

**TIGP Bio 2024 Spring Syllabus**  
**Advanced Statistical Methods in Bioinformatics (S2)**

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:** Rodrigo Espinoza Silva **Email:** rodespinosas93@gmail.com  
**Office hours:** Tuesdays 14:00~16:00 pm  
**Office location:** Room 5021-3, Research Center for Environmental Changes Building (5th floor, ISS), Academia Sinica  
**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/oK7vJzrx9EvybbT9>

(2) TIGP-BP Course Registration Consent Form:

[https://idv.sinica.edu.tw/tigpbio/index/TIGP%20Bioinformatics\\_Class%20Registration%20Consent%20Form.docx](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	2024/2/21 (Wed) 9:00~12:00	Analysis of NGS data I	Analysis of DNA sequencing data	Dr. Shih-Kai Chu	HW with a specified deadline: ▶ April 11th	uhcnivag@gm.ntpu.edu.tw
2	2024/3/1 (Fri) 9:00~12:00	Analysis of NGS data II	Analysis of RNA sequencing data	Dr. Shih-Kai Chu		
3	2024/3/7	Maximum likelihood estimates and the EM algorithm I	Maximum likelihood estimates	Dr. Yen-Tsung Huang	HW with a specified deadline: ▶ April 11th	ythuang@stat.sinica.edu.tw
4	2024/3/13 (Wed) 9:00~12:00	Maximum likelihood estimates and the EM algorithm II	The EM algorithm	Dr. Yen-Tsung Huang		
5	2024/3/21	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	2024/3/28	Resampling methods	Bootstrap for hypothesis testing, confidence interval, and Permutation method	Dr. Grace S. Shieh	HW with a specified deadline: ▶ 6:00 PM, April 26th	
7	2024/4/3 (Wed) 9:00~12:00	Monte Carlo Markov Chains	Monte Carlo Markov Chains	Dr. Shin-Sheng Yuan	HW with a specified deadline: ▶ April 22nd	syuan@stat.sinica.edu.tw
8	2024/4/11	Midterm Exam	--	--	--	
9	2024/4/18	Prediction of Drug Response	Feature selection, 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	2024/4/25	Cluster Analysis	K-Means, Hierarchical Clustering, Heatmap, Cluster Validation	Dr. Han-Ming Wu	HW with a specified deadline: ▶ June 6th	wuhm@g.nccu.edu.tw
11	2024/5/2	Classification and Its Assessment	ROC Curve, Decision Tree, Ensemble Methods	Dr. Han-Ming Wu		
12	2024/5/9	Statistics in Human Genetics/Genomics I	Concept of Statistical Genetics, International Genomic Projects, Linkage Analysis, Genetic Association Analysis	Dr. Hsin-Chou Yang	HW with a specified deadline: ▶ June 10th	hsinchou@stat.sinica.edu.tw
13	2024/5/16	Statistics in Human Genetics/Genomics II	Genome-Wide Association Study, Gene-Gene Interaction, Rare Variant Analysis, Polygenic Risk Score	Dr. Hsin-Chou Yang		
14	2024/5/23	Advanced regression and dimension reduction I	Sliced Inverse Regression and PHD	Dr. Shin-Sheng Yuan	HW with a specified deadline: To Be announced	syuan@stat.sinica.edu.tw
15	2024/5/30	Advanced regression and dimension reduction II	Liquid Association and related developments	Dr. Kang-Chung Yang		kcyang@stat.sinica.edu.tw
16	2024/6/6	Final Exam	--	--	--	