

CHEM 360 - Cambridge Scientists

Instructor: Dana Lashley

This course will satisfy either COLL 300 or alternatively COLL 200 NQR looking out to the CSI domain.

Class time: MTWRF between July 6th and August 7th.

This class is taught synchronously or LIVE at 2.30-4.00pm.

There are no classes held on Fridays (see below under movies and final exam).

Introduction:

The list of prominent scientist associated with Cambridge University is as impressive as it is endless. In this course students will learn about the most eminent of these scientists who have emerged from Cambridge over the past 400 years and whose specialties encompass various fields such as mathematics, physics, biochemistry and biology. The accomplishments of these ingenious scientists, many of whom are Nobel Laureates, have changed the course of mankind forever.

Objectives:

Students will learn about the lives of these scientists through lectures, movies and reading of scientific texts, historical essays and personal memoirs. The most important scientific contributions of each scientist will be discussed to an extent that does not require any college-level science prerequisites so that students from all prospective majors can follow this class. We will investigate how these scientific contributions impacted on society and talk about their modern applications.

Lectures will be complemented by field trips in which we will visit historical sites and “walk in the footsteps” of these Cambridge scientists. Several museum trips accompanied by class assignments will be tied into the class assessment.

Moreover we will talk about the struggles of some of these scientists as a result of sexism, racism, homophobia or ableism and compare to what extent these topics still pose a problem for scientist today.

Prerequisites: This course has no prerequisites.

Textbooks: Readings from these textbooks will be assigned to reinforce understanding of lecture topics in the NQR domain.

Other readings will be handed out or posted on Blackboard. This will include scientific journal articles that pertain to the NQR domain, as well as book excerpts and articles pertaining to the CSI content.

Main Textbook:

- *Cambridge Scientific Minds*. Peter Michael Harmon, Simon Mitton; Cambridge University Press 2002.

FREE access on Blackboard as an e-book. If you can spare the money it could be worth it to purchase the book just so you can take notes in it or underline important or memorable quotes. Available USED on Amazon for less than \$10. Purchase is fully OPTIONAL.

Secondary Textbooks:

I will assign readings from the below two textbooks and make the passages available to you via Blackboard. We will only read excerpts and not the entire books.

- *The Fly in the Cathedral: How a Group of Cambridge Scientists Won the International Race to Split the Atom.* Brian Cathcart; Farrar, Straus & Giroux 2005.
- *The Double Helix: A Personal Account of the Discovery of the Structure of DNA.* Watson, James D., and Gunther S. Stent; New York: Scribner, 1998.

Movies: available FREE of charge for you to access through W&M BOX via these links:

- 1st three movies: <https://wm1693.box.com/s/vz5989ydt1vbn87ijs7pvjo0w9ym5wdx>
- the last one can be accessed via:
<https://digitalcampus.swankmp.net/wm355165/#/play/4CBF409AAE2D75C3?watch=1>
- The Man Who Knew Infinity (2015)
- The Theory of Everything (2014)
- The Imitation Game (2014)
- Gorillas in the Mist (1988)

These movies tell the life stories of Srinivasa Ramanujan, Stephen Hawking, Alan Turing and Dian Fossey respectively.

These will be assigned to watch in lieu of class on Fridays.

Planned lessons: may not be in this order !

1. William Gilbert (16th century astronomer)
2. William Harvey (17th century physician)
3. Isaac Newton (17th century mathematician, astronomer and physicist)
4. Charles Darwin (19th century biologist)
5. George Stokes (19th century mathematician and physicist)
6. William Thompson ("Lord Kelvin") (19th century physicist)
7. James Clerk Maxwell (19th century mathematician and physicist)
8. **Srinivasa Ramanujan** (19th century mathematician)
9. Bertrand Russell (20th century mathematician, philosopher, writer & activist)
10. J.J. Thomson and James Chadwick (20th century physicist)
11. Ernest Rutherford, Niels Bohr and Robert Oppenheimer (20th century physicist)
12. Frederick Gowland Hopkins (20th century biochemist)

13. C.S. Sherrington & Edgar Adrian (20th century neuro- & electrophysiologists)
14. Arthur Eddington (20th century astrophysicist)
15. Paul Dirac (20th century theoretical physicist)
16. **Alan Turing** (20th century computer scientist)
17. James Watson, Francis Crick, Maurice Wilkins (20th century molecular biologists) and Rosalind Franklin (20th century chemist and x-ray crystallographer)
18. Mary Cartwright (20th century Chaos Theory mathematician)
19. **Stephen Hawking** (20th / 21st century theoretical physicist & cosmologist)
20. **Dian Fossey** (20th century primatologist)
21. Frederick Sanger (20th century biochemist)
22. Student presentations on select topics

The names marked in **red** refer to scientists who are also featured in the assigned movies.

Week 1:

Intro on Monday. Lectures Tue-Thu. Watch movie Fri.

Week 2:

Movie discussion Mon. Lectures Mon-Thu. Watch movie Fri.

MUST HAVE PRESENTATION TOPIC PICKED AND APPROVED BY FRIDAY July 17th!

Week 3:

Movie discussion Mon. Lectures Mon-Thu. Watch movie Fri.

Week 4:

Movie discussion Mon. Student presentations Mon-Thu. Watch movie Fri.

Week 5:

Movie discussion Mon. Student presentations continued Mon-Wed. Lectures Wed-Thu.

FINAL EXAM Fri, Aug 7th.

Assessments

Students final grades will be determined according to the below assessments:

- 30% (Group or Solo) Presentation on Select Cambridge Scientist Topic
- 25% Movie Reviews
- 25% Final exam
- 20% Participation

Presentation. Students will prepare a 20 minute presentation on a select Cambridge scientist. Students may optionally work in groups of two, but in that case each student must present for 20 minutes each). Students should choose a

Cambridge scientist of any field of choice who was not discussed at length in lecture. Scientist choices must be made by mid-semester and the selected topics must be approved by the instructor.

The presentation should capture both the scientific importance (NQR) of the discoveries of the scientist as well as its historical and cultural impact, thereby integrating the CSI domain.

Movie Reviews. Each Friday (with exception to the very last Friday), we will watch a movie relating to class content that tells the story of a certain Cambridge Scientists. Students will write a one-page review of each movie based on a handed-out rubric. This consists of writing a synopsis of the movie and its relevance to our class. There will be a total of four movies (listed further above) and hence four reviews. The written reviews are due on the following Monday. We will discuss the movies in class on Monday as well and participation from everyone is expected (see below under participation)

Final exam. The cumulative final exam will assess the students understanding of lecture and reading topics. The final exam will be the major means of assessment for the NQR domain and will test students on the scientific principles discussed in class. The names and life-stories of the scientists involved as well as the historical and cultural contexts (CSI) of their discoveries as highlighted in lecture will also be subject to the exam. The exam will take place on the last Friday of classes. The program Honor Lock may be used to proctor the exam.

Participation. Students are expected to attend class and actively participate by engaging in discussions. Moreover, students are expected to apply their critical thinking skills when presented information and ask questions to seek clarification. This goes both for lectures as well as during Movie review discussions (on Mondays) and after student presentations. During group presentations students may be asked to assess their peers' presentations based on a set of given criteria on a handed out form. We will also have discussions about diversity and the struggles that some of these scientists faced as a result of their gender, race, sexual orientation or disability. I expect a fruitful and civil discussion of this topic.

Final Grades:

A-/A	90-100%	Excellent performance and mastery of the material
B-/B/B+	80-89.99%	Very good understanding of the material
C-/C/C+	70-79.99%	Adequate performance
D-/D/D+	60-69.99%	Poor performance
F	below 60%	Unsatisfactory performance

Inclusion and Diversity: I value all students regardless of their background, country of origin, race, religion, ethnicity, disability status, sexual orientation or gender identity. I am committed to providing a climate of excellence and inclusiveness within all aspects of this course. If there are aspects of your culture or identity that you would like to share with me as they relate to your success in this

class, I am happy to meet to discuss. Likewise, if you have any concerns in this area or facing any special issues or challenges, you are encouraged to discuss the matter with me. You can set up a meeting with me via email with an assurance of full confidentiality (only exception being mandatory reporting of academic integrity/code violations and sexual harassment/misconduct).

Contact: Students should always feel free and comfortable to contact me with any questions or concerns. Please email me to schedule an appointment.

Smart phones / tablets: You may use smart phones and tablets in class during lectures. Most of you have this technology available and you can use it to easily access course material. I trust that you will use them responsibly for class-related issues. You may not use them during exams. I just ask that you be respectful about it and please do keep your phones on silent.

Blackboard: Course related materials such as notes, exam keys and announcements will be posted on Blackboard (www.blackboard.wm.edu).

General information for exams: The Final Exam will be posted on Blackboard. I will give you detailed instructions on how to take the exam and how to submit it to me. The Final Exam will be proctored using Honor Lock.

Grading concerns/re-grades: All grading concerns need to be discussed with me within 3 class days upon receiving your graded exam. After that there will be no re-grades.

Make-up work: Exams, homework and other graded work cannot be easily made-up. See me in the event of extenuating circumstances.

Class Attendance: In accordance with College policy, class attendance is expected and will account for a small amount of your grade. See undergraduate catalog for more information. Please notify me of any absences by email. Attendance will be recorded daily.

Student Accessibility Services: Students with disabilities must contact the Student Accessibility Services in the Dean of Students office to arrange for extra-time during exams. If you are granted special accommodations, such as a quiet testing environment, I will work with you to make arrangements for that. It is the student's responsibility to make contact with me at least a few days prior to the test date.

Honor Code: All students are bound to the Honor Code. There will be **zero tolerance for cheating** and all incidences will be reported to the honor system. See the student handbook for more information on the honor code.

<https://www.wm.edu/offices/deanofstudents/services/communityvalues/studenthandbook/index.php>

Field Experiences and Trips:

These were planned had the course taken place abroad at Cambridge University.

*I will try my best to recreate some of these excursions **virtually!***

I decided to leave the list of excursions on the syllabus, should you ever have the chance to visit the UK, and want a handy list of sites related to what you will learn in this course:

Several field trips will bring the students to discussed historical and modern sites within reach of Cambridge.

As one of the highlights we will visit the Old Cavendish Laboratory in Cambridge itself where Watson and Crick elucidated the structure of DNA, our hereditary material. It is also the site where the electron and the neutron were discovered by J.J. Thompson and James Chadwick, respectively.

Modern day research and development sites can be experienced first hand when we visit and have a guided tour of the Cambridge Science Park, which features many famous pharmaceutical and high-tech Research & Development companies.

Located on Christ College itself, where he was an alumni, we will be able to tour the old quarters of Charles Darwin. Moreover, we will tour Trinity College where a vast majority of big-name scientists once called home.

On occasion, we will visit inspirational historical sites outside of Cambridge, for example, King's College in London as the site where Watson and Crick first saw the presentation of Rosalind Franklin's famous DNA image.

A variety of unique museums can be visited in London that are relevant to medicine and science. We will visit several such museums and the visits will be tied to class assignments. A few select choices are elaborated in the table below.

A trip to Woolsthorpe manor, just outside of Cambridge, will take us the Isaac Newton's childhood home and the iconic place where he discovered the theory of Gravity through the "Apple Incident". The apple tree can still be found there and, interestingly, a descendent of this tree is also planted at W&M outside of Small Hall !

On top of the course-relevant field trips, it is important to take in the iconic sights of the City of London including famous buildings and different unique parts of town to give students a well-rounded experience. I would like to also visit the nearby city of Ely, which is a very old city with a magnificent cathedral.

Please view a collection of possible trips and some details on location, relevance and costs in the table below. Trips to London are between 90min and 1h10min long and cost about £20 round-trip should we decide to take the train instead of the bus.

Trip	Location	Relevance
College of Clinical Medicine	Cambridge	Opportunity to visit an internationally top ranked medical school.
Old Cavendish Laboratory	Cambridge	Watson and Crick discovered DNA structure here. Also site of discovery of the electron and neutron.
Cambridge University Library	Cambridge	600+ year old library - one of the oldest in the world with ancient, highly valuable collections in all fields.
Cambridge University Botanic Garden	Cambridge	40 acres of plants from all over the world - including many with medicinal properties.
The Eagle	Cambridge	Popular lunch location for Watson & Crick. In 1953 Crick interrupted patron's lunchtime to announce that he and Watson had "discovered the secret of life"
Ely	North-East of Cambridge	Cathedral city in Cambridgeshire. Ancient magnificent Cathedral dating back to 1083
King's College	London	Rosalind Franklin worked here as she obtained the first ever X-ray image of DNA. Watson & Crick visited her department presentation here and got the idea for the structure of DNA.
Imperial College and Alexander Fleming Museum	London	Visiting the beautiful campus grounds and the museum housing the reconstruction of the Lab in which Fleming discovered penicillin. Fleming was not a Cambridge scientist but his discovery had a huge impact on treatment of infection and worth learning about.
The Science Museum	London	One of the major science museums in the world! Housing an exhibition on Rosalind Franklin and medical history.
The Freud Museum	London	Specifically relevant for Psychology majors. Home of S. Freud after he escaped Nazi annexation. Featuring remarkable collections and Freud's famous psychoanalytic couch. This could be of interest to some of you.
Natural History Museum	London	A stunning showcase revealing the beauty and diversity of life on Earth. Relevant to our discussions of Darwin
Cambridge Science Park	Cambridge	Research site for many big-name R&D plants from high-tech to pharmaceuticals.
Oxford University	Oxford	The oldest university in the English speaking world (founded 1096) with a rich history in medicine both old and modern.
Different iconic sites: e.g. Buckingham palace, Hyde Park, Westminster Abbey, Tower Bridge, Big Ben and many more	London	Sight-seeing and learning about UK culture
Woolsthorpe Manor	Woolsthorpe-by-Colsterworth	Isaac Newton's childhood home. The site where Newton's apple is said to have fallen from the tree and which lead to his theory of Gravity. Just outside of Cambridge.
Trinity College	Cambridge	Cambridge college that hosted the majority of big-name scientists such as Isaac Newton, James Maxwell, Niels Bohr and Srinivasa Ramanujan.

Table 1: Suggested Trips