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| <p><b>課程名稱</b><br/>(course name)</p>   | <p>大自然啟發的仿生設計<br/>Bioinspiration and Biomimicry</p>   |   |                                  |                                   |            |
| <p><b>開課系所班級</b><br/>(dept. &amp; year)</p>  | <p>通識教育中心</p>   | <p><b>學分</b><br/>(credits)</p>                | <p><b>3</b></p>                  | <p><b>規劃教師</b><br/>(teacher)</p>  | <p>紀凱容</p> |
| <p><b>課程類別</b><br/>(course type)</p>   | <p>必修</p>   | <p><b>授課語言</b><br/>(language)</p>             | <p>中文或英文</p>                     | <p><b>開課學期</b><br/>(semester)</p> | <p>上或下</p> |
| <p><b>課程簡述</b><br/>(course description)</p>  | <p>歷經三十八億年的選汰，生物演化出各式材料結構、行為模式、生理機制等，以適應環境並解決生存繁衍的挑戰。「仿生學」便是以生物為師，將其發展出的生存策略轉化成人類的設計與科技，以突破發展困境，並與自然永續共存；而無論在學術研究或設計應用上，仿生學均須仰賴跨領域合作。</p> <p>這門課程將結合生物學、理工科學、以及設計學三大面向，來（一）認識仿生學的核心概念並進行案例剖析；（二）學習仿生設計方法並進行實務操作；（三）組成跨領域期末專題小組，挑戰「全球仿生設計競賽」年度主題，藉以了解當代人類生存所面臨的全球性議題或共同危機，並透過仿生設計提案來解決其在地效應。過去競賽主題包含能源使用效率、水資源取得與管理、運輸系統、食物供應體系、氣候變遷等。</p> <p>Through 3.8 billion years of history of life, organisms have evolved diverse materials, structures, behavioral patterns, and physiological mechanisms to adapt to the environment and solve the challenges of survival and reproduction. Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies, and relies on cross-disciplinary collaboration.</p> <p>This course will integrate biology, science and technology, and design to (1) understand the core concepts of biomimicry and analyze the classical cases, (2) learn and practice the process of biomimicry design, and (3) form cross-disciplinary team for the annual theme of “Biomimicry Global Design Challenge” (BGDC) to realize the global issues and common crisis faced by human beings, and apply biomimicry design to solve their local consequences. Topics of past challenges include energy efficiency, water access and management, transportation, food systems, and climate change.</p> |   |                                  |                                   |            |
| <p><b>先修課程</b><br/>(prerequisites)</p>   | <p>無</p>  |   |                                  |                                   |            |
| <p><b>課程目標與核心能力關聯配比(%)</b><br/>(relevance of course objectives and core learning outcomes)</p> |   |   |                                  |                                   |            |
| <p><b>課程目標</b></p>   | <p><b>course objectives</b></p>   | <p><b>核心能力</b><br/>core learning outcomes</p> | <p><b>配比</b><br/>合計<br/>100%</p> |                                   |            |

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| (1)認識仿生學核心概念及案例<br>(2)學習仿生設計方法與實務<br>(3)期末小組專題：挑戰「全球仿生設計競賽」年度主題，透過探索生物生存適應機制來進行仿生設計，提出解決方案 | (1) Understand the core concepts of biomimicry and analyze the cases;<br>(2) Learn and practice the process of biomimicry design;<br>(3) Form cross-disciplinary team for the annual theme of “Biomimicry Global Design Challenge” to realize the global issues and apply biomimicry design to solve local consequences. | 人文素養 | 0%  |
|  |  | 科學素養 | 30% |
|  |  | 溝通能力 | 15% |
|  |  | 創新能力 | 30% |
|  |  | 國際視野 | 25% |
|  |  | 社會關懷 | 0%  |

**課程目標之教學方法與評量方法  
(teaching and assessment methods for course objectives)**

| 教學方法 (teaching methods)  | 學習評量方式 (evaluation)  |
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| 講授 lecture、<br>討論 discussion、<br>專題探討與製作 group project (biomimicry design challenge) | 出席狀況 attendance/ participation 15%、<br>作業 homework 40%、<br>口頭報告 oral presentation 20%、<br>書面報告 reports 25% |

**授課內容 (單元名稱與內容、習作 / 考試進度、備註)  
(course content and homework / tests schedule)**

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| <b>I. 生物啟發與設計 (約六週)</b><br>1. 仿生學簡介：師法自然的經典案例及運作機制探究<br>2. 仿生學核心概念：功能與策略、系統思考、自然運作法則<br>3. 設計與設計思考<br>4. 仿生工程與技術<br>5. 校園走遊：探索與啟發              | <b>I. Biomimicry: inspiration &amp; design (~ 6 weeks)</b><br>1. Introduction: cases, function, and mechanisms<br>2. Core concepts: function & strategy, systems, nature’s unifying patterns<br>3. Design & design thinking<br>4. Biomimetic engineering & technology<br>5. Naturalists on site: observation and inspiration                    |
| <b>II. 仿生設計方法與實務操作 (約四週)</b><br>1. 定義：目標課題脈絡並聚焦設計方向<br>2. 轉譯：生物化課題脈絡與功能策略<br>3. 研究：觀察與蒐集文獻，並探討相關生物策略及機制<br>4. 設計：萃取生物策略以啟發設計<br>5. 評估：檢視設計及其功能 | <b>II. Biomimicry process and practice (~ 4 weeks)</b><br>1. Define the challenge: context and focus<br>2. Biologize function and context<br>3. Discover biological strategies by observation, literature survey, and mechanism analyses<br>4. Abstract design strategies and emulate Nature’s lessons<br>5. Evaluate design’s fit and function |
| <b>III. 仿生設計期末專題 (約八週)</b><br>1. 「全球仿生設計競賽」主題探勘與現行方案評估<br>2. 仿生設計專題：設有課題定義、轉譯 (生物化)、文獻研究、設計等考核點及進度報告<br>3. 成果報告：「全球仿生設計競賽」構想提案、生物策略文獻彙集        | <b>III. Final project: biomimicry design (~ 8 weeks)</b><br>1. Biomimicry Global Design Challenge (BGDC): research and survey current solutions<br>2. Biomimicry project: check-points and progress reports on each step of the biomimicry process<br>3. Final report: BGDC proposal & library/inventory of biological strategies               |

**教科書與參考書目 (書名、作者、書局、代理商、說明)**  
**(textbook & other references)**

A. 主要參考書目 (Major reference books):

1. 班娜斯 (1998)《人類的出路—探尋生物模擬的奧妙》台北：胡桃木出版社 (原文版: Benyus, J. (1997, 2002) *Biomimicry: Innovation Inspired by Nature*. NY: Perennial)
2. 伏格 (2000)《貓掌與彈弓：當自然設計遇上人類科技》台北：先覺出版社 (原文版: Vogel, S. (1998) *Cats' Paws and Catapults: Mechanical Worlds of Nature and People*, W. W. Norton & Co.)
3. 佛布茲 (2013)《壁虎腳底的高科技：仿生學向大自然取經，設計未來》台北：遠流出版社 (原文版: Forbes, P. (2006) *The Gecko's Foot: Bio-inspiration: Engineering New Materials from Nature*. W. W. Norton & Co.)
4. 哈爾曼 (2014)《大黃蜂飛得比波音 747 還快？：仿生科技-來自大自然的下一波工業革命》台北：時報出版 (原文版: Harman, J. (2013) *The Shark's Paintbrush: Biomimicry and How Nature is Inspiring Innovation*. White Cloud Press.)
5. Baumeister, D. (2014) *Biomimicry Resource Handbook: A Seed Bank of Best Practices*. Missoula, MT: Biomimicry 3.8.
6. Meyers, M.A. and Chen, P-Y. (2014) *Biological Materials Science – Biological Materials, Bioinspired Materials, and Biomaterials*. Cambridge (UK): Cambridge University Press.

B. 線上工具 (Useful online resources):

1. Biomimicry Institute: <https://biomimicry.org>
2. Biomimicry Global Design Challenge: <https://challenge.biomimicry.org/>
3. AskNature: <https://asknature.org>

**課程教材 (教師個人網址請列在本校內之網址)**  
**(teaching aids & teacher's website)**

另行公告

**課程輔導時間**  
**(office hours)**

另行公告