

## Syllabus

### Ecology Masterclass@Taiwan (EMT4) Spring 2026

(last update 20251028)

2026 Theme: Diversity, ecology, and evolution of terrestrial invertebrates in the Lanyang Plain

*We will accept a maximum of 10 students.*

*We will require a minimum of 3 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 one main and two secondary projects of this year's course. The first is to test if the Formicinae subfamily of ants have evolved a new sex determination gene. Although this looks like a developmental biology question, we plan to solve it using population genomics on these ants, specifically looking for regions with elevated genetic diversity. The second is to obtain the mitochondrial genomes of these species. If at least 6 students enroll in the class, we will include a third project to identify ant food by gut metagenomics analysis, with the goal of improving our understanding of the ecological role of the focal ant species in the local food web.

The next 3 lectures will be preparation including a combination of lectures, group discussions, and lab practicals. In late March, we plan to spend 4 or 5 days at the ICOB Marine Research Station (MRS) in Yilan as a base. Being based there gives us easy access to the Lanyang Plain and surrounding mountainside. It is also near the marine tidepools, so we will take the students one day to look at intertidal marine species. 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 exact dates may shift pending weather.

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 mitochondrial genome data and analysis of the samples, and population genomics. Some 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	
<b>Organizers &amp; Lecturers</b>	John Wang (JW), Tzi-Yuan Wang (TYW), Jen-Pan Huang (JPH), Jr-Kai Yu (JKY), and Benny Chan (BKKC)
<b>Time</b>	Fridays (or sometimes Thursdays), 09:00-12:00
<b>Place</b>	<ul style="list-style-type: none"><li>• B204, 2F, Interdisciplinary Building, Academia Sinica (BRC Building)</li><li>• Lab, Biodiversity Research Center</li></ul>

	<ul style="list-style-type: none"> <li>Marine Research Station, Yilan</li> </ul>		
Date/Class hour	Content	Lecturer	Venue
<b>Class 1 2/26</b> <b>(Thurs, 2hr)</b>	Introduction Course approach, expectations, and weekly schedule Lecture on the basics and overview of ecological genomics and biodiversity studies: Questions asked, techniques used, modern approaches (case studies)	JW, JKY, JPH	B204, BRCAS
<b>Class 2 3/6</b> <b>(3hr)</b>	Lecture and discussion: Introduction to molecular population genetics and Application of NGS techniques to population studies and insects	JW, JPH	BRCAS
<b>Class 3 3/13</b> <b>(3hr)</b>	Basic concepts in molecular ecology. What is DNA, RNA, DNA sequencing, use of DNA sequencing in biodiversity and phylogeny? NGS sequencing and its applications, etc.  Lab practical: DNA extraction for Sanger sequencing– practice for DNA extraction (and PCR)	JW TAs: research assistant (RA)	BRCAS (A304)
<b>Class 4 3/20</b> <b>(3hr)</b>	Lecture: DNA barcoding, metabarcoding, eDNA sequencing and paper discussion  Dry lab practical: eDNA sequencing pipeline on mock data	JW	BRCAS
<b>Five consecutive days@ MRS Yilan</b> <b>Class 5-9 March 27-31</b>			
<b>Class 5 3/23</b>	Lectures on coral reefs in Taiwan preparations; Sampling at tidepool; Tidepool sample processing; Oxford Nanopore (ONT) sequencing; Lectures (ONT sequencing and Evo-Devo) Evening ant collection	<b>All day</b> JKY, JW, TYW, BKKC, +TAs	MRS
<b>Class 6 3/24</b>	Lecture and Lab: Evolutionary developmental biology (EvoDevo)	<b>All day</b> JW, JKY, JPH, TYW, +TAs	MRS

	Sampling ants (afternoon); Sample processing; ONT Lecture and analysis Evening ant collection		
<b>Class 7 3/25</b>	Sampling ants (morning)  Sample processing; Continue sample processing; and ONT analysis	<b>All day;</b> JW, JKY, JPH, TYW, +TAs	MRS
<b>Class 8 3/26</b>	More ant sampling if necessary; Sample processing;	<b>All day;</b> JW, JKY, JPH, TYW, +TAs	MRS
<b>Class 9 3/27</b>	Sample processing; ONT analysis; Clean up	<b>All day;</b> JW, JKY, JPH, TYW, +TAs	MRS
<b>Class 10 4/17 14:00-17:00 (3hr)</b>	Lecture: Sex determination and metabarcoding;  Teaching manuscript writing 1: Results and Methods	JW	B204, BRCAS
<b>Class 11, 12</b> <b>Bioinformatic analysis of NGS and Oxford Nanopore data</b>			
<b>Class 11 4/24 (3hr)</b>	Bioinformatic analysis of NGS and ONT data, part 1. Computer lab to learn basic command line interface. And then on mock data	JW, +TAs	B208 BRCAS
<b>Class 12 5/8 (3hr)</b>	Bioinformatic analysis of NGS and ONT data, part 2.	JW, +TAs	B204, BRCAS
<b>Class 13 5/15 (3hr)</b>	Genome annotation and analysis (from perspective of ecology evolution; mitogenomes). (Practical course)	JW, +TAs	B204 BRCAS

<b>Class 14</b> <b>5/22</b> <b>(3hr)</b>	Teaching manuscript writing 2: Writing the introduction	JW	B208 BRCAS
<b>Class 15</b> <b>5/29</b> <b>(3hr)</b>	Teaching manuscript writing 3: Figures and tables; Discussion; the Submission process.	JW	B208 BRCAS
<b>Class 16</b> <b>6/5</b> <b>(3hr)</b>	Presentation & discussion 1 (Final exam)	JW, JKY, JP	B208 BRCAS