e-ASIA Joint Research Program
Final Report

1. Project title: Dengue viral genetic diversity in selected populations in Myanmar

2. Joint Research period : 1st Aug, 2016 ～ 31st March, 2020

3. Research Team :

■ **JAPAN team** (up to 6 people including the Principal Investigator)
Funding period: 1st Aug 2016 - 31st March 2020
Total Funded Amount (in Local Currency): JPY 30,602,000

	Name	Position	Affiliation	Role in the project
PI	Meng Ling Moi	Professor	Institute of Tropical Medicine, Nagasaki University	Principal Investigator
Collaborator	Futoshi Hasebe	Professor	Institute of Tropical Medicine, Nagasaki University	Researcher
Collaborator	Kouichi Morita	Professor	Institute of Tropical Medicine, Nagasaki University	Researcher
Collaborator	Shingo Inoue	Associate Professor	Institute of Tropical Medicine, Nagasaki University	Researcher
Collaborator	Takeshi Nabeshima	Assistant Professor	Institute of Tropical Medicine, Nagasaki University	Researcher
Collaborator	Mya Myat Ngwe Tun	Assistant Professor	Institute of Tropical Medicine, Nagasaki University	Researcher
Total number of participants including students: 5				

■ **MYANMAR team** (up to 6 people including the Principal Investigator)
Funding period: -
Total Funded Amount (in Local Currency): in-kind

	Name	Position	Affiliation	Role in the project
PI	Hlaing Myat Thu	Deputy Director	Department of Medical Research	Principal Investigator
Collaborator	Moh Moh Htun	Deputy Director		Researcher
Collaborator	Theingi Win Myat	Head of Department		Researcher
Collaborator	Kaw Zin Thant	Director (Retired)		Researcher

Collaborator	Nang Sarm Hom	Researcher		Researcher
Collaborator				Researcher
Total number of participants including students: 0				

■ **USA team** (up to 6 people including the Principal Investigator)
Funding period: -
Total Funded Amount (in Local Currency): in-kind

	Name	Position	Affiliation	Role in the project
PI	Sujan Shresta	Associate Professor	La Jolla Institute for Allergy and Immunology	Principal Investigator
Collaborator	Aaron Carlin	Assistant Professor	La Jolla Institute for Allergy and Immunology	Researcher
Collaborator	Annie Elong Ngogo	Post-doctoral fellow	La Jolla Institute for Allergy and Immunology	Researcher
Collaborator				
Collaborator				
Collaborator				
Total number of participants including students: 1				

4. Summary of the joint research

A) Determination of the virus characteristics of epidemic DENV strains

Determination of DENV serotypes, genotypes, genomic sequences and virological characterization were done for virus strains isolated from the Dengue season, 2017-2020. A total of 1026 samples were collected and tested for Dengue virus. During the Dengue season of 2016-2017, a large DENV outbreak occurred in Yangon, Myanmar. Samples were collected from suspected-DENV patients, tested for DENV NS1 antigen by rapid ICT kit. Further laboratory tests were performed to test for anti-DENV IgM and IgG. A total of 70 samples were collected from children (ages 4-12, M=38, F=32), 41 cases with warning signs, 3 samples from severe Dengue and 26 samples from Dengue patients without warning signs. A further 19 samples were collected from adults, 7 with warning signs and 12 without warning signs. Out of the 89 clinical cases, 72 were positive for IgM antibodies and 17 were positive for IgG antibodies. Using the IgM/IgG antibody results, 24 cases were of primary infection and 21 cases were determined to be secondary infection whereas 44 cases was underterminable due to high levels of IgM and IgG antibody. A total of 28 virus was isolated by using C6/36 mosquito cell lines, DENV-1 was isolated from 9 cases, DENV-3 from 10 cases and DENV-4 from 9 cases. DENV-2 was not isolated from any of the cases. Sequence analyses showed that the isolate was of DENV-1 genotype I and DENV-4 genotype I. While reports on DENV-4 as a dominant serotype are limited, our data suggest changing patterns in serotypes during DENV epidemic in Myanmar and Southeast Asia. All samples collected were tested positive for DENV Ag and none were positive for concurrent infection of other arboviruses such as Chikungunya and Zika virus. Interestingly, we found an increase in DENV-3 patients in concurrent with a new genotype shift in Myanmar (Aung et al., in prep). Ongoing sequencing studies for all the DENV isolates (N=214) to identify viral factors that are involved disease spread. We also found recent evidence that Zika virus causes sporadic outbreaks in Myanmar (Tun Ngwe et al., 2018).

Severe Dengue cases were found in both primary and secondary DENV infections, currently we are analyzing trends of primary and secondary DENV infection in severe vs non-severe cases by using a 42-panel cytokine analyses (Khine et al., in prep). On-going sample collection and DENV sequence study using NGS would determine the virological factors that are associated with disease spread and pathogenesis. In addition, we have developed new ELISA-based tools to analyze cross-reactive flavivirus antibodies (Wijesooriya et al., Lancet Infect Dis., 2020; Balingit et al., Vaccines, 2020). These methods will be used to determine the neutralizing and infection-enhancing activity of the samples collected in Myanmar to determine severe dengue high-risk group. Data has been shared with Myanmar counterpart, and the results from this study will be used to develop better control measures against Dengue in Myanmar.

(B) Analysis of DENV quasispecies and host factors associated with DENV infection

Using DENV-1 strains isolated from clinical samples, 2 clinical isolates that displays differential growth characteristics were isolated from a single sample by using mammalian and a mosquito cell line. Analyses of the full genome by using NGS suggest that 2 variants co-exist in a single patient. In the analyses of quasispecies in DENV, we have previously used an NGS system that is based on the IonProton system. Improvements of an NGS system based on Miseq protocol is currently being developed to better analyze quasispecies in clinical specimens (Fukuta et al., in prep). A digital-PCR system to detect DENV quasi-species was also developed to determine the percentages of variants in a single virus population.

Next, using the isolated variants, a variant with single amino acid alteration at the non-structural protein 4B (NS4B) of DENV was found to result in enhanced growth in a human cell line (dendritic iPS-cell). Infection with a variant carrying a mutation of the NS4B region (NS4B-116M/A) also resulted in differential expression of interferon-b and interferon stimulated genes (Bui et al., 2018). These results suggest that variants in a DENV population plays an important role in virus replication and adaptation between hosts

(mosquito vs human host). The results from this study will be applied for further studies of differential gene expression in human monocytes and a better understanding on the pathological mechanism of DENV infection.
Technical training for collection and analyses of Dengue patient samples (including PBMC samples) for the staff of Department of Medical Research (Myanmar) are being carried out by USA and Japan counterparts. PBMC collection and analyses are currently ongoing for current Dengue season (2017-2020).

5. Outputs and Anticipated Outcomes of Joint Research

5-1 Scientific achievements and implemented activities of the joint research

1. Establishment and improvements of electronic dengue database that includes clinical and virological data
2. Dengue biobank of serum/plasma, virus cultures and viral nucleic acid
3. Analyses of dengue virus factors – DENV cultures, RNA/cDNA, serotype/genotype
4. Analyses of human host factors – anti-DENV antibody and immunological factors
5. Genome sequence analyses of dengue isolates by NGS
6. Better understanding of the epidemiological features of DENV outbreak in the region

5-2 Synergistic effects of the international joint research

1. Training in laboratory methods and technologies developed in Nagasaki University (Japan counterpart) and in La Jolla Institute of Allergy and Immunology (USA counterpart)
2. Exchange of information and ideas on Dengue disease control in the region
3. Collaboration in preparation of result dissemination to develop better strategies for disease control

5-3 Broader impacts including contribution to society

1. Data and results from this study will be used as a baseline for implementation on control strategies, including dengue vaccination program, by the relevant ministries in Myanmar
2. Integration of research efforts in both hospital, academic and governmental institutes for Dengue and arboviral disease control

5-4 Development and sustainability of the cooperation

1. Current exchanges (student and technical staff) and training in Japan and USA will lead to future global leaders that are responsible for further cooperation in Myanmar and Dengue endemic region. Currently, 2 students from Myanmar are enrolled in Nagasaki University for PhD program
2. Japan-Myanmar-USA have expressed willingness to contribute to further research collaboration in the future

Strengthening of ties between 3 countries to develop measures against Dengue and other diseases. This will be useful, particularly during emergency outbreaks, because the foundation for exchange has been developed through this eASIA program

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

1. Continuation of Dengue virus genome sequencing and analyses to determine the epidemiological characteristics in the region
2. Continuation in the development of a database for Dengue virus sequence and patient data of Myanmar and the region

3. Develop sustainable relationship between research groups in Myanmar and USA to further research work on Dengue and other arboviruses of the region

7. Scientific Achievements and Implemented Activities (Publication, Research Exchange, Workshop, etc.)

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8. Recommendations and Comments to the Program

The eASIA project has offered an excellent platform for exchange between the 3 groups –Japan, Myanmar and USA. Using this platform has brought the 3 groups together to develop a network for information exchange and collaborate on strategies to control infectious diseases of importance in Myanmar and Southeast Asia. Through the eASIA program, we were given the opportunity to train 2 students from Myanmar for their PhD program in Nagasaki University. It will be better that some form of funding could be extended/provided to support the research of these students during their study period in Nagasaki University (up to Sept 2022). This will support both research and their program, and further enhance the research network between the 3 counterparts.

Currently, both research institutions in Myanmar and USA are supporting this research program “in-kind” and partner countries would have to use resources from other funding for both man-power and financial support. In these cases, it would be better if Japan-side could offer flexibility in funding, particularly in lower-middle income countries that would benefit greatly with materials and research equipment.

9. Others (agenda of workshop, photos of research teams, meetings, and etc.)

As attached.

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.)
Ngwe Tun MM, Kyaw AK, Hmone SW, Inoue S, Buerano CC, Soe AM, Moi ML, Hayasaka D, Thu HM, Hasebe F, Thant KZ, Morita K. Detection of Zika Virus Infection in Myanmar. Am J Trop Med Hyg. 2018 Mar;98(3):868-871.	10.4269/ajtmh.17-0708	published	Impact factor 2.2
Kyaw AK, Ngwe Tun MM, Moi ML, Nabeshima T, Soe KT, Thwe SM, Myint AA, Maung KTT, Aung W, Hayasaka D, Buerano CC, Thant KZ, Morita K. Clinical, virological and epidemiological characterization of dengue outbreak in Myanmar, 2015. Epidemiol Infect. 2017 Jul;145(9):1886-1897	doi: 10.1017/S0950268817000735	published	Impact factor 2.1

2 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
Bui TT, Moi ML, Nabeshima T, Takemura T, Nguyen TT, Nguyen LN, Pham HTT, Nguyen TTT, Manh DH, Dumre SP, Mizukami S, Hirayama K, Tajima S, Le MTQ, Aoyagi K, Hasebe F, Morita K. A single amino acid substitution in the NS4B protein of Dengue virus confers enhanced virus growth and fitness in human cells in vitro through IFN-dependent host response. J Gen Virol	10.1099/jgv.0.001092	in press	Impact factor 2.9	Japan
Moi ML, Takasaki T, Kurane I. Detection of virus-antibody immune complexes in secondary dengue infection. in "Hemorrhagic Fever Viruses: Methods and Protocols", Editor, Maria S Salvato, Springer 2018;1604:331-337. (book chapter)	10.1007/978-1-4939-6981-4_25	published	-	Japan
Ly MHP, Moi ML, Vu TBH, Tun MMN, Saunders T, Nguyen CN, Nguyen AKT, Nguyen HM, Dao TH, Pham DQ, Nguyen TTT, Le TQM, Hasebe F, Morita K.Dengue virus infection-enhancement activity in neutralizing antibodies of healthy adults before dengue season as determined by using Fc γ R-expressing cells. BMC Infect Dis. 2018 Jan 10;18(1):31	10.1186/s12879-017-2894-7	published	Impact factor 2.8	Japan
Bui TT, Moi ML, Nabeshima T, Takemura T, Nguyen TT, Nguyen LN, Pham HTT, Nguyen TTT, Manh DH, Dumre SP, Mizukami S, Hirayama K, Tajima S, Le MTQ, Aoyagi K, Hasebe F, Morita K. A single amino acid substitution in the NS4B protein of Dengue virus confers enhanced virus growth and fitness in human cells in vitro through IFN-dependent host response. J Gen Virol. 2018 Aug;99(8):1044-1057.	doi: 10.1099/jgv.0.001092.	published		Japan
Development of a universal and lineage-specific primer sets for Zika virus (ZIKV) rapid detection in blood and urine samples by using one-step reverse transcription loop-mediated isothermal amplification (RT-LAMP). Bui TT, Moi ML, Morita K, Hasebe F. Jpn J Infect Dis. 2019 Oct 31.	doi: 10.7883/yoken.JJID.2019.073.	published		Japan
Long-term surveillance needed to detect Zika virus outbreaks in endemic regions. Wijesooriya SL, Nguyen CT, Nguyen TTT, Vu TBH, Taichiro T, Morita K, Le TQM, Dang DA, Hasebe F, Moi ML. Lancet Infect Dis. 2020 Feb;20(2):168-169.	doi: 10.1016/S1473-3099(19)30677-2.	published	Publication in top level journal	Japan

Deconvolution of pro- and antiviral genomic responses in Zika virus-infected and bystander macrophages. Carlin AF, Vizcarra EA, Branche E, Viramontes KM, Suarez-Amaran L, Ley K, Heinz S, Benner C, Shresta S, Glass CK. Proc Natl Acad Sci U S A. 2018 Sep 25;115(39):E9172-E9181.	doi: 10.1073/pnas.1807690115.	published	Publication in top level journal	USA

3	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.
Sept 2017	Oral Presentation	Ngwe Tun MM, Aung KK, Hmone SQ, Inoue S, Buerano CC, Aung MS, Moi ML, Hayasaka D, Hlaing MT, Thant KZ, Hasebe F, Morita K. Detection of Zika virus infection in Myanmar. Toga, pesti, flavivirus Research Meeting, Osaka
Nov 2016	Poster Session	Ngwe Tun Mya Myat, ムタガラ ロヒタ, キョウ アウンキョウ, フェヂナ アヅンゴ, モイ メンリン, 早坂 大輔, 吾郷 昌信, ブエラノ コロゾン, テャン キョウジン, 森田 公一. Differential type I interferon response mediated by RIG-I and MDA-5 in human glioblastoma cells (T98G) following with clinical Chikungunya virus isolate and prototype strain, Japanese Society of Tropical Medicine, Tokyo
Nov 2016	Poster Session	Kyaw Aung Kyaw, Ngwe Tun Mya Myat, Moi Meng Ling, Takeshi Nabeshima, Soe Kyaw Thu, Myint Aye Aye, Daisuke Hayasaka, Buerano Corazon, Thant Kyaw Zin, Kouichi Morita. Clinical, virologic and epidemiologic characterization of Dengue outbreak in Myanmar, 2015. Japanese Society of Tropical Medicine, Tokyo
11-Nov-18	Poster Session	Aung Min Soe et al, Molecular Characteristics of Dengue Virus in Myanmar, 2017, The 59th Annual meeting for the Japanese Society of Tropical Medicine, Nagasaki Japan
10-Nov-19	Poster Session	Aung Min Soe et al, Molecular Characteristics of Dengue Virus in Myanmar, 2017-2018, The 60th Annual meeting for the Japanese Society of Tropical Medicine, Okinawa Japan
10-Sep-19	Poster Session	Aung Min Soe et al, Molecular Characteristics of Dengue Virus in Myanmar, 2017, The 18th Awaji International Forum on Infection and Immunity, Hyogo Japan
30-Oct-19	Poster Session	Aung Min Soe et al, Molecular Characteristics of Dengue Virus in Myanmar, 2017, The Annual meeting for the Japanese Society of Virology, Tokyo Japan
8-Oct-19	Poster Session	Aung Min Soe et al, Molecular characteristics of dengue virus in Myanmar: evolving epidemic with introduction of a new genotype, ASIA INFECTIOUS DISEASE PROJECT JOINT SYMPOSIUM, Jakarta, Indonesia

8 Total

2. 2 Conference Presentations (by Single Team)

Date	Type of Presentation	Speaker, "Title", Conference Name, Location etc.	Country name of the team
Oct 2017	Poster Session	Moi ML, Nguyen CT, Wijesooriya SL, Nguyen TTT, Vu TBH, Le TQM, Morita K, Dang DA, Hasebe F. Seroepidemiological surveillance of Zika virus in Vietnam, 2014–2016, Japanese Society of Virology, Osaka	Japan
Oct 2017	Poster Session	Bui TT, Moi ML, Nabeshima T, Pham Hoai LL, Pham Thi H, Dang Thi D, Nguyen Thi TT, Le Thi QM, Morita K, Hasebe F. Single amino acid substitution on NS4B protein of dengue virus increases virus fitness in mammalian cells, Japanese Society of Virology, Osaka	Japan
Oct 2017	Oral Presentation	Bui TT, Moi ML, Hasebe F, Morita K. One-step RT-LAMP for detection of Zika virus. Toga, pesti, flavivirus Research Meeting, Osaka	Japan
Sept 2017	Oral Presentation	Phu Ly MH, Moi ML, Hau VTB, Ngwe Tun MM, Saunders T, Nguyen NC, Nguyen ATK, Nguyne MH, Dao TH, Pha, QD, Nguyen TTT, Le MTQ, Hasebe F, Morita K.Absence of dengue virus infection-enhancement activity in neutralizing antibodies of healthy adults before dengue season as determined by using Fc γ R-expressing cells. Kyushu Society of Virology (Okinawa)	Japan
Sept 2017	Poster Session	Moi ML, Wijesooriya SL, Nguyen CT, Nguyen TTT, Vu TBH, Tun Ngwe MM, Pha, TD, Pham T, Tran T, Le TQM, Dang DA, Hasebe F, Morita K. Zika virus infection and microencephaly in Vietnam, 2014–2016. The 16th Awaji International Forum on Infection and Immunity, Hyogo	Japan
Sept 2017	Guest/Invited Speaker	Moi ML. 古くて新しい～節足動物媒介性感染症～ジカウイルスの世界的な流行と最近の知見（招待講演）. 第160回日本獣医学会学術集会.（鹿児島）	Japan
May 2017	Poster Session	Luz MA, Moi ML, Dimamay MT, Nabeshima T, Pangilinan LA, Dimamay MP, Matias R, Buerano C, Tria E, Natividad F, Daroy ML, Hasebe F, Morita K. Virological characterization of DENV circulating in Metro Manila, 2015–2016. The 13th Nagasaki-Singapore Medical Symposium.	Japan
May 2017	Poster Session	Nguyen CT, Moi ML, Wijesooriya SL, Tun Ngwe MM, Nguyen TTT, Hau VTB, Pha, TTH, Le TQM, Hasebe F, Morita K. Serological surveillance of Zika virus in Central Vietnam, 2016–2017. The 13th Nagasaki-Singapore Medical Symposium.	Japan
May 2017	Poster Session	Wijesooriya SL, Moi ML, Nguyen CT, Inoue S, Nguyen TTT, Hau VTB, Pham TTH, Le TQM, Morita K, Hasebe F. Seroepidemiological survey for Zika virus antibodies in febrile patients, Central and North Vietnam, 2014–2015. The 13th Nagasaki-Singapore Medical Symposium.	Japan
May 2017	Poster Session	Phu Ly MH, Moi ML, Takamatsu Y, Nabeshima T, Pham HLL, Pham TH, Dang TD, Nguyen NL, Nguyen TTT, Le TQM, Buerano CC, Morita K, Hasebe F. Neurotropic characteristics of dengue serotype 3 virus isolated from a dengue encephalitis patient in Viet Nam. The 13th Nagasaki-Singapore Medical Symposium.	Japan
May 2017	Poster Session	Bui TT, Moi ML, Nabeshima T, Pham HLL, Pham TH, Dang TD, Nguyen NL, Nguyen TTT, Le TQM, Morita K, Hasebe F. Dengue viral genetic diversity in selected dengue patients. The 13th Nagasaki-Singapore Medical Symposium. (Nagasaki).	Japan
8-Nov-19	Oral Presentation	Moi ML, Development of strategies Dengue vaccine, The 60th Annual meeting for the Japanese Society of Tropical Medicine, Okinawa Japan	Japan
30-Oct-19	Oral Presentation	Moi ML, Dissecting the protection mechanism against dengue virus for vaccination strategy development, The Annual meeting for the Japanese Society of Virology, Tokyo Japan	Japan

11-Oct-19	Oral Presentation	Wijesooriya et al., An in-house assay for Zika virus detection: Utility of an IgM assay in screening for Zika virus (ZIKV) infection by using serum samples, General Sir John Kotelawala Defence University International Research Conference, Sri Lanka	Japan
27-May-19	Oral Presentation	Moi ML et al., Viral genetic diversity in dengue: inter-host heterogenecity in enhancing viral growth and host response, The 2nd MSC ID Infectious Disease Symposium: The 14th NUS-Nagasaki Joint Symposium New Horizons in Infection & Immunity Research, Singapore	Japan
10-Oct-19	Oral Presentation	Balingit et al., Development and evaluation of a rapid enzyme-linked immunosorbent assay (ELISA)-based microneutralization test for determination of neutralizing antibodies to Dengue, Zika and Japanese encephalitis virus, 18th Awaji International Forum on Infection and Immunity, Hyogo, Japan	Japan

16 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
Jan, 22-23 2017	Moi Meng Ling	eASIA JRP Kickoff Meeting	Nagasaki, Japan, Nagasaki University	20	
Mar 13-14 2017	Hlaing Myat Thu	Analyses of Genetic Diversity of Dengue Virus, Myanmar: Research Discussion	Yangon, Myanmar, Department of Medical Research	15	
June 6, 2017	Hlaing Myat Thu	Analyses of Genetic Diversity of Dengue Virus, Myanmar: Research Discussion	Yangon, Myanmar, Department of Medical Research	8	

3 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)
23-Jan-17	23-Jan-17	Hlaing Myat Thu	Myanmar	Department of Medical Research	Deputy Director	Japan, Nagasaki University	Project Meeting	2
23-Jan-17	23-Jan-17	Thant Kaw Zin	Myanmar	Department of Medical Research	Director	Japan, Nagasaki University	Project Meeting	2
23-Jan-17	23-Jan-17	Sujan Shrestha	USA	La Jolla Institute of Allergy and Immunology	Associate Professor	Japan, Nagasaki University	Project Meeting	2
13-May-19	15-May-19	Moi Meng Ling	Japan	Nagasaki University	Professor	Yangon, Myanmar, Department of Medical Research	Project Meeting	3
18-Nov-18	21-Nov-19	Moi Meng Ling	Japan	Nagasaki University	Professor	Yangon, Myanmar, Department of Medical Research	Project Meeting	4
7-Nov-17	10-Nov-17	Moi Meng Ling	Japan	Nagasaki University	Professor	Yangon, Myanmar, Department of Medical Research	Project Meeting	4
4-Jun-17	9-Jun-17	Moi Meng Ling	Japan	Nagasaki University	Professor	Yangon, Myanmar, Department of Medical Research	Project Meeting	6
12-Mar-17	14-Mar-17	Moi Meng Ling	Japan	Nagasaki University	Professor	Yangon, Myanmar, Department of Medical Research	Project Meeting	3
11-Jul-17	14-Jul-17	Aung Min Soe	Myanmar	Department of Medical Research	Researcher	Japan, Nagasaki University	Project Meeting, experiments	4
9-Jul-17	13-Jul-17	Khine Mya Nwe	Myanmar	Department of Medical Research	Researcher	Japan, Nagasaki University	Project Meeting, experiments	5
23-Mar-19	30-Mar-19	Theingi Win Myat	Myanmar	Department of Medical Research	Department Head	Japan, Nagasaki University	Project Meeting, experiments, training	8
23-Mar-19	30-Mar-19	Thida Kaw	Myanmar	Department of Medical Research	Researcher	Japan, Nagasaki University	Project Meeting, experiments, training	8
4-Aug-19	31-Aug-19	Lynn Pa Pa Aye	Myanmar	Department of Medical Research	Researcher	Japan, Nagasaki University	Project Meeting, experiments, training	27
30-Mar-20	31-Mar-20	Sujan Shrestha	USA	La Jolla Institute of Allergy and Immunology	Associate Professor	Japan, Nagasaki University	Project Meeting	2
30-Mar-20	31-Mar-20	Hlaing Myat Thu	Myanmar	Department of Medical Research	Deputy Director	Japan, Nagasaki University	Project Meeting	2
30-Mar-20	31-Mar-20	Zaw Than Htun	Myanmar	Department of Medical Research	Director	Japan, Nagasaki University	Project Meeting	2
30-Mar-20	31-Mar-20	Mo Mo Htun	Myanmar	Department of Medical Research	Deputy Director	Japan, Nagasaki University	Project Meeting	2
30-Mar-20	31-Mar-20	Theingi Win Myat	Myanmar	Department of Medical Research	Department Head	Japan, Nagasaki University	Project Meeting	2
30-Mar-20	31-Mar-20	Aaron Carlin	USA	La Jolla Institute of Allergy and Immunology	Assistant Professor	Japan, Nagasaki University	Project Meeting	2

Total (Person) 11

Total (Persond-day) 90

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
23-Mar-20	Nagasaki University President Commendation for Research Award	Shashika Lavangi Wijesooriya		Japan
7-Feb-20	Institute of Tropical Medicine, Nagasaki University, Doumonkai Student Award	Shashika Lavangi Wijesooriya		Japan
3-Nov-19	Female Researcher Prize, Japanese Society of Tropical Medicine and Hygiene	Moi Meng Ling		Japan
31-Oct-19	Poster Prize, Japanese Society of Virology	Shashika Lavangi Wijesooriya		Japan
25-Oct-18	Sugiura Prize, Japanese Society of Virology	Moi Meng Ling		Japan
5-Feb-18	Habataku Prize for Female Researcher, Nagasaki University	Moi Meng Ling		Japan

6 Total