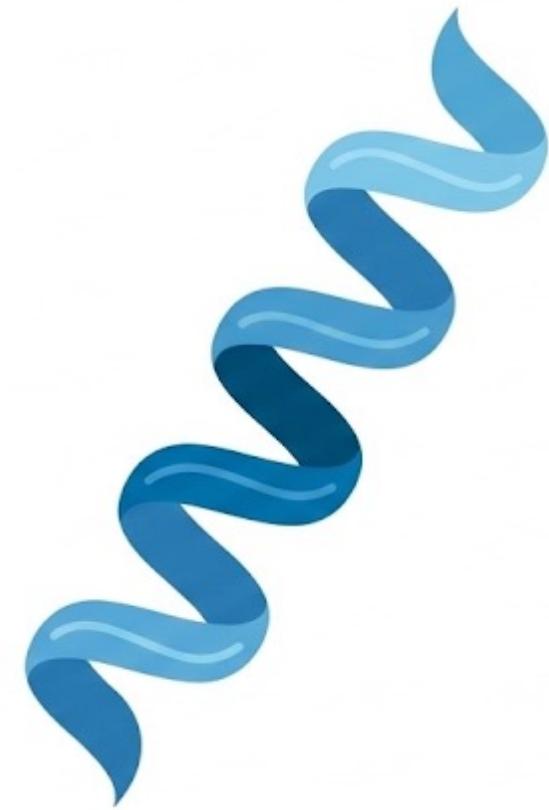


# Biology 3030: Biochemistry

Spring 2026





# Today's Goals



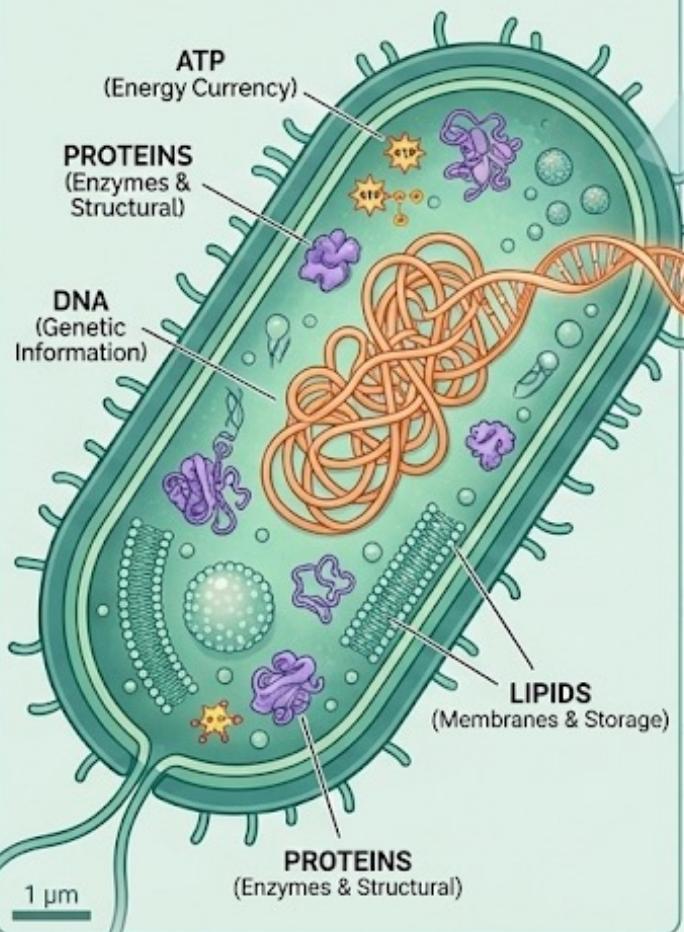
- Why biochemistry matters (and why now)
- How this course works
- How to succeed
- Getting started
- [BREAK] \_\_\_\_\_
- Chapter 1: The Unity of Life

Why We're Here

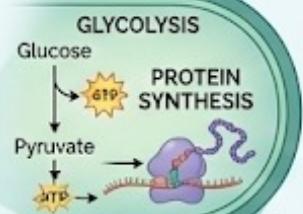
# 'BIOCHEMICAL UNITY ACROSS LIFE: FROM BACTERIA TO MAMMALS'

## LEFT PANEL

*E. coli* (Bacterium) - Prokaryote

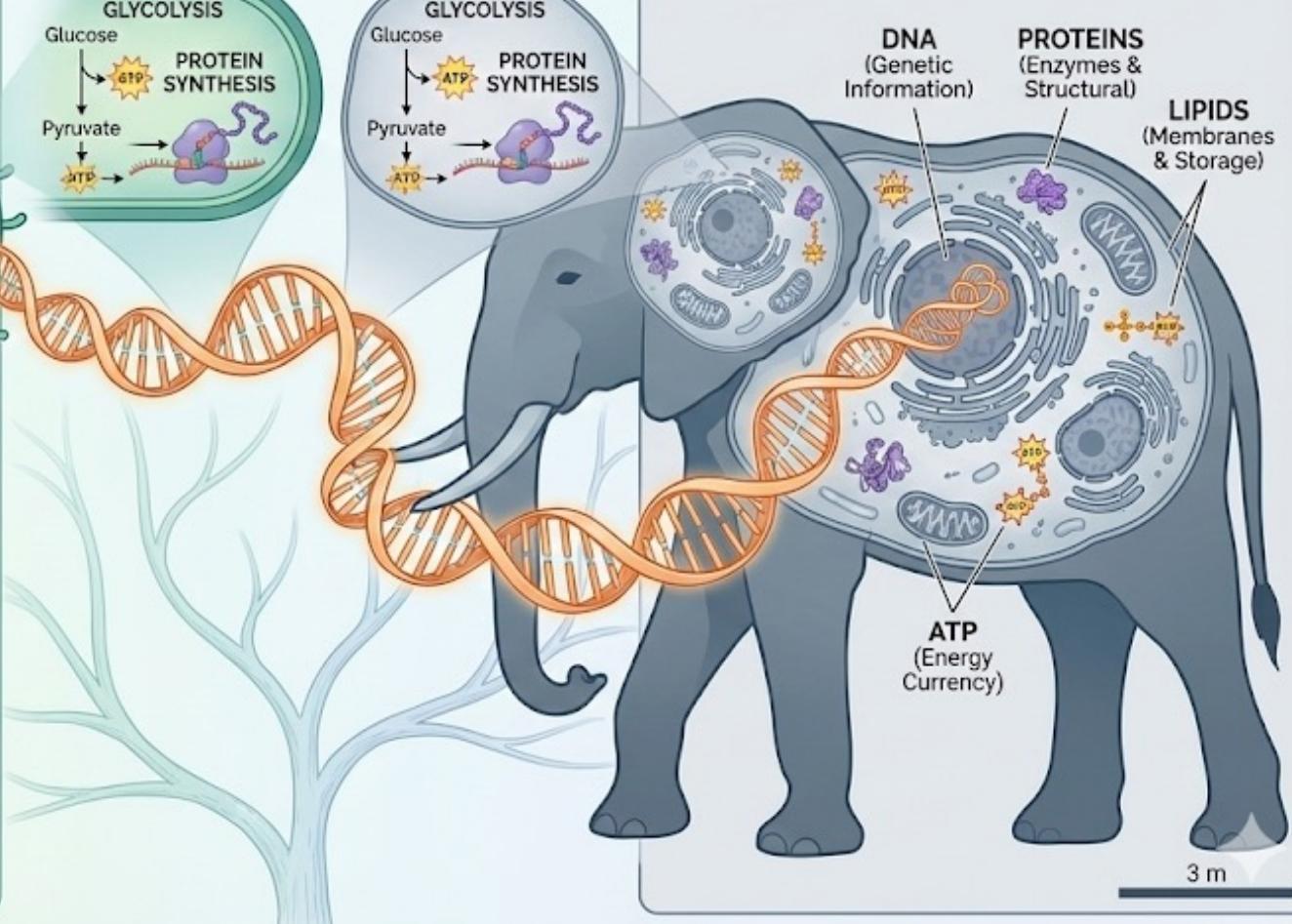


## CENTER

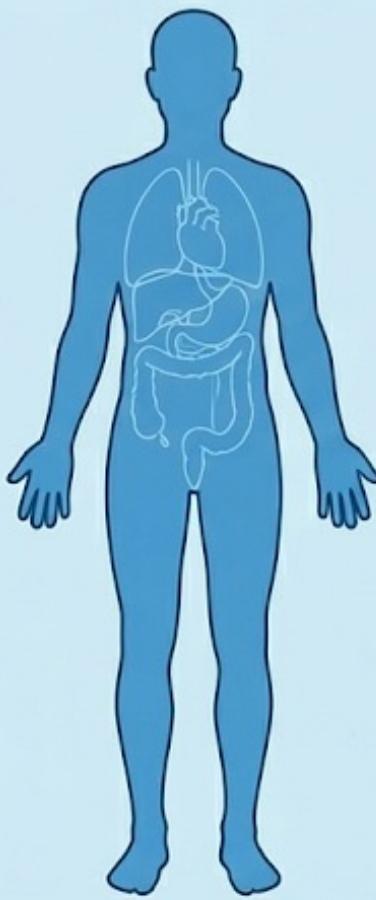


## RIGHT PANEL

African Elephant (Mammal) - Eukaryote



# THE MOLECULAR BASIS OF LIFE

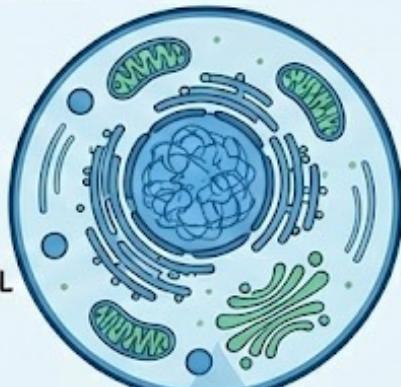


MACROSCOPIC  
TO  
MICROSCOPIC



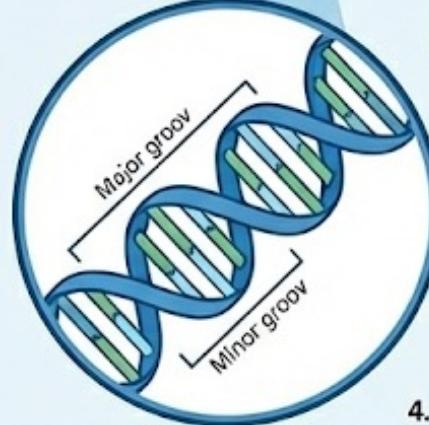
1. ORGAN & TISSUE LEVEL

ZOOM IN



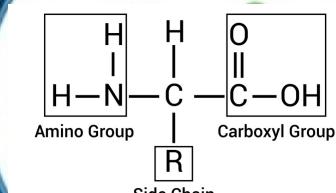
2. CELLULAR LEVEL

ZOOM IN



3. MOLECULAR LEVEL (DNA)

ZOOM IN

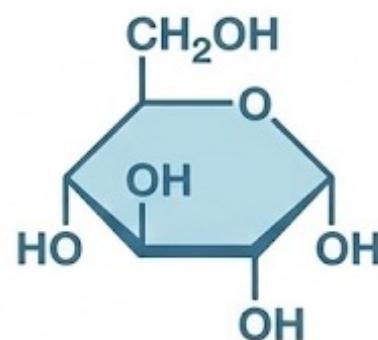


4. MOLECULAR LEVEL  
(AMINO ACID)

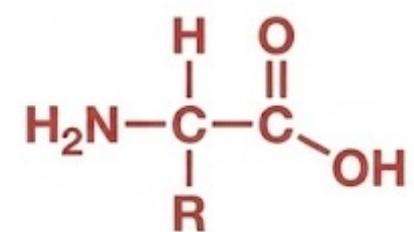
Everything you experience is mediated by molecules. Understanding this language reveals the rules of biochemistry.



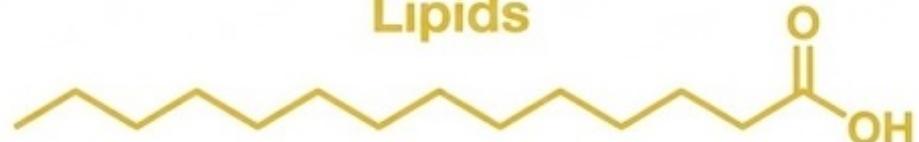
### Carbohydrates



### Proteins



### Lipids



### Nucleic Acids



# The Future is Biochemistry

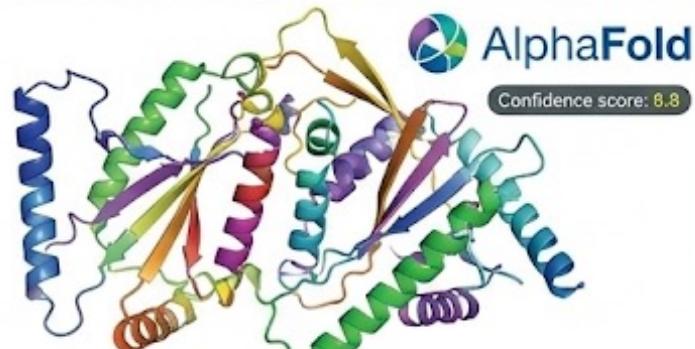
## GENOME EDITING (CRISPR)



## ADVANCED VACCINES



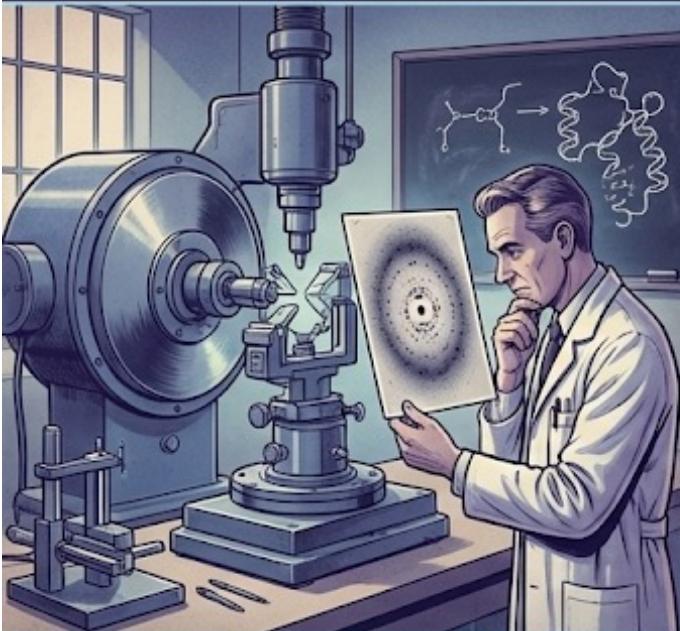
## PROTEIN DESIGN (AlphaFold)



## DRUG DISCOVERY



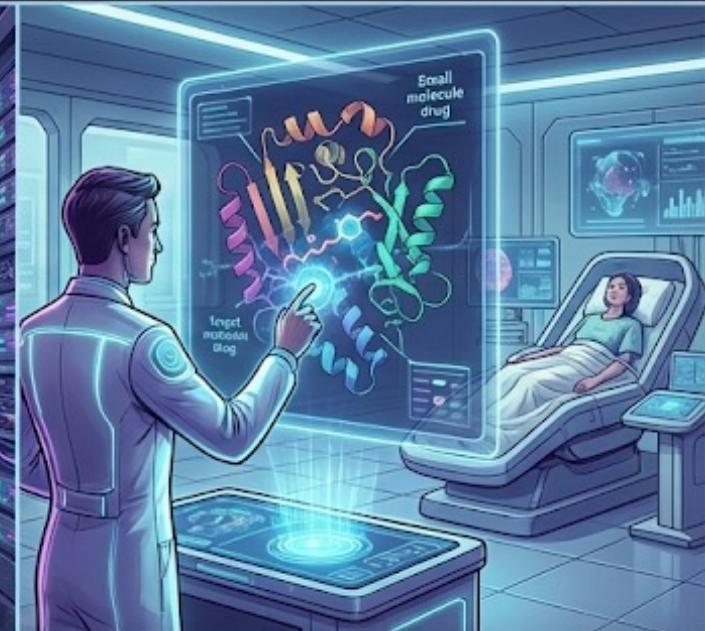
# THE EVOLUTION OF PROTEIN STRUCTURE DETERMINATION



1950s–2020: Years per structure.



2020: AlphaFold—minutes per structure



2025+: AI-designed medicines



## 2024 Nobel Prize in Chemistry: AI Protein Prediction

- AlphaFold turned protein structure prediction into something fast and scalable
- Why you should care: structure helps explain function, disease, and drug design
- This course teaches you the rules underneath the predictions

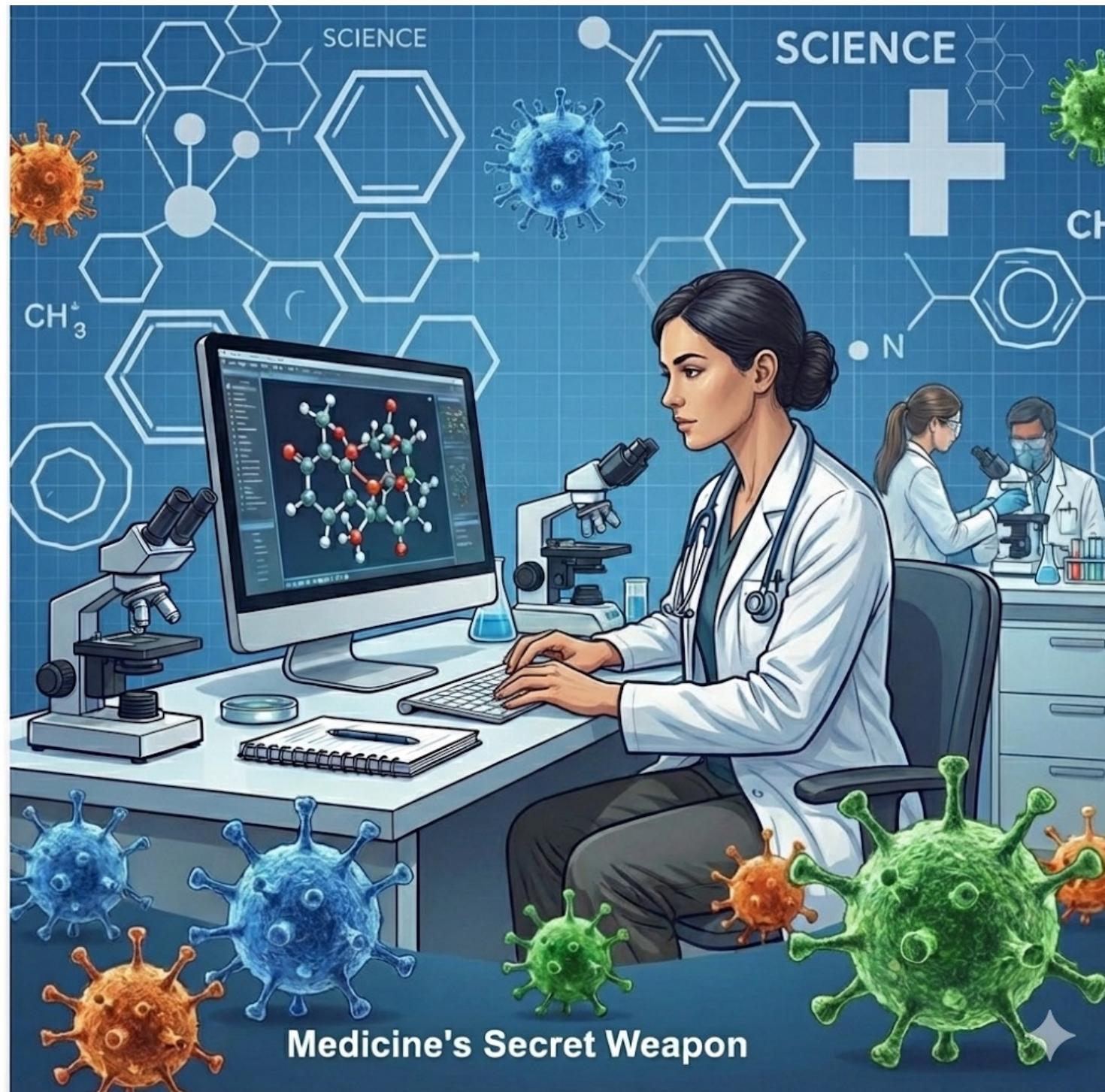
# Why do we care?

**BREAKTHROUGH  
ALERT: Ozempic &  
The "Weight Loss"  
Revolution!**

How a tiny molecule is  
reshaping health headlines  
(and waistlines).

**SEMAGLUTIDE  
(Ozempic)**

The Biochemistry Behind the Buzz:  
Understanding the GLP-1 Agonist Structure



Medicine's Secret Weapon

# This will be challenging



Edmund Hilary (you) Tenzig Norgay (me)



## How This Course Works

# BIOL 3030: Biochemistry

Spring 2026

**Credits:** Three credit hours

**Lecture:** **2 sections:** Tuesday/Thursday 2:00-3:15pm and 3:30-4:45 Chemistry 402

**Discussion:** **2 sections:** Tuesday 5:00-7:00pm, Chemistry 402 and Gilmer 301

## Instructor

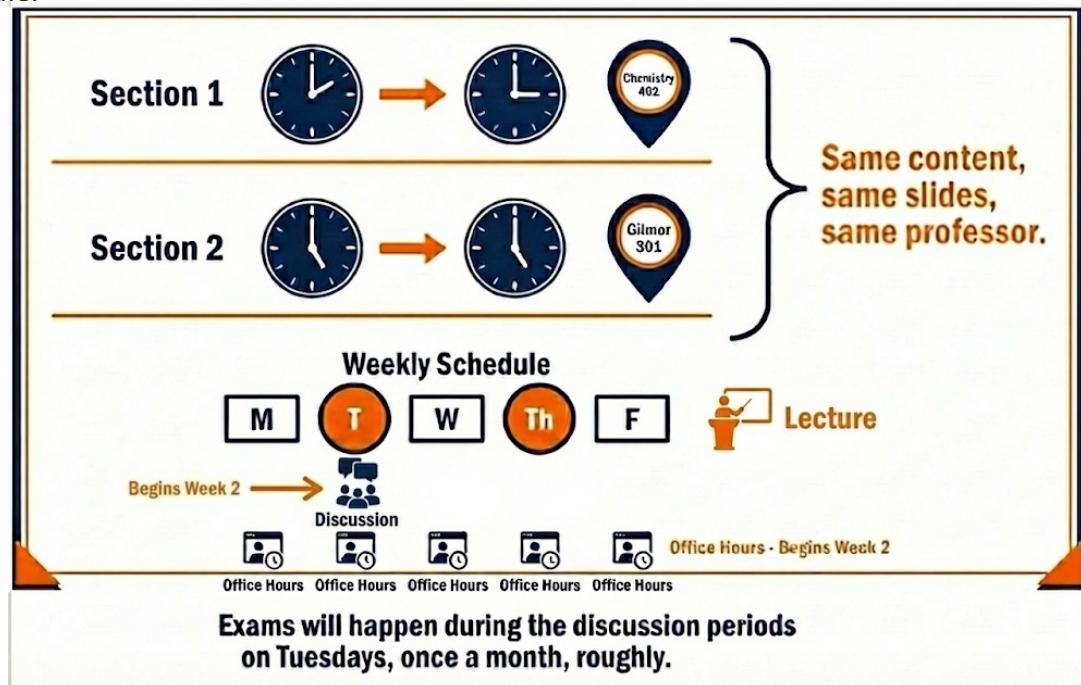
**Christopher Deppmann**

Email: deppmann@virginia.edu

Office Hours: Monday 11:00am-12:00pm

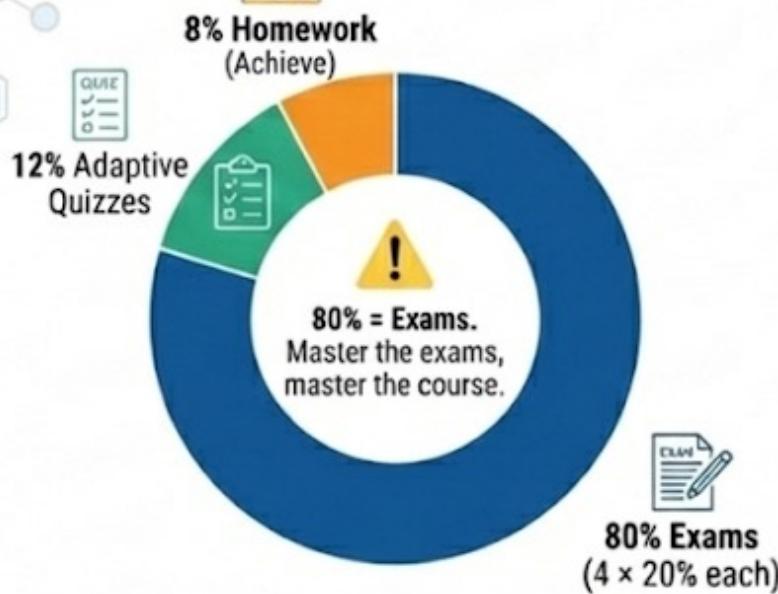
Location: <https://virginia.zoom.us/j/2854285879>

For individual appointments at other times, please email to schedule.

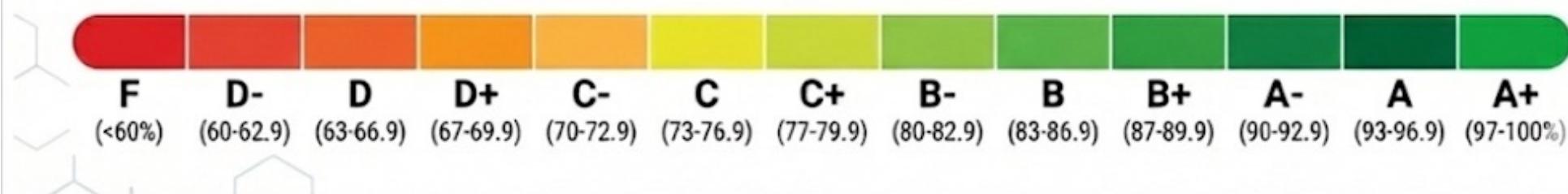


# Logistics

## Grading Structure (Spring 2026)



Component	Weight	Details	Drop Policy
Exams	80%	4 exams at 20% each	Drop lowest (best 3 at 26.67% each)
Adaptive Quizzes	12%	~30 quizzes, graded for correctness	Drop 2 lowest
Homework	8%	~30 assignments, graded for correctness	Drop 2 lowest
Extra Credit	Up to 2-3 pts/exam	Announced in discussion sessions	Added as percentage points to exam scores



**LEVEL 1**

Quick questions? Post on Piazza.  
Average response: 2 hours.

**LEVEL 2**

Conceptual help? UTA Office Hours.  
See schedule on Canvas.

**LEVEL 3**

Still stuck? GTA Office Hours or email.

**LEVEL 4**

Complex issues? Professor Deppmann.  
Email for appointment.

← Start at the top—most questions answered within hours.

# Getting help: Instructional team



## Graduate TAs

- **Jennie Nguyen:** war2ca@virginia.edu
- **Monika Wieliniec:** qdc5xu@virginia.edu
- **Megan Garris:** fmk3uc@virginia.edu
- **Andrew Spira:** abs6ken@virginia.edu

## Undergrad TAs and Question Escalation

Last Name Prefix Range	Pod	Assigned UTA	UTA email	Assigned GTA	GTA email
AA - BA	1	Emma Guo	tbg2rr@virginia.edu	Andrew Spira	<a href="mailto:abs6ken@virginia.edu">abs6ken@virginia.edu</a>
BE - CHEN	2	Sarah Cheon	ucy5db@virginia.edu	Andrew Spira	<a href="mailto:abs6ken@virginia.edu">abs6ken@virginia.edu</a>
CHH - DR	3	Sebastian Moeller	hpp3nu@virginia.edu	Andrew Spira	<a href="mailto:abs6ken@virginia.edu">abs6ken@virginia.edu</a>
DU - GHO	4	Annie Zhao	ttd8us@virginia.edu	Andrew Spira	<a href="mailto:abs6ken@virginia.edu">abs6ken@virginia.edu</a>
GI - HOO	5	Abhi Kodali	mkp7bd@virginia.edu	Jennie Nguyen	<a href="mailto:war2ca@virginia.edu">war2ca@virginia.edu</a>
HOU-KHA	6	Julia Kim	uwq6qw@virginia.edu	Jennie Nguyen	<a href="mailto:war2ca@virginia.edu">war2ca@virginia.edu</a>
KI - LEE	7	Alina Alfaro	sgw3ms@virginia.edu	Jennie Nguyen	<a href="mailto:war2ca@virginia.edu">war2ca@virginia.edu</a>
LEI - MEE	8	Phillip Friedman	vds6vh@virginia.edu	Jennie Nguyen	<a href="mailto:war2ca@virginia.edu">war2ca@virginia.edu</a>
MEH - NGU	9	Tanmayi Alaparti	qbd7vb@virginia.edu	Megan Garris	<a href="mailto:fmk3uc@virginia.edu">fmk3uc@virginia.edu</a>
NI - PRA	10	Nasim Abib	rhu2xr@virginia.edu	Megan Garris	<a href="mailto:fmk3uc@virginia.edu">fmk3uc@virginia.edu</a>
PRE - SCA	11	Hemanya Bhatt	jyb3bt@virginia.edu	Megan Garris	<a href="mailto:fmk3uc@virginia.edu">fmk3uc@virginia.edu</a>
SCH - STR	12	Deetya Gupta	zpz3vw@virginia.edu	Monika Wieliniec	<a href="mailto:gdc5xu@virginia.edu">gdc5xu@virginia.edu</a>
SUH - WAN	13	Maggie Flynn	rgr5eg@virginia.edu	Monika Wieliniec	<a href="mailto:gdc5xu@virginia.edu">gdc5xu@virginia.edu</a>
WAT - ZHO	14	Autumn Bisset	wnp7uy@virginia.edu	Monika Wieliniec	<a href="mailto:gdc5xu@virginia.edu">gdc5xu@virginia.edu</a>

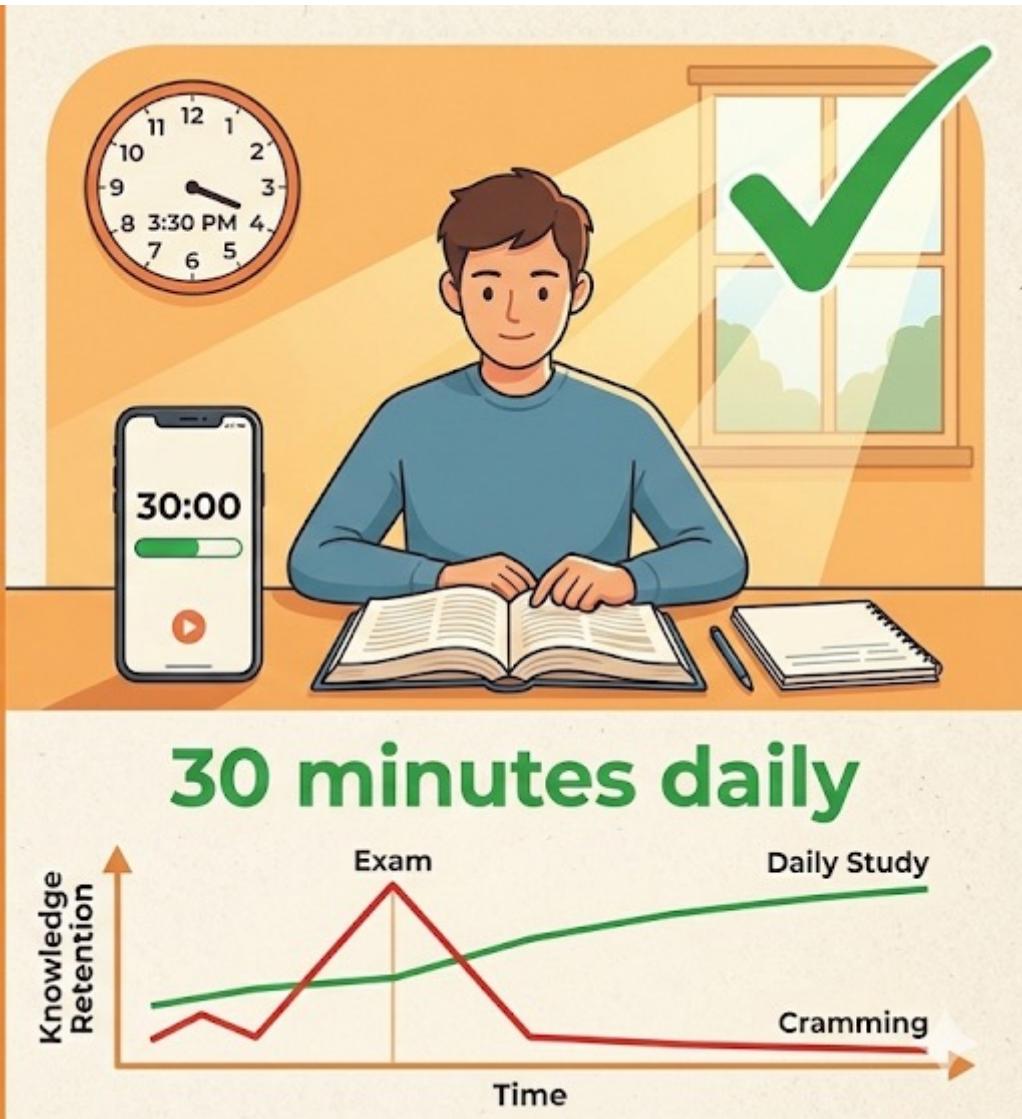
## Office Hours

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00					
9:15		9-10 am OFFICE HOURS		9-10 am OFFICE HOURS	
9:30					
9:45					
10:00					
10:15				10 - 11 am OFFICE HOURS	
10:30					
10:45					
11:00	11am - 12 pm DR. DEPPMANN'S OFFICE HOURS				
11:15					
11:30					
11:45					
12:00					
12:15					
12:30		12:30 - 1:30 pm OFFICE HOURS		12:30 - 1:30 pm OFFICE HOURS	
12:45					
13:00					
13:15					
13:30					
13:45					
14:00					
14:15					
14:30					
14:45					
15:00					
15:15	3:00 - 4:00 pm OFFICE HOURS	Lectures		Lectures	
15:30					
15:45					
16:00					
16:15					
16:30					
16:45					
17:00					
17:15					
17:30					
17:45					
18:00					
18:15	6 - 7 pm OFFICE HOURS		6 - 7 pm OFFICE HOURS		
18:30					

Zoom link for office hours-(note that this is different from Deppmann's)  
<https://virginia.zoom.us/j/94996349116?pwd=sF0tCAJYpcaCj93aqLBfzFBNacYap1.1>



**6-hour cram session  
before exam**



# Biochemistry Course: Assignments & Success Strategies

## QUIZZES = STAY ON TRACK



Due the day of lecture



Designed for active learning and feedback



Keep answering until you reach full credit



No reason not to earn 100 percent



### Early Semester Grace Period

First few quizzes

No late penalty for being a day or two late



Answer  
Try Again



Stop early and the score at that point is what gets recorded.

## HOMEWORK = EXAM PREP



Due the day before each exam



No extensions available



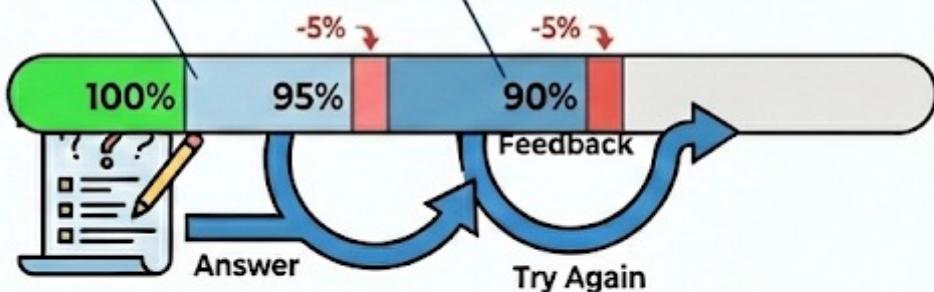
Purpose: Help you prepare for the exam



Unlimited attempts per question

5% penalty for each incorrect attempt

Questions often worth 100 points



These assignments reward persistence, not perfection

# AI in Our Biochemistry Class

## AI tools (e.g., ChatGPT, Claude) encouraged for study aid

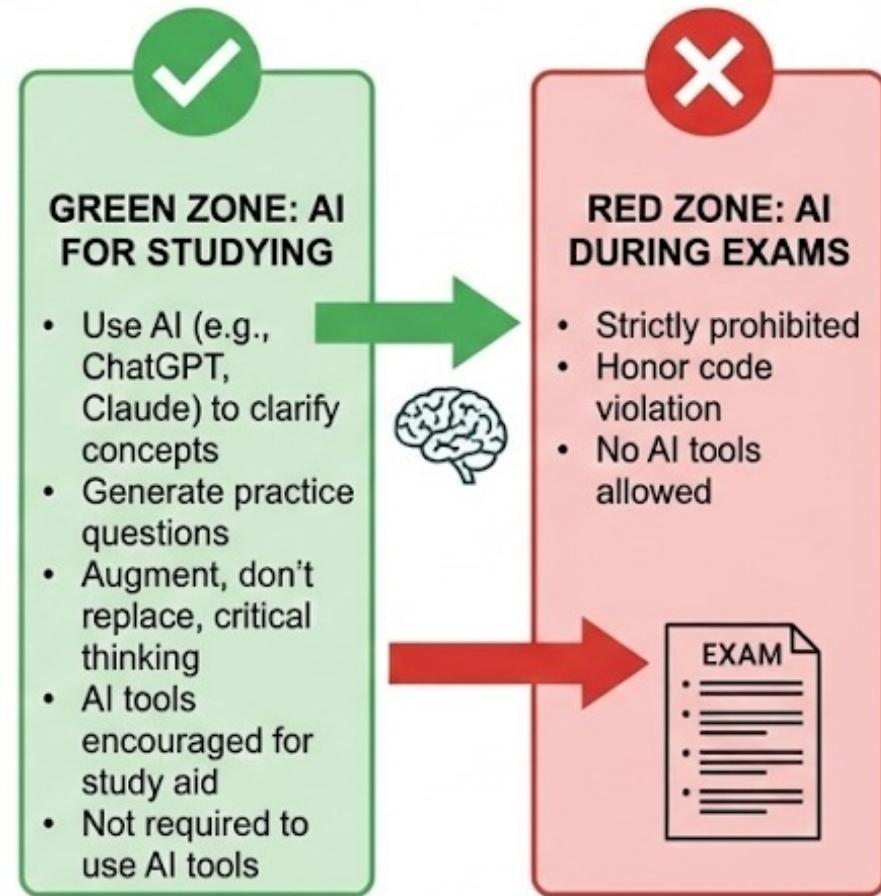
- Responsibility for understanding material remains yours
- I use AI to enhance course prep and content
- AI integration makes course more dynamic and relevant
- Learn to work effectively with AI
- it's here to stay!
- If uncomfortable, course fit

## Student Guidelines:

- Use AI to clarify concepts and generate practice questions
- AI should augment, not replace, your critical thinking
- You are not required to use AI tools

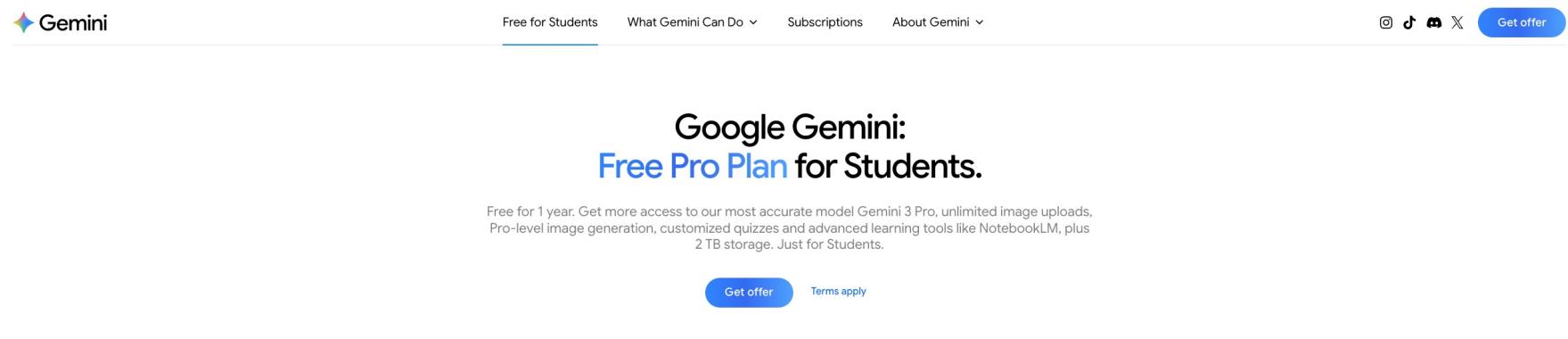
## Remember:

- AI has limitations and potential biases
- Developing AI literacy is crucial for your future careers



**Remember:**  
**AI for studying = YES.**  
**AI during exams = HONOR CODE VIOLATION.**

<https://gemini.google/students/>



The screenshot shows the Google Gemini website's "Free for Students" section. At the top, there's a navigation bar with links for "Free for Students", "What Gemini Can Do", "Subscriptions", and "About Gemini". On the right side of the header are social media icons for Instagram, TikTok, and X, followed by a "Get offer" button. The main headline reads "Google Gemini: Free Pro Plan for Students." Below the headline, a subtext explains the offer: "Free for 1 year. Get more access to our most accurate model Gemini 3 Pro, unlimited image uploads, Pro-level image generation, customized quizzes and advanced learning tools like NotebookLM, plus 2 TB storage. Just for Students." At the bottom of this section are two buttons: "Get offer" and "Terms apply".

Demo of Linus

<https://chatgpt.com/g/g-AbHbD9UtV-linus-gpt>

## **Exam Schedule:**

<b>Exam</b>	<b>Date</b>	<b>Coverage</b>
<b>Exam 1</b>	Tuesday, February 10, 2026	Chapters 1-8
<b>Exam 2</b>	Tuesday, March 17, 2026	Chapters 9-15
<b>Exam 3</b>	Tuesday, April 7, 2026	Chapters 16-22
<b>Exam 4</b>	Finals Week (Date TBA)	Chapters 23-30

## **Exam Format:**

- Closed-book, multiple choice format
- 2 hours to complete
- Multiple exam versions to maintain integrity
- Simple 4-function calculators permitted (no phones or programmable calculators)
- Must present valid UVA student ID to receive and submit exam

## **Exams**

Four exams will be given during the semester to assess your learning and ability to integrate concepts. Exams will be administered during the Tuesday discussion time (5:00-7:00pm) except for the final exam, which will be during finals week.



Bring your UVA ID.



Bring #2 pencils,  
approved calculator.

Assigned seating—  
check Canvas  
24 hrs before.



Arrive 10 min early.



Phones off and stored.

**NO ID = CANNOT TAKE EXAM. NO EXCEPTIONS.**

## Sunday Study Sessions

When: Sunday before each exam, 3:00 PM

Where: [TBA - announced on Canvas] - ALSO ON ZOOM

What: Group review, practice problems, pathway drawing

Bring: Questions, notes, study materials

**zoom**



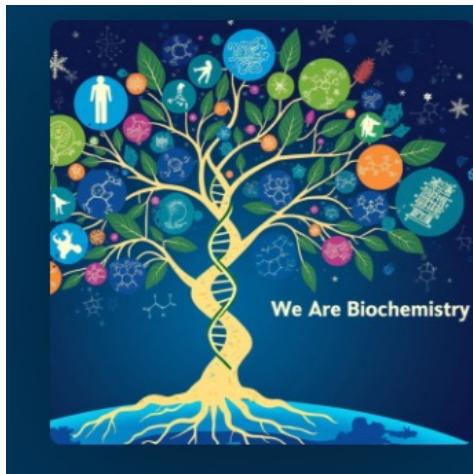


# Extra Credit



Yo, I'm diving in that substrate mix, ah  
Reaction speed, it gets no quicker, nah  
Active site, lock and key  
Drop the pH, watch it flee, ah  
Turnover, check the rate  
Michaelis-Menten state  
I'm the enzyme in your scene  
Breaking bonds like I'm supreme, yeah  
Pump the product, keep it clean  
[Verse: Kinetic King]  
(Yeah, let's go, let's go)  
When I'm catalyzing, it's like a blitz, ah  
Kinetics sharp like a catalyst whiz, cha  
Saturation high, Vmax we hit  
Km so low, competitors quit, yeah  
Affinity tight, substrate's the bait  
Enzyme's delight, complexity's fate  
Inhibition? Naw, I just innovate  
My active realm, where I dominate, aye

## Podcast



Podcast  
**We Are Biochemistry: The Science That Connects Us**  
**1233414575**

<https://open.spotify.com/show/6gUAeZTYYRPzdAc84Lj4Gt?si=d8fb877e6adc4393>

## Music



**Bio3030**  
1 monthly listener

<https://open.spotify.com/artist/7AAFUvIYJtmuGOcoqSMfh?si=TG8CAbiGROCPfE2ovVgv-Q>

Rapid tour of our online environment.

# Getting Your textbook and online assignments

UVA

≡ BIOL\_3030-200 > UVA Bookstore Inclusive Access

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Home

Syllabus

Macmillan Learning

Piazza

Gradescope

Assignments

Grades

SensusAccess

Online Meetings

Course Evaluations

Course Email

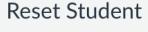
UVA Bookstore Inclusive Access

UVA Library Portal

**1 Course, 0 Materials**

**26Sp Biochemistry**

 You currently have no materials associated with this course.

You are currently logged into Student View  

Resetting the test student will clear all history for this student, allowing you to view the course as a brand new student. 



Account



Dashboard



Courses



Calendar



Inbox



History



My Media



Commons



Studio



Photo Roster



Course Email



UVA Bookstore



Inclusive Access

2026 Spring

## Macmillan Learning Tools

**Achieve**

Access the Achieve homepage.

**Achieve Insights & Reports**

Access the pages for Achieve Reporting &amp; Insights

**Macmillan Content**

Add Bedford/St. Martin's, W.H. Freeman, and Worth content assets to enhance your course.

**Macmillan Learning Diagnostics**

Run diagnostics on your Macmillan Learning connection.

**Macmillan Grade Refresh**

Update student grade data in your course.

**SensusAccess**

Having problems? Please contact Macmillan technical support.

**Online Meetings**

Import content changes made in your Macmillan course.

**Macmillan Content Refresh**

Import content changes made in your Macmillan course.

**Macmillan Background Updates**

View the status of updates to grades, content, and content reference deletion.

**Macmillan Grade Sync Level Refresh**

Change grade sync level and update links

**Macmillan Roster Information**

View list of students who have gained access to Macmillan content.

**Unlink Macmillan Course**

description

**Macmillan User Profile**

View your Macmillan profile information or reset the mapping to your Macmillan account.

**Macmillan Missing Content**

Delete references to removed Macmillan Learning content.

**Macmillan Grade Sync Token Registration**

Register your instructor token for use in grade synchronization.

# Textbook, homework, assignments

You are currently viewing your course as a student. [Return to Instructor View](#)

BIOL 3030: Biochemistry - Spring 2026  Christopher Deppmann ▾

 Course Home 

Viewing by  Assignments

 Course Content

 Resource Type

 Week Outline

 Calendar

 Chapter 1 Biochemical Similarities Demonstrate the Unity of Life  
Pre-class

 Metabolic Map

 Chapter 1 Biochemical Similarities Demonstrate the Unity of Life

 Chapter 2 Water, Weak Interactions, and the Generation of Order Out of Chaos

 Chapter 3 Amino Acids

 Chapter 4 Protein Three-Dimensional Structure

 Chapter 5 Protein Binding, Molecular Recognition, and Allostery

 Chapter 6 Techniques in Protein Biochemistry



You are currently viewing your course as a student.

[Return to Instructor View](#)



BIOL 3030: Biochemistry - Spring 2026



Christopher Deppmann



## Course Home

[See What's New!](#)

### Week Outline

JANUARY 11 – 17

#### Week 1

Week 1

2 Topics

2 Assignments

JANUARY 18 – 24

#### Week 2

Week 2

2 Topics

2 Assignments

JANUARY 25 – 31

#### Week 3

Week 3

2 Topics

2 Assignments

FEBRUARY 01 – 07

#### Week 4

Week 4

Viewing by

Assignments

Course Content

Resource Type

Week Outline

Calendar

In Progress

Not Started

WEEK 1 | JANUARY 11 – 17

## Week 1

2 Assigned

Ch1 Adaptive Quiz: Biochemical Similarities Demonstrate the Unity of Life

Due Jan 13 at 11:59 PM | 100 pts

Ch2 Adaptive Quiz: Water, Weak Interactions, and the Generation of Order Out of Chaos

Due Jan 15 at 11:59 PM | 100 pts



# Textbook, homework, assignments

You are currently viewing your course as a student.

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BIOL 3030: Biochemistry - Spring 2026



Christopher Deppmann ▾

## January 2026



[Back To Resource Type](#)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13 ● Ch1 Adaptive Q...	14	15 ● Ch2 Adaptive Q...	16	17
<	18	19	20 ● Ch3 Adaptive Q...	21	22 ● Ch4 Adaptive Q...	23
25	26	27 ● Ch5 Adaptive Q...	28	29 ● Ch6 Adaptive Q...	30	31
1	2	3 ● Ch7 Adaptive Q...	4	5 ● Ch8 Adaptive Q...	6	7

eve.macmillanlearning.com/courses/xv89ns/mycourse/calendar/12/2025



Note: your first quiz is due today.

# Textbook, homework, assignments

BIOL 3030: Biochemistry - Spring 2026

## February 2026

Viewing by:

Everyone x Search

< > Back To Week Outline

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 ● Ch7 Adaptive Quiz: Basic Concepts of Enzy...	4	5 ● Ch8 Adaptive Quiz: Kinetics and Regulation	6	7
8	9 ● Chapter 1 Homework ● Chapter 2 Homework ● Chapter 3 Homework + 5 More	10 ● Ch9 Adaptive Quiz: Mechanisms and Inhibit...	11	12 ● Ch10 Adaptive Quiz: Carbohydrates and Gly...	13	14
15 <span>&lt;</span>	16	17 ● Ch11 Adaptive Quiz: Lipids	18	19 ● Ch12 Adaptive Quiz: Membrane Structure an...	20	21 <span>&gt;</span>
22	23	24 ● Ch13 Adaptive Quiz: Signal-Transduction Pat...	25	26 ● Ch14 Adaptive Quiz: Digestion: Turning a Me...	27	28
1	2	3	4	5	6	7

# Textbook, homework, assignments

You are currently viewing your course as a student. [Return to Instructor View](#)

BIOL 3030: Biochemistry - Spring 2026

[Table of Contents](#) X

**Navigation Instructions**

- Use **Tab** to move between the close button, navigation instructions, and the list of ebook content.
- Use **Arrow Keys** to move between folders and chapters in the list.
- Press **Enter** to open or close a folder, or to select a chapter.

> About this Book

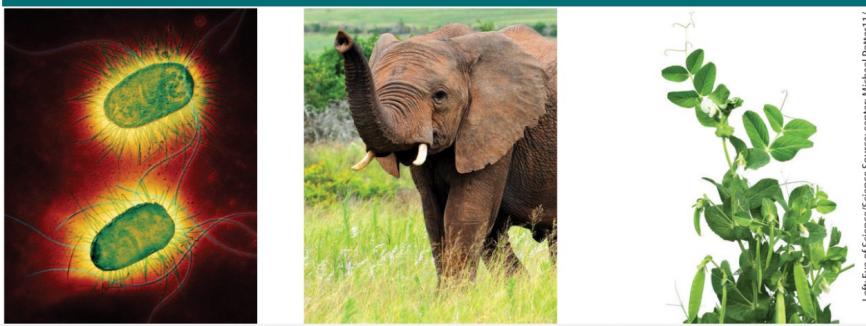
▼ Chapter 1 Biochemical Similariti...

Chapter 1 Biochemical Similarities Demonstrate the Unity of Life

E-book NOTEBOOK 1

CHAPTER 1  
Biochemical Similarities  
Demonstrate the Unity of Life

Left: Eye of Science/Science Source; center: Michael Potter/11/11/Shutterstock; right: omni/Alamy Stock Photo



1.1 Living Systems Require a Limited Subset of Available Atoms and Elements

1.2 There Are Four Major Classes of Biomolecules

1.3 The Central Dogma Describes the Basic Principles of Molecular Biology

1.4 Membranes Delineate the Cell and Carry Out Key Functions

1.5 Scientific Research Forges Diverse Communities of Knowledge

Contents

1.1 Living Systems Require a Limited Subset of Available Atoms and Elements

# Resources on canvas-slides



BIOI\_3030-200 > Syllabus

View as Student

Immersive Reader

## Course Syllabus

### BIOL 3030: Biochemistry

Spring 2026

Credits: Three credit hours  
Lecture: 2 sections: Tuesday/Thursday 2:00-3:15pm and 3:30-4:45 Chemistry 402  
Discussion: 2 sections: Tuesday 5:00-7:00pm, Chemistry 402 and Gilmer 301

## Instructor

Christopher Deppmann  
Email: deppmann@virginia.edu  
Office Hours: Monday 11:00am-12:00pm  
Location: <https://virginia.zoom.us/j/2854285879>  
For individual appointments at other times, please email to schedule.

## Teaching Team

Graduate Teaching Assistants:

- Jennie Nguyen: war2ca@virginia.edu
- Monika Wieliniec: qdc5xu@virginia.edu
- Megan Garris: fmk3uc@virginia.edu
- Andrew Spira: abs6ken@virginia.edu

Undergraduate Teaching Assistants:

- Nacim Abib: rhu2vr@virginia.edu

I'll post slides resources related to the chapters

January 2026						
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

Course assignments are not weighted.



BIOL\_3030-200

2026 Spring

Home

Announcements



Syllabus

Macmillan Learning

Piazza

Gradescope

Modules

Assignments

Discussions



Grades

Files

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Online Meetings

Course Evaluations

Export Grades to SIS

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## Files

Search files

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Enter at least 2 characters to search

26Sp Biochemistry

Name ▲

Exam 1

Exam 2

Exam 3

Exam 4

Uploaded Media

226.8 MB of 4.2 GB used



2026 Spring

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Announcements



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26Sp Biochemistry > Exam 1

	Name ▲	Created ▼	Last Modified ▼
<input type="checkbox"/>	Exam 1 Study Guide.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 1.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 2.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 3.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 4.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 5.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 6.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 7.pdf	Thursday	Thursday
<input type="checkbox"/>	Lecture 8.pdf	Thursday	Thursday

Note: Files are subject to change before a lecture.

# Resources on canvas-piazza

Piazza is the most efficient way to get an answer



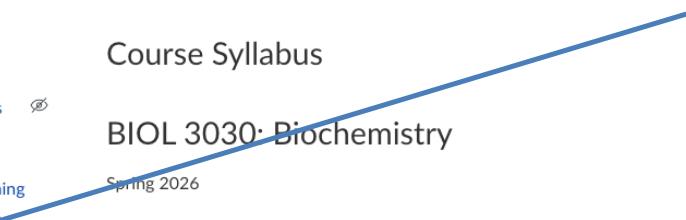
BIOL\_3030-200 > Syllabus

2026 Spring

Course Syllabus

BIOL 3030: Biochemistry

Spring 2026

**Piazza** 

Credits: Three credit hours  
Lecture: 2 sections: Tuesday/Thursday 2:00-3:15pm and 3:30-4:45 Chemistry 402  
Discussion: 2 sections: Tuesday 5:00-7:00pm, Chemistry 402 and Gilmer 301

Instructor

Christopher Deppmann  
Email: deppmann@virginia.edu  
Office Hours: Monday 11:00am-12:00pm  
Location: <https://virginia.zoom.us/j/2854285879>  
For individual appointments at other times, please email to schedule.

Teaching Team

Graduate Teaching Assistants:

- Jennie Nguyen: war2ca@virginia.edu
- Monika Wieliniec: qdc5xu@virginia.edu
- Megan Garris: fmk3uc@virginia.edu
- Andrew Spira: abs6ken@virginia.edu

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- Nacim Abib: rhu2vr@virginia.edu

8 View as Student | Print Course Details

Up to Today | Add to Calendar | January 2026 >

28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

Course assignments are not weighted.

LIVE Q&A Drafts Reading list 10 exam\_1\_topics 126 exam\_2\_topics 121 exam\_3\_topics 70 exam\_4\_topics 84 exam\_5\_topics 51 logistics 85 other 59

New Post Search or add a post...

Show Actions

PINNED

Instr Advice for success 8/23/23  
I'd like to start a thread for our UTAs to share their advice for success in the class. One thing they suggested to

MY READING LIST

Instr Class note sheet for exam 5 12/4/23  
Hi scientists, It's time to make our class note sheet for exam 5! Please send your suggestions as responses to this  
• Added to reading list  
• 3 Unresolved followups

Instr Biochemistry Discussion Ev... 11/29/23  
Hi, scientists! Linked below is the optional Biochemistry Discussion Evaluation. We also have a surprise for you all...  
• Added to reading list  
• An instructor thinks this is a good note

Instr New UTA OH Schedule 10/27/23  
The UTAs have made a more robust OH schedule to accommodate more students for the rest of the semester. Remember that in  
• Added to reading list

WEEK 3/10 - 3/16

worksheet 8 question problem 4 3/11/24  
For this problem I understand how to find B but I thought magnetic field lines always run from north to south so the no

WEEK 12/10 - 12/16

Grade distribution 12/14/23  
Hi! Could we possibly have the grace distribution of final grades?

This class has been made inactive. No posts will be allowed until an instructor reactivates the class.

### Piazza features that professors and students appreciate include:

- 1 Keep your homework and lecture notes organized with **folders**
- 2 Track TA and student **participation**
- 3 Build a single, comprehensive response with a **wiki-style format**
- 4 Quickly **filter posts** to find only the ones needing your attention
- 5 Encourage peer to peer knowledge sharing by **endorsing** good questions and answers
- 6 Create a new post and use **LaTeX equation editor** to easily read and write equations. Also post with **code blocking, equations, images, videos, polls**, and more...

## Piazza Tips:

**Check for Existing Answers** before posting.

**Be Clear and Concise** in your questions and responses.

**Help Each Other** by answering questions—it's a great way to learn!

**Use Descriptive Titles** for easy navigation.

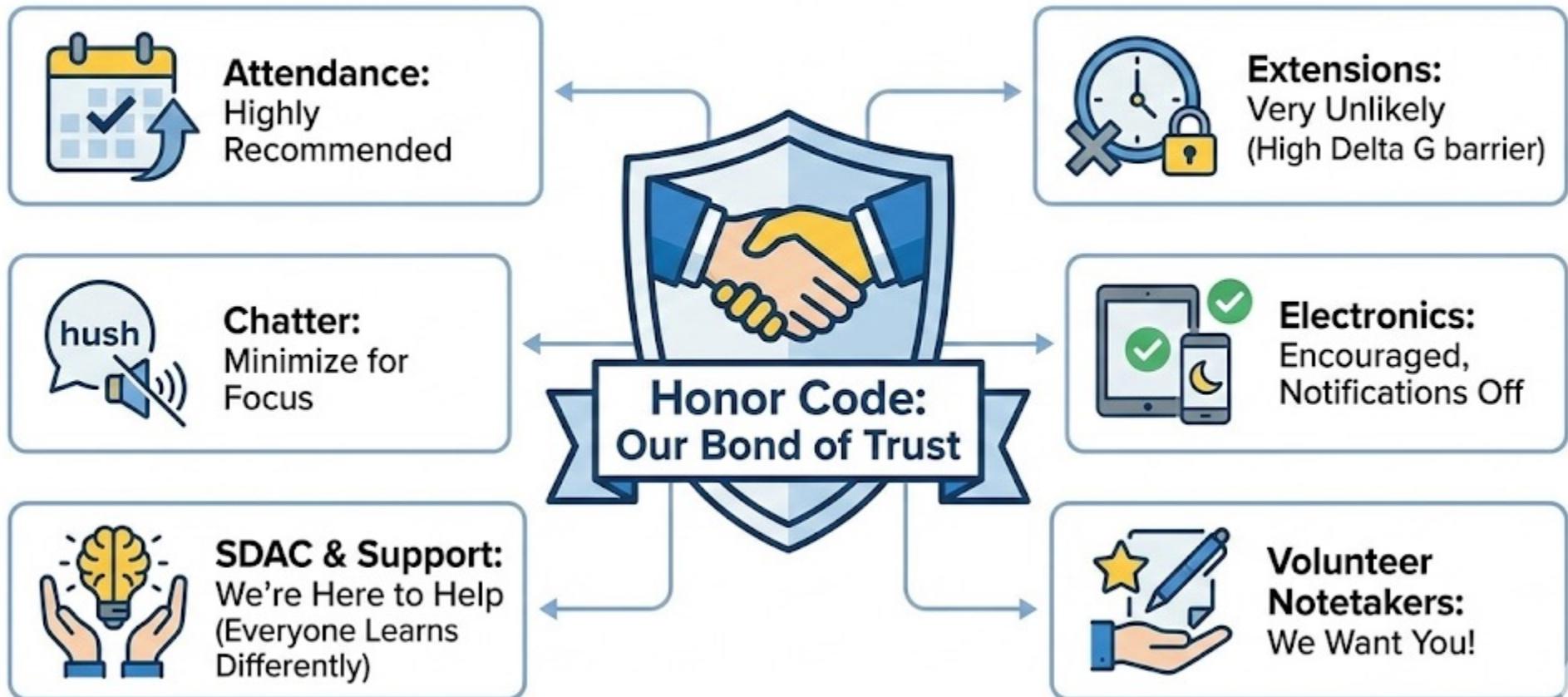
**Stay Engaged** with notifications and follow-ups.

# WEEK 1 CHECKLIST & LAUNCH

- Access Achieve via Canvas
- Read Chapter 1
- Complete Reading Quiz
- Join Piazza
- Add Exam Dates to Calendar
- Decide on Inclusive Access
- ! Note: Discussions Start Week 2



# Course Logistics & Policies



# Academic Integrity

**Honest Study:**  
Deep Understanding & Applied Knowledge



**Professional Competence:**  
Confident, Effective Patient Care

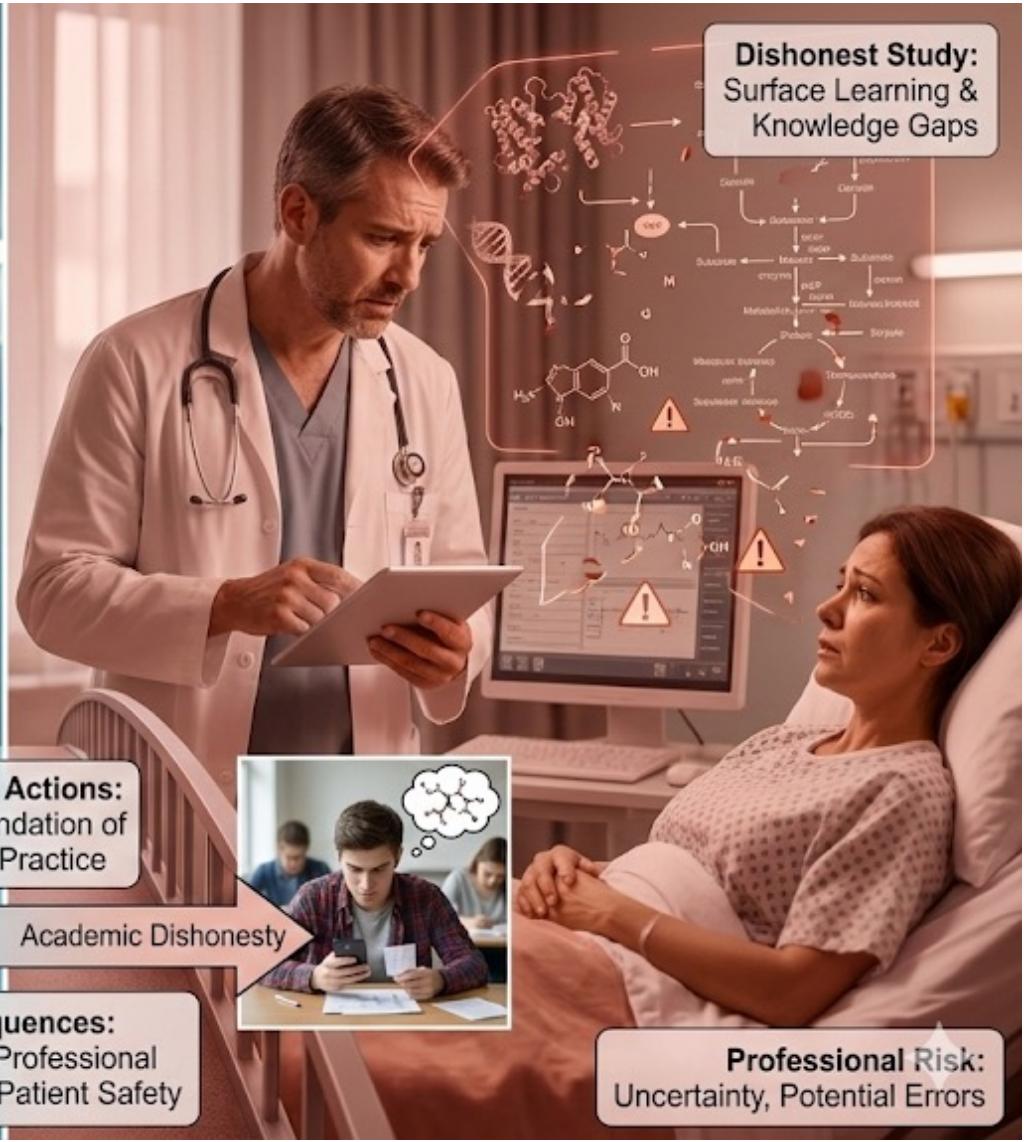
**Student Actions:**  
The Foundation of Future Practice

Academic Integrity

Academic Dishonesty

**Consequences:**  
Impact on Professional Capability & Patient Safety

**Dishonest Study:**  
Surface Learning & Knowledge Gaps



**Professional Risk:**  
Uncertainty, Potential Errors

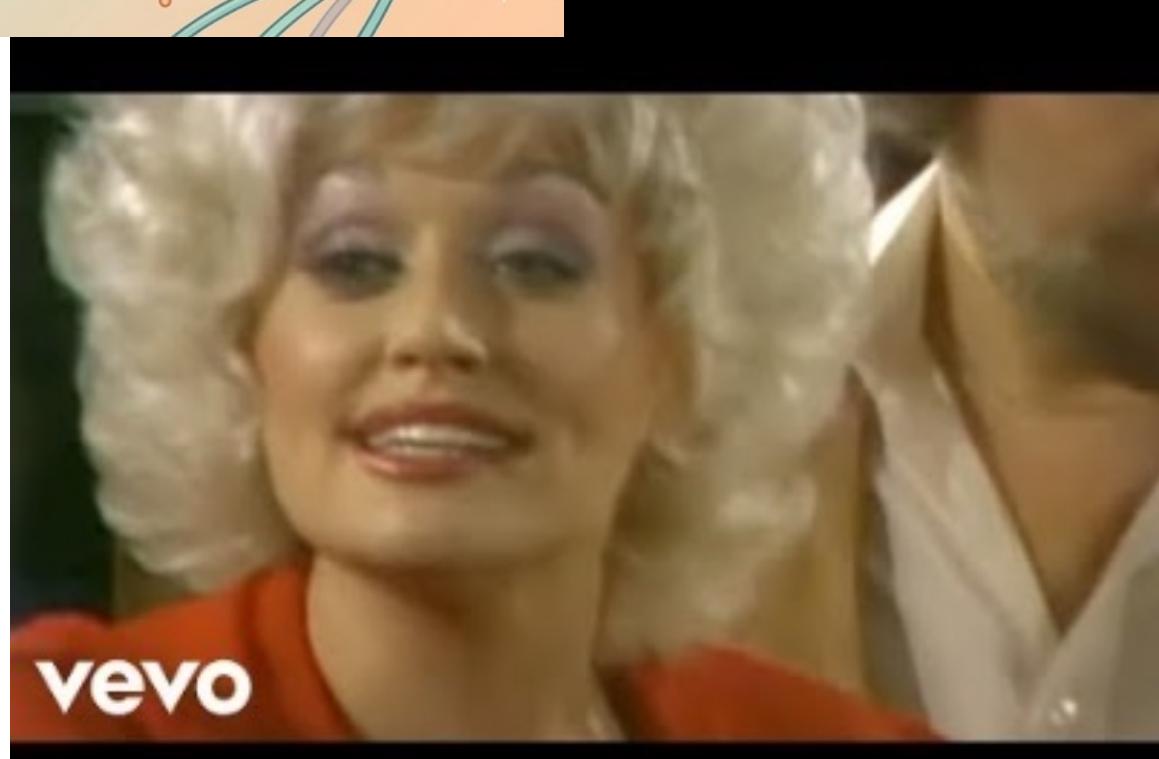
Questions?

# BREAK - Back in 5 minutes



Even ATP needs  
to recharge!

5:00

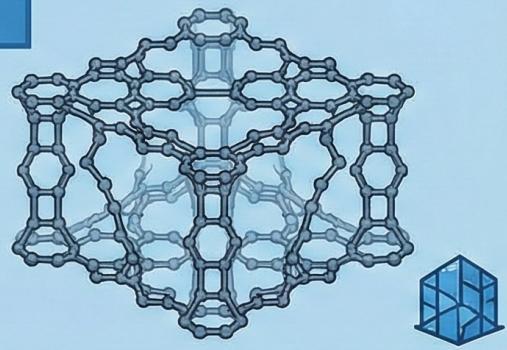


# Chapter 1

# THE BIG SIX: CHNOPS

C

CARBON: THE ARCHITECT



H

HYDROGEN: THE SPARK



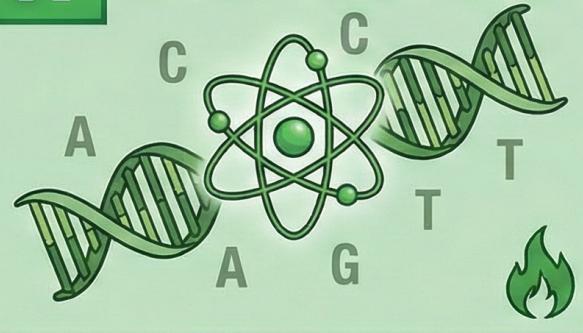
O

OXYGEN: THE ELECTRON HOG



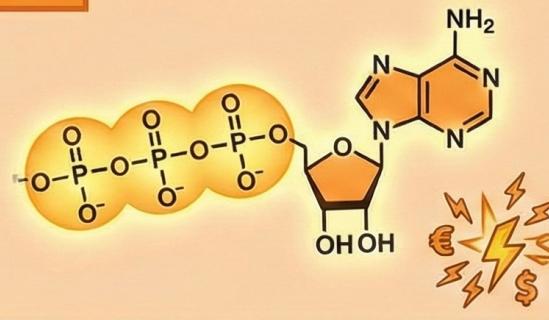
N

NITROGEN:  
THE INFORMATION KEEPER



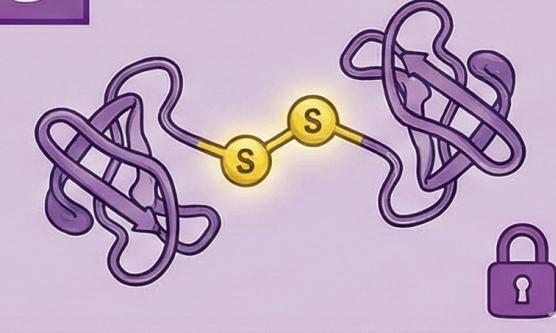
P

PHOSPHORUS:  
THE ENERGY BROKER



S

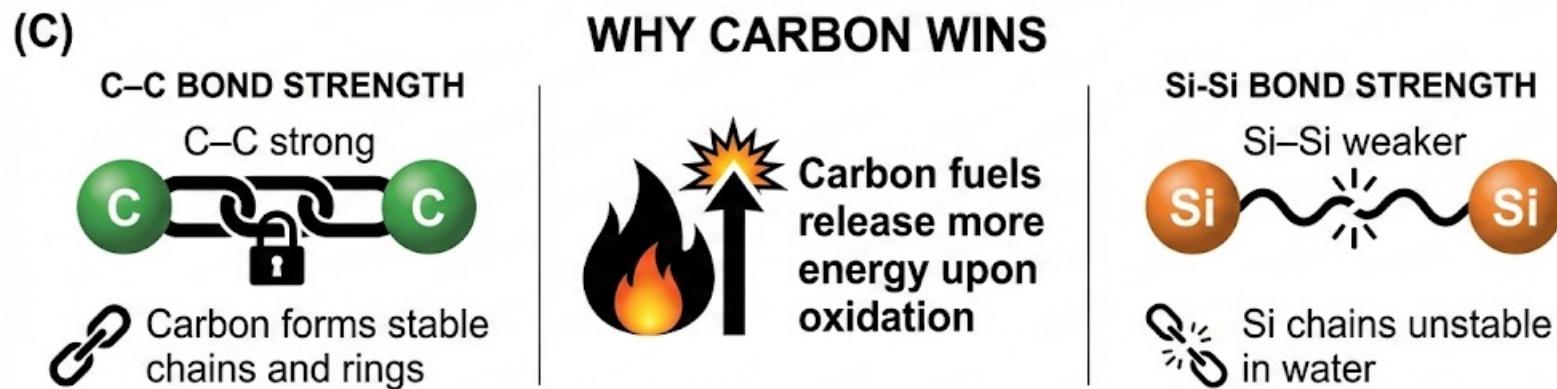
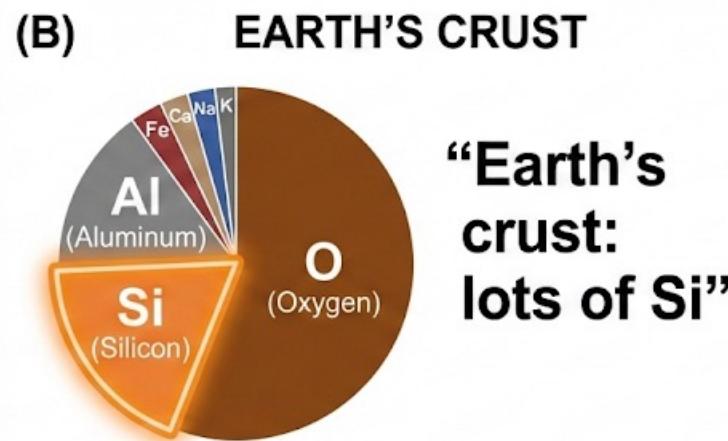
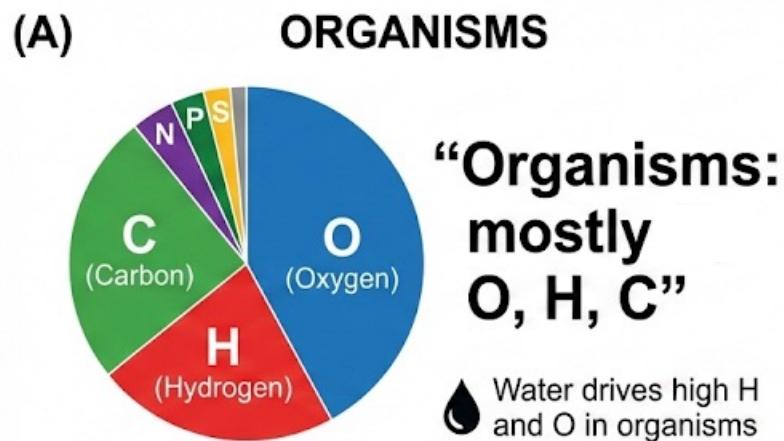
SULFUR: THE BRIDGE



Why carbon?

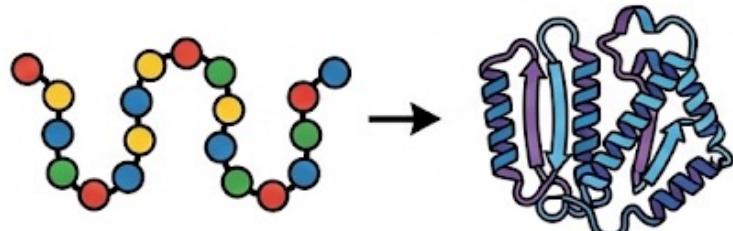
# Section 1.1 Living Systems Require a Limited Variety of Atoms and Molecules

- Of the 90 naturally occurring elements, only three—oxygen, hydrogen, and carbon—make up 98% of the atoms in any organism.
- Hydrogen and oxygen are so prevalent because of the ubiquity of water.
- Carbon is uniquely suited to be a key atom of biomolecules.



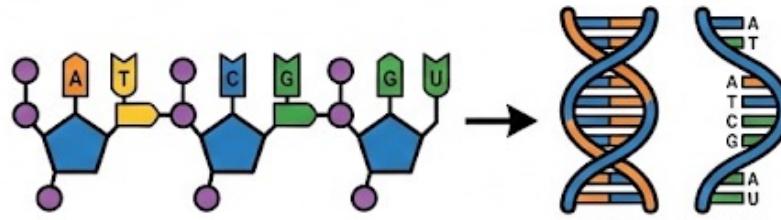
# Four biomolecule classes, four jobs.

## Proteins: function machines



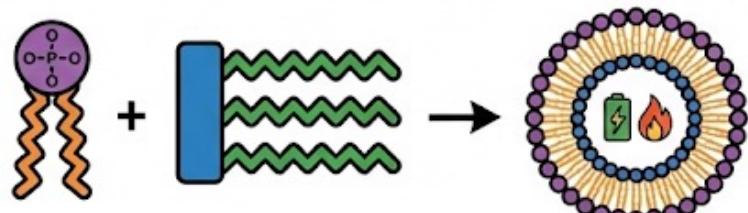
amino acid beads → folded protein icon

## Nucleic acids: information storage and transfer



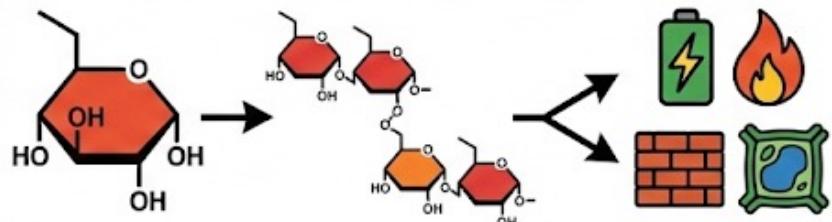
nucleotide chain → double helix + single strand

## Lipids: membranes and energy storage



phospholipid + triacylglycerol  
simplified icons → membrane droplet

## Carbohydrates: energy and structure



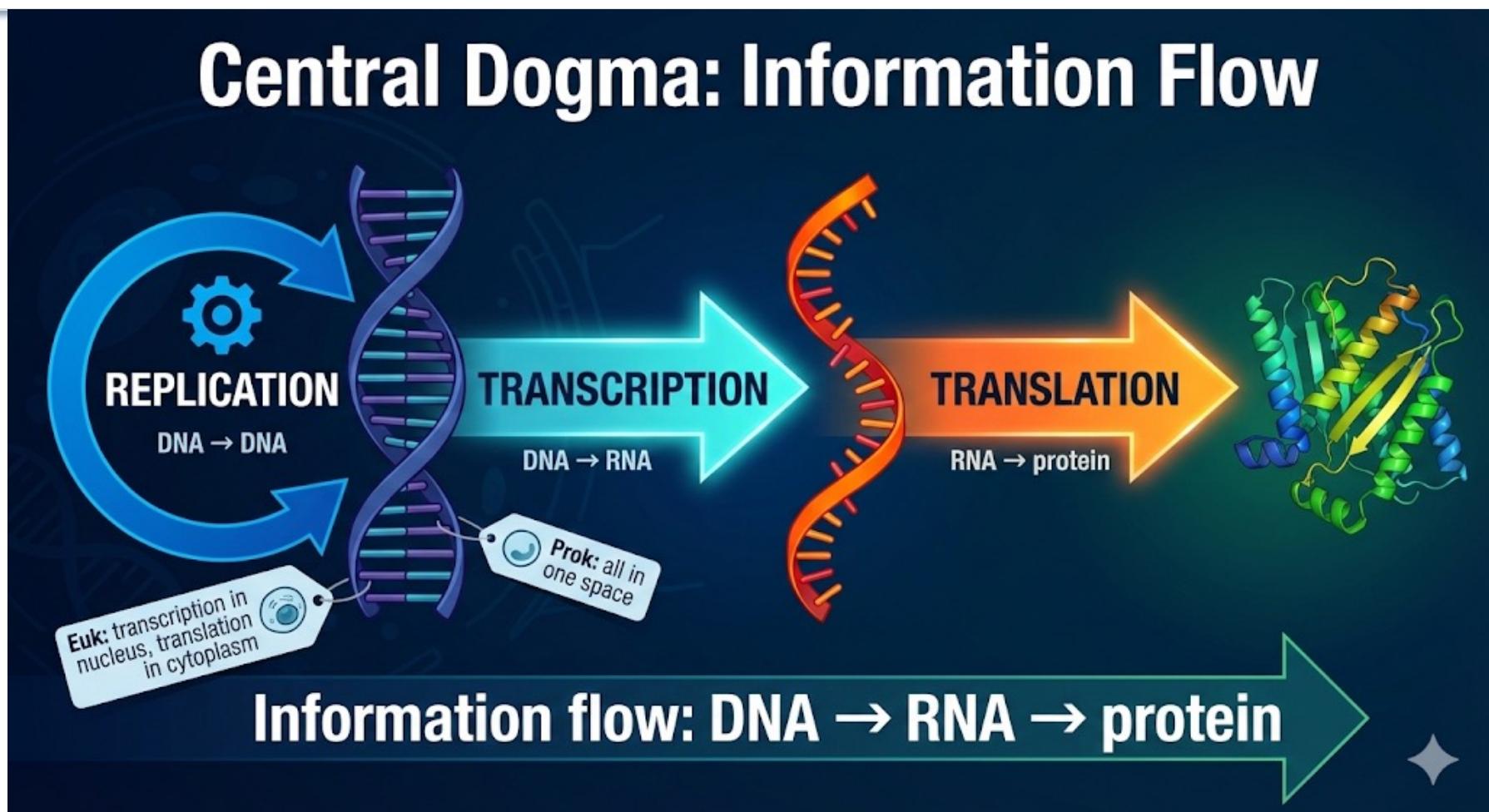
hexose ring + polymer chain → energy and structure icons

## Section 1.2 There are Four Major Classes of Biomolecules

Learning Objective 1: Describe the key classes of biomolecules and differentiate between them.

## Section 1.3 The Central Dogma Describes the Basic Principles of Biological Information Transfer

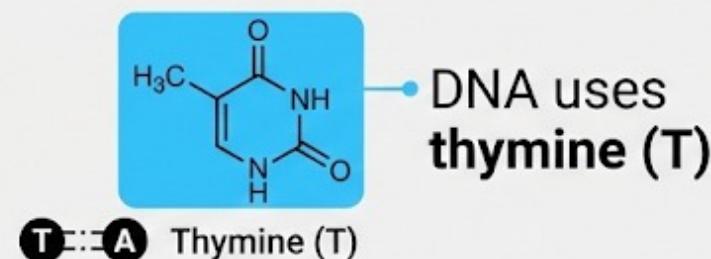
- Learning Objective 2: List the steps of the central dogma.
- The central dogma states that information flows from DNA to RNA to protein. Moreover, DNA is replicated.



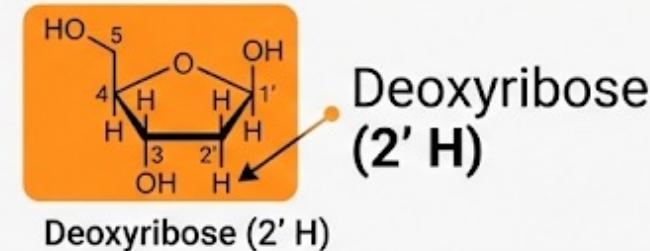
## DNA vs RNA Comparison

### DNA

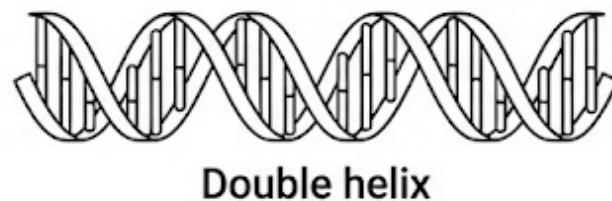
#### BASE



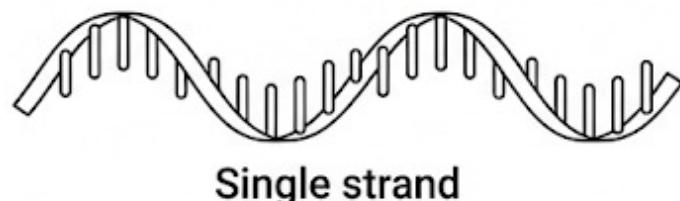
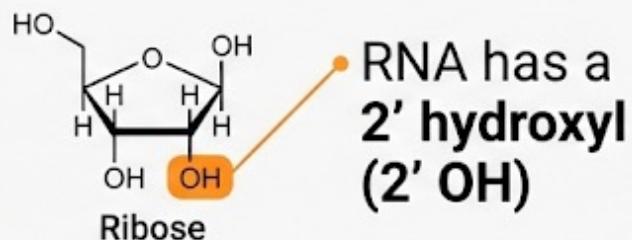
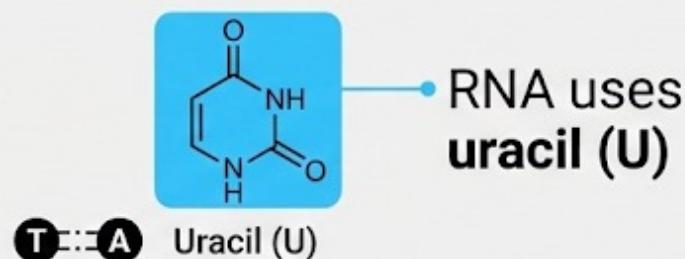
#### SUGAR



#### TYPICAL STRUCTURE

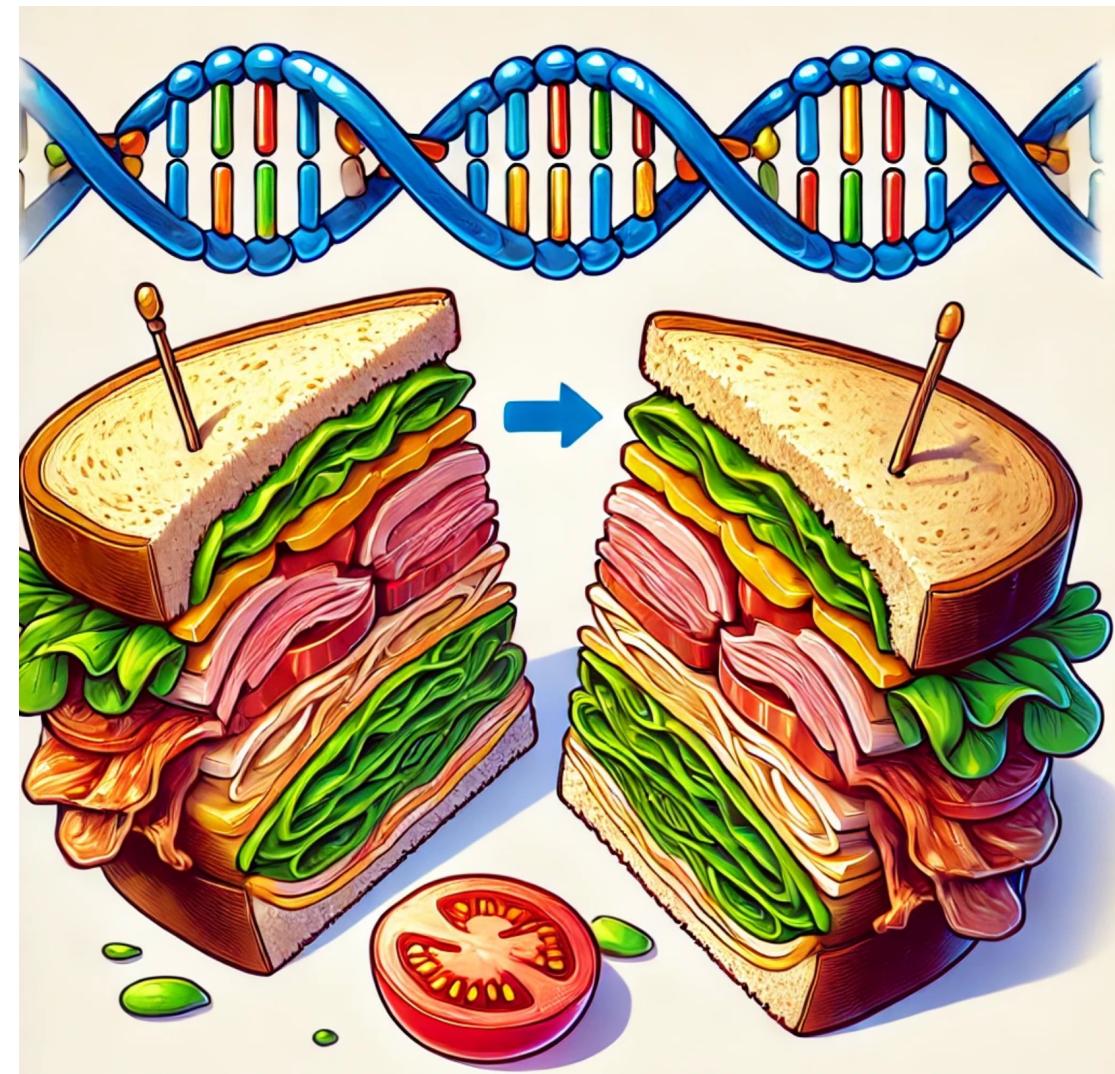
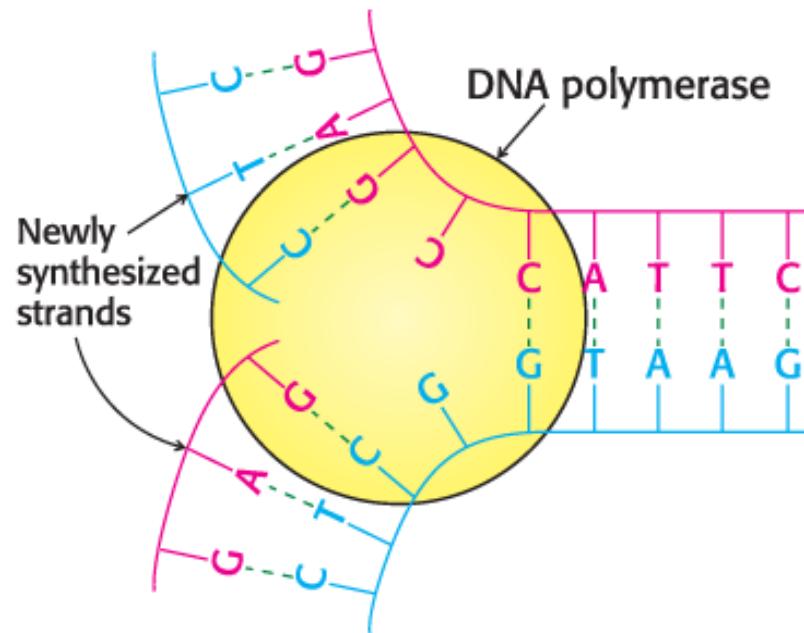


### RNA



# DNA Replication

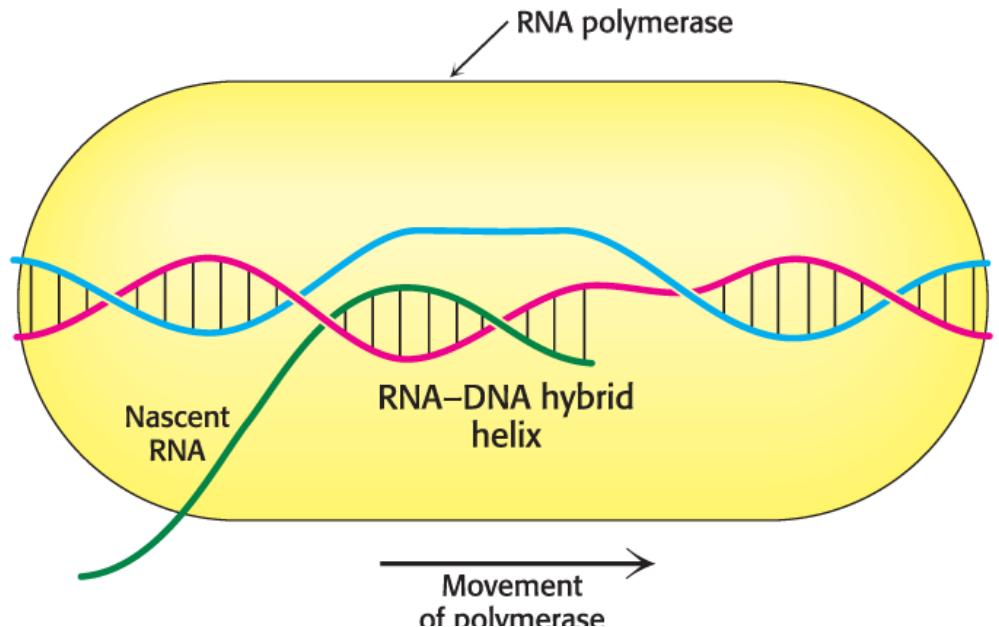
- DNA is heritable information: the genome.
- DNA is replicated by a group of enzymes collectively called DNA polymerase.



# Transcription

- **DID YOU KNOW?**

- As defined in the Oxford English Dictionary, *to transcribe* means “to make a copy of (something) in writing; to copy out from an original; to write (a copy).”
- RNA polymerase catalyzes transcription: the process of copying DNA information into RNA.
- Selective transcription of the genome defines the function of a cell or tissue.



mRNA (the messenger)

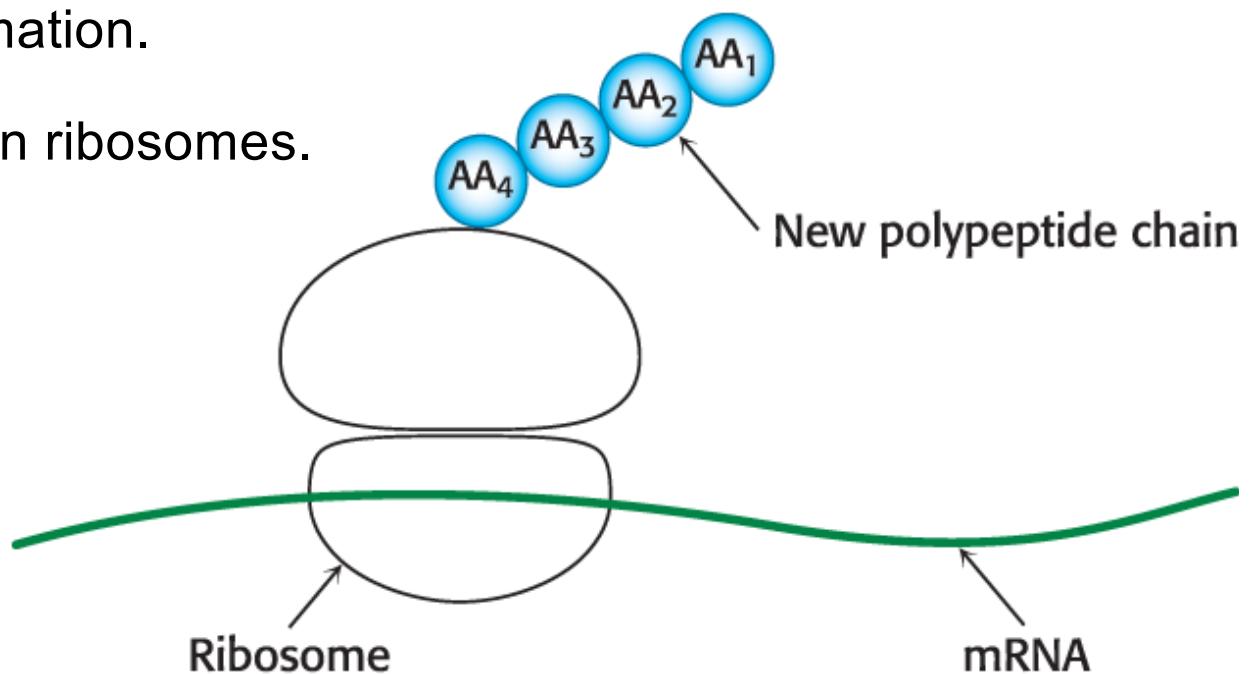
tRNA (the transporter)

rRNA (the builder)

# Translation

---

- Translation converts the nucleic acid sequence information in mRNA into protein sequence information.
- Translation occurs within ribosomes.

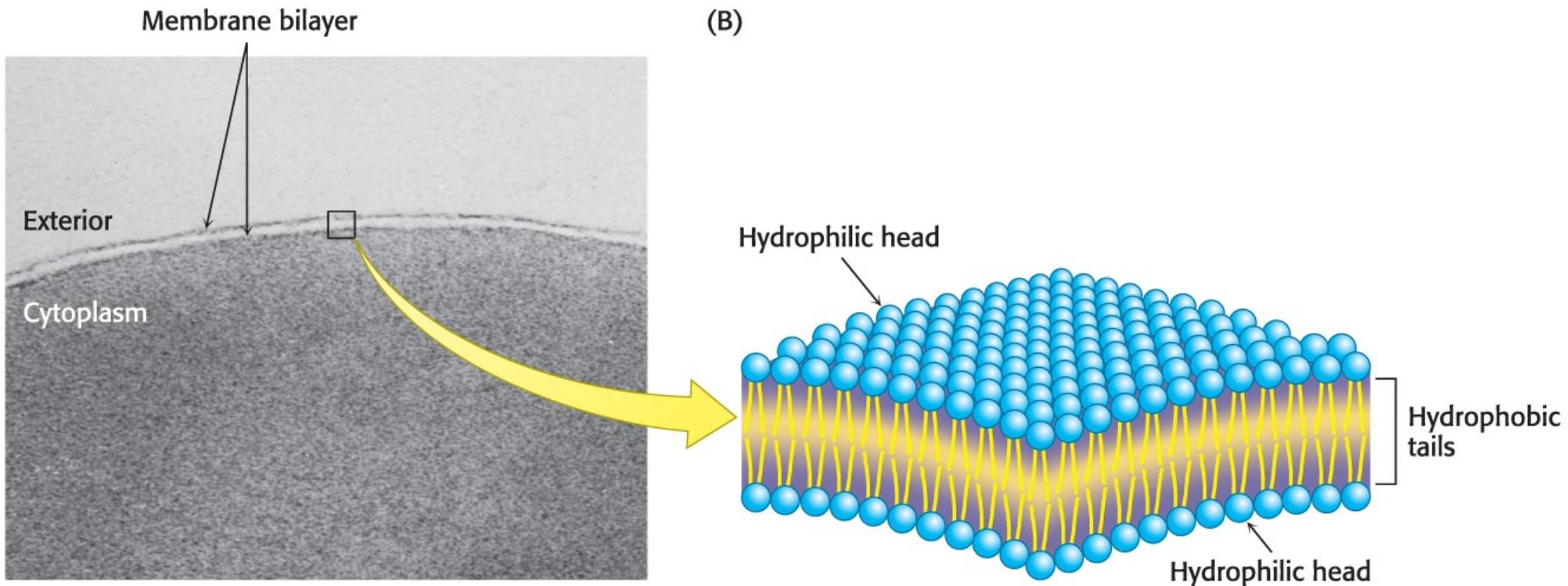


## Section 1.4

# Membranes Define the Cell and Carry Out Cellular Functions

- Learning Objective 3: Identify the key features that differentiate eukaryotic cells from prokaryotic cells.

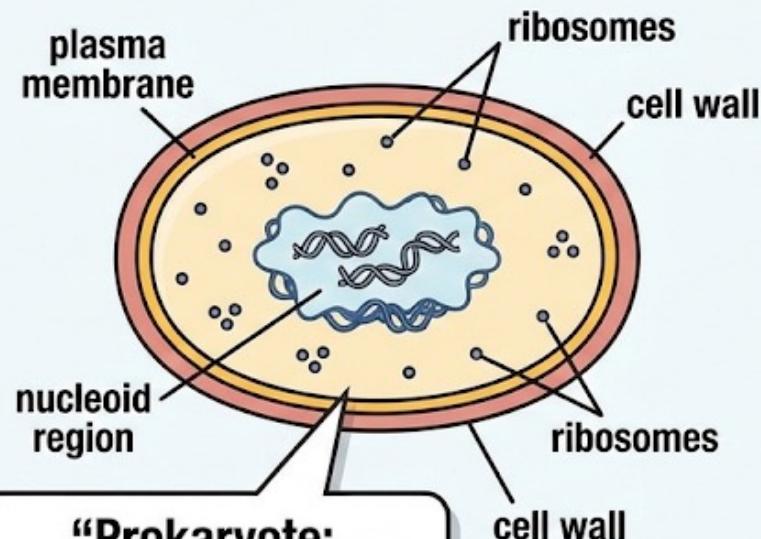
- Eukaryotes contain membrane-enclosed compartments inside the cell.
- Prokaryotes lack intracellular membranes.



# Quick check: are “your” cells all eukaryotic?

“The human body contains only eukaryotic cells.” True or False?

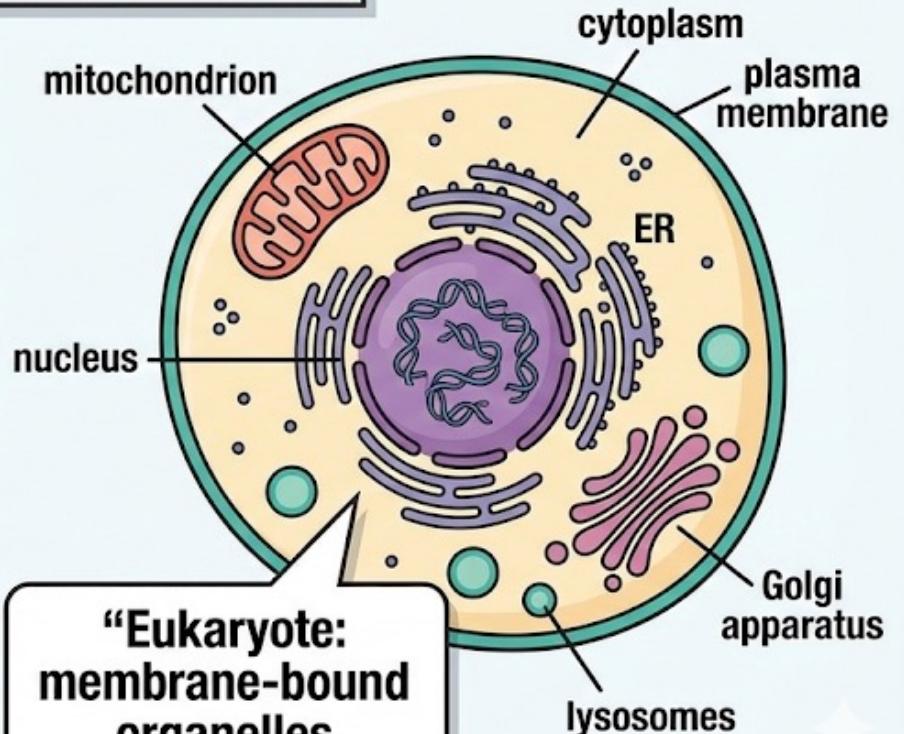
## PROKARYOTE



**"Prokaryote:  
no membrane-bound  
organelles"**

**"Compartments enable  
specialization"**

## EUKARYOTE

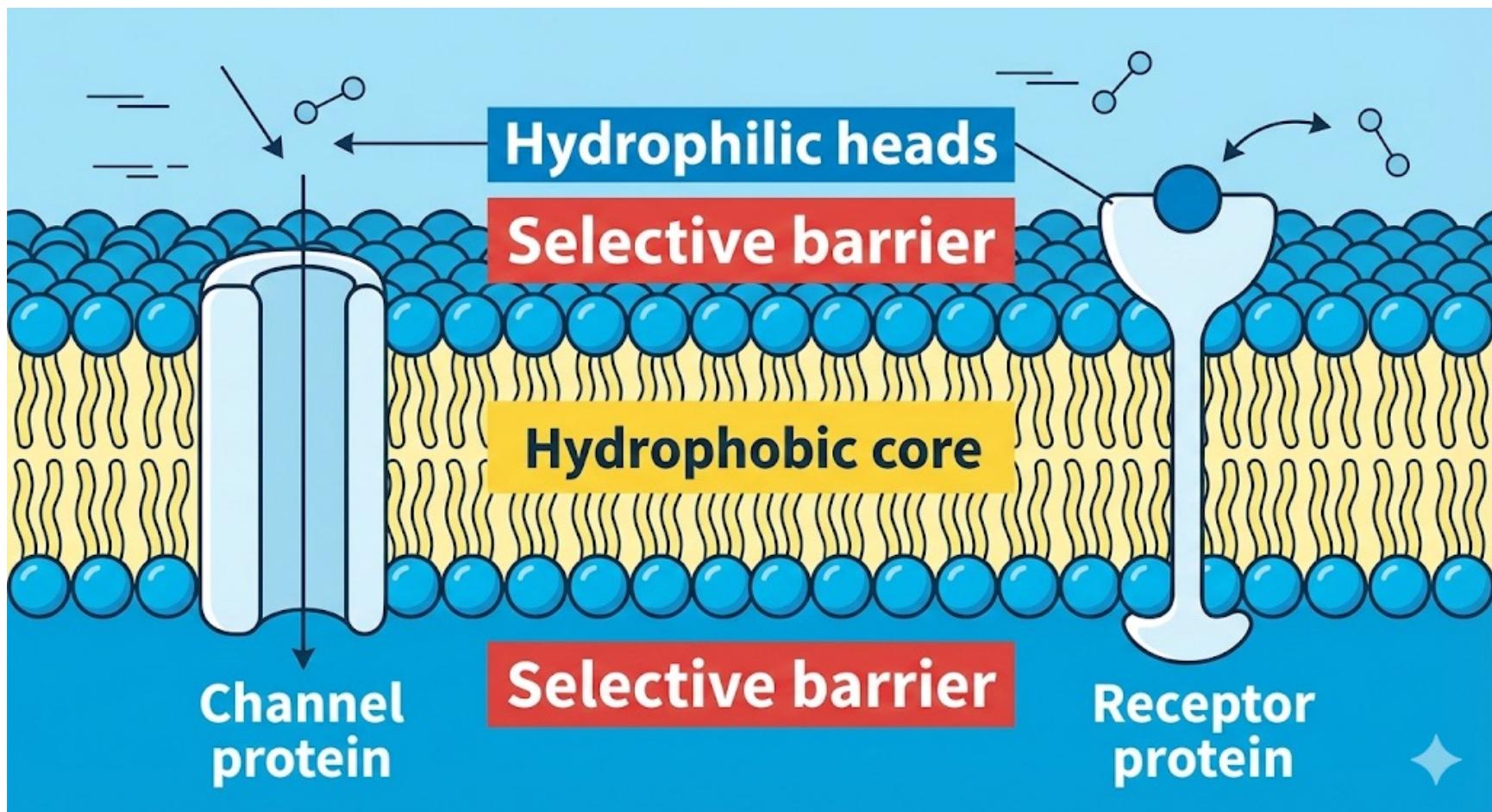


**"Eukaryote:  
membrane-bound  
organelles"**

# Prokaryotic and Eukaryotic Cells

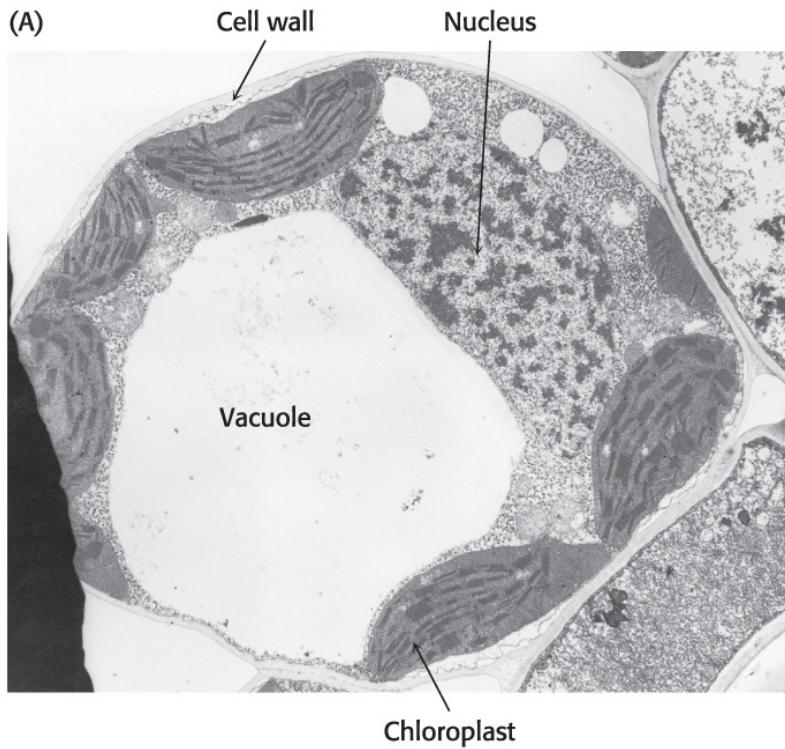
# Plasma Membrane

- The plasma membrane separates the inside of the cell from the outside.
- The plasma membrane is impermeable to most biomolecules.
- Selective permeability occurs because of the presence of proteins associated with the membrane.

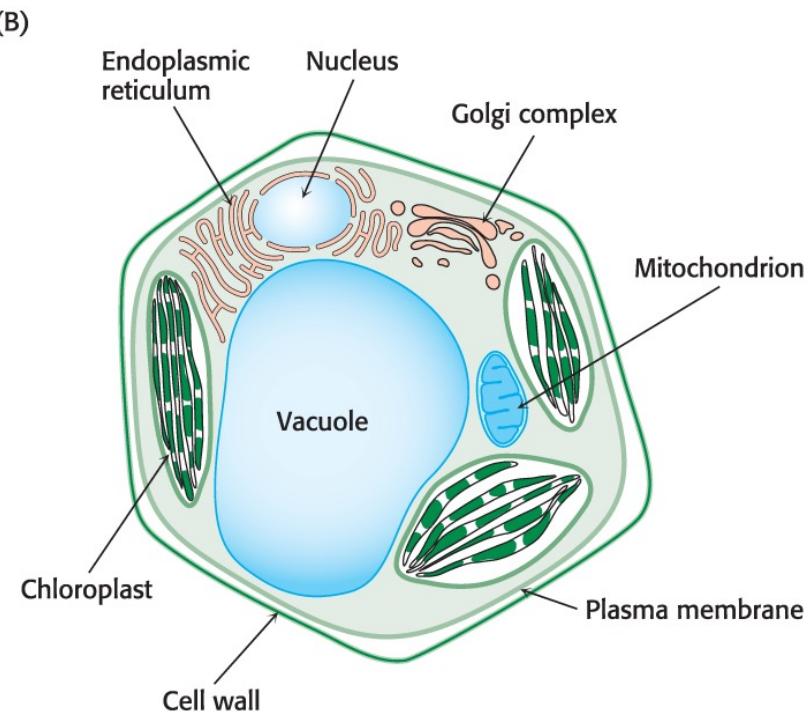


# Plasma Membrane of a Plant Cell

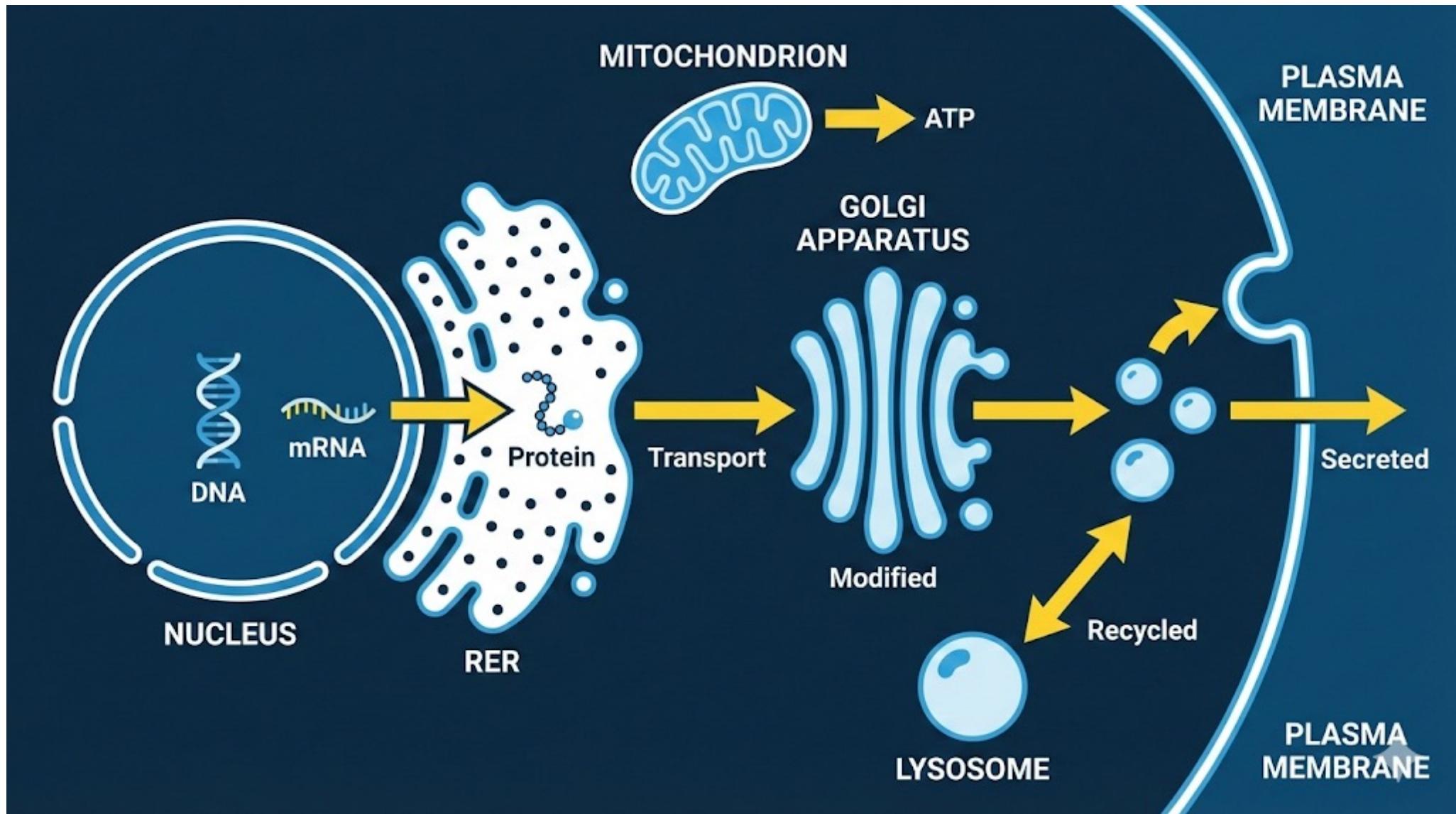
- The plasma membrane of a plant cell is surrounded by a cell wall composed largely of cellulose, a linear polymer of glucose.
- Large vacuoles, unique to plants, store water, ions, and various nutrients.



(A) Biophoto Associates/Science Source.

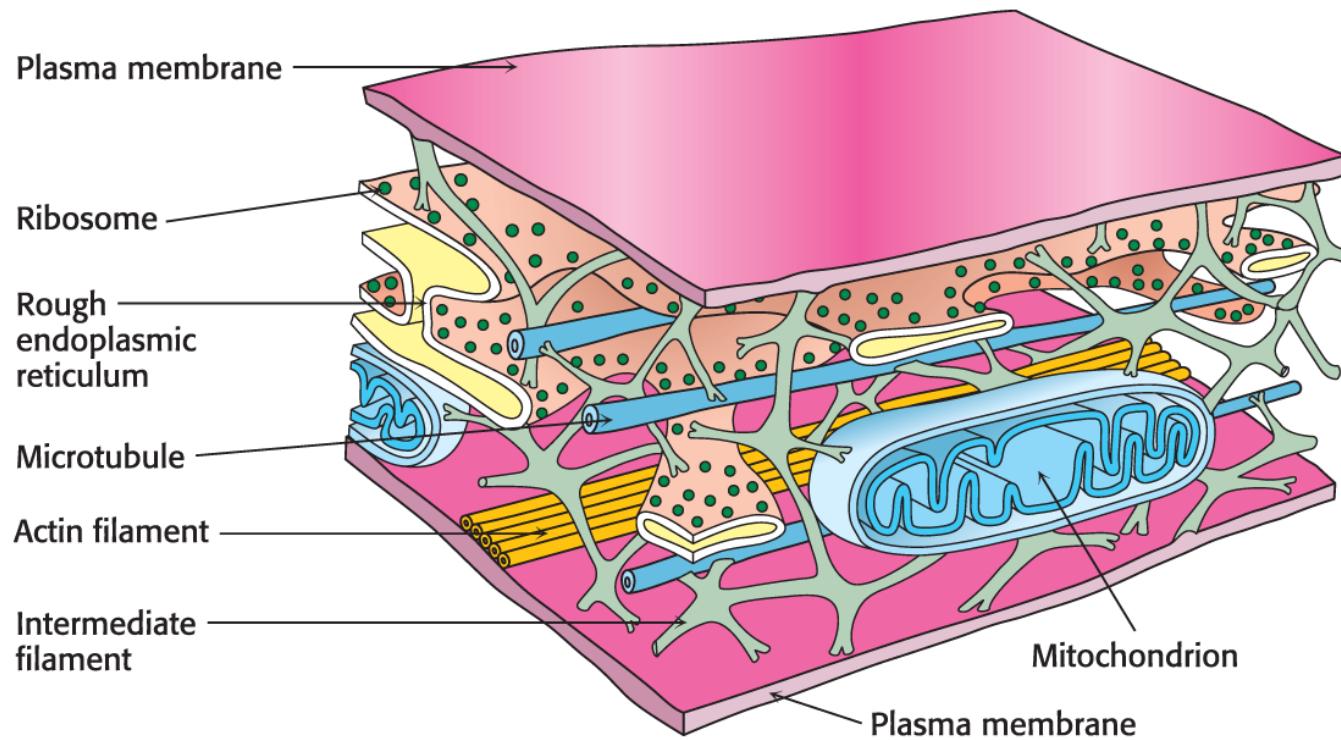


# Organelles



# Cytoplasm

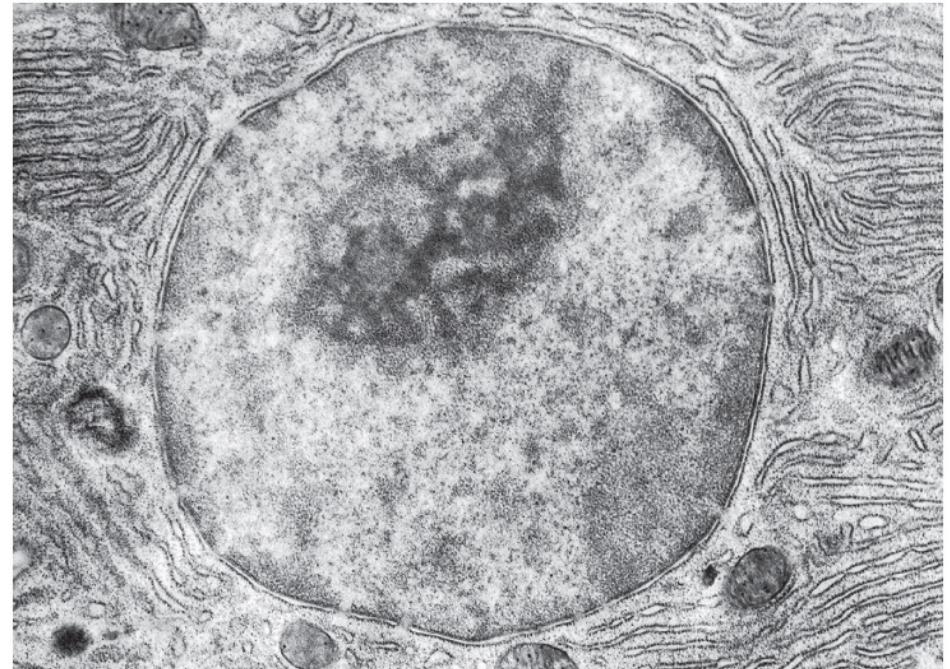
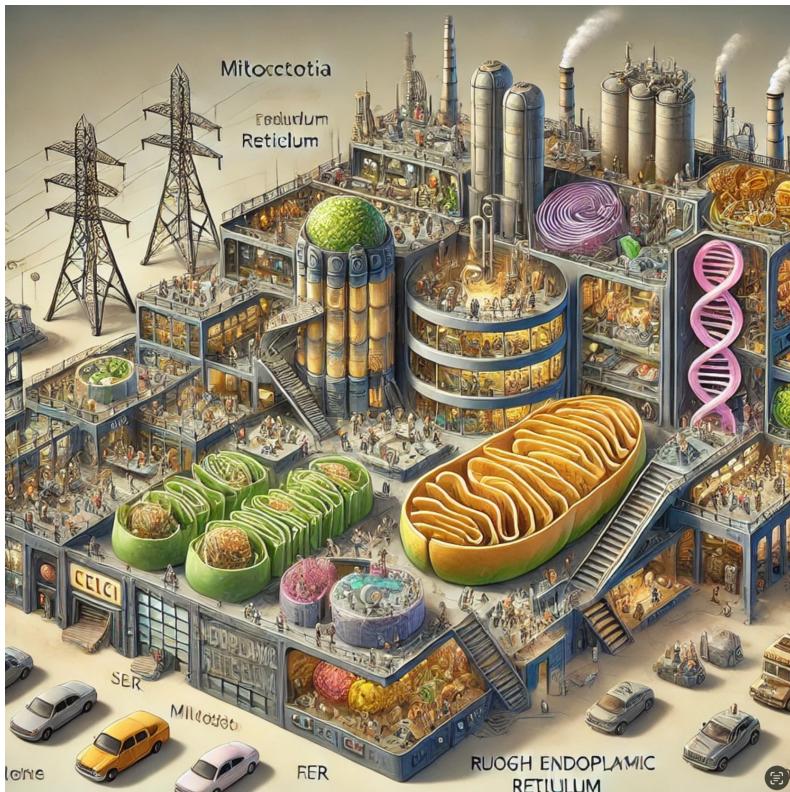
- The cytoplasm is the part of the cell surrounded by the plasma membrane but not enclosed by any intracellular membranes.
- The cytoplasm is organized by a series of structural filaments called the cytoskeleton.



Tymoczko et al., *Biochemistry: A Short Course*, 4e, © 2019 W. H. Freeman and Company

# Cellular Compartments

- Biochemical functions are sequestered in cellular compartments.
- The nucleus is the information center of the cell.



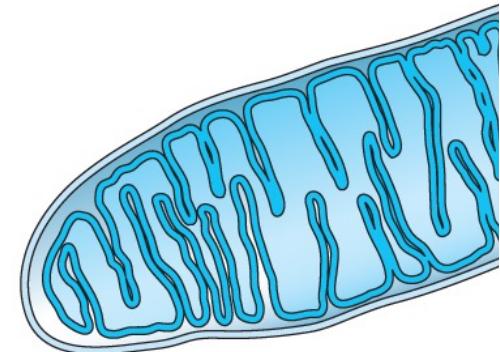
Don W. Fawcett/Science Source.

# Mitochondria

(B)



R. Porter/Science Source.

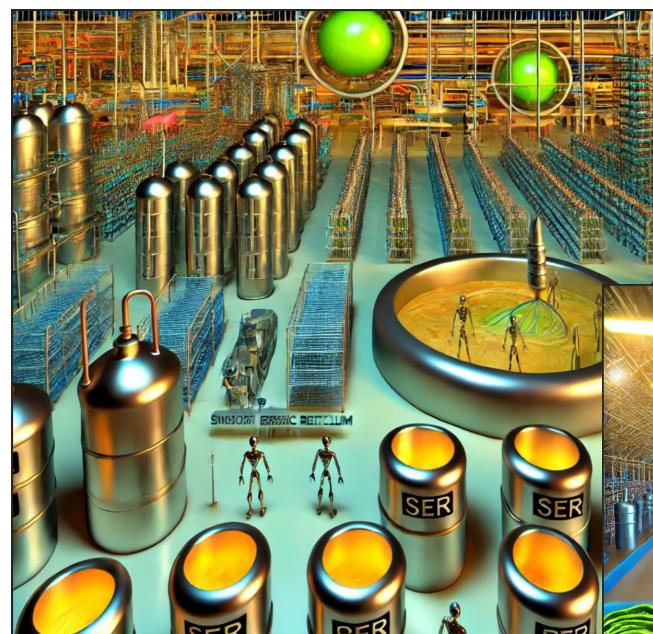
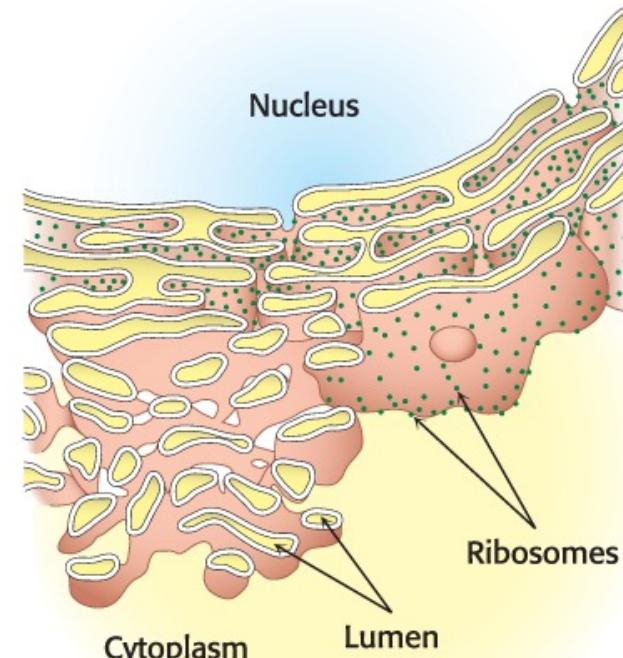


- Mitochondria are the primary site of ATP generation in eukaryotic cells.
- Chloroplasts, found in plant cells, are the site of photosynthesis.



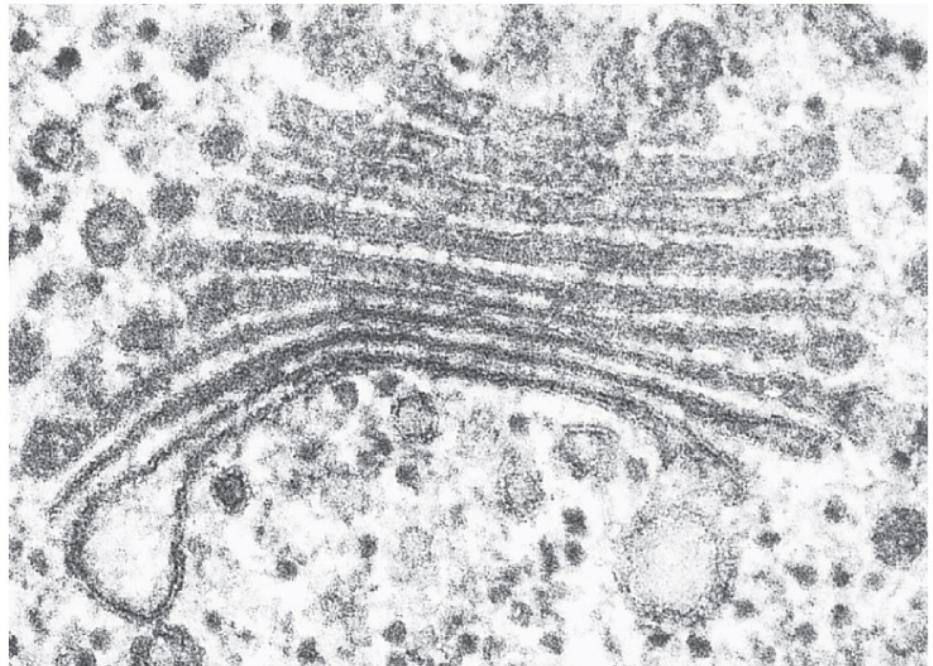
# Endoplasmic Reticulum

- Some organelles process and sort proteins and exchange material with the environment.
- The endoplasmic reticulum (ER) is a series of membranous sacs in the cytoplasm.
- There are two types of ER:
  - Rough ER has ribosomes associated with it and plays a role in protein processing.
  - Smooth ER lacks ribosomes and plays a variety of biochemical roles.



# Golgi Complex

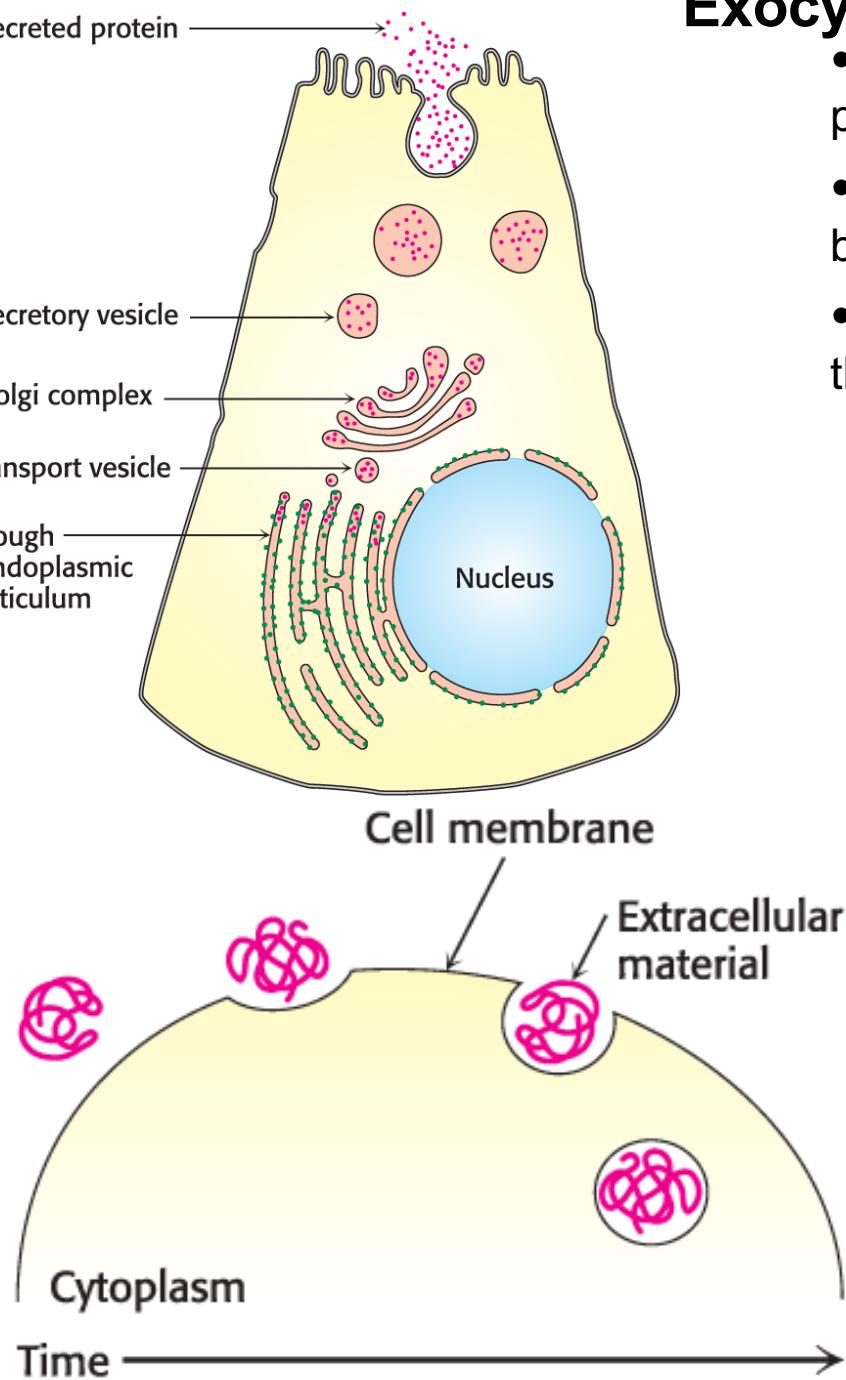
- The Golgi complex is a series of stacked membranes that play a role in protein sorting. Carbohydrates are also attached to proteins in the Golgi complex.
- Proteins are shuttled from the rough ER to the Golgi complex by transport vesicles.



Courtesy of L. Andrew Staehelin, University of Colorado.

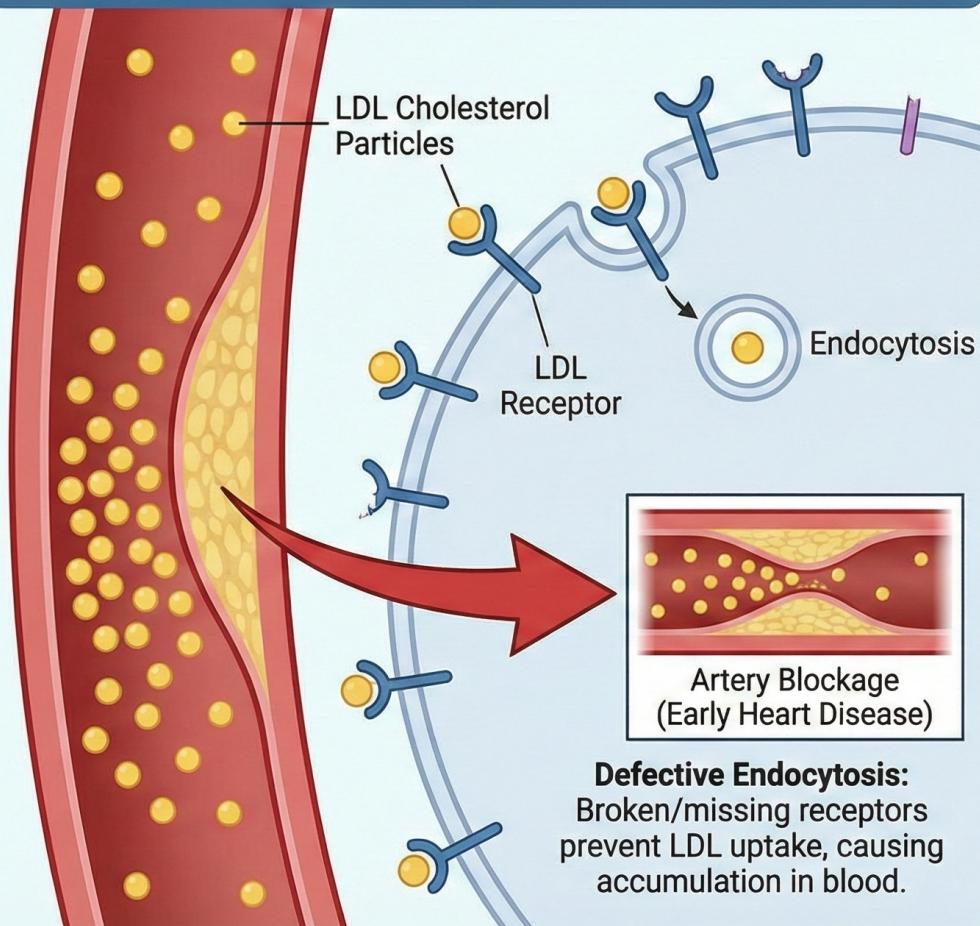
# Exocytosis and Endocytosis

- Secretory granules secrete biomolecules in the process of exocytosis.
- Endocytosis is a means of bringing crucial biomolecules into the cell.
- An endosome is the structure that forms when the plasma membrane invaginates and buds off.

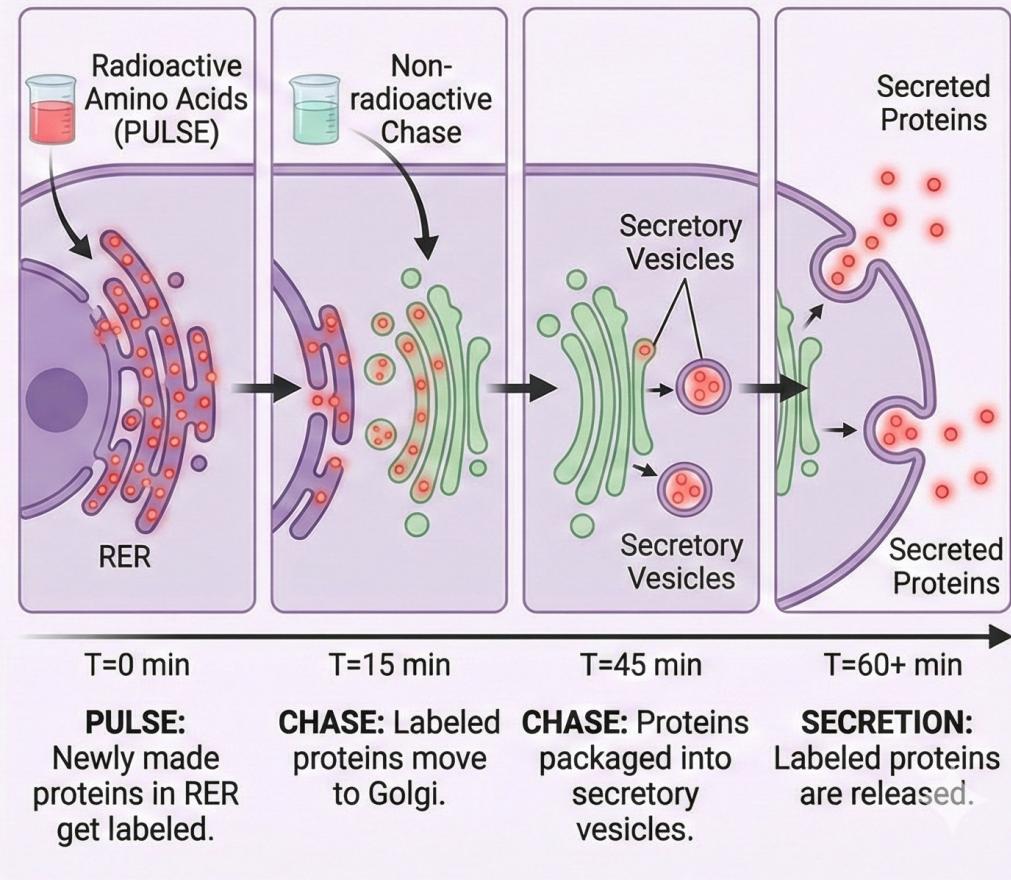


# THE LEVEL UP: MEMBRANE DYNAMICS & PROTEIN TRAFFICKING

## CLINICAL CORRELATE: FAMILIAL HYPERCHOLESTEROLÉMIA (FH)

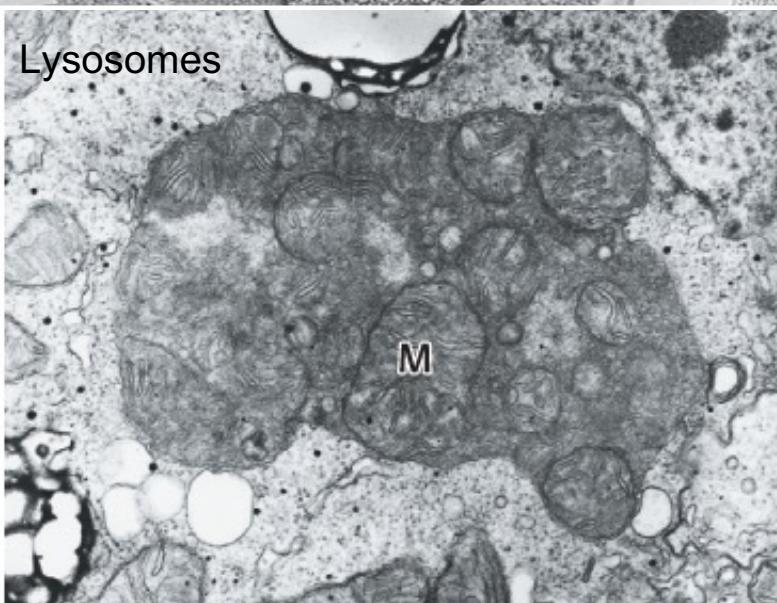


## RESEARCH EDGE: PULSE-CHASE EXPERIMENT (PROTEIN SECRETION)



# Phagocytosis and Lysosomes

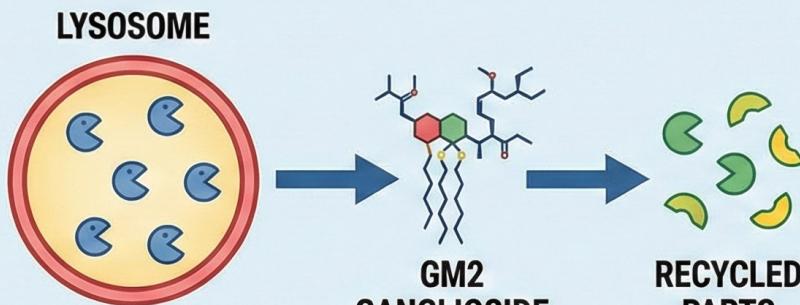
- Large amounts of material can be taken into the cell by the process of phagocytosis.
- Lysosomes contain a variety of digestive enzymes.
- Lysosomes fuse with endosomes to digest material brought into the cell.



# TAY-SACHS DISEASE: LYSOSOMAL DYSFUNCTION & CLINICAL IMPACT

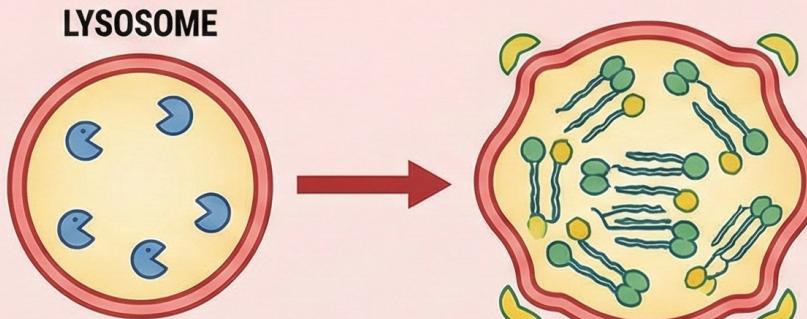
## MECHANISM: THE BROKEN RECYCLING CENTER

HEALTHY NEURON



Functional Hex A Enzyme breaks down GM2 Ganglioside.

TAY-SACHS NEURON



MISSING Hex A Enzyme: GM2 accumulates, damaging cell.

## CLINICAL IMPLICATIONS



**NEUROLOGICAL DECLINE**  
Progressive destruction of nerve cells.

**LOSS OF MOTOR SKILLS**  
Inability to sit, crawl, or move

**EXAGGERATED STARTLE RESPONSE**  
Hyper-reactive to loud noises

**CHERRY-RED SPOT**  
Visible on retinal exam.