Fall 2020

BIOL 202-103: Foundations of Biology: Cell & Molecular Biology Lab

John Yarotsky

120:202 Foundations of Biology: Cell and Molecular Biology Laboratory

Course Syllabus

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		OFFICE:	CKB 340C
COURSE WEBSITE:	https://canvas.njit.edu/		
COURSE LOCATION:	CKB 328	**MEETING TIMES:**	Check Lab Manual (p. viii) for your specific section.

COVID-19 Safety Requirements

All persons physically present in any department facility or classroom shall comply fully with the NJIT COVID-19 safety policy at all times. Masks must be worn before entry to all department facilities, and social distancing guidelines must be followed. Individuals who are unable to wear a face mask due to medical reasons should contact the Office of Disability Services or Human Resources. Students who enter a classroom without wearing a mask properly, or remove their mask, will be cautioned by the instructor. The same is true for students who disregard the seating order or guidelines for social distancing. Students with obvious symptoms of respiratory illness should not come to campus and will be asked to leave. Students who do not comply with a request by a department instructor to adjust their behavior, in accordance with the University Policy, will be subject to disciplinary actions. Instructors have the right to expel the student or terminate the class session at which any student fails to comply with the University Policy.

COURSE DESCRIPTION:

Cell chemical components, structure and methods of study; thermodynamics and metabolism; membrane biology, energy utilization and transfer; protein and nucleic acid structure and function; transcription, translation, and genetic regulation. This laboratory complements the lecture course 120:201 Foundations of Biology: Cell and Molecular Biology. Both courses 120:201 and 120:202 must be taken concurrently, although they are separate courses with different grades.

PREREQUISITES:

21:120:200 Concepts in Biology, and 21:160:115 General Chemistry.

REQUIRED TEXT:

A Laboratory Manual is provided to all registered students as a PDF, downloadable from Blackboard. Students are required to wear a laboratory coat and bring a scientific laboratory notebook (specifications provided in the laboratory manual).

LEARNING OBJECTIVES/GOALS:

This laboratory complements the lecture course 120:201 Foundations of Biology: Cell and Molecular Biology. The course objectives are: To provide biology majors with a deeper understanding of basic phenomena in cell and molecular biology in preparation for higher-level coursework. Topics covered are: The chemical components of the cell; subcellular structure and methods of study; thermodynamics and metabolism; membrane biology, energy utilization and transfer; protein and nucleic acid structure and function; transcription, translation, and genetic regulation.

MISSION STATEMENT

The purpose of this course is to provide students with factual and conceptual tools in the field of cell and molecular biology (CMB), thus facilitating the undertaking of higher-level coursework in the biology major and minor. This is a mid-level core course for biology majors and minors with a general physicochemical background. Foundations CMB aims to initiate students in procedural knowledge through the study and analysis of intracellular processes, with emphasis on eukaryotic models, as well as the application of specific methods in cell and molecular biology. The theoretical component of the course is expanded in the parallel lecture course 120:201.

OUTCOME GOALS

Through selected readings, lectures, discussions and occasional group activities, students are encouraged to learn on their own about the main processes taking place in the cell from a molecular perspective. After successfully completing the course, students will have

- the ability to describe the general structure of biomolecules as well as their role in cellular metabolism and the flow of genetic information;
- information and concepts on bioenergetics and the use of energy by cells;
- the information on the principles of membrane transport mechanisms and their role in important physiological processes at the organismal level;
- acquired concepts and general principles on gene expression and its regulation;
- knowledge on the concepts and general principles on eukaryotic signal transduction;
- the skills to read, interpret and apply general information in the fields of cell and molecular biology;
- evaluate contemporary hypotheses on the functional mechanisms of the cell;
- reinterpret and/or postulate alternative hypotheses or ideas to explain or describe the phenomena studied in the course;
- the opportunity to explore the topics covered in the course in higher level classes which require Foundations 201/202 as pre-requisites in the biology major and minor.

These goals are aligned with Curricular Goals 2, 4, 5 (Reasoning and Problem-Solving Skills), 8, 9, and 12 (Biological Principles) for the Biology Major (revised October 4, 1993).

GRADING POLICY:

Your grade for this course will be determined based on the categories listed in the rubric below:

Attendance/Pre-lab	10%
Notebook	40%
Two Lab Reports	20%
Two Exams	30%
TOTAL	**100%**

- **Notes about grading**
  - Please be advised that you must hand-write your pre-lab and your protocols. Printed and pasted sheets will result in subtracting up to 25 points from that lab grade/
  - If plagiarism is detected and confirmed in a portion of your laboratory notebook, report or assignments, up to 25 points will be subtracted.
  - If the entire report has been plagiarized, you'll be give a zero for that laboratory.

- Lab report
    - Formatting: Times New Roman, Palatino or a readable serif-font type, single spaced, no longer than 6 pages.

    - Report structure and specific points per item:

▪ Title page and appropriate title	5
▪ Introduction and Background	10
▪ Methods	5
▪ Data and Results	30
▪ Discussion	35
▪ Conclusion	5
▪ References	5
▪ Grammar and Formatting (including Bibliography; see style on p. 8)	5

- If there are any quizzes during the semester, they will consist of short-answer type questions on the following aspects of the laboratories:
    - Review
    - Background
    - Experimental errors
    - Results from the previous laboratories

- Due dates: Please discuss with your instructor and write down below.

1.1. Lab 1 Bioinformatics (Posted on Blackboard—use the MS Word version) Due: _____

1.2. Lab Report 1 Due: _____

1.3. Lab Report 2 Due: _____

Mark these dates on your calendars!

- **Course structure:** Foundations of Biology 120:201 (Lecture) and 120:202 (Laboratory) are different courses but must be taken concurrently. Students will not receive credit for 120:201 (Lecture) unless 120:202 (Lab) is completed at the same time.

- The Rutgers University and NJIT's policies on academic honesty and integrity will be followed. You may familiarize yourselves with these policies at:

    - academicintegrity.rutgers.edu/academic-integrity-at-rutgers
    - studentconduct.rutgers.edu/
    - www.njit.edu/academics/integrity.php

- **Determination of Letter Grade**
  - As per University policy, "Grades represent the level of quality of the student's performance measured against standards of knowledge, skill, and understanding as evaluated by the instructor. Grades are reported to the university registrar at the end of each term by the following symbols:" [1]

%	≤59.49	59.5-69.49	69.5-74.49	74.5-79.49	79.5-84.49	84.5–89.49	≥89.5
Letter	**F**	**D**	**C**	**C+**	**B**	**B+**	**A**
Meaning	Failing	Poor	Satisfactory		Good	Excellent	Outstanding

  - ✓ Grading errors: If there is a possible error in grading on one of the exams, students must submit the exam and a written description of the error to your instructor within one week after the exam is returned to them. After one week following the exam, re-grading will not be considered.
  - ✓ Final grades are definitive and will not be changed after the final exam is given.
  - ✓ Exam grades will be posted as indicated by the instructor and will not be given out over the telephone or, for safety reasons, by replying to e-mail messages.

- **Attendance policy**
  - ✓ Laboratory attendance is mandatory and will be taken at the beginning of each laboratory meeting as you show your instructor the prelab on your notebook.
  - ✓ Late work will not be accepted unless there is an excused absence as defined in the university's undergraduate catalog (e.g. physician's note, official documents, etc.).
  - ✓ A student is allowed to miss a maximum of two laboratory sessions with valid excuses. More than two absences will result in an F grade for the laboratory unless the student officially withdraws from the course.
  - ✓ If a student must quit the course but s/he misses the official withdrawal period, he or she must consult the Office of the Dean of Students Affairs to solve this problem.
  - ✓ Each unexcused absence will result in a grade of 0 (zero) for that lab.
  - ✓ There are no make-ups for laboratory exercises or pop-quizzes.
  - ✓ Plan to complete all assignments as scheduled and be ready for quizzes.
  - ✓ Assignments must be delivered to the instructors on the due date; otherwise, that assignment will be worth 0%.
  - ✓ Important: You cannot attend or take exams in a laboratory section other than yours. Make sure you know what section you are registered in. Since the laboratory has physical limitations, all assignments must be fulfilled in your section.
  - ✓ If you have been justifiably allowed by your instructor to make-up the lab in a different section, make sure to notify your TA via e-mail. Please indicate what section you want to attend to make-up the lab. Remember that labs are set up only for a week and it is logistically impossible to recover the labs extemporaneously.
  - ✓ Please notice the list of sections for Bio202 with schedules and instructors on the board near the entrance to LSC 112.

ATTENDANCE, MAKE-UP SESSIONS, AND LATENESS POLICY:

You must attend all sessions of this lab. A maximum of two absences is allowed, but you must show documentation (from a physician or religious minister; court papers,) to justify them. Your attendance is marked when you show your laboratory notebook, with the completed pre-labs, to your instructor at the start of each lab session. Lateness will result in decreasing your attendance points.

The process to request a revision of grade is as follows: Submit a request to your laboratory instructor, in writing, either through e-mail or a print-out, accompanied by any documentation relevant to your request, e.g., lab notebook, exams, reports, medical or court notes. If you are not satisfied with the outcome, then submit your request to the coordinator of the course. If the outcome is still unsatisfactory, them you may submit your request for grade revision to the departmental chairperson.

[1] Adapted from catalogs.rutgers.edu/generated/nwk-ug_0608/pg23594.html, downloaded on 29Aug08.

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120:202 Foundations of Biology:
Cell and Molecular Biology Laboratory

Week of	Activity
No Labs for the first two weeks of September	
September 14	Lab 2. Titration of the diprotic amino acid glycine Orientation Session Group A
September 21	Lab 2. Titration of the diprotic amino acid glycine Orientation Session Group B
September 28	Lab 3. Biological buffers Group A
October 5	Lab 3. Biological buffers Group B
October 12	Laboratory First Exam (Experiments 2 & 3) Lab Notebook Review I Group A
October 19	Laboratory First Exam (Experiments 2 & 3) Lab Notebook Review I Group B
October 26	Lab 4. Protein Determination using the Bradford method Group A

November 2	Lab 4. Protein Determination using the Bradford method Group B
November 9	Lab 6 Group A
November 16	Lab 6 Group B
November 23	No Labs
November 30	Laboratory Second Exam (Experiments 4 & 5) Lab Notebook Review 2 Group A
December 7	Laboratory Second Exam (Experiments 4 & 5) Lab Notebook Review 2 Group B

Knowing your distribution

It is important that you know what section number you are in as well as your lab's day and meeting time. You should also know your instructor's name:

I am in Section ____, which meets on _____ from _____ to _____.

My instructor's name is: _____ (e-mail: _____

General Laboratory Instructions

A) Laboratory Safety Rules

The following is a listing of specific laboratory safety rules for the Foundations Laboratory course that you are required to read and abide by.

1. Eye protection will be worn at all times. No Contact Lenses! (Obviously we cannot monitor this; you must be your own policeman).
2. No food, drink or smoking in the laboratory. Do not bring food with you into the laboratory, even if you plan to keep it for later.
3. Do not dispose of snack wraps or food containers: Inspectors will not distinguish between food eaten outside or inside the laboratory.
4. Never pipet by mouth. Pipette pumps are provided for this purpose.
5. Long hair should be tied back to prevent contact with flame or chemicals.
6. Keep the laboratory benches free of clutter.
7. Work in the fume hoods with volatile or corrosive compounds. Do not remove any chemicals from under the hoods.
8. Clean up spills promptly. Ask for assistance if you are not sure what to do, but do not wait!
9. Always wear closed shoes to the lab. No sandals.
10. Place broken glass in the containers labeled "Broken Glass," not in the "Biohazard" container.
11. Always be alert. No horseplay in the lab.

This is not an all-encompassing list of safety practices. You should consult the Laboratory Safety Rules notice placed by the Department of Radiation and Environmental Health and Safety in this lab.

The use of a laboratory coat in 120:202 Foundations lab is mandatory, *no ifs or buts*. We avoid the use of toxic substances in the lab but dyes or staining liquids may get onto your clothes.

Here are a few places in the northern New Jersey area where lab coats are sold.

- **Rutgers Newark Campus Bookstore**, Hahne's Building, 42 Halsey St, Newark, NJ 07102. Phone (848) 445-9927. Hours: Mon-Thu 9:00 A.M.-9:00 P.M.; Fri 9:00 A.M.-8:00 P.M.; Sat 9:00 A.M.-7:00 P.M.; Fri 9:00 A.M.-5:00 P.M.
- **Atlantic Uniform**, 65 Market Street, Newark, NJ, phone: (973) 273-0786. Hours: Mon and Thu 9:00 A.M.-6:00 P.M.; Tue, Wed, Fri, 9:00 A.M.-5:30 P.M.; Sat 9 A.M.-5 P.M., Sun Closed
- **Atlantic Uniform**, 444 Washington Avenue, Belleville NJ, phone: (973) 751-1242. Hours: Mon and Thu 9:30 A.M.-8:00 P.M.; Tue, Wed, Fri, 9:00 A.M.-6:00 P.M.; Sat 9:30 A.M.-5 P.M., Sun 11 A.M.-4 P.M.
- **Life Uniforms**, West 158, Route 4 East, Paramus, NJ (near Paramus Road). Phone: (201) 843-2288. Hours: Mon-Fri 10 A.M.-9:00 P.M., Sat 10 A.M.-8 P.M., Sun Closed. Online catalog is the same as Scrubs and Beyond.
- **Scrubs and Beyond**, Jersey Gardens Mall, 651 Kapkowski Road, Elizabeth, NJ. Phone: (908) 558-1661. Hours: Mon-Sat 10 A.M.-9 P.M., Sun 11 A.M.-7 P.M. Online catalog: catalog.scrubsandbeyond.com/app.php?RelId=6.6.5.5.11

Your laboratory coat should be long-sleeve, knee-length; it can be any color, it does not have to be white. We will be using Bunsen burners, please make sure that the material of your lab coat is not flammable.

In addition, you may purchase lab coats online:

www.allheart.com/lab-coats/c/103/view/all/
www.amazon.com/b?node=393299011
www.justlabcoats.com/cheap-lab-coats.aspx

C) Guidelines for keeping laboratory notebooks

Good laboratory notebook-keeping is not only part of the skills that you must acquire in this experimental laboratory course. It is also the way to document your activities, results, and thoughts related to your experiments; and, when you eventually work in the laboratory, the clinic, or the field, you must keep track of your data as official records, which are important during corroboration or repetition of your results or for patent purposes.

Please get a bound laboratory notebook at the Rutgers Bookstore (Hahne's Building, 42 Halsey St,). Here are some suggested brands:

1. National Brand Quad Ruled Computation & Lab Notebook ("Rediform") 43-591 or 43-648 (this is also Staples Item 567644; Target also sells this notebook)
2. Student Laboratory Notebook (American Society for Microbiology, ISBN 978-1555813581)
3. Ampad 22-156 or 2-157
4. Roaring Spring 77648
   If you are unable to find any of the above, you may purchase this one:
5. Tops Business Forms Lab & Research Book 35061

Marbled "collegiate-ruled" notebooks are not adequate for the lab. They were designed by people who have no idea what we do in a science lab. A good notebook to be used in a science laboratory (for instruction or research) must have pages that are numbered pages, preferably printed with a quadrille pattern (no lines or blank pages), slightly smaller than (or up to) letter size (8.5 X 11 in, *i.e.* 28 X 21 cm).

First thing to do is to number the pages of your book with **ink** if they are not already numbered (all of the brands above satisfy these requirements).

Second, you should set aside the first two sheets for a table of contents. Notebooks will be checked every laboratory session with your "pre-lab," as indicated by the instructor. You should read the entire laboratory so you have a clear idea of what you are going to do. Then, write or print and cut and paste the lab up to the Procedure.

A brief note about writing the different sections of your lab as you go through the experiment: Pages of lab notebooks are asymmetrical, that is, the odd-numbered pages should contain the

description of the procedure to follow (you may paste a print-out of the protocol). Even-numbered pages should display the description of composition of solutions (if any were prepared), your personal notes and observations and the results, as graphs, pictures, diagrams, descriptions, etc. Your instructor will indicate if s/he prefers to use the pages of the notebook continuously, instead.

The format for keeping the notebook must include the sections below. Remember: You must fill up to the Procedure part as a "prelab."

When writing on your notebook, leave one line between paragraphs.

Title of the experiment(s).

Introduction: This part should be short, one or two paragraphs. Please do not paraphrase the introductions to the labs in the manual; instead, come up with your own.

Date, preferably in the "international" system (day/month/year, as in **8Nov03**). It is fine if you keep the American style (month/day/year, as in 11/08/03), as long as you use it consistently throughout your entire notebook.

Objective: a very short statement of the purpose(s) of the experiment (10 words or less).

Procedure: Refers to the protocol(s) to be followed to perform the experiment and can be given as a flow chart, a bulleted or numbered list, or a table. Please write this on your notebook; no pasting of photocopies or print-outs will be allowed (except for graphs produced in Excel, pictures or drawings resulting from your experimental results). If you do, 25 points will be subtracted from your lab manual grade. Do not make a list of materials and equipment**.** Such list is unnecessary for your lab notebook entry, as it is already embedded in the Procedure.

Records of the procedures and the data collected during the session. The way data are recorded will depend on the particular laboratory, but it may include readings from the spectrophotometer, or the pH-meter, descriptions, drawings, tables, graphs, scans, photographs, etc.

Results, analysis and conclusions should be included in your notebook. This will facilitate writing your discussion.

Discussion: This section should contain an evaluation of the significance of the results. Try to bring everything together here. Point out why you think the observed results were obtained. Remember: "no result" is a result. Any opinions stated in your discussion must have a sound basis on fact. Mention in your discussion if any calculation helped you in particular in interpreting your data.

Discuss and interpret the information you obtained in the experiment. Indicate if the data were what you expected, according with the purpose of the lab. Refer to your tables or figures (e.g., "As it can be seen in Fig. 2, two distinct bands are present and correspond to 100 and 400 bp"). If you obtain unexpected results or made any mistakes, this is the right place to include them:

Learning from your own errors is an important part of the learning process (e.g. "although we expected a pH of 7.5, the pH-meter indicated 6.8" or "I neglected to add 0.25-mL aliquots and added the base in increments of 0.5-mL instead. As a result, I missed the midpoint in the titration procedure."). You may include suggestions on how to improve your results.

Bibliography: Please cite references correctly. A suggested citing style guide can be found on next the pages. You may use the examples below. Styles vary from journal to journal, but you may stick to a standard form that feels comfortable. You may choose not to follow this citation in which case you must choose a style of your own and follow it.

Please do not use this manual as a bibliographic source. The writings here are based on other authors' work and have been adapted by Dr. Cervantes and other professors at Rutgers-Newark. Ergo: Do not cite "Cervantes-Cervantes 2018 Lab Manual, etc."

In case of plagiarism, the penalty goes from assigning a grade of 0 (zero) for the entire lab to a full report to the Academic Integrity Facilitator and the subsequent proceedings.

D) Citation Style Guide

Citing a bibliography comprises two aspects: How to cite within the text and how to write down the references cited.

Citing works within the text you are writing

When citing as you write, there is a difference if the referenced work was produced by one or more authors. For example:

One author: (Nobel, 2003)
Two authors: (Schroeder and Hagiwara, 1990)
Three or more authors: (Bowsher *et al.*, 2008)

Please notice several things: When citing in the text, do not write authors' initials; only their last name should be written and respecting as much as possible the original spelling, *e.g.* (Lütcke, 1987), is preferred over (Lutcke, 1987). Regarding the locution *et al.*, it comes from the Latin *et alli* ("and friends"), so there should not be a period the word *et* and no plural *s* after *al.* And finally the requirement for adding (or not) a comma between the author names and the year varies from journal to journal.

If you are describing work done by several people, both the name of the author(s) and the year should be in parenthesis: "Measurements of tendril tension were made daily (Matista and Silk, 1997)." If quoting or mentioning the name of the authors, it is correct to only write the year in parenthesis: "Nobel (2003) described an equation for K^+ fluxes in guard cells." Standard abbreviations are preferred when citing journals. You may omit the issue number, but the volume and the first and final page of the article should be indicated; the volume number should be either in bold type or underlined (see examples above).

You should not cite references that you did not consult, even if they are cited in articles that you

actually read or at the end of the lab exercises in this manual. It is unethical to cite works that you did not read.

Examples of references from different bibliographic sources

Book

Voet D, Voet JG. Pratt CW (2016) *Fundamentals of Biochemistry: Life at the Molecular Level,* 5th edition. Garland and Francis, Boston. Pp. 361-381.

Hunter LE (2009) *The Processes of Life: An Introduction to Molecular Biology.* The MIT Press, Cambridge, London. Pp. 119-138.

Biswal UC, Biswal B, Raval MK (2003) *Chloroplast Biogenesis: From Proplastid to Gerontoplast*. Kluwer Academic Publishers, Dordrecht, 353 pp.
[NB: This is not a citation from a portion of a publication, but the reference is to the book as a whole; hence, the abbreviation pp. goes after the number of pages.]

Review chapter in a book

Schroeder JI, Hagiwara S (1990) Voltage-dependent activation of Ca^{2+}-regulated anion channels and K+ uptake channels in *Vicia faba* guard cells. Pp. 144-150, in: Leonard, R.T. and P.K. Hepler (eds.), *Calcium in Plant Growth and Development, Current Topics in Plant Physiology, Vol. 4*. American Society of Plant Physiologists. Rockville, Maryland.

Robertson, D., I. Anderson, and M. Bachmann. 1978. Pigment-deficient mutants: Genetic, biochemical and developmental studies. Pp. 461-494, in: Walden, D. (ed.), *Maize Breeding and Genetics*. John Wiley & Sons, New York.

Journal article

Liu CI, Liu GY, Song Y, Yin F, Hensler ME, Jeng WY, Nizet V, Wang AH, Oldfield E (2008) A cholesterol biosynthesis inhibitor blocks *Staphylococcus aureus* virulence. Science **319**:1391-1394.

Abduallah Y, Turki T, Byron K, Du Z, Cervantes-Cervantes M, Wang JT (2017) MapReduce Algorithms for Inferring Gene Regulatory Networks from Time-Series Microarray Data Using an Information-Theoretic Approach. Biomed Res Int 2017:6261802

Szabo CM, Matsumura Y, Fukura S, Martin MB, Sanders JM, Sengupta S, Cieslak JA, Loftus TC, Lea CR, Lee HJ, Koohang A, Coates RM, Sagami H, Oldfield E (2002) Inhibition of geranylgeranyl diphosphate synthase by bisphosphonates and diphosphates: A potential route to new bone antiresorption and antiparasitic agents. J Med Chem **45**:2185-2196.

Wentz CT, Magavi SSP (2009) Caffeine alters proliferation of neuronal precursors in the

adult hippocampus. Neuropharmacology **56**:994-1000.

Online-only journal articles

When searching the internet for *bona fide*, authentic scientific journal articles, you may find three different types of journals:

1. Exclusively online journals, *i.e.*, those which were established in electronic format. For example, the several journals published under the umbrella of PLOS, the Public Library of Science (www.plos.org/publications/journals/).

2. Journals that are transitioning from printed form to electronic. So, it has been reported that the many journals and magazines published by the American Chemical Society will not be printed, but available only through the web (chronicle.com/blogs/wiredcampus/chemistry-journals-go-digital-only/7264).

3. Printed journals (usually available in the library or in professor's personal stacks) which also have online articles (*i.e.*, their entire issues are available in both formats). Examples are: the prestigious journals Science, Nature, Cell and the Proceedings of the National Academy of Sciences of the U.S.A. (better known as PNAS).

In recent years, online-only journals have established a different way to cite. Since there are no paper pages, it suffices to have a number (i.e., an initial page) to indicate where the article starts. In addition, some journals ofer downloadable citation files so writers are be able to cite articles in a more standardized manner.

Zoppoli P, Morganella S, Ceccarelli M (2010) TimeDelay-ARACNE: Reverse engineering of gene networks from time-course data by an information theoretic approach. BMC Bioinformatics **11**:154.

Liang X-J, Xia Z, Zhang L-W, Wu F-X (2012) Inference of gene regulatory subnetworks from time course gene expression data. BMC Bioinformatics **13**(Suppl 9):S3.

Another way to cite online articles, includes the Digital Object Identifier (DOI), which assigns a unique alphanumeric code to electronic papers. For example check the citation for an article from the Public Library of Science: Neglected Tropical Diseases:

Teixeira DE, Benchimol M, Crepaldi PH, de Souza W (2012) Interactive multimedia to teach the life cycle of *Trypanosoma cruzi*, the causative agent of Chagas disease. PLoS Negl Trop Dis **6**(8): e1749. doi:10.1371/journal.pntd.0001749

Of course, DOIs can be used to cite papers that are published in print and online:

Brownlie, D. (2007). Toward effective poster presentations: An annotated bibliography. Eur J Marketing **41**:1245-1283. doi:10.1108/03090560710821161

The DOI offers an excellent alternative to everchanging URLs.

Internet article (not Internet **journal** article)

Given the wide variety of web pages, one may follow a very simple style (e.g. that of the American Psychological Association, which is: Contributors' names (last edited date). *Title of resource*. Retrieved (date of retrieval) from web address for resource).

Angeli, E., Wagner, J., Lawrick, E., Moore, K., Anderson, M., Soderland, L., & Brizee, A. (2010, May 5). *General format*. Retrieved from owl.english.purdue.edu/owl/resource/560/01/

The Edinborough Cell Wall Group. *Professor Stephen Fry's Research Interests*. Retrieved January 27, 2007 from the Word Wide Web: homepages.ed.ac.uk/sfry/research.html

Wolf A, Beegle D (1995) *Recommended soil tests for macronutrients: Phosphorus, potassium, calcium and magnesium*. In: Recommended soil testing Procedures for the Northeastern United States, 2nd Edition, Chapter 5, Delaware Cooperative Extension, Publications from the Soil Testing Laboratory. Northeastern Regional Publication N° 493.
Retrieved August 24, 2009 from the World Wide Web: ag.udel.edu/extension/agnr/pdf/soiltesting/CHAP5-95.pdf.

A final brief note about using Internet citations: Many of the web pages you will find today will not be indefinitely available. Web page turnover is very fast! You should not cite more than 2-out-of-10 web pages per bibliography and that you save the corresponding HTML files for future reference (or print them as PDFs). The way to do this varies according to your computer; in the Mac environment you can print to PDF from any application.

You may check websites such as *The Write Source* of the Modern Language Association for examples of how to cite Internet references: www.thewritesource.com/mla/ or the Purdue Online Writing Lab (owl.english.purdue.edu/owl/resource/560/01/), cited above.

And please remember: No Wikipedia. No dubious or non-curated sources. You may try Google Scholar (scholar.google.com/schhp?hl=en&tab=ws, if you must use a popular engine) and the (truly) intelligently designed WolframAlpha (www.wolframalpha.com).

E) Guidelines for the preparation of laboratory reports

This section on how to write a lab report for Foundations of Biology CMB has been adapted from the General Biology Laboratory at Rutgers Newark. Please notice that the style to write a report is markedly different from notebook keeping.

- **Title Page (5%)**
  Include the title of the experiment, your name, your instructor's name, your group number, and the date the lab report was submitted. The title says what you did. It should be brief (aim for ten words or less) and describe the main point of the experiment or investigation. Begin your title using a keyword instead of an article like 'The' or 'A'.

- **Introduction (10%)**
  The introduction should be about one page and should provide some background knowledge of the lab and explains its objective or purpose. You must state the purpose of the experiment and the hypothesis being tested. The introduction should not be copied from the lab manual; you must write your own.

- **Methods (5%)**
  Describe the approach you used to complete your investigation. Do not list the specific steps you followed or the specific materials you used, as this can be found in the lab manual. Instead, summarize what you did in one or two paragraphs.

- **Data/Results (30%)**
  Data are the numbers, graphs, pictures, illustrations, etc., that you recorded as you conducted the experiment. Data are just the facts without any interpretation of what they mean. They are presented in the form of tables or graphs. These must be labeled with a number and a descriptive title (e.g. Figure 1. Titration curve of glycine with NaOH). Always label both axes on all graphs and all columns of a table, including any units of measurement if applicable (e.g. Reaction time (sec); A_{600}; Reaction rate (μmol/min).

- **Discussion (35%)**
  Discuss your results, including any calculations that help to analyze the data. As you go through the data, discuss/interpret it. Say whether or not the data are consistent with what you would expect if your hypothesis is true. In the text of your report, refer to tables and graphs by number (As you can see in Table 1…). This is also where you would discuss any mistakes you might have made while conducting the investigation. You may also describe ways the study might have been improved.

- **Conclusions (5%)**
  The conclusion is typically a single paragraph that sums up what happened in the experiment. If applicable, whether your hypothesis was accepted or rejected, and what this means.

- **References (5%)**
  Any outside sources that were used in the writing of the report need to be cited within the text of the report and listed in the reference section. Instructions for properly citing and referencing outside sources can be found in the preceding pages. Remember, you are not to reference the lab manual.

- **Grammar/format (5%)**
  Write several drafts of your lab report and edit them for correct grammar before submission, including spelling, complete and structured sentences, punctuation, etc.

F) Pipetting

Proficient pipetting is probably the most crucial part of this class, for three reasons:

- Accurate pipetting of very small volumes is crucial to the success of molecular projects. Mistakes during pipetting may cause your experiments to fail or to be irreproducible, and thus cause long delays and considerable expense

- Pipettes are delicate pieces of equipment with high accuracy, which can easily be knocked off their calibration. Furthermore, they are expensive–the pipette set in front of you costs about $ 1,500, plus maintenance expenses.
- Pipettes must be kept clean; for example, dirty pipettes are the main source of

Fig. 1 Rainin Pipetman

contamination in PCR, and thus can cause problYou may have some experience with pipettes, but a refresher on pipetting is probably quite useful.

Volume Indicator

The volume indicator is read from top to bottom. Up to PR-200, black digits indicate microliters (µL) and red digits tenths and hundredths of microliters. For PR-1000 red digits indicate milliliters (mL) and black digits microliters.

	PR20	PR200	PR1000
Reading on window:	1	1	0
	2	2	7

Volume:

5	5	5
12.5 µL	125 µL	0.75 mL = 750 µL

Sample values, volume ranges, and smallest increments for each Rainin Classic model are shown below:

Model	Capacity (µL)	Recommended range (µL)	Smallest Increment in µL
PR-20	0 to 20	2 to 20	0.02
PR-200	0 to 200	20 to 200	0.2
PR-1000	0 to 1,000	100 to 1,000	2.0

Operation

1. Turn the plunger button or the volume adjustment knob until the volume indicator is 1⁄3 revolution above the desired setting, then turn slowly clockwise until the desired volume shows on the indicator.

4. Always dial down to the desired volume. This prevents mechanical backlash from affecting accuracy. If you pass the desired setting, turn the dial 1⁄3 revolution higher than desired and dial down to reset the volume. The friction ring prevents unintentional volume changes.

   Important note**:** The PR-1000 pipettor has only 3 digits in the volume indicator window. A reading of '100' in the window is the maximum setting for the PR-1000 equaling 1000ul! **Do not attempt to dial the pipettor higher or you will break it!**

1. Attach a new disposable tip to the pipette shaft. Press into the tip with only enough force to make a positive airtight seal.

2. Press the plunger to the **first stop**. This part of the stroke is the volume displayed on the indicator.

3. Holding Rainin Classic vertically, immerse the tip into the sample to the proper depth; see table below.

4. Allow the pushbutton to return slowly to the **up** position. Never let it snap up! See Figure 2A below.

5. Pause briefly to ensure that the full volume of sample is drawn into the tip.

6. Withdraw the tip from the sample liquid. If any liquid remains on the outside of the tip, wipe it carefully with a lint-free tissue, avoiding the tip orifice.

7. To dispense sample, touch the tip end against the side wall of the receiving vessel and depress the plunger slowly to the first stop (see Figure 2B). Wait 1 sec for PR-2, PR-10, PR-20, PR-100, PR-200; wait 1-2 sec for PR-1000; wait 2-3 sec for PR-5000, PR-10ML. Wait longer for viscous solutions.

8. Press the plunger to the **second stop** (bottom of stroke) to expel any residual liquid in the tip.

9. With the plunger fully pressed, withdraw the pipette from the vessel carefully, with the tip against the vessel wall.

10. Allow the plunger to return to the up position.

11. Discard the tip by depressing the tip ejector button. A fresh tip should be used for each sample to prevent sample carryover.

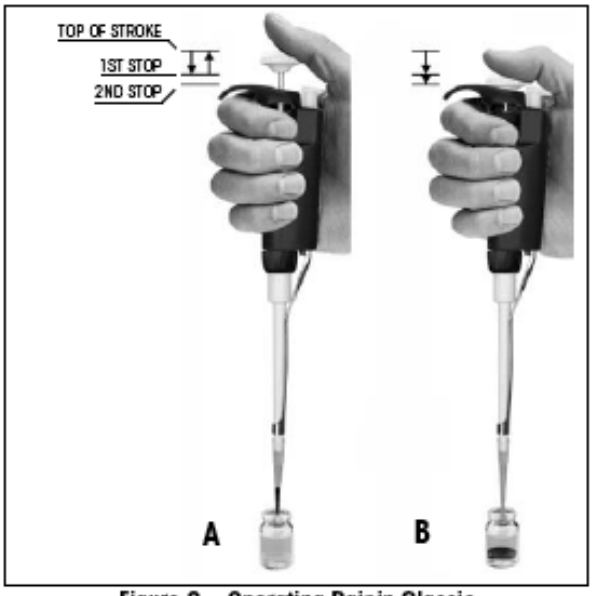

Figure 2 Operating Rainin Classic

Tip Immersion Depth
The recommended depth for tip insertion into the sample for each Rainin Classic model is shown in the table below.

Model	Immersion Depth
2 to 10 µL	1 to 2 mm
20 to 100 µL	2 to 3 mm
200 to 1000 µL	3 to 6 mm
5000 µL, 10 mL	6 to 10 mm

Tip immersion depth is important. If exceeded, the volume measured will be inaccurate, possibly out of specification.