Syllabus Fall 2017 (22 September 2017)
Chemistry and Biochemistry C150/C250 FALL 2017
4 units; Letter Grade only

"Research Integrity and Methods in Cellular Biology, Molecular Biology, and Biochemistry Research"

Course purpose: To learn how to conduct research in this field to reliably advance knowledge in these fields with rigor, reproducibility, and transparency. Emphasis is placed on core issues in research integrity including data acquisition, management, sharing and ownership; mentor/trainee responsibilities; publication practices and responsible authorship; peer review; collaborative science; research on human subjects; research involving animals; research misconduct; conflict of interest and commitment; and scientists as responsible members of society. A special focus of this class will be on research methods that lead to papers with robust and correct conclusions, including topics of data recording (notebooks), setting up experiments, and analyzing data. Quantitative and statistical analyses of data will be examined in detail, as well as methods for ensuring the integrity of research materials and special problems that can occur with immunochemical analyses.

This course helps fulfill the training requirement in research integrity for NIH training grants and individual NRSA awards.

Class Web Site: I'll post the lecture slides and papers here each week: https://ccle.ucla.edu/course/view/17F-CHEMC150-1

I'll also try to post here more general articles of interest to the class including news articles.

Primary web site on research integrity and ethics:
US Department of Health and Human Services Office of Research Integrity http://ori.hhs.gov/

RETRACTION WATCH WEBSITE http://retractionwatch.com/

Instructor: Steven Clarke (310 825-8754, clarke@mbi.ucla.edu)
TA: Rebeccah Warmack (310 825-3137; rawarmack@ucla.edu)

Meeting times: Lecture/Discussion, Tuesdays 10 am – 11:50 am; Room 159 Paul D. Boyer Hall. Student presentations, Thursdays 10 am – 11:50 am; Room 2033 William G. Young Hall.

For students in C150, Thursday classes will be held on September 28th, October 26th, November 9th, December 7th. Optional sessions for help with presentations will be held on October 5th and October 12.

For students in C250, Thursday classes will be held on September 28th (except for those students taking Chemistry and Biochemistry 258 concurrently), October 19th, November 2nd, November 16th, and November 30th. Optional sessions for help with presentations will be held on October 5th and October 12.
Assignments and Grading: Undergraduates and graduates will be evaluated independently to reflect the differences in their experience.

C150 (undergraduate students)

Students will be required to attend the lecture/discussions each week and then write each week a critical analysis of an assigned topic. These topics may include analyses of failed papers in the literature, analyses of papers from laboratories that they are associated with, or interviews with senior graduate students, postdoctoral fellows, or faculty members. Students will complete a total of nine of these papers (about 4 pages each) with additional citations to the literature. Class participation is also required; for students that must miss a class session, makeup papers are assigned by the instructor on the topic of the week. Students will also be required to attend student presentation seminars and to make oral presentations of issues in research integrity that they have critically analyzed.

Grading is based on the following:

1. Participation in all class lecture/discussion sessions (make-up papers for those who are forced to miss a class period for an acceptable reason). (38 percent of the grade)

2. Group presentation of an oral report on a specialized topic of interest (20 percent of the grade)

3. Timely completion of 9 writing assignments (about four pages double spaced text and unlimited references). Papers will be due in class the week after they are assigned. These papers will involve a critical analysis of a specific issue in research integrity and ethics and should be documented with citations to the literature when appropriate. These papers are graded by the instructors for the effectiveness and clarity of the writing, the scientific understanding demonstrated, and the success of their analyses. (36 percent of the grade).

4. Completion of two online courses in animal subject research and human subjects research. Go to the web site at “https://www.citiprogram.org/” and under “Create an account” click on the “Register” button. This will take you to a page where you “Select Your Organization Affiliation” – here type in “University of California, Los Angeles (UCLA) until it comes up and then agree to terms of service and hit the button “continue to step 2” where the registration page will come up. Then go to the courses page and sign up for the “Biomedical Researchers & Staff: Investigators/Staff submitting to the Medical RRBs” button on the “Human Subjects Protection” section (question 1) and then the button for “yes I work with animals” for the “Animal Research” section (question 3). You can then take each course at your leisure – you don’t have to complete either in a single session. It should take about 2 hours for each course. When you are done with each, print out the “completion report” and give them to me. If you have any problems with registering at the site or taking the courses, please let me know! (If you have completed either online course at this site previously, you will just have to print out a new certificate – no need to take them again.) (6 percent of the grade).

C250 (graduate students)

Students will be required to attend the lecture/discussions each week and then write each week a critical analysis of an assigned topic. These topics may include analyses of failed papers in the literature, analyses of papers from laboratories that they are associated with, or interviews with senior graduate students, postdoctoral fellows, or faculty members. Students will complete a
total of nine of these papers (about 4 pages each) with additional citations to
the literature. Class participation is also required; for students that must miss
a class session, makeup papers are assigned by the instructor on the topic of the
week. Students will also be required to attend student presentation seminars and
to make oral presentations of issues in research integrity that they have
critically analyzed.

Grading is based on the following:

1. Participation in all class lecture/discussion sessions (make-up papers for
those who are forced to miss a class period for an acceptable reason). (38
percent of the grade)

2. Individual presentation of an oral report on a specialized topic of interest
(20 percent of the grade)

3. Timely completion of 9 writing assignments (about four pages double spaced
text and unlimited references). Papers will be due in class the week after they
are assigned. These papers will involve a critical analysis of a specific issue
in research integrity and ethics and should be documented with citations to the
literature when appropriate. These papers are graded by the instructors for the
effectiveness and clarity of the writing, the scientific understanding
demonstrated, and the success of their analyses. (36 percent of the grade).

4. Completion of two online courses in animal subject research and human subjects
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& Staff: Investigators/Staff submitting to the Medical RRBs” button on the “Human
Subjects Protection” section (question 1) and then the button for “yes I work with
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It should take about 2 hours for each course. When you are done with each, print
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print out a new certificate – no need to take them again.) (6 percent of the
grade).
Schedule of Lecture/Discussions

Week Zero

**Thursday September 28 2017 - Young 2033**

Organizational Meeting for the Presentations - all students except those concurrently taking Chemistry and Biochemistry 258

Course introduction
Presentation organization
What makes for an effective scientific talk?

Week One

**Tuesday October 3 2017 - Boyer 159**

Introduction; Why is so much of the literature just plain wrong?; misconduct and the penalties for misconduct; the sanctity of the data: laboratory notebooks

What is at stake?
Two types of integrity; integrity versus ethics?
NIH and the Office of Research Integrity
Definition of misconduct - fabrication, falsification, plagiarism
Penalties for misconduct
Frequency of scientific bad behavior
The frequency of medical reversal
Simply wrong science and retractions
Retraction Watch website - PubPeer online journal club
Why most studies are false
Replication of findings
Sloppy Science
How to keep a good notebook – the importance of the laboratory notebook.

Written assignment for next week: As we saw in class, NIH is concerned with the effects of hype in science. It seems like we have found cures over and over again for Parkinson’s diseases, Alzheimer’s disease, heart disease and cancer and yet these diseases are still very much with us!

Go to your favorite news outlet (Google News, CNN, BBC, Los Angeles Times, etc.) and look for a recent article that suggests a new therapy or even a cure is near at hand - here are some recent headlines I have found for Alzheimer's disease:

Hallucinogenic TEA from the Amazon stimulates brain cells...
Rowan's Alzheimer's disease test looks like a game changer...
Pre and post testing show reversal of memory loss from Alzheimer's...
Leaky blood brain barrier linked to Alzheimer's disease
Loss of Y chromosome is a risk factor for Alzheimer’s disease...

If you are a cynic, find a headline that looks like it may promise much more than the work may be able to deliver; if you are not, find a more measured headline (remember that headline writers are often not the authors of the articles!). Then find the article or articles in the popular press that describe the work. Then go and find the scientific paper that the claims are based on. Based on your reading of the scientific paper and the popular news account, write an essay on just how much of the headline can be justified. How you would present the situation
Honestly to a beloved relative of yours who was suffering from the disease? Is a cure or new therapy actually here? If not, what is your estimation of the chances that what is reported may actually make a difference to patients say a year from now or ten years from now? Analyze the news article in context of the original article that it is referencing to see how accurately the science was reported to the public. Finally, comment on the value of “pushing” scientific progress in terms of making the public aware of our research advances versus providing over-optimistic views that may lead to public distrust of science in general.

**Thursday October 5 2017 – Young 2033**

Office hours for helping students pick topics and plan for their presentations

**Week Two**

**Tuesday October 10 2017 – Boyer 159**

Data acquisition, management, sharing, ownership, and analysis: Integrity in collecting and presenting numerical data and introduction to statistics and quantitative analyses

Who owns the data? Data collection and storage. How is data shared between investigators? Nature of variation of experimental data. Statistics. Experimental design. CONTROLS! Independent experiments and replicates - what is an appropriate duplicate/triplicate/multiple? What is the digital output of an instrument really telling you? How many significant figures are appropriate?

Written assignment for next week: Go to the retraction watch website and find a paper in the broad area of cell and molecular biology that has been retracted (you may have to go through the archives of the web site). Looking closely at the original paper, comments on it in websites such as PubPeer, material from the Office of Research Integrity (if available), Retraction Watch write ups, comments from readers of the Retraction Watch, tell in your opinion just what went wrong and how it could have been avoided.

**Thursday October 12 2017 – Young 2033**

Office hours for helping students pick topics and plan for their presentations

**Week Three**

**Tuesday October 17 2017 – Boyer 159**

Statistics and honesty in data presentation #2. Quantitative biology.

How do we have confidence in our experimental results and conclusions? Usefulness of prior probability (Bayesian analyses). Scientific intuition and its limitations. Monty Hall problem. Statistical Power calculations - how many samples? Statistical tests of data. p-values. What is so magic about p < 0.05? Dangers in post-hoc analyses. Typing errors!
Written assignment for next week: Use PubMed to identify articles containing experimental data from your own research laboratory that have been published since 2011. If there are more than 10 papers in this group, pick the most recent 10 of them. If you are not in a research laboratory, you can pick a laboratory you were in previously, or a laboratory within your major, or ask the instructor to assign you a lab. Go over each of these papers in a paragraph to provide a critical evaluation of the appropriateness of replicates. Examine each of the tables and figures and comment for each whether the paper state how many times the experiments were done. For each figure and table, is it clear what is a technical replicate and what is a replicate of the experiment? Are there any true "biological replicates" where variation in nature is tested? For this assignment, you may want to include a table with the information on each paper and then discuss in your essay how well the authors have done in showing that their work is reproducible. Comment also if there is no indication of replicates - do you think this was because the experiment was truly done only once (is that ever appropriate?) or whether the authors simply failed to indicate how many times the experiment was done?

Thursday October 19 2017 - Young 2033

Graduate Student presentations

Week Four

Tuesday October 24 2017 - Boyer 159


Written assignment for next week: Use PubMed to identify articles from your own research laboratory that have been published since 2011. If there are more than 10 papers in this group, pick the most recent 10 of them. If you are not in a research laboratory, you can pick a laboratory you were in or ask the instructor to assign you a lab. Go over each of these papers to look at how numerical data is presented in figures. Are there bar graphs of the average values or do the authors actually show all of the data points? How is the variation in experimental data presented? In how many cases is the inappropriate standard error of the mean metric (SEM or SE) used?

For papers that use statistics, provide an evaluation of the appropriateness of the statistical methods and conclusions. Are the statistical methods appropriate for the type of data (normal versus non-normal distributions)? Do the authors discuss potential problems with multiple comparisons? Do the authors provide actual p-values? Are the statistical methods used described completely? Is there any indication that the statistic approach was determined before the experiments were completed and not after? For this assignment, you may want to include a table with the information on each paper and then write a summary of what you have found.
Thursday October 26 2017 - Young 2033

Undergraduate Student presentations

Week Five

Tuesday October 31 2017 - Boyer 159

Special issues involved in use of cell lines, antibody reagents, kits, and samples from other investigators

Problems with chemical reagents and cell lines, using strains and plasmids from other labs, using outside services, using kits, special problems with immunological reagents, and new technologies.

Written assignment for next week: Use PubMed to identify articles from your own research laboratory that have been published in the last 5 years (if you are not in a research laboratory, you can pick a laboratory you were in or ask the instructor to assign you a lab). Identify all papers (maximum of ten) that make use of antibody reagents for Western analysis and evaluate whether the authors would pass muster from the Editor of The Journal of Comparative Neurology. If your laboratory does not use antibody reagents, let the instructor know and he will assign you to a lab. (“Editorial: An Open Letter to Our Readers on the Use of Antibodies” (2005) Saper CB. Journal of Comparative Neurology 493, 477-478.)

Alternative assignment - do the antibody experiments pass muster from the Journal of Biological Chemistry December 2015 requirements?

Thursday November 2 2017- Young 2033

Graduate Student presentations

Week Six

Tuesday November 7 2017 - Boyer 159

Integrity in figure preparation for publication

Written assignment for next week: Find a recent paper from your laboratory that contains images (gels, micrographs, etc.) and see how well the authors did in explaining the figures with the criteria we talked about in class, especially the presentation of Veronique Kiermer as shown on slides 53-65. If you are not in a research laboratory, you can pick a laboratory you were in or ask the instructor to assign you a lab. Include copies of the relevant pages of the paper.

Thursday November 9 2017 - Young 2033

Undergraduate Student presentations
Week Seven

Tuesday November 14 2017 – Boyer 159

Integrity in authorship and publishing, publication practices and responsible authorship, peer review

What should be published?
What should be included in a publication
Who qualifies for authorship?
What defines plagiarism?
Cash for publication?
Journal impact factors
Access to the literature
Journal responses to fraud

Written assignment for next week: Interview one or more postdoc or graduate students from your laboratory, asking about their experience with the authorship process and the review process for the papers they have published so far.

Thursday November 16 2017 – Young 2033

Graduate Student presentations

Week Eight

Tuesday November 21 2017 – Boyer 159

What to do when a paper needs to be retracted and how to prevent it in the first place; Issues in peer review and collaborative research, Mentor/trainee responsibilities

Written assignment for next week: Interview one or more graduate students or postdoctoral fellows in your or a nearby lab or your research director to find out what the worst collaborative experience they ever had and tell why it went bad.

Thursday November 23 2017

Thanksgiving Holiday

Week Nine

Tuesday November 28 2017 – Boyer 159

Use of Animal and Human Subjects in Biomedical Experimentation – Scientific and practical issues
Written assignment for next week:
Pick any topic of interest to you from the course and write a critical essay on it. A great place to get ideas is the "Weekend Reads" section of the Retraction Watch website (a new one comes every Saturday).

Thursday November 30 2017 - Young 2033

Graduate Student presentations

Week Ten

Tuesday December 5 2017 - Boyer 159

Conflict of interest and commitment; and scientists as responsible members of society, mentor/trainee responsibilities

How to be the best scientist you can be; what makes for good and bad mentoring, careers in cellular and molecular biology; individual development plans.

Thursday December 7 2017 - Young 2033

Undergraduate Student presentations