INTERNATIONAL RANAVIRUS WORKSHOP
Northeast Forestry University
Harbin, China
28 May 2014

I. Introductions (8:00 – 9:00 am)

- **Dr. Matt Gray** welcomed the group and started introductions. Dr. Gray is Director of the Global Ranavirus Consortium (GRC), and his research focuses on the ecology of ranaviruses, which he accomplishes through a combination of field studies and controlled experiments.
- **Dr. Lingbing Zeng** is a lead PI and virologist at the Yangtze River Fisheries Research Institute. His expertise is viruses of lower vertebrates. He recently led efforts to characterize the ranavirus infecting Chinese Giant Salamander (*Andrias davidianus*). His lab works closely with several farms in central China that are raising *A. davidianus*.
- **Dr. Rolando Mazzoni** is a veterinarian at Universidade Federal de Goiás with expertise in diseases of fish and amphibians. He is the South American representative on the GRC Board, and has led most of the research on ranaviruses in South America, which has focused on ranavirus outbreaks in American bullfrog (*Lithobates catesbeianus*) farms in Brazil.
- **Dr. Qiwei Qin** is a lead PI and virologist at the South China Sea Institute of Oceanology. He also is the director of the Chinese Academy of Sciences' Key Laboratory of Marine Bio-resources Sustainable Utilizations. His expertise is marine molecular virology, functional genomics, and immunology. He has led research on the functional genomics of and host-immune responses to Singapore Grouper Iridovirus (SGIV).
- **Dr. XiaoLong Wang** is a wildlife ecologist at Northeast Forestry University, with expertise in wildlife diseases. He has led research in northern China investigating the distribution of ranaviruses in wild amphibian populations.
- **Dr. Jie (Jessie) Ma** is a post-doctoral scientist at the Yangtze River Fisheries Research Institute. Her expertise is virology of lower vertebrates, and has led research in the genomic characterization, morphogenesis, and pathology of Chinese Giant Salamander virus.
- **Dr. Yi Geng** is a veterinarian at Sichuan Agricultural University with expertise in wildlife pathology and virology. His lab also has been working on the pathology of Chinese Giant Salamander virus and developing diagnostic techniques to detect it.
- **Dr. Jinlu Wu** is a lecturer in the Department of Biological Sciences at National University of Singapore. His expertise is virology of

lower vertebrates. His research has focused on the morphogenesis of white spot syndrome virus and SGIV.

- **Dr. Yumi Une** is a veterinary pathologist at Azabu University (Japan), and the Asia representative on the GRC Board. She has been leading research on ranaviruses in Japan, conducting surveillance in wild populations of amphibians and performing controlled experimental challenges.

II. Presentations (9:00 – 11:30 am)

A) Dr. Matt Gray, University of Tennessee

Dr. Gray gave an overview of the Global Ranavirus Consortium, which included discussing previous international symposia on ranaviruses in Minneapolis, MN, and Knoxville, TN, USA. He also talked about ongoing GRC activities, which included upgrading the GRC website, offering annual membership in 2014, creating the Global Ranavirus Reporting System, and writing the first book on ranaviruses.

B) Dr. Yumi Une, Azabu University

Dr. Une gave an overview of the ranavirus surveillance activities in Japan. She has documented ranavirus in several American bullfrog populations as well as native anuran and caudate species. Laboratory studies have shown that several species of Hynobiidae are highly susceptible to ranavirus, many species of which are critically endangered. Dr. Une has characterized one of the isolates, which is similar to RCV-Z virus in North America, suggesting possible introduction to Japan.

C) Dr. Jie Ma, Yangtze River Fisheries Research Institute

Dr. Ma covered the known captive distribution of Giant Salamander Iridovirus (GSIV) in Chinese giant salamander farms, which includes 11 Chinese provinces. Gross and histological signs of GSIV disease are similar to those described for ATV and FV3. She also discussed morphogenesis and the functional genomics of GSIV. They recently developed a loop-mediated isothermal amplification assay (LAMP) for GSIV detection, and used GSIV monoclonal antibodies to detect viral antigens in different organs at various days post-infection. They also have been working on vaccine development using inactivated GSIV, and demonstrated a significant increase in GSIV antibodies and increased survival following subsequent exposure to GSIV.

D) Dr. Rolando Mazzoni, Universidade Federal de Goiás

Dr. Mazzoni discussed bullfrog farming in Brazil, which is a sophisticated, high production process with artificial compartments and ponds to

propagate all life stages. Dr. Mazzoni has been diagnosing ranaviral disease outbreaks for years in these facilities; however, this year he linked ranavirus to the etiology of a vestibular syndrome in adult frogs. The syndrome can be grossly described as frogs losing equilibrium, resulting in them floating on their sides and swimming in circles. Necropsies revealed significant necrosis through the tympanic channel and inner ear, which may have affected nerve function. Viral inclusions were observed throughout the affected tissue, and characterized as an FV3-like ranavirus.

E) Dr. XiaoLong Wang, Northeast Forestry University

Dr. Wang presented on a long-term (2006-2013) ranavirus surveillance study on 4 amphibian species among seven regions of the Heilongjiang Province. Prevalence of ranavirus generally was low (≤5%) in adults, but much higher in larvae (42.5%). At some locations, all larvae of *R. dybowskii* were infected. Genomic comparisons of viral isolates revealed that the ranavirus species was FV3-like and more than one type (strain) was circulating in at least one population. Other pathogens (fungi and parasites) were detected, but generally occurred at lower prevalence than ranavirus.

F) Dr. Yi Geng, Sichuan Agricultural University

Dr. Geng discussed his diagnosis of ranaviral disease in several species of fish (sturgeon, catfish), turtles, and amphibians (*R. nigromaculata, A. davidianus*). He discussed in detail his work on Chinese Giant Salamander Ranavirus (CGSRV), which is similar to soft-shelled turtle iridovirus. Similar to Dr. Zeng's team, Dr. Geng developed PCR and LAMP protocols for CGSRV detection, and is currently working on vaccine development.

G) Dr. Qiwei Qin, South China Sea Institute of Oceanology

Dr. Qin gave an overview of our current understanding of immune evasion strategies of lower vertebrate iridoviruses. He discussed how large DNA viruses often have a "hit and hide" strategy that results in persistence. Dr. Qin discussed the typical immune response of amphibian hosts following work in Jacques Robert's lab. He also discussed evasion strategies such as encoding SOCS, eIF2α, ubiquitin ligase enzyme, and semaphorin homologues that interact with the host's immune response and enhance viral replication. Dr. Qin also discussed how SGIV could encode some homologues that inhibit apoptosis thereby enhancing viral replication.

H) Dr. Jinlu Wu, National University of Singapore

Dr. Wu presented work on the molecular dissection of SGIV. Through the use of new microscope technologies, he created a 3D model of virion structure. He also presented details on SGIV morphogenesis. His future work is investigating processes at the viral assembly site.

III. **Full Group Discussion** (11:30 am – noon)

Presentations ran longer than expected; thus, the group decided to independently brainstorm about the topics below, and provide responses to Matt Gray by **15 June** for distribution to the entire group.

a. What are the most urgent areas of investigation in Asia?

b. What factors limit progress?

c. What funding opportunities exist?

d. Who would you like to collaborate with?

IV. **Small Group Discussions on Possible Research** (1:00 pm – ?)

A field trip of Harbin was planned for the afternoon; thus, the group decided to forgo small group discussions, but they were interested in organizing a small group discussion among ranavirus researchers in Asia during the 2015 International Symposium on Ranaviruses.