

2018年度 課題研究集会 2018.12.02

# UC バークレーでの理系カリキュラム： 化学科での実体験をもとに

**Science Curriculum in UC Berkeley:**  
*Based on My Experience at College of Chemistry*

東京大学教養学部附属教養教育高度化機構  
自然科学教育高度化部門

**中村 優希**

# Topics for Today

## 1) Introduction

## 2) College of Chemistry in UC Berkeley

- introduction to college of chemistry
- required courses for graduation
- example of student's weekly class schedule

## 3) Requirements in science

- list of science courses
- list of allied subjects
- course structure
  - lecture / discussion / lab
  - office hours (TA and professor)

## 4) Requirements in humanities

- list of humanities courses
- list of free electives

## 5) Summary

# University of California, Berkeley



Public university worldwide: U.S.  
News & World Report

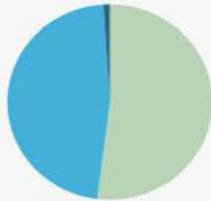


Colleges and Schools



Total student enrollment, Fall  
2017

Undergraduate 30,574  
Graduate 11,336



Undergraduate student gender

Female 52%  
Male 47%  
Decline to state 1%



Nobel Prizes held by faculty  
(total)



Academic Departments and  
Programs

4.41

Average GPA of admitted  
freshman



Admit Rate



Student-to-faculty ratio

# AP (Advanced Placement)

## AP courses bridges the high school and university curriculum:

### *What is AP?*

AP is the college-level curriculum offered in high schools; must take AP Exam offered in May, and get scores higher than 3 or 4 out of 5 to receive a credit at college / university

\*Regular GPA (Grade Point Average): A=4.0; B=3.0; C=2.0; D=1.0; F=0

\*AP GPA: A=5.0; B=4.0; C=3.0...etc. (awarded bonus point)

### History of AP

- *early 20<sup>th</sup> century*: gap between secondary & higher education widened
- *after WWII*: Ford foundation created the fund for the Advancement of Education
  - prep school (Andover, Exeter, and Lawrenceville) and colleges (Harvard, Princeton, and Yale) collected imaginative teachers; planned and set the curricula at high school
- 1952: pilot program was launched
- 1960s: training teachers
- 1970s–80s: expanded
- 1980s–90s: included minority and low-income students

# Courses in University High School

## English

English 1  
English 1 Honors  
English 2  
English 2 Honors  
English 3

### **\*AP English Language**

English 4

### **\*AP English Lit and Composition**

Contemporary Literature  
Communications  
College Prep. Comp. (only offered in summer)  
Creative Writing (only offered in summer)  
Beg. Journalism  
Adv. Journalism

## Science

Earth Systems Science  
Biology  
Honors Biology  
Marine Science  
Anatomy and Physiology

### **\*AP Biology**

Chemistry

### **\*Honors Chemistry**

### **\*AP Chemistry**

### **\*AP Environmental Science**

Physics

### **\*AP Physics B**

Principles of Engineering  
Intro to Engineering

## Mathematics

Algebra 1 A/B  
Algebra 1 C/D  
Algebra 1  
Principles of Geometry  
Geometry  
Geometry Honors  
Intermediate Algebra 2  
Algebra 2  
Algebra 2 Honors  
Functions, Statistics & Trig.  
Pre-Calculus

### **\*Honors Pre-Calculus**

### **\*AP Statistics**

### **\*AP Calculus AB**

### **\*AP Calculus BC**

## **\*AP Computer Science**

## Social Science

Global Perspectives  
Global Perspectives Honors  
United States History

### **\*AP United States History**

Political Science

### **\*AP Political Science**

Economics

### **\*AP Macro Economics**

World History

### **\*AP World History**

Psychology

### **\*AP Psychology**

### **\*AP Human Geography**

The American Experience  
Survey of World Religions  
Speech and Debate

## World Languages

Chinese 1  
Chinese 2  
Chinese 3

### **\*Chinese 4**

### **\*AP Chinese**

French 1  
French 2  
French 3

Latin 1

Latin 2

Latin 3

### **\*Latin 4**

### **\*AP Latin**

Spanish for Native Speakers

Spanish 1

Spanish 2

Spanish 3

### **\*Spanish 4**

### **\*AP Spanish**

American Sign Language I

American Sign Language II

## Visual Arts

Art Studio

Advanced Studio Art

### **\*AP Studio: Art Drawing**

## **\*AP Art History**

Beg. Ceramics

Int. Ceramics

Adv. Ceramics

2D Design (2012-2015)

Graphic Design

Adv. 2D Design (2012-2015)

Adv. Graphic Design

### **\*AP Studio Art: 2D Design**

Visual Imagery

Adv. Visual Imagery

Video Production

Adv. Video Production

Art of Fashion

Photojournalism

## Performing Arts

Dance Technique I

Dance Technique II

Dance Production

UHS Choir

Bella Canta

Madrigal Singers

Music Technology

Drama I

Drama 2

Adv. Drama

Adv. Theatre Production

Tech Theater

Adv. Tech Theater

Concert Band

Symphonic Band

Wind Ensemble

Jazz Ensemble

Concert Orchestra

Symphonic Orchestra

String Orchestra

### **\*AP Music Theory (not offered 16-17)**

## Business

Virtual Enterprise

# Colleges and Schools in UC Berkeley

## Chemistry

Includes departments of Chemistry and Chemical Engineering.

## Education

Master's and doctoral programs, teacher preparation, undergraduate minor program and leadership training.

## Engineering

Includes departments of Bioengineering; Civil & Environmental Engineering; Electrical Engineering & Computer Sciences; Industrial Engineering & Operations Research; Materials Science & Engineering; Mechanical Engineering; and Nuclear Engineering.

## Environmental Design

Includes departments of Architecture; Landscape Architecture; and City and Regional Planning.

## Haas School of Business

Undergraduate degrees, MBA programs and executive education.

## Information

Graduate programs in information management systems and data science.

## Journalism

Two-year immersive Master of Journalism program.

## Law

Offers J.D. and J.S.D. programs, and the first U.S. law school to offer M.A. and Ph.D. degrees in jurisprudence and social policy.

## Letters & Science

Berkeley's largest college includes more than 60 departments in the biological sciences, arts and humanities, physical sciences, and social sciences.

## Natural Resources

Includes departments of Agricultural and Resource Economics; Environmental Science, Policy, and Management; Nutritional Science; and Plant and Microbial Biology.

## Optometry

Professional program for optometry.

## Public Health

Master's and doctoral programs in a wide range of public health disciplines.

## Richard and Rhoda Goldman School of Public Policy

Master's, doctoral and an undergraduate minor program in public policy.

## Social Welfare

Offering master's, concurrent master's, doctoral and credential programs.

: provides undergraduate & graduate studies

: provides undergraduate minor studies & graduate studies

# College of Chemistry

## Rankings

CHEMISTRY	CHEMICAL ENGINEERING
1. Berkeley	1. MIT
2. MIT*	2. Berkeley*
2. Nanyang Tech U.*	2. Caltech*
4. Stanford	2. Stanford*
5. Northwestern U.	5. U. of Minnesota

## Students

ENROLLMENT BY MAJOR, ACADEMIC YEAR 2018-19

	CHEMISTRY	CHEM E.	CHEM BIO
Undergraduates	211	353	196
Graduates	406	117	—
Postdocs	141	23	—

DEGREES AWARDED, ACADEMIC YEAR 2017-18

	CHEMISTRY	CHEM E.	CHEM BIO
Bachelor of Science	48	87	43
Bachelor of Arts	5	—	—
Master of Science	6	34	—
Doctor of Philosophy	55	9	—



# Course Requirements

## Undergraduate Chemistry Program

*A suggested sequence*

Freshman		Sophomore		Junior		Senior	
Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
4A <sup>F</sup> General/Quant Analysis	4B <sup>S</sup>	12A <sup>+F</sup> Organic	12B <sup>+S</sup>	104A <sup>F</sup> Inorganic	104B <sup>S</sup>	125 or C182 Physical Lab	105, 108, 115, or 146 <sup>S</sup>
1A	1B	53	54	<b>Chemistry</b>			
	<b>Mathematics</b>			120A* Physical	Allied Subject	120B <sup>F*</sup> Physical	Allied Subject
<b>Chem</b> 96	7A <b>Physics</b>	7B	Foreign Language		Allied Subjects		Free** Elective
Reading and Composition	Breadth Electives		Free** Elective		Chem Elective	Free Electives**	

F = course offered during fall semesters only  
S = course offered during spring semesters only

\* Chemistry 120A and 120B should be taken in sequence. 120A may be taken in spring of sophomore year; 120B may be taken in fall of junior or senior year.

\*\* Students may need to take additional elective courses in order to acquire the minimum 120 units needed to graduate.

† Chem 12A=112A and Chem 12B=Chem 112B for Spring 2017 or earlier.

# My Class Schedule for Fall Semester, Freshman Year

	Monday	Tuesday	Wednesday	Thursday	Friday
8-9 AM	Chem4A (Lecture)	Physics7A (Lecture)	Chem4A (Lecture)	Physics7A (Lecture)	Chem4A (Lecture)
9-10 AM	Math1A (Lecture)		Math1A (Lecture)		Math1A (Lecture)
10-11 AM	College Writing R1A	Math1A (Discussion)	College Writing R1A	Math1A (Discussion)	College Writing R1A
11-12 PM					
12-1 PM	Chem4A (Lab lecture)		Physics7A O.H. (TA)	Chem4A O.H. (Prof.)	
1-2 PM	Chem4A (Lab)		Chem4A O.H. (Prof.)	Math1A O.H. (TA)	
2-3 PM		Physics7A (Discussion)		Physics7A (Lab)	
3-4 PM					College Writing O.H.
4-5 PM			Chem4A O.H. (TA)		
5-6 PM		Math1A O.H. (Prof.)	Chem96 (Seminar)		Physics7A O.H. (Prof.)

# Details of Classes

## Science Course:

- **Chemistry 4A (4 units)**
  - general chemistry and quantitative analysis for chemistry majors
  - lectures: 3 hours per week; lab: 4 hours per week; lab lecture: 1 hour (2~3 times per semester)
- **Chemistry 96 (1 unit)**
  - introduction to research and study in the college of chemistry
  - must be taken during the first semester of 1<sup>st</sup> year for chemistry majors
  - 1 hour of seminar per week
- **Math 1A (4 units)**
  - introduction to differential and integral calculus for engineering and physical sciences majors
  - lectures: 3 hours per week; discussion: 4 hours per week
- **Physics 7A (4 units)**
  - mechanics and wave motion for science and engineering majors
  - lectures: 3 hours per week; discussion: 2 hours per week; lab: 2 hours per week

## Humanities Course:

- **College Writing R1A (6 units)**
  - accelerated reading and composition to reach entry-level writing skills
  - 6 hours per week of intensive reading and writing

# Topics for Today

1) Introduction

2) College of Chemistry in UC Berkeley

- introduction to college of chemistry
- required courses for graduation
- example of student's weekly class schedule

3) Requirements in science

- list of science courses
- list of allied subjects
- course structure
  - lecture / discussion / lab
  - office hours (TA and professor)

4) Requirements in humanities

- list of humanities courses
- list of free electives

5) Summary

# List of Science Courses Required in College of Chemistry

## **Chemistry (36–37 units)**

- Chem 4A, 4B (General Chemistry & Quantitative Analysis lab; 8 units)
- Chem 12A, 12B (Organic Chemistry & Organic Chemistry lab; 10 units)
- Chem 104A, 104B (Inorganic Chemistry; 6 units)
- Chem 120A, 120B (Physical Chemistry; 6 units)
- Chem 125 (Physical Chemistry Lab; 3 units)
- Chem 105, 108, 115, or 146 (Analytical/Inorganic/Advanced Organic/Radiochemistry Lab; 3–4 units)

## **Mathematics (16 units)**

- Math 1A, 1B (Calculus; 8 units)
- Math 53, 54 (Multivariable Calculus, Linear Algebra & Differential Equations; 8 units)

## **Physics (8–12 units)**

- Physics 7A (Mechanics and Wave Motions; 4 units)
- Physics 7B (Heat, Electricity & Magnetism; 4 units)
- Physics 7C [elective] (Electromagnetic Waves, Optics, Relativity & Quantum Physics; 4 units)

## **Allied subjects and Chemistry Elective (12–15 units)**

## **Research, Breadth Elective, Other (12–16 units)**

# Allied Subjects (238 courses)

- **Astronomy; Economics; Energy and Resources Group; Industrial Engineering and Operations Research** (1 course each)
- **Bioengineering** (22 courses)
- **Biology** (2 courses; must be completed with a grade of C– or better)
- **Chemical and Biomolecular Engineering** (21 courses)
- **Chemistry** (25 courses)
- **Civil and Environmental Engineering** (9 courses)
- **Computer Science** (7 courses)
- **Earth and Planetary Science** (9 courses)
- **Education; Engineering; Integrative Biology** (2 courses each)
- **Environmental Science, Policy, and Management** (9 courses)
- **Materials Science and Engineering** (16 courses)
- **Mathematics** (26 courses)
- **Mechanical Engineering** (6 courses)
- **Molecular and Cell Biology** (23 courses)
- **Nuclear Engineering** (12 courses)
- **Nutritional Science and Toxicology** (7 courses)
- **Physics** (11 courses; 7C must be completed with a grade of C– or better)
- **Plant and Microbial Biology** (17 courses)
- **Public Health** (4 courses)
- **Statistics** (3 courses)

➤ *Total of 25 upper-division subjects that can be related to chemistry*

# Course Structure

## Lecture (3 hours per week)

- Teacher-to-student one-way lecture (writing on the board / power point)
- 2–3 problem sets per semester (optional)
- 2–3 midterm exams (60–90 minutes each) per semester
- 1 final exam (3 hours) per semester
- taught by professors / lecturer
- **TA's will audit and take lecture notes (head TA and regular TA)**

## Lab (4–5 hours per week)

- lab works with a lab partner or by own
- lecture (1~2 times per semester) taught by professors / lecturer
- **actual lab work taught and graded by TA** for labs that are included in the lecture
- 1–2 exams (60 minutes each) per semester

## Discussion (2–4 hours per week)

- problem-solving sections for students
- work with a partner or by own
- **taught and graded by TA**

## Office Hours (2–4 hours per week)

- free Q&A sections for students
- must be offered by both professors / lecturers and **TA's**

# Topics for Today

1) Introduction

2) College of Chemistry in UC Berkeley

- introduction to college of chemistry
- required courses for graduation
- example of student's weekly class schedule

3) Requirements in science

- list of science courses
- list of allied subjects
- course structure
  - lecture / discussion / lab
  - office hours (TA and professor)

4) Requirements in humanities

- list of humanities courses
- list of free electives

5) Summary

# List of Humanities Courses Required in College of Chemistry

## Reading and Composition (8–10 units)

- R&C courses must be taken for a letter grade (C– or higher)
- A-level courses must be completed by end of 1<sup>st</sup> year; B-level by end of 2<sup>nd</sup> year
- **Entry Level Writing requirement must be satisfied**

## American Cultures (3–4 units)

- all UC Berkeley undergraduates must fulfill AC requirement for graduation (C– or higher)
- course must take substantial account of groups from at least 3 of the following:
  - ✓ African Americans
  - ✓ Indigenous peoples of the U.S.
  - ✓ Asian Americans
  - ✓ Chicanos
  - ✓ Latin Americans
  - ✓ European Americans

## Foreign Language (6–8 units)

- completing 1 foreign language in *high school* (C– or higher)
- taking a sequence of courses (at least 2 courses) in 1 foreign language (C– or higher)
- taking a standardized examination with min. scores (e.g., **SAT II: 590 or higher**)

## Breadth Electives (15 units)

- taking courses from the list on campus
- **AP**, IB, and GCE A-level exam credit may be used

# Reading and Composition

## Writing skills:

- **One of the most important and valued skills**
  - all of the standardized exams usually include writing
  - personal statement and additional essays for entrance exams
- **Reading and Composition**
  - 2-part sequence to provide a solid foundation in reading, writing, and critical thinking for work in the major and beyond
  - R&C requirement must be *completed by the end of 2<sup>nd</sup> year, or the enrollment from the 3<sup>rd</sup> year will be blocked*
- **Both humanities and science majors** must meet the entry-level writing skills prior to enrollment in the university:
  - AP English Exam (3 or above)
  - College Board SAT Reasoning Test-Writing Section (680 or above)
  - Other standardized exams: ACT, IB
  - **Analytical Writing Placement Exam** for UC schools (8 or above)
  - completing intense writing course at college (C or higher; 6 hours of lecture per. week for 15 weeks)
    - ✓ satisfies the 1<sup>st</sup> half (A-level) of the R&C requirement

# Importance of Providing Original Work

## Importance of originality:

- Acquired majorly from humanities class (vigorous reading/writing essays)
  - train skills to come up with an original claim/idea, which must be logically supported/proved by giving specific examples

**Plagiarism:** “defined as use of intellectual material produced by another person without acknowledging its source, for example...

- wholesale copying of passages from works of others into your homework, essay, term paper, or dissertation without acknowledgement
- use of the views, opinions, or insights of another without acknowledgement
- paraphrasing of another person’s characteristic or original phraseology, metaphor, or other literary device without acknowledgement”

## **Consequences:**

- College Writing Program has a zero-tolerance policy regarding plagiarism
- Students who submit plagiarized work will be subject to consequences *ranging from a grade of “F” on the assignment to suspension* from the University

# American Culture (265 courses)

- **African American Studies** (12 courses)
- **American Studies** (10 courses)
- **Anthropology** (17 courses)
- **Architecture; Theater, Dance & Performance Studies** (6 courses each)
- **Art Practice; City and Regional Planning; Engineering; French; Information; Interdepartmental Studies; Journalism; Philosophy; Public Policy** (2 courses each)
- **Art History; Letters & Science; Native American Studies** (4 courses each)
- **Asian American Studies; English** (8 courses each)
- **Business Administration; International & Area Studies; Landscape Architecture; Linguistics; Public Health; Religious Studies; Spanish; Undergraduate & Interdisciplinary Studies** (3 courses each)
- **Chicano Studies; Demography; Dutch Studies; Earth & Planetary Science; Environmental Economics; Film Studies; LGBT; Global Poverty & Practice; Integrative Biology; Italian Studies; Mass Communications; New Media; Nutritional Science & Toxicology; Portuguese; Scandinavian** (1 course each)
- **Comparative Literature; Music; Peace & Conflict Studies** (5 courses each)
- **Education; History** (11 courses each)
- **Environmental Science, Policy & Management; Gender & Women's Studies; Psychology; Social Welfare** (7 courses each)
- **Ethnic Studies** (22 courses)
- **Legal Studies; Political Science; Rhetoric** (9 courses)
- **Sociology** (15 courses)

➤ *Total of 58 lower- and upper-division subjects that contains AC courses*

# Topics for Today

1) Introduction

2) College of Chemistry in UC Berkeley

- introduction to college of chemistry
- required courses for graduation
- example of student's weekly class schedule

3) Requirements in science

- list of science courses
- list of allied subjects
- course structure
  - lecture / discussion / lab
  - office hours (TA and professor)

4) Requirements in humanities

- list of humanities courses
- list of free electives

5) Summary

# Incorporating Pros from the Science Education in the U.S.

My personal belief: *“Education in Science can be strengthened by emphasizing science curriculums beyond the boundaries, analytical writing skills, and originality”*

## Prospective aspects:

- ☐ cultivate the broad science knowledge by making students take multiple science courses beyond their major fields, and let them experience the decision-making
- ☐ strengthen the TA system for students to gain teaching experience
- ☐ improve and focus on writing & critical thinking skills / problem solving skills
- ☐ emphasize on the plagiarism education and importance on original work/idea

# Works Cited

- *By the numbers*. UC Berkeley. UC regents. 28 Nov. 2018  
<<https://www.berkeley.edu/about/bythenumbers>>
- *Schools and colleges*. UC Berkeley. UC regents. 28 Nov. 2018  
<<https://www.berkeley.edu/academics/schools-colleges>>
- *College Facts*. UC Berkeley. UC regents. 28 Nov. 2018 <<http://chemistry.berkeley.edu/facts>>
- *AP Program*. The College Board. 1 July 2017.  
<[http://www.collegeboard.com/prod\\_downloads/about/news\\_info/ap/ap\\_history\\_english.pdf](http://www.collegeboard.com/prod_downloads/about/news_info/ap/ap_history_english.pdf)>
- *School Profile 2017–2018*. University High School. Irvine Unified School District. 30 Nov. 2018  
<<http://www.universityhigh.iusd.org/sites/universityhigh/files/documents/pdfs/uni-school-profile-2017-2018.pdf>>
- *B.S. Chemistry*. UC Berkeley. UC regents. 28 Nov. 2018  
<<https://chemistry.berkeley.edu/ugrad/degrees/chem>>
- *Berkeley Academic Guide 2018–2019*. UC Berkeley. UC regents. 28 Nov. 2018  
<<https://classes.berkeley.edu>>
- *Allied Subjects*. UC Berkeley. UC regents. 30 Nov. 2018  
<<https://chemistry.berkeley.edu/ugrad/degrees/chem/allied-subjects>>
- *Berkeley Writing*. UC Berkeley. UC regents. 28 Nov. 2018 <<https://writing.berkeley.edu/node/78>>
- *Undergraduate Education*. UC Berkeley. UC regents. 28 Nov. 2018  
<<http://guide.berkeley.edu/undergraduate/education/#universityrequirementstext>>
- *Academic Honesty*. UC Berkeley. UC regents. 28 Nov. 2018  
<<https://writing.berkeley.edu/students/academic-honesty>>
- *Code of Conduct*. UC Berkeley. UC regents. 28 Nov. 2018 <<https://sa.berkeley.edu/student-code-of-conduct>>
- *Approved AC Courses at Berkeley*. UC Berkeley. UC regents. 30 Nov. 2018 <<https://academic-senate.berkeley.edu/committees/amcult/approved-berkeley>>

*Thank you for your kind attention!*

