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

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

<Plenary Lectures>

Biology Education for Realizing the Preciousness of Life

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Former Professor of Nakamura Gakuen University

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

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

of the preciousness of life."

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

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

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

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This presentation starts with a description of what quality science education is because it is a means by which we can meet the challenges of education for sustainable development (ESD). It shows briefly how the concept of ESD has evolved. It describes the eight ESD content topics and themes: Ecological principles and concepts; Economy, lifestyle, and sustainable consumption; Food and agriculture; Society, peace, and human rights; Governance and citizenship; Human health and the environment; Sustainable urbanization and transportation; and, Indigenous and local knowledge. It also outlines the skills essential to ESD: 1) being able to know where we want to go and work out how to get there (envisioning); 2) learning to question our current belief systems and being able to examine the economic, environmental, social, and cultural structures in the context of SD (critical thinking and reflection); 3) acknowledging complexities and looking for links and synergies to find solution to problems (systemic thinking); 4) promoting dialogue and learning to work together (building partnerships); and 5) participation in decision making (empowering people).

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

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

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

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

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<Oral presentations>

Indigenous Protected Areas in Australia – Opportunities for Environmental Education

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

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

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

Keywords: Australia, biodiversity conservation, culturally significant lands, environmental education, Indigenous Protected Area.

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Understanding Evolution Is Essential in Education of Life

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

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

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

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

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

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

However, three out of six textbooks for the sixth graders published in 2005 do not describe "dissection of fish." Although many problems are left unsolved in enforcement of "dissection of fish" in elementary school science, it seems that "dissection of fish" will be important for "experiential learning" in order for children to have "notion about structure and function of human bodies and other animals," and notice "delicacy of structure of body" that will lead to realization of "the preciousness of life."

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

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

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

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

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

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

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

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

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

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

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

For this summer program I had the theme, *"Why should the chief article of food be carbohydrate? How is the route in the body?"* I wanted to advocate the way that everybody can understand how to feel in reality the location of the internal organs.

Keywords: carbohydrate, chief article of food, cur-

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

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

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

Keywords: biodiversity, ESD program, sustainable development.

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Embedding Academic Skills Development in Course Delivery

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

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

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

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

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Water is one of the most important resources, utilized for every human life, agriculture and industry in every country. However, various problems of water have never disappeared and rather grow into serious affairs in proper areas of the world. Water pollution is one of such problems to be solved. Domestic sewage is a heavy load for river in areas with high population density, especially eastern Asia, whereas outflow of fertilizer induces eutrophication of river water in agricultural areas of continents. For sustainable development better understanding of relationships between human activities and water quality is important and biology education takes an essential role to achieve this aim. We produced educational program featuring diatoms accompanied by multi lingual video movies and simulation software "SimRiver", and are developing a web site (http://www.u-gakugei.ac.jp/~diatom) for sharing these tools and information. By using the same educational tools and comparing learning outcomes it will be expected that students deepen their understanding and cooperation among countries under different circumstances.

Keywords: diatom, simulation software, video movie.

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

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

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

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

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

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It is important to improve the status in developing countries, such as science teachers cannot instruct the practical work in school science because they almost have not had any laboratory experience, and there is absolutely lack of experimental instruments in schools. Purpose of this study is to develop, try and assess the audiovisual (CD) biology teaching materials based on a survey of the status of school science and science teachers in developing countries. We surveyed the status in Cambodia, Philippines and Indonesia, and then tried to use and assess these materials at in-service science teacher training in the former two countries. Then, we made three versions in English, Khmer and Bahasa Indonesia, in addition to selecting experimental materials available in each country. We developed two kinds of "Biology" audiovisual materials: one was on basic scientific skills, such as how to use alcohol, how to make and observe cross sections of a leaf, etc., the other was on teaching biology concepts, such as photosynthesis, marine life, etc. The basic idea of these teaching materials were to develop adequate basic scientific skills based by comparing the correct skill with wrong skill, and to develop inquiry skills based on inquiry learning. The in-service training using these CD teaching materials was highly evaluated by the attending science teachers. This research was supported by the MEXT Japan (2003-2006).

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

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

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

Keywords: professional knowledge, standards for

biology teacher, teacher certification.

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

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

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

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

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

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

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

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

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Examination Method of Teaching Materials Development of "Ferns"

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

Keywords: biology education, fern, teaching material.

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

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

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

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

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

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

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In the study of animal behaviour, it is critical to observe animals with as little disturbance as possible, in order to get valid information. A blind is essential equipment to observe bird behaviour that is unaffected by the observer, especially in breeding season. From 2005 to 2008, 38 pairs of Asian Paradise Flycatchers (*Terpsiphone paradisi*) were observed in the breeding season (March to July) at Chiang Dao Wildlife Research Station, Chiang Mai Province. Fifteen nests were studied from observation blinds on the ground, 10 m away from nest trees, using a 15x – 45x telescope and video camera to record parental behaviour for 12 hours per day. Observation blinds were made from bamboo and the foliage of a herb, *Etlingera* sp., which grew in abundance on the study area. Blinds were built when nest-building was almost finished in order to minimize disturbing the bird's activities, and they were placed parallel to bird's regular flight approach pathway to the nest. Both parents did not show any uneasiness when the observer was inside a blind. None of the observed parent birds abandoned their nests, allowing for complete observations of the breeding cycle. A successful breeding cycle lasted 26 – 34 days and included 2 – 4 days of egg-laying, 14 – 18 days of incubation, and 10 – 12 days of parental care of nestlings in the nest. Natural blinds are, therefore, effective in allowing observations of this bird species and may also be useful for studying other bird species.

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

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

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

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

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

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

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

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

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

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The Society of Practical Education in Biology

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

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

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

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<Poster presentations>

Study on Actinomycetes Soluble Pigments for Suitable Application

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

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

Keywords: actinomycetes, pigments.

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

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The handling processes were investigated in the mud crab, *Scylla serrata,* using pre-cooling and chelae tying methods during emersion storage. Muscle glycogen, muscle lactate, muscle yield, muscle pH, volatile basic nitrogen (VBN), and proximate compositions were analyzed. More than 90% of the glycogen in muscle of non pre-cooling without chelae tying and non pre-cooling with chelae tying disappeared within 3 days of emersion storage while the concentration of glycogen of non pre-cooling with chelae tying and pre-cooling with chelae tying disappeared only about 70% within the same period of time. The content of lactate increased from the initial level (1.20 $mmol.kg^{-1}$) to 14.81±0.28 $mmol.kg^{-1}$ in non pre-cooling without chelae tying while it increased to 11.34±0.58 $mmol.kg^{-1}$, 11.12 ±0.27 $mmol.kg^{-1}$ and 10.08±0.62 $mmol.kg^{-1}$ in treatment of non pre-cooling with chelae tying, pre-cooling without chelae tying and pre-cooling with chelae tying respectively. The muscle pH of all treatments decreased slightly from 6.90 to 6.85, 6.95, 6.90, and 6.94 in non pre-cooling without chelae tying, non pre-cooling with chelae tying, pre-cooling without chelae tying and pre-cooling with chelae tying, respectively. Percentages loss of muscle yield increased to 30.10±1.20 %, 20.95±3.90 %, 22.32±4.26 % and 17.29±4.93 % in non pre-cooling without chelae tying, non pre-cooling with chelae tying, pre-cooling without chelae tying and pre-cooling with chelae tying, respectively. The VBN levels of the non pre-cooling without tying was 60.12±3.36 mgN/100g which is significantly different from the levels of the pre-cooling with chelae tying treatment (48.00±4.38 mgN/100g). There were no significant changes in mean of moisture, protein, fat, and ash content in all treatments. The results indicated that the handling process by pre-cooling with chelae tying could reduce metabolic activity and metabolic stress, which could delay loss of quality and physiological changes of mud crab during emersion storage.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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A Proposal of Recycling Club Model for Environmental Education in Malaysia

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

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

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

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

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

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

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

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

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

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

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

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

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

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Sound Quality of Salor's Bow from Different Horsehair Species

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Salor is a Thai-Northern style music instrument, which is consisted of a body and a bow stringed with horse hair. Each Salor has different sound quality, which is likely depended on the horse hair used. This research was aimed to examine effects of different species of horse hair on the sound quality of the Salor. Phenotypic data of 3 horse species (Lipizzaner, Thoroughbred, and New Zealand Pony) were collected. Sounds made by the different bows of the different horse hair were recorded and analyzed by Fast Fourier Transfer (FFT) to examine their sound qualities. Atomic Force Microscope (AFM) was used to perform roughness analysis (Ra), which might determine the sound quality. It was found that the Palomino Mare New Zealand Pony's hair gives the most satisfied sound quality with the Ra of 11.6585 nm/ 4 nm^2. However, the Ra was not clearly related to the sound quality. Future research may include studies on endurance, longevity, maintenance, and storage of the horse hair to add value and provide musicians with high-quality Salor.

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

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

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

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

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

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

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Cultivation of fishes like *Oreochromis niloticus* is extensive throughout the world, leading to an ongoing endeavor to improve food production by formulating cheaper and nutritionally comparable feed. This study aims to compare the effect(s) of the earthworm-formulated feed and commercial feed in terms of growth and development of *O. niloticus* fingerlings. Two set-ups of glass aquaria, each containing 20 *O. niloticus* (approximately 3 months old) fish, were prepared. One was exclusively fed with earthworm-formulated feed while the other fed with commercial feed. The weight, total length, fork length, caudal length and body depth were measured every week for 8 weeks and the mean values of the two set-ups were compared. The survival and general/feeding behavior of the fish were also observed up to 8 weeks. Statistical analysis showed no significant differences in all morphometric variables between the fish in the two set-ups during 8 weeks. A higher survival rate was observed in the set-up fed with earthworm-formulated feed. As to the feeding behavior, approaching, consuming and stalking of feed were observed in the fish fed with earthworm-formulated feed and commercial feed; the fish fed with commercial feed showed more aggression and loss of interest toward their feed. On the contrary, in the set-up fed with earthworm-formulated feed, there was more incidence of feeding on glass panel of the aquarium exhibited by the fish during the 4th to 6th week. With these, it can be concluded that the earthworm-formulated feed is comparable to the commercial feed in terms of its effects on the growth and development of *O. niloticus*.

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

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

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

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

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

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

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

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

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

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

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

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

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

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Any scholastic program envisioned by a unit of an

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

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

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

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In elementary schools in Japan, activities of raising living things are essential for the life environmental study and the science study. For years, the author has lectured and instructed how to grow plants and breed fish non-biology majors in the required class for the elementary school teacher-training course in Tokyo Gakugei University. There, the students raised plants and fish on their own responsibility and learn with the raised living things at home. At the first term of 2008, about 120 students subjected to the fish breeding activity. Before starting the activity, likes and dislikes about plants and animals and experiences and knowledge of fish breeding that the students had were surveyed. Around the finishing time of the study course, the students' knowledge of fish breeding was again surveyed. Also, at the end of the curriculum, students' consciousness how they were changed before and after the breeding activity was examined by self-evaluating method. Based on the data of above-mentioned study and also the students' opinions and views posted to the college website bulletin board for the class, the influence of the fish breeding activity upon the proficiency of fish breeding and outlook on living things of the students is discussed.

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

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Animal-assisted Education at Japanese Schools with Support from Veterinarians

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

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

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

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

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The Wild Animal Medical Center (WAMC) was established in April 2004 as part of Rakuno Gakuen University and serves as a teaching animal hospital. It is funded by the High Technological Project by the Ministry of Education and Culture, Japan. WAMC is not only a core facility for encouraging and supporting progress of wildlife research and educational activities, but it also co-ordinates research among related societies, government departments and other universities/institutes (*J. Rakuno Gakuen Univ*., **29**: 145-153, 2005). Conservation medicine is defined as an interpretation of the relationship between natural ecosystems and living body mechanisms (*Ibid*, **32**: 169-178, 2008). There are several specialized educational systems for studying zoo and wild animal medicine in Europe, Africa, the USA and Australia (*Zoo Wildl. News,* **(26)**: 10-13, 2008). The present author holds a Master of Science in Wild Animal Health from the Royal Veterinary College, UK (*J. Vet. Med*., **54**: 801-812, 2001), and his experience of taking part in this course has helped provide similar educational activities in the WAMC. Especially, the educational activities on field epidemiology with special reference to the host-parasite relationships between wild avian/mammalian species and their helminths as the Student Short Course (SSC) organized by Japanese Society of Zoo and Wildlife Medicine since 2004 is prominent (*J. Rakuno Gakuen Univ*., **32**: 25-42, 2007), because his research activities are focused on parasitic or infectious diseases/pathogens of zoo and wild animals, and are connected to host ecology and zoogeography. This research background may help educational activities of conservation medicine provide information from micro to macro levels.

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

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Usefulness of Small Scale Biotopes in Kindergarten Education in the Urban Area of Japan

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

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

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

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

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Under the supervision of one of the authors (Y.K.), some students of Ochiai Junior High School have been carrying out environmental research as one of their science club activities since 2003. Every month, they have examined the water quality of an artificial pond in the school and a natural pond in the Otomeyama Natural Park which is located very close to the school. For examining the water quality, *i.e.*, pH, ClO, COD, NH_4, NO_2, NO_3 and PO_4, they use Pack-Tests which are water quality examination kits sold on the market. At the same time, they investigate microorganisms with reference to diatoms living in these ponds. They identify diatoms at the order level, count them and measure their sizes.

There are significant difference in the pH and NO_3 concentration between the two ponds; the pH range of water is 8.0 – 8.5 in the school pond while it is 7.0 – 7.5 in the natural pond. The concentration of NO_3 is 10 – 20 in the school pond and 45 in the natural pond. The diversity of diatoms in the natural pond is greater than that in the artificial pond: the number of orders appearing is around 15 for the former and around 10 for the latter. Larger size diatoms are more abundant in the natural pond. These phenomena have been observed throughout the investigation period.

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

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

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

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

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

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

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

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

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

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

Keywords: biological education, museum collection, myxomycetes.

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

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

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

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

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

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

Keywords: antioxidant, chemopreventive agent, diphenyl picryl hydrazyl, free radical inhibition.

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

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

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

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

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

versity in Baranggay Kanawan in Morong, Bataan.

Keywords: fasting blood glucose, hypoglycymic, nutraceuticals.

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

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

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

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

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

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

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

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

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

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

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The aim of this study was to assess the genotoxicity of cadmium to non-specific immunity of the mature earthworms, *Pheretima peguana* and *Pheretima posthuma*. We studied the nuclear anomalies of coelomocytes, immune cells in the coelomic cavity, by a micronucleus test and a cytokinesis inhibition analysis. The individual earthworms were exposed to different times and concentrations of Cd on filter papers. Using extrusion buffer stimulation allowed us to investigate the appearances of micronucleus, binucleate, necrosis and apoptosis of coelomocytes under 1000 magnification. Results revealed that the exposure times and concentrations of Cd showed significant differences ($P<0.05$) in the changes in micronuclei and binucleates frequencies of coelomocytes of *P. peguana*. Compared to the control, the appearances of micronuclei and binucleates of *P. peguana* increased with the increased Cd concentrations but the effects in *P. posthuma* were not significant. The 0.085 μg Cd/cm^2 of filter paper induced the highest micronucleus changes and binucleate frequencies at 72 h. Micronucleus assay for the assessment of genotoxicity of Cd can be applied for coelomocytes in Micronucleus assay for the earthworm species, *P. peguana*.

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

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Factors Affecting Cadmium Adsorption of *Kirchneriella lunaris*

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

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

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Screening Plant Species for Assessing Cd and Neem Extract Contamination

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The phytotoxic effects of cadmium and azadirachtin (Aza), a most active component present in commercial available neem seed extract, were assessed singly in five plant species. Ninety-six hours after being exposed to 100 ppm $CdCl_2$ or 1.0, 2.5, 5.0, 7.5, and 10 ppm of Aza containing neem extract, the percentages of seed germination and root length were evaluated in all plant species. The screening trials using Cd did not reveal any differences in germination percentage between the treated plants and the control (at 80%) in yard long bean (*Vigna unguiculata* var *sesquipedalis* L.) and tomato (*Lycopersicon esculentum* Mill). The percentages of germination were 6.67, 14.17 and 31.39 % in lettuce (*Lactuca sativa* L.), sweet basil (*Ocimum basilicum* L.) and minnieroot (*Ruellia tuberosa* L.), respectively, whereas the relative inhibition of root length in Cd-treated plants ranged from 65.35 to 91.62%. The reduction in germination percentage as well as root length increased with an increase in the concentration of Aza. The high levels of relative inhibition on seed germination and root length at 10 ppm Aza in lettuce, tomato and minnieroot were 82.58, 63.96, 44.44% and 79.21, 82.68, 75.76%, respectively. The sensitive plant species were selected and cultured in ½ Hoagland solution for two weeks. It was found that treatment of Cd or 10 ppm Aza caused 100% death in lettuce and likewise for sweet basil treated with Cd. The root length of minnieroot treated with Cd was 51.22 % of the control. In contrast, tomato and minnieroot treated with 10 ppm Aza showed similar results as the control. From this study, it could be concluded that these sensitive plants have potential to be used for assessing the contamination of Cd and Aza.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Keywords: anticancer, carcinoma cell line, cytotoxicity, endemic and indigenous plants, extracts, IC_{50}.

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

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

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

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

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Karyotype Studies of Freshwater Snails, *Filopaludina* spp.

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Cytogenetic studies were carried out in two species of freshwater snails in Thailand, namely: *Filopaludina javanica* and *F. sumatrensis polygramma*. Chromosome numbers and karyotypes were analysed from the male portion of the gonad. According to the preliminary studies, it was found that the appropriated method for freshwater snail karyotype analysis was the preparation of well spread chromosomes containing metaphase cells by tissue dissection from 22±2 mm in size of collected snails which were cultured in 0.01% colchicine for 6 h before cell harvesting. To study the chromosome numbers, small pieces of dissected male portion of gonad from those snails were incubated in 0.06 M KCl for 1 h and fixed in Canoy' solution I. Thereafter, slides containing cell samples were made using by air-drying technique followed by conventional Giemsa staining. The chromosome numbers from at least 500 metaphase cells were recorded. The result showed variation of chromosome number which ranged from 7-24 chromosomes in both species. However, the highest frequency of determined cells (63%) showed the chromosome number as 11 chromosomes (n) and also 22 chromosomes (2n). After analysis of karyotypes, it was shown that the somatic chromosome number in these freshwater snail species was 2n=2x=22, which had the haploid karyotype formulas of $L_2^m + L_3^{sm} + M_3^m + M_3^{sm}$ and $L_1^m + L_1^{sm} + M_2^m + M_6^{sm} + S_1^{sm}$ for *F. javanica* and *F. sumatrensis polygramma*, respectively.

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

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

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

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

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

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

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

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

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

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

The results showed that high anxiety types were divided into conviction in logical misconception, insisting on additional variables, lack of confidence and conflict with past experience, whereas low anxiety types were reported as only reasonable modification in this study even though they had been reported as several anxiety types in other study. Also, the results showed that there were differences in explanatory hypotheses before and after the test experiment according to anxiety type of cognitive conflict. Moreover, these anxiety types were variously changed after the test experiment. Especially, students that their anxiety types were changed into reasonable modification showed higher variation of explanatory hypothesis. Therefore, it is concluded that teaching strategy in terms of cognitive conflict should be focused on facilitating students' ability to change their anxiety types into reasonable modification.

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

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

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

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

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

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Close Analysis of Reading Inscriptions in Biology Textbooks

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Biology textbooks contain various inscriptions such as photographs, drawings, graphs, tables, diagrams, etc. Such inscriptions can help students' learning, because the inscriptions can represent science contents that cannot be written in language easily. However, the inscriptions itself is sometimes hard to read for students. The process of reading inscriptions consists of three different kinds of works, structuring, transforming, and translating (*Sci. Edu*. **90**: 173-201, 2006). We analyzed the process of reading biology inscriptions in detail with the model suggested in the previous research by Han and Roth (*Sci. Edu*. **90**: 173-201, 2006). We focused on some examples of complex inscription where two or more inscriptions were layered together to represent the biology contents. We will show a lot of works are required in reading biology inscriptions, and some works may cause difficulties for students to understand the inscriptions in learning biology. The biology teachers should provide more and more resources kindly to students for reading biology inscriptions.

Keywords: inscription, textbook, reading process.

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

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

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

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

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An Exploratory Study on Emotional Factors in the Elementary Science Instruction

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

The major results of the study were as follows:

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

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

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

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

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

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

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

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

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

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Space Educational Program Implementation of Sample Return Missions

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

At KIBO, a wide variety of experiments can be done under different conditions than that of earth, from micro-gravity testing to the effects of space radiation. JAXA carries out sample return missions as part of its "Life in the Universe" program. The purpose of this is for youth to study scientific views about the universe and life, through experiments and observations. In the inboard property room, the dormant eggs of *Daphnia pulex*, and seeds of a *Ipomoea nil* and *Lotus corniculatus* are kept. After about six months, they will be returned to earth, and analyzed. Then, they will be made available to primary, junior, and senior high schools, science museums, etc., who hope to use them for educational activities. Moreover, any experimental ideas about using these samples will be available on the JAXA website.

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

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<Country Reports>

Biology Education in Schools Country Report - Australia

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

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

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

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

Keywords: Australia, biology, VCE, VELS.

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Korean Elementary Science Textbook Development (Grade 3 & 4)

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Korean elementary science textbooks had been developed in 2007. When textbooks were developed, workbooks and teachers' guide were also developed by the same textbook writers. The developed textbooks, workbooks and teachers' guide are now in pilot test. After the pilot test, these textbooks, workbooks and teachers' guide will be revised. Textbooks, workbooks and teachers' guide will be released in 2010. The contents of new elementary science textbooks are adjusted by renewed 2007 Korean National Science Curriculum. There are some differences between old elementary science textbook and new science textbook. First, inquiry will be emphasized with independent chapter. Second, textbook design is far different from old textbook. Third, integration with reading literacy and mathematic ability will be emphasized.

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

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

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

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

Keywords: biologist training, life science education, Singapore.

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Transition of Curriculum Guidelines for Biology Education in Japan

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Ever since the first Curriculum Guidelines Draft in 1947, revision has occurred about every 10 years. In 1969, the curriculum requirement for lower secondary school students in grades 7 – 9 (3-year timeframe) was 420 class periods of science study. The requirement was reduced gradually: it was 350 periods in 1977, 315 – 350 periods in 1989, and 290 periods in 1998. After this decrease in requirements, 2008 has brought a significant increase. The new curriculum guidelines specify 385 class periods of science as necessary.

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

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

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

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

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Status of Biology Education in the Philippines

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Biology Teachers Association of the Philippines, Inc.

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

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

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

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

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

There have been many efforts of various stakeholders in science education to address these concerns. To mention a few, the Science Education Institute of the DOST, the Department of Education, and the UP National Institute for Science and Mathematics Education Development which has three major functions: curriculum development, training and research. The Commission of Higher Education is likewise in the battlefield focusing on biology, chemistry, geology, mathematics, physics and the marine sciences. The Biology Teachers Association of the Philippines, Inc. (BIOTA-Philippines) as a nationwide professional organization of biology teachers on its 43rd year has been involved in the quest as well.

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

Keywords: biology education, BIOTA-Philippines.

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Development of Biodiversity Body of Knowledge in Thailand

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

In Thailand there are 302 species of mammals, 982 species of birds, 350 species of reptiles, 137 species of amphibians, 2,820 species of fishes, and more than 83,000 species of invertebrates but only 14,000 species are identified; most of them are insects. There are 12,000species of vascular plants including 600 species of ferns, 25 species of gymnosperms, 10,000 species of angiosperms, over 1,000 species of orchids and 2,154 species of non-vascular plants.

It is estimated that various living organisms in Thailand constitutes 6 – 10% of the world population of living things comparing with its 0.34% world area.

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

rapidly damaged particularly the habitat.

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

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

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

Objectives of CoEB

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

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

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

Research protocol

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

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

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

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<Workshop>

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

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

fixation, maceration and staining at the same time. Therefore, this developed method enables students not only to prepare the slides but also to observe them under a microscope within the limited lesson time. Furthermore, the use of 50% glycerol as a mounting fluid maintains the good condition of slides over three weeks without any cement. In this work shop, we demonstrate this simple and useful method and will provide assorted samples of acetic dahlia solution, 1 mol/L HCl and 50% glycerol with small packages of onion seeds.

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

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