FELLOWSHIP SUMMARY REPORTS

Name of research fellow: Natsuko Nakayama

Subject title: Application of “phage therapy” to develop bio-control using virus against Harmful algae blooms

Theme number of your research fellowship: Theme III: Transformational Technologies and Innovation

Host institution: The Laboratory of Gene Technology, Faculty of Bioscience Engineering, KU Leuven University

Host supervisor: Professor Rob Lavigne

Dates of your fellowship: From 21st September 2017 to 23rd March 2018, 13 (+ 13) weeks

Consent to the report being posted on the Co-operative Research Programme’s website: Yes

1. Objectives and importance of the research project

My research aims to mitigate the damage to fisheries caused by Harmful Algal Blooms (HABs). HAB has resulted in great damage to the aquaculture industry, human health, coastal economies, and wild fisheries. Methods for mitigation are seriously required, and as a result we have been trying to develop a tool of controlling the HABs by virus. “Phage therapy”, which refers to the therapeutic use of phages for the treatment of pathogenic bacterial infections in humans, is expanding in various fields. The host laboratory I was planning to collaborate with is the front-line laboratory that studies the application of phage therapy in the agricultural field. The aims of this collaboration is to lead to the practical application of bio-control using the virus against HABs in fisheries through the development of phage therapy techniques.

2. Were the objectives of the fellowship achieved.

They are on the way to being achieved.

My collaborator and I had discussions many times and designed our research plan. Following this we have started and often updated the plan, and are pushing the works forward.

3. Major achievements (up to three)

In order to achieve practical application of bio-control through usage of the virus against HABs in fisheries by developing phage therapy techniques, we focused on two algal species and their viruses; *Heterocapsa circularisquama* and HcRNAV, *Karenia mikimotoi* and its KmDNAV. The major achievements are as following;

First, we planned a series of required tests after discussing which method for the practical usage of phage therapy. It means we will do continuing collaboration after in this period.

Second, we began some work on the elucidation of the interaction between phytoplankton and its virus by using molecular techniques. In particular, we focused on the interaction of protein expression between *Heterocapsa circularisquama* and HcRNAV and succeeded at constructing the vector.

Third, we have been analyzing a whole genome of a virus infectious to *Karenia mikimotoi*.

4. Follow-up

- Is a publication envisaged? Will this be in a journal or a publication? When will it appear?
- Is your fellowship likely to be the start of collaboration between your home institution and your host?
- Is your research likely to result in protected intellectual property, novel products or processes?

We are planning to publish in a journal after obtaining some results. The fellowship initiated a collaboration between KU LUEVEN and FRA. We will achieve novel results from this fellowship after additional results are acquired and are currently in the process of applying for further research funding to expand the results. The product of this research might not result in intellectual property.

5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?

Please express this in terms of environmental/food security/food safety/economic/health (human and livestock and plant) benefits, etc.

In fisheries, bio-control has not yet become practical. The development of this project will contribute not only technologically but also to scientific knowledge. In addition, the technological transformation of this crossover discipline will provide the possibility to produce the following technical developments and lead to benefits for not only myself and the host group, but also for fisheries and agriculture, Japan and Belgium, OECD member countries, and developing countries.

6. How was this research relevant to:

- **The objectives of the CRP?**
- **The CRP research theme?**

As mentioned previously, bio-control has not yet become practical in fisheries. The development of mitigation techniques is seriously required, and we have been trying to develop a tool for controlling the HABs by virus. The host laboratory is the front-line laboratory that studies the application of phage therapy in the agricultural field. There are a series of basic studies for the application of phage therapy in other fields and how to establish a system for social acceptance for the practical use of phage therapy in a natural environment. The aim of this collaboration is to lead to the practical application of bio-control by the virus against HABs in fisheries through the development of phage therapy techniques. In this CRP, we picked up some of the work required for the bio-control and started collaborating.

7. Satisfaction

- Did your fellowship conform to your expectations?
- Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? Please specify.
- Did you encounter any practical problems?
- Please suggest any improvements in the Fellowship Programme.

The fellowship exceeded my expectations. I developed new skills on the interaction between the host algae and viruses and collected some useful information during the fellowship. This study was the evaluation, and further research funding was provided by my institution so I extended my stay for three more months. This opportunity in the OECD-CRP helped to expand my research career directly and indirectly. I could collaborate not only with the host institution but also with other researchers who are studying on the frontier of phage therapy in medical science. This visit increased my understanding of viruses in the environment and helped at making a network of research connections. During my stay, I attended some seminars in and outside the lab and we had a lot of discussions, which helped to provide me with new ideas and improving my research. Moreover, the aqua culture symposium I attended provided me with some information on European aquaculture systems.

I thought the Fellowship Programme is very nice.

8. Advertising the Co-operative Research Programme

- How did you learn about the Co-operative Research Programme?
- What would you suggest to make it more “visible”?
- Are there any issues you would like to record?

I learned about the Programme from an advertisement in an e-mail at my home institute and my previous boss who is at the same institution. I think if the website was shared more, it would be helpful for the announcement. Finally, I sincerely appreciate this wonderful opportunity and all of your support.