AsOBiNet Report

International PHOTO.COMM Training Workshop
Bioinformatic analysis of transcriptomic and genomic datasets in metabolic context with emphasis on oxygenic phototrophs

University of Tsukuba
Graduate School of Life & Environmental Sciences
3rd year Ph.D. course
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In September of 2013, I attended the “International PHOTO.COMM Training Workshop”, organized by EU Grant, PHOTO.COMM. PHOTO.COMM is a collaborative project on the photosynthetic microalgae or cyanobacteria for sustainable large-scale production of fuels, chemicals and general biomass. It organizes several meetings and training workshops for graduate students in European countries to learn about the topics all through innovation chain: from fundamental biology to applied technology in commercial use. Fortunately, I was allowed to participate in one such workshop for students: “Bioinformatic analysis of transcriptomic and genomic datasets in metabolic context with emphasis on oxygenic phototrophs” held at the University of Freiburg, Germany. “Omics” approaches, i.e., genomics-based transcriptomics, proteomics and metabolomics are very powerful tools for the understanding biological phenomena. Management of large scale raw data obtained through omics analysis becomes an essential requirement and skill for the biochemist. This workshop was held with an aim to have practical information, knowledge and learning bioinformatic techniques in order to effectively utilize the omics information. The following is my report and impression of the workshop.

Freiburg is a city located in south Germany bordering France and Switzerland. I took a 12-hour flight from Narita to Frankfurt airport. And then I got into the ICE (like Bullet train or Shinkansen) and arrived at Freiburg station. The first day of the workshop was a get-together (with other participants and staff) at the seminar room of University of Freiburg followed by a light dinner and interacting with others. Most of participants were graduate students studying in Germany, and a few were from United Kingdom and Finland.
This workshop was held for four days from 8th to 12th September. Morning session started by the lecture from the teachers and afternoon session was focused on the technical practice via a computer. Four teachers gave talks. Prof. Dr. Wolfgang R. Hess from University of Freiburg, who was one of the organizers of this meeting, gave a talk about fundamental knowledge of cyanobacteria including signal transduction mechanism of cyanobacteria, i.e., transcriptional start site (TSS) determination, two-component system, and small RNA regulation. The second lecture was how-to-analyze a large scale dataset by Dr. Björn Voß, a senior researcher in the laboratory of Prof. Wolfgang. We learned the protocol to deal with raw transcriptomic read data: quality check, read mapping onto genome and visualization of TSS. Prof. Dr. Martin Hagemann from Rostock University gave a talk about photorespiration mechanism in cyanobacteria and metabolomic analysis. Dr. Ralf Steuer from Humboldt University talked about computational biology: computer simulation of enzymatic reaction in photosynthetic organism.

Every afternoon, we actually performed the data analysis using a computer in the computer pool of University of Freiburg. The university owns a private server containing several kinds of tools for bioinformatics. The system is really well-organized and very useful for all type of data analyses. In this class, the real data obtained by transcriptome experiment was given to each student. We sorted out and analyzed the data, and finally visualized the TSS using several tools. We carried out following operations. 1) Transcriptomics: quality check of sequences, read mapping on genome sequence, TSS visualization. 2) Metatranscriptomics using RNA sequence information from natural sea-water sample: sort them into ribosomal RNAs and non-ribosomal RNAs, gene clustering, constructing a phylogenetic tree. We also had a technical class by Dr. Ralf Steuer to perform the computational simulation. All enzymatic reaction in metabolic pathway could be described in mathematical form, including the definition of substrate concentration, Michaelis constant, maximal velocity, etc. We drew the graphs of several enzymatic reactions, i.e., Calvin cycle, glycolysis, and glycolic acid pathway by using a mathematic tool, Octave on Linux.
In the computer room, there were some student- and postdoc- contributors from the laboratory of Prof. Wolfgang, who are very familiar with bioinformatic analyses. If we did not understand how-to-do something, we were able to ask them immediately.

At the end of the workshop, each participant made a short presentation and discussion. We introduced the issue, which we got interested in through the technical practice.

All though this workshop, I realized the importance of bioinformatics on biochemical research and also that of conversation skill by English. At least in the skill of speaking, there was little problem even if I could speak only ‘elementary English’ as we learned in junior-high school, because they could understand my feelings and perspectives. However, in the listening of English (especially the case of non-scientific conversation), I felt a significant hurdle between I and other students from EU countries. I had to train my ears by routinely listening to actual English in order to do without “pardon?” or “sorry, please repeat again”. Despite these shortcomings, I really enjoyed the workshop. Such event in which students of the same age study together is very good for stimulating and encouraging one’s thinking. Although there may not be many opportunities to attend a student community held in a foreign country but, I would like to actively join again whenever I have a chance to do so.

Finally, I greatly appreciate the financial support through the AsOBiNet program and its organizer, Prof. Dr. Yoshihiro Shiraiwa, (Provost of Life and Environmental Sciences) University of Tsukuba (Japan). I also express my sincere thanks to Prof. Dr. Wolfgang R. Hess, University of Freiburg (Germany), who organized this workshop, for giving me a great opportunity to participate.
Photos in Freiburg
Certificate

This is to certify that:

Tomonori Kotajima

Attended the International PHOTO.COMM Training Workshop

Bioinformatic analysis of transcriptomic and genomic datasets in metabolic context

With emphasis on oxygenic phototrophs

September 08 – 12, 2013, Freiburg, Germany

Organized by:
Prof. Wolfgang R. Hess and Dr. Björn Voß, University of Freiburg, Faculty of Biology, Genetics & Experimental Bioinformatics

With participation of:
Dr. Ralf Steuer (Inst. Theoretical Biology, Humboldt-University Berlin) and
Prof. Martin Hagemann (Univ. of Rostock, Germany)

Freiburg, SEP 12, 2013

For the organizers:
Prof. Dr. Wolfgang R. Hess