

課程流水號 Serial Number	24019
課號 Course Number	LS5016
班次 Class	*
科目名稱(中文) Course Title(in Chinese)	分子演化及親源演化關係
科目名稱(外文) Course Title(In English or other languages)	Molecular Evolution and Phylogenetics
授課老師(中文) Instructor(in Chinese)	劉阜果
授課老師(外文) Instructor(In English or other languages)	Fu-Guo Robert Liu
辦公時間(中文) Office Hour(in Chinese)	Friday 13:00~15:00 or e-mail to make an appointment at liur@cc.nuc.edu.tw
辦公時間(外文) Office Hour(In English or other languages)	Friday 13:00~15:00 or e-mail to make an appointment at liur@cc.nuc.edu.tw
課程目標(中文) Course Objective(in Chinese)	The aim of the course is to provide the student with broad knowledge in the field of molecular evolution (i.e., the evolution of DNA, RNA, and proteins), and with in-depth knowledge of model-based methods for phylogenetic tree reconstruction and hypothesis testing in an evolutionary context. Although the study of molecular evolution does require a certain level of mathematical understanding, the basic concepts are fairly easy to understand.
課程目標(外文) Course Objective(In English or other languages)	The aim of the course is to provide the student with broad knowledge in the field of molecular evolution (i.e., the evolution of DNA, RNA, and proteins), and with in-depth knowledge of model-based methods for phylogenetic tree reconstruction and hypothesis testing in an evolutionary context. Although the study of molecular evolution does require a certain level

	of mathematical understanding, the basic concepts are fairly easy to understand.
授課內容(中文) Course Description(in Chinese)	<p>'Phylogenetics' is the reconstruction and analysis of phylogenetic (evolutionary) trees and networks based on inherited characteristics. It is a flourishing area of interaction between mathematics, statistics, computer science and biology. The main role of phylogenetic techniques lies in evolutionary biology, where it is used to infer historical relationships between species. However, the methods are also relevant to a diverse range of fields including epidemiology, ecology, medicine, as well as linguistics and cognitive psychology.</p> <ol style="list-style-type: none"> 1. Data and information resources. 2. Hand-on section: Internet Data Base & MEGA or DnaSP. 3. Hand-on section: Internet Data Base & MEGA or DnaSP. 4. Nucleic acid, amino acid and protein variation. 5. Phylogenetic analysis I: Distance, Parsimony, and Maximum Likelihood. 6. Hand-on section: Analysis Software 7. Hand-on section: Analysis Software 8. Phylogenetic analysis II: Bayesian and Coalescence. 9. The nature of the common ancestor. 10. Natural selection. 11. Models of Molecular evolution. 12. Applications of Molecular Phylogenetics. 13. Molecular evolution rate and molecular clock. 14. Molecular evolution at population, species or higher level. 15. Evolution in Gene regulation and expression. 16. Microarray and other related modern technology in molecular evolution. 17. Final oral report. 18. Final oral report.
授課內容(外文)	'Phylogenetics' is the reconstruction and analysis of phylogenetic (evolutionary) trees

Course Description(In English or other languages)	<p>and networks based on inherited characteristics. It is a flourishing area of interaction between mathematics, statistics, computer science and biology.</p> <p>The main role of phylogenetic techniques lies in evolutionary biology, where it is used to infer historical relationships between species. However, the methods are also relevant to a diverse range of fields including epidemiology, ecology, medicine, as well as linguistics and cognitive psychology.</p> <ol style="list-style-type: none"> 1. Data and information resources. 2. Hand-on section: Internet Data Base & MEGA or DnaSP. 3. Hand-on section: Internet Data Base & MEGA or DnaSP. 4. Nucleic acid, amino acid and protein variation. 5. Phylogenetic analysis I: Distance, Parsimony, and Maximum Likelihood. 6. Hand-on section: Analysis Software 7. Hand-on section: Analysis Software 8. Phylogenetic analysis II: Bayesian and Coalescence. 9. The nature of the common ancestor. 10. Natural selection. 11. Models of Molecular evolution. 12. Applications of Molecular Phylogenetics. 13. Molecular evolution rate and molecular clock. 14. Molecular evolution at population, species or higher level. 15. Evolution in Gene regulation and expression. 16. Microarray and other related modern technology in molecular evolution. 17. Final oral report. 18. Final oral report.
教科書/參考書(中文) Textbook/References(in Chinese)	<p>Li, W.-H., and D. Graur. 2000. Fundamentals of molecular evolution. 2nd Edition, Sinauer Associates, Massachusetts.</p> <p>Page, R. and E. Holmes. 1998. Molecular evolution: a phylogenetic approach. Blackwell, London.</p>

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自編教材比例 Self-compiled Textbook/References Proportion	80%
授課方式 Requirements	講授Lecture 研討Seminar 實習/實驗 Internship/Experiment 個別指導Individual Discussion
評量配分比重(中文) Grading(in Chinese)	課後作業 (70%) 期末報告 (30%)
評量配分比重(外文) Grading(In English or other languages)	Homework (70%) Final report (30%)
課程所屬學制 Educational System	博士班(Doctoral Programme)
課程領域 Course Domain	基礎學科 進階學科 生態演化 生物資訊
跨系課程領域 Cross Department Course Domain	

強度指數 Overall Rating 系所核心能力 Core Competencies of Department	0	1	2	3	4	5	評量方式 Corresponding Assessments
	不具備 Zero	非常低 Very Low	低 Low	普通 Medium	高 High	非常高 Very High	

強度指數 Overall Rating 系所核心能力 Core Competencies of Department	0	1	2	3	4	5	評量方式 Corresponding Assessments
	不具備 Zero	非常低 Very Low	低 Low	普通 Medium	高 High	非常高 Very High	
高等生物專業知識 Advanced Biological Sciences	●	●	●	●	●	●	<input type="checkbox"/> 紙筆測驗/會考 (Test/Exam) <input checked="" type="checkbox"/> 作業練習 (Assignments) <input checked="" type="checkbox"/> 口頭報告/口試 (Presentation/Oral Exam) <input checked="" type="checkbox"/> 專題研究報告(書面) (Research Report(printed on paper)) <input checked="" type="checkbox"/> 實作/實驗 (Practices/Experiments) <input checked="" type="checkbox"/> 出席/課堂表現 (Attendance/Performance) <input type="checkbox"/> 學習檔案評量 (Portfolios Assessment) <input type="checkbox"/> 自我評量/同儕互評 (Self Assessment/ Peer Assessment) <input type="checkbox"/> 作品/創作展演 (Products/Creative Performance) <input type="checkbox"/> 其他(Others) <input type="checkbox"/> 無(No assessment)

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	不具備 Zero	非常低 Very Low	低 Low	普通 Medium	高 High	非常高 Very High	
創新及整合研究 Innovative and integrative research	●	●	●	●	●	●	<input type="checkbox"/> 紙筆測驗/會考 (Test/Exam) <input checked="" type="checkbox"/> 作業練習 (Assignments) <input checked="" type="checkbox"/> 口頭報告/口試 (Presentation/Oral Exam) <input checked="" type="checkbox"/> 專題研究報告(書面) (Research Report(printed on paper)) <input checked="" type="checkbox"/> 實作/實驗 (Practices/Experiments) <input checked="" type="checkbox"/> 出席/課堂表現 (Attendance/Performance) <input type="checkbox"/> 學習檔案評量 (Portfolios Assessment) <input type="checkbox"/> 自我評量/同儕互評 (Self Assessment/ Peer Assessment) <input type="checkbox"/> 作品/創作展演 (Products/Creative Performance) <input type="checkbox"/> 其他(Others) <input type="checkbox"/> 無(No assessment)

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	不具備 Zero	非常低 Very Low	低 Low	普通 Medium	高 High	非常高 Very High	
專業寫作與表達 Professional writing and presentation	●	●	●	●	●	●	<input type="checkbox"/> 紙筆測驗/會考 (Test/Exam) <input checked="" type="checkbox"/> 作業練習 (Assignments) <input checked="" type="checkbox"/> 口頭報告/口試 (Presentation/Oral Exam) <input checked="" type="checkbox"/> 專題研究報告(書面) (Research Report(printed on paper)) <input checked="" type="checkbox"/> 實作/實驗 (Practices/Experiments) <input checked="" type="checkbox"/> 出席/課堂表現 (Attendance/Performance) <input type="checkbox"/> 學習檔案評量 (Portfolios Assessment) <input type="checkbox"/> 自我評量/同儕互評 (Self Assessment/ Peer Assessment) <input type="checkbox"/> 作品/創作展演 (Products/Creative Performance) <input type="checkbox"/> 其他(Others) <input type="checkbox"/> 無(No assessment)

系所核心能力 Core Competencies of Department	0	1	2	3	4	5	評量方式 Corresponding Assessments
	不具備 Zero	非常低 Very Low	低 Low	普通 Medium	高 High	非常高 Very High	
國際觀 International vision	●	●	●	●	●	●	<input type="checkbox"/> 紙筆測驗/會考 (Test/Exam) <input checked="" type="checkbox"/> 作業練習 (Assignments) <input checked="" type="checkbox"/> 口頭報告/口試 (Presentation/Oral Exam) <input checked="" type="checkbox"/> 專題研究報告(書面) (Research Report(printed on paper)) <input checked="" type="checkbox"/> 實作/實驗 (Practices/Experiments) <input checked="" type="checkbox"/> 出席/課堂表現 (Attendance/Performance) <input type="checkbox"/> 學習檔案評量 (Portfolios Assessment) <input type="checkbox"/> 自我評量/同儕互評 (Self Assessment/ Peer Assessment) <input type="checkbox"/> 作品/創作展演 (Products/Creative Performance) <input type="checkbox"/> 其他(Others) <input type="checkbox"/> 無(No assessment)