Issue Number 5 March 2009

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Our monthly newsletter features a variety of information, highlighting current domestic and international issues concerning bioresources.

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- WGR http://www.shigen.nig.ac.jp/wgr/
- JGR http://www.shigen.nig.ac.jp/wgr/jgr/jgrUrlList.jsp

Announcements

(Details are available at http://www.nbrp.jp/)

- **The 3rd International Biocuration Conference (IBC 2009)**
  Date: April 16–19, 2009, in Berlin, Germany
  Details are available at http://projects.eml.org/Meeting2009

Japanese Association for Laboratory Animal Science will launch a serial article on NBRP animal resources in "Experimental Animals"—the in-house journal—in the second issue of Vol. 58 (published in the beginning of April 2009).

Introduction to Resource Center No.31

Possible Applications of Silkworms

Yutaka BANNO, Associate Professor, Graduate School of Bioresource and Bioenvironmental Sciences, Kyushu University

The most common application of silkworms is in the manufacture of silk from cocoons (Fig. 1). However, silkworms have various interesting functions and are actually used in various fields. In this issue, several recent topics on silkworms and their applications will be introduced, which will hopefully provide an opportunity to the readers to reacknowledge the importance of maintaining silkworm resources.

Fig. 1: Silk is used worldwide as a material for the manufacture of good-quality fabrics. (e.g., kimonos in Japan, scarfs in France and China, ties in Italy and Thailand, etc.)

Some cocoons are tolerant toward ultraviolet (UV) light

We exhibited silkworm cocoons of various colors at the exhibitions of the Annual Meeting of the Molecular Biology Society of Japan, organized in Kobe and Yokohama (Fig. 2-1, 2-2). Among the exhibited cocoons, there was a pale yellow cocoon called Sasamayu; recently, it was unexpectedly found to be UV tolerant. Silkworms lose their limbs after pupation and remain in the form of motionless pupae inside their cocoons. Thus far, cocoons have been considered to function as physical shelters for the vulnerable pupae present inside them. However, Dr. Chikara Hirayama et al. at the National Institute of Agrobiological Sciences (NIAS) discovered that the survivability of silkworms decreased when they were directly exposed to UV light during pupation. Among the 3 types of UV light, UV-B is considered harmful. It was found that Sasamayu could considerably better withstand UV-B than the white cocoons, which are formed by the majority of silkworms.

Fig. 2-1: Variation in the Colors of Cocoons. The 2 cocoons in the lower left are Sasamayu and that in the upper right is the cocoon of *Bombyx mandarina*, an ancestral species of silkworms.

It is intriguing why most silkworm cocoons are white, not tolerant toward UV light. Actually, silkworms are extremely domesticated organisms surviving only under the control of humans. Investigation of the cocoons of *B. mandarina*, which is an ancestral species of silkworms, unraveled the genes responsible for the color of Sasamayu. Scientific surveillance and analysis in addition to the observation of phenotypic variations of silkworms are unveiling unexpected capabilities of silkworms and insects in general.

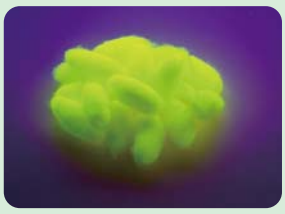

Fig. 2-2: Shining cocoons emitting fluorescence under UV radiation. (photograph provided by Dr. Chikara Hirayama at NIAS)

Application as Medical Materials

Since long, threads of manufactured silks have been used for suturing in operations. This use of silks is attributed to their biocompatibility. A primary component of silk is fibroin, a macromolecular protein. Recently, Dr. Yasushi Tamada *et al.* at NIAS converted fibroin into a sponge instead of a thread for extensive applications in the medical field (Fig. 3). By using the fibroin-manufacturing method developed by Dr. Tamada *et al.*, various stereoscopic structures can presumably be constructed. Although fibroin has more strength than the conventionally used collagen gel, there was an issue regarding its initial adherence to cells, and thus, some improvements have been awaited. Improved fibroin is being developed by using genetically engineered silkworms and the results seem to be promising.

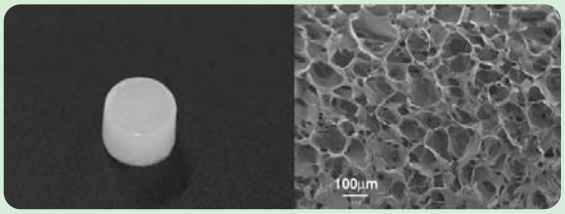

Fig. 3: A porous 3D structure is formed by the addition of a small amount of aqueous organic solvent to silk fibroin solution, followed by freezing and melting processes. (photograph provided by Dr. Yasushi Tamada at NIAS)

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Silkworms as Protein Production Factories

Advancements in the sericulture industry were accompanied by the development of techniques for mass rearing of silkworms. However, emergence of various diseases among silkworms necessitated the investigation of the causes of these diseases and the development of countermeasures in the case of each disease. Among the various diseases, virus infection has been formidable, and considering and devising preventive measures for it hold utmost importance. Meanwhile, an idea of exploiting viruses that are parasitic to silkworms has emerged; the idea is to use silkworms as protein production factories. Nuclear polyhedrosis virus (NPV) explosively proliferates inside silkworms, eventually causing their death. Thus, it would be possible to incorporate useful genes such as interferons in the viral genes and infect silkworms with the genetically engineered viruses to produce target proteins inside the silkworms. In the post-genome era, a research technique of producing proteins from functionally unknown genes to elucidate their functions is frequently used. For this purpose, *Escherichia coli*, cultured cells, or cell-free systems are generally used to produce proteins; therefore, the use of the whole organism such as silkworms is extremely unique. Silkworms are considered useful for the production of proteins with post-translational modifications such as those in sugar chains, which was impossible by using the conventional methods; they are also appreciated for their cost advantage. This method is already in practical use for the production of interferons for pets such as dogs and cats. Silkworm resources of NBRP are used for breeding silkworm strains that are suitable for "insect factories."

Silkworms are very attractive organisms that hold numerous possibilities in basic and applied research studies. ■

"Website of NBRP Silkworm"
http://www.shigen.nig.ac.jp/silkwormbase/

Erudite Lecture Series by Dr. Benno: No. 3

Feces as an Indicator of Disease

Feces are an indicator of health. The condition of feces reflects that of the bowels. A model of healthy feces is the feces of babies. The feces of babies contain 90% bifidobacteria, are yellow in color, have high water content, and smell slightly acidic.

It is suggested that the feces excreted be checked everyday, particularly the quantity. If people are asked whether they empty their bowels every day, most will answer "yes" unless they are constipated. However, the quality and quantity of feces are important for determining the health status of an individual. Unless the quantity of feces is checked every day, the condition of the bowels cannot be understood. The question now arises that what quantity of feces would roughly indicate a healthy bowel. It is known that consumption of 15 g of dietary fiber per day produces approximately 100–150 g of feces. Thus, I would consider a person healthy if he/she excretes >300 g of feces per day. As a rule, 100 g of feces approximately corresponds to the weight of a finger of banana.

When a person is healthy, the bowels can comfortably be emptied without any need to exert pressure on the lower abdomen. Another indication of good health is that the bowel pattern is constant, that is, a person defecates after meal or at the beginning of every day. Inconstant bowel pattern or defecation at 2 o'clock or 3 o'clock in the night is not a good indication. It is ideal that a constant bowel pattern is formed and the bowels are emptied regularly according to the biorhythm.

In addition, consumption of voluminous foods such as vegetables and seaweeds is recommended. Further, one should be aware of the comfort/discomfort at the time of defecation and should check the quantity of feces every time in order to better determine the health status and feel healthy. It is also important to know the time of defecation in the every-day pattern of 3 meals and carefully consider what to eat in order to produce a pile of "healthy" feces.

A conscious change in diet will considerably change the enteric environment. If the primary preventive measure for a disease is a good and balanced diet, the second is exercise. A combination of exercise and good diet will be more effective in disease prevention.

I continuously make an effort to walk >10,000 steps per day. It is important to exercise, including taking a walk, since it strengthens the abdominal muscles and the pressure required for defecation. Even if voluminous foods are consumed, a weak abdominal pressure will not induce active bowel movement, and thus, will not produce the extrusive force required for defecation.

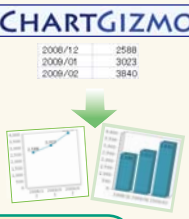
According to the results of research conducted in the US, it is clear that exercise is effective in preventing colon cancer. Regular exercise does not allow food residues to remain in the colon; further, it prevents the accumulation of harmful bacteria, thereby minimizing the production of substances that induce or accelerate tumorigenesis. A good diet alone does not make the bowels healthy. Exercise as well as a stress-free lifestyle is also important.

10 minutes Information Technology - 40 -

"ChartGizmo": Online Chart Creation Service

Have you ever wanted to show graphs on your website or blog? In this issue, we will introduce "ChartGizmo," which enables generation of a code to post charts on websites and blogs.

ChartGizmo is available for free, only requiring user registration.



Let's create a chart by using ChartGizmo.

1. Access the ChartGizmo website (http://chartgizmo.com/) and register as a user by clicking "Create account."
2. Open the Chart Editor screen by clicking "New Chart" on the Charts screen. Configure the chart designs and enter values (Fig. 1). If you would like to edit your previously created charts, click the tool symbol on the Charts screen. (Values can either be entered by typing each value separately in the text boxes or by pasting the Excel data.)
3. Click "Save&Publish" once; the settings get saved and a code is generated.
4. Select the code to post on the Chart Publishing screen and paste the code on websites or blogs.

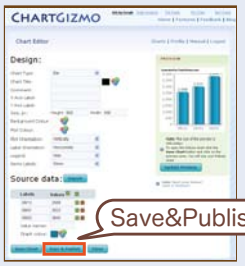


Fig. 1: A screen to input chart information

(Codes displayed on the Chart Publishing pages)

Codes	Explanations
Image Html	Html Img tag of the chart is generated.
Flash	A code to display the chart in Flash is generated.
Dynamic	Javascript to display the chart is generated. (Data can be manually edited.)
Capture	Javascript to create the chart is generated from the data table on the page where the chart will be posted. A data table should be prepared before the generation of javascript for creating this type of chart.

Fig. 2 shows a chart created as an example. The chart depicts the transition of the user numbers of BioResource World (http://resourcedb.nbrp.jp/) from December 2008 to February 2009.

Although a chart can also be created in Japanese, if "Dynamic" and "Capture" are used in the current version of ChartGizmo, labels in Japanese will be garbled.

(Yuka Takahashi)

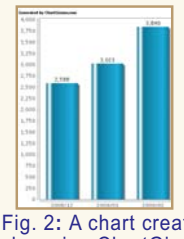


Fig. 2: A chart created by using ChartGizmo

Coming up in the next issue !
The next month's issue will be "Intellectual Property."

Editor's Note Dr. Banno at the Silkworm Genetics Division, Institute of Genetic Resources, Kyushu University, which was established more than 80 years ago, elaborated on the recent topics on silkworms in a lucid manner. The whole genome of silkworms was sequenced by the collaboration of Chinese and Japanese research groups and recently released in February this year. In the near future, the structure of relevant genes will be elucidated by using the collection of mutant silkworm strains in Kyushu University. Photographs of many larvae, cocoons, and eggs of mutant silkworms are available on the website. (Y.Y.)

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