Syllabus

Undergraduate Authentic Research in Biology, BIOL 4910 024, CRN 58844, 1-3 Credits

Catalog description

This course is part of a 5-course program that provides hands on authentic research experience and comprehensive understanding of the scientific endeavor.

Program Description

This course is part of a 5-course program that provides authentic research experience and comprehensive understanding of the scientific process. To accomplish this, students will perform authentic research, learn how to establish research questions, how to pursue funding for their research, report on the research progress, and finally, write a paper that summarizes their research findings.

The first part of the program is two courses of BIOL 3910:

Course 1: Students will establish a research question that they can answer using a genetic approach in fly testes, make a mutant collection to answer the question, and write a research grant about it (1-3 credits).

Course 2: Students will screen for cellular phenotypes called for by their research question, and write and present a poster (2-3 credits).

The second part of the program would be part of courses of BIOL 4910

Course 3: Students will map the mutant of interest using positional cloning and/or will study the mutant flies they identified to answer a biological question. Students will make a progress report based on their research goals and findings for a meeting (2-3 credits).

Course 4: Students will identify the mutant candidate gene using bioinformatics and genomic sequencing, and prepare a seminar presentation for a conference about his or her research (2-3 credits).

Course 5: Students will demonstrate that the gene mutation they identified causes the phenotype they observe using molecular biology and rescue experiments, and then write a paper about their findings (2-3 credits).

Credits

Students can take the course for 1 or 3 credits. 1 credit includes mainly the research part. If you take the course for 3 credits, you will have additional writing and presentation. In course 1 this includes writing and presentation of the proposal. In course 2 this includes writing and presentation of a poster on the research.

When and Where?

Each student will be involved with 3 activities:

1) Recitation – Students will perform activities to practice key concepts related to the course material
2) Regular lab – Teaching assistant guided authentic research work
3) Open lab – Students perform independent research in the lab

Recitation/ assignments time will be on Monday 2:00-3:00pm in Bowman-Oddy Room 1099
Recitation/ activity time will be on Thursday 1:00-2:00pm in Bowman-Oddy Room 1099
Regular lab time will be Thursday 2:00-4:00pm in Bowman-Oddy Room 1099 and Wolfe Hall Room 1265
Open lab time will be in Wolfe Hall Room 1265

Open lab is 3-4 periods of Independent Research a week of about 1-2 hours. This independent research will take place in the morning 8-10 am or evening 7-8 pm. Once you are organized into teams you will set these times between you (see table below).

Each team is made of three students: Student A, Student B, and Student C,

Shift	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
7-10 am	Student A	Student B	Student C	Student C	Student A		
5-8 pm	Student B	Student A	Student A	Student C	Student B		

Course 1 Goal:

The goal of Course 1 is to teach you: how to select a research topic, write a grant, perform mutagenesis, and establish a mutant collection directed to research a particular subject.

Recitation

Recitation times are divided into three parts:

1) Activities to practice introductory material:
    a. Fly testes as a model organ system for cell and developmental biology
    b. Fly genetics
    c. How to write a grant
    d. Student presentations and peer review.
2) A presentation that includes:
    a. Activates to practice how to present a seminar.
    b. Student presentations and peer review.

Tentative Recitation Calendar

Week 1) Drosophila testes: a model system for cell and developmental biology; Grant Title
Week 2) Continuation of Drosophila testes as a model system; Grant Introductory Paragraph
Week 3) Fly Genetics part 1, Grant Specific Aims
Week 4) Fly Genetics part 2, Grant Significance
Week 5), Fly Genetics part 3, Grant Innovation
Week 6) Fly Genetics part 4, Grant Approach-Rationale
Week 7) Mid term
Week 8) Grant Approach-Methods,
Week 9) Grant Approach-Outcome and pitfalls
Week 10) Grant Approach-Preliminary data
Week 11) Grant Approach-Time line & Summary
Week 14) Presenter 1, Presenter 2, Presenter 3
Week 14) Presenter 4, Presenter 5, Presenter 6
Week 14) Presenter 7, Presenter 8, Presenter 9
Week 15) Presenter 10, Presenter 11, Presenter 12

In addition during recitation, each student will go up to the podium and present his or her assignment for 2-3 minutes. During the presentation, other students will write at least three specific constructive criticisms which will then be shared with the presenter and discussed in the class. All students present every week so come prepared.

Regular lab

Students will learn:
1) Basic skills in fly genetics
2) Writing a research log
3) Learning schemes of genetic crosses
4) Summarizing their findings

Each lab section will start with a short quiz intended to examine if critical concepts learned in the previous section are clear for students. Then students will learn the skills necessary to perform their research, how to read, write, and follow schemes of genetic crosses.

Independent Research

Each student will need to come 3-4 times a week in the morning or evening to separate males from females, make crosses, and analyze flies. Each shift the student will make sure one of their partners collected separate males from females in the previous shift. Students will indicate they came to the shift and write a summary of what they did in the group log.

Course resources

The course grant-writing textbook is:

- "Grant Application Writer's Workbook - NIH" by Stephen W. Russell & David C. Morrison

Introductory information on fly genetics:

- "How to design a genetic mating scheme: a basic training package for Drosophila genetics". Roote J, Prokop A. G3 (Bethesda). 2013 Feb;3(2):353-8. doi: 10.1534/g3.112.004820. Uploaded to blackboard as: "Drosophila introduction"

Introductory review papers on Drosophila testes

- "Drosophila Spermiogenesis: Big things come from little packages" by Fabian L and Brill JA. Spermatogenesis. 2012 Jul 1;2(3):197-212.

Introductory review papers on centrosome

- "Centrioles, centrosomes, and cilia in health and disease" By Nigg EA and Raff JW. Cell. 2009 Nov 13;139(4):663-78.
- "Towards a molecular architecture of centriole assembly" By Gönczy P. Nat Rev Mol Cell Biol. 2012 Jun 13;13(7):425-35. doi: 10.1038/nrm3373.
- "Clockwise or anticlockwise? Turning the centriole triplets in the right direction!" By Uzbekov R and Prigent C. FEBS Lett. 2007 Apr 3;581(7):1251-4.

Papers that will be discussed

- **"**Toward a comprehensive genetic analysis of male fertility in Drosophila melanogaster" by Wakimoto BT, Lindsley DL, and Herrera C. Genetics. 2004 May;167(1):207-16.
- "The Zuker collection: a resource for the analysis of autosomal gene function in Drosophila melanogaster" by Koundakjian EJ, Cowan DM, Hardy RW, and Becker AH. Genetics. 2004 May;167(1):203-6.

Grading

Grades will be determined based on 7 factors with an approximate weight as follows:

	3 credits	2 credits
Recitation attendance and participation:	10%	10%
Regular lab attendance and participation:	10%	10%
Independent research attendance and performances:	10%	20%
Quizzes:	10%	20%
Assignments	10%	NA
Midterm	10%	20%
Oral Presentation:	10%	NA
Research summary:	10%	20%
Grant proposal:	20%	NA

Recitation and Regular Lab Attendance and Participation:

Unexcused absences will not be tolerated, and excused absences should be rare and supported by a physician's note or other piece of documentation.

Rubric: Full grade (1 point) – coming to class on time and being there from beginning to end.

0.8 or fewer points - coming to class late or leaving before or during class.

0 points – unexcused absence.

Students must participate in discussions, activities, and demonstrate that they prepared for class. Students are expected to have read the assigned reading material, analyzed it critically, and have done the extra background analysis needed to comprehend the material. Prior to coming to class students are required to research all aspects of class matrial until they understand it or come to class with prepared questions about things not understood.

Rubric: Full grade (1 point) - student made 2 or more meaningful contributions to the discussion.

0.8 points - student that made 1 contribution to the discussion.

0.5 points - student that listen attentively to the discussion.

0 points - unexcused absence from class or not listening to the discussion.

Recitation material will be available before class in blackboard and students are required to read it to be prepared for class.

Independent research attendance and performances:

Unexcused absences will not be tolerated, and excused absences should be rare and supported by a physician's note or other piece of documentation.

In case of inability of a student to attend to his scheduled term of fly collection, the student must contact his group mates and ask them to attend to the flies instead of him.

Students must fill out a log that indicates that they came to their independent research time and collected the flies. This log must be available to the other students in their group and the instructor to make sure they performed the written operation when they collected flies.

Rubric: Full grade (1 point) - student attended to his flies and crosses.

0.5 points - student attended to his flies but not the crosses.

Student that failed to come and collect the flies or make sure that sombody else tend the flies, will lose 5% of the total grade in the course.

Quizzes:

To test comprehension, students should expect short quizzes at the beginning of each section time. Each student will get a feedback on his or her performance on a quiz. Students will need to retake quizzes until they get a perfect score. The average grade of all attempts related to particular quiz will be the final grade for that quiz.

Midterm:

Midterm will cover all subjects learned in the course. The exam is intended to take 60 minutes, and questions are organized from easiest to hardest. At the end of each question you will find the maximum points for that question. Maximum grade is 100/100 and corresponds to ~10% of your final grade in the course.

The exam has 2 parts: the main exam and bonus question. You will get the bonus question after you submit the main exam. The bonus question you should discuss as a group with the other students right outside the classroom. Once you feel the discussion is over, go back to your seat and answer the question individually.

Below is an example of an exam with correctanswers:

1) Draw or describe a female and a male fly noting the differences between each.
(2 minutes) 5 points
- Drawings should depict a male, slightly smaller, with a dark penis apparatus and sex combs on the front legs. The female should be slightly bigger with a cone shaped abdomen.

2) What is the difference between a stock and a cross? When must a cross be thrown out? Why? (2 minutes) 5 points
- A cross is the mating of a male and female of different genotypes, these must be thrown out after 20 days due to unpredictable genotype of second generation progeny. A stock is a culture of flies that mate and produce offspring with the same genotype over multiple generations.

3) How does the heat shock Hid work in the fly? (2 minutes) 5 points
- The gene Hid is present which is attached to a heat shock sensitive promoter. When this promoter is activated, it transcribes the Hid gene, which is apoptotic, and causes cell death during the embryo stage, and therefore allowing only flies without the heat shock Hid transgene to develop past the embryo stage.

4) Given the genotype: **w ; Sp / Cyo ; FRT / TM6B** , draw or describe what this fly will look like. (2 minutes) 5 points
- The drawing should show a fly with the sp hairs, curly wings, humeral, and white eyes.

5) What is a transgene? What is the function of the transgene in our crossing scheme? How do we now the transgene is there (2 minutes) 5 points
- A transgene is a gene taken from one organism's genome and inserted into another. In our crossing scheme, the transgene we use has Ana-1 GFP, which labels the centriole. We also use heat shock Hid transgene which is use to eliminate the unbalanced chromosome and allow us to establish stokes with out collecting brother and sisters. Both Ana1-GFP and Hid transgenes are marked with the w^{mw} gene that help us to know the transgene is present.

6) What Write 3 types of lethality that can occur in the fly? What are the observable characteristics of each? (4 minutes) 5 points
Embryo lethal– no balancer containing larva are missing
Larva lethal– no balancer containing larva are seen and no balancer containing pupa are missing
Pupa lethal– You will see no balancer containing larva and pupa, but no adult flies without balancers
Adult lethal– Empty no balancer containing pupa will be seen and no balancer containing adults are missing.

7) Given the cross: w ; M1 / Cyo ; MKRS / TM6B X w ; Sp / Cyo ; Hid Dr / TM6B
- After a heat shock, what genotypes would you expect to find in your vial after 10 days at 25 C? Please make sure to write it using correct rolls of genotyping (4 minutes) 5 points
w w ; m1 / cyo Cyo ; mkrs MKRS / tm6b TMKb
w ; m1 / sp Sp ; MKRS / TMKb mkrs / tm6b
w ; sp Sp / cyo Cyo ; MKRS / TMKb mkrs / tm6b

8) What is an isogenized fly? When and why is it important to isogenized flies (2 minutes) 5 points
- An isogenized fly is one in which both the homologous chromosomes are identical in their nucleotide sequence. This gives an identical background to all flies when performing a genetic screen.

9) You are analyzing a vial of flies to find out if you have a viable homozygous mutation on the 2nd chromosome. If the parents contained a balancer with *Cy* (Cy make curly wings) and *bl* (*black* mutation that makes the flies black). What phenotype would tell you that you had an adult viable mutation? 5 points
- You would look for flies that do not have curly wings.

10) You are trying to create a new balancer for the x chromosome. What are the 3 properties that you want your balancer to have? Please provide examples of mutation that this balancer chromosome will have (8 minutes) 10 points

1. Dominant Marker, This can be achieved by adding a dominant eye shape mutation
2. Prevent recombination, This can be achieved by massive reordering of gene placement
3. Won't take over the stock. This can be achieved by having a recessive female sterile mutation

11) You have a mutant line that does not produce larva in 25°C. When you examine the vial you see eggs on the surface of the food, but you never get any progeny. One day, you accidentally put the mutant line vial in 18°C, and find it 2 weeks later with pupa covering the vial. What could be the cause of this? (5 minutes) 10 points

- 1 of 2 possible answers:

The mutant line carries a dominate Temperature sensitive embryo lethal mutation.

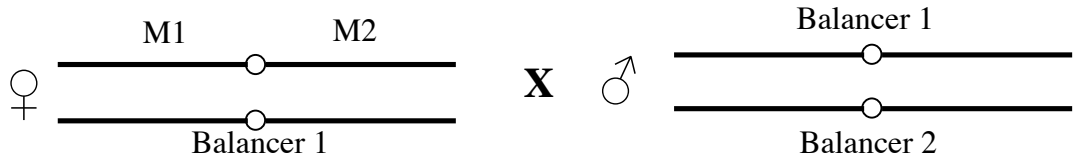
The line has a Hid gene that is sensitive even at 25°C

12) You have established 2 mutant collections each using a distinct batch of EMS mutagenized males. One collection was established using a batch of males you crossed 2 days after exposed to EMS. The other collection was established using a batch of males you crossed 10 days after being exposed to EMS. In the collection established with males that you used crossed 2 days after EMS exposure, you had no repeating mutations. In the group where you used males crossed 10 days after EMS exposure, you notice that you have the same mutation multiple times. What is likely to be the cause of this? (10 minutes) 10

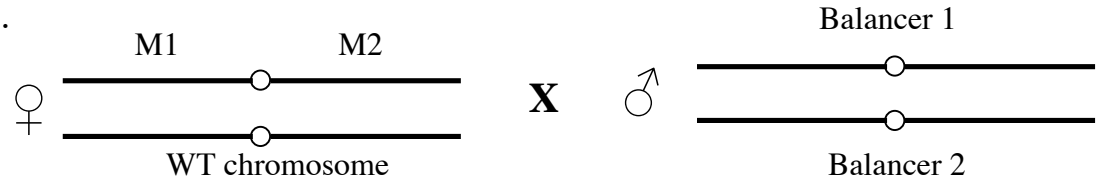
- Using males that are more than 5 days old means that there could be identically mutated sperm caused from the EMS mutation of germ cells or spermatogonia in the testes. From spermatogonia to mature sperm takes 5 days, therefore any mating after 5 days runs the risk of identical mutations.

13) You made the following crosses with M1 and M2 being dominant mutations. When you examine the adult fly progeny how many distinguishable genotypes would you expect from each example? Please explain. (10 minutes) 10 points

A.



B.



In A we expect to have 3 distinguishable genotypes because there is no recombination:

M1, M2 / balancer1 ; M1, M2 / balancer2 ; balancer 1 / balancer 2

In B we expect to have 8 genotypes because there might be recombination:

M1, M2 / balancer1 ; M1, M2 / balancer2 ; WT / balancer1 ; WT / balancer2 ; M1 / balancer1 ; M1/ balancer2 ; M2 / balancer1 ; M2 / balancer2 ;

14) You made 2 crosses, one as a control and one for the test. In the control cross, you put males and females that have wild type chromosome over TM6B. In the test cross you put males and females that have mutant chromosome over TM6B. 3 days after setting the cross you cleared the parents. 10 days after the cross started you observe Tb+ pupa in both the control and test cross. To analyze the adult progeny and avoid having a 2nd generation progeny develop in the vials, you collected the progeny every 12 hours. You found that while the control test gave you Hu+ flies starting at day 11, in the test vial you start seeing Hu+ flies after day17. What kind of mutation can you conclude that you are working with in the test vial? Please explain (10 minutes) 15 points

- The test mutation is a viable mutation that has delayed development.

Bonus Questions:
This question should be discussed as a group, and then answered individually. 10 points

15) You have made a screen and established 2 stocks, each with a different mutation. One stock has flies with purple eyes, and the other stock has flies with small eyes.

15a) You notice that in the purple eyed mutant line, about 1/3 of the flies have purple eyes, whereas in the small eyed mutant line, all flies have small eyes.

15b) When you cross male flies with purple eyes to females with small eyes, you get no progeny.

15c) When you cross females flies with purple eyes to males with small eyes, you got no progeny.

15d) When you cross males with normal eyes from the stock generating purple eyes to females with small eyes, you found that about 2/3 of the flies had small eyes and none had purple eyes.

What could explain all of these observations? (**10 minutes**)

- This can be explained by purple eyes being a recessive sterile mutation and small eyes being dominant mutation, which is recessive lethal, and both stocks have the same balancer. Fly genotype is purple st / TM6B and Small l /TM6B

Original research paper writing assignments:

Before the discussion of each research paper you must submit an assignment. All writing assignments must be uploaded to blackboard, brought to class as hard copies, and handed in on the due date. Because this preparation is critical for your participation in class, failing to submit this assignment before the first discussion of each paper will result in getting 0 points for the assignment.

Read the paper and write (or copy and paste) your answer to the following 3 questions into text box of Blackboard:

1) How was the reading experience?

2) Please write 3 points of interest to discuss in class (be prepared to share them in class)

3) Please write in 100 words.

1. **Background** - What is the subject? What is known about it? Why is this important?
2. **Question** - What is not known? How significant is this question?
3. **Hypothesis** - What is the author's hypothesis? What is the basis of this hypothesis? Is it significant?
4. **Method** - How did the authors study it? What are the advantages and limitations of the method?
5. **Results** - What did the authors find? Explain each finding in detail using the 7-rule.
6. **Conclusion** - What is the author's interpretation? Would you agree with that?
7. **Future direction** - What is next?

Rubric:

<table>
<tr><th>Weight</th><th>Subject/Grade</th><th>4</th><th>3</th><th>2</th><th>1 or 0</th></tr>
<tr><td>15%</td><td>Reading experience</td><td rowspan="2">Satisfactory: Clear and concise supported statement</td><td rowspan="2">Statements needs few improvements</td><td rowspan="2">Statements need substantial improvement</td><td rowspan="2">Rudimentary or missing statement</td></tr>
<tr><td>15%</td><td>Points of interest</td></tr>
<tr><td>10%</td><td>Background</td><td rowspan="7">Satisfactory:
Clear, supported by evident, Concise, and Include an evaluation</td><td rowspan="7">Can be improved:
Slight improvement is needed</td><td rowspan="7">Requires substantial improvement:
Substantial improvement is needed</td><td rowspan="7">Deficient:
Attempt was done to address the subjects
Or
Missing:
No attempt to do assignment</td></tr>
<tr><td>10%</td><td>Question</td></tr>
<tr><td>10%</td><td>Hypothesis</td></tr>
<tr><td>10%</td><td>Method</td></tr>
<tr><td>10%</td><td>Results</td></tr>
<tr><td>10%</td><td>Conclusion</td></tr>
<tr><td>10%</td><td>Future direction</td></tr>
</table>

Oral presentation:

Students will make an oral presentation to the class about their research proposal. Students in the same group will divide between themselves the proposal to equivalent parts. Presentation will consist of a multi-slide powerpoint presentation that includes: Titles, Figure panels, and the notes of the presenter with what the presenter is planning to say. At the end of the presentation the group will answer questions raised by the peer review committee and defend their proposal. Rubric:

Weight	Percent of maximal grade:	**100%** Clear, comprehensive, focus and concise	**75%** Can be improved	**50%** Requires substantial improvement	**25%** Deficient
Introductory statement: 1-3 sentence statement that describes the presentation subject, conclusion and significance					
5%					
Significance: Slides explaining the work important, providing background to what is known, and the research questions					
10%					
Innovation: A slide that provide explanation why the work is different from (better than) what has been done before					
5%					
Question, Aim, and Hypothesis: One or more slides that describe the question, hypothesis and over all approach					
10%					
Research approach: Explaining the activities that will be performed to achieve any of the aims					
5%					
Research Design: explaining each of the activities in detail including, methods, Reagents, Equipment, Animal #, Statistics, Controls, Replication, Results, Interpretation and Time					
20%					
Outcome: for each aim					
10%					
Pitfall and alternative strategies: for each aim					
5%					
Time line: Graphical summery of the time each aim and activity is expected to take					
5%					
Future direction					
5%					
General					
10%	Slide Titles	Described concisely the take home message	Vague, too long or not to the point	Do not include the slide premise	Missing
5%	Cohesiveness of presentation	There is clear connection in the transition between slides	There is connection in the transition between slides that can be improved	The transition between slides needs major improvements	Missing
5%	Presentation mechanics	Students faced the audience and pointed to all slide elements at the appropriate time.	Students inconsistently faced the audience or pointed to slide elements.	Students rarely faced the audience and pointed to the slide elements .	Students did not face the audience and point to the slide elements.
5%	Questions and answer section	Question content is repeated and not its tone and answer is the point	Inconsistent question repeating or answer question tone or answer is unfocused	Failing to repeat question and provide answer that needs major improvements	Failing to repeat question and provide irrelevant or wrong answer

Grant proposal: (20%):

The final term paper will be a 6 page (not more) grant proposal including additional few pages with bibliography:

1. Title (10%)– clear, concise, comprehensive and focused
2. Aim page (20%) – includes a hypothesis and at least one aim
3. Significance (10%) - What is the subject? What is known about it? What is not known? Why is this important?
4. Innovation (5%)
5. Approach (for each aim) (to a total of 34%)
    a. Introduction (3%)
    b. Justification and Feasibility (3%)
    c. Experimental design (or each activity) (to a total of 22%)
        i. Approach (2%)
        ii. Methods (2%)
        iii. Reagents (2%)
        iv. Equipment (2%)
        v. Animal # (2%)
        vi. Statistics (2%)
        vii. Controls (2%)
        viii. Replication (2%)
        ix. Expected Results (2%)
        x. Interpretation (2%)
        xi. Time (2%)
    d. Expected Outcomes (3%) - What are your expected results if your hypothesis is correct or incorrect?
    e. Potential problems & Alternative Strategies (3%)- What are potential pitfalls that can prevent you from getting any progress?
6. Timeline (6%)
7. Future Direction (5%) - What is next?
8. References (5%)
9. Correct format (5%)

Rubric: Section of your assigment will be highlited acording grading

4	3	2	1 or 0
Satisfactory: Clear, supported by evident, Concise, and Include an evaluation	Can be improved: Slight improvement is needed	Requires substantial improvement: Substantial improvement is needed	Deficient: Attempt was done to address the subjects Or Missing: No attempt to do assignment

All writing assignments format: Do not exceed the page limits for whole assignments or part of them. Use Arial font 11. Page margins are 1 inches. Use single-spaced pages. Remember, scientific writing should always be simple, clear, and concise. Not adhering to the format guidelines will result in rejecting assignments or severly reducing the grade. The only accepted format is Microsoft Word Document.

Statement on academic dishonesty: Students handing in assignments that do not represent their own work will receive a failing grade in this course. This means that you cannot copy the instructor's examples and simply modify a few words. Even if you need to express a similar concept, you will need to reconstruct each sentence and paragraph in your own words.

Grades:

	100-93 A	92-90 A-
89-87 B+	86-83 B	82-80 B-
79-77 C+	76-73 C	72-70 C-
69-67 D+	66-63 D	62-60 D-
59- 0 F		

Students can ask instructor to get a pass or no pass grade

We will use Blackboard all the time. Announcements will be routinely posted on Blackboard with your assignments. Please check it often.

Instructors:

Tomer Avidor-Reiss, Ph.D.

- Office / Office Hours: Wolfe Hall room 4259B / By appointment and during the hour after recitation

- Email: Tomer.AvidorReiss@utoledo.edu
  Please make sure the subject line start with: "BIOL4910-024"

- Website: Go to "https://blackboard.utdl.edu/webapps/login/", Log in using UTID and University of Toledo password and then select "BIOL 4910 022 CRN 39651"

Sarah Elizabeth Hynek, B.Sc.

- Office: Wolfe Hall room 4259

- Email: Sarah.Hynek@rockets.utoledo.edu
  Please make sure the subject line start with: "BIOL4910-024"

Important dates:

- Holidays: xxx – *No class*

Suggested literature:

Scientific Writing and Communication Papers, Proposals, and Presentations by Angelika H. Hofmann

Description (as appears on http://www.oup.com/us/catalog/general/subject/LifeSciences/~~/dmlldz11c2EmY2k9OTc4MDE5NTM5MDA1Ng)

A practical presentation carefully introduces such basic writing mechanics as word choice and word location, sentence structure, and paragraph organization before moving into manuscript planning and organizational strategies. Extensive hands-on guidance for composing scientific documents and presentations then follows.

Relevant and multi-disciplinary examples taken from real research papers and grant proposals by writers ranging from students to Nobel Laureates illustrate clear technical writing as well as common mistakes that one should avoid. Examples are drawn from a broad range of scientific disciplines including medicine, molecular biology, biochemistry, ecology, geology, chemistry, engineering, and physics.

Writing guidelines and revision checklists warn scientists against common pitfalls and equip them with the most successful techniques to revise a scientific paper, review article, or grant proposal.

Eight chapters on grant writing demonstrate how to write successful grant applications and how to avoid the most common application mistakes.

Experimental Design for Biologists by David J. Glass

Publication Date: November 28, 2006 | ISBN-10: 0879697350 | ISBN-13: 978-0879697358 | Edition: 1

Book Description as appears at the book web site (http://www.amazon.com/Experimental-Design-Biologists-David-Glass/dp/0879697350):

"The effective design of scientific experiments is critical to success, yet graduate students receive very little formal training in how to do it. Based on a well-received course taught by the author Experimental Design for Biologists fills this gap. 'Experimental Design for Biologists' explains how to establish the framework for an experimental project, how to set up a system, design experiments within that system, and how to determine and use the correct set of controls. Separate chapters are devoted to negative controls, positive controls, and other categories of controls that are perhaps less recognized, such as "assumption controls," and "experimentalist controls." Furthermore, there are sections on establishing the experimental system, which include performing critical "system controls." Should all experimental plans be hypothesis-driven? Is a question/answer approach more appropriate? What was the hypothesis behind the Human Genome Project? What color is the sky? How does one get to Carnegie Hall? The answers to these kinds of questions can be found in Experimental Design for Biologists. Written in an engaging manner, the book provides compelling lessons in framing an experimental question, establishing a validated system to answer the question, and deriving verifiable models from experimental data. Experimental Design for Biologists is an essential source of theory and practical guidance in designing a research plan".

How to give a good talk.

Alon U. Mol Cell. 2009 Oct 23;36(2):165-7.

Abstract: "We depend on talks to communicate our work, and we spend much of our time as audience members in talks. However, few scientists are taught the well-established principles of giving good talks. Here, I describe how to prepare, present, and answer questions in a scientific talk. We will see how a talk prepared with a single premise and delivered with good eye contact is clear and enjoyable".

Style: Lessons in Clarity and Grace (10th Edition) by Gregory G. Colomb and Gregory G. Colomb

This book explains how to write clearly, simply and concisely