e-ASIA Joint Research Program
Progress Report

1. Project Title: A study of latitudinal viral gene migration and reassortment of potentially zoonotic avian influenza viruses along wild bird East Asian - Australasian Flyway in Pacific Rim

2. Joint Research Period: November 1, 2017～ March 31, 2021

3. Principal Investigators:

- Japan: Masatoshi Okamatsu, Associate Professor, Faculty of Veterinary Medicine, Hokkaido University
  - Planned Funding Period: November 1, 2017 – March 31, 2021
- Russia: Alexander Shestopalov, Professor, Research Institute of Experimental and Clinical Medicine
  - Planned Funding Period: February, 1, 2018 – March 31, 2021
- United States: Falk Huettmann, Associate Professor, Institute of Arctic Biology, Biology & Wildlife Department
  - Planned Funding Period: January, 1, 2018 – March 31, 2021
- Vietnam: Duc-Huy CHU, Epidemiologist, Department of Animal Health, Ministry of Agricultural and Rural Development
  - Planned Funding Period: January, 1, 2018 – March 31, 2021 (in Kind)

4. Summary of the Progress of the Joint Research:

The project primarily promotes integration processes in science, field research, and the development of new cooperative relations between Russian, Japanese, Vietnamese, and United States research partner organizations in zoonotic avian influenza surveillance along wild bird East Asian - Australasian Flyway in the Pacific Rim. The project aims at creating new technologies and the attraction of young scientists and specialists to research in the framework of international cooperation with research organizations of these countries. To achieve this aim, the following four main activities have been carried out in this study.

4-1. Global surveillance of avian influenza in wild birds and poultry in the Pacific Rim

A team of researchers from Japan, Russia, and the United States worked together to investigate the virus status of wild birds in the Pacific Rim. With the cooperation of Vietnam, one of the endemic countries for highly pathogenic avian influenza in poultry, we also investigated the status of the avian influenza virus in poultry. The Japanese side has collected 8,631 samples of wild birds and poultry in Japan, Mongolia, and Vietnam for virological examination. The Russian side also collected 1194 samples from the wild birds and performed virological tests as well. The United States side collected epidemiological data for 46,002 birds, including open access data from other agencies.

4-2. Characterization of isolated viruses and the construction of a database of their virological and epidemiological information

The obtained virological information of the genes, antigenicity, and pathogenicity to animals of viruses isolated from wild birds and poultry, together with the epidemiological

information during the field survey, are compiled into a database and shared. From the 939 avian influenza viruses in this study, a total of 117 isolated avian influenza virus strains were sequenced for their genes. The pathogenicity to mice was investigated by genetic analysis and experimental infections in animals. Especially, experimental inoculation of the H5N8 highly pathogenic avian influenza virus isolated at the Uvs-Nur Lake in 2016, Russia was performed using mice. Furthermore, the antigenicity of the virus was determined using the hemagglutination inhibition test, and it was found that the antigenicity of the virus in wild birds was stable, unlike the virus in poultry. This virological and epidemiological information in wild birds and poultry was shared by integrating into a single platform, Hokkaido University Influenza Virus Database System (https://virusdb.czc.hokudai.ac.jp/). In addition, the genetic information of the analyzed virus was registered in a public genetic database to share this information with the researchers around the world.

4-3. Development of an early warning system for avian influenza to prevent the outbreak of highly pathogenic avian influenza in poultry

Based on this information, epidemiological methods have been used to analyze the risk of transmission of highly pathogenic avian influenza viruses to migratory birds. Based on the results obtained, an avian influenza early warning system will be established as a model prediction to help prevent the outbreak of highly pathogenic avian influenza in poultry. With regard to the integration of the data obtained in each country, it was decided which items would be selected for compiling and these data were stored using free GIS software (QGIS), and geospatial epidemiological analysis has been continued. Using over 40 GIS layers from 105 layers of United States GIS data, we have analyzed information on Japanese, Russian, and United States. sample locations and isolated low-pathogenic avian influenza viruses and continue to analyze the ecological mode of transmission of avian influenza viruses in migratory birds. The data were analyzed by adding information from the past 10 years in addition to recent results obtained in this project.

4-4. Challenges to the sustainability of cross-border research networks in the Pacific Rim

We held regular "Workshops" to share the progress of research and promote mutual understanding among research institutions. We also held a "Training course" to train young researchers to cultivate a sustainable research environment. In addition, we have established a sustainable network of researchers through human interaction through "Internships". To date, a total of four workshops have been held in Sapporo (March 2018), Russia (September 2018), Vietnam (December 2018), and the United States (July 2019) to review the progress of the research activities. We also conducted a training course with lectures and practical training for young researchers and students involved in avian influenza research in Russia in 2018. In addition, we sent a Japanese graduate student studying avian influenza to Russia as an internship activity to learn how to collect samples and diagnose avian influenza in wild birds in Siberia in 2019.

5. Scientific Achievements and Implemented Activities (Research Exchange, Workshop, Publication, etc. if any):

For this item, please fill in the attached Excel file.

6. Future Goals and Plan of Activities within and after the project period:

This is a project between researchers in the Pacific Rim region of Japan, Russia, the United States, and Vietnam, and four meetings have been held so far, which indicates that the project has achieved its objective in terms of human interaction. Although each researcher's area of expertise was different, they functioned in a complementary manner to each other, and the significance of the research as a collaboration was considered to be very high. It would be desirable to continue personnel exchanges by holding regular meetings during this e-ASIA project in 2020 and the future.

The integration processes in science, field research, and the development of new cooperative relations between Russian, Japanese, Vietnamese, and United States research partner organizations in the Pacific Rim will be promoted for the control of avian influenza. The new technologies and attraction of young scientists and specialists to research in the framework of international cooperation will be created. The presentation of results at international conferences and followed up as workshops will contribute to the joint publications of our research outcome. Nucleotide sequences will be made available to public databases and repositories (GenBank, GISAID, and others).

The results of these activities are now being summarized as joint papers under the following titles:

1. Druzyaka Olga R., Druzyaka Aleksey V., Gulyaeva Marina A., Huettmann Falk, Shestopalov Aleksandr M. Modern application and prospects of the stable isotopes method for studying avian influenza A virus transmission in migratory birds. South of Russia: ecology, development, V 14(3), 2019, p-p. 92-100. ISSN: 1992-1098e, ISSN: 2413-0958.

2. Glushchenko AV, Alikina TY, Yurchenko KS, Shekunov EV, Gulyaeva MA, Matsuno K, Okamatsu M, Kabilov MR, Shestopalov AM. Nearly Complete Genome Sequence of a Newcastle Disease Virus Strain Isolated from a Wild Garganey (Spatula querquedula) in Russia. Microbiol Resour Announc. 2019 Dec 12;8(50). pii: e01072-19. doi: 10.1128/MRA.01072-19. ISSN: 2576-098X

3. Data Mining and Model-predicting a global disease reservoir on an international landscape-scale: Low-pathogenic Avian Influenza in the wider Pacific Rim using Big Data sets (in progress)

7. Recommendations and Comments to the Program (if any):
(ex. Any support to request from the Program in order to achieve item 6.)

The new coronavirus, COVID-19, which is currently in the pandemic, has made it very difficult for people to travel abroad. We hope your organization will kindly understand that some of the activities we have planned for this year will have to be done remotely.

Lists of Achievements and Implemented Activities

1. Original Publication of Articles etc.

1. 1 Original Publications (Articles co-authored among Research Teams)

All Authors' Names, Title, Journal Name, Volume, Edition, Page, Year of Publication	DOI Code	Publication Status	Remarks (e.g. publication in top level journals etc.)
Glushchenko AV, Alikina TY, Yurchenko KS, Shekunov EV, Gulyaeva MA, Matsuno K, Okamatsu M, Kabilov MR, Shestopalov AM. Nearly Complete Genome Sequence of a Newcastle Disease Virus Strain Isolated from a Wild Garganey (Spatula querquedula) in Russia. Microbiol Resour Announc. 2019 Dec 12;8(50). pii: e01072-19. doi: 10.1128/MRA.01072-19. ISSN: 2576-098X	doi: 10.1128/MRA.01072-19	published	Japan and Russia
Druzyaka Olga R., Druzyaka Aleksey V., Gulyaeva Marina A., Huettmann Falk, Shestopalov Aleksandr M. Modern application and prospects of the stable isotopes method for studying avian influenza A virus transmission in migratory birds. South of Russia: ecology, development, V 14(3), 2019, p-p. 92-100. ISSN: 1992-1098e, ISSN: 2413-0958		published	Rusia and USA
Le KT, Okamatsu M, Nguyen LT, Matsuno K, Chu DH, Tien TN, Le TT, Kida H, Sakoda Y. Genetic and antigenic characterization of the first H7N7 low pathogenic avian influenza viruses isolated in Vietnam. 2020. Infect Genet Evol 78:104117.	doi: 10.1016/j.meegid.2019.104117	published	Japan and Vietnam
Nguyen LT, Firestone SM, Stevenson MA, Young ND, Sims LD, Chu DH, Nguyen TN, Van Nguyen L, Thanh Le T, Van Nguyen H, Nguyen HN, Tien TN, Nguyen TD, Tran BN, Matsuno K, Okamatsu M,Kida H, Sakoda Y. A systematic study towards evolutionary and epidemiological dynamics of currently predominant H5 highly pathogenic avian influenza viruses in Vietnam. 2019. Sci Rep 9:7723.	doi: 10.1038/s41598-019-42638-4	published	Japan and Vietnam

4 Total

1. 2 Original Publications (Articles by Single Team only)

All Authors' Names, Title, Journal Name, Volume, Edition, Page, Year of Publication	DOI Code	Publication Status	Remarks (e.g. publication in top level journals etc.)	Country name of the team
Ulaankhuu A, Bazarragchaa E, Okamatsu M, Hiono T, Bodisaikhan K, Amartuvshin T, Tserenjav J, Urangoo T, Buyantogtokh K, Matsuno K, Hattori T, Kondoh T, Sato M, Takadate Y, Torii S, Isono M, Okuya K, Saito T, Kasajima N, Kida Y, Maruyama J, Igarashi M, Takada A, Kida H, Batchuluun D, Sakoda Y. Genetic and antigenic characterization of H5 and H7 avian influenza viruses isolated from migratory waterfowl in Mongolia from 2017 to 2019. Virus Genes 2020. in press	doi: 10.1007/s11262-020-01764-2	in press		Japan
Shibata A., Harada R, Okamatsu M, Matsuno K, Arita T, Suzuki Y, Shirakura M, Odagiri T, Takemae N, Uchida, Y, Saito T, Sakoda Y, Osaka H. Characterization of a novel reassortant H7N3 highly pathogenic avian influenza virus isolated from a poultry meat product taken on a passenger flight to Japan. 2019. J Vet Med Sci 81:444-448.	doi: 10.1292/jvms.18-0628	published		Japan

2 Total

Lists of Achievements and Implemented Activities

2. presentations at Academic Conferences etc. (Seminars, Workshops, Symposia)

2. 1 Conference Presentations (Joint Presentations among Research Teams)

Date	Type of Presentation	Speaker, "Title", Conference Name, Location, etc.

0 Total

2. 2 Conference Presentations (by Single Team)

Date	Type of Presentation	Speaker, "Title", Conference Name, Location etc.	Country name of the team
2018/11/1-2	Guest/Invited Speaker	Matsuno K. Okamatsu M, Sakoda Y, Kida H., Surveillance of avian influenzain migrating ducks, domestic poultry, and illegally imported poultry products, Asian-Pacific Centenary Spanish 1918-flu Symposium., China	Japan
2018/9/11-13	Oral Presentation	Lam Thanh Nguyen, Mark Stevenson, Simon Firestone, Les Sims, Duc Huy Chu, Long Van Nguyen, Tien Ngoc Nguyen, Norikazu Isoda, Keita Matsuno, Masatoshi Okamatsu, Hiroshi Kida, Yoshihiro Sakoda, Spatiotemporal and risk analysis of H5 highly pathogenic avian influenza occurrence in Vietnam during 2014 – 2017. The 161st meeting of the Japanese Society of Veterinary Science, Japan	Japan
2018/10/28-30	Oral Presentation	Lam T. Nguyen, Simon Firestone, Mark Stevenson, Neil Young, Les Sims, Huy D. Chu, Tien N. Tien, Thanh L. To, Tung T. Le, Hung V. Nguyen,Hung N. Nguyen, Long V. Nguyen, Tien N. Nguyen, Keita Matsuno, Masatoshi Okamatsu, Hiroshi Kida, Yoshihiro Sakoda, A systematic study to reveal distinct evolution of predominant H5 highly pathogenic avian influenza viruses in Vietnam during 2014 – 2017. The 66th Annual Meeting of the Japanese Society for Virology, Japan	Japan
2019/5/21-23	Guest/Invited Speaker	Sakoda Y, Okamatsu M, How to implement cooperation among Asian countries for the control of highly pathogenic avian influenza (HPAI)?, NIES_NIER_USGS International workshop, Japan 2019,	Japan
2019/6/7-9	Guest/Invited Speaker	Okamatsu M., Avian influenza surveillance and disease control efforts in Vietnam, 岡松正敏, The 33rd Annual Influenza Researcher Exchange Meeting. Japan 2019,	Japan
2019/9/10-12	Oral Presentation	Kien TL, Nguyen TL, Chu DC, Nguyen TN, Nguyen LV, Tien TN, Matsuno K, Okamatsu M, Kida H, Sakoda Y., Genetic and antigenic characterization of H7N7 low pathogenic avian influenza viruses firstly isolated in Vietnam,The 162st meeting of the Japanese Society of Veterinary Science, Japan	Japan
2019/9/19-20	Poster Session	Genetic and antigenic characterization of H7N7 low pathogenic avian influenza viruses firstly isolated in Vietnam, Kien Trung LE, Masatoshi Okamatsu, Lam Thanh Nguyen, Keita Matsuno, Duc-Huy Chu,Tien Ngoc Tien, Tung Thanh Le, Hiroshi Kida, Yoshihiro Sakoda, 7th Sapporo Summer Seminar for One Health, Japan 2019,	Japan
2019/10/2-4	Oral Presentation	OIE-Asia: Regional Expert Group Meeting for the Disease of Poultry in Asia and the Pacific Region. Surveillance of avian influenza in Russia: monitoring migratory wild birds; potential risks to/from neighbouring countries. Gulyaeva M.A., Sobolev I. A., Sharshov K.A., Shestopalov A.M.	Russia
2019/8-9/28-01	Poster Session	OptionsX PATHOGENICITY OF HPAI H5N8 VIRUS, FIRST ISOLATED IN THE RUSSIAN FEDERATION, FOR CHICKEN. Gulyaeva M.A., Gao Jingfan, Kurskaya O.G., Sharshov K.A., Shestopalov A.M., Shestopalova L.V.	Russia

9 Total

Lists of Achievements and Implemented Activities

3. Workshops, Seminars, Symposia and Other Events (Organized by the Project)

Event duration	Name of Organizer	Title of the Event	Location (Country, City, Venue)	Number of Participants (Including Team Members)	Overview
Mar 13-14 2018	Masatoshi Okamatsu	e-ASIA Workshop #1in Sapporo	Japan, Sapporo, Hokkaido	15	
Sep 11-15 2018	Alexander Shestopalov	e-ASIA Workshop #2 in Russia	Russia, Novosibirsk, Federal Research Center of Fundamental and Translational Medicine	10	
Dec 3-6 2018	Duc-Huy Chu	e-ASIA Workshop #3 in Vietnam	Veitnam, Hanoi, Vietnam National University of Agriculture	20	
July 27-30 2019	Falk Huettmann	e-ASIA Workshop #4 in USA	USA, Araska, University of Alaska, Fairbank	15	
Sep 11-15 2018	Alexander Shestopalov	e-ASIA Avian influenza training course	Russia, Novosibirsk, Federal Research Center of Fundamental and Translational Medicine	10	
Dec 5 2018	Duc-Huy Chu	e-ASIA International Symposium for avian Influenza (open style)	Veitnam, Hanoi, Vietnam National University of Agriculture	40	

6 Total

Lists of Achievements and Implemented Activities

4. Record of Research Exchanges

Date of Departure	Date of Return	Last Name & First Name	Country of Affiliation	Affiliation	Position	Exchange Destination (Country, City, Research Organization etc)	Description of Exchange Content/Purpose	Duration of Exchange (autocompleted)
September 3, 2019	September 13, 2019	Hirotaka Hayashi	Japan	Hokkaido University	Ph.D. Program Graduate School 4-year students	Federal Research Center of Fundamental and Translational Medicine, Federal State Budgetary Scientific Institution, Novosibirsk, Russia	To participate in avian influenza surveillance from wild waterfowl at Lake Chany in Siberia to learn the realities of avian influenza virus research activities in Russia	11
								0
								0
								0

Total (Person) 1

Total (Persond-day) 11

Lists of Achievements and Implemented Activities

5. Patent Applications

5. 1 Independent Applications by Single Team

Application Number	Name of Patent/Patent Name	Application Date	Patent Applicants (Fill in All Members)	Publication Number (leave blank if unpublished)	Inventor	Country of Application	Registration Number (leave blank if unregistered)	Country Name of the Team

0 Total (Number of Application)

0 Total (Number of Registration)

5. 2 Joint Applications

Application Number	Name of Patent/Patent Name	Application Date	Patent Applicants (Fill in All Members)	Publication Number (leave blank if unpublished)	Inventor	Country of Application	Registration Number (leave blank if unregistered)

0 Total (Number of Application)

0 Total (Number of Registration)

Lists of Achievements and Implemented Activities

6. Awards

Date of Award	Name of Award	Recipient	Remarks	Country Name of the Team

0 Total