



**College of Arts and Sciences  
Department of Biology  
Principles of Biology I (211-01)  
Spring 2019 Syllabus**

**Course intended for partial fulfillment of the Pitt State pathway curriculum**

**Time:** Lecture M-W-F 9:00-9:50; Room 307, Russ Hall  
Lab T 10:00-11:50 Room 216 Heckert-Wells Hall

**Instructor:** Dr. Phillip Harries

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**Office Hours:** 10AM – 12PM M-F (or by appointment)

## **PITT STATE PATHWAY**

### ***Mission Statement***

The Pitt State Pathway curriculum serves as the heart of the university education by fostering interdisciplinary competencies that typify the educated person. It is designed to facilitate the development of key proficiencies including communication and information literacy. The Pitt State Pathway curriculum provides a transformational experience that challenges students to think creatively and critically, and to immerse themselves in the productive examination of humans in their global setting. By encouraging the development of skills that promote life-long learning, the Pitt State Pathway fosters a sense of personal responsibility, an appreciation of diversity, and an understanding of interconnectedness in our truly global society.

### ***Pitt State Pathway Pillar to Be Covered in This Course***

#### ***Global Understanding and Civic Engagement***

As global citizens, students need a comprehensive understanding of where they live and of the larger, interconnected global system of which they are part, and on which they depend. While identifying commonalities among people and places is important, it is crucial that students understand and appreciate the diverse cultural, social, political, economic, and environmental contexts that create differences. Understanding the role of responsible citizens in their own community and beyond ensures effective and ethical participation at all levels. Students also need to understand how biological, physical, and chemical systems work, how they change naturally, and how they can change due to human involvement. Understanding the implications of the interaction between humans and non-human systems is essential for long-term decision-making.

*Learning Outcome:* Students will explore global systems conscientiously.

#### ***Quantitative/Analytic Methods and Scientific Literacy***

Students will be able to apply quantitative and scientific methods to answer questions and to effectively communicate the results in a variety of formats (e.g. tables, graphs, statistical inference, and mathematical equations). Quantitative literacy is the ability to recognize and analyze numerical problems through the use of formal tools (e.g. logical or statistical inference, probability, or mathematical analysis) to draw valid conclusions using higher-order thinking skills. Scientific literacy is the ability to apply systematic methods of inquiry to solve objective questions using evidence-based reasoning.

*Learning Objective:* Students will analyze data logically.

## ***Pitt State Pathway Core Element to Be Covered in This Course***

### ***Natural World within a Global Context***

Biological, physical, and chemical systems form the context for life. Students need to understand how these systems work, how these change naturally, and how these can change as a result of human activities. The implications of these changes are essential for long-term decision-making. Competency in this element means:

- Analyzing biological, physical, and/or chemical systems;
- Evaluating the implications of changes that result from interactions between natural and human systems.

## ***Pitt State Companion Element to Be Covered in This Course***

### ***Scientific Inquiry***

The scientific method is the systematic approach to understanding the world around us. Through experimentation and hypothesis testing, students will apply analytical skills and appropriate methods of scientific inquiry (i.e. qualitative and quantitative) to solve a variety of research questions. Competency in this element means:

- Composing appropriate research questions and hypotheses, drawing from experts, reliable sources, or previously collected data;
- Collecting, synthesizing, and analyzing data from multiple sources;
- Drawing logical conclusions, assessing for gaps or weaknesses, and addressing potential consequences and implications;
- Communicating results using appropriate delivery methods or formats.

## **Course Description:**

This course provides an introduction to and overview of a wide array of topics in Biology. We will cover everything from basic organic chemistry to molecular biology, genetics, and evolution. This course is intended for science majors and is designed to give you the solid footing required to succeed in upper division biology classes.

### **Course Objectives:**

Students who complete this course will be able to:

1. Demonstrate an understanding of the basic principles, facts, and theories of the biological sciences
2. **Analyze** various biological processes through experimentation in a laboratory setting
3. Demonstrate an understanding of the basic methods of inquiry, analysis, and description in the biological sciences.
4. **Describe** basic biochemical molecules
5. **Describe** the key structures and functions of living cells
6. **Explain** energy concepts and key biochemical processes in living cells including enzymes, cellular respiration, fermentation, and photosynthesis
  - a. Sustainability: Students will **explain** the complementation between photosynthesis and respiration and how their balance is essential for life on earth.
7. **Explain** the forms and processes of cell division
8. Identify the basic principles of Mendelian and molecular genetics, and relate these to the basic principles of Natural selection and evolution. **Analyze** data from genetic crosses
9. **Describe** the basis of heredity and the connection between genes and proteins
10. **Explain** genomes and the way in which gene expression and mutation can affect development and evolution
11. Discuss the patterns and processes of evolution of life on earth
12. **Describe** key features of bacteria, Archaea and viruses
  - a. Sustainability: Students will demonstrate an understanding of the key role bacteria play in nutrient cycling.
13. Discuss the application of the biological sciences to medicine and the advancement of biotechnology.

## **Student Responsibilities:**

**Readings:** We will be using **Life: The Science of Biology** by Sadava, Hillis, Heller, Berenbaum, 11<sup>th</sup> edition, ISBN: 978-1-3190-1016-4; available at the bookstore or online at various retailers. I appreciate that textbooks are a significant expense but this book will be used not only for this course but also for Principals of Biology II. Reading the book is an integral part of this course. Read the chapters that will be covered in lecture before coming to class. If

you do not have the book you will severely limit your ability to succeed in this course! The lab manual is available for sale in the bookstore or is available on Canvas. If you download from Canvas you will need to print the 80 page manual. Please bring the lab manual with you to lab each week.

**Attendance:** Attendance is expected. If you know in advance that you will miss a class, let me know. If you miss class unexpectedly, let me know as soon as possible afterward to discuss the material. It is not possible to make up labs.

**Academic Integrity:** All students at PSU are expected to maintain high standards of academic integrity. University policy states that “When an instructor has a reasonable good faith belief that a student(s) has committed academic misconduct, that instructor has the sole discretion to give the student an F on the assignment/test to which the student committed academic misconduct or an F for the entire course.” Such an incident may also be reported as an FX (failed for academic dishonesty) on a student’s transcripts. Let’s not go there. No phones or programmable calculators will be allowed during exams.

**Classroom Protocol:** Let’s create a courteous, respectful classroom environment. Please silence and put away your cell phones during class. Laptops are fine if they are being used to take notes. Late arrivals, early departures, and inappropriate conversations are all unacceptable distractions.

**Academic Accommodations:** All students are expected to meet the standards for this course as set by the instructor. However, students with learning disabilities who may need reasonable accommodations should discuss options with the Center for Student Accommodations (x4452) during the first two weeks of class. The CSA will contact professors with suggested classroom needs and accommodations. Approved documentation needs to be on file in the CSA prior to the start of the semester.

**Additional Information:** Please see the PSU syllabus supplement at the following link for more important dates and information: [https://www.pittstate.edu/registrar/\\_files/documents/syllabus-supplement-spring-2019-updated-10-5-18-.pdf](https://www.pittstate.edu/registrar/_files/documents/syllabus-supplement-spring-2019-updated-10-5-18-.pdf)

## **Methods of Assessment:**

**Your final Principles of Biology grade will be determined by the cumulative results of lecture (75% of final grade) and lab (25% of final grade) point totals based upon a 90/80/70/60 grading scale.**

### **Lecture (75%) - Exams (500 pts)**

This course covers a lot of material so I have divided it up into a relatively large number of exams. We will have six lecture exams each worth 100 points. One score will be dropped at the end of the semester for a total of 500 exam points. If you miss an exam, this is the score that will be dropped and you will not have the opportunity to make up that exam (unless we have some prior arrangement for an excused absence). If you have an overall grade of A (90%+) going into exam 6 you may use this exam as your drop. If you do not have an A going into the last exam (exam 6), this score WILL NOT be dropped. The lowest of your first five scores will be dropped instead.

### **Review Sheets (50 pts)**

Review sheets are available on Canvas. Each review sheet is a list of questions designed to help you study for the exams. If you can answer the questions on these sheets you will be in great shape for the exams. I am more than happy to look over your review sheets to make sure you have answered them correctly. Answers to the review sheets will be turned in on exam days (consider this your ticket into the exam) and will be worth 10 points for a complete group (for example: exam 1 covers chapters 1-4 so review sheets for chapters 1-4 should be handed in at exam 1). Since I am taking your 5 highest exam grades, I will likewise include 5 review sheet grades. However, if you complete all 6 sets of review sheets, I will count the last set as 10 pts extra credit.

### **Article Analysis (25 pts)**

Over the course of the semester we will read 5 news articles related to recent topics in biology. These will be topics that students of science should be aware of. This information will not be on the exams! However, I will open an online discussion forum for each article. Discussion forums will be on Canvas. Each forum will only be open for a limited time period (due dates on Canvas). You will need to make at least two posts per discussion to get full points

and they need to be more than just a quick “I agree/disagree.” I want to see that you have read the article and put at least some thought into what you read.

## Lab (25%) -

### Exams (100 pts)

There will be two lab exams worth 50 pts each.

### Quizzes and Lab Reports (85 pts)

We will have a short quiz (5 pts each) almost every week at the beginning of lab on the material we covered the previous week. Get to lab on time or you will miss the quiz. There will not be make-ups on quizzes. Lab reports (5 pts each) will be turned in at the end of each lab period or in some cases the following class. Late lab reports will not be accepted.

### Your keys to Success:

The difficulty in this course comes from the large volume of material covered. The key to success is to stay on top of the material. Read the chapter, come to class and pay attention, then do the review sheet for that chapter shortly after the lecture. Make sure you come talk to me if you are not sure about the answers to the review sheets. If you wait to study or review until a few days before the exam it will be too late!

Your book has lots of excellent resources available: There are sample problems at the end of each chapter (answers are in the back) and lot of great stuff online (study activities, movies, podcasts etc). Use these resources! Lecture slides are available online through Canvas. Take advantage of this. If there is something you don't understand or are unsure about, come talk to me!

In lab, the key to success is to show up and pay attention. Because labs cannot be made up, you will lose valuable points if you are not there. Read the lab instructions before you arrive so the lab is not a total surprise. Review what you did the week before so you will be ready for the quiz.

### Tentative Course Schedule:

Date	Topic	Material	
January	14	Course Introduction/Syllabus/Pretest Evaluation	
	15	No Lab	
	16	Studying Life	Chapter 1
	18	Small Molecules and the Chemistry of Life	Chapter 2
	21	No Class (Martin Luther King Jr. Holiday)	
	22	Lab: Research Lit	Lab 5
	23	Proteins and Carbohydrates	Chapter 3
	25	Lipids and Nucleic Acids	Chapter 3, Chapter 4
	28	Review/catch-up	
	29	Lab: Biological Chemistry	Lab 2
30	Exam 1 (Chapters 1-4)- Review Sheets Due		
February	1	Cells - Part 1 (Article 1 forum open)	Chapter 5
	4	Cells - Part 2	Chapter 5
	5	Lab: Microscopy and Cell Function	Lab 1
	6	Cell Membranes	Chapter 6
	8	Cell Signaling and Communication	Chapter 7
	11	Review/catch-up	
	12	Lab: Enzymes	Lab 3
	13	Exam 2 (Chapters 5-7)- Review Sheets Due	
	15	Energy, Enzymes and Metabolism (Article 2 forum open)	Chapter 8
	18	Harvesting Chemical Energy- Part 1	Chapter 9
19	Lab: Cellular Respiration	Lab 4	
20	Harvesting Chemical Energy- Part 2	Chapter 9	
22	Photosynthesis	Chapter 10	
25	Review/catch-up		
26	Lab: Photosynthesis	Lab 6	
27	Review/catch-up		
March	1	Exam 3 (Chapters 8-10)- Review Sheets Due	
	4	Cell Cycle and Cell Division- Part 1 (Article 3 forum open)	Chapter 11
	5	Lab Exam 1	
	6	Cell Cycle and Cell Division- Part 2	Chapter 11
8	Inheritance, Genes, and Chromosomes- Part 1	Chapter 12	

	11	<b>No Class! Spring Break</b>	
	12	<b>No Class! Spring Break</b>	
	13	<b>No Class! Spring Break</b>	
	15	<b>No Class! Spring Break</b>	
	18	Inheritance, Genes, and Chromosomes- Part 2	Chapter 12
	19	<a href="#">Lab: Mitosis, Meiosis and Inheritance</a>	<a href="#">Lab 7</a>
	20	DNA and Its Role in Heredity- Part 1	Chapter 13
	22	DNA and Its Role in Heredity- Part 2	Chapter 13
	25	From DNA to Protein- Part 1	Chapter 14
	26	<a href="#">Lab: DNA Extraction and DNA Processing- Electrophoresis</a>	<a href="#">Lab 8 and Lab 9</a>
	27	From DNA to Protein-Part 2	Chapter 14
	29	Review/catch-up	
<b>April</b>	1	Review/catch-up	
	2	<a href="#">Lab: Systematics and Evolution</a>	<a href="#">Lab 10</a>
	3	<b>Exam 4 (Chapters 11-14)- Review Sheets Due</b>	
	5	Mutation <span style="float: right;">(Article 4 forum open)</span>	Chapter 15
	8	Regulation of Gene Expression	Chapter 16
	9	<a href="#">Lab: Bacteria - Start Lab</a>	<a href="#">Lab 11</a>
	10	Genomes	Chapter 17
	12	Genes, Development, and Evolution	Chapter 19
	15	Evolution	Chapter 20
	16	<a href="#">Lab: Finish Bacteria lab /Lab Exam 2</a>	
	17	Review/catch-up	
	19	<b>Exam 5 (Chapters 15- 17, 19, 20)- Review Sheets Due</b>	
	22	Reconstructing and Using Phylogenies <span style="float: right;">(Article 5 forum open)</span>	Chapter 21
	23	<b>No Lab!</b>	
	24	Speciation	Chapter 22
	26	Evolution of Genes and Genomes	Chapter 23
	29	Bacteria, Archaea, and Viruses	Chapter 25
	30	<b>No Lab!</b>	
<b>May</b>	1	Review/catch-up	
	3	<b>Exam 6 (Chapters 21-23, 25) - Review Sheets Due</b>	

## Sample Assessments:

### Sample Chapter Review Sheet

## Chapter 7 Review

1. **Describe** a signal transduction pathway.
2. **Compare** paracrine signals, autocrine signals, and hormone signals.
3. What does a receptor do in a signal transduction pathway?
4. **Describe** a ligand.
5. **Explain** what usually physically happens when a ligand and receptor interact. Is this interaction permanent?
6. Many signal transduction pathways contain protein kinases. What do protein kinases do?
7. Many drugs are antagonists of signaling pathways. **Justify** this statement and **explain** how do these drugs generally have their effect.
8. Most receptors are in the plasma membrane but some are in the cytoplasm. What kind of ligands would bind to a cytoplasmic receptor?
9. **Explain** how ion channel receptors work.
10. **Explain** how do protein kinase receptors work.
11. What is a phosphorylation cascade? Why are these cascades particularly useful for a signaling pathway?
12. **Describe** the steps involved with initiating a signaling pathway containing a G protein-linked receptor.
13. **Compare** first messengers and second messengers. List several common second messengers.
14. cAMP is synthesized from what molecule? What enzyme is responsible for its synthesis?
15. DAG and IP3 are synthesized from what molecule? What enzyme is responsible for their synthesis?
16. How do cells normally keep  $\text{Ca}^{2+}$  levels low in the cytoplasm?
17. **Name** two ways that cells commonly regulate signal transduction pathways (has to do with enzyme regulation).
18. **Differentiate** between three common effects (end results) of signal transduction pathways.
19. What type of cell junctions allow direct communication between cells in animals? Plants?

**Sample Exam Questions:**

**20. Mendel's crossing of spherical-seeded pea plants with wrinkled-seeded pea plants resulted in offspring that all had spherical seeds. This shows that the spherical-seed trait is**

- a. codominant.      b. dominant.      c. recessive.      d. Both a and b      e. Both a and c

**21. Pleiotropy is characterized by**

- a. an intermediate phenotype      b. a dominant phenotype  
 c. two genes controlling a single phenotype      d. one gene controlling multiple phenotypes  
 e. three or more alleles of a single gene

**22. The appearance of an organism is referred to as the organism's \_\_\_\_\_**

- a. genotype.      b. phenotype.      c. allele frequency.      d. mutation.      e. phylogeny.

**23. Design a Punnett square for the cross  $AaBb \times AaBb$ . Based on your analysis, what fraction of the offspring from this cross will have the following genotype :  $AABb$ ? Show your work in a punnett square. (2 pts for answer, 2 pts for Punnett square)**

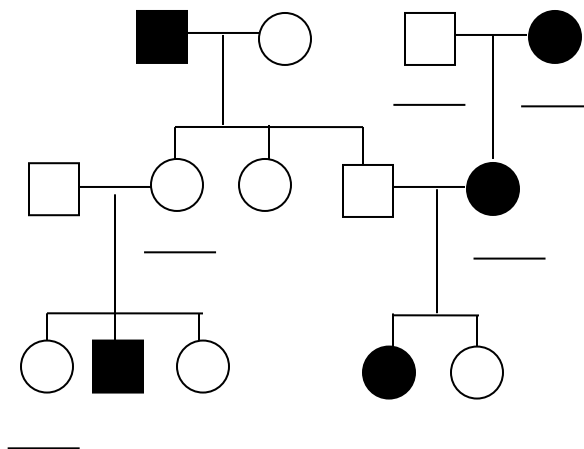
- a.  $\frac{1}{4}$       b.  $\frac{1}{2}$       c.  $\frac{1}{8}$       d.  $\frac{3}{8}$       e.  $\frac{1}{16}$

**24. Using the multiplication rule, assess the outcome of the following cross:  $DdEeFfGg \times DDEeffGg$ . What fraction of offspring will have the following genotype:  $DdEEfFGG$ ? Show your work.**

- a.  $\frac{1}{16}$       b.  $\frac{2}{16}$       c.  $\frac{1}{32}$       d.  $\frac{1}{64}$       e.  $\frac{1}{128}$

**25. The pedigree below follows inheritance of Hypertrichosis ("werewolf syndrome"- individuals have excessive hair of face and ears (yes, it's a real thing)). Based on the pedigree, is this trait dominant or recessive? \_\_\_\_\_ (1pt)**

**Examine the pedigree below and fill in the blank lines with the genotypes of the individuals above each line (use the letters A and a to represent the alleles of the gene controlling this trait) (5pts)**



## Sample Article Analysis:

☰ 19SP-BIOL-211-01 > Discussions > Discussion Forum 2

19 Spring

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This is a graded discussion: 5 points possible due Feb 20

### Discussion Forum 2

Please read the following interview with Craig Venter: [Craig Venter Interview.pdf](#)

Venter is a big figure (and personality) in the world of molecular biology. He led one of the first efforts to sequence the human genome and a few years ago he made headlines by creating the first "synthetic cell." In this effort, his team basically synthesized a bacterial genome from scratch in the lab and then introduced that genome into a bacterial cell that had its genome removed. In this interview he discusses this synthetic cell as well as a number of other projects he is working on. What do you think of these projects? Are they a good idea or a bad idea? Why?

**Compose** a new post in this discussion with your **appraisal** of the article. This doesn't have to be particularly lengthy but should be **critical assessment** of the article. **To get full points you will need to give your own thoughts in a post and also reply to at least two other posts.** I look forward to hearing what you have to say!

Search entries or author Unread 👁️ ⬆️ ⬇️ ✓ Subscribe

↩ Reply

## Sample Laboratory Analysis:

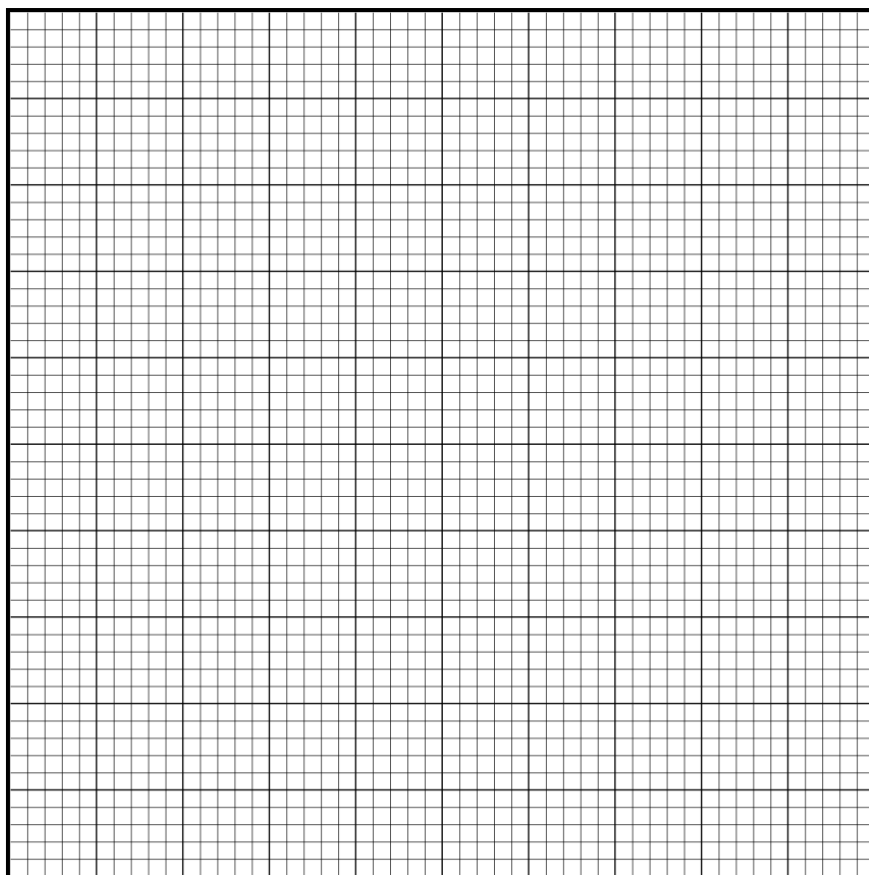
**Report Form:**  
**Lab 3. Enzyme Action**

**Name** \_\_\_\_\_

*1. Preparation of Standard Curve*

Table 1. Standard curve of absorbance of p-nitrophenol at 410 nm.

Test Tube	# 1	# 2	# 3	# 4	# 5	# 6
p-nitrophenol (mM)	0.00	0.02	0.05	0.10	0.20	0.50
absorbance	_____	_____	_____	_____	_____	_____



*Fig 1.*

a. Do your points fit well on the best fit straight line? If not, why do you think this could be the case?



b. What do the readings from the spectrophotometer mean? In other words, explain why more product results in a higher reading on the spectrophotometer.

2. *Effect of Changing Substrate Concentration*

Table 2. Absorbance of p-nitrophenol at 410 nm as a function of substrate concentration.

<b>Tube</b>	<b>Substrate Concentration (mM)</b>	<b>Absorbance</b>	<b>Concentration (mM)</b>	<b>Activity (mM/minute)</b>
#1	0.0			
#2	0.1			
#3	0.5			
#4	1.0			
#5	5.0			
#6	10.0			
#7	20.0			

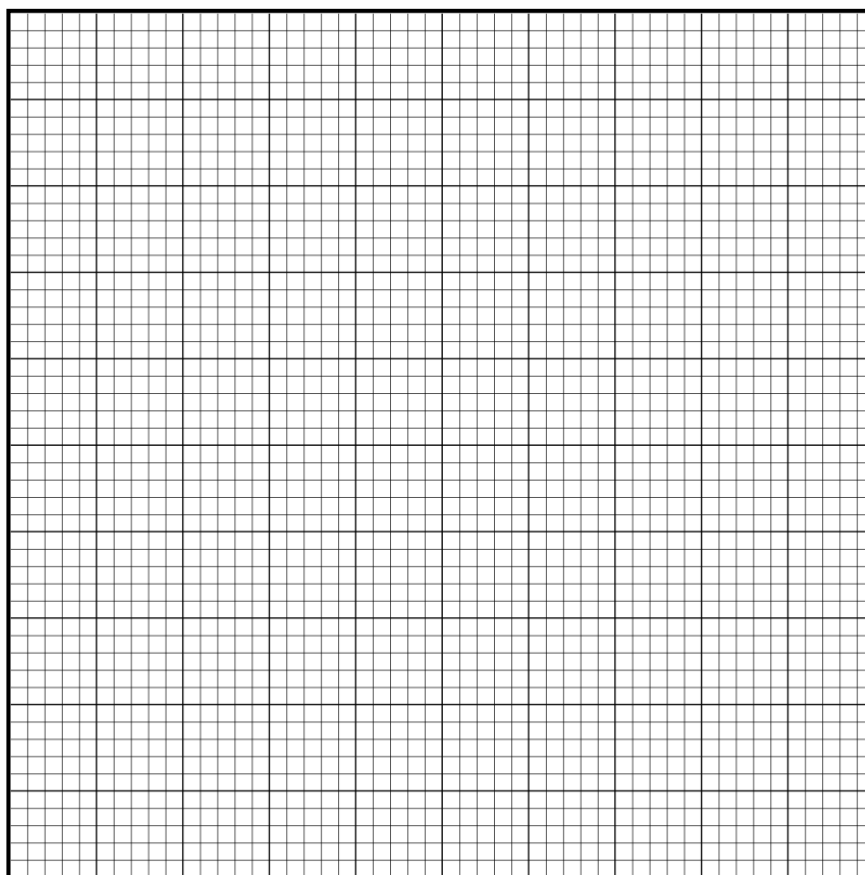


Fig 2.

Describe the shape of your curve in Figure 2. Why did increasing substrate concentration result in this type of pattern?

### 3. Effect of Changing pH

Table 3. Absorbance of p-nitrophenol at 410 nm as a function of pH

Tube	Buffer pH	Absorbance	Concentration (mM)	Activity (mM/minute)
#1	3			
#2	4			
#3	5			
#4	7			

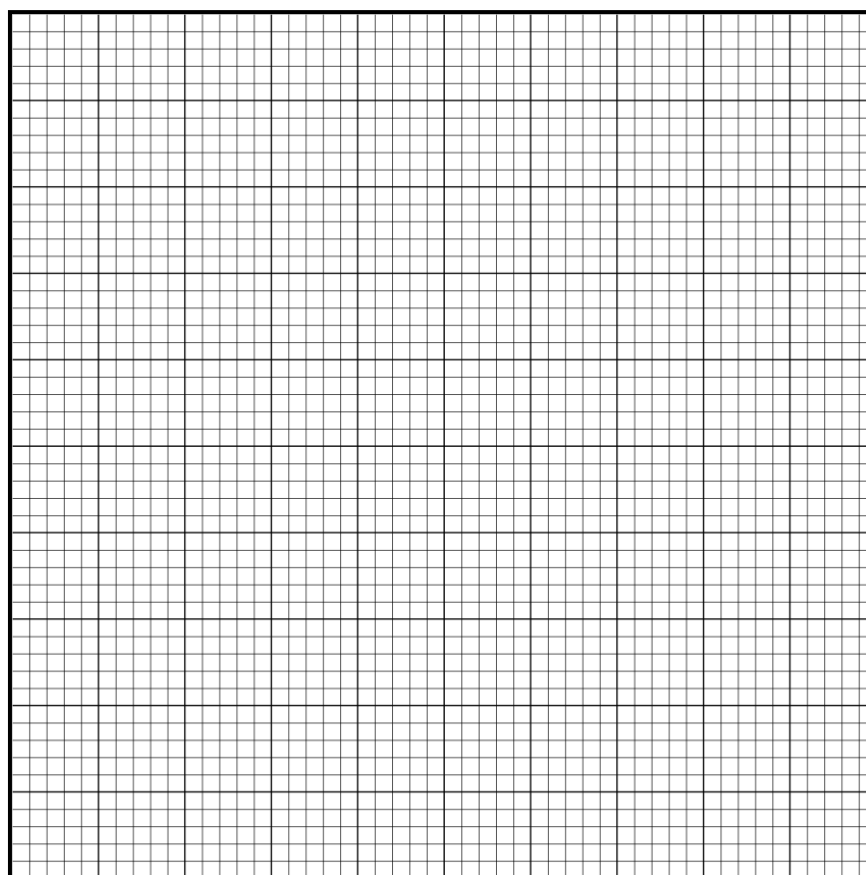


Fig. 3

a. Describe the relationship between enzyme activity and buffer pH based on the data in Fig. 3. What mechanism(s) explain this pattern?

b. Recalling what you know about pH, why is there such a large change between only one pH unit on either side of the optimum?