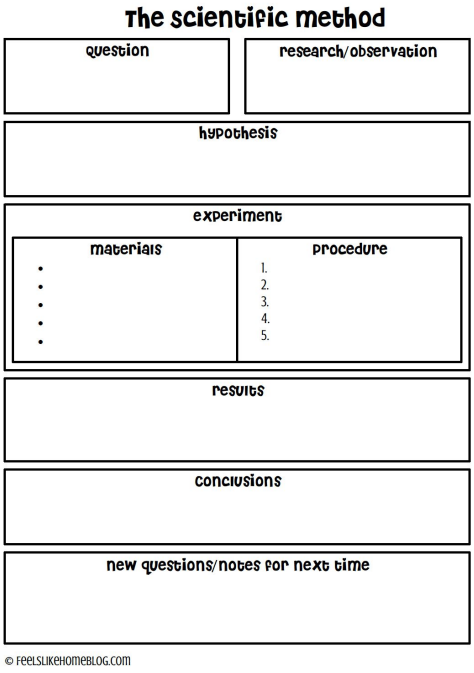
Biology 1: Introduction to Cell biology

Week 1: Introduction to the scientific theory and method - practicing collecting data and conducting an experiment (potential experiments: everyone comes up with an observable experiment in class and fills out a scientific method worksheet outlining their process).



Concepts:

- The scientific method
- Importance of constructing hypothesis before getting results
- Quantitative vs qualitative data

Optional Homework: Go onto google scholar and explore different professional scientific papers, in particular the Methods section and the different ways in which they collect and analyze data (don't worry if you don't understand a lot of the terms!)

Week 2: Overview of atoms, atomic structure (protons, neutrons, etc), bohr model, etc.

Concepts:

- Atoms
- Protons, neutrons, electrons
- Atomic number and mass
- Elements
- How to model atoms

Helpful Reading: https://opentextbc.ca/introductorychemistry/chapter/atomic-theory-2/

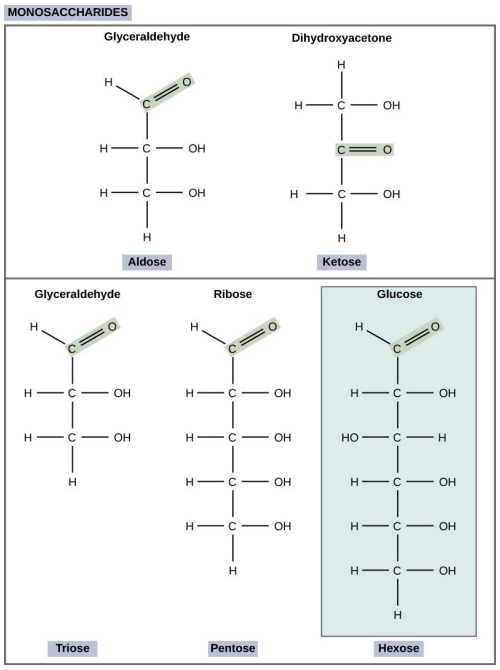
We would like to acknowledge and thank Phillips Academy Andover and their Biology100/580 class for inspiration in this curriculum.

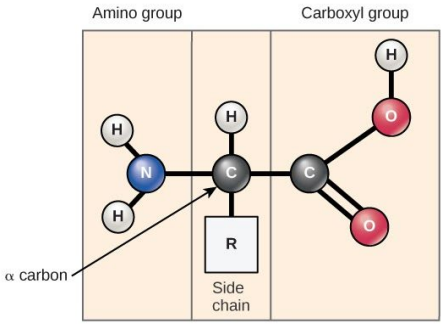
Optional homework: Create a bohr model of an element with materials available in your home like pipe cleaners, paper, etc. Example of how to make them:
https://www.youtube.com/watch?v=-mjXi1b4PMo

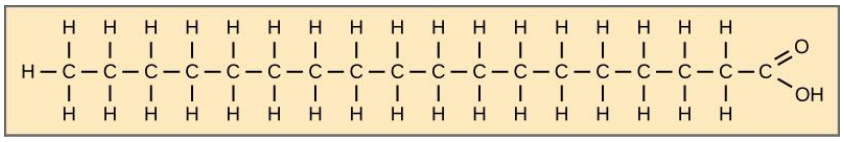
Week 3: Macromolecules: Proteins, carbohydrates, lipids
Concepts:

- Monomer vs. polymer
- Examples of each macromolecule
- Functions and structures of each macromolecule
- Discuss examples of monomer/polymer structures in everyday life.

Explore this page on your own during class:
https://learn.genetics.utah.edu/content/basics/proteintypes/







Optional Homework: Read this page to learn about protein folding
https://openstax.org/books/biology-ap-courses/pages/3-4-proteins

Week 4: Enzymes.
Concepts:

- What is an enzyme (type of protein)
- Function of enzyme
- How to recognize an enzyme

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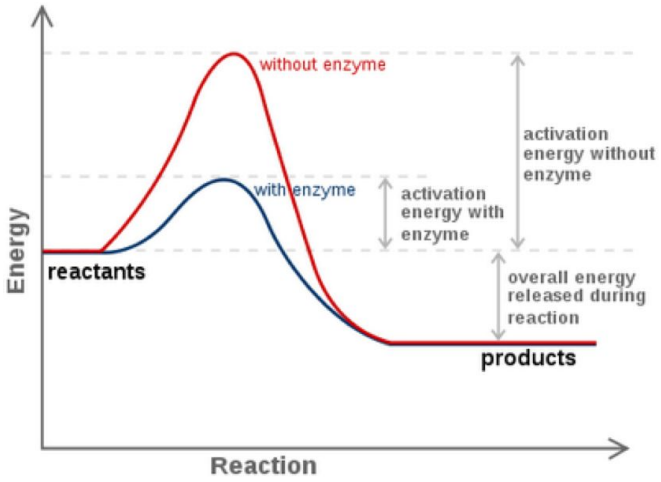
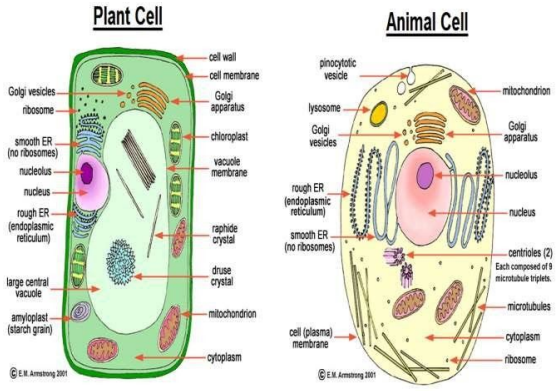
- Examples of enzymes in biological processes
- Competitive vs. noncompetitive inhibition

Intro video: https://www.youtube.com/watch?v=UVeoXYJlBtI



Optional Homework (practice problems)
https://www.khanacademy.org/test-prep/mcat/chemical-processes/enzymes/e/enzymes-questions

Week 5: Cells introduction! Look at pictures of different types of cells under a microscope. Learn about components of a cell such as nucleus and organelles and come up with and draw a metaphor of the organelles as a system (like a cell is like a school and this organelle correlates to this aspect of a school). Prokaryotes Vs. Eukaroytes and Animal Vs Plant Cells
https://www.ncbi.nlm.nih.gov/books/NBK26880/ contains Example Images
Resources: https://www.genome.gov/genetics-glossary/Organelle
Plant vs animal cells;



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Organelles:
https://mass.pbslearningmedia.org/resource/39ad5b1c-d00d-4702-9f19-c70dfd646f0e/cell-structure/
Optional Homework: Video about COVID-19 Structure
https://www.youtube.com/watch?v=4S3DXXtRZZg
Practice Problems: https://openstax.org/books/biology-ap-courses/pages/4-review-questions
(# 1- 19)

Week 6: Cell continued-plasma membrane.
Concepts:

- Fluid mosaic model
- Structure and function of plasma membrane
- Integral proteins and carbohydrates
- Temperature regulation with cholesterol

Resource for learning: https://www.ncbi.nlm.nih.gov/books/NBK9898/
Optional Homework: https://www.quia.com/jg/65947.html Play any of the games for practice, https://www.wisc-online.com/learn/natural-science/life-science/ap1101/construction-of-the-cell-membrane More practice and reading on PM

Week 7: Water-important properties of water to sustain life (density, polarity, cohesion, adhesion), additionally go over concepts like density and polarity and solvent vs. solute as it pertains to water.

Watch some videos demonstrating surface tension.
https://www.youtube.com/watch?v=5NCOnr3VSAY

Optional Homework:
https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level

Week 8: Create your own lab design (don't have to actually complete so think big) incorporating something previously learned, like a density experiment or a property of water. Share ideas and methods of data collection and analysis with the class.
If time, begin pH.

Optional homework for intro to pH: https://www.youtube.com/watch?v=LS67vS10O5Y

Week 9: pH, why pH is important in living systems and connection to human physiology-discussion of equilibrium in living systems.

- What is pH
- Acid base scale

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- Buffers
- pH in living system, such as the human body

In class reading about real life ex of pH: https://oceanservice.noaa.gov/facts/acidification.html
The pH scale: https://www.usgs.gov/media/images/ph-scale
Homeostatis:
https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-body-structure-and-homeostasis/a/homeostasis

Optional project/assignment: pick a person who has made an important scientific discovery/contribution to a field of science that is lesser known and research them and write a short write up of them and their contributions (ex: Rosalind Franklin, Chien-Shiung Wu, Mae Jemison)

Week 10: DNA! What is DNA, structure, how it's replicated.
Experiment (to watch a video of or perform yourself if resources): Strawberry DNA extraction experiment.
https://www.youtube.com/watch?v=vPGKv53zSRQ

Concepts:
- Structure of DNA (nucleic acids)
- Function
- Basics of DNA replication

Video to watch: https://www.youtube.com/watch?v=lSvF5-rBRGQ

https://dnalc.cshl.edu/resources/animations/

Optional Homework: https://dnalc.cshl.edu/resources/animations/pcr.html

Week 11: Continuation of DNA and RNA- Central Dogma of Life (making proteins)
Concepts
- Transcription
- Translation

In class video: https://www.youtube.com/watch?v=oefAI2x2CQM&t=104s
Practice Problems:
https://www.khanacademy.org/science/high-school-biology/hs-molecular-genetics/hs-rna-and-protein-synthesis/e/hs-rna-and-protein-synthesis

Optional Homework: https://learn.genetics.utah.edu/content/basics/telomeres/

Week 12: Connecting concepts to learn about COVID-19-

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- Cellular structure of COVID-19
- RNA producing process
- Macromolecule composition

Video: https://www.youtube.com/watch?v=8hgc2iZflTI

In class do a little research independently on one aspect of COVID-19 pathology (for ex: How masks work, why is ___ a risk factor, what is the zoonotic origin?) and share with the class

Resources

- https://opentextbc.ca/introductorychemistry/chapter/atomic-theory-2/
- https://www.youtube.com/watch?v=-mjXi1b4PMo
- https://learn.genetics.utah.edu/content/basics/proteintypes/
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- https://www.youtube.com/watch?v=UVeoXYJlBtI
- https://www.khanacademy.org/test-prep/mcat/chemical-processes/enzymes/e/enzymes-questions
- https://www.ncbi.nlm.nih.gov/books/NBK26880/
- https://www.genome.gov/genetics-glossary/Organelle
- https://mass.pbslearningmedia.org/resource/39ad5b1c-d00d-4702-9f19-c70dfd646f0e/cell-structure/
- https://www.youtube.com/watch?v=4S3DXXtRZZg
- https://openstax.org/books/biology-ap-courses/pages/4-review-questions
- https://www.ncbi.nlm.nih.gov/books/NBK9898/
- https://www.quia.com/jg/65947.html
- https://www.wisc-online.com/learn/natural-science/life-science/ap1101/construction-of-the-cell-membrane
- https://www.youtube.com/watch?v=5NCOnr3VSAY
- https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level
- https://www.youtube.com/watch?v=LS67vS10O5Y
- https://oceanservice.noaa.gov/facts/acidification.html
- https://www.usgs.gov/media/images/ph-scale
- https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-body-structure-and-homeostasis/a/homeostasis
- https://www.youtube.com/watch?v=vPGKv53zSRQ
- https://www.youtube.com/watch?v=lSvF5-rBRGQ
- https://dnalc.cshl.edu/resources/animations/
- https://dnalc.cshl.edu/resources/animations/pcr.html
- https://www.youtube.com/watch?v=oefAI2x2CQM&t=104s

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- https://www.khanacademy.org/science/high-school-biology/hs-molecular-genetics/hs-rna-and-protein-synthesis/e/hs-rna-and-protein-synthesis
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