

# BioResource Now!

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New Series!

From the Scene of a Resource Center

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(Graduate School of Agriculture, Kyushu University)

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New Series! From the Scene of a Resource Center

# Fascinated by Silkworms

Yuko Minohara, Technical Staff  
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Four years have already passed since I started working as a staff member at the National BioResource Project Silkworm. I started as a member of the administrative staff, and, at that time, I did not even know whether cocoons or pupae are necessary for the support of a cocoon investigation. However, I later became a member of the technical staff and fell for the charms of silkworms, experiencing silkworm resources by conducting experiments, breeding them, and administering the databases. In the meantime, I was asked to contribute to an article for the new series in this newsletter that would introduce local input, and, thus, I would like to describe the charms of the silkworms that I have recently experienced.

The first charm is the appearance of a larva. A larva, which is as small as an ant immediately after hatching, sheds its skin 4 times within about 20 days and becomes as plump as a little finger. It is indeed spectacular that the larva does nothing but eat mulberry leaves in order to grow day by day. The dry touch of a firm and well-padded last-instar larva before cocoon formation feels like baby skin. A larva can also grab me firmly with its many little legs just as a baby would. The body patterns of larvae vary a great deal depending on their genes. A typical body design of a larva includes moon- and star-like patterns (crescent and star spots) on the back of its white body and eye-like patterns (eye spot) (Fig. 1), while others exhibit black stripes or sesame and salt patches (Fig. 2).



Fig. 2: Various larval body patterns

My favorite body pattern of a larva involves ocular markings that look like a Nico-chan (smiley face), and this pattern is also the most popular among our staff members.

In addition, the names of silkworms are charming. Because silkworms have a long history of being bred in Japan, many strains have Japanese names that sound like familiar sisters, such as 姫蚕 (Himeko), 虎蚕 (Torako), 竹蚕 (Takeko), 樽蚕 (Taruko), and 臭蚕 (Kusako). The gestures of silkworms are also adorable. My favorite action is when a 5th-instar larva sticks its head out from a small hole (Fig. 3). A moth popping its head out of the cocoon is another lovely sight, and wriggling pupae are captivating.



Fig. 3: A 5th-instar larva sticking its head out from a small hole.

Furthermore, I suppose that my fascination with silkworms also comes from the fact that silkworms have been domesticated over many years, and they cannot survive without human intervention. During the season of spring rearing, a day goes by quickly while the tasks that are required for their care, such as controlling the temperature and humidity, feeding and cleaning (disposing leftover foods and

feces) twice a day, and changing the size of the mulberry leaves and rearing tools depending on the growth stage of the silkworms, are completed. Well-grown spinning silkworms are transferred to a Mabushi, which is a rack that allows silkworms to make cocoons. A week later, the cocoons are taken off the Mabushi, and their fluffs are removed in order to facilitate the smooth emergence of the adult. Upon copulation following emergence, the moths are separated for egg deposition, and this step completes the generation change. Because fertilized eggs have a year-long life span and freeze-preservation techniques are still under investigation, this process is repeated every year. Laboratory notes, which have been passed down by researchers since 1911, make us appreciate the important lessons learned through history and responsibility.

My work is not simply to cradle the silkworms fondly but to treat them rather cruelly most of the time during the year. The ovaries are extracted from 4th-instar silkworms while they are anesthetized by freezing, and the ovaries are then frozen or implanted. The spermathecae of male worms are taken out, and the sperm are scraped out and frozen. The female worms are then artificially fertilized with defrosted sperm (Fig. 4).

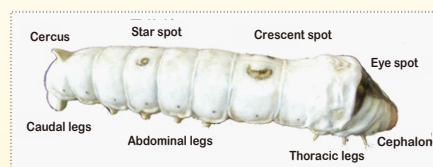


Fig. 1: Typical silkworm

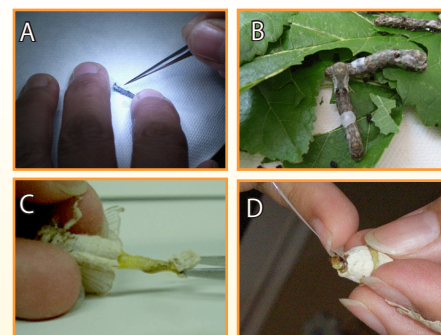


Fig. 4 A: Ovarian resection  
B: Silkworms after ovarian graft  
C: Extraction of spermathecae from a male worm  
D: Artificial fertilization

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The only thing I can do to make up for this is to pray that the silkworms do not bear a grudge against me at the Houjoya (Hakozakigu taisai) every year. I sincerely hope that our efforts will improve efficiency, reduce the burdens on the strain preservation tasks, and help with the various lines of research.

Silkworms are manageable insects that do not sting, bite, run, flee, or fly. We would like to continue to enrich our resources and provide further information

through databases in order to meet the multitudes of requests that are made by many users. Please see the following websites and our resources. ■

<http://silkworm.nbrp.jp/>  
<http://www.shigen.nig.ac.jp/silkwormbase/>



## Watch Out for Location Information



Are you aware that information other than photographic subjects is additionally recorded when resources are photographed by smart phones or digital cameras? An increasing number of recently released smart phones and digital cameras automatically record location information when photographs are taken. If pictures of precious resources are taken by these models and the image data are released to the public without deleting the location information, habitat and depository information will also be released accidentally. In this issue of the newsletter, I would like to introduce a procedure that will prevent the attachment of location information to photo data.

### Do not record location information in pictures!

A procedure to delete location information in pictures will be introduced using an iPhone4S as an example. The camera application of the iPhone requests permission regarding the acquisition of location information at the start-up of the application at the first use. If this request is refused, no location information will be recorded for the pictures that are taken subsequently; however, if accepted, the recording of location information can be turned off using the following procedure:

- 1) Start up the "Settings" application (Fig. 1).
- 2) Touch "Location Service" (Fig. 2).
- 3) Slide the camera from "ON" to "OFF" (Fig. 3).



Fig. 1: Setting application of iPhone4s



Fig. 2: Setting screen



Fig. 3: Location information service screen

The unwitting recording of information can be prevented by refusing the recording of location information in the camera application. It is recommended that users of smart phones or digital cameras with other GPS functions refer to their manuals regarding the management of location information during photography.

## Ongoing Column [No. 72]



### Delete location information from pictures!

There are several ways to delete location information from pictures. One rough method is to change the extension of image files, and another is to delete location information using exclusive software, both of which will be introduced.

- 1) Changing the extension from JPG

The extension of picture files to which location information has been added is JPG. Therefore, location information can be deleted from picture files by changing the extension of the files from JPG to others, such as GIF, and then resaving the files with Paint software.

- 2) Deletion of location information by exclusive software

Location information can be deleted with free software, such as ExifEraser. Download and install the software according to the program instructions. Subsequently, location information can be deleted simply by dragging and dropping pictures with such information to the icon (Fig. 4).

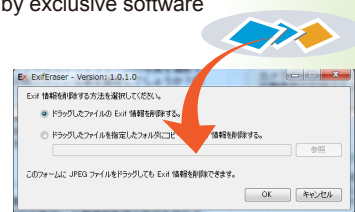


Fig. 4: Drag and drop a picture

ExifEraser : <http://www13.plala.or.jp/himanote/exiferaser.html>

The technology for recording location information has long been known as Exif. However, because of a recent development in smart phones and digital cameras, information other than the subjects of the photograph, such as location information, is recorded without the knowledge of the photographers. It is recommended that photographers check whether location information is recorded whenever resources are photographed.

(Tohru Watanabe)

[This column is only available for Japanese]

## Recommended Book ! <NO.8>



### "Endless Forms Most Beautiful"

By Sean B. Carroll, translated by Masataka Watanabe et al. (Kobunsha, 2007)

As implied by the subtitle of the book, "The New Science of Evo Devo," the book is a scientific treatise for the public that was written by Carroll, who is one of the key players in the Evo Devo (evolution and developmental biology) Revolution.

The commonality of *hox* genes, which were discovered in *Drosophila* and mice in the 1980s, is considered the greatest discovery of the century in the field of biology. Because of this finding, research in developmental biology began to be associated with genetics, and it was modernized dramatically. However, the process of embryogenesis is complex and involves many types of genes, which have different names depending on the model organism. Thus, studying with textbooks often produces little progress in the understanding of embryology. However, Carroll's writing, which is full of pithy sentences, explains the essentials without fussing over details. Therefore, it is easy even for outsiders, such as me, to follow his arguments. Carroll, who holistically named the genes that were involved in the morphogenesis of animals "toolkit genes," emphasized the commonality in the genes that are responsible for determining fundamental body plans, such as segments, appendages, and organs, including eyes and hearts, between arthropods and vertebrates, which are taxonomically far apart. However, the author explained that the differences and diversities that we observe in the morphologies of animals are derived from the differences in the number and the type of gene switches (more accurately cis-regulation elements) that control the expression of the toolkit genes. The eye spot on the wing of a butterfly that is portrayed on the front cover in the Japanese edition of the book represents Carroll's achievement, as he and his colleagues demonstrated that the eye spot can be generated by the activity of the toolkit genes. (K.N.)

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## Editor's Note

The daily activities of resource centers are supported by many technical staff members. However, it is normally difficult to see them and ask them about their tasks. I had a chance to talk to Ms. Minohara at my last visit to the silkworm resource center, and I was impressed by her enthusiasm for her work and her deep feelings for the silkworms. I therefore requested this contribution from her. I imagine that readers can visualize her black eyes twinkling during her affectionate explanations of the silkworms through the article. (Y.Y.)

## BioResource Information

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