

# Syllabus

## Ecology Masterclass@Taiwan (EMT3) 2024 (Spring)

Running course title: Ecology and evolution of marine symbiosis diversity: Animal-algal associations of the Northeast Coast of Taiwan

*We will accept a maximum of 10 students.*

*We will require a minimum of 4 students to run the course.*

*Please note that the week of the field work at ICOB Marine Research Station (MRS) in Yilan may shift due to weather and other circumstances. This may also cause shifts in the other classes.*

In the first lecture we will introduce the concept of this TIGP signature course to students and the two major subtopics of this year's course. The first is using to investigate the biodiversity of the acoel *Waminoa* and their algal symbionts in the Northeast Coast of Taiwan. The goal is to reconstruct the evolutionary history and ecological niche of the association among corals, *Waminoa*, and the *Symbiodiniaceae* or *Amphidinium* symbionts. The second is to obtain the mitochondrial and possibly the chloroplast genomes of these species. Students will also be introduced to some basic developmental biology. If at least 6 students enroll in the class, we will also include a minor project investigating genetic diversity of jellyfish. The goal of this part will be to compare two populations of *Aurelia aurita*: one is from sub-tropical waters around Taiwan and another one originates from temperate regions near the central part of Japan. Samples for Taiwanese strain can be obtained by plankton sampling near Yilan during the course, but in case of adverse weather conditions backup samples for both strains are available from ICOB. Jellyfish of temperate and tropical strains differ morphologically and by using Nanopore sequencing we can estimate the level of their genetic differences in order to answer the question whether these are just strains or separate species.

The next 3 lectures will be preparation including a combination of lectures, group discussions, and lab practicals. In late March, we plan to spend 5 days at the ICOB Marine Research Station (MRS) in Yilan. Being based there allows us to easily access the marine tidepools for the main field aspects of the course. Additionally, we will conduct most of the developmental biology coursework at the MRS. Students will also learn how to use the cutting edge and portable Oxford Nanopore Technologies sequencing platform on site.

The remaining part of the course will be based at the main campus of Academia Sinica. Students will receive lectures and practicals on NGS data handling, assembling mitogenome (and chloroplast) data and analysis of the samples. Illumina sequencing will be done in collaboration with the BRCAS High Throughput Genomics Core. Lectures will also be given on manuscript writing. At the end, students will be divided into subgroups to write up one or more short manuscripts.

**Ecology Masterclass@Taiwan (EMT):  
Next-generation mentality and knowledge for conservation  
(Ecology and Conservation 2024 Spring)**

<b>Coordinator</b>	John Wang (JW)		
<b>Lecturers</b>	Yi-Jyun Luo (YJL), Konstantin Khalturin (KK), Sung-Yin Yang (SYY), Jr-Kai Yu (JKY), Tung-Yung Fan (TYF), Sen-Lin Tang (SLT), Tzi-Yuan Wang (TYW), Benny K.K. Chan (BKKC)		
<b>Time</b>	Fridays, 09:10-12:00		
<b>Place</b>	<ul style="list-style-type: none"> <li>• B204/B208, 2F, Interdisciplinary Building, Academia Sinica (BRC Building)</li> <li>• A303, 3F, Interdisciplinary Building, Academia Sinica (BRC Building)</li> <li>• Marine Research Station, Institute of Cellular and Organismic Biology, Yilan</li> <li>• Shih-Liang International Conference Hall, National Taiwan University (NTU)</li> </ul>		
<b>Date/Class hour</b>	<b>Content</b>	<b>Lecturer</b>	<b>Venue</b>
<b>Class 1 2/23 (2hr)</b>	<b>Introduction</b> Course approach, expectations, and weekly schedule; Lecture on the basics and overview of ecological and evolutionary genomics and biodiversity studies; Questions asked, techniques used, modern approaches (case studies)	YJL, KK, JKY	B204 BRCAS
<b>Class 2 3/1 (3hr)</b>	<b>Lecture: Introduction to molecular evolution</b> Application of NGS techniques to population studies and phylogeny reconstructions in the animal Tree of Life; Microbiomes in coral reefs	KK, SYY	B204 BRCAS
<b>Class 3 3/8 (3hr)</b>	<b>Lecture: Basic concepts in molecular ecology and evolution</b> What is DNA, RNA, DNA sequencing, use of sequencing in biodiversity/phylogeny. NGS sequencing and its applications, etc. <b>Lab:</b> DNA extraction for Sanger sequencing– practice for DNA extraction (and PCR)	YJL TAs: Yi-Ling Chiu, Isabel Liao	A303 BRCAS
<b>Class 4 3/15 (3hr)</b>	<b>Lecture: RNA sequencing and paper discussion</b>	YJL TAs: Tom Lewin, Isabel Liao	B204 BRCAS

	<b>Lab:</b> DNA/RNA sequencing pipeline on mock data		
<b>Four consecutive days@ MRS Yilan Class 5-9: March 19-22</b>			
<b>Class 5 3/19</b>	<b>Lecture: Coral reefs in Taiwan</b> <b>Lab:</b> Sampling at tidepool; Tidepool sample processing; Oxford Nanopore sequencing; Lectures (ONT sequencing and Evo-Devo)	<b>All day</b> TYF, YJL, KK, JKY, TYW, BKKC +TAs	MRS
<b>Class 6 3/20</b>	<b>Lecture: Evolutionary developmental biology (EvoDevo)</b> <b>Lab:</b> Sampling around Northeast Coast (afternoon); Sample processing; Oxford Nanopore Lecture and analysis	<b>All day</b> YJL, KK, JKY, TYF, TYW, BKKC +TAs	MRS
<b>Class 7 3/21</b>	<b>Lab:</b> Sampling around Northeast Coast: tidepool collection (or SCUBA diving); Sample processing; Continue sample processing; EvoDevo; and ONT analysis	<b>All day;</b> YJL, KK, JKY, TYF, TYW, BKKC +TAs	MRS
<b>Class 8 3/22</b>	<b>Lab:</b> Sampling around Northeast Coast; Sample processing; Developmental biology lab; Oxford Nanopore analysis	<b>All day;</b> YJL, KK, JKY, TYF, TYW +TAs	MRS
<b>Class 9 3/29</b>	Attending SMBE Taiwan meeting <a href="https://www.tsecb.org.tw/conferences/2024smbe_regional_meeting">https://www.tsecb.org.tw/conferences/2024smbe_regional_meeting</a>		Shih-Liang International Conference Hall, NTU
<b>Class 10 4/12 (3hr)</b>	<b>Lecture: Cooperation and cheating in symbioses</b> <b>Writing workshop:</b> Teaching manuscript writing 1: Results and Methods	JW, YJL	B204 BRCAS

<b>Class 11, 12</b>			
<b>Bioinformatic analysis of NGS and Oxford Nanopore data</b>			
<b>Class 11</b> <b>4/19</b> <b>(3hr)</b>	<b>Lab:</b> Bioinformatic analysis of NGS and Oxford Nanopore data (part 1) Computer lab to learn basic command line interface. And then on mock data	YJL, KK TAs: Isabel Liao, Tom Lewin	B204 BRCAS
<b>Class 12</b> <b>4/26</b> <b>(3hr)</b>	<b>Lab:</b> Bioinformatic analysis of NGS and Oxford Nanopore data (part 2)	YJL TAs: Isabel Liao, Tom Lewin	B204 BRCAS
<b>Class 13</b> <b>5/3</b> <b>(3hr)</b>	<b>Lab:</b> Genome annotation and analysis (from perspective of ecology and evolution; metagenomics and metatranscriptomics)	YJL TAs: Isabel Liao, Tom Lewin	B208 BRCAS
<b>Class 14</b> <b>5/10</b> <b>(3hr)</b>	<b>Writing workshop 2:</b> Manuscript writing: Writing the introduction	JW	B208 BRCAS
<b>Class 15</b> <b>5/17</b> <b>(3hr)</b>	<b>Writing workshop 3:</b> Manuscript writing: Preparation of figures and tables; Writing the discussion; submission process	JW	B208 BRCAS
<b>Class 16</b> <b>5/31*</b> <b>(3hr)</b>	<b>Presentation &amp; discussion</b> (Final exam)	YJL, KK, JW, JKY, SLT	B208 BRCAS

\*5/24 for presentation preparation