

## 「醣化學」

The ability to make structurally-defined glycans is essential for modern glycobiology. Such compounds are invaluable probes of glycan-mediated biology and they can also be used to generate vaccine candidates and serve as lead compounds for drug development. This course will provide students with an understanding of modern synthetic carbohydrate chemistry and give them a knowledge base that will allow further investigation either through independent study or in the laboratory. The focus will be primarily on synthetic carbohydrate chemistry, however, carbohydrate active enzymes (CAZymes) and their use in glycoside bond synthesis will also be covered. In addition, methods to characterize glycans using NMR spectroscopy and probe the binding of glycans by glycan-binding proteins will be discussed.

製作結構明確的聚醣能力對於現代醣生物學來說是非常重要的。這類化合物是探測及探討與醣相關的生物學的寶貴分子，它們也可以被開發成疫苗，並作為藥物開發的先驅化合物。本課程將為學生提供現代合成醣在化學上的知識基礎，使學生能夠在往後的研究中實行或激起對醣更深入的探討。課程重點將放在醣合成的化學上，且包括碳水化合物活性酶（CAZymes）和它們在醣苷鍵合成中的應用。此外，還將討論使用核磁共振光譜來描述醣的特徵，以及探測醣結合蛋白對醣結合的方法。下一頁將提供更詳細的課程安排。

### Course Outcomes

1. Understand carbohydrate structure and conformation and their effect on chemical reactivity.
2. Understand and apply protecting group strategies and functional group manipulations to prepare selectively protected carbohydrate derivatives, including using *de novo* approaches.
3. Understand the principles behind chemical and enzymatic glycosylation reactions and apply that information in designing the synthesis of a target molecule.
4. Understand how glycan–protein interactions are measured and the molecular interactions typical of these binding events.

課號：BChem5062

課程識別碼：B46 U1220

授課教師：呂桐睿

上課時間：每星期四 15:30 – 17:20

上課地點：生化館 N101 教室

| 週次 | 日期    | 授課內容                                                                                                            |
|----|-------|-----------------------------------------------------------------------------------------------------------------|
| 1  | 09/10 | 關鍵的有機和物理化學概念；碳水化合物結構和構型<br>Key Organic and Physical Chemistry Concepts; Carbohydrate Structure and Conformation |

|    |       |                                                                                          |
|----|-------|------------------------------------------------------------------------------------------|
| 2  | 09/17 | 碳水化合物的結構和構型; 降解反應; 保護基<br>Carbohydrate Structure and Conformation; Degradative Reactions |
| 3  | 09/24 | No Class                                                                                 |
| 4  | 10/01 | 保護基 Protecting Groups                                                                    |
| 5  | 10/08 | 保護基 Protecting Groups                                                                    |
| 6  | 10/15 | 保護基 Protecting Groups                                                                    |
| 7  | 10/22 | 功能基的相互轉化解決問題 Functional Group Interconversions                                           |
| 8  | 10/29 | 功能基的相互轉化解決問題 Functional Group Interconversions                                           |
| 9  | 11/05 | 期中考試 Mid Term Exam                                                                       |
| 10 | 11/12 | 糖苷鍵的化學合成 Chemical Glycosidic Bond Formation                                              |
| 11 | 11/19 | 糖苷鍵的化學合成 Chemical Glycosidic Bond Formation                                              |
| 12 | 11/26 | 糖苷鍵的化學合成 Chemical Glycosidic Bond Formation                                              |
| 13 | 12/03 | 合成單糖的新方法 De Novo Synthesis of Monosaccharides                                            |
| 14 | 12/10 | CAZymes 和糖苷鍵的酶催化合成 CAZymes and Enzymatic Synthesis of Glycosidic Bonds                   |
| 15 | 12/17 | 碳水化合物的核磁共振和糖蛋白結合的生物物理學測量 NMR of Carbohydrates and Measurements of Glycan-Protein Binding |
| 16 | 12/24 | 期末考試 Final Exam                                                                          |

### ***Requirements***

| <b>Assignment</b> | <b>Points</b> |
|-------------------|---------------|
| Midterm           | 120           |
| Synthesis Problem | 120           |
| Weekly Problems   | 120           |
| Final Examination | 120           |
| Total             | 480           |

### ***Important Dates***

|                               |                              |
|-------------------------------|------------------------------|
| Midterm                       | November 5, 2026             |
| Synthesis Problem Distributed | November 19, 2026            |
| Synthesis Problem Due         | December 17, 2026 (by email) |
| Final Examination             | December 24, 2026            |

### ***Weekly Problems***

The weekly problems distributed with each lecture must be completed and returned (as a pdf file) by email to [tlowary@as.edu.tw](mailto:tlowary@as.edu.tw) by the following Thursday at noon. For example, the problems distributed on September 10, 2026 are due by noon on September 17, 2026. Failure to send them by that time will lead to a grade of 0 for that assignment.

### ***Synthesis Problem***

You will each be assigned an oligosaccharide that you will need to provide a synthetic route to using the material you have learned in the course, as well as what you can find in literature.

### ***Comments Regarding the Synthesis Problem***

The Synthesis Problem is an assignment on which you ***MUST*** work independently. Collaboration between each other, or with other graduate students, postdoctoral fellows or faculty is not allowed. You are, however, welcome to talk with me about any ideas you have in solving the problem.

### ***Problem Sets***

Problem sets will be distributed, but are for practice only. They will not be graded.

### ***Help in Chinese – 中文幫忙***

Should you need assistance about the course material in Chinese, you may contact Dr. Anthony Chu (朱駿勸) by email at [9623010@gmail.com](mailto:9623010@gmail.com). Dr. Chu has extensive experience in carbohydrate chemistry and is an award-winning teacher.