

TIGP Bioinformatics Program

Advanced Statistical Methods in Bioinformatics (S2)

Spring 2026 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) / Start from 2026/4/1—Dr. Shin-Sheng Yuan (syuan@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.

Prerequisite course: Fundamental Statistical Methods in Bioinformatics (S1)

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%.

【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

※ 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	2026/2/25 (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.	uhcnivag@gm.ntpu.edu.tw
2	2026/3/4 (Wed) 9:00-12:00	Analysis of NGS data II	Analysis of RNA sequencing data	Dr. Shih-Kai Chu		
3	2026/3/12	Maximum likelihood estimates and the EM algorithm I	Maximum likelihood estimates	Dr. Yen-Tsung Huang	Take-home exam with a specified deadline.	ythuang@stat.sinica.edu.tw
4	2026/3/19	Maximum likelihood estimates and the EM algorithm II	The EM algorithm	Dr. Yen-Tsung Huang		
5	2026/3/26	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	2026/4/2	Resampling methods	Bootstrap for hypothesis testing, confidence interval, and Permutation method	Dr. Grace S. Shieh	Take-home exam with a specified deadline.	
7	2026/4/9	Monte Carlo Markov Chains	Monte Carlo Markov Chains	Dr. Shin-Sheng Yuan	Take-home exam with a specified deadline.	syuan@stat.sinica.edu.tw
8	2026/4/16	Midterm Exam	—	—	—	
9	2026/4/23	Prediction of Drug Response	Feature selection, logistic ridge, KNN, ML and transfer learning	Dr. Grace S. Shieh	No exam.	gshieh@stat.sinica.edu.tw
10	2026/4/30	Cluster Analysis	K-Means, Hierarchical Clustering, Heatmap, Cluster Validation	Dr. Han-Ming Wu	Take-home exam with a specified deadline.	wuhm@g.nccu.edu.tw
11	2026/5/7	Classification and Its Assessment	ROC Curve, Decision Tree, Ensemble Methods	Dr. Han-Ming Wu		
12	2026/5/14	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.	hsinchou@stat.sinica.edu.tw
13	2026/5/21	Statistics in Human Genetics/Genomics II	Genome-Wide Association Study, Gene-Gene Interaction, Rare Variant Analysis, Polygenic Risk Score	Dr. Hsin-Chou Yang		
14	2026/5/28	Advanced regression and dimension reduction I	Sliced Inverse Regression and PHD	Dr. Shin-Sheng Yuan	Take-home exam with a specified deadline.	syuan@stat.sinica.edu.tw
15	2026/6/4	Advanced regression and dimension reduction II	Liquid Association and related developments	Dr. Kang-Chung Yang	Take-home exam with a specified deadline.	kcyang@stat.sinica.edu.tw
16	2026/6/11	Final Exam	—	—	—	