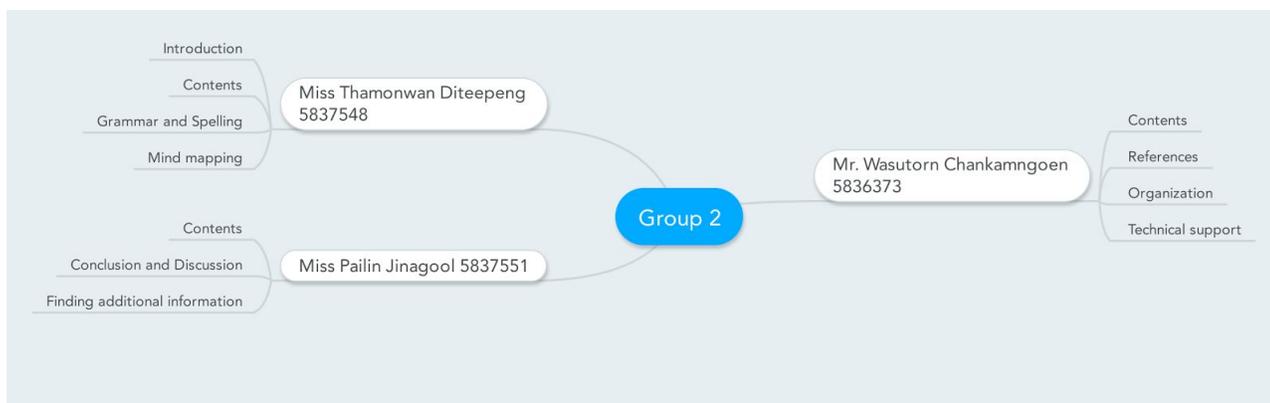


## What we have learned from Current Topics in Molecular Biology classes

### ● Group 2

1. Miss Thamonwan Diteepeng 5837548
  - a. Introduction
  - b. Contents
  - c. Grammar and Spelling
  - d. Mind mapping
2. Mr. Wasutorn Chankamgoen 5836373
  - a. Contents
  - b. References
  - c. Organization
  - d. Technical support
3. Miss Pailin Jinagool 5837551
  - a. Contents
  - b. Conclusion and Discussion
  - c. Finding additional information



## **1. Introduction**

Reading scientific research paper is one of many ways to expand scientific knowledge for scientists. It can also help scientists to write their own research paper in a good quality. However, scientific research paper is not easy to read like newspaper or other articles. There are several obstacles to understand the details in each research paper. Firstly, scientific knowledge background is required for better understanding such as molecular biology, biochemistry or cell biology, etc. Furthermore, each papers have different format which make people confuse. For example, some papers divide and order the detail into each topics but some papers combine all details together such as results and discussion are mixed together. Therefore, it is hard to summarize and analyze the major points of each paper. Moreover, The most necessary concern for research paper is scientific publication ethics which are avoiding any misconduct. Scientists should be honest in their work.

For this reason, the Current Topics in Molecular Biology classes is important for students by teaching them to read efficiently, to summarize and to analyze the main idea based on molecular biology knowledge. Also, this class will guide students to discuss the pros and cons of each paper and compare the example of good and bad published paper.

## **2. Contents**

### **Aj. Apinunt's class**

In Aj. Apinunt's class, the importance of research ethics and the misconduct in scientific research were discussed. Ethics is a guideline for scientists to begin their research paper or experiment. This definition of research ethics are different from ethics from the law because there is no exact right and wrong thing. Depending on social beliefs, culture and other factors, ethics are different in each society. There are many types of scientific research misconduct, for example,

the republishing of the same paper into different journals, the submission of someone's work as their own, and the leak of other people's paper that you were reviewing before it was published. Also, one of the most important things of research ethics is that scientists should not make up or manipulate the data or copy others work into their own work which is called "Plagiarism". The way to avoid plagiarism is that we should give the appropriate citation, use quotations, and paraphrase. (Mohan et al., 2015 and Debnath 2016)

### **Aj. Kanokporn's class**

In Ajarn Kanokporn's class, the topic of "Evaluation of Genetic Diversity in Chinese Wild Apple Species Along with Apple Cultivars Using SSR marker" was discussed. Ajarn taught us how to read the paper easily by paying more attention into results and discussion together and then we can know the main idea of each parts. Therefore, we can understand and know what this paper is talking about even though we do not know the details about that field before. Also, we discussed about the use of molecular markers in biodiversity research and breeding management. The Simple Sequence Repeat (SSR) marker is a technique that uses specific primers to amplify repetitive sequences in organism's genome and the products are compared with other organisms. This marker is used for evaluating the diversity or similarity between same or different species. However, the result can be different by depending on the statistical analysis of the markers, the number of markers used, and the purpose of the study. (Zhang et al., 2012)

### **Aj. Nitwara's class**

In Ajarn Nitwara's class, the topic of "An Infectious cDNA Clone of Zika Virus to Study Viral Virulence, Mosquito Transmission, and Antiviral Inhibitors" was discussed. This paper will have benefits for viral production by using molecular genetic techniques. From this class, we knew more about the Zika virus and the method to

construct the virus from the sequence in the database even though we have not got any viruses in hand. We studied about the difference between forward genetic, which is the way to study the changed genotype (gene) from phenotype, and the reverse genetic, which is how the constructed gene effects on the phenotype. For example, in this paper, the author transfected the constructed cDNA clone of Zika virus into A129 and AG129 mice and then observed the behavior and characteristics such as weight loss, hunched posture and ruffled fur. Therefore, we can determine the viral virulence from the animal model. Furthermore, we studied the term of quasispecies which is the DNA sequence that has more mutations because it was replicated from the initial viral gene without proofreading. Also, we knew the method to track the viral virulence by using the signal expression of Luciferase which was engineered into viral cDNA and these techniques can be used for antiviral drug discovery. (Shan et al., 2016)

### **Aj. Sarin's class**

In Ajarn Sarin's class, the session is about the use of CRISPR/Cas9 as a tool to investigate the viral genome. The CRISPR/Cas9 is a bacterial defense mechanism against viruses. This adaptive immune response of bacteria can memorize the virus genome that associates into bacterial genome by cleaving the foreign genome into pieces about 20 bases in size. Then, bacteria use this sequence as a guide for Cas9 protein to find the invader's genome and cleave them off. CRISPR technique can completely knockout genes and it is found only in bacteria.

In mammalian study, researchers need to engineer the cell to be able to produce the Cas9 protein. Also, CRISPR technique can allow the researcher to cleave DNA strand and insert some genes into the cleavage site before repairing mechanism take place. This method can be used to correct some genetic diseases that are caused by the missing of important genes. The designed CRISPR

sequences library can be used for knockout mutagenesis, for studying gene function or multiple gene interactions. For example, in this study, they aim to investigate the host factors that involved in Flavivirus invasion and replication. They used CRISPR to generate knockout human cell line. The survived cells contained non-essential gene knockout and then they were challenged with Dengue and Hepatitis C virus. The cells that were able to survive from infection were the one that lack of essential gene for virus life cycle. (Marceau et al., 2016)

### **Aj. Panadda's class**

In Aj. Panadda's class, we discussed about the new emerging shrimp disease called Acute hepatopancreatic necrosis disease (AHPND) that caused by *Vibrio parahaemolyticus*. In molecular biology research, the authors found that *V. parahaemolyticus* infection can cause lesions such as hepatopancreatic tube epithelium sloughing and hemolytic encapsulation without bacteria present in the lesion which means that there is some kind of secretory toxin that cause the cell death. They proved this hypothesis by comparing the DNA sequence from non-virulence strain *V. parahaemolyticus* with AHPND causing strain. They found that all AHPND causing strain contained a common plasmid pVA1. In VA1 plasmid, they identified two genes PirA and PirB that can be transcribed into PirAB toxin. This toxin had similar structure with insecticidal protein Cry toxin.

Moreover, we have learned the presentation techniques because we had to present one part of the result and then Ajarn commented about presentation from each group and suggested us about how to present properly, what is the main point of this result, and describe details in each figure. (Lee et al., 2015)

### **Aj. Wipa's class**

In Ajarn Wipa's class, we discussed about the alternative fuel source from engineered-microalgae as fossil fuel is not sustainable

and causes the pollution. The microalgae that can produce oil is one of the alternative ways of biofuel production. The development of microalgae oil production has been studied for a long time but the production is still not sufficient for industrial use. This study tried to improve the amount of oil production in microalgae by transferring gene from oil producing plant to the algae. Although the engineered algae can successfully produce high amount of oil, the oil production reduced and the plasmid disappeared after subculturing for more than 200 generations. For this reason, they suggested the use of cryopreservation for algae preservation to overcome this problem.

Moreover, in this class, Ajarn taught us how to write the research paper that can attract the readers by presenting the introduction and discussion in a range of experiments, and we have learned how to conclude the details in each figure. (Ahmad et al., 2015)

### **Aj. Poochit's class**

In Aj. Poochit's class, we learned the way to discover the antibiotics that can kill bacteria. This discovery includes many processes such as screen, hit, cell line testing, animal model study, and clinical trial which spends over 10 - 20 years.

This class focused on the problem of antibiotic resistant gram positive bacteria such as beta-lactam resistant *S. aureus*. This bacteria uses beta-lactamase enzyme which is different from other mechanisms in gram negative bacilli to destroy beta-lactam antibiotic. The study tried to restore the bactericidal effect of beta-lactam antibiotics by finding the inhibitors of wall teichoic acid biosynthesis which caused it to be highly susceptible to beta-lactam antibiotics. They proposed that TarocinA which is another antibiotic derivatives can alter the production mechanism of bacterial cell wall. (Lee et al., 2016)

### **Aj. Charongrat's class,**

In this class, we played the game to find the winner who got the highest score from answering the question. We discussed about the colocalization of purinosome and mitochondria. Purinosome is the vesicle that contains purine biosynthesis enzyme. It is very important for purine biosynthesis in *de novo* pathway to maintain the nucleic acid level. In this research, they show the co-localization between purinosome and mitochondria by using new technique about fluorescence microscope which called STORM (super resolution microscope). STORM gives higher resolution of pictures even if the sample is tiny organelles. Moreover, this research showed the functional link between purinosome and mitochondria. Mitochondrial dysregulation can lead to an increase in purinosome level, and the purinosome induction can lead to an increasing in intermediate of mitochondrial metabolism level. (French et al., 2016)

#### **Aj. Duncan's class**

In this session, we were introduced to the ways to evaluate the papers. There are several scientific misconducts that can be happened in research paper. Scientists should not believe anything in published papers especially the figure. Ajarn showed us the examples from bad papers. There were many figures that they made up and many results that were duplicated. Therefore, it makes us realize that the published paper may not be real. The reader should read carefully especially the figures because some authors made up the figure by copy and paste or cut out some unwanted result. There are 3 types of the scientific misconduct which are fabrication, falsification and plagiarism. The scientists must avoid all of these scientific misconduct in their published paper and must follow the research ethics (Samie et al., 2016)

### **3. Conclusion**

Current topics in molecular biology class is part of the molecular genetics and genetic engineering program that aims to help students to be

able to analyze scientific literatures while developing the interactive learning manner. In each session, students will be assigned to read papers in different fields of molecular biology and then discuss with the instructor. The topic and style of learning are varied to help students to understand other research fields that are probably useful for their future work. Furthermore, students can evaluate different point of views and can develop the critical thinking skill. As rapidly expanding and changing trends in molecular biology evolve, students must prepare themselves in order to root and grow to become a good molecular biology scientist who can provide and support scientific research in the future.

#### 4. References

- Ahmad, I., A. K. Sharma, H. Daniell and S. Kumar (2015). "Altered lipid composition and enhanced lipid production in green microalga by introduction of brassica diacylglycerol acyltransferase 2." Plant biotechnology journal **13**(4): 540-550.
- Debnath, J. (2016). "Plagiarism: A silent epidemic in scientific writing - Reasons, recognition and remedies." Med J Armed Forces India **72**(2): 164-167.
- French, J. B., S. A. Jones, H. Deng, A. M. Pedley, D. Kim, C. Y. Chan, H. Hu, R. J. Pugh, H. Zhao, Y. Zhang, T. J. Huang, Y. Fang, X. Zhuang and S. J. Benkovic (2016). "Spatial colocalization and functional link of purinosomes with mitochondria." Science **351**(6274): 733-737.
- Lee, C.-T., I. T. Chen, Y.-T. Yang, T.-P. Ko, Y.-T. Huang, J.-Y. Huang, M.-F. Huang, S.-J. Lin, C.-Y. Chen, S.-S. Lin, D. V. Lightner, H.-C. Wang, A. H. J. Wang, H.-C. Wang, L.-I. Hor and C.-F. Lo (2015). "The opportunistic marine pathogen *Vibrio parahaemolyticus* becomes virulent by acquiring a plasmid that expresses a deadly toxin." Proceedings of the National Academy of Sciences of the United States of America **112**(34): 10798-10803.
- Lee, S. H., H. Wang, M. Labroli, S. Koseoglu, P. Zuck, T. Mayhood, C.

- Gill, P. Mann, X. Sher, S. Ha, S. W. Yang, M. Mandal, C. Yang, L. Liang, Z. Tan, P. Tawa, Y. Hou, R. Kuvelkar, K. DeVito, X. Wen, J. Xiao, M. Batchlett, C. J. Balibar, J. Liu, J. Xiao, N. Murgolo, C. G. Garlisi, P. R. Sheth, A. Flattery, J. Su, C. Tan and T. Roemer (2016). "TarO-specific inhibitors of wall teichoic acid biosynthesis restore beta-lactam efficacy against methicillin-resistant staphylococci." Sci Transl Med **8**(329): 329ra332.
- Marceau, C. D., A. S. Puschnik, K. Majzoub, Y. S. Ooi, S. M. Brewer, G. Fuchs, K. Swaminathan, M. A. Mata, J. E. Elias, P. Sarnow and J. E. Carette (2016). "Genetic dissection of Flaviviridae host factors through genome-scale CRISPR screens." Nature advance online publication.
- Mohan, M., D. Shetty, T. Shetty and K. Pandya (2015). "Rising from Plagiarising." J Maxillofac Oral Surg **14**(3): 538-540.
- Samie, N., S. Muniandy, M. S. Kanthimathi, B. S. Haerian and R. E. Azudin (2016). "Novel piperazine core compound induces death in human liver cancer cells: possible pharmacological properties." Sci Rep **6**: 24172.
- Shan, C., X. Xie, A. E. Muruato, S. L. Rossi, C. M. Roundy, S. R. Azar, Y. Yang, R. B. Tesh, N. Bourne, A. D. Barrett, N. Vasilakis, S. C. Weaver and P. Y. Shi (2016). "An Infectious cDNA Clone of Zika Virus to Study Viral Virulence, Mosquito Transmission, and Antiviral Inhibitors." Cell Host Microbe **19**(6): 891-900.
- Zhang, Q., J. Li, Y. Zhao, S. S. Korban and Y. Han (2012). "Evaluation of Genetic Diversity in Chinese Wild Apple Species Along with Apple Cultivars Using SSR Markers." Plant Molecular Biology Reporter **30**(3): 539-546.