

**COLUMBIA COLLEGE  
FU FOUNDATION SCHOOL OF ENGINEERING AND APPLIED SCIENCE**



# **PREDENTAL HANDBOOK**

**2018-2019  
Edition**

## **PREPROFESSIONAL ADVISING**

403 Lerner Hall

2920 Broadway, MC 1201

New York, NY 10027

Phone: (212) 854-6378

[preprofessional@columbia.edu](mailto:preprofessional@columbia.edu)

<https://www.cc-seas.columbia.edu/preprofessional>

### **Prehealth Advisors:**

**Niki Cunningham, Senior Advising Dean**

**Chair, Prehealth Advisory Committee**

[njc2001@columbia.edu](mailto:njc2001@columbia.edu)

**Megan M. Rigney, Associate Dean**

[mr2168@columbia.edu](mailto:mr2168@columbia.edu)

### **Prehealth Program Coordinator:**

**MaryMartha Ford-Dieng, Program Coordinator/Advisor**

[mef2209@columbia.edu](mailto:mef2209@columbia.edu)

## INTRODUCTION

This booklet is designed for all Columbia College and Fu Foundation of Engineering and Applied Science students who are considering a career in the health professions, specifically dentistry. While each undergraduate is assigned an Advising Dean in the Center for Student Advising, prehealth professions students are also expected to work directly with a prehealth adviser throughout their time at Columbia. We hope that you find this booklet helpful and look forward to getting to know you!

Dental education in the United States falls into two (or three) distinct stages: undergraduate studies, dental school, and possibly residency training for dentists seeking to specialize. The undergraduate education focuses on coursework which provides the foundational concepts necessary for your success in dental school. In addition to undergraduate coursework, pre dental students are expected to test their motivation for a career in dentistry by exposing themselves to different venues where dental medicine is practiced. The content of dental school curricula is similar from program to program. However in recent decades, the structure for imparting that knowledge has undergone widespread reform. There is currently a good deal of difference in the way schools organize their four years of curriculum. However, it can be said that all programs deliver some combination of instruction in the basic medical and dental sciences as well as training in clinical work and patient care. After graduation from dental school, the dentist either proceeds to practice General Dentistry or proceeds to a period of intensive clinical residency training of two years before being licensed to practice a specialty.

We are concerned here with describing the appropriate curriculum for a pre dental student, discussing pertinent extracurricular options, and explaining the dental school application procedure. It should be noted that while a large number of pre dental students have decided upon that track before entrance to Columbia and start right in with the required courses, it is entirely possible to drop into the program at any point in the undergraduate years, or, indeed, thereafter. This may well delay entrance to dental school but is in no way a bar to eventual acceptance. In fact, it is worth noting that the average age of first-year dental students at many dental schools is 24.

To obtain more detailed information about any of the health professions, refer to the Preprofessional Advising Website:

<https://www.cc-seas.columbia.edu/preprofessional>

## PREPROFESSIONAL ADVISING

Preprofessional Advising is a part of the Center for Student Advising. We are here to serve as a resource to students and alumni during all phases of their pre dental preparation. The advising team sponsors workshops and programs of interest to premedical and pre dental students and is available to meet one-on-one with any student interested in discussing his/her individual situation. We have prepared this booklet as an introduction, but as you will learn, there is no one "right" way to pursue a pre dental path. We look forward to getting to know you over the next few years and hope that you will take full advantage of the resources available at Columbia. Good luck and we'll see you soon.

## ACADEMIC PREDENTAL PREPARATION

Dental schools in the United States all list as entrance requirements four specific science courses: General Chemistry, Organic Chemistry, Biology, and Physics. An increasing number of schools require Biochemistry in addition or in place of one semester of Organic Chemistry; many others strongly recommend Biochemistry. Some schools require calculus or some other math options including statistics, others require additional biology courses such as Anatomy or Microbiology, and a handful will have social science requirements. Most require a year of English. **While the prescribed Columbia pre dental curriculum will cover most of the basics, students should be certain to check with individual schools for additional requirements and recommended courses.**

1 year of General Chemistry and General Chemistry Lab

1 year of Introductory Biology and Biology Lab

1 year of Organic Chemistry and Organic Chemistry Lab

1 year of General Physics and Physics Lab

Additional Information on Requirements:

- Most dental schools require a year of English – emphasizing skill acquisition in writing.
- Although most dental schools do not specify a math requirement, those that do want to see either a year of calculus or a year of college math. Calculus is a co-requisite of general chemistry at Columbia so pre dental students will generally have at least one semester.

- A number of dental schools require a semester of biochemistry (no lab) and an increasing number will likely add it as a requirement in the future. Although our introductory biology sequence covers many of the foundational concepts of biochemistry, we cannot at this time guarantee that dental schools will accept this in fulfillment of a prerequisite requirement.
- A smaller subset of schools require more than one year of introductory biology. Many recommend specific advanced level classes.
- A few schools also have social and behavioral science courses into their requirements including, but not limited to, psychology and sociology.

**PLEASE NOTE:** It is your responsibility to keep up to date with prerequisite requirements for the schools to which you intend to apply. These are subject to change from year to year. Check the current edition of the ADEA Official Guide to Dental Schools, which is updated annually and can be purchased online at: <http://www.adea.org/publications/Pages/OfficialGuide.aspx>

### **The Major**

Dental schools are genuinely indifferent to the student's choice of undergraduate major. They like to see a range of interests in their student body and are just as happy with the art history major (assuming good performance in the required science courses) as they are with the biochemist or chemical engineer. They would not want a class consisting entirely of either. Your choice of major should be guided solely by your own intellectual interests and aptitudes. Predental is not a major and therefore in addition to completing coursework to prepare for dental school, students will all choose a major or concentration.

**Columbia College (CC)** has two graduation options: the major and the concentration. Specifics of each are outlined in the department listings in the Bulletin. You should choose the one that best suits your own interests. Both are equally respected by the College and by dental schools. We have seen no evidence that full majors are more likely to win acceptance to dental school. Any way you look at it, you will be taking a minimum of 124 credits in order to graduate. Dental schools are interested in the variety and difficulty of your courses, your course load, and your grades. Whether or not it adds up to a major or concentration is immaterial as long as you are challenging yourself along the way.

**The Fu Foundation School of Engineering and Applied Science (SEAS)** has one graduation option: the major. Students in SEAS who wish to do so, can also

declare a minor. Students from every major have been accepted to dental school, so you need not think that you must major in Biomedical Engineering if you are planning to attend health professional school. However, you should consider a plan for completing required prerequisite courses alongside your major, for there is more limited free space in engineering course plans.

## PREDENTAL COURSES AT COLUMBIA

This list of courses covers the most common predental requirements. The other consideration in your science preparation is the DAT, the standardized entrance exam for dental school. The third column

	Required by most dental schools	Required by some dental schools	Recommended for preparation for DAT
1 Year of English	x		x
1 Year General Chemistry with Lab	x		x
1 Year of Introductory Biology (Cell and Molecular) with Lab	x		x
Additional Biology		x	
1 Year of Physics with Lab	x		
1 Year of Organic Chemistry with Lab	x		x
1 Year of Mathematics		x	x
1 Semester Biochemistry		x	

The following lists the most common course options at Columbia for both CC and SEAS students.

### **ENGLISH:**

University Writing and either Literature Humanities or Contemporary Civilization will generally fulfill this requirement. SEAS students would be well served by choosing one of these options. SEAS students may also take another English literature course to fulfill this requirement in addition to University Writing. NOTE: Global Core classes will NOT fulfill this requirement UNLESS they are in the English Department.

**ENGL CC1010 University Writing 3 pts.** Teaches general techniques and strategies for academic reading and writing.

**HUMA CC1001-C1C002 Masterpieces of Western Literature and Philosophy I and II, 4 pts each.** Taught by members of the Departments of Classics, English and Comparative Literature, French, German, Italian, Middle East and Asian Languages and Cultures, Philosophy, Religion, Slavic Languages, and Spanish; and members of the Society of Fellows. Major works by over twenty authors, ranging in time, theme, and genre from Homer to Virginia Woolf. Students are expected to write at least two papers, to complete two examinations each semester, and to participate actively in class discussions.

**COCI CC1101-CC1102 Contemporary Civilization I and II, 4 pts each.** Taught by members of the Departments of Anthropology, Classics, English and Comparative Literature, French, German, History, Middle East and Asian Languages and Cultures, Philosophy, Political Science, Religion, Slavic Languages, and Sociology; and members of the Society of Fellows. A study in their historical context of major contributions to the intellectual traditions that underpin contemporary civilization. Emphasis is on the history of political, social, and philosophical thought. Students are expected to write at least three papers to complete two examinations, and to participate actively in class discussions.

### **CHEMISTRY:**

Chemistry should be taken in the first year. Most pre dental students will take General Chemistry. Students who want to be considered for an advanced chemistry sequence MUST take the placement exam during New Student Orientation to determine which sequence is most appropriate. The placement exam results will indicate which lecture is recommended. You may choose to register for a lower level course, but you may not register for a higher level course which you did not place into.

**The one semester General Chemistry laboratory is equivalent to a year of lab for dental school purposes and can be taken during either term.**

#### Option 1:

<b>CHEM UN1403-UN1404 General Chemistry I and II</b>	<b>8 pts.</b>
<b>CHEM UN1500 General Chemistry Laboratory</b>	<b>3 pts.</b>

**CHEM UN1403-UN1404 General Chemistry I and II (Lecture), 4 pts each.** Prerequisites: concurrent registration in *MATH UN1101*; for *UN1404*: *CHEM UN1403*. Preparation equivalent to one year of high school chemistry is assumed and concurrent registration in Calculus I. Students lacking such preparation should plan independent study of chemistry over the summer or take *CHEM UN0001* before taking *UN1403*. Topics include stoichiometry, states of matter, chemical equilibria, acids and bases, chemical thermodynamics, nuclear properties, electronic structures of atoms, periodic properties, chemical bonding, molecular geometry, introduction to organic and biological chemistry, solid state and materials science, polymer science and macromolecular structures, chemical kinetics, coordination chemistry, and electrochemistry. Although *UN1403* and *UN1404* are separate courses, students are expected to take both terms sequentially. The order of presentation of topics may differ from the order presented here, and from year to year. Recitation Section Required.

**CHEM UN1500 General Chemistry Laboratory** 3 pts. Corequisites: *CHEM UN1403 or UN1404*. Laboratory Fee: \$140. An introduction to basic techniques of modern experimental chemistry, including quantitative procedures and chemical analysis.

Option 2:

**CHEM UN1604 Second Semester General Chemistry (Intensive)** 4 pts.

**CHEM UN1507 Intensive General Chemistry Laboratory** 3 pts.

Or

**CHEM UN1500 General Chemistry Laboratory** 3 pts.

Second Semester General Chemistry (Intensive) (CHEM UN1604) is appropriate for students who have an acceptable score on the placement exam. Completion of this course with a grade of C or better will enable a CC or SEAS student to receive 3 credits of AP credit in Chemistry (if they scored a 4 or 5 on AP exam) **These AP credits are important to fulfill your one-year Chemistry requirement for some dental schools. If you take this course but DO NOT have AP or IB credit, you may end up without enough Inorganic Chemistry credits for some dental schools.** Students who complete this sequence are still encouraged to go forward and take additional chemistry at the advanced level (biochemistry and/or other upper level chemistry) so that they may strengthen skills and background and meet requirements for schools that are less open to accepting AP credit.

**CHEM UN1604 Second Semester General Chemistry (Intensive)** 4 pts. Prerequisites: A grade of "B" or better in *CHEM UN1403* or acceptable performance on the Department placement exam. **Corequisites: UN1102 Calculus II.** Topics include: Gases (Kinetic Theory of Gases); Binary Collision Model for Chemical Reactions; Chemical Kinetics; Acid-base Equilibria; Thermochemistry (Thermodynamics I); Thermodynamics II Spontaneous Processes; Chemical Bonding in Polyatomic Molecules. Recitation Section Required.

**CHEM UN1507 Intensive General Chemistry Laboratory** 3 pts. Prerequisites: *CHEM UN1604 or UN2045*. Laboratory Fee: \$140. An introduction to basic techniques and practices of modern experimental chemistry, including qualitative procedures and chemical analysis. This course differs from *CHEM UN1500* in its emphasis on instrumentation and methods.

Option 3:

**CHEM UN2045-UN2046 Intensive Organic Chem for First Year Students** 8 pts.

**CHEM UN1507 Intensive General Chemistry Laboratory** 3 pts.

**CHEM UN2493-UN2494 Organic Chemistry Lab I and II** 3 pts.\*

Or **CHEM UN2545 Intensive Organic Chemistry Lab** 3 pts.

\*You must also register for the Organic Chemistry Lab Lecture course CHEM UN2495 and CHEM UN2496. Credits are attached to these course numbers.

Intensive Organic Chemistry is appropriate for students who have an acceptable score on the placement exam. Completion of this course with a grade of C or better will enable a CC or SEAS student to receive 6 credits of AP credit in Chemistry (if they scored a 4 or 5 on AP exam) **These AP credits are important to fulfill your one-year Chemistry requirement for some dental schools. If you take this course but DO NOT have AP or IB credit, you may end up without enough Inorganic**

**Chemistry credits for some dental schools.** Students who complete this sequence are still encouraged to go forward and take additional chemistry at the advanced level (biochemistry and/or other upper level chemistry) so that they may strengthen skills and background and meet requirements for schools that are less open to accepting AP credit.

**CHEM UN2045-UN2046 Intensive Organic Chemistry for First-Year Students I and II (Lecture) 4 pts each.** Prerequisites: An acceptable grade on the placement examination given during new student orientation. Not open to students who have taken other courses in college-level chemistry. This course covers the same material as *CHEM UN2443-UN2444*, but is intended for students who have learned the principles of general chemistry in high school. The level of instruction is appropriate for those who have not had a college course in general chemistry. Students enrolled in *CHEM UN2045-UN2046* are expected to enroll concurrently in *CHEM UN1507*.

**CHEM UN1507 Intensive General Chemistry Laboratory 3 pts.** Corequisite: *CHEM UN2045* or Prerequisite: *CHEM UN1604*. An introduction to basic techniques and practices of modern experimental chemistry, including qualitative procedures and chemical analysis. This course differs from *CHEM UN1500* in its emphasis on instrumentation and methods. The lab should be taken in the fall semester.

**CHEM UN2493-UN2494 Organic Chemistry Laboratory 1.5 pts.** Prerequisites: *CHEM UN1500*. Corequisites: *CHEM UN2443-UN2443*. Laboratory Fee: \$63 each term. Techniques of experimental organic chemistry, with emphasis on understanding fundamental principles underlying the experiments in methodology of solving laboratory problems involving organic molecules.

**CHEM UN2545 Intensive Organic Chemistry Laboratory 3 pts.** Prerequisites: *CHEM UN2045* and *UN2046* and *UN1507*. Laboratory Fee: \$125. The course covers the same material as *CHEM UN2493-UN2494* but is intended for those students who have taken Intensive Organic Chemistry for First-Year Students, *CHEM UN2045-UN2046*.

## ORGANIC CHEMISTRY

Those students who took General Chemistry or Intensive General Chemistry in their first year will take Organic Chemistry in either their sophomore or junior year.

<b>CHEM UN2443-UN2444 Organic Chemistry</b>	<b>8 pts.</b>
<b>CHEM UN2493-UN2494 Organic Chemistry Lab</b>	<b>3 pts.</b>

**CHEM UN2447-UN2448 Organic Chemistry (Lecture) 4 pts each.** Prerequisites: *CHEM UN1404* or *UN1604*, and *UN1500*. The principles of organic chemistry. The structure and reactivity of organic molecules are examined from the standpoint of modern theories of chemistry. Topics include stereochemistry, reactions of organic molecules, mechanisms of organic reactions, syntheses and degradations of organic molecules, and spectroscopic techniques of structure determination. Recitation Section Required.

**CHEM UN2493-UN2494 Organic Chemistry Laboratory 1.5 pts.** Prerequisites: *CHEM UN1500*. Corequisites: *CHEM UN2443-UN2444*. Laboratory Fee: \$63 each term. Techniques of experimental organic chemistry, with emphasis on understanding fundamental principles underlying the experiments in methodology of solving laboratory problems involving organic molecules.

## BIOLOGY

Biology is most often taken by students in their sophomore year. Although you may receive AP credit for Biology, this does not place you out of this introductory class. We recommend all students take this course.

## Option 1

### **Lecture:**

#### **BIOL UN2005-UN2006 Intro to Biology I and II**

**8 pts.**

**BIOL UN2005 Introductory Biology I: Biochemistry, Genetics & Molecular Biology** 4 pts. Prerequisite: One year of college chemistry, or a strong high school chemistry background. Lecture and recitation. Recommended as the introductory biology course for biology and related majors, and for premedical students. Fundamental principles of biochemistry, molecular biology, and genetics. Website: <https://courseworks2.columbia.edu/courses/63615>

**BIOL UN2006 Introductory Biology II: Cell Biology, Development & Physiology** 4 pts. Prerequisites: *EEEE UN2001* or *BIOL UN2005*, or the instructor's permission. Lecture and recitation. Recommended second term of biology for majors in biology and related majors, and for premedical students. Cellular biology and development; physiology of cells and organisms.

### **Biology Lab Options:**

#### **BIOL UN2501 Contemporary Biology Lab**

**3 pts.**

**BIOL UN2501 Contemporary Biology Laboratory** 3 pts. Corequisites: Strongly recommended prerequisite or required corequisite: *BIOL UN2005* or *BIOL UN2006*. Enrollment limited to 24 students per section. Attendance at the first class is mandatory. Fee \$150. Emphasis on experimental techniques and data analysis in a variety of biological disciplines.

BIOL UN2501 is the most common lab taken by premedical students, but students may also pursue other lab options. **The one semester laboratory is equivalent to a year of lab for dental school purposes.**

A student may also fulfill the laboratory requirement by taking:

- a 5-point biology laboratory; or
- two terms of *BIOL UN3500* taken for 3 credits and a letter grade, including the submission of a satisfactory research report; or
- with permission of the Summer Undergraduate Research Fellowship (SURF) director or director of undergraduate studies, one summer of research as part of the Columbia SURF program (see below), plus one term of *BIOL UN3500* in the same laboratory.

Note: Biomedical Engineering students may fulfill their Biology lab prerequisite with the completion of their three BME labs.

## Option 2

This option is appropriate for those students who are primarily interested in majoring in Environmental Science or Sustainable Development. However, students who choose this option may need to self-study some of the content in BIOL C2005 in order to be prepared for the DAT.

### **Lecture:**

#### **EEEE UN2001 Environmental Biology I: Molecules to Cells**

**4 pts.**

#### **BIOL UN2006 Intro to Biology II: Cell Biology and Physiology**

**4 pts.**

**EEEB UN2001 Environmental Biology I: Molecules to Cells 4 pts.** Introductory biology course for majors in biology or environmental biology, emphasizing the ecological and evolutionary context of modern biology.

**BIOL UN2006 Introductory Biology II: Cell Biology, Development & Physiology 4 pts.** Prerequisites: *EEEB UN2001* or *BIOL UN2005*, or the instructor's permission. Lecture and recitation. Recommended second term of biology for majors in biology and related majors, and for premedical students. Cellular biology and development; physiology of cells and organisms.

### Lab:

#### **BIOL UN2501 Contemporary Biology Lab**

**3 pts.**

**BIOL UN2501 Contemporary Biology Laboratory 3 pts.** Corequisites: Strongly recommended prerequisite or required corequisite: *BIOL UN2005* or *BIOL UN2006*. Enrollment limited to 24 students per section. Attendance at the first class is mandatory. Fee \$150. Emphasis on experimental techniques and data analysis in a variety of biological disciplines.

**The one semester laboratory is equivalent to a year of lab for dental school purposes.**

A student may also fulfill the laboratory requirement by taking:

- a 5-point biology laboratory; or
- two terms of *BIOL UN3500* taken for 3 credits and a letter grade, including the submission of a satisfactory research report; or
- with permission of the Summer Undergraduate Research Fellowship (SURF) director or director of undergraduate studies, one summer of research as part of the Columbia SURF program (see below), plus one term of *BIOL UN3500* in the same laboratory

Note: Biomedical Engineering students may fulfill their Biology lab prerequisite with the completion of their three BME labs.

### PHYSICS

All SEAS students and any CC students interested in majors in Physics should take Physics during their first year. Other CC students generally take Physics either sophomore or junior year. There are four different Physics sequences. Students should choose a sequence based on their planned course of study (major(s)/concentration(s)/minor(s))

#### Option 1

**PHYS UN1201-1202 General Physics**

**6 pts.**

**PHYS UN1291-1292 General Physics Laboratory**

**2 pts.**

This option is appropriate for all pre dental students with the **exception of SEAS students, and those interested in majors or concentrations in Chemistry, Physics, Biophysics, Chemical Physics, and Astronomy.**

**PHYS UN1201-UN1202 General Physics 3 pts.** Prerequisites: Prerequisite for PHYS UN1202: PHYS UN1201 The course will use elementary concepts from calculus. Students should therefore have some basic background in calculus or should be concurrently taking *MATH UN1101, Calculus I*. The accompanying laboratory is *PHYS UN1291-UN1292*. Basic introduction

to the study of mechanics, fluids, thermodynamics, electricity, magnetism, optics, special relativity, quantum mechanics, atomic physics, and nuclear physics. Science Requirement: Partial Fulfillment.

**PHYS UN1291-UN1292 General Physics Laboratory 1 pt.** Corequisite: *PHYS UN1201-UN1202*. This course is the laboratory for the corequisite lecture course and can be taken only during the same term as the corresponding lecture.

### PHYSICS Option 2 – 4

These options are appropriate for all SEAS students and some CC students who are considering majors that would require a higher level physics. Students should choose a lecture sequence and choose a lab based on their program/major area of study.

### LECTURE OPTIONS

#### **2. PHYS UN1401-1402 Physics**

**6 pts.**

**PHYS UN1401 Introduction To Mechanics and Thermodynamics 3 pts.** Corequisite: *MATH UN1101*, or the equivalent. Fundamental laws of mechanics, kinematics and dynamics, work and energy, rotational dynamics, oscillations, gravitation, fluids, temperature and heat, gas laws, the first and second laws of thermodynamics. Science Requirement: Partial Fulfillment.

**PHYS UN1402 Introduction To Electricity, Magnetism, and Optics 3 pts.** Prerequisite: *PHYS UN1401*. Corequisite: *MATH UN1102*, or the equivalent. Electric fields, direct currents, magnetic fields, alternating currents, electromagnetic waves, polarization, geometrical optics, interference, and diffraction. Science Requirement: Partial Fulfillment.

#### **3. PHYS UN1601 – 1602 Physics**

**7 pts.**

**PHYS UN1601 Physics, I: Mechanics and Relativity 3.5 pts.** Corequisite: *MATH UN1102* or the equivalent. Fundamental laws of mechanics, kinematics and dynamics, work and energy, rotational dynamics, oscillations, gravitation, fluids, introduction to special relativity and relativistic kinematics. The course is preparatory for advanced work in physics and related fields. Science Requirement: Partial Fulfillment.

**PHYS UN1602 Physics, II: Thermodynamics, Electricity, and Magnetism 3.5 pts.** Prerequisite: *PHYS UN1601*. Corequisite: *MATH UN1201* or the equivalent. Temperature and heat, gas laws, the first and second laws of thermodynamics, kinetic theory of gases, electric fields, direct currents, magnetic fields, alternating currents, electromagnetic waves. The course is preparatory for advanced work in physics and related fields. Science Requirement: Partial Fulfillment.

#### **4. PHYS UN2801-2802 Accelerated Physics I and II**

**9 pts.**

**PHYS UN2801-UN2802 Accelerated Physics, I and II, 4.5 pts.** Prerequisites: Advanced Placement in physics and mathematics, or the equivalent, and the instructor's permission. (A special placement meeting is held during Orientation.) This accelerated two-semester sequence covers the subject matter of *PHYS UN1601*, *UN1602* and *UN2601*, and is intended for those students who have an exceptionally strong background in both physics and mathematics. The course is preparatory for advanced work in physics and related fields. There is no accompanying laboratory; however, students are encouraged to take the intermediate laboratory, *PHYS UN3081*, in the following year.

### LAB OPTIONS

**PHYS UN1291-1292 General Physics Lab**

**2 pts.**

**PHYS UN1494 Intro to Experimental Physics Lab**

**3 pts.**

<b>PHYS UN2699 Experiments in Classical and Modern Physics</b>	<b>3 pts.</b>
<b>PHYS UN3081 Intermediate Lab</b>	<b>2 pts.</b>

**PHYS UN1291-UN1292 General Physics Laboratory** 1 pt. Corequisite: *PHYS UN1201-UN1202*. This course is the laboratory for the corequisite lecture course. It is best to be taken concurrently with the lecture.

**PHYS UN1494 Introduction To Experimental Physics** 3 pts. Prerequisite: *PHYS UN1401, UN1402, and UN1403*. Laboratory work associated with the three prerequisite lecture courses. Experiments in mechanics, thermodynamics, electricity, magnetism, optics, wave motion, atomic physics, and nuclear physics.

**PHYS UN2699 Experiments In Classical and Modern Physics** 3 pts. Prerequisites: *PHYS UN1601 (or UN1401), UN1602 (or UN1402), and UN2601*. Laboratory work associated with the three prerequisite lecture courses. Experiments in mechanics, thermodynamics, electricity, magnetism, optics, wave motion, atomic physics, and nuclear physics.

**PHYS UN3081 Intermediate Laboratory Work** 2 pts. Primarily for junior and senior physics majors. Other majors require the instructor's permission. May be repeated for credit by performing different experiments. The laboratory has available thirteen individual experiments, of which two are required per 2 points. Each experiment is chosen by the student in consultation with the instructor. Each section meets one afternoon per week, with registration in each section limited by the laboratory capacity. Experiments (classical and modern) cover topics in electricity, magnetism, optics, atomic physics, and nuclear physics.

## **MATHEMATICS**

Although mathematics is not required by all dental schools, a number of schools require competency in this area, often equivalent to one semester of calculus and/or one of statistics. Your choice of courses should be based on your background and your intended program of study – there are some majors which will require a year or more of calculus. Please consult the CC or SEAS Bulletin for more specific information.

AP credit can, in most cases, be applied toward this one year recommended math requirement.

### **Calculus Options:**

**MATH UN1101 Calculus I** 3 pts. Prerequisites: see Courses for First-Year Students. Functions, limits, derivatives, introduction to integrals.

**MATH UN1102 Calculus II** 3 pts. Prerequisites: *MATH UN1101* or the equivalent. Methods of integration, applications of the integral, Taylor's theorem, infinite series.

**MATH UN1201 Calculus III** 3 pts. Prerequisites: *MATH UN1101* with a grade of B or better or *Math UN1102*, or the equivalent. Vectors in dimensions 2 and 3, complex numbers and the complex exponential function with applications to differential equations, Cramer's rule, vector-valued functions of one variable, scalar-valued functions of several variables, partial derivatives, gradients, surfaces, optimization, the method of Lagrange multipliers.

### **Statistics Options:**

The Department of Statistics offers three elementary survey courses, *STAT UN1001* (Introduction to Statistical Reasoning), *UN1101* (Introduction to Statistics - without Calculus), and *UN1201* (Introduction to Statistics - with Calculus). While any one of the three would be acceptable to medical schools, the best course for preparation for a future in medicine is probably *STAT UN1111*.

Some engineering students have a statistics course required for the major. These courses should also meet the prerequisite requirement.

**STAT UN1001 Introduction to Statistical Reasoning 3 pts.** Prerequisites: Some high school algebra. A friendly introduction to statistical concepts and reasoning with emphasis on developing statistical intuition rather than on mathematical rigor. Topics include design of experiments, descriptive statistics, correlation and regression, probability, chance variability, sampling, chance models, and tests of significance. Science Requirement: Partial Fulfillment.

**STAT UN1101 Introduction to Statistics (without calculus) 3 pts.** Prerequisites: Intermediate high school algebra. Designed for students in fields that emphasize quantitative methods. Graphical and numerical summaries, probability, theory of sampling distributions, linear regression, confidence intervals and hypothesis testing. Quantitative reasoning and data analysis. Practical experience with statistical software. Illustrations are taken from a variety of fields. Data-collection/analysis project with emphasis on study designs is part of the coursework requirement.

**STAT UN1201 Introduction to Statistics (with calculus) 3 pts.** Prerequisites: one semester of calculus. Designed for students who desire a strong grounding in statistical concepts with a greater degree of mathematical rigor than in STAT UN1111. Random variables, probability distributions, pdf, cdf, mean, variance, correlation, conditional distribution, conditional mean and conditional variance, law of iterated expectations, normal, chi-square, F and t distributions, law of large numbers, central limit theorem, parameter estimation, unbiasedness, consistency, efficiency, hypothesis testing, p-value, confidence intervals. maximum likelihood estimation. Satisfies the pre-requisites for ECON UN3412.

**SIEO WN4150 Introduction to Probability and Statistics 3 pts.** Prerequisites: Calculus (MATH UN1101, UN1102 or the equivalent). A quick calculus-based tour of the fundamentals of probability theory and statistical inference. Probabilistic models, random variables, useful distributions, expectations, laws of large numbers, central limit theorem. Statistical inference: point and confidence interval estimation, hypothesis tests, linear regression. Students seeking a more thorough introduction to probability and statistics should consider STAT GU4001 and GU4204.

**IEOR E3658 Probability for Engineers 3 pts.** Prerequisites: *Calculus*. For undergraduates only. This course is required for the OR:FE concentration. This class must be taken during (or before) the third semester. Students who take IEOR E3658 may not take SIEO E3600 or E4150 due to significant overlap. Fundamentals of probability theory. Distributions of one or more random variables. Moments, generating functions, law of large numbers and central limit theorem.

**STAT GU4001 Introduction to Probability 3 pts.** Prerequisites: MATH UN1101 and UN1102 or the equivalent. A calculus-based introduction to probability theory. A quick review of multivariate calculus is provided. Topics covered include random variables, conditional probability, expectation, independence, Bayes' rule, important distributions, joint distributions, moment generating functions, central limit theorem, laws of large numbers and Markov's inequality.

**STAT GU4204 Introduction to Statistical Inference 3 pts.** Prerequisites: STAT GU4203, or the equivalent. Calculus-based introduction to the theory of statistics. Useful distributions, law of large numbers and central limit theorem, point estimation, hypothesis testing, confidence intervals maximum likelihood, likelihood ratio tests, nonparametric procedures, theory of least squares and analysis of variance.

## **BIOCHEMISTRY**

One semester of biochemistry is required by a growing number of dental schools. While some dental schools may consider our BIOL 2005-2006 sequence in fulfillment of this requirement because it covers a lot of the foundational concepts, most dental schools will not accept this in fulfillment. Additionally, a course in biochemistry will help prepare you for the DAT.

**BIOC UN3300 Biochemistry 3 pts.** Prerequisites: one year each of Introduction to Biology and General Chemistry. Corequisites: Organic Chemistry. Biochemistry is the study of the chemical processes within organisms that give rise to the immense complexity of life. This complexity emerges from a highly regulated and coordinated flow of chemical energy

from one biomolecule to another. This course serves to familiarize students with the spectrum of biomolecules (carbohydrates, lipids, amino acids, nucleic acids, etc.) as well as the fundamental chemical processes (glycolysis, citric acid cycle, fatty acid metabolism, etc.) that allow life to happen. In particular, this course will employ active learning techniques and critical thinking problem-solving to engage students in answering the question: how is the complexity of life possible?

**BIOC UN3501 Biochemistry, I: Structure and Metabolism** 4 pts. Prerequisites: ENVB UN2001 or BIOL UN2005 and one year of organic chemistry. Lecture and recitation. Students wishing to cover the full range of modern biochemistry should take both BIOC UN3501 and UN3512. Protein structure, protein folding, enzyme kinetics, allostery, membrane transport, biological membranes, and protein targeting. Chemistry and metabolism of amino acids, carbohydrates, lipids, purines, and pyrimidines. Recitation Section Required.

### **IMPORTANT NOTE:**

As Columbia courses are not specifically designed nor taught to prepare students for any standardized test, including the DAT, there may be some concepts or topics on the DAT which were not covered in your courses. However, given the strong foundation and background that you will develop through coursework here, you will be able to pick up this additional content through self-study or through a test preparation course.

## SPECIAL NOTES RELATED TO CURRICULUM

### *AP Credit:*

Policies regarding the acceptance of AP credit in fulfillment of pre dental requirements varies from dental school to dental school, and sometimes from course to course. Most dental schools will accept AP credit but require applicants to take at least one additional college level course in the subject area should they receive AP credit for the course requirement. Some dental schools will not accept AP credit for requirements but will accept them for recommended courses.

Additionally, the AP policies at Columbia vary from department to department as they are the purview of the faculty in each field of study. Some departments do not grant credit until an advanced course has been completed successfully. Additionally, even though you may receive AP credit for an introductory level course, this does not necessarily mean a department will exempt you from a requirement for the major. In any case, AP credits are not awarded until the conclusion of the first year at Columbia.

The most common question surrounding AP credit and pre dental requirements relates to Chemistry. Students who begin in either CHEM C3045- W3046 Intensive Organic Chemistry for First Year Students or CHEM W1604 Second Semester General Chemistry (Intensive) will receive 6 and 3 credits of AP respectively (should they have 4 or 5 on AP test, and earn a C or better in the sequence). These students are however still encouraged to go forward and take additional chemistry at the advanced level (biochemistry and/or other upper level chemistry) so that they may strengthen skills and background and meet requirements for schools that are less open to accepting AP credit.

### *Labs:*

It is generally desirable to complete the labs before senior year; however, this is not critical. Biology and biochemistry majors often will not take the major lab until senior year, and this presents no problem. Others may put off either the biology or the organic chemistry lab until senior year if necessary.

### *Barnard Courses:*

It is permissible to take premed requirements at Barnard. It should be noted, however, that the Biology and Chemistry Departments in the College may not accept the courses towards the major. You should discuss this decision with your Advising Dean before making a decision. (You can always look up the name of your Advising Dean in [SSOL](#).)

You should have good reasons for taking courses at Barnard and if you elect a sequence there you should try to take the entire sequence for consistency.

**Note:** some Barnard sequences begin in the spring and end in the fall. Thus, before choosing a Barnard sequence, please discuss the pros and cons with your Advising Dean or prehealth advisor.

### ***Summer Courses***

#### *Columbia College:*

Summer courses at other institutions are not transferable to Columbia (**CC ONLY**) except in a few clearly outlined circumstances. Summer work at Columbia is, of course, acceptable. It is however, not desirable to take pre dental sciences over the summer, except in unusual circumstances. Occasionally, a student's schedule will require taking summer courses, but the reason should not be to lighten your load during the academic year. Dental schools want to be assured of an applicant's capacity to handle heavy science loads and therefore may question your decision to take summer courses, if you have not demonstrated the ability to take on high volumes during the regular academic year. Additionally, the summer is a great time to pursue other types of experiences like research or clinical exposure.

Again, please consult an advisor before taking required pre dental courses during summer session. If it is decided that summer is the best route, you need not take the course at Columbia in order for it to fulfill prerequisites for dental school – just as long as you don't need this course for your major or to fulfill other requirements.

#### *School of Engineering and Applied Science:*

The curriculum at **SEAS** can be very full and demanding, thereby requiring you to take one of the required pre dental courses during a summer. Because SEAS students typically take four science courses a semester, a course taken over the summer won't raise the same concerns as it might for students enrolled at the College. However, taking courses over the summer might lead you to miss out on other important opportunities, including summer research and clinical experiences.

### ***Study Abroad:***

Pre dental courses should not be taken during study abroad programs. Unfortunately, many dental schools will not accept coursework taken outside of the United States in fulfillment of requirements and therefore we do not recommend taking these required courses while abroad. However, we do absolutely encourage study and work abroad opportunities, for they offer many other benefits including cultural immersion. If you

are interested in studying abroad, you should consult a pre dental advisor so that you may carefully plan for this endeavor.

### ***Postbaccalaureate Studies:***

Not all Columbia students will know from the very start that dentistry is where they want to end up. Some discover this part way through their undergraduate years or even after graduating. As a result, some students will finish their pre dental coursework after graduating or enroll in a post-baccalaureate program that is specifically designed to allow one to complete the preparatory courses before application. These students may still take advantage of all of the advising services and the committee evaluation offered through Preprofessional Advising.

## **THE DAT**

The Dental Admission Test is a standardized, multiple-choice examination, required for application to dental school in the United States and Canada. It is computerized and can be taken at Prometric test centers in the United States, its territories (including Guam, Puerto Rico, and the Virgin Islands), and Canada.

There are **four sections** in the DAT, which are:

- Survey of Natural Sciences (Biology, General Chemistry, Organic Chemistry)
- Perceptual Ability Test
- Reading Comprehension Test
- Quantitative Reasoning Test

Dental college admissions committees consider an applicant's DAT scores as part of their evaluation of applicants' academic readiness for dental school.

In order to be prepared to take the DAT, we recommend that students complete the following:

- 1 year of General Chemistry and General Chemistry Lab
- 1 year of Cell and Molecular Biology and Biology Lab
- 1 year of Organic Chemistry and Organic Chemistry Lab

The timing of your DAT depends on your application timeline. If you plan to apply to go straight on to dental school after graduation, you will need to take the DAT no later than the summer after your junior year. Remember that the average age of an entering

dental school student is 24, and about 80% of Columbia students apply as alumni rather than as enrolled students.

Because the DAT is a computerized exam offered at Prometric Test Centers, it can be taken whenever you are ready to take it and can schedule an appointment with a Prometric location near you.

The DAT is a test you can and should prepare for. Whether you do it by means of a commercial preparatory course, or on your own with one of the myriad preparation books is a matter of personal taste. Whichever you decide, if you prepare as a full-time enrolled student, you should probably make some attempt to lighten your course or activities load during the semester/summer when you prepare.

Timing is essential for the dental school application, and it will be important that you take this test in a timely manner. It is helpful to consult a pre-dental adviser regarding your individual timing.

## NON-ACADEMIC PREDENTAL PREPARATION

Dental school admissions committees are looking for more than just a solid academic preparation. They are looking for people with the interpersonal skills and character to become healthcare professionals. Healthcare professionals are mature, ethical, and reliable. They are interested in learning, able to lead *and* work in teams, and have the impulse to help alleviate the distress of others. They are resilient and adaptable, accountable and self-aware. These are qualities that you will need to assess in yourself and demonstrate to dental schools. When it comes time to apply, you won't be able to simply tell them you want to help people, you'll need to show them that you have a history of helping people. The activities that you pursue outside of the classroom and during the summers will help you develop and demonstrate these qualities.

## EXTRACURRICULAR OPPORTUNITIES FOR PREHEALTH STUDENTS

It is first of all important to understand that dental schools are quite genuinely interested in what you have done in college besides taking courses and preparing for the DAT. You really are more than a composite of GPA and DAT scores. However, it is equally important to understand that impressive extracurricular involvement will not save you if your numbers are too low. You will have to figure out for yourself what the appropriate balance is. The dental profession needs people who have learned the best ways to balance their professional responsibilities and their personal lives. Some dentists will tell you it is the hardest thing they had to learn. College is not a bad time to start.

By and large, your choice of extracurricular activities should be guided quite simply by your interests. There is nothing intrinsically better about a cultural organization, a literary society, or the football team. Depth of involvement and leadership in one or two things rather than membership in many will probably be more meaningful, but really, this is an area where you should simply do what appeals to you. It may well be true that activities which involve taking care of people (children, the elderly, and the homeless) are appealing to dental schools, but so are activities that demand judgment, efficiency, organization, team work, and dedication. Do what suits you. When considering your activities, think about the personal qualities that dental schools are interested in assessing. This might help to guide you in terms of ways to stretch yourself into areas that you have not yet developed or shown competency. For example, if all of your activities are solitary, a dental school may not have appropriate evidence to evaluate your social, interpersonal or teamwork skills. Community work, or other activities where you are "helping," may help a dental school to assess your interest in service. Since dentistry is a service-related profession, demonstrating that you have a history of

serving others is certainly helpful. Community work also provides you with the opportunity to step outside of your comfort zone, interacting with diverse populations.

Also consider sticking with whatever you begin. Depth of involvement in an activity often leads to leadership opportunities, and this type of depth and commitment is something that is valued by professional schools.

Paid employment must also be seen as an extracurricular activity. It is recognized that some students must work in order to help contribute to their college expenses. Although it would no doubt be pleasant and interesting for you to be able to work in some health-related field – a dentist's office, a hospital or clinic, a lab – this is not always possible. However, a great many non-health care-related jobs will require intelligence, responsibility, integrity, judgment, good humor, and the ability to deal well with the public. All of these things and many more are of interest to schools. The point is to do whatever you *are* doing well and look for opportunities where you will grow and develop as an individual.

**There are two areas of extracurricular activity that may be seen as specifically appropriate for pre dental students: research experience and clinical experience.**

There is a long-standing myth that dental schools "expect" lab experience. It is certainly true that much of the information upon which dental treatments are based was ascertained in the laboratory. It is also true that participating in a research experience (whether bench or clinical) will help you to be a more literate reader of the current research. But an outside lab experience is not absolutely required for entrance into dental school. The exception here is the student who, in fact, wishes to pursue a career in dental research and may even be applying for a combined DDS/PhD degree. If these are your interests, you will not only want, but need, to get extensive experience in research beyond that provided by your course work. Opportunities are legion, both in our own departments and at our dental school (including those through the Summer Undergraduate Research Fellowships), but also at many of the dental schools and research establishments throughout the city and around the nation.

Clinical exposure is a different matter. There is obviously nothing at all in your pre dental course work which prepares you for the actual business of taking care of people. Many kind, compassionate, concerned, good-hearted individuals find that their own particular personality is not at all suited for health care. It is better to find that out before going to dental school rather than after. Clinical exposure will also help you to demonstrate your commitment and knowledge of the field of dentistry, including both the rewards and challenges. You should get exposure specifically to dentistry but also general exposure to clinical medicine is a fine thing to pursue.

There are a number of ways in which a Columbia student can acquire clinical experience. Probably the most convenient because of proximity is volunteering at St. Luke's Hospital. It's close by, it's a teaching hospital, and it's accustomed to training prospective physicians and dentists at every stage of education. The program is not open to first-year students until second semester. It is also possible to volunteer in a number of other hospitals and other healthcare delivery settings throughout the city and often near your own home in the summers. Please refer to our volunteer list at: <http://www.studentaffairs.columbia.edu/preprofessional/health/volunteer.php>

## **PREDENTAL RELATED STUDENT ORGANIZATIONS**

This list is just a sampling – there are too many related organizations to list. Please attend the Activities Fair and check out the Student Development and Activities website to peruse other opportunities.

### **AMSA**

The American Medical Student Association is a predental society at Columbia University. This student club is a great community of students who share an interest in attending medical or dental school. They plan programs and different lectures that are of interest to its members.

### **CAPS**

Columbia University Association of Predental Students

This organization is dedicated to bringing together our predental students. It conducts panel discussions and field trips related to dentistry and dental school application.

### **CU-EMS**

Columbia University Emergency Medical Service is a Division of Health Services at Columbia and the Department of Public Safety. It is a student operated, New York State certified, Basic Life Support (BLS) volunteer ambulance corps. CU EMS provides pre-hospital emergency medical care, free of charge, to Columbia University's Morningside Heights Campus and the surrounding area 24 hours a day, 7 days a week, 365 days a year. The corps has approximately 65 active members and responds to over 700 emergency calls per year.

### **CUSJ**

Columbia University Science Journal. Student led publication focused on undergraduate research.

### **CHARLES DREW SOCIETY**

The Charles Drew Predental Society was established in order to increase the number of minority students applying and entering into health professional schools. Charles Drew

serves as a support group and a resource for all underrepresented pre dental students in the Columbia community.

## **HEALTH LEADS**

Health Leads is a non-profit organization that aims to improve health by providing support and resources to the urban underserved. They operate student-run community help desks at both Harlem Hospital and Columbia Presbyterian.

## **PEER HEALTH EXCHANGE**

Peer Health Exchange recruits and trains students to teach health education in underresourced high schools in NYC. Volunteers teach twelve different workshops ranging from sexual health to substance abuse and nutrition. This is a great way to gain leadership experience and to impact the lives of young people.

## **THE APPLICATION PROCESS**

Students who wish to enter dental school in the fall following graduation from college will complete the application process in the summer between junior and senior years. Detailed instructions about the timetable and procedures are available for each new class in the fall semester of junior year, and there will be general required and optional meetings for all prospective applicants to review the entire process. The important points to bear in mind before that time are the following:

### **Predental Advisors**

During your first two years, you and your Advising Dean will work out a course plan, which includes the predental courses. In the fall or spring of your sophomore year, you will declare your major or concentration; at that time, you will be assigned an additional adviser in your department. It is highly advisable that you also meet with a Preprofessional Advising Dean in the Center for Student Advising. You can do this at any time and as early as your first semester. Your official predental advisor will be assigned to you after your major declaration in the fall of your junior year. Your predental adviser will guide you through the application process and contribute to the writing of your committee evaluation for dental school.

### **Prehealth Advisory Committee Letter of Evaluation**

The Prehealth Advisory Committee (PAC) Evaluation is a comprehensive letter of evaluation and supporting document that is written for current students and alumni applying to graduate schools of the health professions. It is designed to provide the

admissions committee with a complete understanding of each candidate's background and experiences both academic and extracurricular.

This letter is written on a student's request and only after the student completes all committee application requirements by the stated deadline. The committee application includes submission of letters of recommendation, resume, autobiography, activities grid, supplemental information form, as well as an interview with the PAC.

During the fall semester, Preprofessional Advising staff will hold an informational meeting for all students planning to apply to medical, dental, or veterinary school in the coming summer. At this time the application for the Committee Evaluation will be distributed and students will register their intent to apply to health professional school in the coming summer.

It is highly advisable to start accumulating letters of recommendation from faculty, employers, etc. at the end of each semester, unless you expect to have a continued association with your prospective referee, in which case you will request the letter directly prior to application. Forms are available on the Preprofessional website:

<https://www.cc-seas.columbia.edu/preprofessional/health/forms>

These letters should be sent (or emailed) by the writer (give that person an addressed envelope) to the Center for Student Advising/Preprofessional Advising (403 Lerner ) or at [preprofessional@columbia.edu](mailto:preprofessional@columbia.edu). The letters of reference will be kept on file until your application year. The recommendation waivers must accompany each letter received in our office and you must make a consistent decision for all of your letters regarding the waiver. This is essential because eventually all of your letters will become a part of the Prehealth Advisory Committee Letter of Evaluation. If you have questions about this, please consult a preprofessional advisor.

### **Application Timing**

Many students choose to apply to dental school after they have graduated from college. This may be because they started predental courses later in their college careers, want more time to finish prerequisites, wish to improve their records before applying, need more time to explore the field of dentistry and gather professional experience, or desire to achieve other goals before starting dental school. Today, the average entering age of matriculants is 24. Dental schools highly value the maturity that comes with experience in the world and therefore taking a gap year or two to grow in other ways outside the classroom may indeed enhance to your candidacy.

Whatever the reason, it is always better to wait to apply to dental school until you are absolutely sure you are ready. It is too pressured and too expensive to embark upon casually. Dental schools have absolutely no bias against older applicants, and many students will present a much more impressive profile if they wait a bit. Columbia will, of

course, continue to assist you in the application process whenever you choose to apply. In fact, approximately 80% of the applicants to dental school from Columbia have already graduated from college and take at least one year between college and dental school.

### **Columbia Outcomes**

Dentistry's popularity as a profession is increasing, and we have seen a rise in applicants in recent years. However despite this increase in competition, Columbia regularly sees a very high percentage of its applicants accepted to medical and dental school. Broadly educated students, who have been involved in life as well as books, do extremely well in the competition. The key seems to be to see yourself first as a Columbia student, and second, as a pre-dental student.

## **SUBSCRIBE TO THE**

# ***CCSEAS-PRE-HEALTH LISTSERV***

The listserv provides students and alumni with information about upcoming on and off-campus events, scholarships, volunteer and research opportunities, summer programs, and other relevant information for those interested in health professions.

To subscribe, please visit: <https://lists.columbia.edu/mailman/listinfo/ccseasprehealth>