

TIGP Bio 2025 Spring Syllabus

Basic Molecular Biology II (B2)

For the latest syllabus, please visit the BP website: <https://idv.sinica.edu.tw/tigpbio/>

Place: Room 308, Institute of Statistical Science, Academia Sinica
Time: Tuesday 09:00-12:00
Chair: Dr. Ho-Ming Chen (homing@gate.sinica.edu.tw)
Aim: Introduce key concepts and methods to manage, integrate and analyze bio big data in the era of post-genomics life sciences
Outline: Big Data in Bioinformatics - From Data-Driven Analysis to Knowledge
Textbook: (Reference books, not required)
1. Scalable Big Data Analytics for Protein Bioinformatics [Publisher: Springer; 1st ed. 2018 edition (September 26, 2018)]
2. Computational Intelligence and Big Data Analytics: Applications in Bioinformatics [Publisher: Springer; 1st ed. 2019 edition (September 9, 2018)]
3. Big Data in Omics and Imaging [Publisher: Chapman and Hall/CRC; 1 edition (June 19, 2018)]
4. Big Data Analytics in Genomics [Publisher: Springer; Softcover reprint of the original 1st ed. 2016 edition (April 25, 2018)]
TA: N/A (Please refer to the lectures respectively shall you have any questions for each class)
Grades: Midterm exam 50%. Final exam 50%.

【For Non-BP student】

For Non-BP student to register/sit-in any BP course, it is required to gain course chair's permission:

(1) Basic Enrollment Information form: <https://forms.gle/oK7vJzzrx9EvybbT9>

(2) TIGP-BP Course Registration Consent Form
https://idv.sinica.edu.tw/tigpbio/index/TIGP%20Bioinformatics_Class%20Registration%20Consent%20Form.docx

※ Deadline: **the 4th week** of each semester.

※ Signature of the course chair should be collected before submission. Incomplete form will not be accepted.

※ Course grade will NOT be given (even class enrollment is completed at school) if fail to follow the procedures.

Week	Date	Topics/Brief Description	Lecturers	Evaluation Method	Email
1	2025/2/18	Class rescheduled to 2/24.	--	--	--
2	2025/2/24 (Mon) 9:00-12:00 @Webex Only	Genomics and Genome Analysis	Dr. Ueng-Cheng Yang	Take-home exam with a specified deadline: ▶ March 10th	uyang@nycu.edu.tw
2	2025/2/25	Genome Assemblies and Annotations	Dr. Isheng Jason Tsai	In-class exam on midterm exam date	ijtsai@gate.sinica.edu.tw
3	2025/3/4	Epigenomics	Dr. Pao-Yang Chen	In-class exam on midterm exam date: 【 open-book 】	paoyang@gate.sinica.edu.tw
4	2025/3/11	Comparative and Evolutionary Genomics	Dr. Isheng Jason Tsai	In-class exam on midterm exam date	ijtsai@gate.sinica.edu.tw
5	2025/3/18	Microbiome	Dr. Sen-Lin Tang	Take-home exam with a specified deadline: ▶ April 30th	sltang@gate.sinica.edu.tw
6	2025/3/25	Metagenomics	Dr. Sen-Lin Tang		
7	2025/4/1	Review Week (no class)	--	--	--
8	2025/4/8	Midterm Exam	--	--	--
9	2025/4/15	Population Genomics	Dr. Jen-Pan Huang	Take-home exam with a specified deadline: ▶ 5:00 PM, May 2nd	jphuang@gate.sinica.edu.tw
10	2025/4/23 (Wed) 9:00-12:00 @Webex Only	Medical Genomics	Dr. Tai-Ming Ko	Take-home exam with a specified deadline: ▶ May 14th	taiming23@gmail.com
11	2025/4/29	Transcriptomics	Dr. Hung-Hsin Chen	Take-home exam with a specified deadline: ▶ May 26th	hunghsinchen@ibms.sinica.edu.tw
12	2025/5/6	Proteomics Informatics	Dr. Chuan-Chih Hsu	In-class exam on final exam date	cchsu@gate.sinica.edu.tw
13	2025/5/13	Structural Bioinformatics	Dr. Lee-Wei Yang	Take-home exam with a specified deadline: ▶ May 29th	lwyang@life.nthu.edu.tw
14	2025/5/20 @Google Meet Only	Metabolomics	Dr. Yufeng Jane Tseng	Take-home exam with a specified deadline: ▶ June 3rd	yjtseng@csie.ntu.edu.tw
15	2025/5/27	Review Week (no class)	--	--	--
16	2025/6/3	Final Exam	--	--	--

TIGP Bioinformatics Program
Advanced Algorithms (C2)
Spring 2025 Syllabus

For the latest syllabus, please visit the BP website: <https://idv.sinica.edu.tw/tigpbio/>

Place: Room 308, Institute of Statistical Science, Academia Sinica
Time: Friday 14:00-17:00
Chair: Dr. Li Su (lisu@iis.sinica.edu.tw)
Co-Chair: Dr. Trees-Juen Chuang (trees@gate.sinica.edu.tw)
Outline: This course is basically about data mining, machine learning and statistical modeling from data, and some other algorithms and applications.

Resources:
There are 7 topics given in the way of **Videos Preview** (about 2~3 hours) + **In-class discussions** (about 1~1.5 hours).
Please find the link (<https://reurl.cc/GWko1L>) that WILL provide the links of the following:
(1) the videos to be watched BEFORE the class
(2) the questions to be discussed IN the class
(3) the homework to be completed AFTER the class

References:
1. Learning from Data- A Short Course (Abu-Mostafa, Magdon-Ismael, Lin, 2012)
2. Learning Pattern Classification (Duda, Harg, and Stork, 2001)
3. An Introduction to Support Vector Machines and Other Kernel-based Learning Methods (Cristianini and Shawe-Taylor, 2000)
4. [DL in Life Science] <https://mit6874.github.io/>
5. [ML for Genomics] <https://www.classcentral.com/course/youtube-6-047-6-878-machine-learning-for-genomics-fall-2020-48203>

TA: Tzu-Hsiang Lin **Email:** d84122701181@gmail.com
Office hours: Wednesday, 17:00 pm - 19:00 pm
Office location: Room A622, Agricultural Biotechnology Research Center
Grades: Midterm exam 50%. Final exam 50%.

【For Non-BP student】

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(1) Basic Enrollment Information form <https://forms.gle/oK7vJzzrx9EvybbT9>
(2) TIGP-BP Course Registration Consent Form
https://idv.sinica.edu.tw/tigpbio/index/TIGP%20Bioinformatics_Class%20Registration%20Consent%20Form.docx

※ Deadline: **the 4th week** of each semester.
※ Signature of the course chair should be collected before submission. Incomplete form will not be accepted.
※ Course grade will NOT be given (even class enrollment is completed at school) if fail to follow the above procedures.

Week	Date	Topics/Brief Description	Lecturers	Lecture Style	Evaluation Method	Email
1	2025/2/21	Data Classification	Dr. Li Su	Lectures	Take-home exam with a specified deadline: ▶ March 7th	lisu@iis.sinica.edu.tw
2	2025/2/28	Class rescheduled to 3/25 . 228 Peace Memorial Day (no class)	--	--	--	--
3	2025/3/7 @Webex Only	Convolutional Neural Networks, Recurrent Neural Networks (optional: Graph Neural Networks)	Dr. Che Lin	Preview videos + Online discussions	Take-home exam with a specified deadline: ▶ April 7th	chelin@ntu.edu.tw
4	2025/3/14	Hidden Markov Models	Dr. Yu Tsao	Lectures	In-class exam on midterm exam date	yu.tsao@citi.sinica.edu.tw
5	2025/3/21 @Webex Only	[DL in Life Science] GWAS and Variants	Dr. Tzu-Pin Lu	Preview videos + Online discussions	Take-home exam with a specified deadline: ▶ April 7th	tplu@ntu.edu.tw
6	2025/3/25 (Tues) @Webex Only 14:00-17:00	Boolean and Bayesian networks	Dr. Henry Horng-Shing Lu	Online lectures	Take-home exam with a specified deadline: ▶ April 11th	henryhslu@nycu.edu.tw
6	2025/3/28	Single cell RNA-seq	Dr. Yao-Ming Chang	Preview videos + in-class discussions	Take-home exam with a specified deadline: ▶ April 17th	petitming@ibms.sinica.edu.tw
7	2025/4/4	Tomb-Sweeping Day and Children's day / Review Week (no class)	--	--	--	--
8	2025/4/11	Midterm Exam	--	--	--	--
9	2025/4/18 @Webex Only	Network Analysis	Dr. Hsuan-Cheng Huang	Lectures	Take-home exam with a specified deadline: ▶ May 9th	hsuancheng@nycu.edu.tw
10	2025/4/25	[DL in Life Science] Graph Analysis [DL in Life Science] Drug Discovery	Dr. Yueh-Hua Tu	Preview videos + in-class discussions	Take-home exam with a specified deadline: ▶ May 9th	a504082002@gmail.com
11	2025/4/30 (Wed) 14:00-17:00	[DL in Life Science] Protein Structure Prediction	Dr. Chien-Yu Chen	Preview videos + in-class discussions	Take-home exam with a specified deadline: ▶ May 14th	chienyuchen@ntu.edu.tw
12	2025/5/6 (Tues) 14:00-17:00	Advanced Algorithms for Proteomics	Dr. Ching-Tai Chen	Preview videos + in-class discussions	Take-home exam with a specified deadline: ▶ May 30th	ctchen@utapei.edu.tw

13	2025/5/13 (Tues) 14:00-17:00	Exploring modeling in enzyme kinetics and pharmacokinetics	Dr. An-Chi Wei	Lectures	Take-home exam with a specified deadline: ▶ 11:59 PM, June 6th	acwei86@ntu.edu.tw
14	2025/5/23 @Google Meet Only	Systems Biology and Biological Modeling of Gene Regulation	Dr. Yu-Chao Wang	Preview videos + Online discussions	Take-home exam with a specified deadline: ▶ June 6th	yuchao@nycu.edu.tw
15	2025/5/30	Make-up Holiday for Dragon Boat Festival / Review Week (no class)	--	--	--	--
16	2025/6/6	Final Exam (take-home exams, no class)	--	--	--	--

TIGP Bioinformatics Program
Advanced Statistical Methods in Bioinformatics (S2)
Spring 2025 Syllabus

For the latest syllabus, please visit the BP website: <https://idv.sinica.edu.tw/tigpbio/>

Place: Room 308, Institute of Statistical Science, Academia Sinica
Time: Thursday 9:00-12:00
Chair: Dr. Grace S. Shieh (gshieh@stat.sinica.edu.tw)
Outline: Introduction to useful and advanced statistical methods in computational biology. The topics include: Analysis of next generation sequencing (NGS) Data (e.g., RNA-Seq and ChIP-Seq), maximum likelihood estimation, the EM algorithm, Bayesian inference, Monte Carlo methods, Resampling (Bootstrap & permutation test), Human Genetics, clustering and classification, dimension-reduction and missing data.
Textbook: N/A
TA: N/A (Please refer to the lectures respectively shall you have any questions for each class)□
Grades: Midterm exam 50%. Final exam 50%.

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(2) TIGP-BP Course Registration Consent Form:
https://idv.sinica.edu.tw/tigpbio/index/TIGP%20Bioinformatics_Class%20Registration%20Consent%20Form.docx
※ Deadline: **the 4th week** of each semester.
※ Signature of the course chair should be collected before submission. Incomplete form will not be accepted.
※ Course grade will NOT be given (even class enrollment is completed at school) if fail to follow the above procedures.

Week	Date	Topics/Brief Description	Sub-topics/Detail Descriptions	Lecturers	Evaluation Method	Email
1	2025/2/19 (Wed) 9:00-12:00	Analysis of NGS data I	Analysis of DNA sequencing data	Dr. Shih-Kai Chu	Take-home exam with a specified deadline: ▶ 11:59 PM, April 12th	uhcnivag@gm.ntpu.edu.tw
2	2025/2/26 (Wed) 9:00-12:00	Analysis of NGS data II	Analysis of RNA sequencing data	Dr. Shih-Kai Chu		
3	2025/3/6	Maximum likelihood estimates and the EM algorithm I	Maximum likelihood estimates	Dr. Yen-Tsung Huang	Take-home exam with a specified deadline: ▶ 11:59 PM, April 10th	ythuang@stat.sinica.edu.tw
4	2025/3/13	Maximum likelihood estimates and the EM algorithm II	The EM algorithm	Dr. Yen-Tsung Huang		
5	2025/3/20	Bayesian Statistics	prior dist., conjugate families & applications to genetics	Dr. Grace S. Shieh	In-class exam on midterm exam date	gshieh@stat.sinica.edu.tw
6	2025/3/27	Resampling methods	Bootstrap for hypothesis testing , confidence interval, and Permutation method	Dr. Grace S. Shieh	Take-home exam with a specified deadline: ▶ 11:59 PM, April 30th	
7	2025/4/2 (Wed) 9:00~12:00	Monte Carlo Markov Chains	Monte Carlo Markov Chains	Dr. Shin-Sheng Yuan	Take-home exam with a specified deadline: ▶ 11:59 PM, April 30th	syuan@stat.sinica.edu.tw
7	2025/4/3	Makeup Holiday for Children's Day (no class)	--	--	--	--
8	2025/4/10	Midterm Exam	--	--	--	--
9	2025/4/17	Prediction of Drug Response	Feature selction, logistic ridge, KNN, ML and transfer learning	Dr. Grace S. Shieh	No exam. (was HW with a specified deadline)	gshieh@stat.sinica.edu.tw
10	2025/4/24	Cluster Analysis	K-Means, Hierarchical Clustering, Heatmap, Cluster Validation	Dr. Han-Ming Wu	Take-home exam with a specified deadline:	
11	2025/5/1	Classification and Its Assessment	ROC Curve, Decision Tree, Ensemble Methods	Dr. Han-Ming Wu	▶ June 5th	wuhm@g.nccu.edu.tw
12	2025/5/8	Statistics in Human Genetics/Genomics I	Concept of Statistical Genetics, International Genomic Projects, Linkage Analysis, Genetic Association Analysis	Dr. Hsin-Chou Yang	Take-home exam with a specified deadline: ▶ June 5th	hsinchou@stat.sinica.edu.tw
13	2025/5/15	Statistics in Human Genetics/Genomics II	Genome-Wide Association Study, Gene-Gene Interaction, Rare Variant Analysis, Polygenic Risk Score	Dr. Hsin-Chou Yang		
14	2025/5/22	Advanced regression and dimension reduction II	Liquid Association and related developments	Dr. Kang-Chung Yang	Take-home exam with a specified deadline: ▶ June 5th	keyang@stat.sinica.edu.tw
15	2025/5/29	Advanced regression and dimension reduction I	Sliced Inverse Regression and PHD	Dr. Shin-Sheng Yuan	Take-home exam with a specified deadline: ▶ June 5th	syuan@stat.sinica.edu.tw
16	2025/6/5	Final Exam (take-home exams, no class)	--	--	--	--

TIGP Bioinformatics Program

Seminar

Spring 2025 Syllabus

For the latest syllabus, please visit the BP website: <https://idv.sinica.edu.tw/tigpbio/>

Seminar Announcement: <https://www.stat.sinica.edu.tw/cht/index.php?>

Place: Auditorium, B1F, Institute of Statistical Science, Academia Sinica.

Time: Thursday 14:00-15:20

Chair: Academia Sinica: Dr. Chung-Yen Lin (Informatics), Dr. Chien-Ling Lin (Biology), Dr. Wei-Chung Liu (Statistics)

Remarks:

1. Attend 2 non-BP Seminars (on or off campus) conducted in English within the current semester. *The deadline for the report is **June 12th, 2025**.
2. Write 2 seminar reports (1-page A4, 12pt font, single-spaced). Template: “[TIGP-BP Seminar Student Report](#)”(click to download).
3. Send the reports to your advisor/lab professor for grading and signature.
4. Submit the graded and signed reports (PDF file) to the BP office before June 12th.

Grades: Attendance 100% (2 non-BP seminar reports included)

Week	Date	Topics/Brief Description	Speaker's Affiliation	Speaker	Abstract	Student Host
1	2025/2/20	DNA-protein crosslinks (DPCs) in cancer	Institute of Precision Medicine, National Sun Yat-sen University	Prof. Hao-Yi (Ricky) Li	🔗	Hsin-Ying Chang (1)
2	2025/2/27	Causal Inference and Genome-wide Multimediator Analyses	Institute of Statistical Science, Academia Sinica	Dr. En-Yu Lai	🔗	Apriandy Angdresey (1)
3	2025/3/6 @Webex Only	AI in drug discovery and clinical trials	Graduate Institute of Biomedical Engineering and Bioinformatics, National Taiwan University	Prof. Yufeng Jane Tseng	🔗	Daniel Garcia-Ruiz (1)
4	2025/3/13 @Webex Only	Uncovering Amyloid Beta Misfolding Mechanisms and Inhibitors: Insights from Molecular Docking and Dynamics Simulations	School of Electrical & Computer Engineering, University of Georgia	Prof. Zhong-Ru Paul Xie	🔗	Cai-Sian Liao (1)

5	2025/3/20	How p53 Keeps the Beat: Allelic Buffering Sustains Robust Oscillations	Institute of Molecular Biology, Academia Sinica	Dr. Feng-Shu Hsieh	🔗	Ru-Yin Jian (1)
6	2025/3/27	Investigating long-range cis-regulation mechanisms in Drosophila using deep learning	Department of Biomedical Engineering, National Cheng Kung University	Prof. Tzu-Hsien Yang	🔗	Shang-Kok Ng
7	2025/4/3	Makeup Holiday for Children's Day & Review Week (no class)	--	--	--	
8	2025/4/10	Midterm Exam Week (no class)	--	--	--	
9	2025/4/17 @Webex Only	Machine Learning for Oncology Care Management from risk assessment, diagnostic support, to treatment selection and development	Electrical Engineering Department, National Taiwan University	Prof. Joyce Tzu-Yu Liu	🔗	Apriandy Angdresey (2)
10	2025/4/24	Bacteriophages carrying lipopolysaccharide (LPS) endoglycosidase sensitize bacteria to interbacterial antagonism	Institute of Molecular Biology, Academia Sinica	Dr. See-Yeun Ting	🔗	Cai-Sian Liao (2)
11	2025/5/1	Multiplexed assays of human disease-relevant mutations reveal UTR dinucleotide composition as a major determinant of RNA stability	Institute of Statistical Science, Academia Sinica	Dr. Jia-Ying Su	🔗	Daniel Garcia-Ruiz (2)
12	2025/5/8	Fatty Liver Classification via Risk Controlled Neural Networks Trained on Grouped Ultrasound Image Data	Institute of Statistical Science, Academia Sinica	Dr. Tso-Jung Yen	🔗	Ping-Yun Ou
13	2025/5/15	Leveraging Genomic Data for Precision Diagnosis and Population Health Insights in Taiwan	Graduate Institute of Medical Genomics and Proteomics, National Taiwan University	Prof. Jacob Shujui Hsu	🔗	Ru-Yin Jian (2)
14	2025/5/22	Nile Rat (<i>Arvicanthis niloticus</i>) as a Model for Advancing Biomedical and Evolutionary Science	Institute of Population Health Sciences, National Health Research Institutes	Dr. Ben Yang Liao	🔗	Hsin-Ying Chang (2)

15	2025/5/29	Review Week (no class)				
16	2025/6/5	Final Exam Week (no class)				

TIGP Bioinformatics Program
Student Presentation
Spring 2025 Syllabus & Guidelines

Latest syllabus: <https://idv.sinica.edu.tw/tigpbio/>

Place: Online (Skype): <https://join.skype.com/ycvKdxnlMeku>

Time: Thursday, 15:30-17:00

Chair: Dr. Chen-Ching Lin (chenching.lin@nycu.edu.tw)

*Effective from the 2014 Fall semester, all TIGP-BP students are required to present once a semester in student presentation.

*First Year Students: the paper should be assigned by your lab professor.

*The following schedule is confirmed and will not be changed. Please contact Dr. Chen-Ching Lin if you do have difficulty with the assigned date.

*The presenter shall introduce the host and attended professors at the beginning of each seminar.

Week	Date	Topic	Student
1	2025/2/20	BANKSY unifies cell typing and tissue domain segmentation for scalable spatial omics data analysis	Hsuan-Ya Chiu 邱暄雅 (NYCU)
2	2025/2/27	Eye-brain connections revealed by multimodal retinal and brain imaging genetics	Cai-Sian Liao 廖才嫻
3	2025/3/6	Opportunistic detection of type 2 diabetes using deep learning from frontal chest radiographs	Apriandy Angdresey 林明智
4	2025/3/13	Spatial Architecture of Myeloid and T Cells Orchestrates Immune Evasion and Clinical Outcome in Lung Cancer	Hsu-Ching Huang 黃煦晴 (NYCU)
5	2025/3/20	Structurally divergent and recurrently mutated regions of primate genomes	Ru-Yin Jian 簡茹茵
6	2025/3/27	Prediction of virus-host associations using protein language models and multiple instance learning	Hsin-Ying Chang 張心盈
7	2025/4/3	Makeup Holiday for Children's Day (no class)	--
8	2025/4/10	Midterm Exam Week (no class)	--
9	2025/4/17	A deep-learning framework to predict cancer treatment response from histopathology images through imputed transcriptomics	Chien-Jung Huang 黃千容 (NYCU)
10	2025/4/24	--	--
11	2025/5/1	--	--
12	2025/5/8	--	--
13	2025/5/15	--	--
14	2025/5/22	--	--
15	2025/5/29	Review Week (no class)	--
16	2025/6/5	Final Exam Week (no class)	--

Seminar presentation guidelines for Ph.D. program students:

2023-01-18

This research seminar course is intended to provide students planning a research career in Bioinformatics with the opportunity to develop the skill of critically reading and evaluating research papers. The course consists of a weekly timetabled session in which students will read, present and discuss research papers published on high impact journals. A fixed threshold of impact factors is not imposed. Use your common sense instead.

Guidelines:

1. **Research article:** Each week, students will choose RESEARCH papers to be presented. The paper (+ **supplements**) pdf file should be emailed to chenching.lin@nycu.edu.tw (Dr. Chen- Ching Lin), tigpbio@gate.sinica.edu.tw (TIGP-Bioinformatics Program), all students in student presentation class, and also other participating professors **at least one week before** your in-class seminar presentation takes place. Any delay will result in 10 points deducted from your final grade. Please also send the slides to everyone **2 days before** the report. Because some modifications may be made right before the report, it is okay if the slides are not the final version.
1. **Article selection:** **You are required to select a recent RESEARCH article that was published after September 2020. (Review articles are NOT acceptable.)**
2. **Presentations:** Everyone in the class will present one paper. You should plan to talk for around 40 minutes. Starting from this you should initiate a discussion of the paper (so it is a good idea to conclude your slide presentation with a selection of points to consider and discuss). We should plan to have time for a lively discussion of each paper; your job in giving a presentation is to initiate this discussion. Make sure to
 - a. Draw **valid** conclusions from results of your presented paper.
 - b. **Summarize evidence for each conclusion.** (How does the paper support its conclusions?)
 - c. **Compare the results with other similar experiments published previously, if appropriate.**
 - Please refrain from presenting an article written by your supervisor or your friends/classmates. You need to increase the exposure to the breadth and depth of bioinformatics research.
 - Students are encouraged to prepare a few questions for group discussion at the end of the presentation. Students are not expected to simply sit in the class.
 - Please make a rehearsed presentation if you don't know how long your presentation is

going to last. An over-length presentation doesn't translate to a good one.

3. **Language of presentation:** You are required to present your research article **in English**.

Evaluation Criteria:

You will be evaluated by the following criteria:

1. Your seminar presentation (70%).
2. Your participation of discussion (30%).

Note: you must participate the discussion, e.g., at least asking one question in each presentation, to obtain this 30% of your final grade. If you don't ask question in any class, this grade will be zero.

TIGP Bio 2025 Spring Syllabus

Lab Rotation

Dear 1st year student:

1. Your lab advisor must be one of the [BP core faculty](#).
2. Inform the BP office for the laboratory you are rotating by [March 1st, 2025](#).
3. Submit the [Lab Rotation Form](#) with lab advisor's signatures and score to the BP office by [June 12th, 2025](#).

Student (2024 enrolled)	Lab advisor
Hsin-Ying Chang 張心盈	Dr. Hsin-Chou Yang 楊欣洲
Ru-Yin Jian 簡茹因	Dr. Chien-Yu Chen 陳倩瑜
Apriandy Angdresey 林明智	Dr. Wei-chung Liu 劉維中