction (PCR) has been provided to students in the form of a CD-ROM as a supplementary learning aid. The package includes the Concept, the Practice, and the Assessment sections. Throughout the

package, interactive components are built in to test the student's concepts and knowledge. Students find these interactive components most useful by offering them challenges and in enhancing their understanding of the topic.

### **Production of Genetically Manipulated Food: A Model in the Teaching of Biology**

**Tang, P. L. and Shiu, O. Y.**

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Hong Kong SAR*

The introduction of technological advancement, biotechnology, brings among other things, the food supply in terms of quantity and quality of the world into a new era. Traditionally, the quality as well as quantity of a crop may be improved artificially or naturally by cross breeding within species. This is a time consuming and unpredictable process. Presently, assisted by biotechnology, a selected gene controlling a particular trait can be shared between species, such as a cold resistance gene from the fish can be put into the plant. In the presence of the foreign gene, the plant can grow under unfavourable conditions that would not be possible otherwise. The crops and livestock produce so obtained are called genetically modified (GM) food. Examples of GM food are plenty many. Standard protocols in the production of GM foods have been widely published.

Nevertheless in teaching this module, the following questions need be considered. Does one need to know the number and kinds of GM food in the market? The kind of gene being inserted into GM food? The aim of adding such gene(s)? The sources of foreign gene(s)? The effects of foreign gene(s) on human health if consumed? The needs for the GM food? In the 21st century, should these topics be brought to the secondary education to widen student's horizon?

Work was supported by Hong Kong Polytechnic University Research Grant: Acct A-P134.

### **Research and Development in GM Soybean**

**Cheowtirakul, C. and Ruangchai, D.**

*Assumption University, Thailand*

The utilization and application of GMO soybean as foods, ingredients, potential development and consumer perception are reviewed in this paper. The aspects of review are listed as the following outline:

1. What is "genetically engineering food?"
2. Genetically engineered v. s. germplasm mutants
3. Research and development in genetically modified soybean.
4. Agricultural biotechnology (GMO) products on the market.
5. List of companies that "use genetically engineered ingredients in some or all of their products."
6. Genetically engineered food with antibiotic marker genes. (Example: Ciba Geigy GMO Maize)
7. Public concerns about GMOs in the environment.
8. Are genetically engineered foods safe?
9. How agricultural biotechnology produce GMO.

### **Floristic Study and Flower Biology of *Ficus* spp. (Moraceae) Found in Mts. Palay-Palay-Mataas Na Gulod National Park (Cavite, Philippines)**

**Alejandro, G. D. and Madulid, D. A.\***

*University of Santo Tomas; \*Philippine National Museum, Philippines*

A total of 15 species and five varieties of the genus *Ficus* were collected and identified from Mts. Palay-palay-Mataas na Gulod National Park. Two taxonomic keys using vegetative parts and reproductive parts were constructed for a better guide in the identification of the *Ficus* species studied. The diversity of *Ficus* species is highest at lowland elevation from 100 – 300 m above sea level. Seven endemic species found in the National Park are also widespread in the Philip-

pinus. The different flowers of the *Ficus* species (short-style female flower or gall flower, long-style female flower, male flower, and neuter flower) were studied and differentiated. A study on the insect pollinators was conducted and two genera of Aganoid wasps were identified: *Blastophaga* and *Ceratosolen*.

- 1) Amatya, S. M. (1989) *Ficus semicordata* Buch. Ham. ex Sm. and Its Taxonomy. Forest Research Division, Kathmandu. 1-29.
- 2) Corner, E. J. H. (1965) Check-list of Fucus Asia and Australasia with keys to identification. *The Gardens' Bulletin Singapore* 21: 1-86.
- 3) Merrill, E. D. (1923) *An Enumeration of Philippine Flowering Plants 2*. Manila Bureau of Printing. pp. 44-69.
- 4) Pancho, J. V. (1983) Vascular flora of Mount Makiling and vicinity (Luzon, Philippines), Part I. Kalikasan. *Philippine Journal of Biology*, Suppl. 1: 67-111.

### **Excretory System of Male Tilapia of Various Genotypes (YY, XY-GMT, XY)**

**Herrera, A. A., Catibog, C. and the Fisheries Genetics Breeding Program\***

*University of the Philippines, Diliman;  
\*Central Luzon State University, Philippines*

To solve the problem of small-sized tilapia, *Oreochromis niloticus* due to excessive reproduction, a fast-growing monosex male population was developed using the YY technology by a collaborative study of the University of Swansea, UK, and the Central Luzon State University, Philippines. Development of the organ systems of YY male, XY-GMT and the ordinary XY male tilapia was compared. This paper presents the results on the excretory system where the trunk kidneys, tubules and cells were significantly bigger in the YY male than in the XY-GMT and ordinary XY male.

- 1) Mair, G. C., Abucay, J. S., Skibinski, D., Abella, T. and Beardmore, J. (1997) Genetic manipulation of sex ratio for the large-scale production of all-male tilapia. *Can. J. Fish. Aquat. Sci.* 54: 396-404.
- 2) Wohlfarth, G. W. and Hulata, G. I. (1981) *Applied Genetics of Tilapia*. ICLARM, Philippines.

### **Histological Investigation of the Kidney of Swiss Albino Mice Fed with *Morinda citrifolia* Fruit Puree Extract**

**Ramos, G. and Herrera, A. A.\***  
*De La Salle University; \*University of the Philippines, Diliman, Philippines*

*Morinda citrifolia* is a plant with several alleged medical properties. It is the key ingredient in the very popular Noni Juice. Dubbed as the "miracle juice" it is claimed to have many miraculous effects. Local folks take the fresh fruit puree to cure illness. This study aimed at testing any effect of the puree on the kidney. Acute exposure of experimental mice to 4.7 ml/kg bodyweight was done for seven days. Paraffin slides showed glomerulus sclerosis, widened Bowman's space and tubule wall thickening.

- 1) Abt, A. B., Oh, J. V., Huntington, R. A. and Burkhart, K. K. (1995) Chinese medicine-induced acute renal failure. *Arch. Int. Medicine* 155(2): 211-212.
- 2) Solomon, N. (1999) *Tropical Fruit with 101 Uses: Liquid Inland Noni, *Morinda citrifolia**. Woodland Publishing, Pennsylvania.

### **Screening for Anti-*Staphylococcus aureus* Activity of Plant Extracts**

**Phrommanich, S., Techasauvepak, P., Mujchacheep, S. M. and Hrimpeng, K.**  
*Burapha University, Thailand*

Sticks and leaves of 14 species in five families of plants, Ebenaceae, Melastomataceae, Caparaceae, Guttiferae and Rutaceae from Samae-sarn island, were extracted with 95% ethanol. Twenty eight of the plant ethanol extracts were tested for antibacterial activity against *Staphylococcus aureus* ATCC 25923 by standard disc diffusion and broth dilution methods. The anti-*S. aureus* activity of 16 extracts, six of *Diospyros* spp., seven of *Melecylon* spp., two of *Garcinia* spp. and one of *Cratocylum* sp., were demonstrated at various levels of minimum inhibition concentration (MIC). The range of MIC was 400 – 1,600 µg/ml. However, only eight of

them demonstrated bacteriocidal activity at various minimum bacteriocidal concentrations (MBC), the range of MBC was 800 – 3,200 µg/ml. The leaf extracts of *Diospyros* sp. and *Garcinia* sp. (PTL1003 and PTL1012) showed the highest bacteriocidal activity with the MBC of 800 µg/ml. Accordingly, they were chosen for testing the antibacterial activity against 20 clinical isolated Staphylococci, 15 isolates of methicillin-resistant *S. aureus* (MRSA) and five isolates of methicillin-susceptible *S. aureus* (MSSA), by agar dilution method. The MIC of PTL1003 against 1, 3 and 10 of 15 isolates of MRSA were 800, 1600 and 3,200 µg/ml, respectively. The MIC of PTL1003 against 1 and 3 of five isolates of MSSA were 800 and 1,600 µg/ml, respectively. The MIC of PTL1012 against 2 and 10 of 15 isolates of MRSA were 800 and 1,600 µg/ml, respectively. The MIC of PTL1012 against 4 of five isolates of MSSA was 1,600 µg/ml.

- 1) Phengklai, C. (1987) *Thai Forest Bulletin (Botany) No. 11*. Forest Herbarium, Bangkok.
- 2) Lennette, E. H., Balows, A., Hausler, W. J. and Shadomy, H. J. (1985) *Manual of Clinical Microbiology*. American Society for Microbiology, Washington.

### **Anti-microbial Activity of Onion and Shallot on *E. coli* and *S. aureus***

**Kulpradit, N. and Kunnathigan, V.**  
*Assumption University, Thailand*

Herbal medicines are used to cure the disease for a long time while modern medicines are recently used with more popularity due to their strong and rapid effects. In this project herbal medicines, *Allium cepa* (onion) and *Allium ascalonicum* (shallot), were used to study the antimicrobial activity on *E. coli* and *S. aureus* (TISTR97). These two herbs are locally used to relieve cold and cure digestive system diseases. The process has been done by blending onion or shallot to get its extract along with a solvent extraction method using 95% alcohol and hexane and concentrating the extract two fold. Then the herbal extract

was tested for its ability to inhibit bacterial growth using the Disc Diffusion Method. The results show that *S. aureus* is more sensitive to onion and shallot than *E. coli*.

The clear zones observed from the use of onion and shallot concentrates were 2.7 mm and 2.7 mm, respectively for *S. aureus*, and 2.9 mm and 2.8 mm, respectively for *E. coli*. The use of fresh onion, onion (alcohol), onion (hexane), fresh shallot, shallot (alcohol) and shallot (hexane) give effective result at one level. Onion and shallot concentrates give more effective result than others. The learning in this project can be used as a guidance to gain benefits from herbal medicines, which are widely available in cheaper price.

### **Partial Purification and Characterization of Surface Tegumental Antigens of Liver Fluke *Fasciola gigantica***

**Krailas, D., Ukong, S., Vejaratpimol, R., Panomsuk, S. and Taisrivichai, S.**  
*Silpakorn University, Thailand*

*Fasciola gigantica* is a veterinary important parasite found to infect cattle, water buffaloes and sheep. In Thailand, it costs economic damages in terms of meat and milk production. The current method for diagnosis of infection in cattle is based on the microscopic detection of eggs in feces. Convenient and reliable immunodiagnostic methods based on the detections of antibodies or antigens in the blood of infected animals should be used for epidemiological studies. The tegumental proteins whose covering membrane and associated antigens turnover rapidly and are released into the host's circulatory system. The surface tegumental antigens of *F. gigantica* were partially purified and characterized. Gel filtration (Sephadex G-100) was used to fractionate the antigens. One major fraction of crude antigen was obtained and characterized by Native Gel Electrophoresis and SDS-PAGE. Only one band of protein was observed in non-denaturing PAGE. However,

SDS-PAGE demonstrated that the proteins had molecular weight of 49, 32, 29 and 20 kDa.

This work was supported by the Research and Development Institute, Silpakorn University.

- 1) Fagbemi, B. O. and Hillyer, G. V. (1992) The purification and characterization of a cysteine proteases of *Fasciola gigantica* adult worms. *Vet. Parasitol.* **43**: 223-232.
- 2) Krilas, D., Viyanant, V., Ardseungnoen, P., Sobhon, P., Upatham, E. S. and Keawjam, R. (1999) Identification of circulating antibodies in fasciolosis and localization of 66 kDa antigenic target using monoclonal antibodies. *Asian Pac. J. Allergy Immunol.* **17**: 53-57.
- 3) Viyanant, V., Krilas, D., Sophon, P., Upatham, E. S., Kusamran, T., Chompoochan, T., Thammarsart, S. and Parasitit, P. (1997) Diagnosis of cattle fasciolosis by the detection of a circulating antigen using a monoclonal antibody. *Asian Pac. J. Allergy Immunol.* **15**: 153-159.

### **Localization of Antigen in Frozen Sections of Adult Worms *Fasciola gigantica***

**Krailas, D., Ukong, S. and Jumnearn, S.**  
*Silpakorn University, Thailand*

Fasciolosis caused by *Fasciola gigantica* infection in ruminants produces a great economic loss throughout the world. In Thailand it costs economic damages in terms of meat and milk production. The detection of circulating antigens is considered to be amore reliable method for evaluating the status of infection which could be used to monitor the efficacy of treatment. Monoclonal antibodies were developed from partially purified surface tegumental antigens of *F. gigantica*. Five monoclonal antibodies were used for anatomical localization of adult *F. gigantica*. The reaction was demonstrated by the Avidin-Biotin method. The experiment revealed that the reaction occurred mainly on the tegument of the adult worm which covered its surface and spine.

This work was supported by the Research and Development Institute, Silpakorn University.

- 1) Krilas, D., Viyanant, V., Ardseungnoen, P., Sobhon, P., Upatham, E. S. and Keawjam, R.

(1999) Identification of circulating antibodies in fasciolosis and localization of 66 kDa antigenic target using monoclonal antibodies. *Asian Pac. J. Allergy Immunol.* **17**: 53-57.

- 2) Sobhone, P., Anantavara, S., Dangprasert, T., Viyanant, V., Krilas, D., Upatham, E. S., Wanichanon, C. and Kusamran, T. (1998) Studies of the tegument as a basis for the developments of immunodiagnosis and vaccine. *South-east Asian J. Trop. Med. Public Health.* **29**: 387-400.
- 3) Viyanant, V., Krilas, D., Sophon, P., Upatham, E. S., Kusamran, T., Chompoochan, T., Thammarsart, S. and Parasitit, P. (1997) Diagnosis of cattle fasciolosis by the detection of a circulating antigen using a monoclonal antibody. *Asian Pac. J. Allergy Immunol.* **15**: 153-159.

### **The Monogeneans of Cultured Hybrid Catfish (*Clarias macrocephalus* x *Clarias gariepinus*) in Thailand**

**Mhrad-Arehin, N. and Wongsawad, C.**  
*Chiang Mai University, Thailand*

The monogeneans were collected from cultured hybrid catfish (*Clarias macrocephalus* x *Clarias gariepinus*) from San Sai District, Chiang Mai Province, during December 1999 to April 2000. The prevalence of infection in fishes was 80.9% (123/152). Two species of monogeneans were shown, *Gyrodactylus* sp. and *Quaudriacanthus* sp. with prevalence 60.5% (92/152) and 55.3% (84/152), respectively. Intensity of infection were 11.02% (1675/152) and 3.92% (596/152), respectively.

This work was supported by the TRF/BIOTEC Special Program for Biodiversity Research and Training Grant BRT 542083.

### **Scanning Electron Microscopy to Identify Some Helminths in Watersnake, *Xenochropis piscator*, from Thailand**

**Nichapun, A., Wongsawad, C. and Sripalwit, P.**  
*Chiang Mai University, Thailand*

The trematode, *Acanthostomum burminis* and the acanthocephalan, *Sphaerechinorhynchus macro-pithospinus* were investigated by light micro-

scope and scanning electron microscope (SEM). These worms were collected from the watersnake, *Xenochropis piscator*, from Maesa Stream, Doi Suthep-Pui National Park, Chiang Mai Province, Thailand, during June 1998 to May 1999. *A. burminis* was collected from intestine and *S. macropithospinus* was collected from the muscle. The worms were fixed, stained and mounted by permanent slides processing. The identification was observed by light microscope. Some details were observed by SEM (JEOL JSM 840A). The body size of *A. burminis* is elongated and slender subcylindrical, crown of spines 26 in number, genital pore is located immediately in front of the acetabulum, bifurcate ceca opening to outside posterior part of the body. *S. macropithospinus* is long; trunk elongate and cylindrical, widest anterior and tapers in both direction, more gradually posterior; posterior areas widens; body spine absent; proboscis globular, slightly wider than long; proboscis spines in 14-15 alternating longitudinal rows of nine spines each including three anterior rooted robust spines and six posterior rootless spiniform spines.

This work was supported by the TRF/BIOTEC Special Program for Biodiversity Research and Training Grant BRT 541064.

### **Diversity of Helminths in Maesa Stream, Chiang Mai, Thailand**

**Wongsawad, C., Rojanapaibul, A.,  
Rojtinnakorn, J.\*, Wongsawad, P., Marayong, T.  
and Suwattanacoupt, S.**

*Chiang Mai University; Maejo University, Thailand*

Freshwater vertebrates from Maesa Stream, Doi Suthep-Pui National Park, Chiang Mai, were collected from January 1997 to June 1999. They were 3,900 of 32 fishes; 149 of nine amphibians; three of three reptiles. Fifty-six species of helminths were recorded: five monogenea are *Dactylogyrus* sp. I and II, *Trianchoraus* sp., *Gyrodactylus* sp. and *Diplozoon* sp.; 27 trematodes are *Allocreadium* sp. I and II, *Haplorchiodes* sp. (metacercaria; meta), *Haplorchiodes*

sp. (adult), *Posthodiplostomum* sp., *Gauhatiiana* sp., *Plagiophorus* sp., *Transversotrema patialense*, *Euryhormis* sp. (meta), *Centrocestus caninus* (meta), *Acanthostomum* sp. (meta), *Genarchopsis goppo*, *Genarchopsis* sp. (meta), *Phyllodistomum* sp. I, II and III, *Brevicreadium* sp., *Gorgoderina gracilis* n. sp., *Pleurogenoides sphaericus*, *Stellantchasmus falcatus* (meta), *Haplorchis* sp. (meta), *Urotrema* sp., *Encyclometra bungara*, *Pleurogenes chiangmaiensis*, *Telorchis* sp., *Mantereill* sp. and *Ganeo tigrinus*; Six Cestodes are *Senga changmaiensis* n. sp., *Ptychobothrium mystacoleucusi* n. sp., *P. maesae* n. sp., *P. rojanapaibuli* n. sp., and *Circumoncobothrium baimaii* n. sp. Three Acanthocephala are *Cystacanth*, *Pallisentis* sp. and *Acanthocephalus lucidus*; 15 nematodes are *Spinitectus* sp. (larva), *Spinitectus* sp., *Rhabdochona* sp. I, II and III, *Camallanus* sp., *Zanclophorus* sp., *Anisakis* sp., *Proleptus* sp., *Cosmocerca* sp., *Ascaridia* sp., *Camallanus anabantis*, unknown I and unknown II. Specimens were surveyed one of each season for the first year. The prevalence (%) and intensities of infection were recorded, first year in season and second to third year in every two months. Parasitic distribution, relationships between host and parasite, and classification were analyzed by cluster analysis.

This work was supported by the TRF/BIOTEC Special Program for Biodiversity Research and Training Grant BRT 139031.

### **Prevalence of the Rumen Cow Flukes in Chiang Mai and Lumphun Province, Thailand**

**Sripalwit, P., Wongsawad, C. and  
Anuntalabhochai, S.**

*Chiang Mai University, Thailand*

The rumens of cows (*Bos indicus*) from Amphur Maung, Chiang Mai Province and Amphur Maung, Lumphun Province were examined during January to March 2000; 37 cows were investigated while 29 cows were infected by trema-

todes. The prevalence of infection was 78%. Three trematode species found are as follows: *Fischoederius elongates* (Poiries 1883), *Orthocoelium parvipapillatum* (Stiles & Goldberger 1910) and *Paramphistomum epiclitum* (Fischoesdes 1904). The prevalence of infection was 41%, 49% and 76% in these species, respectively. In Chiang Mai Province, the prevalence was 88% while it was 81% in Lumphun Province. The parasitic infections were caused by *F. elongates* (50% and 33% in Chiang Mai and Lumphun Province, respectively), *O. parvipapillatum* (50% and 48%) and *P. epiclitum* (81% and 71%). This work was supported by the TRF/BIOTEC Special Program for Biodiversity Research and Training Grant BRT 542084.

### **Contraceptive Effects of Some Thai Medicinal Plants in Rats**

**Kaweewat, K., Smitasin, Y.\*, Kananthai, W. and Saenphet, S.\***

*Chiang Mai University; \* Mae Fa Luang University, Thailand*

Some Thai medical plants are reputed to prevent conception. This study was carried out to investigate the contraceptive effects of ten extracts: (1) hexane and (2) chloroform extracts from *Sida rhombifolia*; (3) hexane, (4) methanol and (5) aqueous extracts from *Aegle marmelos*; (6) methanol and (7) aqueous extracts from *Monordia charantia*; (8) chloroform, (9) methanol and (10) aqueous extracts from *Pueraria mirifica*. Groups of male and female rats were orally treated with 50 mg/kg b. w. of each extract for 20 days, and subsequently mated with untreated rats. After 14 days of pregnancy, females were sacrificed for examining the success of fertility and fetal malformation, if present. The results showed that extracts 7, 9 and 10 effectively prevented pregnancy. With exception of rats treated with extract 2, all treated females had significantly lower numbers of implantation as compared to controls. In the case of treated male rats, all ten extracts did not have any sig-

nificant effect on testicular weight. Nevertheless, seminal vesicle weight of rats treated with extracts 2, 3, 4, 6, 9 and 10 were significantly lower than those of controls. Moreover, a decrease in the number of implantation was observed in untreated females mated with males treated with extracts 1, 2, 4, 5, 6, 8, 9 and 10. No sign of fetal abnormality was observed in fetuses of both treated males and females. It could be concluded from the results that extracts 7, 9 and 10 could be effectively used female birth control, while the other extracts could only reduce fertility.

### **Low-cost Nutritive Cookies (LCNC)**

**Trimala, N. and Cheowtirakul, C.**  
*Assumption University, Thailand*

Humans require close to 50 specific substances in sufficient quantities to meet the body's needs that must be taken into the body in order to have them perform properly. These essential materials are nutrients. This project is aimed to produce a product, low cost nutritive cookies (LCNC), which contains every essential nutrient to meet the body's needs. The LCNC contains at least 38 essential substances, which meet the Recommended Dietary Allowances required by the man at the age 25 years and 75 kg weight. Besides the complete nutrients, these cookies are also low at cost because we selected all the raw materials, which are available in Thailand. The 530 grams of LCNC can substitute the whole day diet and the cost is only 23 baht per day.

Both quantitative analysis and qualitative analysis were done on the LCNC. Animal feeding test for a period of 28 days on mouse showed the weight gain was 123.97 grams when fed with the LCNC and 109.89 grams in control. The proximate analysis result showed that the LCNC contains 11.92% of protein, 26.64% of fat, 61.18% of carbohydrate and fiber, 3.12% of ash and 0.51% of moisture content.

<Talks>

**Hong Kong Country Parks and Nature Education**

**Ngar, Y. N.**

*Agriculture, Fisheries and Conservation Department, the Government of Hong Kong SAR*

There are 23 country parks in Hong Kong and they cover about 40% area of the HK territory. They have been and will continue to be a major environment for nature conservation, education and out door recreation. Large variety of activities are organized every year for the public, in particular the teachers and students, to enhance their interests, understanding and appreciation of the natural environment. Ultimately, it is hoped that all citizens will take up an environmental-friendly concept to conserve the precious nature.

**Hong Kong Marine Parks and Marine Reserve**

**Kwok, A.**

*Agriculture, Fisheries and Conservation Department, the Government of Hong Kong SAR*

In Hong Kong, there are three marine parks and one marine reserve, covering a total area of 2,160 hectares. They comprise scenic coastal areas, seascapes, and important marine habitats. Marine parks and reserve are managed by Agriculture, Fisheries and Conservation Department for conservation, education, scientific studies and recreation. Law enforcement actions are taken against the prohibited activities such as trawling, unauthorized fishing, hunting or collecting marine life, damaging marine and coastal features in marine parks and reserves. To arouse public awareness of the need to conserve the marine environment, educational activities such as guided tours, beach clean-ups, seabed clean-ups, seminars and public lectures are regularly organized.

<Abstracts submitted>

**A Simple, Rapid, Inexpensive and Wholistic Method in the Detection of Toxic Chemicals and Fecal Coliforms in Drinking Water Based on Luminous Bacteria Immobilized on Filter Paper Disc and the Lactose Fermentation and Iodole Production Tests**

**Quinto, E. A.**

*University of Santo Tomas, Philippines*

Clean and safe drinking water is based on the absence of harmful pathogenic bacteria as well as the absence of harmful chemicals (toxicants). Examination of water for potability is just usually based on the Fecal Coliform Test. A test based on bacterial bioluminescence to measure chemical water toxicity is currently available in the market <sup>1)</sup>. Both tests are quite expensive to perform and require sophisticated laboratory equipment and gadgets. The wholistic method described does not need any sophisticated laboratory device and is user-friendly, rapid and quite inexpensive. The fecal coliform test is done by simply adding 100 ml of water sample to two containers (A and B): A contains lactose, tryptophan, sodium lauryl sulfate, Phenol Red and Brilliant Green with an inverted tube while B contains tryptophan, potassium phosphate and sodium lauryl sulfate. After 24 to 48 hours of incubation at room temperature assuming an averaged tropical daily temperature of at least 30°C, turbidity, yellow-green coloration and gas formation is observed for A and red upper layer is observed for B after the addition of 30 ml of Kovac's Reagent. This result is indicative of the presence of the fecal coliform bacterium: *Escherichia coli* in the water sample. For the bacterial bioluminescence test, a 6.0 mm Whatman No. 1 filter paper disc is immersed in a brightly luminous broth culture of *Photobacterium leiognathi* causing the immobilization of luminous cells on the paper. The paper disc is immersed in 10 ml water sample contained in a screw capped tube which has been previously made 3.0% saline and pH 7.0. Complete or par-

tial light inhibition in one to two hours compared to a negative control is indicative of the presence of minute amount of toxicants in the water sample. Water samples negative for both tests: fecal coliform and bioluminescence tests are considered clean and safe to drink.

- 1) Bulich, A. A., Tung, K. K. and Scheibner, G. (1990) The luminescent bacteria toxicity test. Its potential as an in vitro alternative. *J. Biolum. Chemilumin.* 5(2): 71-77.

### **The Isolation, Cultivation, Preservation and Phenotypic Characterization of Marine Luminous Bacteria Obtained from the Seawater of Manila Bay and Indigenous Saltwater Fishes and Squid**

**Quinto, E. A.**

*University of Santo Tomas, Philippines*

Fifty marine luminous bacteria were isolated from different sources. Three luminous bacterial isolates were obtained from the seawater of Manila Bay while the remaining 47 were obtained from the intestinal content of various saltwater animals namely: *Trichiurus leptus* Linn. 1758 (Espada), *Nemipterus* sp. (Bisugo), *Leiognathus* sp. (Sapsap), *Selar crumenophthalmus* Bloch 1793 (Matang Baka), *Decapterus* sp. (Galunggong), *Caesio* sp. (Dalagang Bukid) and *Loligo* sp. (Pusit)<sup>1</sup>. Pure culture technique and cultivation of the marine luminous bacteria were done in trypton-yeast extract-glycerol-seawater medium. The 50 isolates were classified and subsequently identified using a battery of morphological, cultural, physiological, biochemical and ecological characterizations. Comparison of the phenotypic characterizations was done with 2 luminous bacterial type strains: *Vibrio harveyi* DSM6904 and *Vibrio fischeri* DMS7151. The three luminous bacteria obtained from seawater were classified as belonging to the genus *Vibrio* while other 47 luminous bacteria obtained from the intestinal tract of fishes and squid were classified as belonging to the genus *Photobacterium*<sup>2</sup>. The *Vibrio* species were identified as *Vibrio harveyi*, *Vibrio orientalis* and *Vibrio*

*splendidus* while all the Photobacteria were identified as *Photobacterium leiognathi*. Preservation of the cultures is done in soft agar trypton-yeast extract-glycerol-seawater stab medium overlaid with sterile light mineral oil and kept at chilled to room temperature.

- 1) Conlu, P. (1986) *Guide to Philippine Flora and Fauna Vol. IX Fishes*. JMC Press.
- 2) Nelson, K. H. and Hastings, J. W. The luminous bacteria. In: Balows, A. H., Trueper, G., Dworkin, M., Harder, W. and Schleifer, K. H. (eds) *The Prokaryotes 2nd ed.* Springer-Verlag, New York.

### **Immunomodulating and Free Radical Scavenging Activity of *Schefflera odorata***

**Ramos, M. C. R. and De Castro Bernas, G.**

*University of Santo Tomas, Philippines*

The butanolic extract of the leaves of *Schefflera odorata* was investigated in view of its immunomodulating and free-radical scavenging effects. The immunomodulating activity was assessed in terms of the release of cytokines, like interleukin-1 (IL-1) and tumor necrosis factor (TNF- $\alpha$ ) from human macrophages using the ELISA method. The release of IL-1 and TNF- $\alpha$  from human macrophages was induced by incubation with the butanolic extract for 24 hours at concentrations 20, 40, 50, 100 and 150  $\mu\text{g/ml}$  using 10  $\mu\text{g/ml}$  lipopolysaccharide (LPS) as the positive control. LPS induced the release of 339  $\text{pg/ml}$  of IL-1, whereas the leaf extracts at 20, 40, 50, 100 and 150  $\mu\text{g/ml}$  released 83, 64, 249, 1612 and 722  $\text{pg/ml}$ , respectively. On the other, 4191  $\text{pg/ml}$  TNF- $\alpha$  was released by LPS at 10 $\mu\text{g/ml}$ . The leaf extract stimulated the release of 361, 755, 438, 801 and 1118  $\text{pg/ml}$  TNF- $\alpha$  at 20, 40, 50, 100 and 150  $\mu\text{g/ml}$  of the leaf extract respectively.

The free-radical scavenging activity of *S. odorata* was determined using the Electron Spin Resonance (ESR) technique. Briefly, hydroxyl and superoxide free-radicals were generated and measured by spin trapping technique. In the presence of the butanolic extract of *S. odorata*, 69.18% of hydroxyl radicals were scavenged at

1.136 mg/ml while at 11.63 mg/ml of the extract almost 100% of hydroxyl radicals were scavenged. On the other hand, *S. odorata* did not show any significant superoxide scavenging effect.

### **Teaching Developmental Biology Using *Rhacophrus leucomystax* (Boie) Embryos**

**Simeon, E. C.**

*University of Santo Tomas, Philippines*

*Rhacophrus leucomystax* (Boie) or known as Banana frog produces embryos at any time of the year. It can be obtained from ponds or from moist grasses. The embryos are embedded in usually floating white jelly masses. Each jelly mass normally contain about 200 to 2,000 embryos that are at the same developmental stages to have ideal experimental sampling size. Several jelly masses can be collected at different period of the day especially during rainy seasons, hence, embryos that represent the various stages of development of a typical vertebrate can be readily available. These can be easily reared in the laboratory in simple, inexpensive and health-safe culture medium of rain water and cutting of *Hydrilla* sp. in clear plastic glasses. They are not very sensitive to light and temperature changes. The development of the embryos can be observed with the naked eyes or with the use of a simple had lens. Monitoring their development can be done within 5–7 days from the cleavage stage to the 7 mm embryonic stage. No feeding nor complicated management are needed within their period of embryonic development. With these conditions, the embryos of *R. leucomystax* are very practical and safe to use for classroom demonstration on the study of vertebrate embryonic development.

This paper initially presents the different stages of development of *R. leucomystax* embryos. This can be used as a basic reference for the study of developmental biology. It further presents a study which demonstrates the use of these embryos to determine anti-mitoticity, cytotoxic-

ity, embryonic toxicity and teratogenicity of substances or agents that may affect developing embryos. The principles of growth inhibition and acceleration are also included in the study.

### **Biogeography of *Nepenthes* Species in the Philippines**

**Madulid, R.S.**

*University of Santo Tomas, Philippines*

The population of 14 species of *Nepenthes*<sup>1)</sup> are discussed with important notes on their distribution, habitat whether highland or lowland, the kind of soil where they thrive, climate as well as rainfall.

While *N. alata* has the widest range covering the whole islands, *N. ventricosa* ranks second occurring in a moderately broad range. Two recently named species *N. argentii* and *N. sibuyanensis* have been found to be confined only in one small island in Luzon. There are some six species that occur in the northeastern strip of the Philippines that includes the mountains in the Bicol region moving downward to Samar and to the upper tip of the island of Mindanao particularly Surigao and still downwards towards Davao. There is the big elongate island of Palawan along the southeast boundary of Philippine territory where three *Nepenthes* species has been secluded and in the island of Mindoro, another species *N. burkei* seem to have remained cloistered through the year.

Distribution maps for the 14 species will be presented to show their various occurrences. Of the 14 species of *Nepenthes*, 13 are endemic to the islands. Species richness is apparent where there has been history of volcanic activity.

1) Jebb, M. and Cheek, C. (1997) A skeletal revision of Nepenthaceae. *Blumea* **41**: 1-90.



# 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 Papers:** 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 Note does 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 Papers,” “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](mailto: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 Paper: 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. 42 lines/page) throughout. The recommended font is 11 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*: Jörgensen, 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.

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[From the Editor]

The fifth volume of the *Asian Journal of Biology Education* (AJBE) contains two research papers, one practical report and one country report. According to the general rules for the publication of this journal, the abstracts of the presented papers at the latest (23rd) Biennial Conference of the AABE, which was held at the National Institute of Education, Singapore, from the 18th to the 20th of October, 2010, should be contained in this volume. However, the publication of these abstracts was postponed. This is because the Organizing Committee for the Conference decided to publish a book of conference proceedings in which selected papers would be recorded. After the publication of the book, the abstracts of the presented papers can be published in this journal.

In this volume, the abstracts of papers presented at the 18th Biennial Conference of the AABE which was held at the Hong Kong Polytechnic University, Hong Kong SAR, from the 1st to the 5th of August, 2000, are included as archives of the AABE. From now on, the abstracts of presented papers at the biennial

conferences of the AABE before the 18th one as well as certain distinguished papers which were already published in the past proceedings of biennial conferences will be recorded in this journal for readers' convenience. The Editorial Board is responsible for the selection of these papers.

Still, we have some papers and reports submitted from AABE members and other contributors. Those papers and the abstracts of papers presented at the 23rd Biennial Conference of the AABE which I mentioned above may be in the next issue which will be published next year. The Editorial Board, however, would like to ask the AABE members and the readers to submit their research papers and practical reports to this journal. For preparing the manuscript, please refer to "**Instructions to Contributors for the Asian Journal of Biology Education**" which was revised recently and is included in this volume.

I am grateful to Mr. John R. Cantillon for his help to prepare the final draft of the volume.

**Dr. Nobuyasu Katayama**