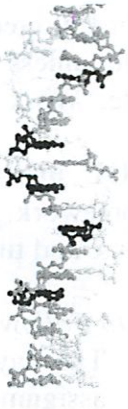
Michael Plagmeier

Biology I
Spring 2008

BIOLOGY I



Welcome to the exciting world of biology! In this course, we will be exploring the amazing world of the biological sciences- an area of continuing growth and technological advance that is constantly shaping the world in which we live. From a strand of DNA to the membrane of a cell, from the adaptation of organisms over time to the complex relationships of organisms with each other and with their environments, biology is a fascinating and diverse subject. This semester, we will be exploring biology through a variety of class activities, lab experiences, individual and group assignments, and in-class presentations.

Text: Prentice Hall Biology, aka **The Dragonfly Book**

Topics we'll cover:

- The Nature of Science and Biology
- The Chemistry of Life
- Cells: Structure and Function
- Cellular Energetics: Photosynthesis and Respiration
- Cell Growth and Division
- Genetics
- DNA and RNA
- Genetic Engineering and the Human Genome
- Evolution
- Diversity of Organisms
- Ecology (Stream Field Trip…)

Wiki password

biology rocks

EXPECTATIONS:

1. **Be on time and ready** to work when the bell rings. After the door shuts, you are late.
2. **Be prepared** for class. Materials required:
    1. a 3-ring binder (at least 1 inch)
    2. loose-leaf paper
    3. your covered textbook
    4. a pen and/or pencil
3. **No drinking or eating** in our classroom for safety reasons, as this is a science lab.
4. **Remain at your table** until you are dismissed at the end of class.
5. **Show respect: -** for the speaker, our classroom resources, your work, and the work of others.

IF YOU *CHOOSE* NOT TO ADHERE TO THESE EXPECTATIONS, these are the consequences:

1. **If you are late** to class, unexcused:
    The first time - you will be assigned a teacher detention (classroom community service).
    The second time - teacher detention and your parents/guardians will be notified.
    The third time - you will be reported to your grade level principal.
2. **If you choose to cut class**, you will receive two 45-minute teacher detentions, a "0" for all work missed, your parents will be notified and your grade level principal will be notified.
3. **Disruptions and inappropriate behavior**:
    First time - you will receive a warning.
    Second – you will spend time in the hallway, possibly writing your guardian a letter…
    Third - teacher detention (classroom community service) and a phone call home.

Homework/Missed Work Policy

For full credit, **assignments are due at the <u>beginning</u> of class.** Any work collected later will be counted late, unless you have already talked to me. Late work will be marked down one letter grade for each day late. Work more than one week late will be given a 50.

YOU are responsible for the work missed when you are absent from class. This includes notes, homework, tests and quizzes. **It is YOUR responsibility** to get the work, schedule makeup quizzes and tests, and turn in any assignments collected while you were out!

Steps to Follow in Order to Make Up Work:

1) The day you return to school, it is your responsibility to find out what notes, homework, or other assignments you missed **from your class buddies, the website, or me.** Copies of handouts or other worksheets that you may have missed can be found in the class file - **it is your responsibility to check the file on your return.**

2) Turn in any assignment that was due the day(s) you were absent on the first day of your return. Place your work in the "Absent/Late" basket, marking the top "Absent" so that credit is not subtracted.

3) Make up your work as quickly as possible. Unless otherwise stated or discussed with me, you will be expected to make up work no later than: # of days absent + 1 day. (Example: if you are absent one day (Tuesday) and return on Wednesday, your work is due at the beginning of class on Friday.)

Test Policy:

Tests are given whenever a major topic has been covered. All tests and most quizzes are announced; tests should be announced at least two days in advance and quizzes one day in advance, although pop quizzes may be given to check homework reading, etc. If you are absent for a quiz/test, **<u>you</u> will have to make arrangements** to promptly take a make-up quiz/test **outside of class** upon your return (within the time allowance allowed for make-up work). The formatting of typical test questions is multiple choice, true/false, matching, short answer/essay, and labeling of diagrams.

Grading:

This course consists of tests, quizzes, homework assignments, class work, labs, activities, projects, presentations, and class participation. At times, you will be expected to write formal laboratory reports. All assignments will be given a point value. Points will be accumulated for the entire marking period and a grade will be determined from this value. Extra credit projects are available if completed by the grade deadline for the marking period. You must have no missing assignments to be eligible for extra credit.

Extra Help:

I am available for extra help before (from 7:00-7:30) or after school (until 3:00), unless I have a meeting. Feel free to just pop in anytime for a quick question or mini-review, etc.

The best way to contact me is via email: vpollard@havsd.net
Or send in a note and I'll get back to you.

Biology Notebooks

- Special Instructions:
    - Use a 2", 3-ring binder as your notebook.
    - The cover of your notebook should have your name, subject, & period.
    - Dividers with tabs labeled with the name of each section must be included.
    - All papers must be clipped into the notebook in the correct order, which is BACK to FRONT. In other words, put the most recent work in the front of each section, so that the recent work is easy to find, right behind the section divider.
    - Notebooks should be brought to class each day. There will be open note pop quizzes.
    - Students will only receive credit for their notebook each four weeks IF it is kept in order!

Notebook Sections:

- SECTION 1 - WEEKLY ASSIGNMENTS
    - Each week, assignments should be written on the same sheet of paper with that week's date at the top. Make a new sheet for each week. Do not write on the back of these sheets
- SECTION 2 - HANDOUTS to BE SAVED ALL YEAR
    - Class expectations, notebook guidelines, safety rules, how to write abstracts & lab reports
- SECTION 3 - CHAPTER WORK
    - Include a cover sheet for each chapter with its number & title
    - Include outlines, notes, worksheets, handouts, study guides, labs, etc.
    - Each sheet must have the chapter & title and your name, date, & period
- SECTION 4 - GRADE REPORTS: Printed every 2 - 3 weeks

1/28

Science is
- study of the world by verifyable means
- to gain an understanding
-
    - for ↑ quality of life
- natural phonemumum

Biology is
- study of life

Scientists should be
- logical problem solvers
- paitent
- deterimination
- persistance
- open minded
- curious
- pratical
- honesity
- integerity

Scientific Method

1/29/08

- traditonal steps not really done in actuallity
- big "web" of parts of science

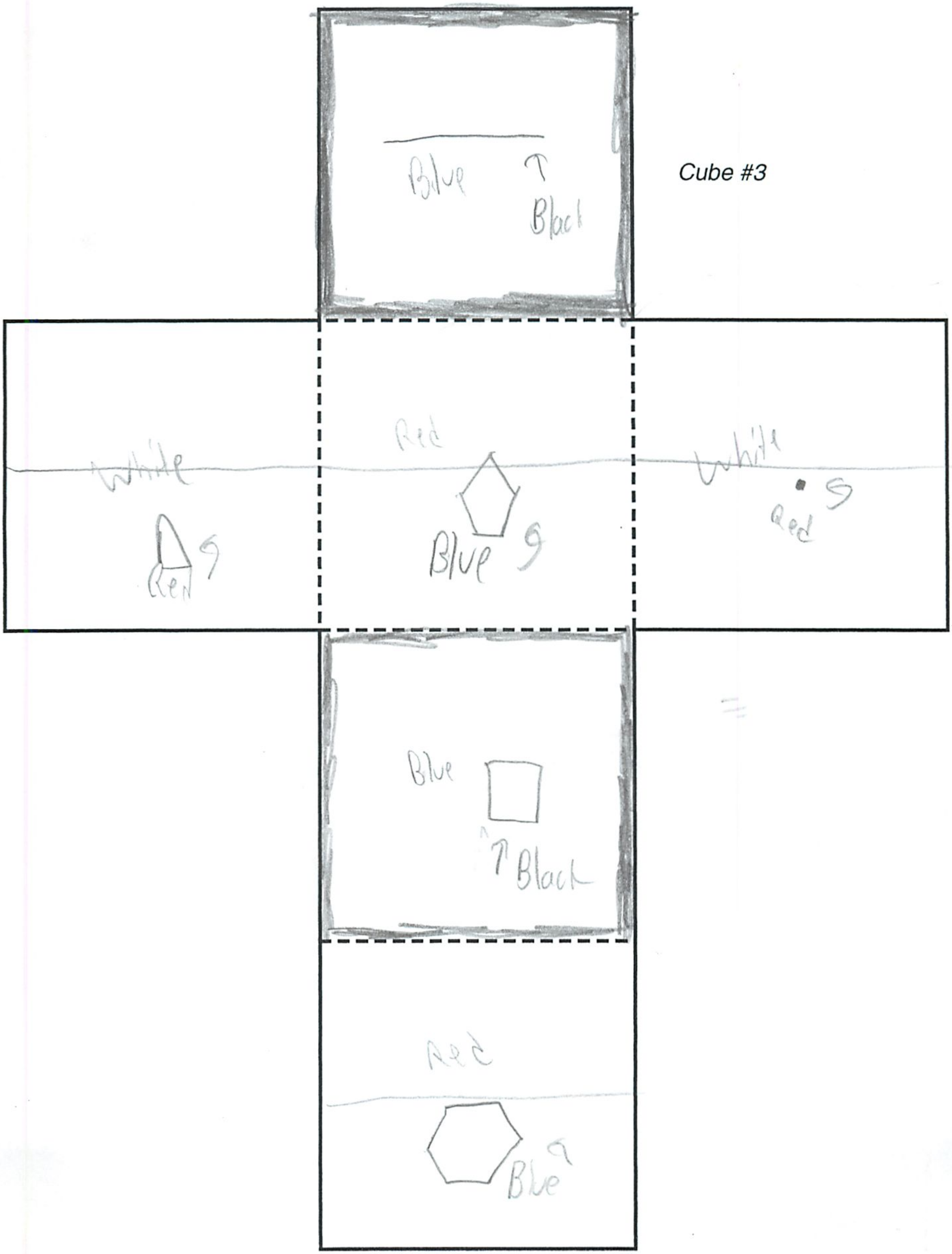
- also includes
  - politics
  - external culture
  - human factor
    - mistakes
  - results of others
  - luck
  - church
  - timing
  - intuition

Observation → inference → hypothesis
- possible explanations
  - can come from guesses

hypotsis must be testable
proved right + wrong
predict an outcome
↑ remember → can learn from if it is wrong

---

answers are probabilistic + limited
- don't get exact answer
- don't know it you are correct



Cube #3

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Metric System (SI)

8/10

Scientist use a single, standard system of measurement. The official name of the measurement system is **SYSTEME INTERNATIONAL d'UNITES** (International System of Measurements) or **SI**. **The metric system is based on the number 10.**

Basic Units of Measurement		
Length	Volume	Mass
meter (m)	liter (l)	gram (g)

Common prefixes:

Metric Conversion Table					
Kilo- (k)	Base Unit (m, l, g)	Centi- (c)	Milli- (m)	Micro- (μ)	nano- (n)
x 1000	meter, gram, liter	100	1000	1 000 000 000	1 000 000 000 000
1000	1	.01	.001	.000001	.000000001

Convert the following values by moving the decimal point the correct number of spaces in the right direction.

Michael Plasmeier
Melanie Solano

1. 69.8 meters (m) = 6980 centimeters (cm) ✓

2. 152.97 milliliters (ml) = 1.5297 liters (l) ✗

3. 42.67 liters (l) = 4267 milliliters (ml) ✗

4. 299.32 kilometers (km) = 2.9932×10^{14} **nanometers (nm)** ✓

5. 26 grams (g) = .026 kilograms (kg) ✓

6. 123.43 centigrams (cg) = 1.2343 grams (g) ✓

7. 75.2 liters (l) = 75200 milliliters (ml) ✓

8. 456.3 grams (g) = 456 300 000 **micrograms μg** ✓

9. 4507.22 kilometers (km) = 4507220 millimeters (mm) ✗

10. 0.00297456 kilograms (kg) = 2 974 560 000 **nanograms (ng)** ✓

Michael Plosmeier

Nice

Biology.1 07/08
Study Guideline

1/29

Chapter 1: The Science of Biology

The goal of science is to investigate and understand nature, to explain events in nature, and to use those explanations to make useful predictions. Scientists use scientific methods to test hypotheses. Whenever possible, only one variable is tested at a time. All other variables are kept the same, or controlled. This is called a controlled experiment. Biology studies life. Life has several key characteristics.

Section 1.1 What is Science

Vocabulary:

- science Organized way of using evidence to learn about the natural world
- observation gathering information in careful orderly way
- data a info gatered
- inference logical intepertation based on prior experience
- hypothesis proposed explination

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Concepts:

- Explain the goal of science. to investigate + understand natural world, explain it, + make useful predictions
- What 3 features make science different from other human endeavors?
  - natural world
  - info collected in orderly manner + look for connections
  - prepore explinations which can be tested by examining evidence
- Science often starts with an Observation.
- Two different types of data are:
  - quantative - #
  - qualitative - desciptive
- A logical interpretation of data is an inference.
- A possible explanation for a result is a hypothesis.
- Where do hypotheses come from? good observations
- What makes a hypothesis a "good" one? able to be tested
- Qualities of a scientist: open minded, curious, ethical, skeptical
- Human values: How does biology benefit us in everyday life?
  - health
  - medicine
  - diseases

Paradigm- theory which has stood the test of time

Biology.1 07/08
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Section 1.2: How Scientists Work

Vocabulary:

- variable
  = parameter
  item which changes
- spontaneous generation
  idea that animals could just appear- from non living matter
- controlled experiment
  test were 1 variable is changed at a time
- theory
  well-tested explianation that unifies a broad range of observations

Concepts

- List the 5 "idealized" steps often used to describe the scientific process.

  Ask A Qu
  Form Hypotness
  Do Controled experiment
  Record + Analize Results
  Draw a Conclusion

- How do you design a "controlled" experiment? (use the terms control and variable)

  You keep constant everything except what you are testing → variable
  The control is what you refer to (unmodified)

- Describe Redi's experiment with spontaneous generation:

  He had 2 identical cups w/ meat. One had a cloth cover. The one with the cover did not form maggots

Needham's:

thought Redi was wrong - boiled gravy to kill off organisms then let it sit + organisms appeared

Spallanzani's:

repeated Needham - but had anoter jar of gravy which was sealed - said organismsm entered jar through the air

Pasteur's:

did same thing w/ broth - but one jar had curved tube which air but not organisms could enter

- Explain how a scientific theory develops. Compare a theory with a hypothesis.

  Many different experments prove it
  theory is proven by many confirmed hypothes's

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Section 1.3: Studying Life

Vocabulary:

- biology
  science of the living world
- cell
  collection of living matter enclosed by a borrier
- sexual reproduction
  cells from 2 porents unite to produce new 1st cell
- asexual reproduction
  1 parent -> sometimes a cell splits in two
- metabolism
  combo of chem, reactions which organism builds up/breaks down materials in its life process
- homeostasis
  internal feed back methods which adjust to let the organism survive
- evolve
  to adapt to your surroundings

Concepts:

1.3.1 Describe the 8 characteristics of living things.

- made up of units called cells -> all cells surronded by membrain contain cyloplasm + organelles
- reproduce
- based on a universal genetic code (DNA)
- grow and develop - (expand or form new, different cells)
- obtain + use materials + energy (metabolism)
- respond to their environments (stimuli)
- maintain a stable internal environment (homeostasis)
- taken as a group -> change over time -> evolve

✓

1.3.2 Explain how life can be studied at different levels.

Biosphere - Earth containing all ecosystems
Ecosystem - Community + non living things in it
Community - Poupulation in a defined area
Poupulation - group of organisms in 1 area
organism - 1 living thing
Group of Cells - tissues + organs
Cells - smallest unit of life <- Molecules - groups of atoms

each gives different perspective

✓

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Study Guideline

1/30

Section 1.4 Tools and Procedures

Vocabulary

- metric system
  (SI) decimal based - multiples of 10 - based on physical items
- microscope
  devices that produce magnified images too small to see w/ unaided eye
- compound light microscope
  allow light to pass through a specimin - 2 lenses - up to 1000x
- electron microscope
  use beams of electrons to allow 1000 x more magnification
- cell culture
  group of cells which develpped from 1 cell ✓
- cell fractionation
  brealing apart a cell in a blender to study 1 part

Concepts:

1.4.1 Describe the measurement system most scientists use.

Metric System - based on Physical measurements
multiples of 10
common prefixes (SI) ✓

1.4.2 Compare and contrast light microscopes and electron microscopes.

Light	Electron	Both
cheaper ✓	~~a~~ ✓	better than Eye
good mag.	better magnification	allow us to study + see cells + microorganisms
living + dead	only dead	

Nice - might move the both (column) to the middle like Venn

1.4.3 Describe two common laboratory techniques.

cell culture - a cell is placed in a dish w/ nutriants so it reproduces

cell fractionation - a cell is broken up in order to study a part of the cell

1.4.4 Explain why it is important to work safely in biology.

You are working with dangorous chemicals + hot + breakable stuff, as well as organisms you might not be able to see. So you should make sure those can't affect you.

Michael Plasmeier

Identifying Controls and Variables

5/5

1/30

Smithers thinks that a special juice will increase the productivity of workers. He creates two groups of 50 workers each and assigns each group the same task (in this case, they're supposed to staple a set of papers). Group A is given the special juice to drink while they work. Group B is not given the special juice. After an hour, Smithers counts how many stacks of papers each group has made. Group A made 1,587 stacks, Group B made 2,113 stacks.

Identify the:

1. Control Group B ✓

2. Independent Variable Juice ✓

3. Dependent Variable Papers Stapled ✓

4. What should Smithers' conclusion be?
No correlation ✓
- Potentially Juice hurt

5. How could this experiment be improved?
repeating it ✓
feeding one water ← A had less time b/c drinking

Homer notices that his shower is covered in a strange green slime. His friend Barney tells him that coconut juice will get rid of the green slime. Homer decides to check this out by spraying half of the shower with coconut juice. He sprays the other half of the shower with water. After 3 days of "treatment" there is no change in the appearance of the green slime on either side of the shower.

6. What was the initial observation? Shower covered in green slime ✓

Identify the-

7. Control Group
cleaning w/ water ✓

8. Independent Variable
coconut juice ✓

9. Dependent Variable
amt. slime ✓

10. What should Homer's conclusion be?
coconut makes no difference vs water ✓

Bart believes that mice exposed to microwaves will become extra strong (maybe he's been reading too much Radioactive Man). He decides to perform this experiment by placing 10 mice in a microwave for 10 seconds. He compared these 10 mice to another 10 mice that had not been exposed. His test consisted of a heavy block of wood that blocked the mouse food. he found that 8 out of 10 of the micro waved mice were able to push the block away. 7 out of 10 of the non-micro waved mice were able to do the same.

Identify the-

11. Control Group

non microwaved mice ✓

12. Independent Variable

microwaves ✓

13. Dependent Variable

ability to move block ✓

14. What should Bart's conclusion be?

No clear conclusion ✓

15. How could Bart's experiment be improved?

repeating it with longer sample, different strenght test ✓

Krusty was told that a certain itching powder was the newest best thing on the market, it even claims to cause 50% longer lasting itches. Interested in this product, he buys the itching powder and compares it to his usual product. One test subject (A) is sprinkled with the original itching powder, and another test subject (B) was sprinkled with the Experimental itching powder. Subject A reported having itches for 30 minutes. Subject B reported to have itches for 45 minutes.

Identify the-

16. Control Group

Test Subject A ✓

17. Independent Variable

brand itching power ✓

18. Dependent Variable

lenght of itching ✓

19. Explain whether the data supports the advertisements claims about its product.

No, Needs longer sample + different batches ✓

Lisa is working on a science project. Her task is to answer the question: "Does Rogooti (which is a commercial hair product) affect the speed of hair growth". Her family is willing to volunteer for the experiment.

20. Describe how Lisa would perform this experiment. Identify the control group, and the independent and dependent variables in your description.

Give some people Rogooti, others normal shampoo and others no shampoo (?) Independent: shampoo Dependent: hair lenght change ✓

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Reviewer leaked data to Glaxo

He breached confidentiality rules in fax to drug's maker.

By **Karl Stark Inquirer Staff Writer**
Source: **Philadelphia Inquirer, The (PA)**; 633 words
Published: **2008-01-31**
Section: **BUSINESS** | Page **C01** | Edition: **CITY-D**

A prominent researcher who reviewed a critical study on the diabetes drug **Avandia** for a major medical journal leaked the findings before publication to the drug's maker, GlaxoSmithKline P.L.C., according to the journal Nature.

don't want to steal experiment to get credit for it

The reviewer, Steven M. Haffner, a professor of internal medicine at the University of Texas Health Science Center at San Antonio, breached confidentiality rules of the New England Journal of Medicine by faxing the study to a friend working for GlaxoSmithKline, in Upper Merion.

NDA rules

The leak was also confirmed by U.S. Sen. Charles E. Grassley (R., Iowa), a noted industry critic who yesterday released a letter he sent to GlaxoSmithKline asking for a detailed accounting of how the firm handled the fax.

Grassley also cited FDA documents showing that Haffner had received at least $75,000 in consulting fees and honoraria from GlaxoSmithKline since 1999.

money vs. whats right

?but cotidentality hurts - b/c people still affected by it

Haffner was not returning media calls yesterday. "Why I sent it is a mystery," he told Nature. "I don't really understand it. I wasn't feeling well. It was bad judgment."

The article Haffner reviewed was written by Cleveland Clinic cardiologist Stephen Nissen and concluded that **Avandia** raised the risk of heart attack. After Nissen's study appeared online on May 21, Glaxo's stock sank that day nearly 8 percent and has continued downward. The decline in **Avandia**, then the firm's second-biggest seller, has helped lead GlaxoSmithKline to lay off thousands of workers worldwide.

Nancy Pekarek, a company spokeswoman, said Haffner faxed the article May 3 to Alexander Cobitz, senior director of metabolism in new medicines development, based in Upper Merion.

"He got the fax because the reviewer had told us he had concerns about the methodology used in the [Nissen] analysis," Pekarek said. "It was a request for technical advice.

"We actually decided it was inappropriate for **GSK** to respond," Pekarek continued. "We thought it was better to have independent comment."

Stock sales on inside info

No senior **GSK** executive profited from the information by selling shares between May 3 and 21, Pekarek said. "I haven't analyzed the entire company," she added. One of the firm's U.S. headquarters is in Philadelphia.

Confidentiality is key in medical journals. Without it, "somebody else could scoop the conclusion by publishing their own work more quickly," said Christine Laine, senior deputy editor of the Annals of Internal Medicine, the nation's largest specialty journal, published in Philadelphia.

"I worry that people are not always following the confidentiality policy completely," Laine said. "It probably happens a lot more than comes to our attention. We would certainly not use that reviewer anymore." The journal would also notify the reviewer's institution about the "ethical breach," she said.

The New England Journal yesterday issued a statement, saying "any breach of ethics by a reviewer would be taken very seriously by the editors, but would be handled as a private matter."

Last year, the journal slapped another reviewer, Columbia University cardiologist Martin B. Leon, for disclosing an article's findings on heart stents at a medical conference before the article appeared. The journal banned Leon from reviewing articles for five years and said he could not publish commentary during that time.

In San Antonio, medical school dean William L. Henrich also issued a statement, saying: "This issue has just come to light on our campus. We are embarking on a complete investigation of the facts. Once the facts are understood, we will take swift and appropriate action."

Haffner was a co-author of a 2006 New England Journal article that was highly supportive of **Avandia**. In that study, financed by GlaxoSmithKline, Haffner reported receiving grant support and consulting and lecture fees from the company.

disclosure required by ethics

Haffner is a national expert in diabetes. His university's Web site calls him "one of the highest-funded investigators, in terms of [National Institutes of Health] funding, in Health Science Center history."

Contact staff writer Karl Stark at 215-854-5363 or kstark@phillynews.com.

Illustration/Photo: Steven M. Haffner, who reviewed a medical journal article on the drug **Avandia** before publication, breached confidentiality rules.

Photograph by: Feed Loader

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When Scientists have a Conflict of Interest

Science Advisors Were Paid Industry Consultants Two scientists testifying at a public hearing about the safety of a new pesticide today admitted that they had once worked for the pesticide's manufacturer. Both researchers denied that their testimony was influenced by the company. However, neither scientist had disclosed the relationship before giving a recommendation.

Scientists are expected to be completely honest about their investigations. Doctors are expected to place the welfare of their patients first. Yet, conflicts of interest can often threaten the credibility of a researcher. A conflict of interest exists when a person's work can be influenced by personal factors such as financial gain, fame, future work, or favoritism.

The Viewpoints

Regulation is Necessary

Some scientists argue that, because the public must be able to trust the work of science, some rules are essential for preserving scientific integrity. Every profession should regulate its members, and every science publication should have strict rules about avoiding conflicts of interest. In any published work, announcements of potential conflicts should be required. In some cases, scientists should avoid or be forbidden to do work that involves personal gain in addition to the usual payment for doing the work. Some form of government regulation may be needed.

Regulation Is Unnecessary

Other scientists insist that conflict-of-interest regulations are unnecessary for the majority of researchers, who are honest and objective about their work. It is unfair to assume that a researcher's discoveries would be different because a particular organization has paid for an investigation. In fact, without additional funding from some organizations, new drugs or new techniques would never have been developed. So, it is important that scientists be allowed to investigate any topic, especially when it would help others.

You Decide

1. Defining the Issue. When might scientists have a conflict of interest? Are financial incentives more dangerous to a scientist's objectivity than other conflicts of interest? Explain.

2. Analyzing the Viewpoints. How might the views about a possible conflict of interest differ among a group of scientists, a science-journal editor deciding to publish a scientist's work, the company employing a scientist, and people seeking information from a scientist?

3. Forming Your Opinion. How do you think this problem of possible conflicts of interest should be decided? Include information or reasoning that answers people with the opposite view.

4. Role-Playing. Suppose doctors who own a company developing a new medicine want their patients to help test the medicine. Let one person represent a doctor, a second person a patient, and a third person a medical reporter asking: Should the patients take part in the tests?

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INTEGRITY in SCIENCE

A CSPI PROJECT

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> *It's as though financial conflicts of interest were a given of nature or a Constitutional right (neither of which they are... [F]inancial conflicts of interest are not inherent to the research enterprise... I believe we need to stop dancing on the margins of this issue and deal with it head-on.*
>
> – Marcia Angell, Remarks delivered at the HHS Conference on Financial Conflicts of Interest, August 16, 2000

Our Mission

Over the last thirty years, the commercialization of science in the United States and around the world has increased dramatically. The revolution in genetics, patent protections for bioengineered molecules, laws strengthening intellectual property rights, and the 1980 Bayh-Dole Act authorizing licensing and patenting of results from federally-sponsored research created new incentives for scientists, clinicians, and academic institutions to join forces with for-profit industry in an unprecedented array of entrepreneurial activities.

Although many have cheered partnerships between industry and the research community, it is also acknowledged that they entail conflicts of interest that may compromise the judgment of trusted professionals, the credibility of research institutions and scientific journals, the safety and transparency of human subjects research, the norms of free inquiry, and the legitimacy of science-based policy.

For example:

- There is strong evidence that researchers' financial ties to chemical, pharmaceutical, or tobacco manufacturers directly influence their published positions in supporting the benefit or downplaying the harm of the manufacturers' product.
- A growing body of evidence indicates that pharmaceutical industry gifts and inducements bias clinicians' judgments and influence doctors' prescribing practices.
- There are well-known cases of industry seeking to discredit or prevent the publication of research results that are critical of its products.
- Studies of life-science faculty indicate that researchers with industry funding are more likely to withhold research results in order to secure commercial advantage.
- Increasingly, the same academic institutions that are responsible for oversight of scientific integrity and human subjects protection are entering financial relationships with

the industries whose product-evaluations they oversee.

In response to the commercialization of science and the growing problem of conflicts of interest, the Integrity in Science Project seeks to:

- raise awareness about the role that corporate funding and other corporate interests play in scientific research, oversight, and publication;
- investigate and publicize conflicts of interest and other potentially destructive influences of industry-sponsored science;
- advocate for full disclosure of funding sources by individuals, governmental and non-governmental organizations that conduct, regulate, or provide oversight of scientific investigation or promote specific scientific findings;
- encourage policy-makers at all levels of government to seek balance on expert advisory committees and to provide public, web-based access to conflict-of-interest information collected in the course of committee formation;
- encourage journalists to routinely ask scientists and others about their possible conflicts of interests and to provide this information to the public.

CSPI SUBSCRIBE TO NUTRITION ACTION

Jump to:

I. THE TYPES OF SCIENTIFIC MISCONDUCT

Negligence

There are two broad categories of scientific misconduct that must initially be taken into consideration. The first category is perhaps best classified as *scientific negligence*. For this classification, we will include those instances where scientists have provided erroneous information, but have not set out from the beginning with the intent to defraud. For these cases, not only is the public "fooled", but the scientist is also deceived. The scientist who experiences this *self-deception* is one who has no premeditated plans to be dishonest. The researcher is exposed as having human faults, a trait that may be considered by many to be inappropriate for the scientist to exhibit.

The false information promulgated by such erroneous research may not ever be discovered. This would depend on a number of factors; the primary of these being the relative importance of the work in that specific field of research. As a case in point, consider the cold fusion *fiasco* of recent years.(3) Is it reasonable to assume that such a fuss would have been made over erroneous results reported with regard to relatively "uninteresting" bits of research? It is most unlikely.

It is noteworthy that contemporary cases of proven negligence are not well documented in the pertinent literature. An exception to this observation is the aforementioned cold fusion problem. The details associated with the attempt by scientists to achieve cold fusion have been described elsewhere.(3) The controversy itself stems from the claimed success of achieving fusion at room temperatures by two scientists, B. Stanley Pons (University of Utah) and Martin Fleischmann (University of Southampton in England). Initially many of their contemporaries believed that Pons and Fleischmann achieved their results through experimental error and poor procedures; however, a panel of outside scientists has deemed that the research performed at the Utah National Cold Fusion Institute is scientifically sound.(4) So why all the fuss?

Pons and Fleischmann did not follow the commonly accepted procedures for announcing their experimental findings. It is standard practice for scientists to submit their experimental methodologies and collected data to a scholarly journal for review and eventual publication. Evidently, Pons and Fleischmann did submit a paper to the journal Nature; however, it was rejected on the grounds that it contained insufficient detail regarding their experiments. Thus, in their haste to go public with the claim, their research methods and results were not reviewed by a panel of their peers prior to being released to the public via the media and popular press. They didn't even have the opportunity to perform basic control experiments of their own.

Why did they release information about their work prematurely? The opportunity to claim priority for the discovery of cold fusion was undoubtedly an important reason. In another frequently publicized accusation of misconduct (perhaps originally stemming from an act of negligence), it has been suggested that Robert Gallo may not actually have priority in his claim to have co-discovered the cause of the AIDS virus.(5) Initially, one might wonder "Why make such a fuss? Why does it really matter who was first in discovering the cause of AIDS?". Two primary motivating factors have been illuminated: gain of notoriety (which includes the soon-to-follow prestige and bolstering of reputation) and financial gain. Gallo's group was able to patent their sensitive method of detecting the AIDS virus. Therein lies a portion of the financial motivation. Granted, many scientists are personally motivated by the self-satisfaction and excitement associated with doing novel research. Many practicing scientists are extremely dedicated to their work; however, being a scientist is also a **job**. Scientists must foster the growth of their careers no differently than persons in other vocations. They must prove that they are proficient in the performance of the tasks that they set out to accomplish. A claim of priority in a new discovery is strong supporting evidence. Returning to the cold fusion example, it has been suggested that administrators at the University of Utah encouraged Pons and Fleischmann to release information about their experimentation prematurely. The university would have shared not only in the prestige associated with the claim, but they stood to gain significant financial allocations from the state and federal governments as well.

Would things have turned out differently if Pons and Fleischmann had waited for the completion of the peer review process? This is an impossible question to answer. It may only be surmised that their peers would have recognized the paper describing the cold fusion process to be flawed. However, this might not have been the case. It has been noted that "...in physics, textbook science may be about 90% right whereas the primary literature [published research] is probably 90% wrong.".(6) There are many documented cases illustrating the ease with which unsound research papers have succeeded in achieving publication.(1) An additional difficulty associated with the cold fusion case rests with reproducibility of Pons and Fleischmann's experimental work. Soon after they released the details concerning their physical apparatus and experimental methods, other laboratories attempted to reproduce this room temperature fusion. Some laboratories claimed success and others reported failure. The jury is still out regarding the likelihood of room temperature fusion. Even as recently as March 27, 1992 (the third anniversary of the announcement of cold fusion), advocates for cold fusion research "...bitterly attacked the scientific establishment for its rejection and disregard of the controversial phenomenon.".(7) The same article reports that Pons recently told Italian journalists that he expected a cold fusion demonstration device to be unveiled before the end of the year. As for the possibility of cold fusion, only time will tell. If it actually works, Pons and Fleischmann will assuredly not be remembered solely for their negligence.

Deliberate Dishonesty

The second category of scientific misconduct involves the deliberate attempt by a scientist to be dishonest. Included are premeditated acts of fraud that may include forged or fabricated data, falsified or invented results, plagiarism, piracy, hoaxes, and other such malicious acts.

Two recent texts concerned with instances of scientific misconduct have been quite explicit in defining the types of premeditated cheating that may occur.(1,2) Broad & Wade attribute the descriptions of "trimming", "cooking", and forging to Charles Babbage's 1830 text *Reflections on the Decline of Science in England*. It would seem that there were concerns about premeditated scientific misconduct well over one-hundred and fifty years ago. *Trimming*, according to Babbage, would essentially be the act of forcing observations to fit a desired mean by removing portions of those data points that deviate in excess and adding these portions to those data points that deviate in the other extreme. Babbage defined *cooking* as the process of making many measurements and then only reporting those choice measurements that are deemed satisfactory by the appropriate standards. Finally, he describes *forgery* as the act of recording fictitious results by one who wishes to build a scientific reputation.

Kohn attempts to translate these terms into contemporary jargon in Chapter 1 of his text.(2) Cooking, he writes, would now be recognized as *finagling* and trimming will be recognized as *massaging the data* or *fudging*. He also notes that plagiarism may simply be considered as another type of forgery.

A thorough discussion of the documented cases of scientific dishonesty will not be found here. Interested readers are encouraged to consult the following texts: Betrayers of the Truth, by Broad and Wade, and False Prophets, by Kohn.(1,2) Both texts cite not only contemporary instances of misconduct, but many historical cases as well. Bauer has written that "It is difficult enough to prove a living person guilty of deliberate deceit, even greater caution is appropriate in finding guilty those who came before.".(6) Heeding this warning, we will consider as an example of scientific fraud the eminent and contemporary instance commonly referred to as the Baltimore case.

In 1986, a researcher in the field of immunology, Margot O'Toole, raised questions about a paper submitted to the journal *Cell* by Thereza Imanishi-Kiri. At that time, O'Toole was a postdoctoral student in Imanishi-Kiri's laboratory and she lost her job as a result of this *whistle-blowing*.(8) David Baltimore, former president of Rockefeller University, shared responsibility for the paper as one of five authors. Baltimore discussed the disputed data with Imanishi-Kiri in 1986; however, the records weren't scrutinized due to reported disorganization of the notebooks and supporting documents. Baltimore staunchly defended the work of his co-author; a retraction of the paper in question was not initiated. O'Toole was not satisfied. She brought her concerns to immunologists at Tufts University and in June of 1986 they concluded that there was no evidence of foul play. This conclusion was supported by a following review at MIT. O'Toole persisted. In January 1989, an NIH panel investigated the matter. Although some questions were raised regarding the acquisition of the scrutinized data, the panel concluded that the paper was essentially sound. Baltimore continued to support the work of his colleague and placed 100% trust in the integrity of the *Cell* paper.

In May of 1989, Baltimore, Imanishi-Kiri, O'Toole, and others participated in official hearings before a U.S. Congress investigations subcommittee. The Secret Service offered potential evidence of foul play obtained from forensic analyses of ribbon ink, printer, and paper upon which the data in question were produced. Baltimore dismissed this evidence and continued to adamantly defend his colleague. He provided a stirring commentary regarding these hearings for the periodical Technology Review. Titled "Self-Regulation of Science", Baltimore offered the view that "The worth of a piece of research is determined when scientific peers attempt to reproduce or, more commonly, extend an experimenter's results.".(9) He argued that there were those who

> "want to substitute criteria and methods more appropriate for ferreting out corporate fraud than for evaluating a scientific investigation. They wish to impose rules that would not merely regulate science but regiment it. This poses a danger to the integrity of the scientific process.".(9)

It is ironic that Baltimore would agree in his short essay that "We must be alert to indications of fraud and misconduct, and ready to discipline the perpetrators.". In March of 1991, NIH investigators concluded that Imanishi-Kiri forged entire sets of data during the years from 1986 to 1988 in order to support her *Cell* paper. The investigation didn't resolve the question of whether simple error, mistakes, or fraud led to the original discrepancies in the paper. Once it came under scrutiny however, Imanishi-Kiri began to systematically fabricate data to support it.(10) In March of 1991, Baltimore finally requested that *Cell* retract the paper in question. In May, he issued a statement to NIH that included an apology to Margot O'Toole.(11) He cited that his defense of his colleague was fueled "by my respect for Dr. Imanishi-Kiri's demonstrated abilities as a scientist, by my belief that the paper's scientific conclusions were sound, and by my trust in the efficacy of the peer review process.". It is tragic that Baltimore would argue so adamantly for the self-regulation of science and yet not make a positive contribution to the process himself.

Those who read Baltimore's literary accounts will find that he is a very careful writer. Many of his statements express keen insight into the workings of science as an institution. At the same time, his handling of the affair as portrayed by the media is a terribly embarrassing example of 'how not to handle an allegation of scientific misconduct'. Dr. Baltimore wanted to be such a strong spokesperson for his colleagues (and seemingly *defend the honor of science as well*), that he neglected to mind the affairs at hand. He made extraordinary statements before NIH investigators; such as "You can make up anything that you want in your notebooks, but you can't call it fraud unless it's published."!(10) He responded with hostility toward the initiators of the congressional investigative committees in which he was invited to participate. Baltimore's credibility was soon damaged if not completely destroyed. He has since resigned from his position as president of Rockefeller University. Even Nobel laureates share human character flaws and motives -- both his personal and scientific reputations have undoubtedly suffered dearly following this spectacle. A full literary account of this affair will undoubtedly provide for interesting reading.

- Return to Misconduct in Science
- Next Chapter

Michael Plasmeier

1/31

Scientific Method & Blood

INTRODUCTION:

In this lab you will learn to form a hypothesis, conduct experiments around that hypothesis, and collect and analyze data. One of the most important characteristics of modern science is its quantitative approach to solving problems. One of the first scientists to use quantitative methods was William Harvey, who discovered that blood circulated through the body. At the time Harvey began his work, anatomists believed that the liver produced blood from the food that the body consumed. The blood was then carried by veins to the heart, purified in the lungs, and then pumped to the various organs of the body, where it was consumed. Harvey measured that the left ventricle of the heart held roughly 100 ml of blood. He also measured that the heart beats an average of 64 times per minute.

QUESTION 1:

From the information above, and assuming that 1 ml of blood weighs 1 g, how much blood would the body need to produce per hour in (g/hr.) to replace the blood consumed by the organs? 384,060 g/hr.

Harvey hypothesized that the same blood must circulate continuously throughout the body.

MATERIALS:

Watch with second hand, or clock

PROCEDURE:

1. While sitting quietly at your desk, find the pulse in your wrist and count the beats for one minute. You and your lab partner can do this on yourselves, or each other. Record the names of both subjects and their beats per minute heart rate on DATA TABLE 1 as sample 1.
2. Repeat step 1 two more times for each subject. Record the data in the appropriate place on DATA TABLE 1.
3. Calculate the average pulse rate for each subject and record the results on DATA TABLE 1.

How do you think standing or holding your breath will affect your pulse rate?

Go up

QUESTION 2:

Choose one of these activities and formulate a hypothesis about its effect on pulse rate. What is the independent variable? What is the dependent variable?

Hypothesis Holding your breath causes heart rate to ↑

Independent Variable Air circulation

Dependent Variable heart rate

4. Repeat steps 1, 2, and 3 for each subject, this time with the subjects standing or holding their breath. Record your data and calculations in the appropriate DATA TABLE

Resting

Michael 75

Philip

DATA TABLE 1: *Resting heart rate*

	NUMBER OF BEATS PER MINUTE			AVERAGE NUMBER OF BEATS PER MINUTE
SUBJECT	**sample 1**	**sample 2**	**sample 3**	
Michall	70	80	78	76
Melanie	75	74	76	75

DATA TABLE 2: *Heart rate standing*

	NUMBER OF BEATS PER MINUTE			AVERAGE NUMBER OF BEATS PER MINUTE
SUBJECT	**sample 1**	**sample 2**	**sample 3**	
Michael	86	88	86	87
Melanie	72	72	73	72.5

DATA TABLE 3: *Heart rate holding breath*

	NUMBER OF BEATS PER MINUTE			AVERAGE NUMBER OF BEATS PER MINUTE
SUBJECT	**sample 1**	**sample 2**	**sample 3**	
Michael	92	92	84	89 1/3
Melanie	70	72	74	72

Conclusion: Compare your data from step **4** with your data from step **3**.

1. **How do your results in step 4 compare with the hypothesis you made?**

No correlation found in both cases

2. **What measurement did you use as a control in this investigation?**

Resting heart rate

3. **What are some possible sources of error in this experiment?**

Measuring your pulse yourself
People conducting exeperment are the subjects

Search

XL: How to Create a Bell Curve Chart

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Revision : 1.0

SUMMARY

A bell curve is a plot of normal distribution of a given data set. This article describes how you can create a chart of a bell curve in Microsoft Excel.

MORE INFORMATION

In the following example you can create a bell curve of data generated by Excel using the Random Number Generation tool in the Analysis ToolPak. After Microsoft Excel generates a set of random numbers, you can create a histogram using those random numbers and the Histogram tool from the Analysis ToolPak. From the histogram, you can create a chart to represent a bell curve.

To create a sample bell curve, follow these steps:

1. Start Excel.
2. Enter the following column headings in a new worksheet:

   ```
   A1:Original B1:Average C1:Bin D1:Random E1:Histogram G1:Histogram
   ```

3. Enter the following data in the same worksheet:

   ```
   A2: 23 B2: A3: 25 B3: STDEV A4: 12 B4: A5: 24 A6: 27 A7: 57 A8: 45 A9: 19
   ```

4. Enter the following formulas in the same worksheet:

   ```
   B2: =AVERAGE(A2:A9) B3: B4: =STDEV(A2:A9)
   ```

   These formulas will generate the average (mean) and standard deviation of the original data, respectively.
5. Enter the following formulas to generate the bin range for the histogram:

   ```
   C2: =$B$2-3*$B4
   ```

   This generates the lower limit of the bin range. This number represents three standard deviations less than the average.

   ```
   C3: =C2+$B$4
   ```

   This formula adds one standard deviation to the number calculated in the cell above.
6. Select Cell C3, grab the fill handle, and then fill the formula down from cell C3 to cell C8.
7. To generate the random data that will form the basis for the bell curve, follow these steps:
   a. On the **Tools** menu, click **Data Analysis**.
   b. In the **Analysis Tools** box, click **Random Number Generation**, and then click **OK**.
   c. In the **Number of Variables** box, type **1**.
   d. In the **Number of Random Numbers** box, type **2000**.

      NOTE: Varying this number will increase or decrease the accuracy of the bell curve.
   e. In the **Distribution box**, select **Normal**.
   f. In the **Parameters** pane, enter the number calculated in cell B2 (29 in the example) in the **Mean** box.
   g. In the **Standard Deviation** box enter the number calculated in cell B4 (14.68722).
   h. Leave the **Random Seed** box blank.
   i. In the **Output Options** pane, click **Output Range**.
   j. Type **D2** in the **Output Range** box.

      This will generate 2,000 random numbers that fit in a normal distribution.
   k. Click **OK**.
8. To create a histogram for the random data, follow these steps:
   a. On the **Tools** menu, click **Data Analysis**.
   b. In the **Analysis Tools** box, select **Histogram**, and then click **OK**.
   c. In the **Input Range** box, type **D2:D2001**.
   d. In the **Bin Range** box, type C2:C8.
   e. In the **Output Options** pane, click **Output Range**.
   f. Type **E2** in the **Output Range** box.
   g. Click **OK**.
9. To create a histogram for the original data, follow these steps:
   a. On the **Tools** menu, click **Data Analysis**.
   b. Click **Histogram**, and then click **OK**.
   c. In the **Input Range** box, type **A2:A9**.
   d. In the **Bin Range** box, type **C2:C8**.
   e. In the **Output Options** pane, click **Output Range**.
   f. Type **G2** in the **Output Range** box.
   g. Click **OK**.
10. Create labels for the legend in the chart by entering the following:

    ```
    E14: =G1&"-"&G2 E15: =E1&"-"&F2 E16: =G1&"-"&H2
    ```

11. Select the range of cells, E2:H10, on the worksheet.
12. On the **Insert** menu, click **Chart**.
13. Under **Chart type**, click **XY (Scatter)**.
14. Under **Chart sub-type**, in the middle row, click the chart on the right.

    NOTE: Just below these 5 sub-types, the description will say "Scatter with data points connected by smoothed lines without markers."
15. Click **Next**.
16. Click the **Series** tab.
17. In the **Name** box, delete the cell reference, and then select cell E15.
18. In the **X Values** box, delete the range reference, and then select the range E3:E10.

19. In the **Y Values** box, delete the range reference, and then select the range F3:F10.
20. Click **Add** to add another series.
21. Click the **Name** box, and then select cell E14.
22. Click the **X Values** box, and then select the range E3:E10.
23. In the **Y Values** box, delete the value that's there, and then select the range G3:G10.
24. Click **Add** to add another series.
25. Click the **Name** box, and then select cell E16.
26. Click the **X Values** box, and then select the range E3:E10.
27. Click the **Y Values** box, delete the value that's there, and then select the range H3:H10.
28. Click **Finish**.

    The chart will have two curved series and a flat series along the x-axis.
29. Double-click the second series; it should be labeled "- Bin" in the legend.
30. In the **Format Data Series** dialog box, click the **Axis** tab.
31. Click **Secondary Axis**, and then click **OK**.

You now have a chart that compares a given data set to a bell curve.

REFERENCES

For more information about creating charts, click **Microsoft Excel Help** on the **Help** menu, type **create a chart** in the Office Assistant or the Answer Wizard, and then click **Search** to view the topic.

APPLIES TO

- Microsoft Excel 2000 Standard Edition
- Microsoft Excel 97 Standard Edition

Keywords: kbhowto KB213930

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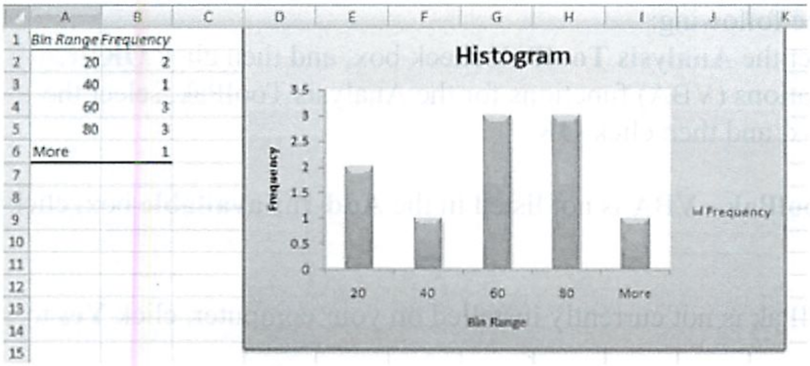
Present your data in a histogram (Excel 2007)

You can analyze your data and display it in a histogram (a column chart that displays frequency data) by using the Histogram tool of the Analysis ToolPak. This data analysis add-in (add-in: A supplemental program that adds custom commands or custom features to Microsoft Office.) is available when you install Microsoft Office Excel 2007, but it might not be loaded automatically.

Important If you don't see the **Data Analysis** button in the **Analysis** group on the **Data** tab, you must load the Analysis ToolPak add-in.



Bin Range	Frequency
20	2
40	1
60	3
80	3
More	1

What do you want to do?

- Learn more about plotting data in a histogram
- Load the Analysis ToolPak
- Create a histogram

Learn more about plotting data in a histogram

To create a histogram, you must organize the data in two columns on the worksheet. These columns must contain the following data:

- **Input data** This is the data that you want to analyze by using the Histogram tool.
- **Bin numbers** These numbers represent the intervals that you want the Histogram tool to use for measuring the input data in the data analysis.

When you use the Histogram tool, Excel counts the number of data points (data points: Individual values plotted in a chart and represented by bars, columns, lines, pie or doughnut slices, dots, and various other shapes called data markers. Data markers of the same color constitute a data series.) in each data bin. A data point is included in a particular bin if the number is greater than the lowest bound and equal to or less than the greatest bound for the data bin. If you omit the bin range, Excel creates a set of evenly distributed bins between the minimum and maximum values of the input data.

The output of the histogram analysis is displayed on a new worksheet (or in a new workbook) and shows a histogram table and a column chart that reflects the data in the histogram table.

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Load the Analysis ToolPak

1. Click the **Microsoft Office Button** , and then click **Excel Options**.
2. Click **Add-Ins**.
3. In the **Manage** box, click **Excel Add-ins**, and then click **Go**.
4. In the **Add-Ins available** box, do one of the following:
    - To load the Analysis ToolPak, select the **Analysis ToolPak** check box, and then click **OK**.
    - To include Visual Basic for Applications (VBA) functions for the Analysis ToolPak, select the **Analysis ToolPak - VBA** check box, and then click **OK**.

    Tip If **Analysis ToolPak** or **Analysis ToolPak - VBA** is not listed in the **Add-Ins available** box, click **Browse** to locate it.

5. If you see a message that the Analysis ToolPak is not currently installed on your computer, click **Yes** to install it.

Tip After you load the Analysis ToolPak, the **Data Analysis** command is available in the **Analysis** group on the **Data** tab.

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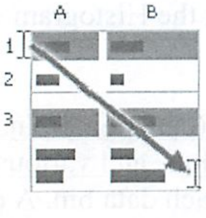
Create a histogram

1. To enter the data that you want to analyze in a histogram, do one of the following:
    - Copy the example worksheet data to your worksheet.

        ⊞ How to copy the example worksheet data

        1. Create a blank workbook or worksheet.
        2. Select the example in the Help topic.

            Note Do not select the row or column headers.

            Selecting an example from Help

        3. Press CTRL+C.
        4. In the worksheet, select cell A1, and press CTRL+V.

	A	B
1	**Input Range**	**Bin Range**
2	87	20
3	27	40
4	45	60
5	62	80
6	3	
7	52	
8	20	
9	43	
10	74	
11	61	

- On a worksheet, enter your own data as follows:
  1. In one column, type the input data.

     Note You must enter quantitative numeric data (such as item amounts or test scores) in each cell of the input column — the Histogram tool does not work with qualitative numeric data (such as identification numbers).

  2. In another column, type the bin numbers that you want to use for the analysis. The bin numbers must be entered in ascending order.

     Note If you don't enter the bin numbers on the worksheet, the Histogram tool automatically creates evenly distributed bin intervals by using the minimum and maximum values in the input range as start and end points. However, these bins may not be useful — we recommend that you use your own bin numbers.

     Tip If you want, you can add a label in the first cell of these columns.

2. On the **Data** tab, in the **Analysis** group, click **Data Analysis**.
3. In the **Analysis Tools** box, click **Histogram**, and then click **OK**.
4. Under **Input**, in the **Input Range** box, enter the cell reference for the range of data you want to analyze.

   Tip If you are using the sample worksheet data, type **A1:A11**.

   You can also click the **Collapse Dialog** button, select the range on the worksheet, and then click the **Collapse Dialog** button again to return to the dialog box.

5. Under **Input**, in the **Bin Range** box, enter the cell reference to a range that contains an optional set of boundary values that define bin ranges.

   Tip If you are using the sample worksheet data, type **B1:B5**.

You can also click the **Collapse Dialog** button, select the range on the worksheet, and then click the **Collapse Dialog** button again to return to the dialog box.

Note If you do not enter a range in the **Bin Range** box, the Histogram tool creates a set of evenly distributed bins between the data's minimum and maximum values. However, we recommend that you enter or select the bin range that you used on the worksheet.

6. If you included column labels when you selected the input and bin range data, select the **Labels** check box.
7. Under **Output options**, do one of the following:
    - To paste the output table on the same sheet, click **Output Range**, and then enter the cell reference (cell reference: The set of coordinates that a cell occupies on a worksheet. For example, the reference of the cell that appears at the intersection of column B and row 3 is B3.) of the upper-left cell of the output table.

      Note The Histogram tool automatically determines the size of the output area and displays a message if the output table will replace existing data.

    - To insert a new worksheet in the current workbook and paste the output table starting at cell A1 of the new worksheet, click **New Worksheet Ply**.

      Tip You can type a name in the **New Worksheet Ply** box.

    - To create a new workbook and paste the output table on a new worksheet in the new workbook, click **New Workbook**.
8. Under **Output options**, do any or all of the following:
    - To present data in the output table in descending order of frequency, select the **Pareto (sorted histogram)** check box.
    - To generate an output table column for cumulative percentages and to include a cumulative percentage line in the histogram chart, select the **Cumulative Percentage** check box.
    - To generate an embedded histogram chart with the output table, select the **Chart Output** check box.
9. Click **OK**.

Tip After the bin and frequency table is generated, you can select any of the text and change the default labels. When you click the histogram, you can use the design, layout, and format options of the **Chart Tools** to change the display of the chart. For more information about changing the design and format of a chart, see the links in the **See Also** section.

Living Things

2/4

Have cells
- cells wrapped in membrains
- have cyloplasm + organells
  - nuclus is one organells
    - contains the DNA + regulates the cels
- simplest cell -> prokaryotes <- before it has a nuclus
  - bacteria
  - single celled
  - No Nucleus or membraine bound organells
- more complex -> eukaryotes
  - plants, animals, protists, fungi
- Unicellular + multicellular organisms
- we are made up of about 80 types of cells

Reproduction
- Sexual
  - 2 parents — variety
  - increases genitic diversity
- Asexual
  - 1 parent
  - quicker, so can have more — numbers
  - children same as parent
  - less genitic mixing + diversity

- Genetic Code
  - DNA -> deoxribose nucleic acid
  - helix (double)
  - all organisms have it
  - codes for proteins that make up the cells

Growth
- grow by producing more cells

Food + Energy
autotrophs make their own food
photoautotropes - use sunlight to make food
↑ photosynthesis
chemoautotropes - use chemicals such as iron + sulfer (at the bottom of the ocean)
heterotropes - can't make food
- consume other organisms
- all have metabolism → chemical reactions
- sunlight is the ultimate source of energy
- resporation is releasing chemical energy stored in food

Respond to Stimuli
- temperature
- water
- food
- supplies
- in order to survive + reproduce

Homeostasis
- pH need to be in range
- temp
- water

Evolve
- groups change over time
- fossil records show past

Levels of Organization

2/4

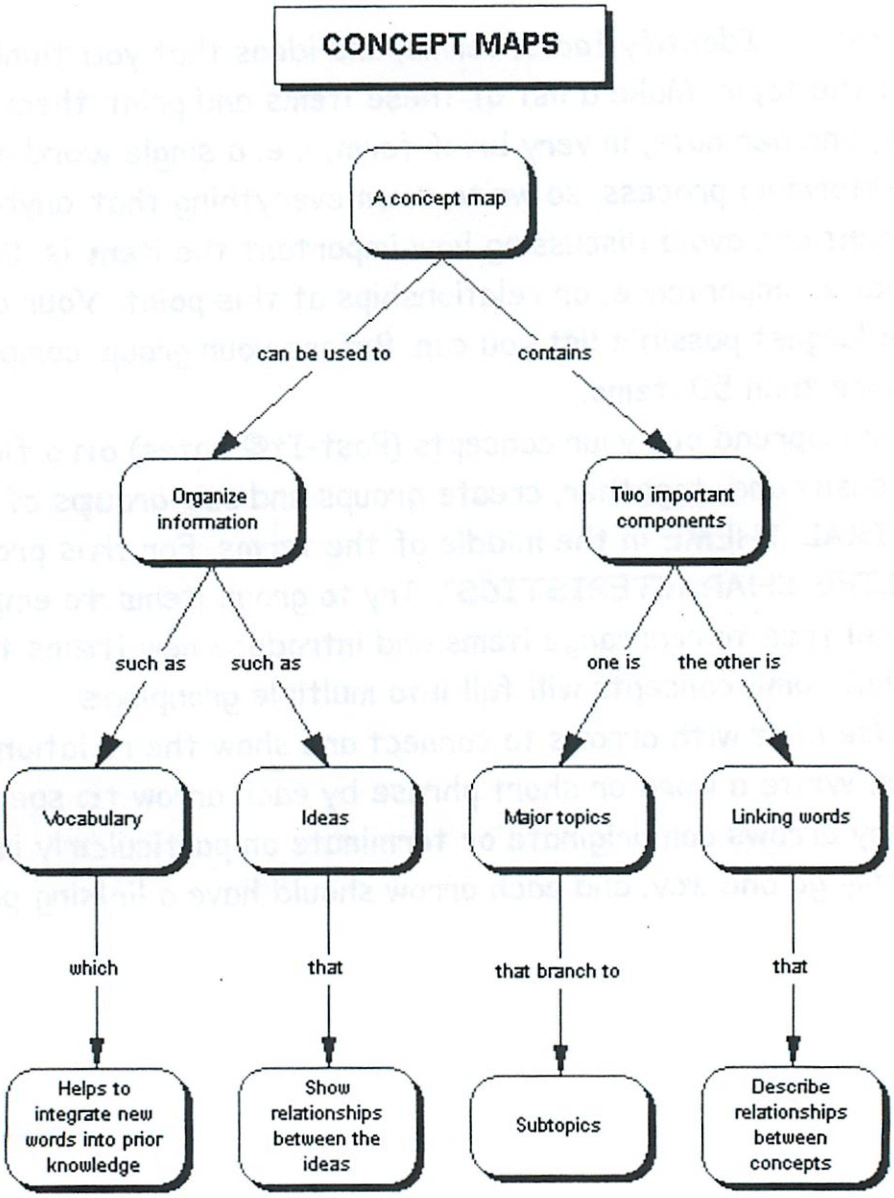
- Atoms
- Molecules
- Organells
- Cells ← life ⤵
- Tissue
- Organs
- System
- Organism
- Population
- Community
- Ecosystem ← Abiotic ⤵
- Biosphere

Constructing a Concept Map of the Characteristics of Life

Objective: Students will work in groups to construct a concept map of the characteristics of life that demonstrates their knowledge of the attributes and criteria used by biologists to measure life.

1. **Brainstorming Phase**: Identify facts, terms, and ideas that you think are in anyway associated with the topic. Make a list of these items and print them neatly on small Post-It® notes, one per note, in very brief form, i. e. a single word or short phrase. This is a brain-storming process, so write down everything that anybody in your group thinks is important and avoid discussing how important the item is. Don't worry about redundancy, relative importance, or relationships at this point. Your objective here is to generate the largest possible list you can. Before your group completes this step, you may have more than 50 items.
2. **Organizing Phase**: Spread out your concepts (Post-It® notes) on a flat surface so that all can be read easily and, together, create groups and sub-groups of related items. Place your **CENTRAL THEME** in the middle of the terms. For this project, the theme of the map is "**LIFE CHARACTERISTICS**". Try to group items to emphasize relationships. Feel free to rearrange items and introduce new items that you omitted initially. Note that some concepts will fall into multiple groupings.
3. **Linking Phase**: Use lines with arrows to connect and show the relationship between connected items. Write a word or short phrase by each arrow to specify the relationship. Many arrows can originate or terminate on particularly important concepts. Arrows should only go one way, and each arrow should have a linking phrase attached to it.

Example of a Concept Map - On Concept Maps



Grading

	Rarely (1)	Sometimes (2)	Frequently (3)	Extensively (4)
Overall	The concept map does not seem to have a focus.	The purpose of the concept map is not clear. Few characteristics of life are represented.	The concept map has a focus, though it is somewhat disjointed or difficult to decipher. Most characteristics of life are represented.	The concept map clearly has a focus and a purpose. A casual viewer would understand what the map is trying to convey. All characteristics of life are represented.
Terms	Very few relevant terms present	Not enough terms are used to show clear relationships and purpose or many terms are irrelevant	Extensive use of terms, a few obvious points missing, or irrelevant terms present	An extensive use of terms and vocabulary used in the map. Terms are relevant.
Links	Many links not clear and unlabeled. Failure to show relationships.	Some links not clear or unlabeled. Relationships between ideas poorly established.	Links show the relationships between concepts. A few terms have more than one link present.	Links clearly show the relationships between concepts. Most of the concepts have more than one link present
Technical	Very poor organization, map impossible to follow.	Map somewhat difficult to follow. Organization poor.	Map easy to read and to follow. Organization fair.	Map easy to read and to follow. Organization good. No grammar or spelling errors.

Parts of a Microscope

Before the microscope was invented, people thought there was nothing smaller than the smallest things that could be viewed with the human eye. Then early microscope designers like Robert Hooke changed all that. Robert Hooke made a microscope out of two lenses placed at opposite ends of a long tube. The tube was attached to a stand, and an oil lamp provided light. Hooke also added a mirror to focus the light onto the object being examined. He used his microscope to magnify visible things like fleas.

Today, most microscopes are called **compound microscopes**, and use two lenses for greater magnification. The upper lens is called the **ocular lens** or **eyepiece**, and the lower lens (or lenses, as there may be a choice of sizes) is called the **objective lens.** ***Label and Color the ocular lens light blue***. Most eyepiece lenses are 10X magnification. The magnification of each objective lens will be marked on the side of the objective. To determine the **total magnification**, multiply the eyepiece power (10X) times the magnification of the objective you are using.

Always begin focusing a microscope on the lowest power and then move to the next higher power and refocus. *Label and color* the low power objective pink and the high power objective red. The eyepiece is at the top of the body tube. *Label* the body tube. The objective lenses are located on a **revolving nosepiece at the bottom of the body tube.** *Label and color* the nosepiece brown and the body tube orange.

When an image is formed, it is actually **magnified twice**. First, the image is formed at the bottom by the objective lens. Then the image is projected through a tube and magnified again by the eyepiece at the top. The image is always upside down, so what you see through a microscope shows up as the opposite of what you are doing. Any movement of the object also shows up in the opposite way. When you move an object to the right, it appears to move to the left, and when you move it up, its image moves down. Use black arrows to show the pathway that light takes through the microscope to your eye.

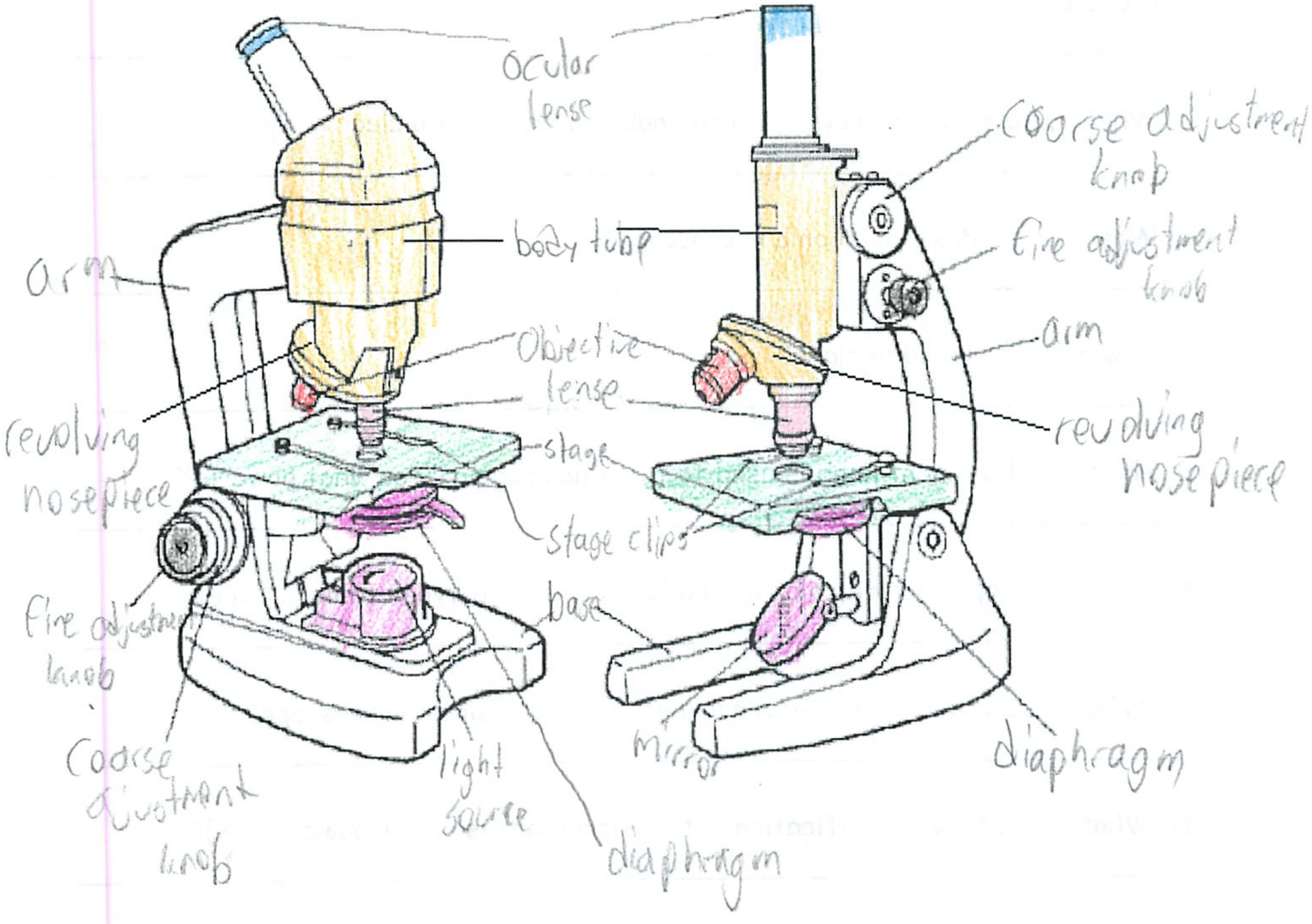
When setting up a microscope, be sure to carry the scope with two hands. Place one hand under the **base** and the other hand on the **arm**. *Label* the arm and base. Make sure that the microscope is away from the edge of the table and that the electrical cord is on the table so that it can't be accidentally caught and pull off the microscope. Uncover the microscope and turn on the light source.

To use a microscope, you need to place a slide or a specimen on the **stage**. ***Label*** the stage and ***color*** it light green. You should make sure that the slide on the specimen is sitting over the hole in the stage. Stage clips hold the slide in place on the stage. The **mirror** or **light source**, under the stage, will reflect the light source you are using to light up your specimen. ***Label and color*** the light source or mirror violet. For safety reasons, you should never use a microscope in direct sunlight. This could hurt your eyes. Locate the **diaphragm** directly under the stage. This may be a rotating wheel with different size holes or a lever that moves back and forth. ***Label and color*** the diaphragm dark purple. While looking through the eyepiece of your microscope at your specimen, adjust the diaphragm to get the right amount of light coming through the microscope.

Place a microscope slide with your specimen on the stage under the **stage clips** to hold the slide in place. ***Label*** the stage clips. Look through the eyepiece to see the specimen. If your microscope has more than one objective lens, start with the low power objective to get the clearest and largest view of the specimen. To focus on low power, raise the stage all the way to the top using the **coarse adjustment knob** (larger). Look through the microscope at your specimen and turn the coarse adjustment knob until the image is clear. Remember that you always need to keep both eyes open while looking into the microscope, because this will help you to avoid a painful condition called eyestrain. After the image is clear on the lowest power, turn the nosepiece to the next highest power and focus the image using the **fine adjustment knob** (smaller). ***Label and color*** the fine adjustment knob black. ***Label*** the coarse adjustment knob. Once you are finished with your microscope, remove the slide, return the scope to low power, and turn off the light.

Label and Color the Parts of both microscopes!

Parts of the Microscope



Questions:

1. What is the difference between ocular and objective lenses?
They are 2 different things. The objective lense sees it 1st and tan the ocular magnifes it more. The ocular is usually 10x and objective varries

2. What part of a microscope helps adjust the brightness of an image?

diaphragm

3. How should a microscope be carried?

With 2 hands - one on the base and the arm

4. The ocular and objectives are found at the top and bottom of what part of a microscope?

body tubes

5. When focusing on low power, which knob is used to get a clear image?

Coarse adjustment knobs

6. Where are slides placed on a microscope?

On the stage

7. How are slides held in place?

Stage clips + gravity

8. The fine adjustment knob is used to focus an image only on what power(s)?

higher powers

9. The microscope you are coloring and labeling is what type of microscope?

compound light

10. What should be done whenever you are finished using a microscope?

Remove slide, return to high power + turn off light

11. What is the total magnification if the microscope is on low power (20X)?

20x · 10x = 200x

12. What would be the magnification, if you were using a 40X objective?

40 · 10 = 400 x

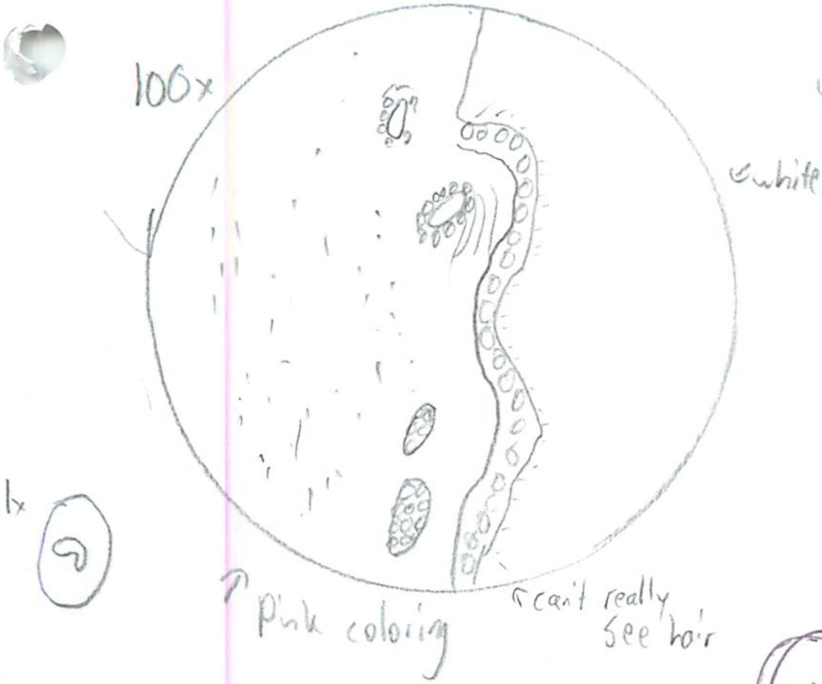
Michael Plasmeier

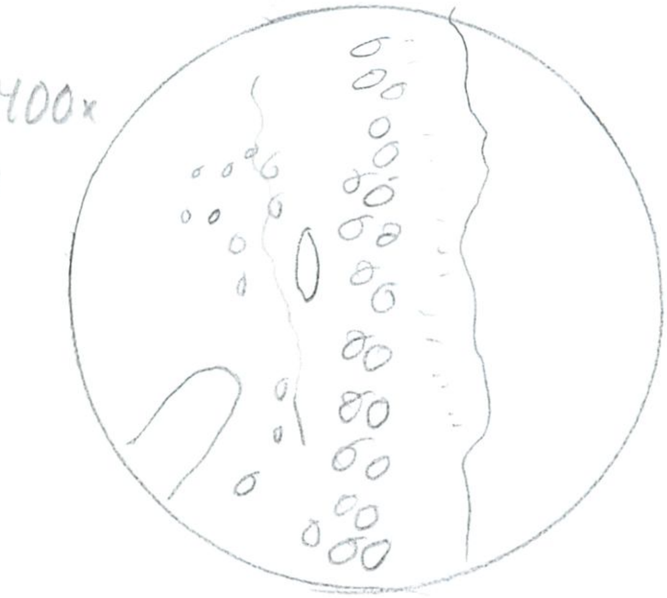
Antony van Leeuwenhoek was an unlikely scientist. Leeuwenhoek was born in Delft on October 24, 1632. A drawing of one of Leeuwenhoek's "microscopes" is shown at the left. Compound microscopes (that is, microscopes using more than one lens) had been invented around 1595, nearly forty years before Leeuwenhoek was born. In 1673, Leeuwenhoek began writing letters to the newly-formed Royal Society of London, describing what he had seen with his microscopes -- his first letter contained some observations on the stings of bees. Leeuwenhoek looked at animal and plant tissues, at mineral crystals and at fossils. Leeuwenhoek soon became famous as his letters were published and translated.

Michael Plasmeier

Antony van Leeuwenhoek was a Dutch tradesman turned scientist. He made some of the best early microscopes which allowed him to make many important discoveries. He was very good at shaping glass and he was able to produce a microscope with 200x magnification. He is sometimes credited with inventing the microscope; however he first saw the idea in books. Although he was not a "real" scientist, he published many articles in scientific journals about his discoveries including bacteria and blood cells and lake water. To this day, he is known as one of the first to have studied the microscopic world up close.

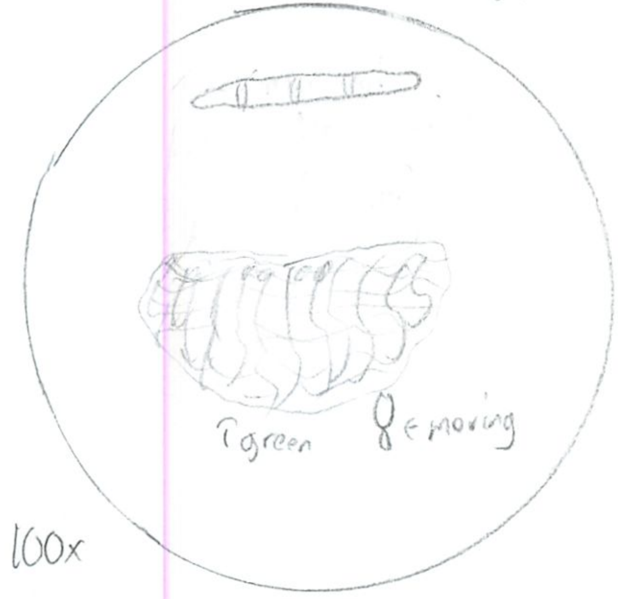
Cilated Cocmnor Epithelium (Small intestine lumen)

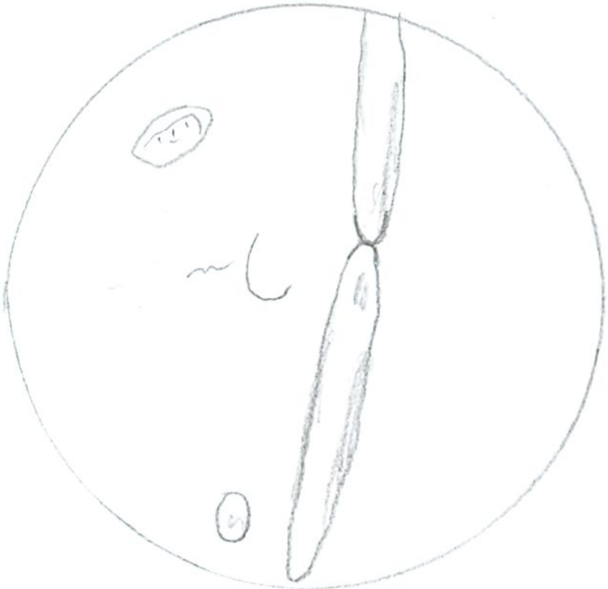




10/10

Spirogyra sp.





Michael Plasreier

Name: Michael Plasmeier **Class:** Bio 4 **Date:** 2/8/08 **ID: B**

Biology - I, 1 Chapter 1 Test

96/100

Multiple Choice

Identify the choice that best completes the statement or answers the question.

C 1. A theory
a. is always true.
b. is the opening statement of an experiment.
[✓ c. may be revised or replaced.]
d. is a problem to be solved.

a 2. The process by which organisms keep their internal conditions fairly constant is called
[✓ a. homeostasis.] c. metabolism
b. evolution. d. photosynthesis.

d 3. A controlled experiment allows the scientist to isolate and test
a. a conclusion. c. several variables. ← Psyc
b. a mass of information. [✓ d. a single variable.]

d 4. In the metric system, the basic unit of length is the
a. centimeter. c. millimeter.
b. kilometer. [✓ d. meter.]

c 5. Scientific hypotheses must be proposed in a way that
a. ensures that a scientist makes money.
b. allows them to be proven true.
[✓ c. allows them to be tested.]
d. doesn't contradict previous hypotheses.

d 6. The basic unit of mass in the metric or International System of Units, or SI, is the
a. meter. c. liter.
b. ounce. [✓ d. gram.]

d 7. During cell fractionation, an instrument used to separate cell parts according to density is the
a. compound light microscope. c. blender.
b. electron microscope. [✓ d. centrifuge.]

c 8. What is the term for a group of organisms of one type living in the same place?
a. biosphere [✓ c. population]
? b. ecosystem d. environment

a 9. An instrument that allows light to pass through the specimen and uses two lenses to form an image is a(an)
[✓ a. compound light microscope.] c. TEM.
b. electron microscope. d. SEM.

c 10. All of the following are characteristics of all living things EXCEPT
a. growth. [✓ c. movement.]
b. reproduction. d. use of energy.

d 11. Scientists publish the details of important experiments so that
a. their work can be repeated.
b. their experimental procedures can be reviewed.
c. others can try to reproduce the results.
[✓ d. all of the above]

a 12. Which of the following terms includes all the others?
[✓ a.] biologist
b. botanist
c. zoologist
d. microbiologist

b 13. A well-tested explanation that unifies a broad range of observations is a(an)
a. hypothesis.
[✓ b.] theory.
c. inference.
d. controlled experiment.

b 14. Which is NOT a unit of measurement in the metric or International System of Units?
a. meter
[✓ b.] ounce
c. liter
d. gram

d 15. Hypotheses may arise from
a. prior knowledge.
b. logical inferences.
c. imaginative guesses.
[✓ d.] all of the above

c 16. To observe a small living organism, a scientist might use a(an)
a. electronic balance.
b. centrifuge.
[✓ c.] compound light microscope.
d. electron microscope.

d 17. Which of the following is NOT a way that scientists generate hypotheses?
a. using informed, creative imagination
b. using logical inference
c. using prior knowledge
[✓ d.] using a feeling about what should occur to confirm

c) none of the above

b 18. The work of scientists begins with
a. testing a hypothesis.
[✓ b.] careful observations.
c. creating experiments.
d. drawing conclusions.

d 19. The ability to reproduce results is an important part of any
a. hypothesis.
b. theory.
c. law.
[✓ d.] experiment.

b 20. Biology is the study of
a. the land, water, and air on Earth.
[✓ b.] living things.
c. animals and plants only.
d. the environment.

b 21. What is the term given to a group of cells grown in a lab that develop from a single original cell?
a. community
[✓ b.] cell culture
c. nutrient solution
d. cell fractionation

d 22. A controlled experiment allows the scientist to isolate and test
a. a conclusion.
b. a mass of information.
c. several variables.
[✓ d.] a single variable.

Completion

Complete each statement.

23. The information you gather during an experiment is called your data.

24. The name given to the idea that life could arise from nonliving matter is called Spontanous generation

25. A variable that is deliberately changed in an experiment is the independent variable.

Name: ______________________ **ID: B**

26. The compound light microscope is generally used in high-school laboratories.

27. The smallest units that are considered to be alive are called cells.

? 28. The information gathered from observation is called observations → qualitative

29. Based on his hypothsis, Redi made a prediction that keeping flies away from meat would prevent maggots appearing on the meat.

30. The chemical reactions through which an organism builds up or breaks down materials as it carries out its life processes is called metabolism.

Short Answer

31. Can a theory change over time? Explain your answer.

Yes, more experiments can be doe which contridict prior findings. If these experiments are sucessful a theory could be over turned

32. What is the difference between a theory and a hypothesis?

A theory is created after many hypothesises were evaluated. A theory is basically considered to be true while a hypothesis still needs an experiment to prove or dis prove it.

33. List and define five of the levels of organization that biologists study.

Ecosystem - all of the living + non living things in a certain area

Poupulation - all of the organisms of one type in

Organisms - a living thing

Groups of cells - a certain tissue or organ in an organism

Cell - the smallest living thing in an organism

Molecules - what cells are made of

Nice!

34. What is the difference between an inference and an observation?

An obsevation is a direct recording of what you see.

An inference is an attempted interpetation or prediction which is made on top of an observation

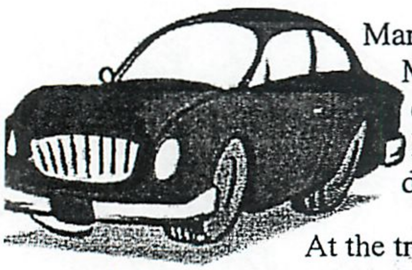
Name: ______________________ **ID: B**

35. Suppose someone told you that plants grow faster when given milk than when given water. Explain the steps of the process you would use to test this using scientific methods.

Well that above is a hypothsis I would then design an expriment. I would tale 10 of the same seeds put them in the same type of pot, etc. 5 of them would be watered with X mL of milk while 5 of them would be watered with the same amant of water. The sunlight and everything else would be the same. After a certain amount of time, I would measure their height + color.

Case

36. The Martian and the Car:



Marty Martian was sent to Earth by the Martian government to find life. While on Earth, Marty captured a car and brought it back to Mars. He thought he'd found a good example of life on Earth. The Martian government does not believe that the car Marty brought back is alive. Marty must stand trial for failing to perform his Martian duties.

At the trial, Marty spoke in his defense. "I first saw these life forms rolling along roads in great numbers. They were giving off thick clouds of poisonous waste as they moved. They seemed to exhibit herding behavior, as many of the cars moved in the same direction. They appeared to have a great deal of energy, some of them moved faster than 60 kilometers per hour. When one of these life forms stopped or slow down, the others behind it responded. They slowed down and gave off a reddish light from the back, and sometimes they would make honking noises. I observed that they would stop to feed on a liquid substance."

Take the part of Marty's defense attorney and make a good case for the car's being alive. Then be the prosecutor and show that the car is a nonliving thing. List as many reasons as you can.

Be sure to mention all the characteristics of living things at least once.

Defense Attorney (says the car is alive)	Prosecutor (says the car is not alive)
1. Moves	1. Dosn't reproduce
2. Takes in Energy	2. Doesn't re-adjust to environment
3. Responds to environment (stop at light)	3. Needs something to make it move another organism
4. Has exhaust	4. No DNA
5. variety of colors + shapes	5. Doesn't change over time
All of the cars have a	Not made of living cells

homeostasis!

ex. temprat

(-2)

grow + develop!

2.1

Matter, Atoms, Elements

2/11/08

matter -> takes up space + has mass
anyway

atom -> smallest unit of an element
- character
- protons ⊕
- neutron
- electron ⊖

mass = quantity of matter in an object

weight = pull of gravity on an object

elements - pure substances
- can't be broken down further

atomic mass = protons + neutrons

atomic #
= number of protons

1 AMU = 1 proton
1 neutron

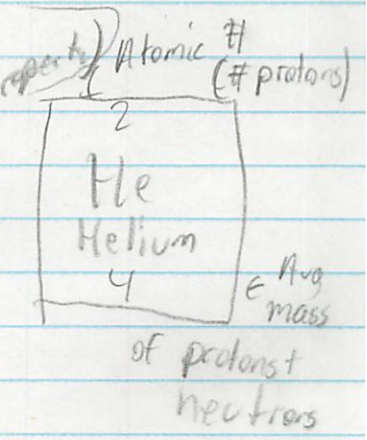
isotopes -
same element, different # of neutrons - same chem properties
sum protons + neutons = mass numbers

radioactive isotypes
- nuclas unstable
- can be used for dating

some unstable

compund
- combos of elements
- have different properties (emergent property)

noble gasses
- don't react w/ anything (stable)
- complete -> 8 valence electrons
↑ every other element is unstable



4 elements = 90% of organisms

atoms are very small
but electrons are even smaller
atoms are mostly empty space

• nucleus = grain of sand
football field
1/100 grain of sand

nucleus = central core
most of the mass

diff # of nectrons = isotypes

chemical bonds
- ionic bond - 1 or more electron transfored
  ion - positivly or negitivly charged ion
  Oppositly charged ions have a strong ionic bond

- Covalent bond
  - electrons shared between ions
    - travel in both orbits
  2 electrons = single covalent bond
  4 " double " "
  6 " triple " "
  - combined structure = molecules

Van der Waals
- very weak bonds
- on surface of all things
- allow Geccos to climb walls

Name Michael Plasmolar Class ______ Date 2/11/08

10/10

SECTION 2-1 REVIEW

COMPOSITION OF MATTER

VOCABULARY REVIEW Define the following terms.

See study Guide

1. atom ______

2. neutron ______

3. compound ______

4. covalent bond ______

5. ion ______

MULTIPLE CHOICE Write the correct letter in the blank.

______ 1. The atomic number of carbon is 6. Therefore, the number of protons in a carbon atom equals

a. 3. [✓ b. 6.] 11 c. 7. d. 12.

______ 2. One of the kinds of particles found in the nucleus of an atom is the

[✓ a. proton.] b. electron. c. ion. d. boron.

______ 3. The maximum number of electrons that can be held in an atom's second energy level is

a. 2. b. 4. c. 6. [✓ d. 8.]

______ 4. Of the following elements, the one that is most likely to form ionic bonds is

a. hydrogen. b. carbon. [✓ c. sodium.] NaCl d. oxygen.

______ 5. An example of a compound is

[✓ a. water.] b. hydrogen gas. c. oxygen gas. d. chloride ion.

H_2O

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Name ______________________ Class ____________ Date ____________

SHORT ANSWER Answer the questions in the space provided.

✓ 1. What is the difference between mass and weight? Mass is th amount of matter in an object. Weight is gravity's affect on th mass

✓ 2. Identify the elements and the number of atoms of each element in each of the following compounds:

BO_2 1 Boron, 2 Oxygen

KCl 1 Potassium, 1 Clorine

$C_6H_{12}O_6$ 6 Carbon, 12 Hydrogen, 6 Oxygen

NH_3 1 Nitrogen, 3 Hydrogen

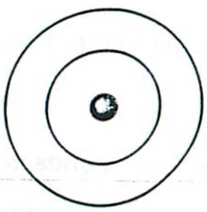
3. How many pairs of electrons do the two oxygen atoms in an oxygen molecule share with each other? Explain your answer.

2 pr

✓ 4. **Critical Thinking** The atomic number of argon is 18. Will argon tend to form bonds with other elements? Explain your answer. No orgon is a noble gas - its outer ring is full

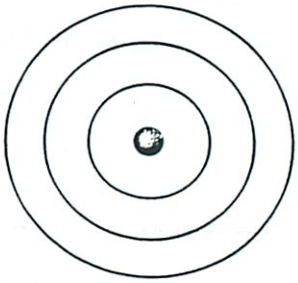
STRUCTURES AND FUNCTIONS Label each atom in the spaces provided, and complete the models by drawing the correct number of electrons at each energy level.

The diagrams below represent incomplete models of the atoms helium (atomic number 2), carbon (atomic number 6), and sulfur (atomic number 16). Note: The third energy level can contain up to eight electrons.



a Carbon

b helium



c Sulfur

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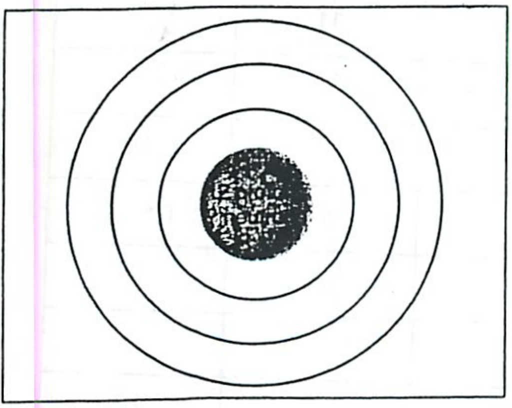
WHAT DO THE PICTURES SHOW?

Each picture below shows an atom. Some information is given about each atom. Use this information to answer the questions about each atom.

REMEMBER, protons + neutrons = atomic mass

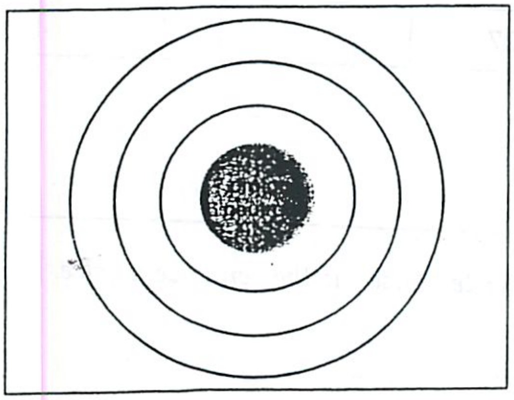


12 protons
? neutrons

Figure H *Atomic mass = 24*

1. How many neutrons does this atom have? 12
2. How many protons? 12
3. What is the atomic number? 12

✓

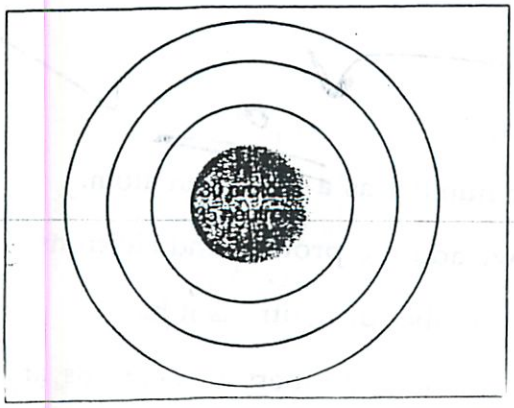


? protons
6 neutrons

Figure I *Atomic mass = 11*

1. How many protons does this atom have? 5
2. How many neutrons? 6
3. What is the atomic number? 5

✓



30 protons
35 neutrons

Figure J *Atomic mass = ?* 65

1. What is the atomic mass of this atom? 65
2. How many protons? 30
3. What is the atomic number? 30

✓

COMPLETE THE CHART

Complete the chart by filling in the missing information.

	Kind of Matter	Protons	Neutrons	Atomic Mass	Electrons	Atomic Number
1.	Oxygen	8	8	16	8	8
2.	Sodium	11	12	23	11	11
3.	Carbon	6	6	12	6	6
4.	Phosphorus	15	16	31	15	15
5.	Potassium	19	20	39	19	19
6.	Iron	26	30	56	26	26
7.	Copper	29	35	64	29	29
8.	Chlorine	17	18	35	17	17
9.	Boron	5	6	11	5	5
10.	Aluminum	13	14	27	13	13

???

TRUE OR FALSE

In the space provided, write "true" if the sentence is true. Write "false" if the sentence is false.

False 1. An atom has no mass.

False 2. An electron is the larget part of an atom.

False 3. All atoms have the same mass.

True 4. All protons have the same mass.

True 5. All oxygen atoms have the same mass. unless isotopes !

False 6. An oxygen atom has the same atomic number as a hydrogen atom.

False 7. To find the atomic mass of an atom, we add the protons and electrons.

False 8. The atomic number of an atom is the number of neutrons it has. protons

True 9. Atoms of the same kind that have different numbers of neutrons are called isotopes.

False 10. Atomic number = atomic mass.

INTERPRETING ATOMIC DIAGRAMS

Below and on the following page are diagrams of six different atoms. In the spaces provided to the right of each diagram, fill in the number of protons, neutrons, electrons, positive charges, negative charges, and the overall charge of each atom.

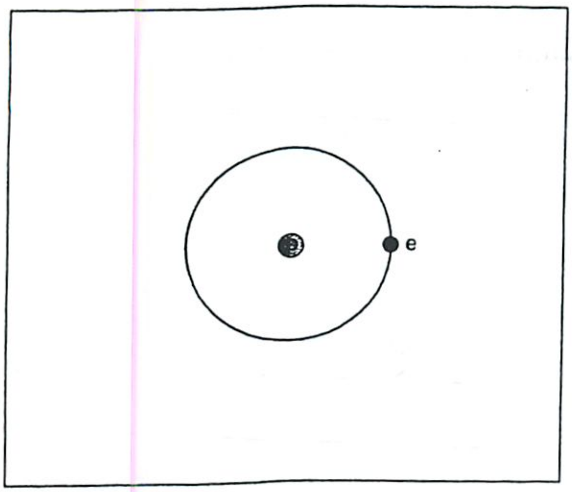


Figure D *Hydrogen*

Protons 1 ✓

Neutrons 0 e?

Electrons 1

Positive charge +1

Negative charge +1

Overall charge 0 ✓

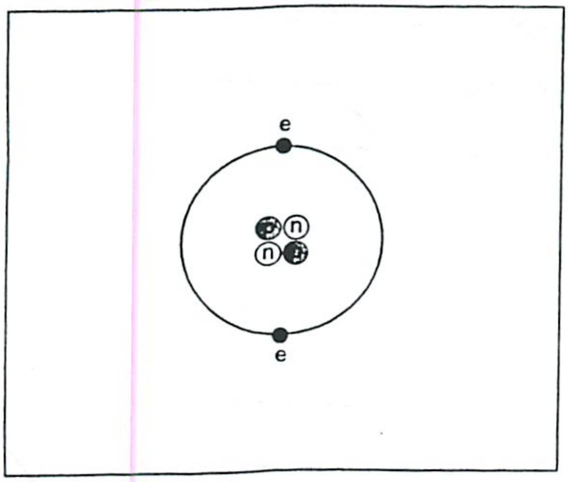


Figure E *Helium*

Protons 2

Neutrons 2

Electrons 2

Positive charge +2

Negative charge -2 ✓

Overall charge 0

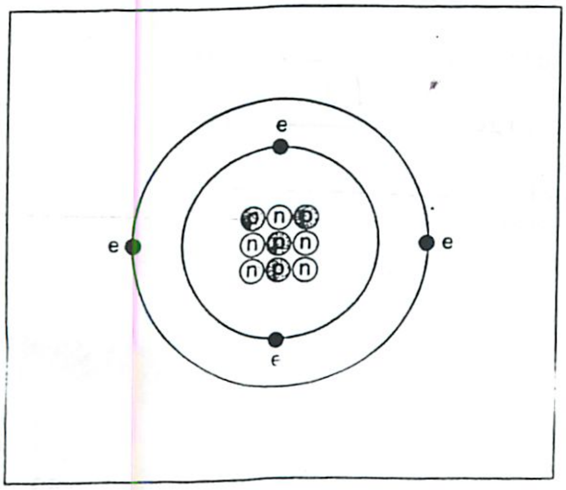


Figure F *Beryllium*

Protons 4

Neutrons 5 ✓

Electrons 4

Positive charge +4

Negative charge -4

Overall charge 0

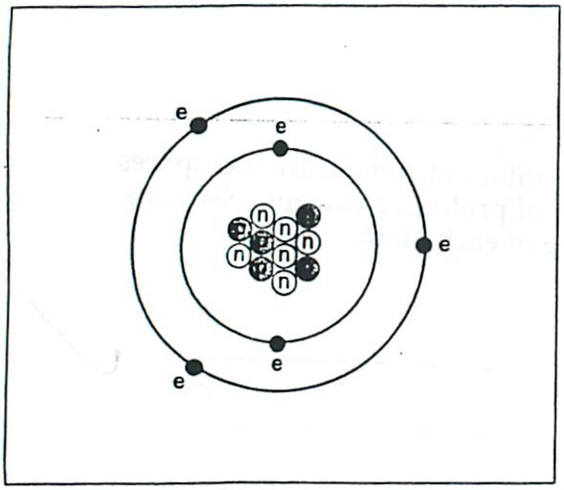


Figure G *Boron*

Protons 5

Neutrons 6

Electrons 5

Positive charge +5

Negative charge -5

Overall charge 0

✓

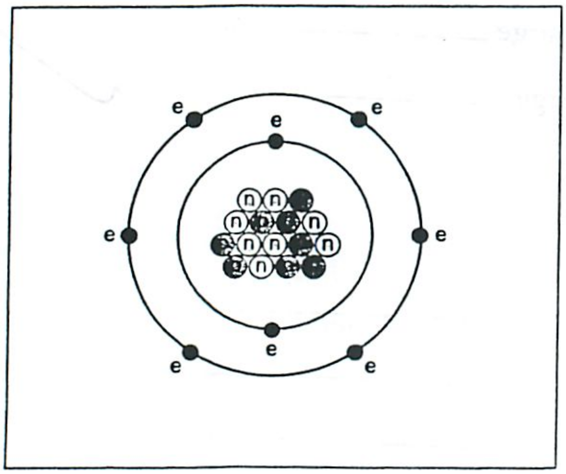


Figure H *Oxygen*

Protons 8

Neutrons 8

Electrons 8

Positive charge +8

Negative charge -8

Overall charge 0

✓

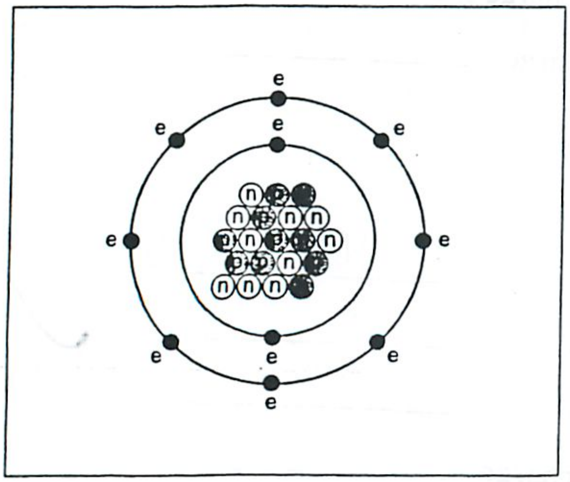


Figure I *Neon*

Protons 10

Neutrons 10

Electrons 10

Positive charge +10

Negative charge -10

Overall charge 0

✓

Review Sessions

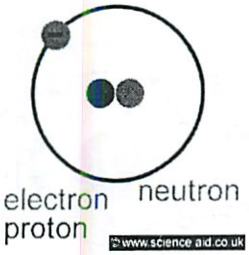
2/11/08

Chap 1

- Dependent + Independant
    - Use example
- Papulation
- Sample Graop
- Control
- Hypothsis
- Variable
- Ethical issue
    - don't lie - but double blind
- Correlation Studies
- Mode, Median, Mean
- Standard Deviation
- Correlation Coefficent
- Informed Concent
    - must know + understand what you are testing for

Michael Plasrecior

Biology – I
Pollard
07/08



Study Guide for: Chap. 2 – The Chemistry of Life

Life depends on chemistry. Everything you do, feel, and think happens through chemical reactions. The first job of a biologist is to understand chemical reactions.

Section 2.1: The Nature of Matter

Vocabulary:

atom – basic unit of matter
nucleus – Center of atom → neutron + proton
electron – Orbiting negitive particle - mass = 1/1840 proton
element – pure substance - 1 type of atom
isotope – atoms of same element - diff # neutrons
compound – Combo 2 (or more) elements in defined proportions
molecule – smallest unit of a compound ↑ properties different
chemical bond - how atoms are held together in a compound
covalent bond - bond where electrons are shared
ionic bond - electrons transfered from 1 atom to another ↲ 2 types
van der Waals forces – slight attraction that develops b/w opposetely charged regions of nearby molecules

atoms = equal # protons + electrons ↑ (unless ion)

protons = nectrons most of the time (unless isotype)

Concepts:

1. Identify the three particles that make up an atom, and describe their location and charge.

proton - ⊕ charge, in nucleus
neutron - no charge - in nucleus
electron - ⊖ charge, orbiting outside

2. Explain how all the isotopes of an element are similar and how they are different.

isotopes have the same chemical properties as well as the same # of protons + electrons - but have a different number of neutrons - they are identifed by mass (proton+neutron)

3. Explain what a chemical compound is and give an example.

A chemical combeund is the combo of 2 or more elements mixed chemically together in defined proportions

4. Describe the two main types of chemical bonds.

ionic bond - electrons are transfered from 1 to another
ions are formed which are charged
covalent bond - electrons are shared b/w atoms
result is called a molecule

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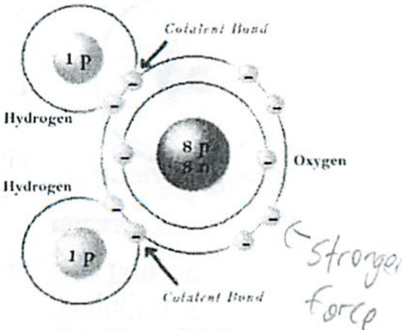


Bohr Model of H_2O

Section 2.2: Properties of Water

Vocabulary:
cohesion – attraction b/w molecules of same substance
causes curve in the test tube → adhesion – " " " " different substances
mixture – materials mixed togeter physicaly, not chemically
solution – mixture of substances were molecules are evenly devided
solvent – the substance which is disolved
solute – " " " solute disolves " in
suspension – mixture of water + non disolved material
pH scale- indicates concentration of H^+ ions in a solution
more
1-7 H^+ acid- higher H^+ concentrations and <7 - produces H^+
7-14 OH^- base- lower H^+ concentrations and >7 produces OH^-
buffer- weak acids or bases in the body which reacts w/ strong acids or bases in the body to stop sudden pH change

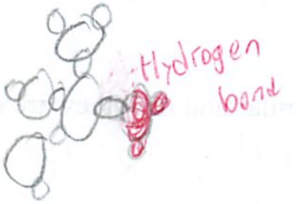
Concepts:

1. Draw a water molecule.

2. Explain why water molecules are considered to be polar.

It's polar because it has a slight charge- there is an uneven distribution of electrons between Oxygen + hydrogen atoms

3. Draw a water molecule, and then draw 3 other water molecules hydrogen bonded to it.



4. Differentiate between a solution and a suspension.

A solution is where 2 or more substances are mixed evenly together and distributed

A suspension is where substances are not evenly mixed

5. Explain what acidic solutions and basic solutions are. What is a buffer?

see top

Only 1/350 million atoms become ions →

Acidic solutions have extra H^+ ions and Basic solutions have extra OH^- ions

2.2 Nessessites of Life → Water

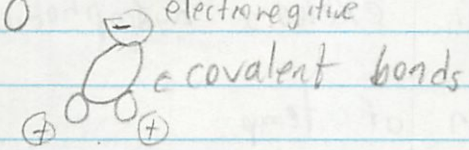
2/12

- life + water are closlly linked
- oxygen → not required

aliens

  - water developed before life
  - was poisonous to very early life
  - early life actually produced oxygen
- needs water
- everything else is not really required

- water makes life habital
  - H_2O



  - likes to stick to itself + anything else that has a charge
- 4 properties
  - cohesive behavior ← takes a lot of energy to heat it
    - sticks to itself ← high spefic heat
  - ability to moderate temprature ← keeps temp of Earth in livable range
  - expansion upon freezing
  - versatility as a solvant

one of the only naturally occuring substance which gets larger ← so it floats + forms insulation at top
↑ helps keep things alive in water
↑ important when life 1st developed

- bonds get remade farther apart

- cohesion
  - water transport in plants
    - adhesion at side of wall = capilitory action
    ↑ like evaporation

adhesion

Cohesion
- suface tension
  - bugs can walk on water

- frozen water floats
  - forms 6 sided rings
  - less dense then liquid water

- universal solvent
  - will disolve anything that has a charge
  - water exclues hydrophobic substances it can't bond w/

- moderation of temp
  - water absorbs heat from warm air + releases in cool air
  - water resists temp Δ - high spefic heat 2

- dissociation of water
  - forms hydronium ion H_3O^+ ↓proton H^+
  - hydroxide ion OH^- OH^-) ph scale
  - each step on pH scale is 10x (logarithmic)

Cohesion + adhesion
caplitory action

Name(s): Michael Plasmeier Date: ________ Bl: ___ Item: ____

The Polarity of Water:
A Laboratory Investigation

Purpose:

In today's lab, you will attempt to demonstrate the strength of hydrogen bonding and the polarity of water; vital characteristics that allow for life to continue on Earth!

Materials:

Small beaker, dropper, water, one penny, paper towels, dish detergent

Prodedure:

Part I:

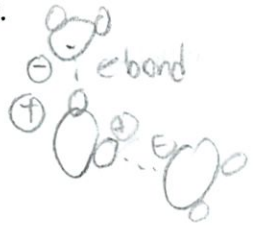
1. Make a prediction about how many drops of water will fit on a penny. 7
2. Obtain 20 ml of water in your beaker. Using your water dropper, slowly and steadily place one drop of water at a time onto your penny. Count the number of drops that you can get to stay on the top of the penny. How many drops of water fit onto the penny? 59
3. The scientific method requires several trials to prevent errors. Dry your penny and test again.
   Trial 2: 39 Trial 3: 61 Trial 4: 73 Trial 5: 43

Clean Penny
Cold water

4. Find the average of your trials. What is the average number of drops that can fit on a penny? 55
5. What type of chemical properties does water have that allowed it to demonstrate the behavior you observed? Explain your response.

   cohesion

6. Using your notes and text, draw the structure of water. Remember to include the charges on the molecule. Draw multiple molecules, illustrating how they bond together.



polar, opposet sides attract

7. What variables might impact how many drops of water the penny could hold? Explain how they may have impacted your results.

Age of penny
Size of drops
Temp of penny
Temp of water
height of drop of water
level of table
penny rim + surface

8. How can the polarity of the water molecule be used to explain why the water rushed off the penny once the surface tension was broken?

One surface tension is broken - the rest of the molecules rush after it like a roller coaster

Part II:

9. Now, add detergent to the water. Make a prediction about how many drops of soapy water will fit on a penny. Is your prediction for the soapy water different then the "plain" water? Explain your hypothesis below.

Use an older flatter penny
-I think it will hold more drops

10. Test your prediction with five trials. Record your results below.

Trial 1: 45 Trial 2: 22 bad Trial 3: 57 Trial 4: _____ Trial 5: _____

11. Did the kind of water make a difference in your lab today? How does soapy water behave differently then non-soapy water? What was the chemical impact of the addition of soap to your solution?

Part III:

12. Before cleaning up your lab, dip the corner of your paper towel in your beaker and observe what happens. Record your qualitative observations below.

The paper towel absorbs the water and the water climbs up the paper towel.

13. What is the name for the process you observed with the paper towel? Why would this process be important to plants?

This is capillary action, It uses both cohesion + adhesion to climb the side of a plant, this process lets plants absorb water

Conclusion:

Explain how and why the polarity of water is vital for life on Earth. Include how the chemistry of water relates to specific examples in our world. (Hint: Include the terms *adhesion, cohesion, hydrogen bonding, polarity,* and *capillary action* in your explanation!) Attach an additional page if necessary.

Polarity refers to the slight electrical charge caused by covalent bonding with oxygen. Water molecules bond with through hydrogen bonding each other which is called cohesion. Water also sticks with other charged molecules, which is called adhesion. These two forces combine to create capillory action which helps spread water in plants. Adhesion also creates acidity another important part of life. Besides cohesion, water is good at moderating tempr[illegible]e, expands when frozen, and is a goo[illegible] solvent.

Proporties of Water
Penny Lab

2/14/08

Testing the effect of Acid on the ability of water to remain on a penny.

Baseline - Test putting drops of water (pH 7) on a penny until surface tension is broken

Data

Matt	Plaz	Staci	Veronica	Melissa
31		34	42	25
29		35	45	38
35		31	34	42
32		42	40	50
31,75		35,5	40,25	38.75

Avg group 36,56

Experiment - ,25 molar sulfuric acid pH 2

Matt	Plaz	Staci	Veronica	Melissa
35	34	37	25	32
34		35	35	28
27		35	37	35
42		36	25	32
34,5		34,25	31,25	31.75

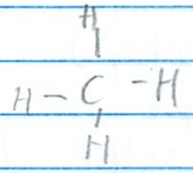
Avg gr. 32,94

3,62 drop decrease (avg change)

Carbon Compounds

2/20/08

- in much of what we eat
  - sugar
  - cellulose (plant cell walls) ← most abundent
- although we are mostly water - almost everything else in us is carbon
- carbon likes to bond with itself (up to 4 times)
- hydrogen carbon



$$H-\overset{H}{\underset{H}{C}}-H$$

← methane

- endless diversity of shapes + chains
  - ultimate Lego piece
- releases energy when burned
- main molecules in gas + fat
  - ↑almost exactly same reaction
- each has its own unique shape
  - determins function
- reduced = gained electrons
- oxidized = lose electrons
- giant molecules = polymers or macromolecules
  - made from monomer
    - protiens
    - lipids
    - carbohydrates
    - nuclic acid

nucleotide = monomer of nucleic acid
- remember Carbons are implied at the junction in molecules

linking monomers = dehydration synthsis
- water is formed as a by product

break down polymers = hydrolysis
- need to add water

Monosaccharides
- simple sugars
↑milk sure
- fructose, glucose, galactrose
- $C_6H_{12}O_6$ -ore = sugar
    - same formula - but different (isomers)
- in watory solutions - form rings
- main fuels cells use for cell work

Disaccharides
- sucrose (table sugar)
- 2 monosacchorides togetler (by removing water)
- lactose → galactose + glucose
- maltose → 2 glucose

Polysaccharides
- complex carbohyrdades
- takes your body longer to break down
- stortch → plants → potatoes + grains
- glycogen → animals + muscels
- cellulose → made of glucose molecules
    - most abundent compand on earth
    - known as diatory fibre
    - long strands

Lipids
- hydrophobic
    - don't mix with water
- need it so you don't disolve in water
- Fats store energy, insulate, protect organs, form membrains
- saturated
    - have max # of hydrogens bonded -solid
- unsaturated
    - has extra space for hydrogen -liquid at room temp
    - extra double bond
    - body treats completly different
- trans fats
    - processed differently
    - are unsaturated
    - "partially hydrogenated" - try to get H to bond to make them more solid
    - tastes better + longer shelf life
- triglyceride
    - composed of glycerol + 3 fatty acid chains
    - forms backbone of fat in bodies
- most animal fats - heigh in saturated fat (solid)
- plant fats - unsaturated (liquid)
    - better for you
- cell membrains
    - phospholipids
    - head which attracts water -> polar
    - 2 tails which are non polor - not attract wate
- steriods
    - 4 fused rings
    - based from cholesterol
    - synthetic anabolic steriods
        - try to build up muscels quickly

- heath risks
  - infirtility since stops
  - stunt growth
    - growth plates close quicker
  - makes heart work harder

Proteins

- made of monomers called amino acids
  - 20 types of amino acids.
  - build cells
  - do most of the work
- 4 types
  - structural
  - contractile
  - storage
  - transport
- body can make 10
- need to eat others
- similar structure (different R-group)
- hydrophillic and -phobic

Michael Plasmeier

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↓ was once thought to be only for living things

Section 2.3 Carbon (organic) Compounds:

Vocabulary:

Macromolecule- molecules in living things made up of thousands of smaller molecles
- monomer – small units which make up polymers
- polymer – many monomers connected together

carbohydrate – compounds made of carbon, hydrogen, + oxygen at 1:2:1 ratio + main source of energy for living things
- monosaccharide – single sugar molecules
- polysaccharide – large molecules formed from many monosacthrides

lipid – large biological molecules not soluable in water → fats, oils + waxes - Store energy

nucleic acid – macromolecules w/ hydrogen, oxygen, nitrogen, carbon + phosphorous assembled from nucleotides
- nucleotide – 5-carbon sugar, phosphate group + nitrogen base
- ribonucleic acid (RNA) – sugar ribos
- deoxyribonucleic acid (DNA) – sugar deoxy riboss store hereditory info

protein – macromoleccles containg nitrogen + carbon, hydrogen + oxygen
- amino acid- what the polomer protien is made of
  more than 20 types differentiated by R-group
  have different roles

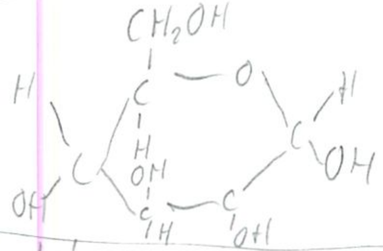
Concepts:

1. Give 2 reasons why carbon is such a special element and forms the basis for all organic compounds. Carbon has 4 valance electrons + bonds convalently easily single / double - triple
carbon can bond w/ carbon and form very long chains (versitile)

2. Name the four groups of organic compounds and describe the function(s) of each.
   1.– Carbohydrates - main source of energy → break down of sugar
   2.- Lipids - Store energy + waterproof coverings + membrains
   3.- Nucleic Acid - store + transmit genetic (hereditory) info RNA + DNA
   4.- Protien - Some control rote of reaction + regulate cell processes
   Some form bones + muscels. Some transport substances into + out of cells to fight disease.

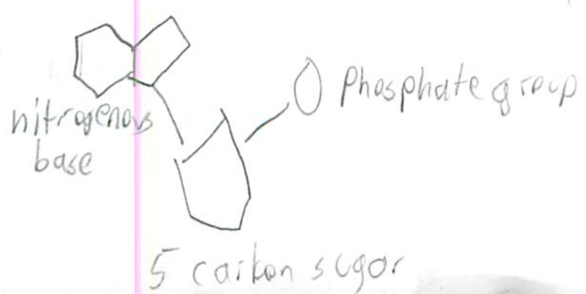
3. Give an example of each of type of organic compound.

Carbohydrate → Startch

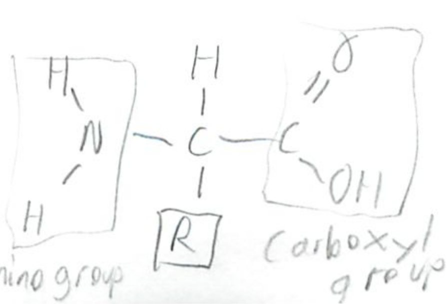


Lipid → Glycerol + Fatty Acid

Nucleic Acid → Nucleotide monomer



Protein → amino acid



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Pollard
07/08

Section 2.4 Chemical Reactions and Enzymes:

Vocabulary:

chemical reaction- process that changes or transforms 1 set of chemicals into another (mass + energy conserved)
reactant- elements or compounds entering chemical reaction
product- " " " produced by " "
activation energy- energy needed to start a reaction
catalyst- Substance that speeds up a chemical reaction } -lower activation energy
enzyme- protiens that act as biological catylists
substrate- reactants of enzyme-catalyzed reactions
↑sites where reactants can be brought togheter

Concepts:

1. How do chemical reactions affect chemical bonds in compounds?

They change the bonds

2. Describe how energy changes affect how easily a chemical reaction will occur?

important factor - Chemical reactions that release energy often occur spontaneously. Chemical reactions that absorb energy - need energy

humans need energy to function

3. Explain why enzymes are important to living things? (What do they do?)

Enzymes lower the activation energy (catalyst) which was too high for reaction to take place

4. How do enzymes do their jobs? (Use the words: enzymes, active sites, substrate, enzyme-substrate complex)

Enzymes provide cites where reactants can be brought togeter to react easily. Substraites (the reactants) Fit like a lock + key into the enzyme at active sites. These bond to form a enzyme-substrate complex + undergo a reaction. The products of a reactant are released + enzyme starts process again.

5. List some factors that affect enzyme activity.

- any variable that affects a chemical reaction
- pH level
- temprature (most 37°F)
- cells can regulate w/ proteins

Enzymes - regulate chem pathway, make materials needed by the cell, release energy + transfer info

Name Michael Plasmeier Date 2/21 Block ___ Item# ___

Nutrition Lab

"Oh no!!! Who was the wise guy that took all the labels off the baby food jars at the daycare center. I've got kids here with serious food allergies and now I don't know what the foods are. If I give them the wrong food they may become really sick, or worse…die. I just don't know what to do. I've got little Mary here with diabetes, Timmy whose family has a history of high blood triglycerides (fats) and cholesterol…what am I going to do? I also care for kids like Angela, who is a healthy, active little girl with no family history of any health problems…which baby food should I give her? Aaahhhh…this is so frustrating. Help, PLEASE!!!"

Observation: There are 6 types of food and kids with special diatary tests. We need to do 4 tests on each food to deteimn if it is safe.

Question that can be answered by doing an experiment: Is the food safe to eat for this child

Background Information (Data Collection) - Do a positive control to make sure tests work + know what results look like

Organic Compound	Sample	Using What Indicator	Notes	Initial Appearance	Final Appearance
Glucose	Corn Syrup	Test Strip	Add water(?) Wait 2-3 min.	Baby Blue test strip	Brown test strip
Starch	Corn Starch	Iodine	Only 1 drop	Brown-Red	Black
Fat/Lipids	Vegetable Oil	Sudan	in test tube ~4 drops + shake	Red	Flurocent pink at top
Protein	Egg White	Biuret	~4 drops wait	Blue	Purple

Hypothesis Baby food w/ glucose turns (test strips brown) Baby food with starch turns black in the presence of iodine; Baby food with fat turns flurocent pink in the presence of sudan; baby food with protein turns purple in presene of biuret

Experiment: There will be a total of six samples you will be examining for four different macromolecules. Begin the experiment by labeling the depression plates accordingly (see the table below to help). Write a description of the sample in the first column. You will write your results of each test in the remaining columns. Fill the depression about 1/4 full with the sample...you only need a small amount in order to see the result, plus you want to make sure you leave room to add the indicators. When you have completed the tests and recorded your results, you should clean your equipment and work area.

Sample/ description	Glucose	Starch	Fat	Protein
1 Organish Chicken Noodle	✓	✓	✓	
2 Yellowish Corn	✓	✓	✓	
3 Tanish Beef w/ Broth			kinda ✓!	✓
4 Green glossy String Beans	✓	✓	Not Really	
5 Brown gel Apple Sauce w/ Rice	Really Positive ✓	✓	✓	kinda Positive
6 Lime green liquid Milk w/ Food coloring				✓

Conclusions: This is where you report what is found and not found in each of the samples and how this information can be used.

Mary can eat 3 or 6 Angela can eat everything
Timmy can eat 4 and 6

Implementation: Apply what you learned in this lab to a real life situation. Review the three children described in the beginning of this lab. What food(s) should **not** be given to baby Mary? Why? What food(s) should baby Timmy be served? Why? What food(s) should be given to baby Angela as a main course in order for her to receive a well balanced diet? What should she have for dessert?

Mary should not eat glucose (1, 2, 4, 5)
Timmy should not eat fat (1, 2, 3, 5)
Angela should eat 5 since that has some of everything. She could have some more protien as in 6.

Fire

2/25

→ cellous (polymer of gluycose) $(C_6H_{12}O_6)_n$

1. reactants - wood, oxygen O_2

2. products - ash, smoke, CO_2 + H_2O

3. Heat + light energy are given off.

↙ speeds up chem reaction

4. You need some catylist to get it to start.
   - heat = activation energy

5. Fire keeps burning - don't need to keep restarting
   - gives off enough heat to keep it going

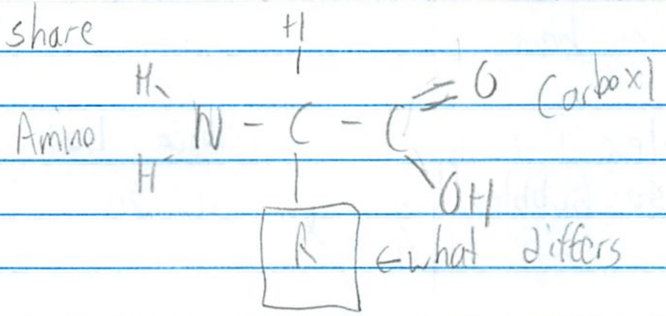
- Oxygen
- Heat
- Fuel

} Chain reaction

Enzymes

2/25

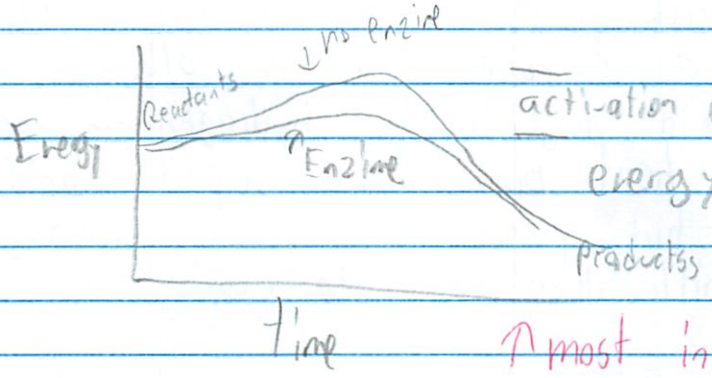
20 Amino Acid monomers
- like different types of chormes on a braclet
- are more than 20 - but not a living protiens
- share



- can be put togeter w/ dyhydroxation
  - lose water to gain peptide bond

↙ are protiens

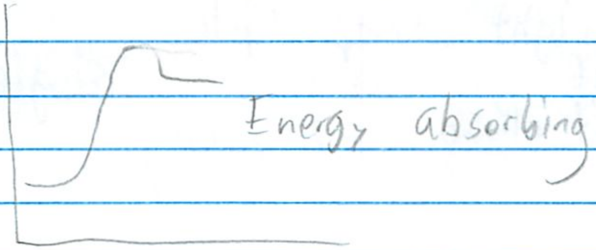
- lower activation energy needed to start a reaction



activation energy without = with enzine ↙ smaller

energy released (exothermic)

↑ most in our bodies



* it also slows down + regulates reactions so they occure in the same order + where they happen
- keeps "chaos under control

enzyme + substrate = Product
- enzyme is released to be used again

Proteins have a primary protien structure

catylese's role is to remove hydrogen perxeid
- so bubbles when put it on cut
  $H_2O + O_2$

- each protien has its own spefic order
- DNA specifies order

- folds into 2ndary structures
- and again...
- each protien has a different 3-D structure
- can combine with each other
- held together by hydrogen in water = coformations
  - heat blows bonds a part + acid
  - but primary structure remains
- milk denatures into curds when lemon juice adde

↑ The reason why your body has to be at right temp + pH level
- if you change a single amino acid it changes everything

Name: Michael Plasmeier **Class:** 4 **Date:** 2/26 **ID: B**

-2 +4 +2

102/100

Beautiful!

Chapter 2

-2

Multiple Choice

Identify the choice that best completes the statement or answers the question.

b 1. Suspensions are mixtures
- a. in which the components are evenly distributed throughout the solution.
- [✓ b.] of water and nondissolved material.
- c. both a and b
- d. neither a nor b

d 2. If a reaction in one direction releases energy, the reaction in the opposite direction
- a. destroys energy.
- b. cannot occur.
- c. also releases energy.
- [✓ d.] absorbs energy.

b 3. The most abundant compound in most living things is
- a. sodium chloride.
- [✓ b.] water.
- c. sugar.
- d. carbon dioxide.

X a 4. Water molecules are polar, with
- [✓ a.] the oxygen side being slightly positive and the hydrogen side being slightly negative.
- b. the oxygen and hydrogen sides being slightly negative.
- c. the oxygen and hydrogen sides being slightly positive.
- d. the oxygen side being slightly negative and the hydrogen side being slightly positive.

0/2

Backwards....

c 5. Which statement is true?
- a. Simple sugars are made of polysaccharides.
- b. Glycerol is made of fatty acids.
- [✓ c.] RNA molecules are made of nucleotides. → nucleic acid
- d. Amino acids are made of proteins.

d 6. A substance that speeds up the rate of a chemical reaction is called a(an)
- a. molecule.
- b. element.
- c. lipid.
- [✓ d.] catalyst.

d 7. When hydrogen and oxygen combine to form water, water would be
- a. both a product and a reactant.
- b. a reactant.
- c. neither a product nor a reactant.
- [✓ d.] a product. - what is made

a 8. Which of the following is NOT a function of proteins?
- [✓ a.] store and transmit heredity
- b. control the rate of reactions and regulate cell processes
- c. used to form bones and muscles
- d. help to fight disease

c 9. Enzymes affect the reactions in living cells by changing the
- a. products of the reaction.
- b. temperature of the reaction.
- [✓ c.] speed of the reaction.
- d. pH of the reaction.

activation energy?

a 10. A substance with a pH of 6 is called
- [✓ a.] an acid.
- b. both an acid and a base.
- c. a base.
- d. neither an acid nor a base.

✓

Name: ____________________ **ID: B**

a 11. A monosaccharide is a
- [✓ a.] carbohydrate.
- b. protein.
- c. lipid.
- d. nucleic acid.

b 12. The space surrounding the nucleus of an atom contains
- a. ions.
- [✓ b.] electrons.
- c. protons.
- d. neutrons.

d 13. Which of the following makes up a molecule of water? H_2O
- a. one atom of sodium and one atom of chlorine
- b. one atom of hydrogen and two atoms of oxygen
- c. one atom of hydrogen and one atom of oxygen
- [✓ d.] two atoms of hydrogen and one atom of oxygen

d 14. Which of the following statements about a compound is true?
- a. Only the chemical properties of a compound are usually the same as those of the elements from which it is formed.
- b. The physical and chemical properties of a compound are usually the same as those of the elements from which it is formed.
- c. Only the physical properties of a compound are usually the same as those of the elements from which it is formed.
- [✓ d.] The physical and chemical properties of a compound are usually very different from those of the elements from which it is formed.

d 15. A solution is a(an)
- a. chemical reaction.
- b. combination of two or more liquids.
- c. breaking of a chemical bond.
- [✓ d.] evenly distributed mixture of two or more substances.

d 16. Isotopes are atoms of the same element with the same number of protons and — See #24
- a. a different number of molecules.
- b. the same number of neutrons. normal
- c. a different number of electrons. ion
- [✓ d.] a different number of neutrons.

d 17. When salt is dissolved in water, water is the
- a. reactant.
- b. solute.
- c. solution.
- [✓ d.] solvent. = water is universal solvent

a 18. The nucleus is made of
- [✓ a.] protons and neutrons.
- b. protons, neutrons, and electrons.
- c. electrons and neutrons.
- d. protons and electrons.

d 19. Ice floats on water because
- a. water shrinks when it freezes.
- b. of cohesion.
- c. ice has a higher density than water.
- [✓ d.] water expands when it freezes.

C 20. Which of the following organic compounds is the main source of energy for living things?
- a. lipids
- b. nucleic acids
- [✓ c.] carbohydrates
- d. proteins

d 21. What type of ion forms when an atom loses electrons?
- a. neutral
- b. possibly positive or negative
- c. negative
- [✓ d.] positive

d 22. The three particles that make up an atom are
- a. protons, neutrons, and isotopes.
- b. neutrons, isotopes, and electrons.
- c. positives, negatives, and electrons.
- [✓ d.] protons, neutrons, and electrons.

Completion (1pt ea.)
Complete each statement.

23. The elements or compounds produced by a chemical reaction are known as products.

24. If an atom contains 15 protons, it must contain 15 electrons. else ion

25. Because they have the same number of protons and electrons, all isotopes of an element have the same Chemical properties.

26. Due to Wan de Veel forces, the design of a gecko's feet enables it to climb up vertical surfaces.

27. The pH scale is a measurement system that indicates the concentration of hydrogen$^+$ ions in solution.

28. Chemical reactions that absorb energy will not occur without a source of energy.

29. A water molecule is polar because there is an uneven distribution of electrons between the oxygen and hydrogen atoms.

Short Answer

30. Name two essential roles that enzymes play in cells.

-Speed up reactions which might not have taken place
-regulate the reactions so they do not all occure at once

31. What is one of the most important factors in determining whether a chemical reaction will occur?

If all of the reactants are present, the right conditions and enzymes are ready as well as the proper activation energy.

32. Use the terms solvent and solute in describing how to prepare a salt solution.

Pour water (the solvent) into a beaker. Slowly add salt (the solute) and stir.

33. What accounts for water's properties of adhesion and cohesion?

The bonds between atoms in water make water slightly polar. This polarity lets water stick to itself (adhesion) and other things (cohesion)

Name: ______________________ **ID: B**

water - ionic bonds

34. Explain the difference between ionic compounds and covalently bonded compounds.

Ionic bonds - trade electrons - much stronger

backwards...

Covalently bonded - share electrons - weaker, easier to break

35. Compare protons, electrons, and neutrons with respect to location within atoms, electric charge, and mass.

(+) (−) no charges

Protons + Neutrons are in the nucleus. They are relitily large and massive.

Electrons are located around the rings (relitivly) far away. They are like 1/2000 the mass of an proton - thus far smaller.

majority (?)

Other

USING SCIENCE SKILLS

x10 hydrogen ↑

pH Values of Some Common Substances	
Substance	**pH**
Hydrochloric acid	1.0
Sulfuric acid	1.2
Tomatoes	4.2
Rainwater	6.2
Pure water	7.0
Sea water	8.5
Ammonium chloride	11.1
Sodium hydroxide	13.0

H^+

OH^-

Figure 2–1

36. **Applying Concepts** What is the strongest acid listed in Figure 2-1? hydrochloric acid

37. **Applying Concepts** According to the pH values of Figure 2-1, does a solution with a hydrogen ion concentration less than that of pure water have a pH greater or less than 7? greater → basic

38. **Applying Concepts** What is the pH of the weakest acid listed in Figure 2-1? rainwater → 6.2

39. **Calculating** A change of one unit on the pH scale represents a tenfold increase in the concentration of hydrogen ions. According to the pH values listed in Figure 2-1, how much greater is the hydrogen ion concentration in tomatoes than in rainwater? 100x

(negitive Δ)

40. **Applying Concepts** What is the pH of the strongest base listed in Figure 2-1?

Sodium hydroxide 13.0

+4

USING SCIENCE SKILLS

mass

Pro+Neu

Element	Symbol	Protons	Neutrons	Electrons	Atomic Number	Mass Number
Hydrogen	H	1	0	1	1	1
Helium	He	2	2	2	2	4
Carbon	C	6	6	6	6	12
Oxygen	O	8	8	8	8	16
Neon	Ne	16	16	10	10	20
Aluminum	Al	13	14	13	13	27
Zinc	Zn	36	35	30	30	65

Figure 2–2

41. **Applying Concepts** Based on Figure 2-2, what is the atomic number of oxygen? 8

42. **Calculating** Based on Figure 2-2, what is the mass number of carbon? 12

Dragonfly Biology 07/08: Chapter 7 Study Guide Name: Michael Plasmeier
Cell Structure and Function

✓

Robert Hooke + Anton van Leeuwenhoek
- microscopes

microscopes needed to see cells

? like Monk's rooms

Section 7.1: Life is Cellular
Vocab:
cell - very small basic unit of life
cell theory - 3 basic laws about cells (see below)
nucleus - large membrane-enclosed structure that contains genetic material (DNA)
eukaryote - cells that contain nuclei
prokaryote - Cells that do not contain nuclei (before nuclei ∈ name)
-genetic material stored elsewhere

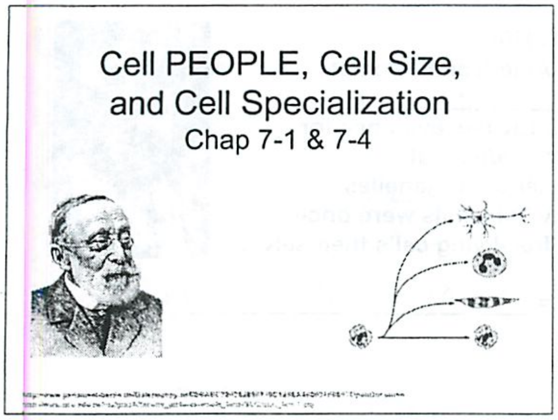
1. What are the three parts of the cell theory?
-all living things are made of cells
-cells are basic units of structure + function
new cells formed from old ones

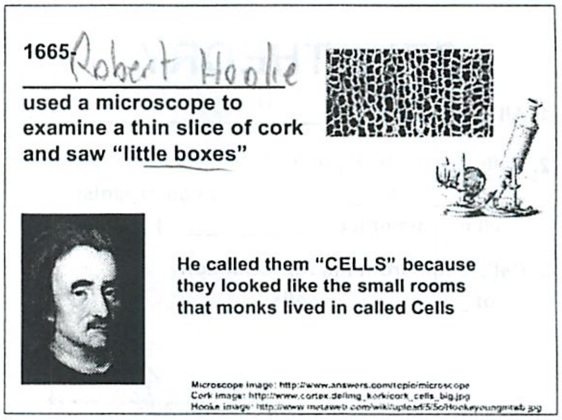
2. Name 3 structures that all cells have:
Surrounded by barrier called cell membrain
carry biological info → DNA

3. What distinguishes eukaryotes from prokaryotes?

genetic material in nucleus	gentic material <u>not</u> in nucleus
generally larger + more complex	generally smaller + simpler
higly specialized internal structures	some internal membrains
single celled organisms to plants + animals	carry out same functions
	bacteria

2/27


Cell PEOPLE, Cell Size, and Cell Specialization
Chap 7-1 & 7-4


1665- Robert Hooke
used a microscope to examine a thin slice of cork and saw "little boxes"

He called them "CELLS" because they looked like the small rooms that monks lived in called Cells

Microscope image: http://www.answers.com/topic/microscope
Cork image: http://www.cortex.de/img_kork/cork_cells_big.jpg
Hooke image: http://www.metaweb.com/wiki/upload/5/5o/Hookeyoungmeb.jpg

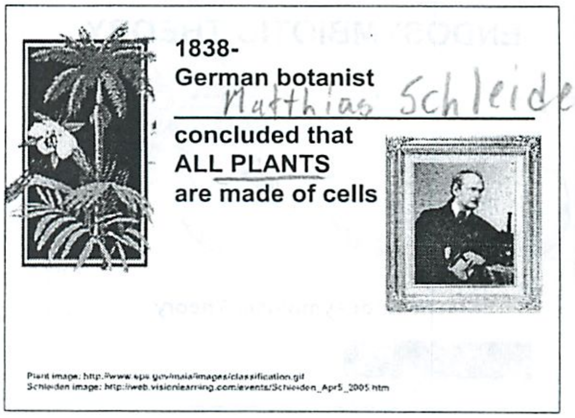
1st to describe cells

was his hobby →

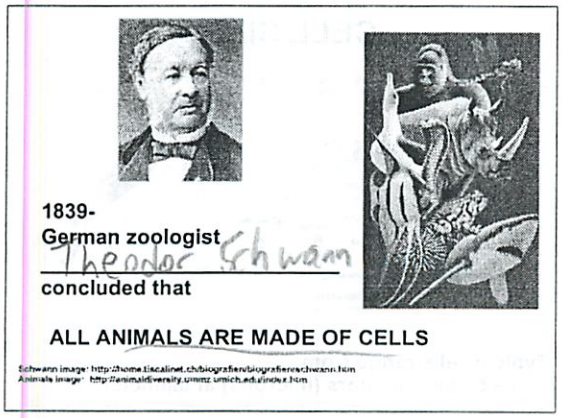
1st to describe little cells


1673- Anton van Leeuwenhoek
a Dutch microscope maker was the first to see LIVING ORGANISMS.

Microscope/Leeuwenhoek image: http://www.answers.com/topic/microscope
Animation from: http://web.jjay.cuny.edu/~acarpi/NSC/13-cells.htm

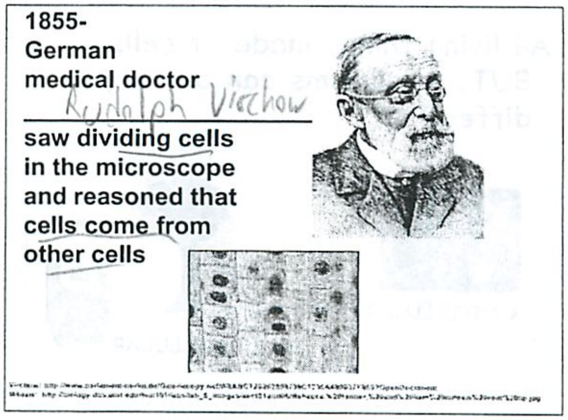

1838-
German botanist Matthias Schleiden
concluded that ALL PLANTS are made of cells

Plant image: http://www.sps.gov/maia/images/classification.gif
Schleiden image: http://web.visionlearning.com/events/Schleiden_Apr5_2005.htm


1839-
German zoologist Theodor Schwann
concluded that

ALL ANIMALS ARE MADE OF CELLS

Schwann image: http://home.tiscalinet.ch/biografien/biografien/schwann.htm
Animals image: http://animaldiversity.ummz.umich.edu/index.htm


1855-
German medical doctor Rudolph Virchow
saw dividing cells in the microscope and reasoned that cells come from other cells

CELL THEORY

1. All living things are made of cells.
2. Cells are the basic unit of Structure & Function in an organism.
   (cell = basic unit of life)
3. Cells come from the reproduction of existing cells

Cell image: http://waynesword.palomar.edu/lmexer1a.htm

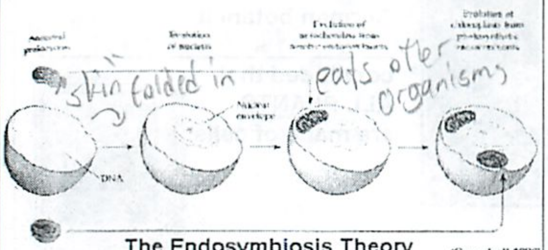
many parts

1970-
American Biologist
Lynn Margvils
provides evidence for the idea that certain organelles within cells were once free-living cells themselves.
= Endosymbiotic theory

http://en.wikipedia.org/wiki/Lynn_Margulis

conglomation of different organisms which came to live togeth

ENDOSYMBIOTIC THEORY



The Endosymbiosis Theory (Campbell 1996)

[redacted]

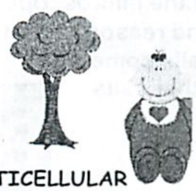
evolved so they can only work together

Evidence for Endosymbiotic theory

1. Mitochondria and chloroplasts have circular DNA similar to bacteria.
2. Mitochondria and chloroplasts have Ribosomes whose size and structure resemble bacterial ribosomes.
3. Mitochondria and chloroplasts replicated using binary fission like bacteria.
4. Iner Menbranes of mitochondria and chloroplasts have a composition similar to bacterial membranes.

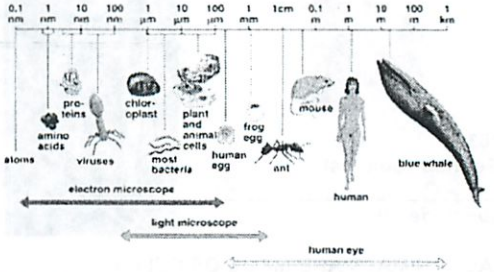
All living things made of cells BUT… organisms can be very different.

UNICELLULAR

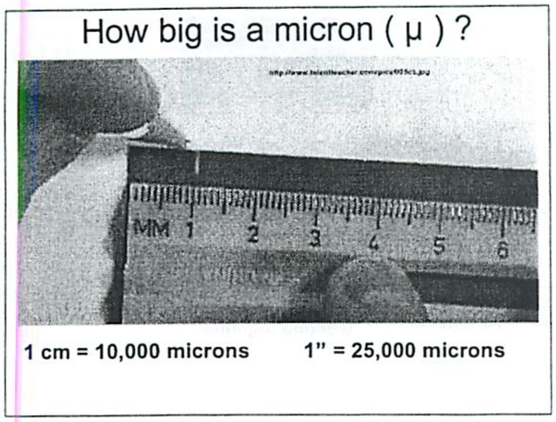


MULTICELLULAR

CELL SIZE



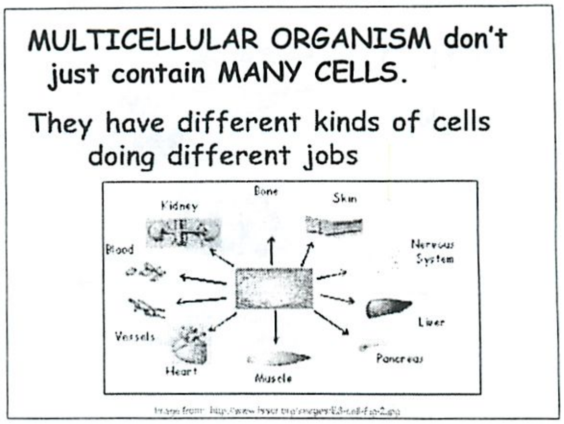
Typical cells range from:
5 – 50 micrometers (microns) in diameter



How big is a micron (μ) ?

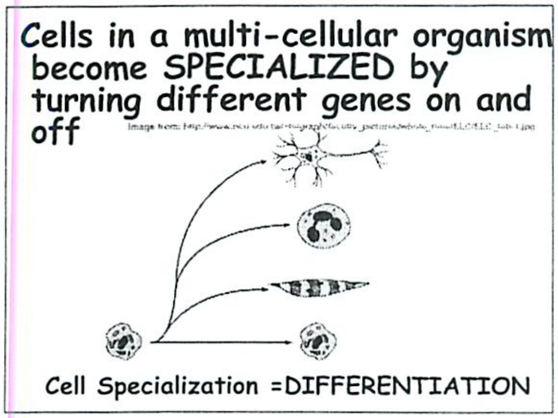
1 cm = 10,000 microns

1" = 25,000 microns



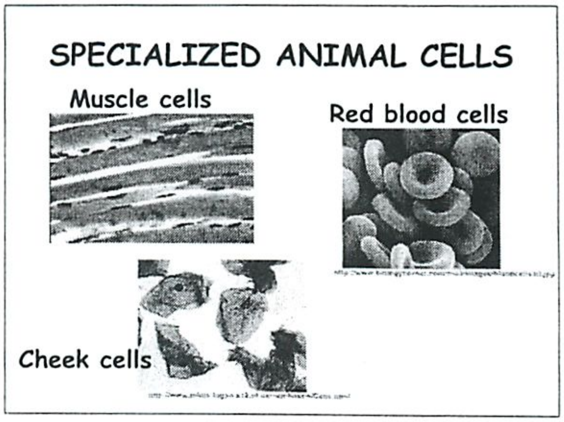
MULTICELLULAR ORGANISM don't just contain MANY CELLS.

They have different kinds of cells doing different jobs



Cells in a multi-cellular organism become SPECIALIZED by turning different genes on and off

Cell Specialization =DIFFERENTIATION

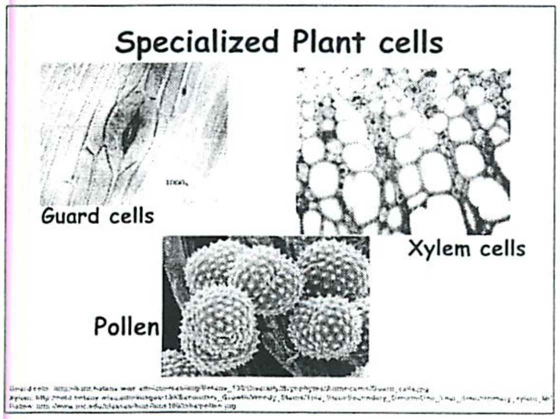


SPECIALIZED ANIMAL CELLS

Muscle cells

Red blood cells

Cheek cells

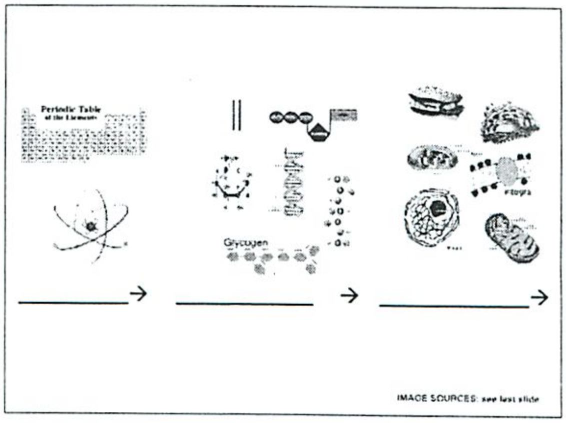


Specialized Plant cells

Guard cells

Xylem cells

Pollen

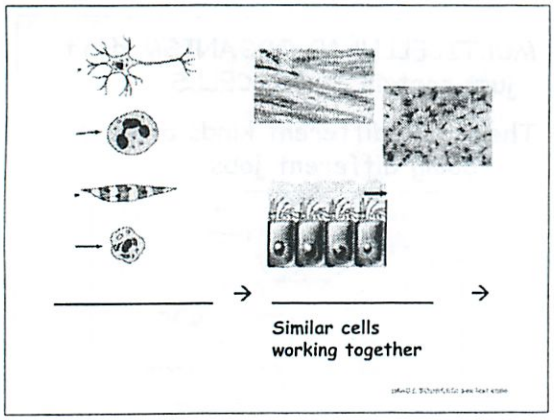


________ →

________ →

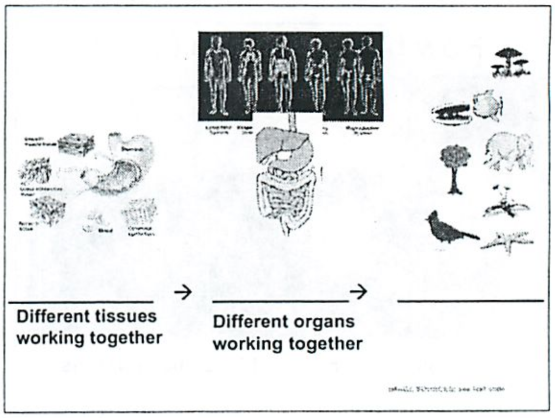
________ →

IMAGE SOURCES: see last slide



________ → ________ →

Similar cells
working together



________ → ________ → ________

Different tissues
working together

Different organs
working together

Michael Plasmeier ✓ 2/27

Section 7.2: Eukaryotic Cell Structure

Vocab.

organelle = structures in cells like little organs

cytoplasm - portion of cell outside nucleus

nuclear envelope - 2 membrane covering of nucleus - allows traffic in and out

chromatin - genetic material in nucleus - DNA bound to protien

chromosome - condensed chromatin to allow cell to split

nucleolus - where assembly of ribosomes begins - small, dense region

ribosome - small particals of RNA + protien in cytoplasm - assemble protien

endoplasmic reticulum - where lipid components are assembled + protiens + other stuff exported

goli apparatus - modify, sorts + packages protien for storage or secretion - organelle

lysosome - small organells filled w/ enzymes to break down lipids, carbs + protiens

vacuole - sack like structure which holds water, salts, protiens + carbs

mitochondrion - Organells that convert food into compounds for cell to use

chloroplast - organells that do Photosynthis - convert energy from sun

cytoskeleton - structure in eukaryotic cells which is the structure

centriole - structure located near nucleus to help animal cell division

1. Know the different cell structures and their functions..
(You'll receive a chart)

Key Facts

- nucleus - contains nearly all of te cells' DNA
  - coded instrucions for making protiens + other important molecules
- Ribosomes - protiens assembled on this
- Endoplasmic reticulum - site where lipid components of membrane assembled + protiens + other materials exported from cell

2. What are the differences between plant and animal cells?

- Golgi apparatus - modify, sort + package protiens + other materials from ER to storage in cell or secretion outside cell "custom shop"
- Lysosomes - filled w/ enzymes to break down lipids, carbs and protiens into smaller molecules
- Vacuoles - store material (water, salts + protiens)
  Presure helps plants
  vacuole pumps help homeostasis
- Mitochondria - convert food into compounds for cell to use - come from ovum
- Chloroplasts - organells that convert sun light to energy → photosynthsis
- Cytoskeleton - network of protien filaments that help cell maintain its shape + involved in movement

Plant	Animal
cell walls	have centrioles
large vacuoles	form tissue + organs
Chlorplasts	Cell membrane only
largest cell	
photo synthsis	

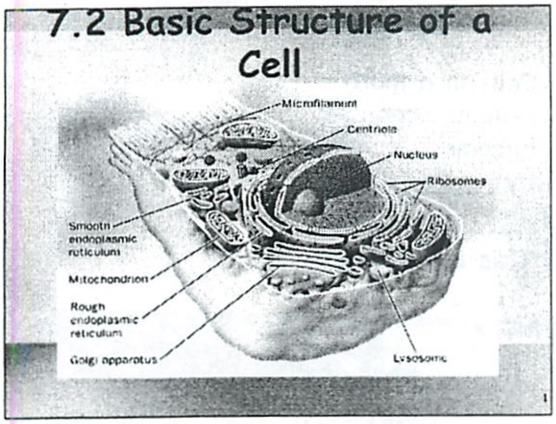
Eukaryotes (have nucleus)
endoplasmic Reticulum
nucleolus
linear DNA
Cytoskeleten
Cell membrane

Michael Plasmeor

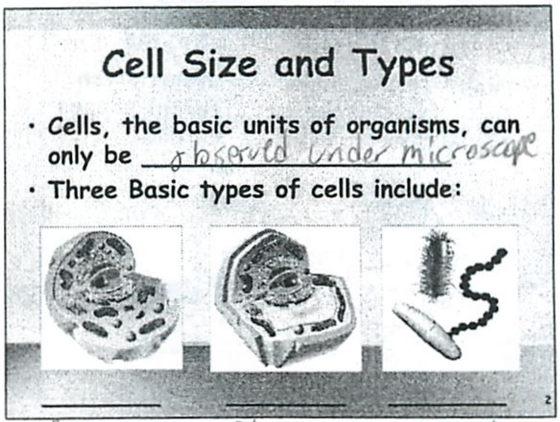
$\downarrow CO_2$ ↗ O_2
1. Chlorplast organells - use sunlight to produce food (photo synthist) ↑sugar

Rigid
2. Cell wall - provide structural support - animals have skeletons via Turger presure

Larger
3. Valcoles - hold water + provide pressure



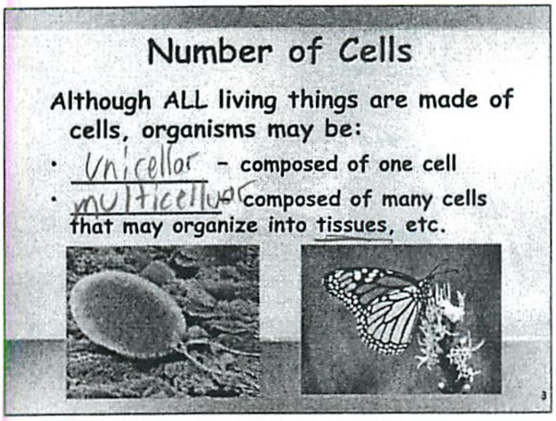
7.2 Basic Structure of a Cell



Cell Size and Types

- Cells, the basic units of organisms, can only be observed under microscope
- Three Basic types of cells include:

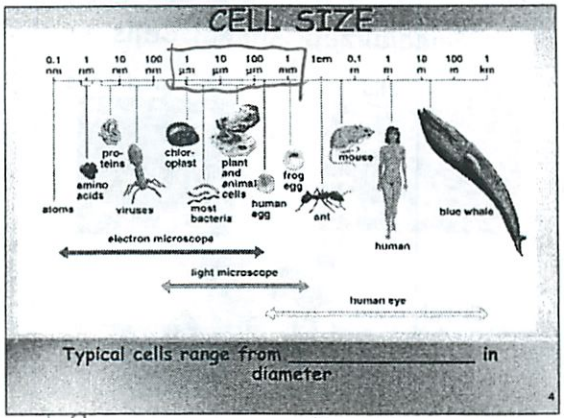
Animal Plant Bacteria



Number of Cells

Although ALL living things are made of cells, organisms may be:

- Unicellar - composed of one cell
- multicelluar composed of many cells that may organize into tissues, etc.

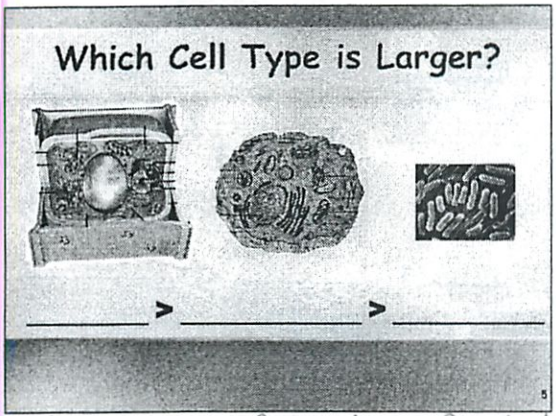


CELL SIZE

Typical cells range from ______________ in diameter

u
.10

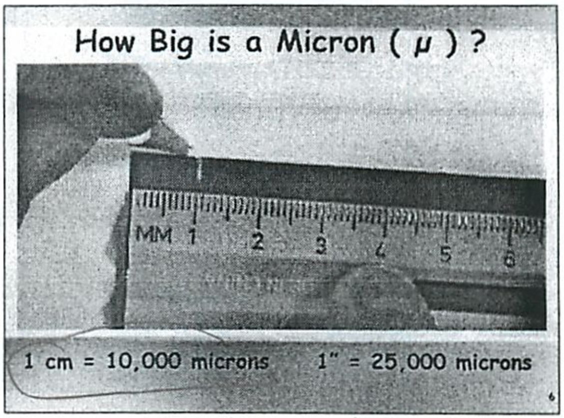
5-15 m



Which Cell Type is Larger?

______ > ______ > ______

Plant Animal Bacteria

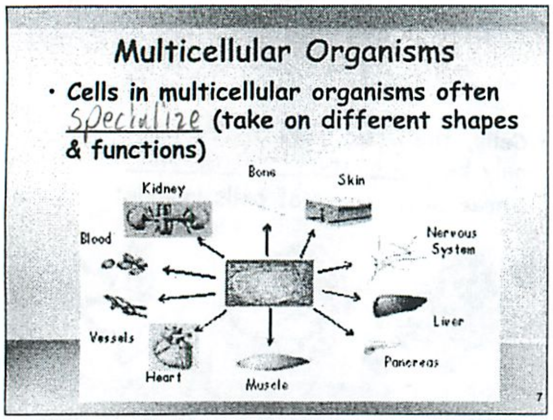


How Big is a Micron (µ) ?

1 cm = 10,000 microns 1" = 25,000 microns

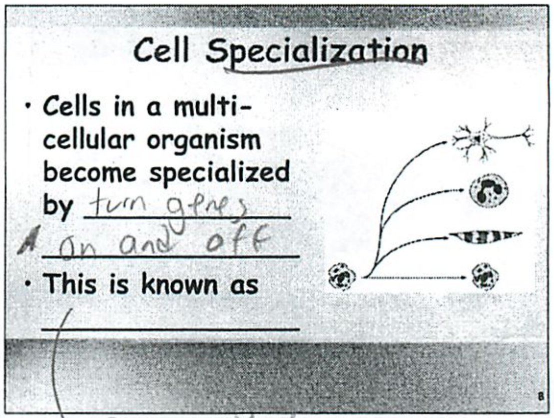
1mm = 1000 microns

↓ important



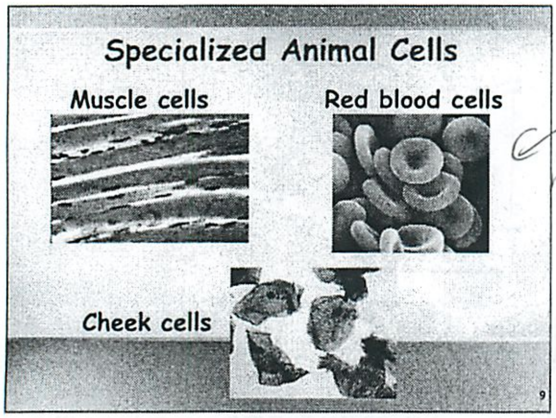
Multicellular Organisms

- Cells in multicellular organisms often specialize (take on different shapes & functions)



Cell Specialization

- Cells in a multi-cellular organism become specialized by turn genes on and off
- This is known as Differentiated

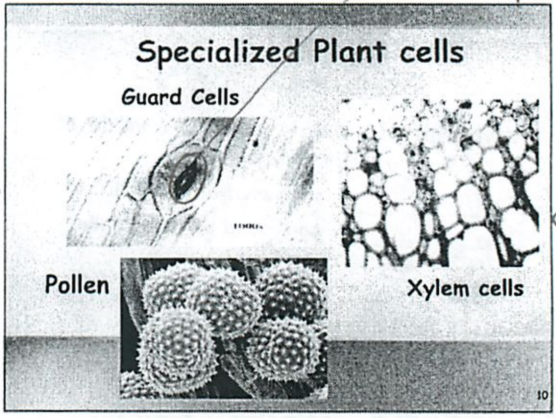


Specialized Animal Cells

Muscle cells

Red blood cells ← no nuclius

Cheek cells

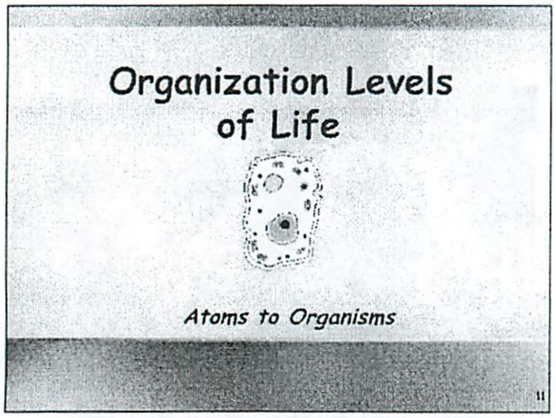


Specialized Plant cells

Guard Cells — Stoma – open + close to let gasses in + out

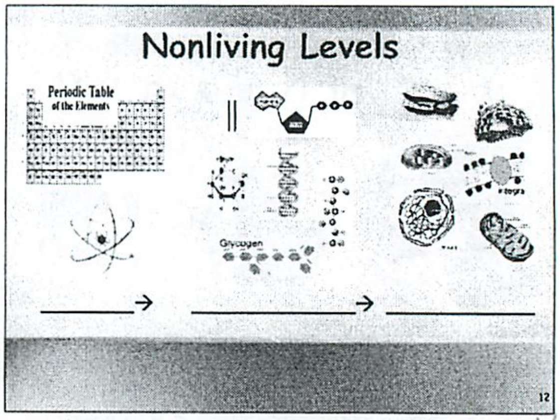
Pollen

Xylem cells ← carry water



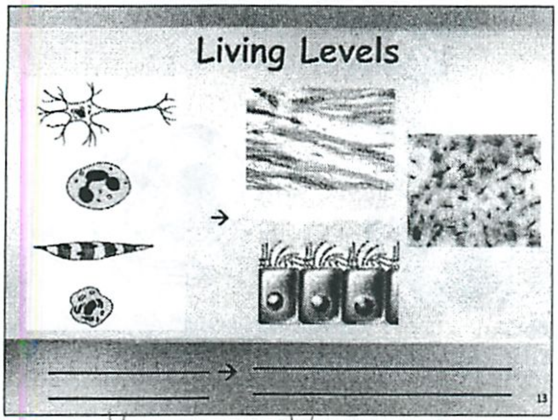
Organization Levels of Life

Atoms to Organisms



Nonliving Levels

atoms → molecules → organells

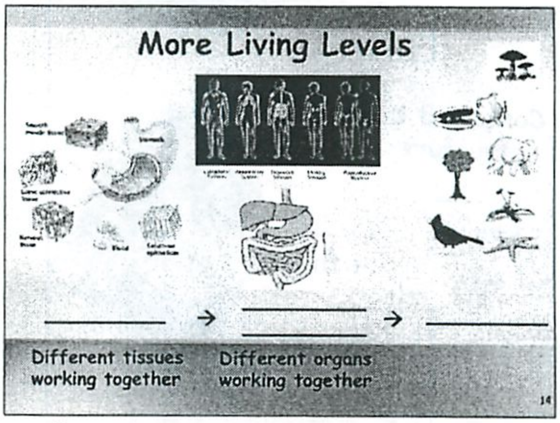


Living Levels

→

Cells
life starts here

tissue
cells working together



More Living Levels

→ →

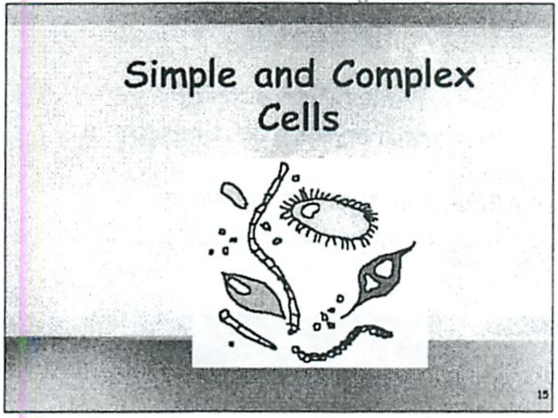
Different tissues working together

Different organs working together

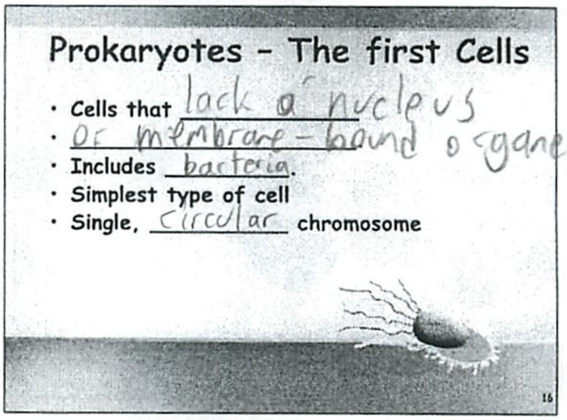
Organs

organ system

Organism

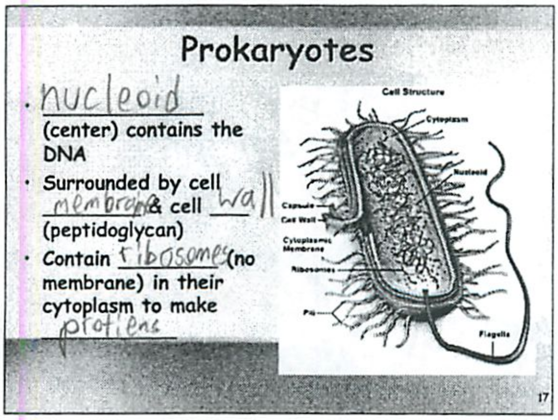


Simple and Complex Cells



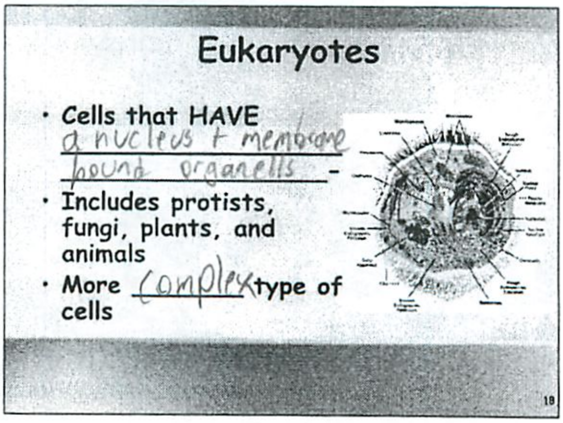
Prokaryotes - The first Cells

- Cells that lack a nucleus
- or membrane-bound organells
- Includes bacteria.
- Simplest type of cell
- Single, circular chromosome



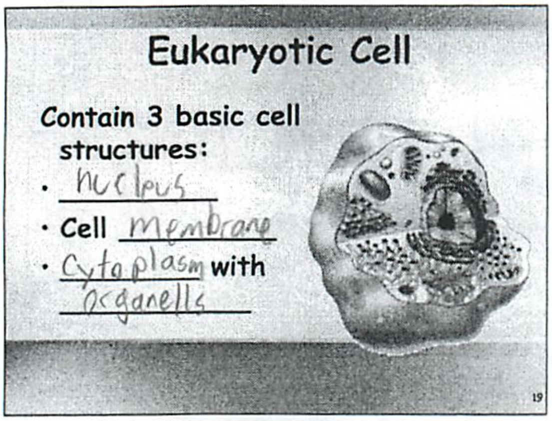
Prokaryotes

- nucleoid (center) contains the DNA
- Surrounded by cell membrane & cell wall (peptidoglycan)
- Contain ribosomes (no membrane) in their cytoplasm to make protiens



Eukaryotes

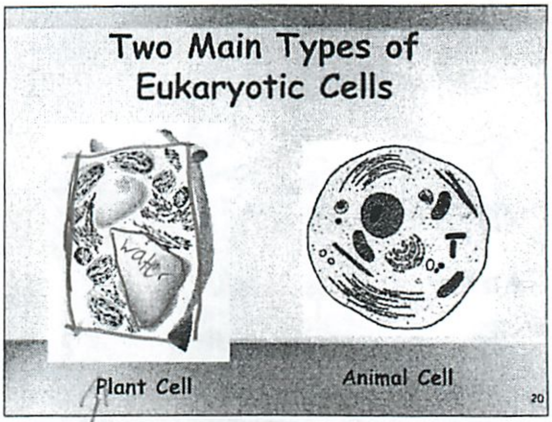
- Cells that HAVE a nucleus + membrane bound organells
- Includes protists, fungi, plants, and animals
- More complex type of cells



Eukaryotic Cell

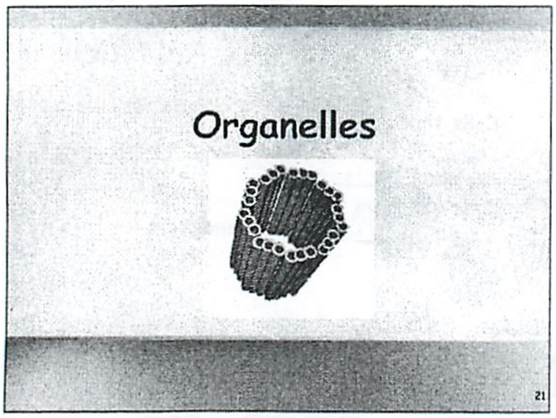
Contain 3 basic cell structures:

- nuclous
- Cell membrane
- Cytoplasm with organells



Two Main Types of Eukaryotic Cells

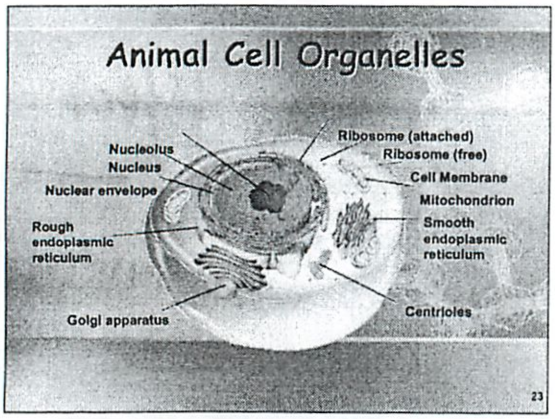
strong border
rectangular



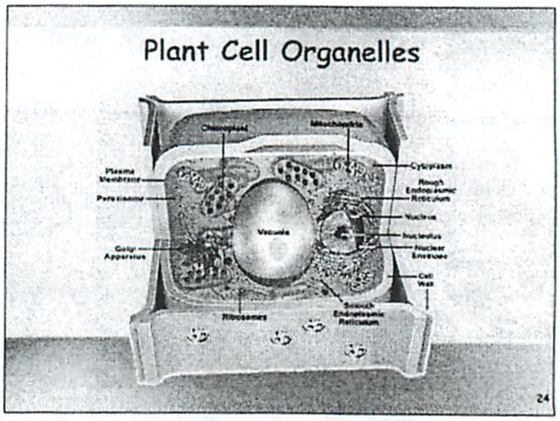
Organelles

Organelles

- Very small (Microscopic)
- Perform various functions for a cell
- Found in the cytoplasm
- May or may not be membrane
- bound.



Animal Cell Organelles

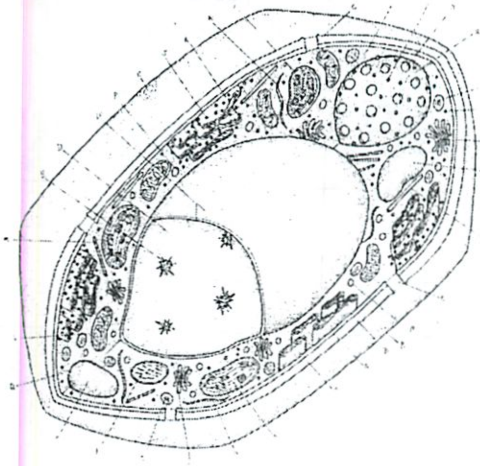


Plant Cell Organelles

Dragonfly Biology 07/08 Pollard

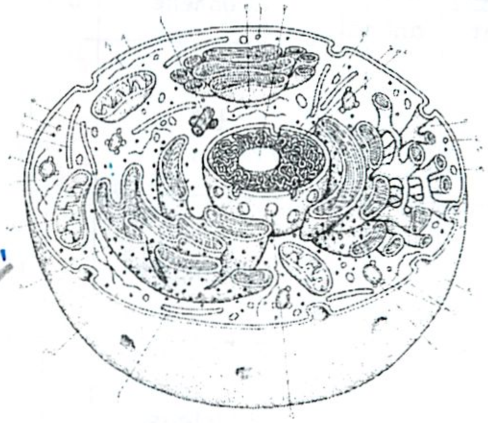
Cell Structures Web Activity

Name: Michael Plasmeier Date: 3/5 Block:________



30/30

~~Venn?~~



Objectives: Identify and describe the main functions of the major structures in plant and animal cells.

Outcome: A completed organelle/structure chart, colored plant and animal cell diagrams, and Venn diagram comparison of the major structures in the eukaryotic cells.

PA Standards:
3.3.12 A. Explain the relationship between structure and function at all levels of organization.

- Explain and analyze the relationship between structure and function at the molecular, cellular and organ-system level.

B. Analyze the chemical and structural basis of living organisms.

- Evaluate relationships between structure and functions of different anatomical parts given their structure.

Procedure:

- Use the following interactive websites to explore cell structures and their function:
  - Active Art for Cell Structures: click start and choose plant or animal cells.
  - Cells Alive!
  - Inside a cell
  - Cell Structure and Function – BioCoach
  - Animal cell anatomy - hover over the organelles for an explanation.
- Using the information you obtain, fill out the chart comparing cell types, structures, and functions.
- Color and label the diagrams of the plant and animal cells.
- Fill in the Venn diagram using the words in the word banks.

Adapted from activities found at http://brookings.k12.sd.us/biology/Cell%20Structure.htm

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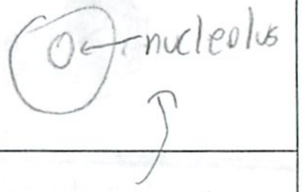
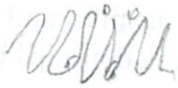
Complete the following chart by putting a check mark by the cell(s) that have each organelle and by writing the organelle's function.

Prok	Eukaryote		Organelle	C	Smooth Function	Structure (Photo/Drawing)
	plant	animal				
	✓	✓	endoplasmic ER rectum	🟧	lipid + steroid hormone synthis break down lipid-solubles in control of calcium release Rough transports ribosomes	liver cells 
✓	✓	✓	Cytoplasm	🟨	holds + protects organells where most cell activities done	fliud that fills cell Outside Nucleus
	✓	✓	Nucleus	🟥	holds the DNA gives messages + commands cell	
	✓	✓	Nucleolus	🟥	Starts assembly of ribosomes	
✓	✓	✓	Cell membrane	🟩	Seperates cell from others semipermable	Outside of cell
	✓	✓	Golgi	🟪	Organelle - process + package macromolecules like protiens + lipids (esp. for secretion)	
Smaller ✓	✓	✓	Ribosomes	🟦	complexes of RNA + protien found in cells	
✓	✓		Cell wall	🟩	Structural support, protection and filtering mechnism	Outside of cell beyond cell membrane
	✓	✓	Mitochondria	🟦	"cell power plants" make ATP Signeling, cell differentation + cell death	Organelle 
	✓		Chloroplast	🟩	absorb light to make sugar for food - photosynthsis	

covers

✓

Adapted from activities found at http://brookings.k12.sd.us/biology/Cell%20Structure.htm

	✓	✓	**Nuclear envelope**	🟥	Double membrane around nucleus - seperates pores allow stuff in + out	
✓ Nuckoid	✓	✓ Nucleus	**Chromatin**	🟦	DNA + Protien that makes up chromosomes	
		✓	**Centrioles**	🟫	Cell Divison	 9 groups of 3 microtubes
	✓	Some smaller	**Vacuoles**	▨	Storage, secretory, excretory maintaining PH, holding waste	
			Lysosomes	🟫	Organells- digest organells, food, viruses	
	✓	✓	**Microfilament**		thinnest fillement of cytoskelton - use ATP to move	
			Microtubules		structural part of Cytoskelton - mitosis, Cytokinesis	
✓	✓ Rare	✓ Rare	**Cilia**		move + sense things sometimes called	
✓		✓ Rare	**Flagella**		propells cell	
✓	✓	✓	**Chromosome**		Organized structures of DNA + Protien	

✓

Adapted from activities found at http://brookings.k12.sd.us/biology/Cell%20Structure.htm

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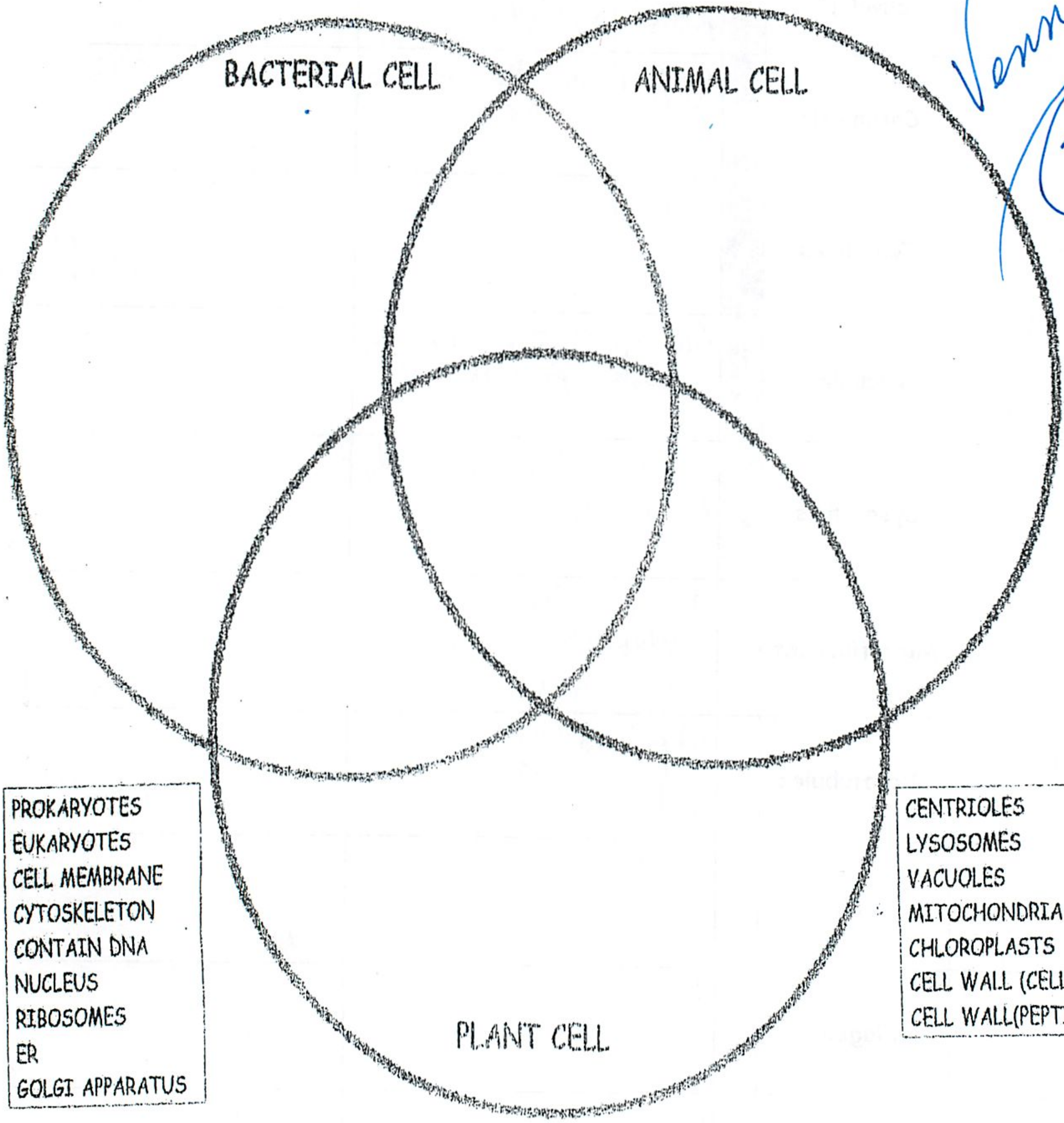
USE WORDS FROM THE WORD BANKS TO COMPLETE THE VENN DIAGRAM COMPARISON

Venn?

-10



PROKARYOTES
EUKARYOTES
CELL MEMBRANE
CYTOSKELETON
CONTAIN DNA
NUCLEUS
RIBOSOMES
ER
GOLGI APPARATUS

CENTRIOLES
LYSOSOMES
VACUOLES
MITOCHONDRIA
CHLOROPLASTS
CELL WALL (CELLULOSE)
CELL WALL(PEPTIDOGLYCAN)

Adapted from activities found at http://brookings.k12.sd.us/biology/Cell%20Structure.htm

Michael Plasmeier

Bacteria	Animal	Plant
- Prokaryotes - Flagella - circular DNA	form tissue + organs Centriole	~~Cell walls~~ large vacuole chlorplasts largest cell photosynthisis

10/10

golgi

X

X

Eukaryotes (have nucleus)
Endoplasmic Reticulum

nucleplus
linear DNA

Cytoskeleton

new research

Cell walls

X

Ribosomes
have genetic materal
are alive

made of elements + atoms
have DNA + RNA
Cytoplasm

Use energy

Dragonfly Biology 07/08

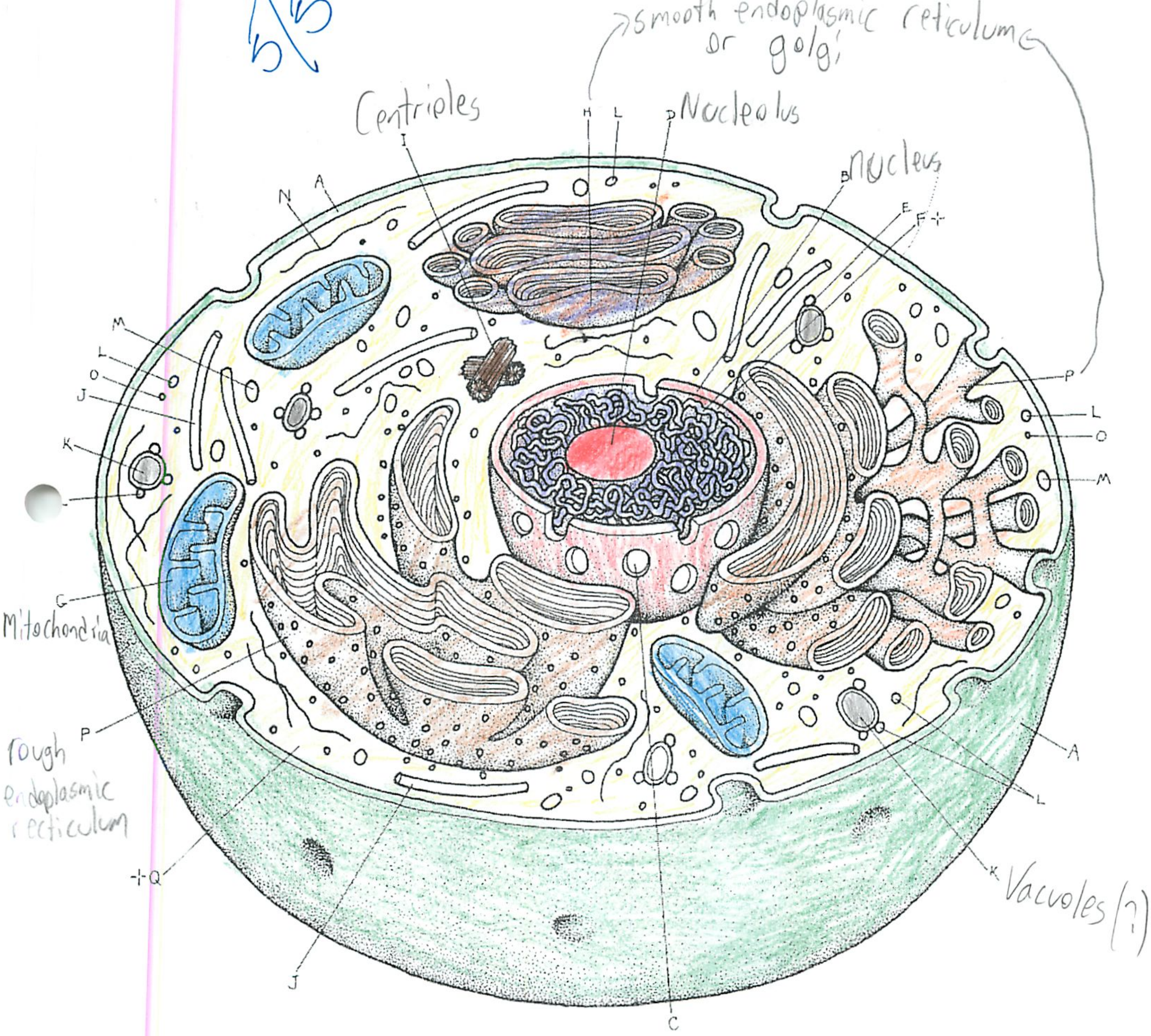
Michael Plasmple

Pollard

Animal

Nice!

5/5



Adapted from activities found at http://brookings.k12.sd.us/biology/Cell%20Structure.htm

Michael Plasmeier

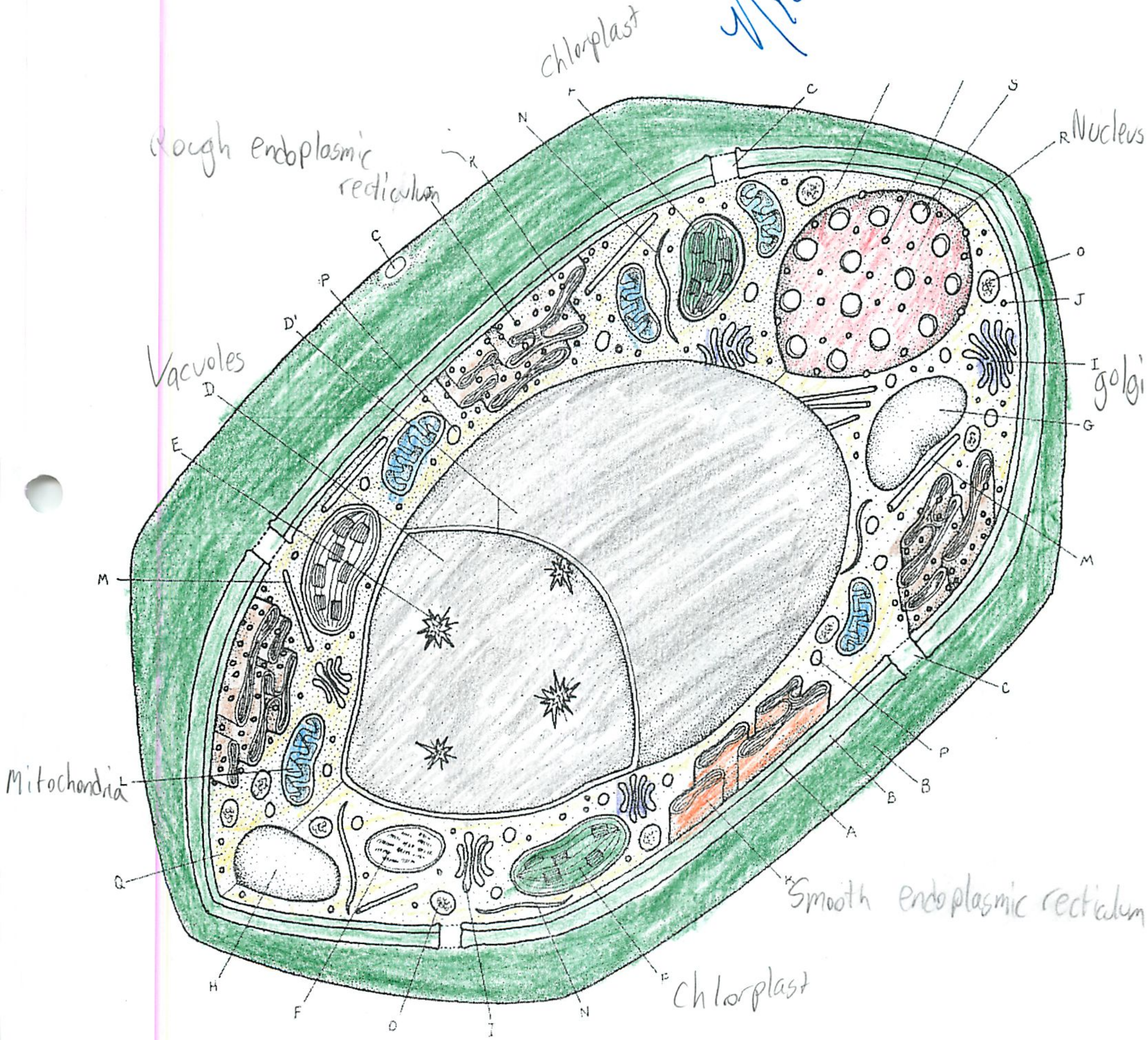
Pollard

Dragonfly Biology 07/08

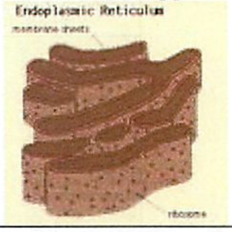
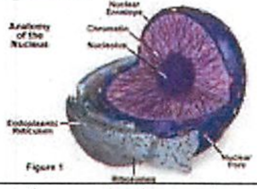
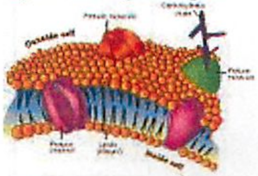
6/6

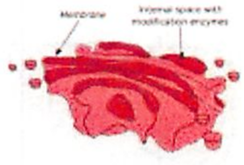
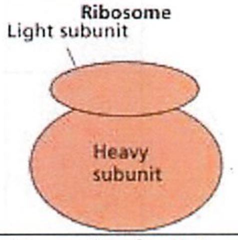
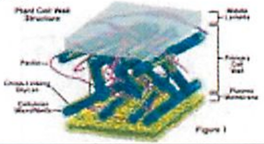
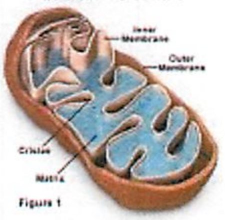
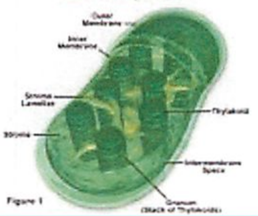
Plant

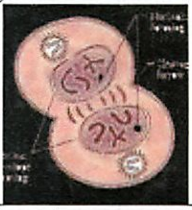
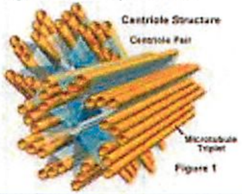
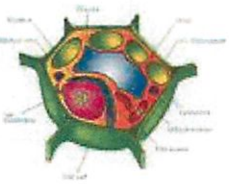
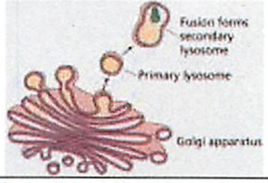
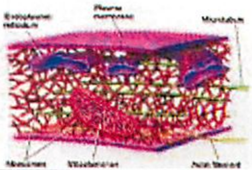
Nice!

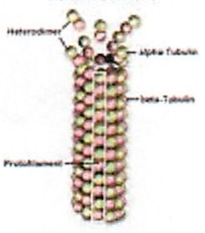
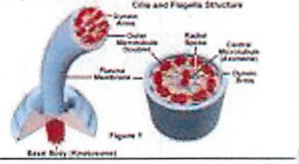
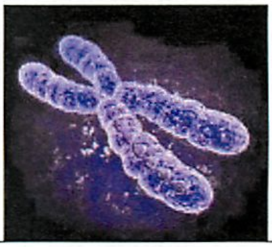


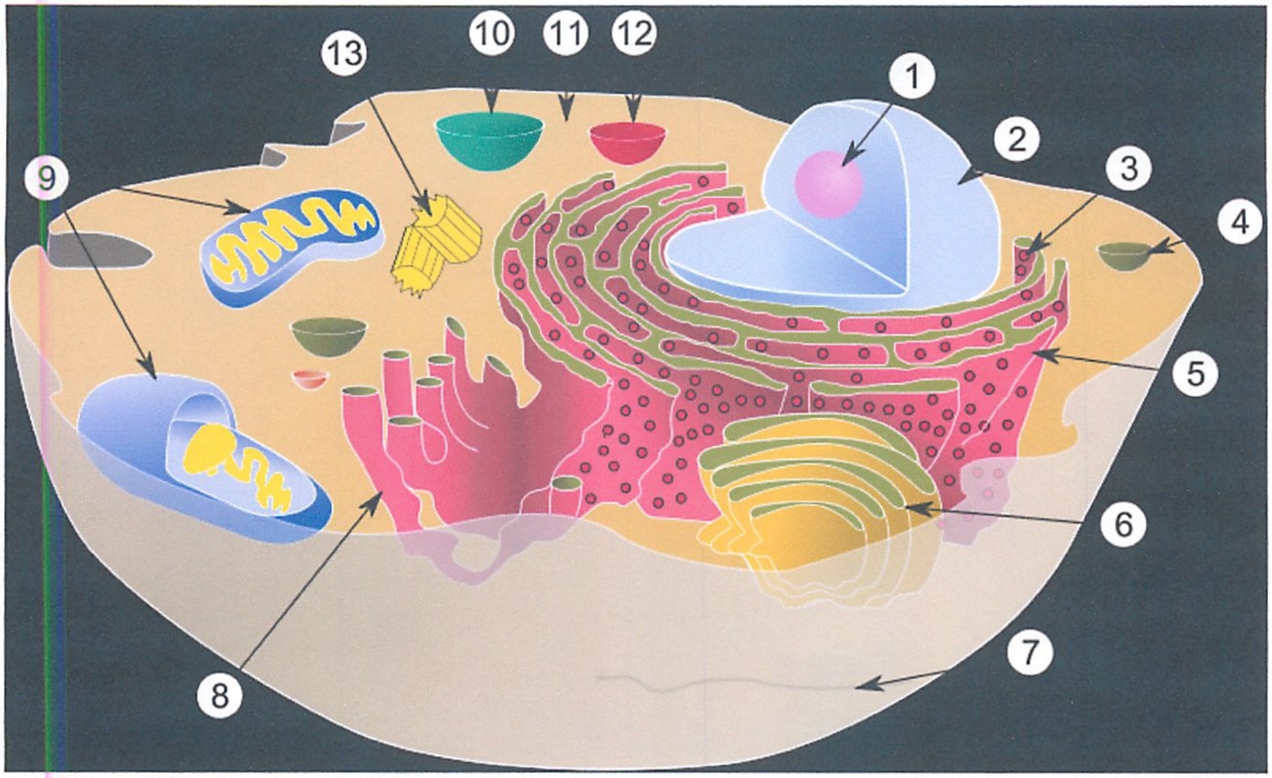
Adapted from activities found at http://brookings.k12.sd.us/biology/Cell%20Structure.htm

Prokaryote	Eukaryote		Organelle	Color on Chart	Function	Structure
	Plant	Animal				
	✓	✓	ER (Endoplasmic Reticulum)	Rough Smooth	The rough section helps with protein synthesis and transport (rough). While the smooth section synthesizes and transports lipids and steroids.	The rough section is made of interconnected membranes that form flat sacs. Ribosomes are often attached to them. The smooth section does not contain ribosomes and has a smooth appearance. 
		✓	Cytoplasm		"Goo" that fills the cell except the Nucleus	Located between the cell membrane and the nucleus. Shown in gel-like goo. 
	✓	✓	Nucleus		Monitors internal and external conditions by turning on and off different genetic programs.	Surrounded by a membrane that contains holes (thus allowing the nucleus to communicate with the cytoplasm). 
	✓	✓	Nucleolus		Is where ribosomes synthesis starts and contains high levels of RNA.	Contains packed proteins, chromosomes, and RNA strands. 
	✓	✓	Cell Membrane		Gives the cell support and protects it from its outside environment. It contains openings that let food go in and waste goes out through its pores.	A double layer of lipid molecules that have the ability to change shape. 

	✓	✓	Golgi		Contains enzymes that modify, sort, and package macromolecules to transport to other parts of the cell.	A membrane-bound structure, with a single membrane. It appears as a stack of membrane-bound vesicles. 
✓	✓	✓	Ribosome		Translates the genetic message in RNA into the production of protein. (It is the site of protein synthesis.)	A granular appearance in electron microscopes. Contains a large subunit and a small subunit. 
✓	✓		Cell Wall		Provides and maintains the shape of polysaccharides and serves as a protective barrier.	Is rigid– made of cellulose that is held together with lignin. 
	✓	✓	Mitochondria		Provides energy for cells to move, divide, produce secret products, and contract. ATP energy source.	Membrane bound– the outer surface is smooth, the inner is highly convoluted (forming folds (cristae) seen in the cross section).  Figure 1
	✓		Chloroplast		Capture the energy from sunlight and convert it into chemical energy (photosynthesis).	Surrounded by two membranes. The inside contains large stacks of other membranes (which contain chlorophyll).  Figure 1
			Nuclear		Controls what enters and leaves	Composed to two membranes

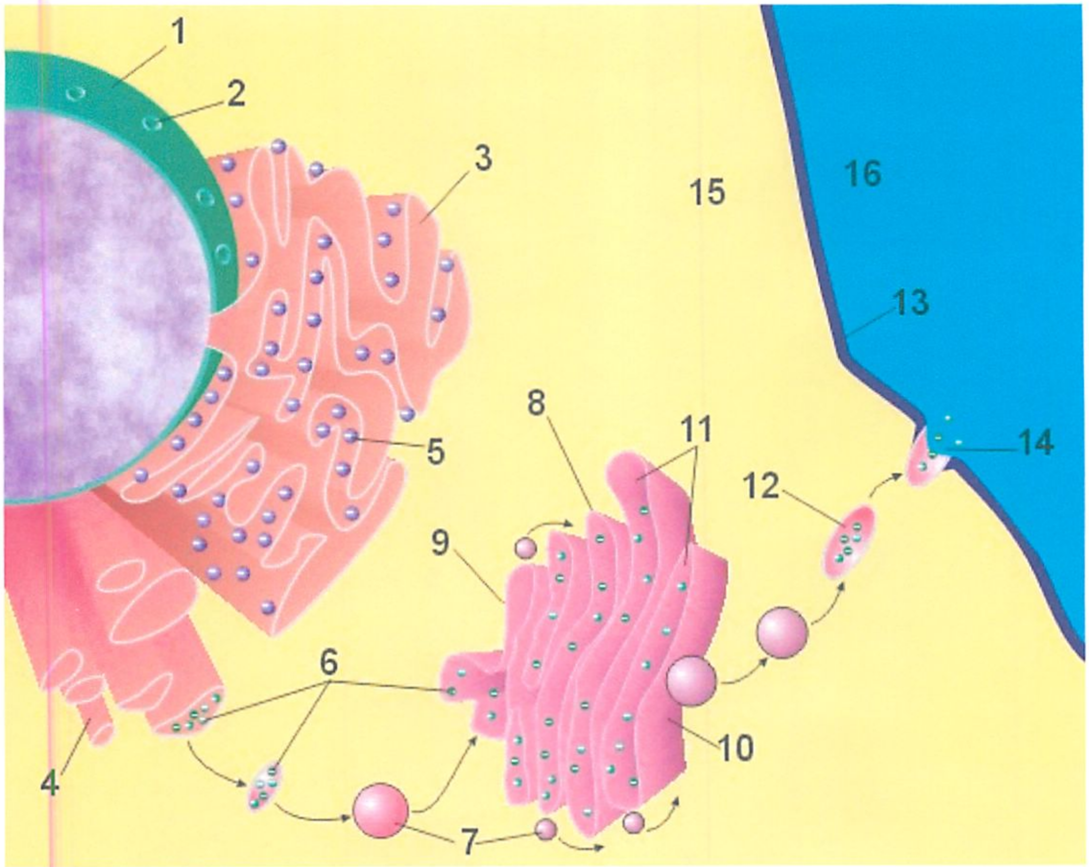
			Envelope/Membrane		the cell. It also gives the cell shape and protection.	which surround the nucleus. Lipid solutes pass through the membrane by dissolving into it. Water passes through the protein lined pores. 
			Chromatin		Consists of DNA bound to protein. When a cell divides, it condenses to form chromosomes.	The granular material seen in the nucleus. Is usually spread throughout the nucleus. 
		✓	Centrioles		They pull chromosomes apart during mitosis.	Contains nine groups of three microtubules that are arranged in a cylinder. 
	✓	✓	Vacuoles		Stores materials such as water, salts, proteins, and carbohydrates. Makes it possible for plants to support heavy structures (such as leaves and flowers). A contractile vacuole contracts to pump excess water out of the cell.	Sac-like structures. 
	✓ (uncommon)	✓	Lysosomes		They digest, and breakdown lipids, carbohydrates, and proteins into small molecules that can be used by the rest of the cell.	Small organelles that are filled with enzymes. 
			Microfilament		Provides strength and support to the cell and provides movement for cells (such as white blood cells).	This helps to make up the cytoskeleton. 

			Microtubules		They form the basis of the cells cytoskeleton, by helping to maintain the structure and shape of the cell. They also help to transport material in the cell by acting as paths. They are also sometimes used for cellular movement and to pull chromosomes away from the center of the cell.	Is made of proteins that form a tube (looks like a spiral). 
✓			Cilia		Used to move fluid in cells.	Short-like hair structures that come out of the cell membrane. 
✓			Flagella		Their main function is motility.	Flagella are long appendages which rotate by means of a "motor" located just under the cytoplasmic membrane. 
	✓	✓	Chromosome		Contain the genetic information that is passed from one generation of cells to the next.	Is made of genes that contain DNA. 



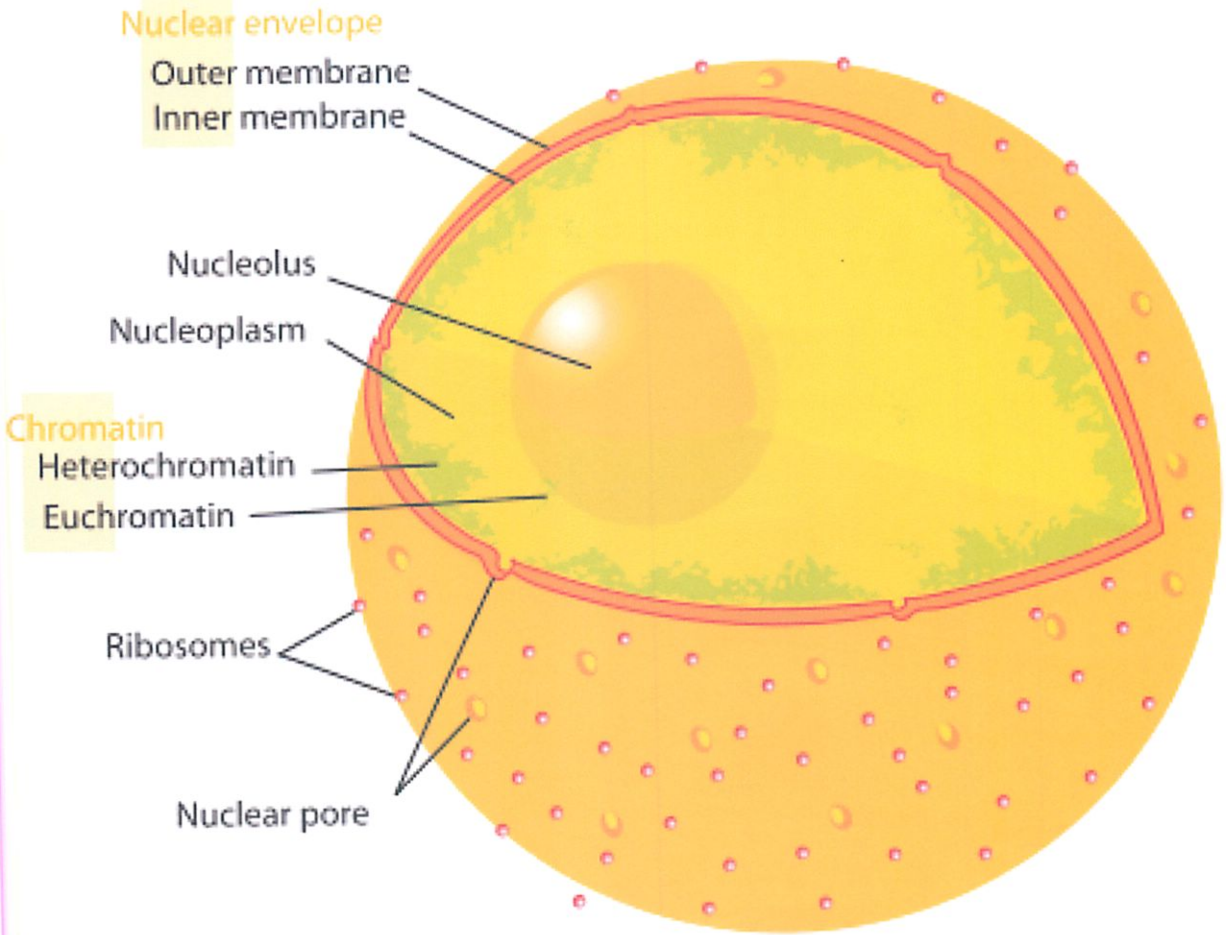
English: Diagram of a typical animal cell. Organelles are labelled as follows:

1. Nucleolus
2. Nucleus
3. Ribosome
4. Vesicle
5. Rough endoplasmic reticulum
6. Golgi apparatus (or "Golgi body")
7. Cytoskeleton
8. Smooth endoplasmic reticulum
9. Mitochondrion
10. Vacuole
11. Cytoplasm
12. Lysosome
13. Centriole



Secretory pathway diagram, including nucleus, endoplasmic reticulum and Golgi apparatus.

1. Nuclear membrane
2. Nuclear pore
3. Rough endoplasmic reticulum (REM)
4. Smooth endoplasmic reticulum
5. Ribosome attached to REM
6. Macromolecules
7. Transport vesicles
8. Golgi apparatus
9. *Cis* face of Golgi apparatus
10. *Trans* face of Golgi apparatus
11. Cisternae of Golgi apparatus
12. Secretory vesicle
13. Cell membrane
14. Fused secretory vesicle releasing contents
15. Cell cytoplasm
16. Extracellular enviroment


Nuclear envelope
Outer membrane
Inner membrane
Nucleolus
Nucleoplasm
Chromatin
Heterochromatin
Euchromatin
Ribosomes
Nuclear pore

Group Project: Cell Analogy OR 3 Dimensional Model

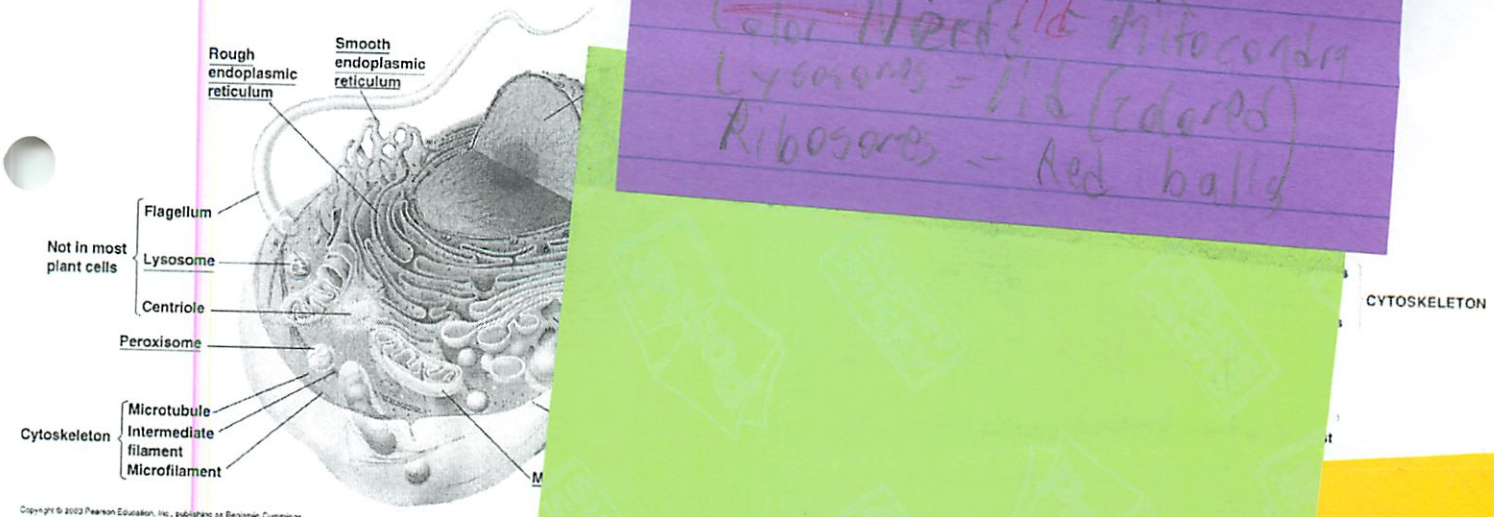
Objective: In groups of 3 or 4, you will create either a 3D model of a cell or a cell analogy of a plant or animal cell. In both projects, you will relate the parts of the cell to the structure and/or function of everyday objects. Each project must be accor description of your project explaining your choice of materials or analogies and h
PROJECTS WILL BE PRESENTED during

Procedure:

- Choose your cell: plant or animal.
- Choose your project: model (all "fou
- Brain storm ideas: What analogy c w will you present it (model, powerpoi
- Develop your analogy/model conce diagrams below (add nucleolus, ch
- Divide up jobs: Who will bring in n ss?), divide up slides for a powerpoint, w per, etc.

Animal Grp 1
Model 1

Ball = Nucleus
Pins = Nuclear pores
Straws = centrioles
Pipe cleaners = DNA
" " wire = ccomatin
~~Straws~~ Needs rope ~~Pins~~ = ER
~~Color Nerds~~ lid Mitocondria
Lysosomes = lid (colored)
Ribosomes = Red balls



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Rubric (100 pts total):
Features all ~ 15 structures:
Appropriateness/strength of analo
Creativity/neatness/polish
Originality
Presentation (everyone involved)
Paper 15 points

Ask
not including
all (from paper)

permarket
n food
Wawa
computer
amusement park
school E
cruise ship
Prision
Fedaal Gov.
Movie Theater
Mall

Animal

Model 1

Ball = Nucleus
Pins = Nuclear pores
Straws = centrioles
Pipe cleaners = DNA
" " wire = cromatin
~~Straws, pics~~ nerds rope = ER
~~Color Nerds~~ lid = Mitocondra
Lysosomes = lid (colored)
Ribosomes = Red balls

Pipe cleaners = cillia flagella

box = cell membraine

white cotton balls = valcoole

straws + pins = golgi

straws on wall = micro tubes

Plant Grp 1
Model 2

Cell wall = box

blue lake = vascules

Soft ball = nucleus

Red thing = mitocondra

green thing = clorplasts

Smooth Blue string = ER Rough = too thin

sponge = Golgi

eraser grips = ~~ribosomes~~ cytoskel

tin foil = cell membrane

black area = nuclius

⑮ paper

airport
City
restornt
computer
* School ←
Prision
Fedaal Gov.
Movie Theater
Mall

Supermarket
↑ food
Wawa
amusement park
cruise ship

Animal

~~Office~~

front gate - pores ✓

office > nucleus ✓

CEO - nucleous ✓

food services -> ribosomes

vesicule - trash truck

Rough ER - ~~monorail~~ boat ride

Golgi - trash compactors
Cytoskelton - fense / or stuff to hide fense
smooth er - monorail station
mitocondica - generators
vacuole - large lake in middle
lysomes - clean up men
~~Centriol~~

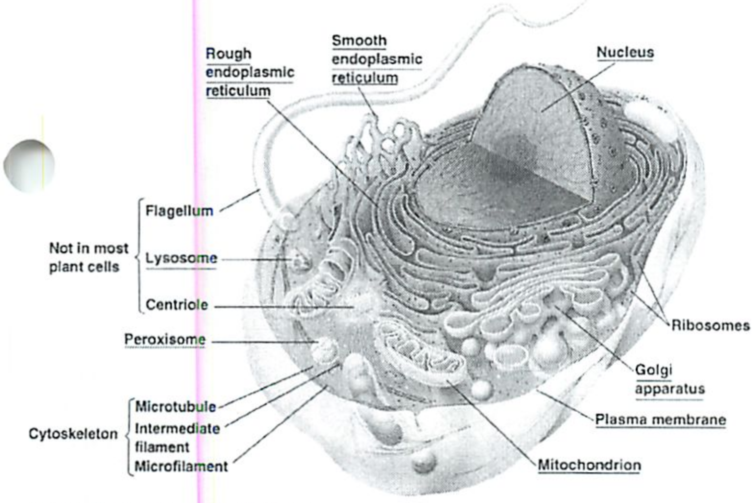
Chromatin - ~~Designer~~ paper
plans on
Chromosome - plans
nucleolus - food service
office

Group Project: Cell Analogy <u>OR</u> 3 Dimensional Model

Objective: In groups of 3 or 4, you will create either a 3D model of a cell or a cell analogy of a plant or animal cell. In both projects, you will relate the parts of the cell to the structure and/or function of everyday objects. Each project must be accompanied by a short description of your project explaining your choice of materials or analogies and how they represent the structure/function of the cell parts. PROJECTS WILL BE PRESENTED during the second half of class tomorrow, Tuesday, March 4th .

Procedure:

- Choose your cell: plant or animal.
- Choose your project: model (all "found" objects) or analogy (must be creative,,).
- Brain storm ideas: What analogy do you like, what materials are appropriate for a model, how will you present it (model, powerpoint, poster, pamplet, movie...) etc.
- Develop your analogy/model concept, being sure to include all of the cell structures in the diagrams below (add nucleolus, chromatin, and nuclear envelope to the animal cel).
- Divide up jobs: Who will bring in materials, who has poster board (do we have paper in the class?), divide up slides for a powerpoint, who will present which structures, who will type the short paper, etc.



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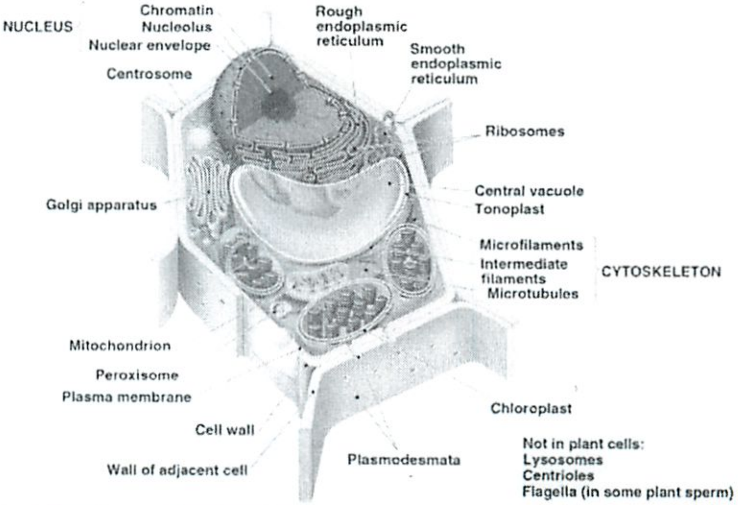

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<u>Rubric (100 pts total):</u>

Features all ~ 15 structures:	30 points
Appropriateness/strength of analogy:	15 points
Creativity/neatness/polish	10 points
Originality	10 points
Presentation (everyone involved)	20 points
Paper	15 points

Ask abat
not including
all (from paper)

Animal Cell/Amusement Park Analogy

In today's society, it would be virtually impossible for anyone to truly live on their own. There would always have to be some aspect of the "modern life" present. Airports, amusement parks, hotels, and many other large businesses would not be able to function if everyone (and everything) working there did not work together, for without the help of others, nothing would be able to function on its own. By analyzing the comparison between animal cells and amusement parks, we can better understand why the organelles of cells work together, and why cells and amusement parks are actually quite similar.

Animal cells are made up of about sixteen different organelles that work together to make the cell function properly. The main center of operations is the nucleus and the nucleolus working hand in hand. They control the cell and contain DNA that gives the cell specific characteristics. The cell also contains a Golgi apparatus that serves as transportation for macromolecules, smooth endoplasmic reticulum breaks down and controls toxins in the cell, rough endoplasmic reticulum that hold proteins before they are transported to other parts of the cell, a cell membrane that serves as a protective coating for the cell, among many other organelles. If each organelle did not do its part, the cell would not function properly.

Modern-day amusement parks operate in a similar fashion. Corporate officials control how the park is run by monitoring cash inflow, purchasing new rides, and listening to the ideas of their customers. Many men and women work together to keep the park runs smoothly. Some act as cleaners by picking up trash and empting garbage cans, while others control when the rides begin. Some employees are responsible for transporting people on a monorail or shuttle bus, while still others work to provide food for the guests. Without all of these people working together, amusement parks would not be nearly as enjoyable as they are now.

Universal Studio's Islands of Adventure theme park can be easily compared to an animal cell. The outer fence that surrounds the park is similar to the cell membrane. They both the fence and the membrane work to protect their insides from outsiders and let it keep its shape. As you enter the amusement park, you are greeted by the front gate which is very similar to the membrane channel of a cell. The membrane channel contains openings that let food go in and waste go out through its pores just as the front gate lets people in, and merchandise, food, waste, and satisfied customers out. As you continue inside, you are greeting by facades that are similar to the cytoskeleton of a cell. Since the cytoskeleton helps the cell to keep its shape, the facades help the park to remain in shape as well. The pathways throughout the park compare nicely to the cytoplasm of a cell. The cytoplasm helps to move materials around the cell, just as the paths help to move people around the park. The cytoplasm also fills up the cell, just like the paths in Islands of Adventure make up the park.

The office of the theme park is similar to the nucleus of a cell because they both monitor what is going on in their environments (Islands of Adventure controls their staff, rides, and other park managements, while the cell's nucleus turns on and off different genetic programs in the cell). The blueprints of the park are similar to the chromosomes of a cell because they carry information that tells how the cell/park should be built. The paper that these blueprints are on is the chromatin in a cell because it holds the "ink" of the blueprints (without paper the park's blueprints would have no foundation). Islands of Adventure's advertising office is similar to the cell's nucleolus. It entices people to come to the park, just as the nucleolus synthesizes ribosomes. The cars in the parking lot are symbolic of a ribosome because it causes the proteins to assemble.

The boat ride in Islands of Adventure theme park is similar to the endoplasmic reticulum of a cell because they both get things ready to transport, and then transport them to their destinations. The sense of "family time" is like the Golgi in a cell because it is what is manufactured from the park.

The park's clean-up crews are similar to the lysosomes because they break down "once edible materials" into smaller molecules. The trash trucks can be easily compared to the vesicles because they transport waste away from the cell, just as a trash truck removes waste from the park. The back pathways would then serve as vacuoles because they both house and transport materials. The mitochondria is similar to the park's generators because it provides energy for the park.

By comparing Island of Adventure to a common animal cell, many similarities can be easily seen. Both structures require many different people/organelles to keep things running correctly. They also both have related jobs for the people/organelles to perform. By analyzing how well cells compare to amusement parks, it is easier to learn the functions of each of its organelles.

Michael Plasmeier

3/5

Section 7.3: Cell Boundaries:

Vocab:

uneer blood plasma

cell membrane -(plasma membrane) - thin, flexable barrier

cell wall - rigid outer wall (beyond membrane) for strenght + protection

lipi bilayer

concentration

diffusion - principal way molecules can cross cell boundries - molecules move automatically from higer to lower concentrations

equilibrium

osmosis diffusion of water through semi-permeble membrane

isotonic - same strenght - water level stays the same

hypertonic higher concentrations outside - water rushes out

hypotonic lower concentrations outside - water rushes in

facilitated diffusion - diffusion in which protien channels allow certain compounds to quickly pass through in either direction

active transport - materials moved againts a concentration difference run by protien pumps

endocytosis - taking material into the cell w/ pockets in membrane (infolding)

phagocytosis - "cell eating" - cytoplasam surrounds particles brings food into cell

pinocytosis - taking in liquid as pockets turn into vacuoles

exocytosis - pushing material out of cell w/ vacuoles fusing w/ membrane

aquaporins - water channel protines

1. What are the main functions of the cell membrane?

- regulates what enters + leaves cell
- provide cell with protection and support
- flexable struture + strong barrier
  - lipids + carbs create fluid mosaic model
  - protiens form pumps to cross boundries
  - carbs: chemical ID cards

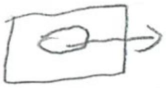
2. What happens during diffusion? How does osmosis work?

diffusion - molecules of a substance move from areas of higer concentrations to areas of lower concentrations

osmosis - diffusion through semi permible membrane substance wants to move from areas of high concentration to areas of low concentration.

3. What are the effects of different solute concentrations on animal cells? How do plant cells differ?

Solution Outside

Solution	Animal	Plant
Isotonic =		
Hypertonic higer		
Hypotonic lower		

← Plants cell walls cause it not to burst

4. What are the different ways that things can move through the cell membrane?

diffusion -
facilitated diffusion -
osmosis -
active transport
molecular transport
bulk transport
endocytosis
phagocytosis
pinocytosis
exocytosis

> Note: For the past several years, I've been puzzling how to integrate new discoveries on the nature of water movement through cell membranes into Chapter 7. The Section below is a draft of my first efforts to integrate the role of aquaporin, the water channel protein, into a discussion of passive transport and osmosis. Comments and criticisms are most welcome.
>
> *-Ken Miller (July, 2007)*

Section 7-3 Cell Boundaries

Key Questions (One for each B-head in Lesson)

- *What is the function of the cell membrane?*
- *How does diffusion allow materials to cross cell membranes?*
- *Can cells actively take in the materials they need??*
- *How do cells communicate with each other??*

THINK ABOUT IT When you first study a country, you may begin by examining a map of the country's borders. Before you can learn anything about a nation, it's important to understand where it begins and where it ends. The same principle applies to cells. Among the most important parts of a cell are its borders, which separate the cell from its surroundings, and determine what comes in, and what goes out.

Cell Walls and Membranes

What are the functions of the cell membranes and cell walls?

All cells are surrounded by a thin, flexible barrier known as the **cell membrane**. The cell membrane is sometimes called the plasma membrane because many cells in the body are in direct contact with the fluid portion of the blood—the plasma. Many cells also produce a strong supporting layer around the membrane known as a cell wall.

Cell Membranes The composition of nearly all cell membranes is a double-layered sheet called a lipid bilayer.. The lipid bilayer gives cell membranes a flexible structure that forms a strong barrier between the cell and its surroundings. **The cell membrane regulates what enters and leaves the cell and also provides the cell with protection and support.**

In addition to lipids, most cell membranes contain protein molecules that are embedded in the lipid bilayer. Carbohydrate molecules are attached to many of these proteins. In fact, there are so many kinds of molecules in cell membranes that scientists describe their understanding of the membrane as the "fluid mosaic model" of membrane structure. As you will see, some of the proteins form channels and pumps that help to move material across the cell membrane. Many of the carbohydrates act like chemical identification cards, allowing individual cells to identify one another

Cell Walls Cell walls are present in many organisms, including plants, algae, fungi, and many prokaryotes. Cell walls lie outside the cell membrane. Most cell walls are porous enough to allow water, oxygen, carbon dioxide, and certain other substances to pass through easily. **The main function of the cell wall is to provide support and protection for the cell.**

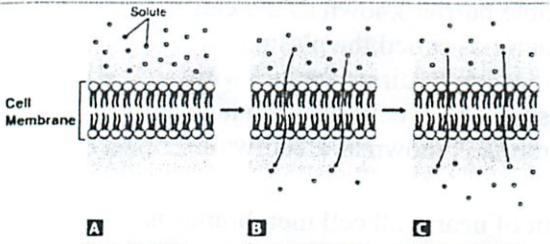
Most cell walls are made from fibers of carbohydrate and protein. These substances are produced within the cell and then released at the surface of the cell membrane where they are assembled to form the wall. Plant cell walls are composed mostly of cellulose, a tough carbohydrate fiber. Cellulose is the principal component of both wood and paper, so every time you pick up a sheet of paper, you are holding the stuff of cell walls in your hand

Passive Transport

How does diffusion allow materials to cross cell membranes?

Every living cell exists in a liquid environment. It may not always seem that way; yet even in the dust and heat of a desert, the cells of cactus plants, scorpions, and vultures are bathed in liquid. One of the most important functions of the cell membrane is to regulate the movement of dissolved molecules from the liquid on one side of the membrane to the liquid on the other side.

Diffusion One of the principal ways in which molecules cross cell membranes is a process known as diffusion. The cytoplasm of a cell is a solution of many different substances dissolved in water. You should recall that a solution is a mixture of two or more substances, and that the substances dissolved in the solution are called solutes.



A There is a higher concentration of solute on one side of the membrane as compared to the other side of the membrane.

B Solute particles move from the side of the membrane with a higher concentration of solute to the side of the membrane with a lower concentration of solute. The solute particles will continue to diffuse across the membrane until equilibrium is reached.

C When equilibrium is reached, solute particles continue to diffuse across the membrane in both directions.

Diffusion Diffusion is the process by which molecules of a substance move from areas of higher concentration to areas of lower concentration. **Diffusion does not require the cell to use energy.**

In any solution, solute particles move constantly. They collide with one another and tend to spread out randomly. As a result, the particles tend to move from an area where they are more concentrated to an area where they are less concentrated, a process known as diffusion (dih-FYOO-zhun). When the concentration of the solute is the same throughout a system, the system has reached equilibrium.

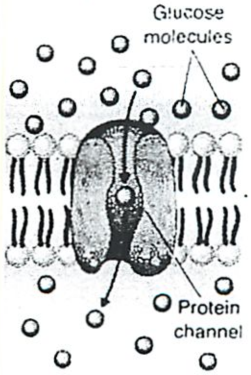
The concentration of a solute is usually expressed as the amount dissolved in a certain volume of solvent. For example, if you dissolved 12 grams of salt in 3 liters of water, the concentration of the solution would be 12 g/3 L, or 4 g/L (grams per liter). If you had 12 grams of salt in 6 liters of water, the concentration would be 12 g/6 L, or 2 g/L. The first solution would be twice as concentrated as the second solution.

What do solute concentration, diffusion, and equilibrium have to do with cell membranes? Suppose a substance is present in unequal concentrations on either side of a cell membrane. If the substance can cross the cell membrane, its particles will tend to move toward the area where it is less concentrated until equilibrium is reached. At that point, the concentration of the substance on both sides of the cell membrane will be the same.

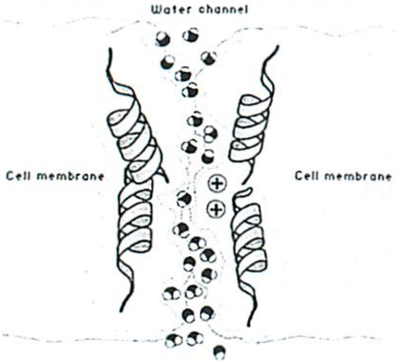
Because diffusion depends upon random particle movements, substances diffuse across membranes without requiring the cell to use additional energy. Even when equilibrium is reached, particles of a solution will continue to move across the membrane in both directions. However, because almost equal numbers of particles move in each direction, there is no further change in the concentration on either side.

← doesn't movement use energy?

Facilitated Diffusion Some molecules, such as the sugar glucose, seem to pass through the cell membrane much more quickly than they should. One might think that these molecules are too large or too strongly charged to cross the membrane, and yet they diffuse across quite easily.



How does this happen? Cell membranes have protein channels that act as carriers, making it easy for certain molecules to cross. Red blood cells, for example, have membrane proteins with carrier channels that allow glucose to pass through them. Only glucose can pass through this protein carrier, and it can move through in either direction. This is sometimes known as carrier-facilitated diffusion. These cell membrane channels are also said to facilitate, or help, the diffusion of glucose across the membrane. The process, shown in Figure 7–x, is known as **facilitated diffusion.** Hundreds of different protein channels have been found that allow particular substances to cross cell membranes.



Surprising new research has added water to the list of molecules that enter cells by facilitated diffusion. Water molecules have a tough time crossing the cell membrane's lipid bilayer, and therefore water diffuses in and out of many cells very slowly. However, many cells contain huge numbers of water channel proteins, known as **aquaporins**, that allow water to pass right through them (Figure 7-x). As we will see in a moment, the movement of water through cell membranes by facilitated diffusion is an extremely important biological process[1].

Although facilitated diffusion is fast and specific, it is still diffusion. Therefore, a net movement of molecules across a cell membrane will occur only if there is a higher concentration of the particular molecules on one side than on the other side. This means that the movement of molecules by facilitated diffusion does not require any additional use of the cell's energy.

Osmosis Although many substances can diffuse across biological membranes, some are too large or too strongly charged to cross the lipid bilayer. If a substance is able to diffuse across a membrane, the membrane is said to be **permeable** to it. A membrane is **impermeable** to substances that cannot pass across it. Most biological membranes are selectively permeable, meaning that some substances can pass across them and others cannot. Selectively permeable membranes are also called semipermeable membranes.

Water moves quite easily through the aquaporin water channels in many cells, even though many solute molecules cannot. An important process known as osmosis is the result. Osmosis is the diffusion of water through a selectively permeable membrane. bold

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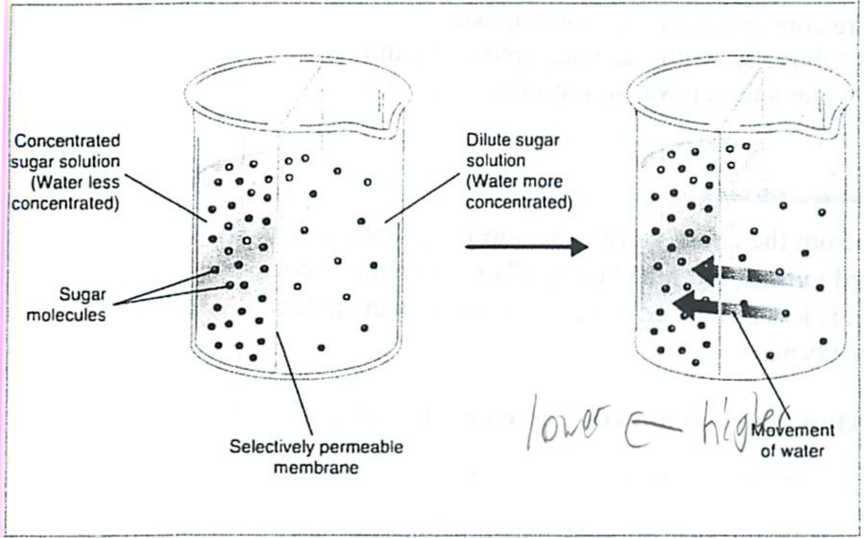
[1] Note: The 1994 discovery of Aquaporin by Peter Agre should be placed on the timeline.

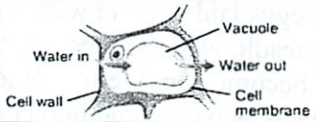
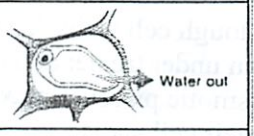
. . .



Osmosis Osmosis is the diffusion of water through a selectively permeable membrane. In the first beaker, water is more concentrated on the right side of the membrane. As a result, the water diffuses (as shown in the second beaker) to the area of lower concentration.

How Osmosis Works Look at the beaker on the left in Figure 7–15. There are more sugar molecules on the left side of the membrane than on the right side. That means that the concentration of water is lower on the left than it is on the right. The membrane is permeable to water but not to sugar. This means that water can cross the membrane in both directions, but sugar cannot. As a result, there is a net movement of water from the area of high concentration to the area of low concentration.

The Effects of Osmosis on Cells

Solution	Animal Cell	Plant Cell
Isotonic: The concentration of solutes is the same inside and outside the cell.		
Hypertonic: Solution has a higher solute concentration than the cell.	 Higer Solute	
Hypotonic: Solution has a lower solute concentration than the cell.	 Lower Solute	

Effects of Osmosis Cells placed in an isotonic solution neither gain nor lose water. In a hypertonic solution, animal cells shrink, and plant cell vacuoles collapse. In a hypotonic solution, animal cells swell and burst. The vacuoles of plant cells swell, pushing the cell contents out against the cell wall. **Predicting** ***What would happen to the animal cell in the isotonic solution if it were placed in pure water?***

Water will tend to move across the membrane until equilibrium is reached. At that point, the concentrations of water and sugar will be the same on both sides of the membrane. When this happens, the two solutions will be **isotonic,** which means "same strength." When the experiment began, the more concentrated sugar solution was **hypertonic,** which means "above strength," as compared to the dilute sugar solution. The dilute sugar solution was **hypotonic,** or "below strength."

Word Origins

Hypotonic comes from the Greek word *hupo,* meaning "under," and the New Latin word *tonicus*, meaning "tension" or "strength." So a hypotonic solution is less strong, or less concentrated, than another solution of the same type

If *derma* means "skin," how would you describe a hypodermic injection?

Osmotic Pressure For organisms to survive, they must have a way to balance the intake and loss of water. Osmosis exerts a pressure known as osmotic pressure on the hypertonic side of a selectively permeable membrane. Osmotic pressure can cause serious problems for a cell. Because the cell is filled with salts, sugars, proteins, and other molecules, it will almost always be hypertonic to fresh water. This means that osmotic pressure should produce a net movement of water into a typical cell that is surrounded by fresh water. If that happens, the volume of a cell will increase until the cell becomes swollen. Eventually, the cell may burst like an overinflated balloon. Fortunately, cells in large organisms are not in danger of bursting. Most cells in such organisms do not come in contact with fresh water. Instead, the cells are bathed in fluids, such as blood, that are isotonic. These isotonic fluids have concentrations of dissolved materials roughly equal to those in the cells themselves.

→ chart shows water going out ?

Some cells, such as the eggs laid in fresh water by fish and frogs, lack water channels. As a result, water moves into them so slowly that osmotic pressure does not become a problem. Other cells, including those of plants and bacteria, which do come into contact with fresh water, are surrounded by tough cell walls. The cell walls prevent the cells from expanding, even under tremendous osmotic pressure. However, the increased osmotic pressure makes such cells extremely vulnerable to injuries to their cell walls.

Active Transport

Can cells actively take in the materials they need?

As powerful as diffusion is, cells sometimes must move materials in the opposite direction—against a concentration difference. **The movement of material against a concentration difference is known as active transport.** As its name implies, active transport requires energy. The active transport of small molecules or ions across a cell membrane is generally carried out by transport proteins or "pumps" that are found in the membrane itself. Larger molecules and clumps of material can also be actively transported across the cell membrane by processes known as endocytosis and exocytosis. The transport of these larger materials sometimes involves changes in the shape of the cell membrane.

Molecular Transport Small molecules and ions are carried across membranes by proteins in the membrane that act like energy-requiring pumps. Many cells use such proteins to move calcium, potassium, and sodium ions across cell membranes. Changes in protein shape, seem to play an important role in the pumping process. A considerable portion of the energy used by cells in their daily activities is devoted to providing the energy to keep this form of active transport working. The use of energy in these systems enables cells to concentrate substances in a particular location, even when the forces of diffusion might tend to move these substances in the opposite direction

Bulk Transport Larger molecules and even solid clumps of material may be transported by movements of the cell membrane known as bulk transport. Bulk transport may take several forms, depending upon the size and shape of the material taken into or out of the cell.

Endocytosis Endocytosis (en-doh-sy-TOH-sis) is the process of taking material into the cell by means of infoldings, or pockets, of the cell membrane. The pocket that results breaks loose from the outer portion of the cell membrane and forms a vacuole within the cytoplasm. Large molecules, clumps of food, and even whole cells can be taken up in this way. Two examples of endocytosis are phagocytosis (fag-oh-sy-TOH-sis) and pinocytosis (py-nuh-sy-TOH-sis).

Phagocytosis means "cell eating." In phagocytosis, extensions of cytoplasm surround a particle and package it within a food vacuole. The cell then engulfs it. Amoebas use this method of taking in food. Engulfing material in this way requires a considerable amount of energy and, therefore, is correctly considered a form of active transport.

In a process similar to endocytosis, many cells take up liquid from the surrounding environment. Tiny pockets form along the cell membrane, fill with liquid, and pinch off to form vacuoles within the cell. This process is known as pinocytosis.

Exocytosis Many cells also release large amounts of material from the cell, a process known as exocytosis (ek-soh-sy-TOH-sis). During exocytosis, the membrane of the vacuole surrounding the material fuses with the cell membrane, forcing the contents out of the cell. The removal of water by means of a contractile vacuole is one example of this kind of active transport.

Cellular Communication

How do cells communicate with each other?

For cells in a large organism to act together, they must be able to communicate with each other. **Cells communicate by means of chemical signals that are passed from one cell to another.** These chemical signals vary widely, and so do the ways in which cells respond to them.

Cellular Junctions Many cells form cellular junctions that attach them to neighboring cells. Skin cells, for example, are joined by tough junctions that keep them from being pulled apart. The cells lining the digestive system have another type of junction that forms a tight seal between them. This helps to prevent material from leaking between cells, and enables layers of such cells to form a barrier. Junctions such as these help to keep the contents of the digestive system, including what you might have had for lunch today, from leaking out between the cells and into the rest of the body.

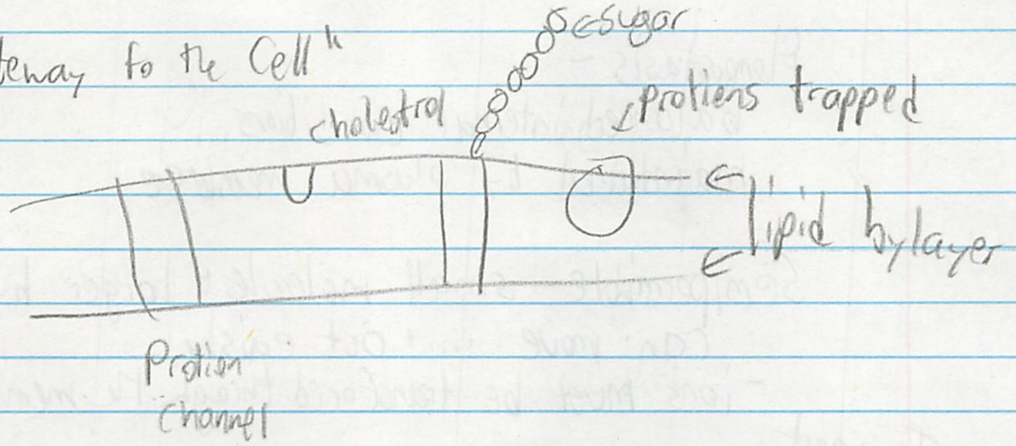
Other cells, including those in the heart and liver, form junctions that allow small molecules to pass directly from one cell to the next. These junctions mean that changes in the concentrations of small molecules and ions can spread very quickly from cell to cell. As a result, a chemical message or signal produced in one cell can travel to the next, allowing the cells joined by these kinds of junctions to act together. Such junctions are one of the principal reasons why the cells of the heart muscle are able to contract in a coordinated fashion.

Cellular Signaling Many cells release molecules that can travel to other cells carrying chemical messages or signals. These cellular signals can speed up or slow down the activities of the cells that receive them, and can even cause a cell to change what it is doing in a most dramatic way. To respond to one of these chemical signals, a cell must have a **receptor** to which the signaling molecule can bind (Figure 7-x. Sometimes these receptors are on the cell membrane, although the receptors for certain types of signals are inside the cytoplasm. The chemical signals sent by various types of cells can cause important changes in cellular activity.

Plasma Membrane

3/7

"Gateway to the Cell"



lipids bond to form layers

cholesterol - keeps lipids from sticking

sugar - communication + idenity

fluid mosaic model — pattern resembles a mosaic

^ components move freely as a liquid

phosphold lipid - contain 2 nonpolar fatty acid chain
head is polar
- PO_4 group
polar heads = hydrophillic (love water) ← So that is why
non polar tails = hydropobic (hates water) sandwhich shape

membrane is selective about what it crosses

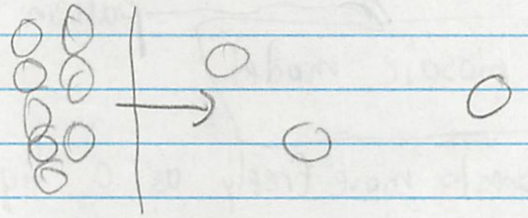
function
- protective barrier - interlocking surfaces bind in junction
- regulates transport - contain cytoplasm
- allow cell recognition
- achoring site for cytoskeleton
- binding site for enzymes

Homeostasis -
balanced internal conditions
maintained by plasma membrane

Semipermible - small molecules + larger hydropobic
can move in + out easily
- ions must be transfored through the membrane (active transport)

Transport

Difusion (simple)
- no energy
- high to low concentrations
- small + hydropobic molecules
- passive since molecules have kinetic energy



Osmosis = Difusion of water

facilitated

no energy
uses protien

Isotonic - No net movement

Hypotonic -
↙ until 15% - but
10% NaCl   20% NaCl   salt can not move out
water moves in
^ so water is going rush in + and it will burst

Hypertonic - water will move in

Some is active + passive
Other needs to be
controlled or regulated
Some needs to be
brought in activly phobic
~~Simple~~ diffusion high → low (no energy)
Michael
Osmossois
active - against concentration Plasmeel
← facillitate difusion - useing protiens philic

Hypotonic (burst) = Cytolys

Hypertonic (shrink) = Plas
?wh ter

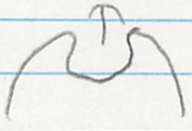
Plants like to be in rger
pressure in order to stanc up

Active transport
- requires ATP

Protiens
- different types
- channel
  - have a pore (tunnel)
- carrier
  - changes shape to move molecules across
  - Some bond w/ molecule to move it across

Active Transport
- sodium - potasium pump
  - creates a membrane potential
  - used to power some things

Exocytosis
- moving things out
- large molecules from golgi fuse with plasma membrane where a hole is made



Endocytosis
- moving big stuff in
- slowly moves off from plasma membrane
- pinocytosis
  - most common
  - like taking a little drink "cell drinking"
- receptor-mediate
  - receptors wait for certain molecules
- phagocytosis
  - surround + engulf molecule + digest
  - white blood cells do to bacteria

Gummi Bear Lab

3/5

A gummi bear is put in a cup of water and allowed to disolve

1. Prediction

Based on preliminary research - we predict that a gummy bear will increase in size.

(Based on the research of Chris Null using cold water)

2. Observe

2.54 g
Red
Translucent
13 mm in width
11 mm high
21 m lenght

Shaped like a bear
Swishy
Symetrical y axis
taste gummy + squishy

3. Add cold water (120 cc) to solo cup

23°C pH 6.5

Put on windowsill for 22.5 hrs from 2:20 PM
Removed 1 PM next day

4. Results

pH = 6.5
18°C
Water is lightly pink
lighter
much bigger: $3\frac{1}{4}$ cm, 1.1 cm, 2.3 cm
↑ unchange

Bubbles or white dots on edge before removing water

very fragile - easly cut

* water defused from water into gumny bear

difusion of water = ossmosis
↑ all particles have Brownican energy
(kinotic energy from heat)
↑ always bouncing off each other

Michael Plasmeier ✓ 3/10

Section 7.4: The Diversity of Cellular Life

Vocab:

cell specialization - cells throughout an organism can develop in different ways to perform different tasks

tissue - groups of simlar cells that perform a particular function

organ - groups of tissues working together

organ system - completes a series of specialized tasks

1. What is cell specialization? Why is it important for multicellular organisms?

- Cells developing to perform a certain, different function
- Allowed multicelluar life to happen
  - Musles let us walk
  - Certain cells get food
  - Pancreatic cells loaded w/ Golgi to produce protien

2. What are the four levels of organization in multicellular organisms?

Cell →

Tissues - peform functions
  muscel, epithelial, nervous, connective tissue

Organs - groups of tissues working together

Organ Systems - organs combine to complete tasks

makes multicelluar life possible
  each cell specializes + is interdependent
    -remarkable aspect of living things

3/11/08

10/10

Name Michael Plasmeier

Viewing Plant Cells

Pre-Lab Questions

1. What is the function of chloroplasts?

to turn light energy into usable energy ✓

2. Name two structures found in plant cells but not animal cells.

chloroplasts + ~~plant~~ cell walls ✓

3. Name three structures found in plant cells AND animal cells.

nucleus
cell membrane ✓ ER

4. What structure surrounds the cell membrane (in plants) and gives the cell support.

cell wall ✓

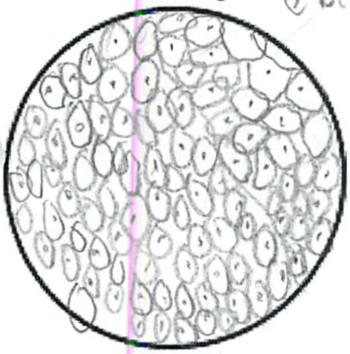
PART A - Onion Cells

Obtain a prepared slide of onion cells. View under scanning, low and high power.
Sketch the **cells** at each magnification.

Label the:
-- Cell Wall
-- Nucleus
-- Cytoplasm

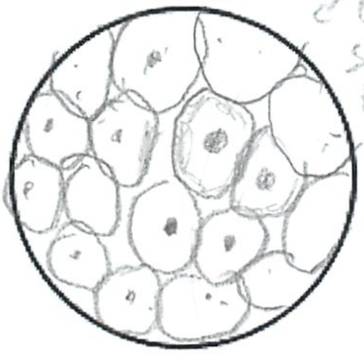
100 x
Scanning

✓ better

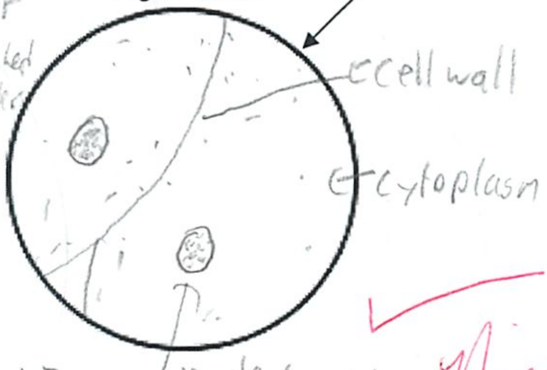


400 x
Low Power

✓ except squashed together



1000 x
High Power



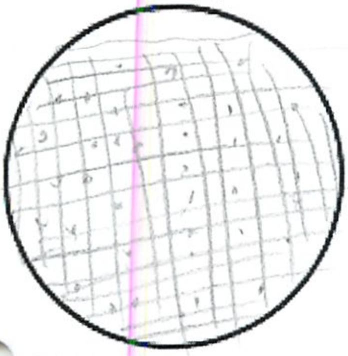
Estimate how many cells you can see under low power: 17 high power: 4 ✓ Nice!

PART B - Elodea Cells

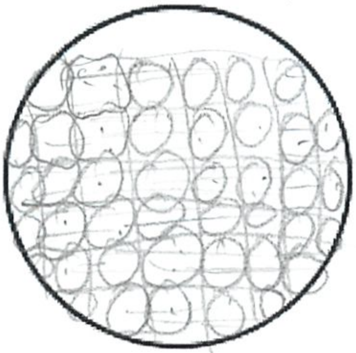
View a prepared slide of an elodea (a simple water plant).
Sketch the cells at each magnification. As the slide warms, you may see chloroplasts moving.

Label the:
-- Cell Wall
-- Chloroplasts
-- Cytoplasm

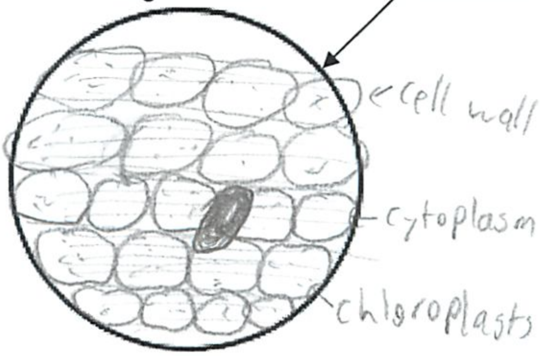
Scanning



Low Power



High Power



Estimate how many cells you can see under low power: 25 high power: 10

Post Lab Questions

1. Describe the shape and the location of chloroplasts.

   Everywhere inside the cell - looked like little green dots

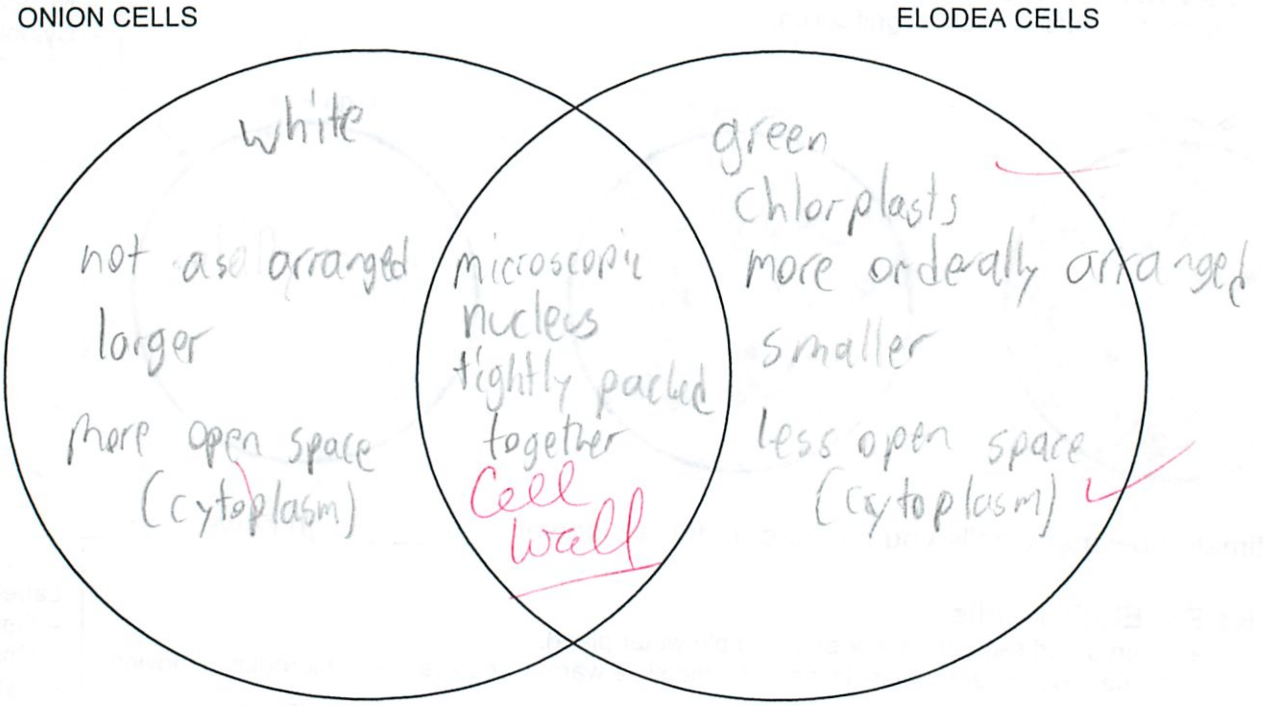
2. Why were no chloroplasts found in the onion cells? (hint: think about where you find onions)

   Onions are made underground

3. Which type of cell was smaller – the onion cells or the elodea cells?

   elodea

4. Fill out the Venn Diagram below to show the differences and similarities between the onion cells and the elodea cells.



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Name Michael Plasmeier

The Human Cheek Cell

10/10

1. List the 3 parts of the Cell Theory

- all living things are made of cells
- cells are basic units of structure + function

?

2. Write a short description of each of the following:

--cell membrane contains the cell

--cytoplasm "goo" that makes up the rest of a cell

--nucleus center gives instructions

--organelle little parts of a cell that does a certain function

--eukaryote - cells that have a nucleus

--cytoskeleton - structure of eukaryote cell + provide movements

Procedure:

1.Put a drop of methylene blue on a slide.Caution: methylene blue will stain clothes and skin.

2. Gently scrape the inside of your cheek with the flat side of a toothpick.Scrape lightly.

3. Stir the end of the toothpick int the stain and throw the toothpick away.

4. Place a coverslip onto the slide

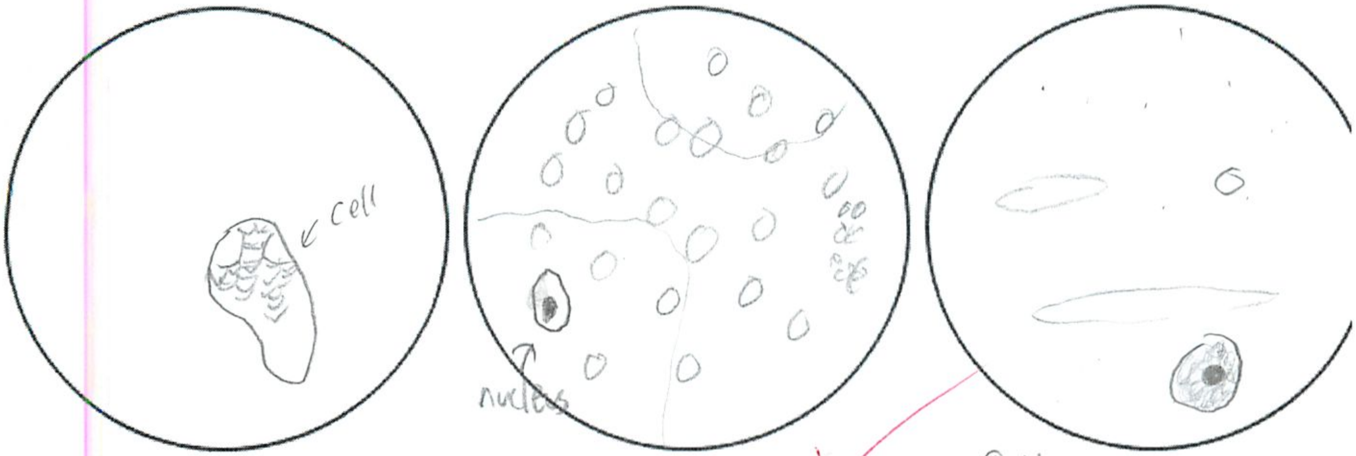
5. Use the SCANNING objective to focus.You probably will not see the cells at this power.

6. Switch to low power. Cells should be visible, but they will be small and look like nearly clear purplish blobs.If you are looking at something dark dark purple, it is probably not a cell

7. Once you think you have located a cell, switch to high power and refocus.(Remember, do NOT use the coarse adjustment knob at this point)

---**Sketch** the cell at low and high power.Label the nucleus, cytoplasm, and cell membrane. Draw your cells to scale.

Scanning Low High



? didn't come out right

3.Why is methylene blue necessary?

To stain it so you can see it

4.Cheek cells do not move on their own, so you will not find two organelles that function for cell movement. Name these organelles.

Cilia + Flagella

5.The light microscope used in the lab is not powerful enough to view other organelles in the cheek cell.What parts of the cell were visible.

Nucleus Cytoplasm
Cell Menbrane Nucleous

6. List 2 organelles that were NOT visible but should have been in the cheek cell.

Golgi
Mitocondra

7.Is the cheek cell a eukaryote or prokaryote? How do you know?

Eukaryote - has a nucleus

8. Keeping in mind that the mouth is the first site of chemical digestion in a human.Your saliva starts the provss of breaking down the food you eat.Keeping this in mind, what organelle do you think would bem numerous inside the cells of your mouth?

Golgi

ALTERNATIVE: (Use Skin cells from your wrist instead)

Procedure:
1. Wash the underside of a wrist that will be sampled for epidermal cells with soap and water.
2. Stick a clean piece of clear tape on the underside of the washed wrist.
3. Gently remove the piece of tape from the wrist being careful to avoid getting fingerprints on the tape. A forceps might help to remove the tape and avoid fingerprinting the tape.
4. Place the tape, sticky-side up, on a clean microscope slide.
5. Stain the top, sticky side of the tape with 2 or 3 drops of 1% methylene blue solution.
6. Use a dissecting needle to gently place a cover slip over the sticky tape. Lower the coverslip down onto the tape and then

Michael Plasmeier

3/12

Osmosis & Diffusion in an Egg

Objective:

In this investigation, you will use a fresh hen's egg to determine what happens during osmosis & diffusion across membranes.

Materials: (per lab group)

1-2 fresh hen eggs in their shells, masking tape & marker, distilled water, clear sugar syrup (Karo, for example), vinegar, clear jar with lid, tongs, electronic balance, paper towels, paper, pencil

Procedure:

Start New egg

Day 1

1. **Label the jar with your lab group & the word "vinegar".**
2. **Mass the egg with the electronic balance & record in the data table.** 59,47 g
3. **Carefully place the raw egg into the jar & cover the egg with vinegar.**
4. **Loosely re-cap the jar & allow the jar to sit for 24 to 48 hours until the outer calcium shell is removed.** after weekend

After vinegar

small bubbles all around the egg

light brown in color

dark brown lines structure suspended in water

small crack in shell

Day 2

1. **Open the jar & pour off the vinegar.**
2. **Use tongs to carefully remove the egg to a paper towel & pat it dry.**
3. **Record the size & appearance of your egg in your data table.**
4. **Mass the egg on an electronic balance & record.**
5. **Clean and re-label the jar with your lab group & the word "distilled water".**
6. **Carefully place the egg into the jar & cover the egg with distilled water.**
7. **Loosely re-cap the jar & allow it to sit for 24 hours.**

After water

- bubbles (small)
- a few remaining brown spots
- Some areas becoming transparent yellow

Day 3

1. Open the jar & discard the distilled water.
2. Use tongs to carefully remove the egg to a paper towel & pat it dry.
3. Record the size & appearance of your egg in your data table.
4. Mass the egg on an electronic balance & record.
5. Clean and re-label the jar with your lab group & the word "syrup".
6. Carefully place the egg into the jar & cover the egg with clear syrup.
7. Loosely re-cap the jar & allow it to sit for 24 hours.

After syrup

- lost shape
- squished + squishy
- yellow showing through even more
- deflated

Day 4

1. Open the jar & pour off the syrup.
2. Use tongs to very carefully remove the egg & rinse off the excess syrup under slow running water.
3. Pat the egg dry on a paper towel.
4. Record the size & appearance of your egg in your data table.
5. Mass the egg on an electronic balance & record.
6. Clean up your work area & put away all lab equipment.

Dissembly

- small off white sack containing light yellow liquid
- intact dark orange gold yolk - firm
not really affected

Data:

RESULTS OF DIFFUSION			
	Original Mass	Final Mass	Appearance of Egg
VINEGAR	59.47g	84.98g	No shell
WATER	84.98g	88.68g	bigger
SYRUP	88.68g	37.84g	deflated

- firmer then usuall

Questions & Conclusion:

59.47g
?. mL

1. Vinegar is made of acetic acid & water. Explain how it was able to remove the calcium shell. The acidic acid solution disolves the egg's shell
-Corrosive

Overnight 84.98g

2. (a) What happened to the size of the egg after remaining in vinegar?
(see observations on page 1)

(b) Was there more or less liquid left in the jar?
didn't keep track - but less since egg heavier

230 mL

(c) Did water move into or out of the egg? Why?
move in - since the egg is heavier

305mL

Overnight

3. (a) What happened to the size of the egg after remaining in distilled water?
grew slightly larger

305 mL

(b) Was there more or less liquid left in the jar?
less liquid left in jar

88.68g

(c) Did water move into or out of the egg? Why?
into the egg - egg heavier

250mL

4. (a) What happened to the size of the egg after remaining in syrup? Overnight
got smaller + deflated

300mL

(b) Was there more or less liquid left in the jar?
50ml more liquid

37.82g

(c) Did water move into or out of the egg? Why?
Out - solution hypertonic

5. Was the egg larger after remaining in water or vinegar? Why?
Distilled water - Has a low concentrations of solute
water = hypotonic

6. Why are fresh vegetables sprinkled with water at markets?
To make them plump up

7. Roads are sometimes salted to melt ice. What does this salting do to the plants along roadsides & why?
The salt absorbs the water (salt is hypertonic - water lower concentration inside cells of tree since the water leaves the cell

Name: Michael Plasrea **Class:** ________________ **Date:** 3/13 **ID: A**

80/80

Chapter 7

✓

Multiple Choice

Identify the choice that best completes the statement or answers the question.

C 1. Which cell structure contains the cell's genetic material and controls many of the cell's activities?
a. organelle [✓ c.] nucleus
b. cell envelope d. cytoplasm

d 2. The diffusion of water across a selectively permeable membrane is called
a. facilitated diffusion. c. active transport.
b. osmotic pressure. [✓ d.] osmosis.

d 3. Eukaryotes usually contain
a. a nucleus. c. genetic material.
b. specialized organelles. [✓ d.] all of the above

a 4. Which term refers to cells having different tasks in an organism?
[✓ a.] cell specialization c. unicellular
b. multicellular ← d. levels of organization

C 5. Which organelle would you expect to find in plant cells but not in animal cells?
a. mitochondrion [✓ c.] chloroplast
b. smooth endoplasmic reticulum d. ribosome

C 6. The main function of the cell wall is to
a. store DNA. [✓ c.] support and protect the cell.
b. direct the activities of the cell. d. help the cell move.

d 7. Which structure makes proteins using instructions that come from the nucleus?
a. Golgi apparatus c. vacuole
b. mitochondrion [✓ d.] ribosome

d 8. Diffusion occurs because
a. molecules never move or collide with one another.
b. the concentration of a solution is never the same throughout a solution.
c. the concentration of a solution is always the same throughout a solution.
[✓ d.] molecules constantly move and collide with one another.

d 9. Which of the following is NOT found in the nucleus?
a. nucleolus c. DNA
b. chromatin [✓ d.] cytoplasm

C 10. Which structures carry out movement inside the cell and help power cilia and flagella?
a. cytoplasm and ribosomes
b. chromosomes
[✓ c.] microtubules and microfilaments
d. nucleolus and nucleus

d 11. Which organelle converts the chemical energy stored in food into compounds that the cell uses to provide energy for cellular processes?
a. chloroplast c. endoplasmic reticulum
b. Golgi apparatus [✓ d.] mitochondrion

a 12. An animal cell that is surrounded by fresh water will burst because the osmotic pressure causes
[✓ a.] water to move into the cell. c. solutes to move into the cell.
b. water to move out of the cell. d. solutes to move out of the cell.

d 13. Which of the following is a function of the cell membrane?
a. breaks down lipids, carbohydrates, and proteins from foods
b. stores water, salt, proteins, and carbohydrates
c. keeps the cell wall in place stays alto
[✓ d.] regulates which materials enter and leave the cell

C 14. Cells fall into two broad categories, depending on whether they
a. have a cell wall. [✓ c.] have a nucleus.
b. contain genetic material. d. contain chloroplasts.

b 15. The work of Schleiden and Schwann can be summarized by saying that
a. all plants are made of cells.
[✓ b.] all plants and animals are made of cells.
c. all animals are made of cells.
d. plants and animals have specialized cells.

C 16. An organ system is a group of organs that
a. are made up of similar tissues.
b. work together to perform all the functions in a multicellular organism.
[✓ c.] work together to perform a specific function.
d. are made up of similar cells.

a 17. Which organelle breaks down compounds/waste into small particles that the cell can use?
[✓ a.] lysosome c. endoplasmic reticulum
b. Golgi apparatus d. mitochondrion

a 18. Which of the following is an organ of the digestive system?
[✓ a.] stomach c. muscle cell
b. epithelial tissue d. nerve tissue

Completion (1pt ea.)

Complete each statement.

7/8

19. Eukaryotes contain structures that act as if they are specialized organs. These structures are called organells.

20. The levels of organization in a multicellular organism are cells, tissues, organs, and organ systems.

21. According to the cell theory, new cells are produced from existing cells.

22. The cell takes in food and water and eliminates wastes through the cell membrane.

23. Unlike smooth endoplasmic reticulum, rough endoplasmic reticulum has ribosomes attached to it.

Name: ________________________ **ID: A**

Short Answer

24. How do prokaryotes and eukaryotes differ?

Prokaryotes - don't have a nucleus or membrane bound organells as well as have round cromosomes. Eukaryotes have, a nucleus and membrane bound organells and have twisted chromosomes.

Good!

25. A hypertonic salt solution has a higher concentration of solutes than a blood cell. Explain what happens when a blood cell is placed in a hypertonic salt solution.

The water will rush from a place of higer concentration (the cell) to the lower concentration (salt solution) of the water so the cell will shrink.

26. How do facilitated diffusion and active transport differ?

Active transport uses energy (ATP) to seek out and move substances into and out of the cell.

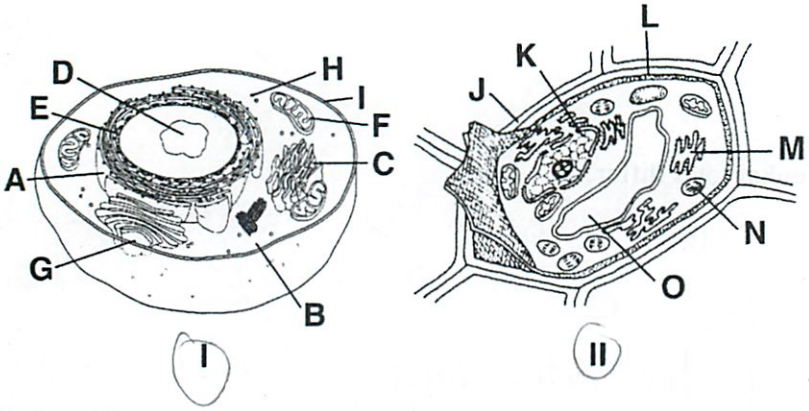
What about fac. diff.?

more

27. Explain, in terms of osmosis, why a raisin placed in a cup of pure water overnight will puff up with water.

The water is hypotonic to the rasin, the water will try to go from higer concentration (cup of water) into the rasin which has a lower concentration of water. This will cause the rasin to expand

Name: ____________________ **ID: A**



-(Notice the dots!)

Figure 7-1

28. Using Figure 7-1, give the label letters and full names of the three structures that are found in drawing II but not in drawing I. State the function of each of these structures.

J→cell wall O - lorge vacuol
N→chlorplasts

29. Using Figure 7-1, give the letter of the structure in drawing II that corresponds to structure H in drawing I. Name the structure and state what process occurs in it.

30. **Comparing and Contrasting** Give the letter of the structure in drawing I of Figure 7-1 that corresponds to structure L in drawing II. What is the name of this structure?

Cell membrane I

31. **Interpreting Graphics** Do the drawings in Figure 7-1 represent prokaryotes or eukaryotes? How do you know?

Eukaryote - has a nucleus and membrane bound organells

32. **Interpreting Graphics** Which organelle is labeled F in Figure 7-1? What is the function of this organelle?

Mitocondra - converts chemical energy stored in food into compounds that th cell uses to provide energy for cellular process (#11)

33. **Comparing and Contrasting** Look at Figure 7-1. Give the letter of the structure in drawing I that corresponds to structure M in drawing II. What is the name of this structure?

Rough Endoplasmic reticulum

34. **Interpreting Graphics** Which drawing in Figure 7-1 contains a structure that captures sunlight and converts it into chemical energy? What is the name of the structure described, and what is it labeled in the diagram?

Chlorplasts N

Michael Plasmeier (off Melanie's typed notes I was absent for) ✓ 3/26

WHAT SHOULD I KNOW ABOUT PHOTOSYNTHESIS (Chapter 8)

Section 8.1:

What is an autotroph? Give examples:

An autotroph is anything that can make its own food by using energy from sunlight. (ex. Green plants and a few bacteria)

A Heterotroph? Give examples:

A heterotroph is anything that gets energy by consuming other organisms. (ex. Animals, fungi, and most bacteria) Cells use energy for movement, synthesis of biomolecules, and reproduction.

eats autotrophs or other heterotroph

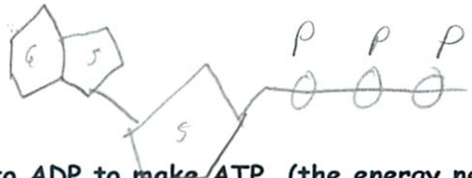
What molecule is used as a basic energy source in cells?

The molecule ATP is used as a basic energy source in cells.

adenosine triphosphate

What are the parts of an ATP molecule? Draw one.

Adenine, ribose, and ~~two~~ 3 phosphate groups.



How is energy stored and released using ATP?

Cells store energy by adding the phosphate Back On to ADP to make ATP. (the energy needed to complete this comes from foods like glucose) Energy is released by the creation of ADP (the bonds are broken between the phosphate bonds).

2 phosphate groups ← posit charged battery

a Use energy for protien pumps + to move

synthize protien

[illegible] light

firefly

Which molecule stores more than 90 times the energy in ATP?

ATP is great for transferring energy, but not good for storing large amounts for the long term. A single molecule of glucose stores more than 90 times the chemical energy. Cells only keep enough ATP around to last a few seconds and recharge it by burning glucose.

not for large amts of long term storage

How do animal cells store glucose for later?

Glycogen is the way animal cells store glucose for use later.

How do plants store glucose for later?

The glucose moves together to create starches. Molecules made by joining many sugar molecules together are called polysaccarhrides.

Section 8.2:

Be able to explain the contributions of these scientists to our understanding of photosynthesis.

Jan van Helmont: (1643), a Belgian physician that determined the mass of a pot of dry soil and a mall seedling. Then he planted the seedling in the pot and watered it regularly. At the end of five years the seedling had gained about 75 kg, but the mass of the soil was almost unchanged. He decided the increase in plant had to come from the water…that was the only thing he had added.
He did not realize that that was carbon dioxide in the air and that plants use carbon

Jan Ingenhousz: (1779) a Dutch scientist that showed that Priestly's experiment only worked when the plant was exposed to light.

photosynthesis - plants use sun's energy to convert water and carbon dioxide into high-energy carbohydrates (sugar + starchs) - Oxygen is waste product

Joseph Priestley: (1771) an English minister that discovered that a flame burning in a closed jar would die out. If he placed a live plant in the jar and allowed a few days to pass, the candle could be lit again. The plant produced something "required for burning" that the candle used up (Oxygen).

Melvin Calvin: discovered light-independent reaction's biochemical reactions called the Calvin cycle

What was "wrong" with van Helmont's conclusion?

He did not know plants need carbon from carbon dioxide

Be able to write the chemical equation for photosynthesis:

(Carbon dioxide: $6CO_2$) + (Water: $6H_2O$) → (LIGHT) → (Sugars: $C_6H_{12}O_6$) + (Oxygen: $6O_2$)

What is a pigment?

light absorbing molecules - how plants convert low-energy raw materials into high-energy sugars

What is the main pigment used by green plants to absorb energy?

Chlorophyll

What are the 2 kinds of chlorophyll?

Chlorophyll a

chlorophyll b

Which wavelengths of light are best absorbed by chlorophyll a & b?

Red, violet a | b Blue, Orange

Which are reflected?

Blue, Green, Yellow | Green, Red

How are carotenoid pigments different from chlorophyll?

reflect red + orange b/c absorb other colors

Why do plants have these other pigments besides chlorophyll?

to get more energy

Why do plants look green?

Green light is reflected by leaves

Section 8.3:

Be able to label the parts of a chloroplast and explain where the reactions for photosynthesis happen. (You labeled and colored this diagram in class)

What is $NADP^+$?

Nicotinamide adenine dinucleotide phosphate - accepts + holds 2 high energy electrons and H^+ ion

How is it changed into NADPH?

What does it do?

Provides energy to light-independent reaction
- which makes sugars

Where does the H in NADPH come from? (Look at your diagram you drew)

H^+ ions

Be able to describe the two sets of reactions involved in photosynthesis

Light-dependent reactions:

Produces oxygen gas + converts ADP and $NADP^+$ into ATP NADPH

Calvin cycle: Uses ATP + NADPH to produce high energy sugar

Where are they located and what happens in each?

Light: In the thylakoids
Calvin: Outside the " , in stoma
} in chloroplast

Be able to label the molecules that participate in the light-dependent reactions and tell what they do.

Why does Photosystem II come before Photosystem I in the light-dependent reactions?

Since they were named before cycle order understood

What is another name for the Calvin Cycle?

light-independent reaction

Which reactions in photosynthesis require light?

light dependent

Which do not?

light independent

How and where are ATP and NADPH made?

In the light dependent reaction
ATP: ATP synthase
NADPH: enzymes in membrane

What happens to water during the light-reaction?

Gets split off

Which molecule is given off as a waste gas?

Oxygen

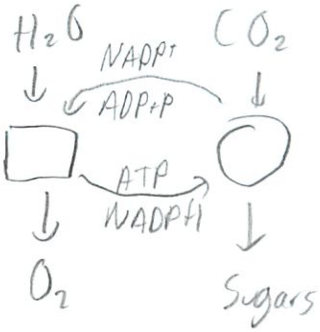
Which molecules produced by the light-dependent reaction are used during the Calvin cycle?

ATP + NADPH

What happens during the Calvin cycle?

ATP + NADPH changes into high energy sugar

Be able to give reactants and products for each of the reactions.



Where does the Carbon and oxygen in glucose come from?

CO_2 H_2O

Where does the Hydrogen in glucose come from?

NADPH

Which factors affect the rate of photosynthesis? How?

- Shortage of water - req. for photosynthsis
- Temprature - $0^\circ C < x < 35^\circ C$ (slows enzymes)
- Intensity of light - needed for photosynthsis
  max rate varies plant to plant

8.2

Photosynthsis

3/26

complex series of reactions

Reactants → Products (Reactants) → Products

Light + water → Light-Dependent Reactiont → Oxygen

↑10 steps

↓

ATP
NADPH

↓

Light-Indepent Reactions (calvin Pathway) → $(CH_2O)_n$

↑20 steps

Simple form

$6CO_2 + 6H_2O \xrightarrow{light} C_6H_{12}O_6 + 6O_2$

(carbon dioxide + water $\xrightarrow{light}$ sugars + oxygen)

↑
Combines many reactions into 1

↑2 seperate reactions
seperate places
can also be seperate time

Sunlight is made of different wavelenghts

Plants gather sunlight with pigments
- we see it as colors

Chlorophyll is a pigment + is main energy absorbing molecule

Carotenoids are pigments as well
- in carrots, yellow, orange + brown

In summer carotnoids hides chlorplasts
- always there

2 types of chloraphil
- type A
  - absorbs red + violet light best
  - reflects blue + green light
- type B
  - absorbs red and even more blue-violet light
  - looks (reflects) green + yellow light
- both reflect lots of green light
  - why plants are green → -so looks green

Carotenoids absorb more light (for more energy)
- don't absorb red + yellow
  - so looks red + yellow

Plants look the color of light they are reflecting

Light = Energy
- the extra energy knocks the electrons in a higer orbit → stolen → moves through reactions → makes ATP

Michael Plasmeier

3/26
3/27

Chromatography of Plant Pigments

10/10

INTRODUCTION:

Chlorophyll often hides the other pigments present in leaves. In Autumn, chlorophyll breaks down, allowing xanthophyll and carotene, and newly made anthocyanin, to show their colors.

The mix of pigments in a leaf may be separated into bands of color by the technique of paper chromatography. Chromatography involves the separation of mixtures into individual components. Chromatography means "color writing." With this technique the components of a mixture in a liquid medium are separated. The separation takes place by absorption and capillarity. The paper holds the substances by absorption; capillarity pulls the substances up the paper at different rates. Pigments are separated on the paper and show up as colored streaks. The pattern of separated components on the paper is called a chromatogram.

seperate chlaaphil a and b

PRELAB PREPARATION:

Gather leaves from several different plants. **CAUTION:** Avoid poisonous plants. Autumn leaves from deciduous trees are especially interesting. Sort the leaves by kind (maple, etc.) and color. Review a diagram of a plant cell . Find the grana and the chloroplasts of the cell.

MATERIALS:

Safety goggles
Chromatography solvent (92 parts Petroleum ether to 8 parts acetone)
Chromatography paper (or filter paper) about 1 cm x 15 cm
Ethyl alcohol
Fresh spinach
Test tube
Test tube rack
Scissors and Ruler
Fresh leaves of plants
Glass stirring rod
Paper clip
Cork (to fit test tube)
Mortar and pestle
Sand (optional)
10-ml Graduated cylinder

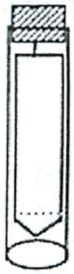


FIGURE: 1. Apparatus for paper chromatography

PROCEDURE:

CAUTION: Chromatography solvents are flammable and toxic. Have no open flames; maintain good ventilation; avoid inhaling fumes.

1. Cut a strip of filter paper or chromatography paper so that it just fits inside a 15-cm (or larger) test tube. Cut a point at one end. Draw a faint pencil line as shown in figure 1. Bend a paper clip and attach it to a cork stopper. Attach the paper strip so that it hangs inside the tube, as shown. The sides of the strip should not touch the glass.

2. Using a quarter, make a line of pigment across the bottom of the chromatography paper by placing the leaf on top of the paper and rolling the edge of the quarter across the leaf. Repeat 5 times, making sure to go over the same line in order to concentrate the pigment in the line. The thinner and sharper the line, the better your pigment bands will look.

3. Fit the paper and cork assembly inside the test tube. Adjust it so that the paper point is just a millimeter above the bottom of the tube. See your teacher to obtain solvent. The pigment line must be above the level of the solvent. Watch the solvent rise up the paper, carrying and separating the pigments as it goes. **At the instant** the solvent reaches the top, remove the paper and let it dry. Observe the bands of pigment. The order, from the top, should be **carotenes** (orange), **xanthophylls** (yellow), **chlorophyll a** (yellow-green), **chlorophyll b** (blue-green), and **anthocyanin** (red). Identify and label the pigment bands on the dry strip. Write the species of leaf on the strip as well.

Record the species, external color, and chromatogram pigments in the **DATA TABLE** of your report sheet.

4.. Each pigment has an R_f value, the speed at which it moves over the paper compared with the speed of the solvent.

Rf = Distance moved by the pigment / Distance moved by the solvent

Measure the distance in **cm** from the starting point (pencil line) to the center of each pigment band. Then measure the entire distance traveled by the solvent. Remember, the starting point for the solvent is also the pencil line and the ending point for the solvent is the top edge of the paper. Do the required divisions and record your R_f values in the **DATA TABLE** of your report sheet.

DATA TABLE:

Chromatography Data

Leaf Type (species)	**External color**	**Chromatogram Pigments**		
		Colors from the Top	Pigment Names	R_f Values
Wax-leaf	Green			

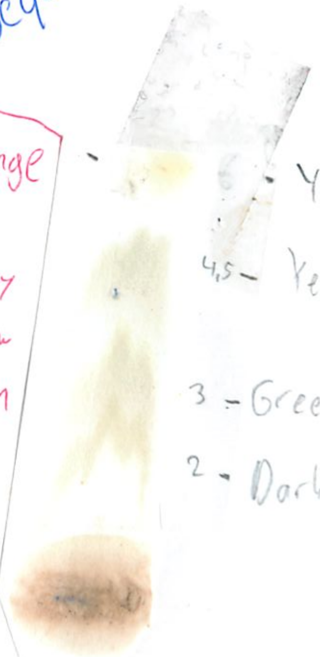
See paper

Begunia

Michael
Melanie
Melissa

Nice!

Wax-leaf Begonia



			Pigment / solvant
6 - Yellow	-	Xanthophylls	6/6 = 1
4.5 - Yellow -Green	-	Chlorophyll a	.75
3 - Green			.5
2 - Dark green	-	Chlorop hyll b	1/3

Other Plant

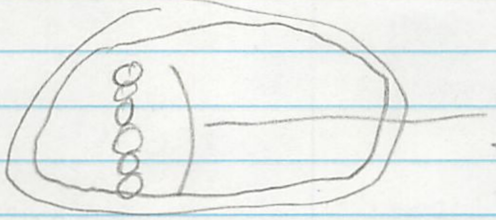
6cm

	orange
.82	grey
.65	yellow
.37	blue-green
.25	yellow-green
.09	pink

8.3 Reactions of Photosynthsis

3/27

enzymes for photosynthis are in chloroplasts



Space

Space in membrane (outside chlorplast) - cytoplasm
gel-filled space around thylakoids - stroma
gel - filled space inside thylakoid - thaylakoid space

protiens part of the thylakoid organize light absorbing pigments into photosystems

products of light-dependent reactions

ATP - Molecules that carry energy
NADP+ - molecules that carry high energy electrons

NADP+ is like a frying pan carring high energy electrons

$NADP^* + 2e^- + H^+ \rightarrow NADPH$

light dependent reaction

takes place inside thaylakoid space
photosythnis sets up imbalance in thakloid
diffusion allows H^+ ions to move through
ATP synthhase
↑
like a dam with a turbine

Chemiosmosis - The Mechanism of ATP Synthesis in Chloroplasts

The **thylakoid membrane** is composed of a **phospholipid bilayer** (*color phospholipids "B" light blue*) and **photosystem I and photosystem II.** Although they both work simultaneously, it is best to look at them one at a time, starting with photosystem II. The first and most important event in either system is the capturing of light energy (***color*** "E" orange) by the pigments associated with each photosystem. ***Color*** the pigments of **Photosystem II (P2)** dark green and the pigments of **Photosystem I (P1)** light green. **Pigment 680** (***color*** dark green) is associated with Photosystem II, and **Pigment 700** (***color*** light green) is associated with Photosystem I.

When a **photon** of light strikes the **reaction center** of Photosystem II, it excites an **electron**. Two **water molecules** bind to an **enzyme** that splits water into **hydrogen ions** (protons) and releases an **oxygen atom**. ***Color*** the protons (H+) yellow and the oxygen atoms (O2) red. This process is called PHOTOLYSIS and is illustrated by the arrows labeled "L", which you should ***color*** pink. Two electrons are released in this process, and these electrons can be traced through **photosystem II** and **photosystem I**. ***Color*** the electrons (e) grey. Two oxygen atoms will join together to create an oxygen molecule which is released from the plant as a **byproduct** of the entire reaction.

The **primary electron acceptor** for the light-energized electrons leaving photosystem II is **plastoquinone** (***color*** PQ purple). The **reduced plastoquinone** passes the excited electrons to a **proton pump** embedded in the membrane called the **b6-f complex** (***color*** dark blue). This proton pump moves protons (H+) atoms across the membrane against their **concentration gradients**, which eventually causes a build-up of protons in the **thylakoid space**. This will be important later. The thylakoid membrane is NOT permeable to protons, so they may only cross the membrane via **transport proteins**. The protons will exit the thylakoid space via a special channel provided by **ATP Synthetase** (*color* "S" pink). The protons move through the ATP synthase with the concentration gradient, which allows them to do work-namely drive ATP synthesis. As protons pass through the ATP synthetase, **ADP** is **phosphorylated** (-P added) to **ATP** and released into the **stroma**. The process of making ATP is called **PHOTOPHOSPHORYLATION**. The arrow labeled "Z" represents photophosphorylation - *color* orange. This ATP (*color* orange) is now on its way to the **Calvin Cycle** where it will be used to generate glucose.

The **electron** that was used in **Photosystem II** is just sitting around, all **de-energized** but its story is not finished. A small protein called **plastocyanin** (*color* brown) carries the electron to **Photosystem I.** Light absorbed by photosystem I energizes this electron and passes it to another **primary electron acceptor** called **ferredoxin** (*color* "Fd" turquoise). The enzyme **NADP Reductase** (*color* "R" dark purple) transfers these electrons to **NADP** to form **NADPH**. The electron is now on its way to the Calvin Cycle as part of an NADPH molecule (*color* light purple). Electrons lost from photosystem I are replaced by electrons generated from photosystem II.

Remember you colored the electrons grey, now *color* the path they take through both systems grey also (represented by the arrow labeled "X").

Remember you colored the protons yellow, now *color* the path they take through the systems in yellow also (represented by arrows labeled "Y").

Colors

Phospholipids - light blue	Electron path (X) - grey
Light energy - orange	Plastoquinone - purple
Photosystem II - dark green	b6-f complex - dark blue
P680 - dark green	ATP Synthetase - pink
Photosystem I - light green	Photophosphorylation (Z) - orange
P700 - light green	ATP - orange
Protons - yellow	Plastocyanin - brown
Proton path (Y)- yellow	Ferredoxin - turquoise
Oxygen - red	NADP Reductase - dark purple
Photolysis - pink	NADPH - light purple
Electrons - grey	

Questions:

1. Trace the flow of protons through the thylakoid.

The yellow path - Got pulled through proton pump in b6-f complex. Then they move out ATP synthetase, spining it

2. Trace the flow of electrons through the thylakoid

They are split off water by photosystem 2, than they are accepted by plastoquinone. This excites electrons to power protien pump. Then plastocyanin carries it to photosystem 1. Light energizes this electron and goes to ferredoxin. NADP Reductase transferes electrons to NADP to form NADPH. This goes to Calvin Cycle.

3. Explain the role of each of the following:

---- P680

---- P700

---- ATP Synthetase

---- Plastocyanin

---- Plastoquinone

---- Ferredoxin

---- NADP Reductase

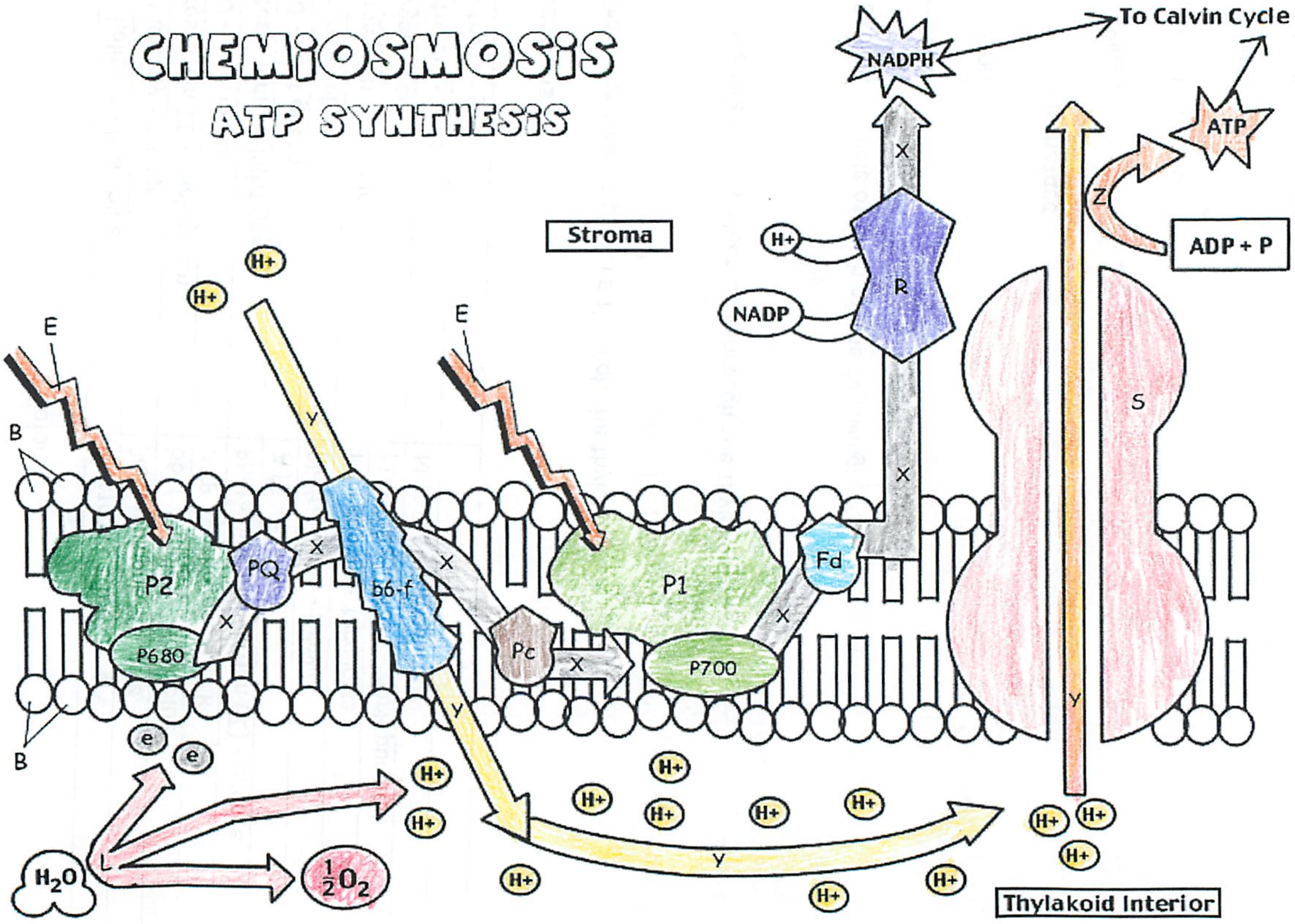
See paper

4. Explain how the concentration gradient affects the process of ATP synthesis.

Concentration gets higer inside as protien pump adds H+ This surplus lets ATP synthetase happen

CHEMIOSMOSIS

ATP SYNTHESIS



Cont.

3/27

P680 - Pigment in photosystem 2 (excites electrons)

P700 - Pigment in photosystem 1 (excites electrons)

ATP synthetase - produces ATP as hydrogens$^+$ go through

Plastocyanin - carries electron to photosystem 1

Plastoquinone - primary electron acceptor for light-energized electrons leaving photosystem 2

Ferredoxin - primary electron acceptor for light-energized electrons leaving photosystem 1

NADP Reductase - enzyme that transfers electrons from ferredoxin to convert NADP into NADPH

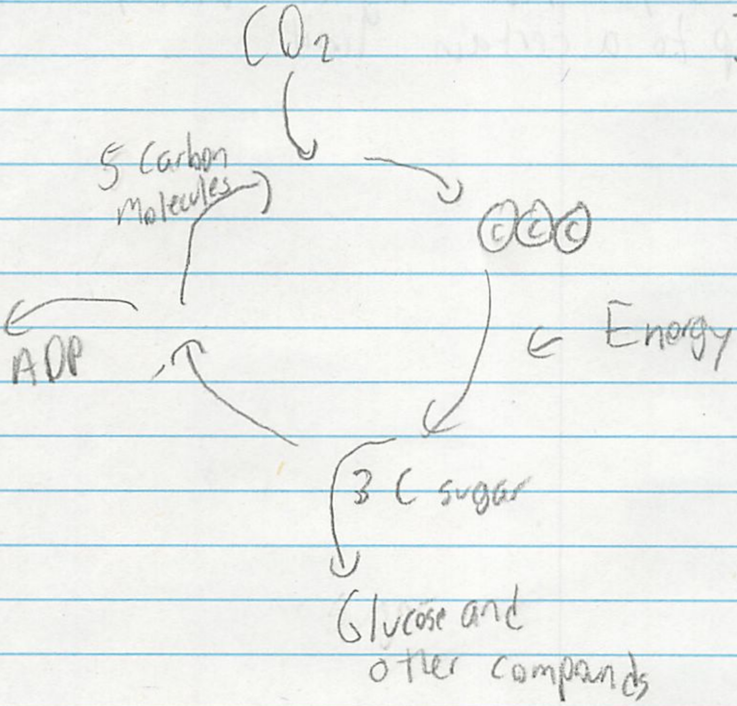
8.3

Light-Independent Cycle

3/28

Calvin Cycle

In stoma



- does not need light
- in stroma b/w thaylakoid
- ATP brings energy
- CO_2 gives ________

- Enzymes works best at certain temp and pH
  - too hot
  - too acidic
  - example: heating eggs

- Factors that affect
  - water → can slow or stop
    - Desert plants have waxy coating + seperate light dep. and indep.
  - temprature b/w 0°C and 35°C
    Pine trees can only do photosynthesis every so often

Homeostais - temp + pH needs to stay constant
Light intensity - more light = more photosynthsis
up to a certain limit

NATIONAL GEOGRAPHIC NEWS
NATIONALGEOGRAPHIC.COM/NEWS

The Science of Lance Armstrong: Born, and Built, to Win

Stefan Lovgren
for National Geographic News

July 22, 2005

better cellvar resporation

Oversized heart
VO_2 max high (lung capucity)
low lactic acid levels
fast twitch to slow twich
Muscel efficenciy increased

As Lance Armstrong cruises to a probable seventh consecutive victory in the Tour de France, the world's premier road cycling event, most of us are left to marvel: How does the man do it?

Is there something in the 33-year-old Texan's genetic makeup that makes him superhuman? Not if you ask Ed Coyle, director of the Human Performance Laboratory at the University of Texas at Austin.

mentally tough

Coyle has been testing Armstrong, who will retire from cycling after this Tour de France, for 13 years. The result is a rare comprehensive study of an athlete over his entire career. Coyle's findings were reported in a recent issue of the *Journal of Applied Physiology.*

no effects from cancer
dedicated

Armstrong clearly has some great genetic advantages.

His oversized heart can beat over 200 times a minute and thus pump an extraordinarily large volume of blood and oxygen to his legs. His VO2 max—the maximum amount of oxygen his lungs can take in, an important measurement for an endurance athlete—is extremely high.

more mitocondra

But other elite athletes have similarly powerful hearts and lungs. Instead, Coyle says, smarter training may have contributed to giving Armstrong an edge over his competitors.

Early in his career Armstrong showed only average muscle efficiency—the percentage of chemical energy that the muscles are able to harness to produce power. Higher muscle efficiency means greater production of power.

From 1992 to 1999, the year of his first Tour de France win, Armstrong was able to increase his muscle efficiency by 8 percent through hard and dedicated training. Coyle says Armstrong is the only human who has been shown to change his muscle efficiency.

"It was believed that muscle efficiency is something you're born with, that you can't change," Coyle said. "But we've documented that Armstrong has indeed changed it while training intensely."

By making his muscles 8 percent more efficient, Coyle said, "Armstrong is 8 percent more powerful on the Tour de France"—enough to get his competitors off his wheel.

Acid Test

To become a great athlete, a person must first fit the physiological requirements of a given sport. Great basketball players, for example, generally need to be tall.

"If I put Lance Armstrong in a wrestling contest at the Olympics, I doubt that he would do very well," said William Kraemer, a professor of kinesiology at the University of Connecticut in Storrs.

According to the University of Texas's Coyle, there are certain physiological traits that a person must have to excel in an endurance sport such as long-distance cycling.

"To be the best on the planet, you don't have to be superhuman in any of these components, but you can't be weak in any of them," Coyle said.

In addition to a high VO2 max, Coyle's components include low lactic acid levels, and Armstrong has the lowest levels Coyle has ever seen.

When people reach exhaustion, their muscles build up acid, which causes the muscles to stop contracting. But Armstrong's muscles produce about half as much acid as the average person's muscles do when they get fatigued. This allows him to recover much faster than other people.

"You can see when Armstrong races, he can attack better than anybody," Coyle said. "He makes a break, then backs off and then breaks again, wearing [the others] down until they can't recover, and then he just takes off."

Slow-Twitch Muscle Fibers

Though Armstrong had a genetic head start in some areas, he did not have an advantage in one area: muscle efficiency.

Our muscles work much like the cylinders in a car. When air is mixed with gasoline in the cylinders of a car, a small explosion occurs and energy is released. Likewise, the muscles burn the food we eat, they produce raw chemical energy.

The movement of an engine's pistons allows most cars to capture 5 to 8 percent of that raw energy. In our bodies little chemical motors known as muscle fibers allow us to capture 18 to 23 percent of the energy.

At 21, Armstrong had a distinctly average 21 percent muscle-efficiency rate. Seven years later that rate had increased to 23 percent, a huge leap.

Researchers suggest there may be two ways to improve efficiency through training.

One way is to train for higher maximum capacity—in other words, to increase the upper limit of performance (as a sprinter might). Another way is to train for greater submaximal capacity—to expend less energy for sustained performance (as a marathoner might).

Armstrong did both.

"We don't know exactly what accounted for Armstrong's muscular-efficiency change," Coyle said. But he suspects that Armstrong was able to convert fast-twitch muscle fibers to slow-twitch muscle fibers.

While fast-twitch fibers are good for sprinting, for example, slow-twitch muscle fibers are twice as efficient and are good for endurance sports.

With more slow-twitch muscle fibers, and increased muscle power, Armstrong is able to move his legs faster. As a result, his pedaling rate has gone up from 85 revolutions per minute to 105.

Surviving Cancer

During Coyle's study, Armstrong was diagnosed with cancer and underwent surgery and chemotherapy. Remarkably, Armstrong showed no ill effects from the cancer upon his recovery.

It has been suggested that Armstrong lost weight from the cancer, making him a leaner (and better) cyclist. But Armstrong's weight eight months after his chemotherapy was the same as before his cancer treatment, according to Coyle.

However, surviving cancer almost certainly made Armstrong a stronger athlete mentally. Sports scientists agree that Armstrong is one of the most disciplined and focused athletes in the world.

"[He] is on top of the cycling world because of the combination and interaction of his genetic endowment, years of incredible training, competitive experience, and obsessive drive to achieve and persevere," said Phillip B. Sparling, a professor of applied physiology at the Georgia Institute of Technology in Atlanta.

It's a combination that's made Armstrong a rarity among men, but still just a man. "Most athletes are happy to perpetuate the myth of the superhuman," Coyle said. "But now that Lance is retiring, I think he'd be the first one to admit that he's not superhuman at all."

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Sign up for our Inside National Geographic newsletter. Every two weeks we'll send you our top stories and pictures (see sample).

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9.1 Cellular Resporation

3/28

All living things do it
- including plants for themselves

Happens in mitrocondra
- cristae = inner membrane
- has a double membrane
- between = innermembrae space
- matrix - inside inner membrane (lake like)

Heterotrophs release energy from food (glucose) to make ATP

Happens slow + many steps
- otherwise all energy would be lost in heat and light
- like fire

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy
- exact oppset of photosynthis
(loop of life)

lower → calorie = heat to raise 1 g water 1°C
upper case Calorie (food) = 1000 calories

$NADP^+$ = high energy electron carrier
NAD^+ } same function - also used
FAD

3 steps

→

3 steps

Glycolysis - happens in cytoplasm (1st step)
sweet - split apart → splitting sugar

does not require oxygen
needs energy (ATP)

Glucose + 2 ATP
↳ 2 Pyruvic Acid
↓
4 · ATP + 2 · NADH

Net gain
2ATP
2NADH

Pyruvic acid + NADH → Alcohol + CO_2 + NAD^+

No oxygen - anaerobic
- do fermentation → alcoholic → alcohol → bread
→ lactic acid → muscels during exercise makes soreness

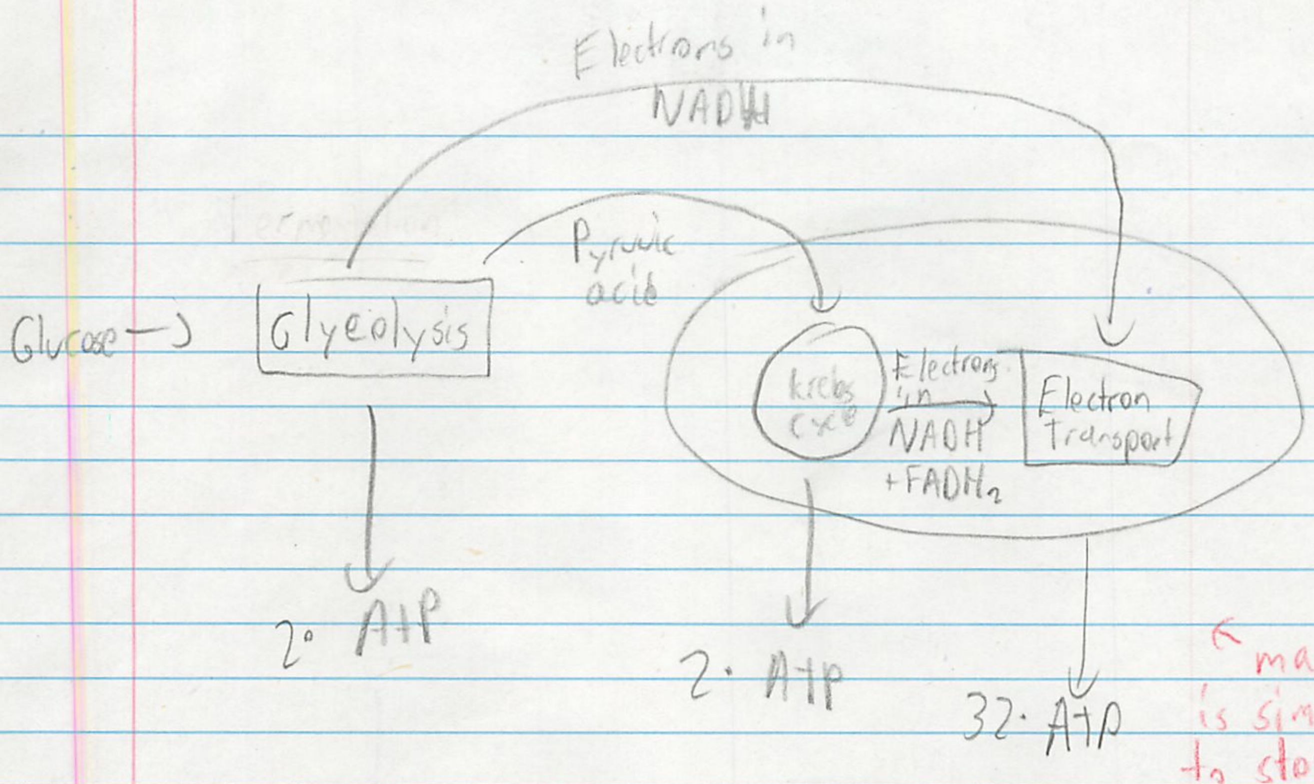
W/ oxygen
- Krebs Cycle → Electron transport chain

Pyruvic acid + NADH → Lactic acid + NAD^+
- chease
- yogert

↓ ATP

alcoholic
- not done by humans
- Only by creatures to which oxygen is a poison

Why Do Fermentation?
- w/o oxygen pyruvic acid builds up and NAD^+ fills up
- fermentation happens so glycolysis keeps up
- helps cells produce ATP w/o oxygen

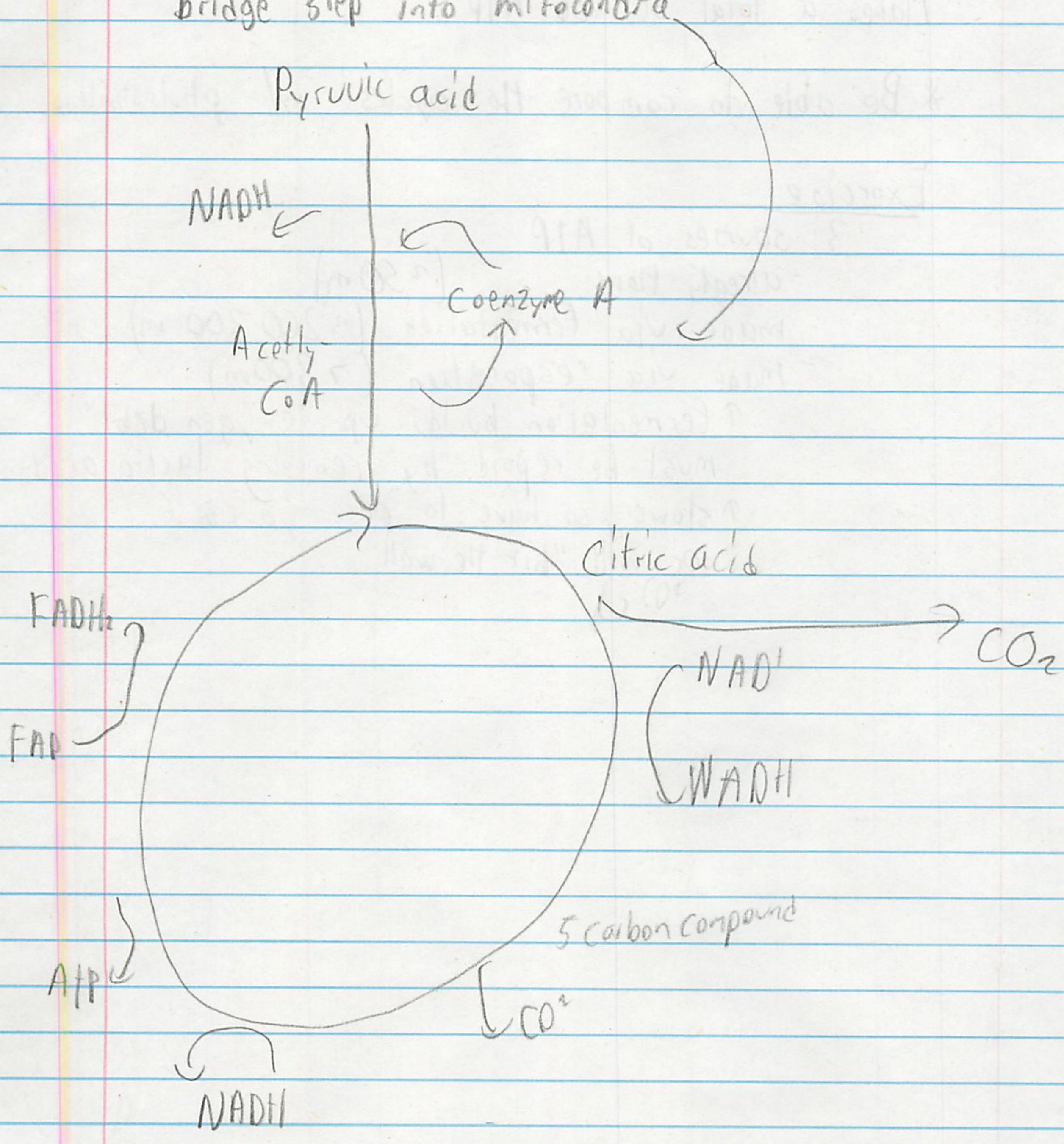


← matrix is similar to stoma in photosynth

9.2 Krebs Cycle + Electron Transport

4/3

bridge step into mitocondra



Electron transport chain very similar
Oxygen recieves an electron
- why you need oxygen
- without it you die

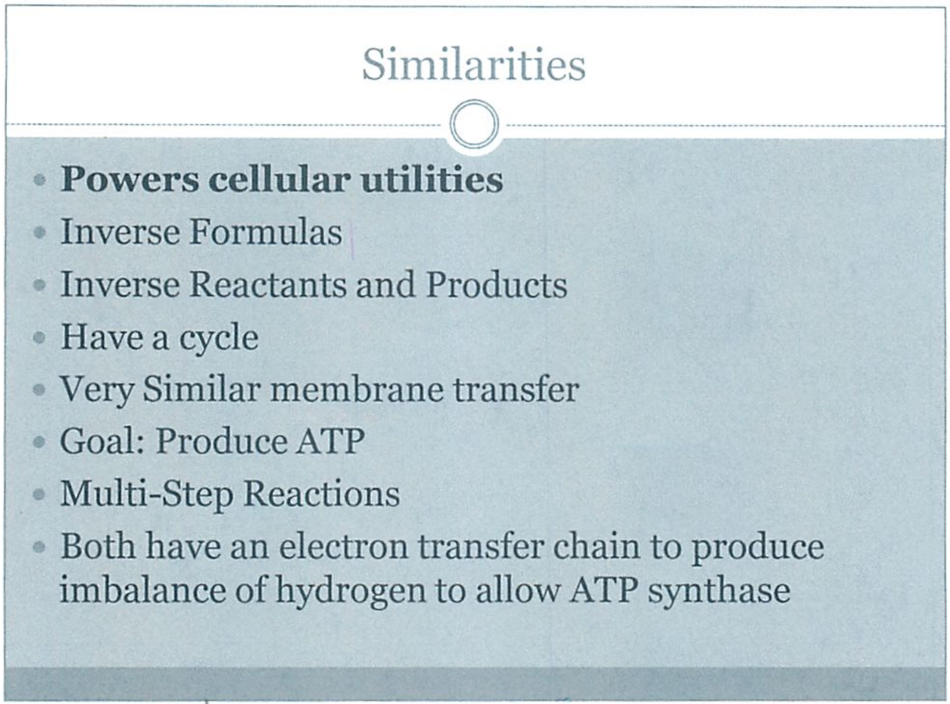
Makes a total of 36 ATP

* Be able to compare the cycles w/ photosynthis cycles

Exercise

3 sourses of ATP
- already there (~50 m)
- made via fermentation (~200-300 m)
- made via resporation (>300 m)
  - ↑ fermentation builds up "oxygen debt" must be repaid by removing lactic acid
  - ↑ slower, so have to pace yourself or will "hit the wall"

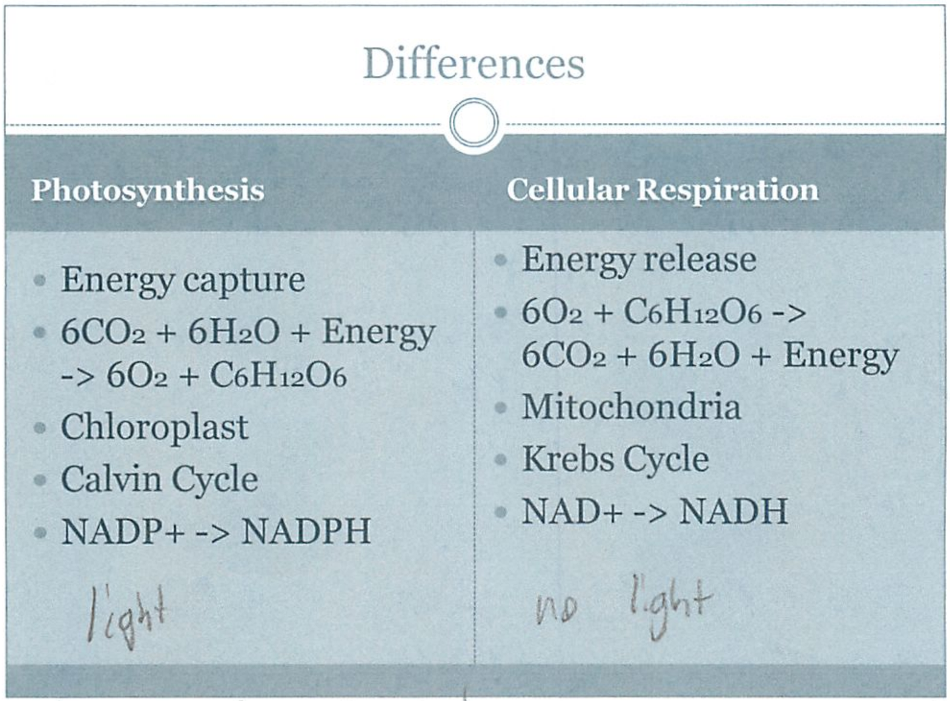
Michael Plasmeier
Matt McMullon



Similarities

- **Powers cellular utilities**
- Inverse Formulas
- Inverse Reactants and Products
- Have a cycle
- Very Similar membrane transfer
- Goal: Produce ATP
- Multi-Step Reactions
- Both have an electron transfer chain to produce imbalance of hydrogen to allow ATP synthase

both in plants



Differences

Photosynthesis	Cellular Respiration
Energy capture	Energy release
$6CO_2 + 6H_2O + Energy \rightarrow 6O_2 + C_6H_{12}O_6$	$6O_2 + C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O + Energy$
Chloroplast	Mitochondria
Calvin Cycle	Krebs Cycle
$NADP+ \rightarrow NADPH$	$NAD+ \rightarrow NADH$
light	no light

makes glucose (energy)	breaks down glucose (energy)
Plants, algae, some bacteria	eukaryotes, some prokarotes
Stoma	Matrix
autotrophs	heliotropohs

WHAT SHOULD I KNOW ABOUT RESPIRATION

Matt McMullan

Be able to label parts in a mitochondrion and tell where the different reactions happen.

What is a calorie?
The amount of energy required to take 1 gram of water and raise the temperature by 1 degree
What is a Calorie?
1000 calories
How are these related?
They are units of energy
What is the chemical formula for cellular respiration?
6O2 + C6H12O6 -> 6CO2 + 6H2O + Energy
How does this equation compare to the equation for photosynthesis?
Very Similar

Be able to describe the steps of the pathways for:
glycolysis,
break down of glucose
alcoholic fermentation,
pyruvic acid + NADH -> Alcohol + CO2 + NAD+
lactic acid fermentation,
pyrvic acid + NADH -> lactic acid + NAD+
Krebs cycle,
pyruvic acid is broken down into carbon dioxide in a series of energy-extracting reactions.
and Electron transport chain
uses high energy electrons to turn adp into atp

Be able to identify and name the molecules used in the pathways you learned about.
(glucose, pyruvic acid, Coenzyme A, acetyl-CoA, citric acid, FAD, NAD^+, NADH, CO_2, $FADH_2$, citric acid, ATP, ATP synthase, Electron transport chain,)

If given a diagram of a pathway, you should be able to fill in reactants and products and tell where does it go next?

Be able to tell which stages require oxygen and which DON'T.
Electron Transport needs Oxygen-removal of lactic acid requires oxygen
Which molecule forms when glucose is broken in half?
Pyruvic acid

What is the other name for Krebs cycle?
Citric acid cycle

What happens to CO_2, produced during the Krebs cycle?
Exhaled
What is the final electron acceptor at the end of Electron Transport?
Oxygen

What happens to the NADH's produced during glycolysis and Krebs cycle?
They go to the electron transport chain

What high energy electron carriers are used in respiration?
NADH and FADH2

How are these different from the carrier you learned about for photosynthesis?
photosynthesis uses NADP+ and NADPH

How many ATP's , NADH's, CO_2, $FADH_2$, molecules are produced in each stage?
Glycolysis: 2 ATP + 2 Pyruvic acid + 2 NADH
Krebs: 2 NADH + 6ATP + 2ATP + 6 NADH + 18 ATP + 2 FADH2 + 4ATP + 3CO2

What happens to the carbons in glucose as they pass through cellular respiration?
get put with oxygen to form carbon dioxide

What does anaerobic mean?
Without oxygen

What does aerobic mean?
With oxygen

What needs to be added to make glycolysis happen?
Glucose and 2 ATP

What happens to pyruvic acid if there is no oxygen?
It builds up -> turns to lactic acid-> builds up making muscles sore

What are the two kinds of fermentation?
alcoholic fermentation
Lactic acid fermentation
Be able to give the equations for the two kinds of fermentation?
pyruvic_acid+NADH->alcohol+CO2+NAD+
pyruvic_acid->lactic_acid+NAD+
Be able to give examples where each of these is used.
alcohol: making bread
lactic acid: muscles for movement
What molecule is burned to provide quick energy during exercise?
ATP -some stored, then lactic acid fermentation from glycolysis from glucose

Which molecules are burned for energy during long term exercise?
Cellular respiration - stored in glycogen (15-20 min of activity), than other stored molecules including fats burned

Why do cells use fermentation? (Hint: It's NOT to make alcohol or lactic acid)
To make ATP

Explain what happens during Electron Transport Chain?
The high energy electrons leave their carriers and pass through - bringing a hydrogen ion in. These then leave spinning the ATP synthase.

Which ion ends up in the intermembrane space during Electron Transport?
H+

How does ATP synthase work to make ATP?
H+ ions escape through channels into proteins, the ATP syntheses spin. Each time it rotates, the enzyme grabs a low energy ADP and attaches a phosphate, forming a high energy ATP

What is creatine and what does it do?
Creatine is nitrogenous organic acid that occurs naturally in vertebrates and helps to supply energy to muscle and nerve cells.

acts as an intracellular energy transport system from those places where ATP is generated (mitochondria and glycolysis) to those places where energy is needed and used, e.g., at the myofibrils for muscle contraction, at the sarcoplasmic reticulum (SR) for calcium pumping, and at the sites of many more biological processes that depend on ATP

Cellvor Resporation

4/4

water with pH indicator →
- Light Blue @7
- Green-Yellow - acidic
- Dark Blue - basic

Yellow	Blue	Same
Snails	Plants	Both
↑	↑	
give off CO_2 (acidic)	use CO_2 (basic)	

Experiement

1. Both
2. Snails
3. Plant
4. Water

} light

5. Water
6. Snails
7. Plant
8. Both

} darkness

Group Notes

4/8

A. don't want stock pile of drugs
humanistic idea
violates spirit of sport
2 of 3
increase preformance
puts athleate of risk
againts spirt of sports

2. reading worning lable
younger athletes
no sci studies
-not really sure

3. large doses not good
good for short-term
no long term effects
short term: muscel cramping + nousea

4. load up for 5-7 days
take low doses for months
side effect weight gain

5. 1.1 million young people
76% could not identify negitive effects
74% say pose public health problems
39% sports parents say most important problem
creatine most reported PED
71% of youth strongly don't like athletes
vast majority of adults think should be more regulation

6. Many side effects
nausa
vomiting

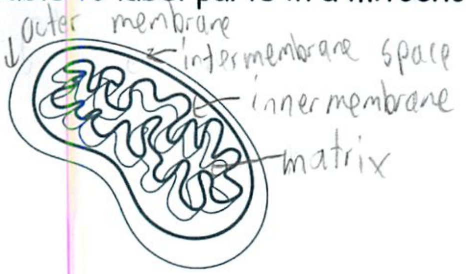
No concrete evidence

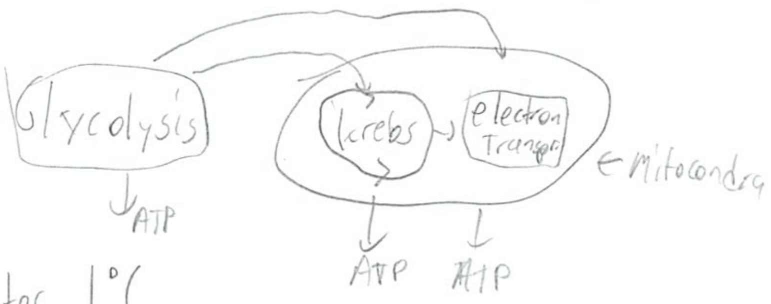
✓ Chap 9 Michael Plasmeier 4/3

WHAT SHOULD I KNOW ABOUT RESPIRATION

turn food eaten into energy

Be able to label parts in a mitochondrion and tell where the different reactions happen.





What is a calorie?

amt energy to heat 1 g, water 1°C

What is a Calorie?

a food calorie - 1000 calorie

purpose

How are these related?

1 Calorie = 1000 calories

What is the chemical formula for cellular respiration?

$6O_2 + C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O$ + Energy

Oxygen glucose carbon dioxide water energy

How does this equation compare to the equation for photosynthesis?

reverse of

Be able to describe the steps of the pathways for:

glycolysis, Split sugar, gains 2ATP, 2NADH, no oxy needed
* glucose broken in half - 2x pyruvic acid

alcoholic fermentation,
w/o oxygen, makes Pyruvic acid

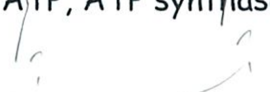
energy small - but fast
Only a few sec.

lactic acid fermentation,
mucels do during exercise

Krebs cycle,
Pyruvic acid is broken into CO_2 - extracting energy

and Electron transport chain
uses high-energy electrons from krebs cycle to convert ADP into ATP

Be able to identify and name the molecules used in the pathways you learned about.
(glucose, pyruvic acid, Coenzyme A, acetyl-CoA, citric acid, FAD, NAD^+, NADH, CO_2, $FADH_2$, citric acid, ATP, ATP synthase, Electron transport chain,)



intro to krebs cycle

If given a diagram of a pathway, you should be able to fill in reactants and products and tell where does it go next?

Be able to tell which stages require oxygen and which DON'T. ← glycolysis + fermentation

↑ aerobic

krebs cycle + electron transfer chain

Which molecule forms when glucose is broken in half?

2 molecules of Pyruvic acid

What is the other name for Krebs cycle?

Citric acid cycle

What happens to CO_2, produced during the Krebs cycle?

It is released

What is the final electron acceptor at the end of Electron Transport?

Oxygen

What happens to the NADH's produced during glycolysis and Krebs cycle?

it is turned into NAD^+ and the electrons go down the chain

What high energy electron carriers are used in respiration?

NAPH + $FADH_2$

How are these different from the carrier you learned about for photosynthesis?

NADPH + ATP

How many ATP's , NADH's, CO_2, $FADH_2$, molecules are produced in each stage?

Glycolysis : 2 ATP + 2 Pyruvic Acid + 2NADH

Krebs : 2 NADH + 6 ATP + 2ATP + 6 NADH + 18 ATP + 2 $FADH_2$ + 4 ATP

$3CO_2$

What happens to the carbons in glucose as they pass through cellular respiration?

It is released as CO_2 among other stuff

What does anaerobic mean?

No oxygen required

What does aerobic mean?

Oxygen required

What needs to be added to make glycolysis happen?

Glucose + 2 ATP

What happens to pyruvic acid if there is no oxygen?

It builds up → Lactic acid fermentation → Lactic acid builds up making muscles sore

What are the two kinds of fermentation?

Alcoholic - forms ethyl alcohol + carbon dixoide

Lactic Acid: allows gycolisis to continue - but builds up lactic acid

Be able to give the equations for the two kinds of fermentation?

Alcoholic: pyruvic acid + NADH → alcohol + CO_2 + NAD^+

Lactic Acid: pyruvic acid + NADH → lactic acid + NAD^+

Be able to give examples where each of these is used.

Alcohol: bread

Lactic Acid: muscels

What molecule is burned to provide quick energy during exercise?

ATP - some stored, then use lactic acid fermentation from glycolsis from glucose

Which molecules are burned for energy during long term exercise?

Cellvor resporation - stored in glycogen (15-20 min) than other stored molecules including fats

Why do cells use fermentation? (Hint: It's NOT to make alcohol or lactic acid)

To produce energy without oxygen

Explain what happens during Electron Transport Chain?

The high energy electrons leave their carriers + pass through - bringing a hydrogen ion in. These then leave spinning the ATP synthase

Which ion ends up in the intermembrane space during Electron Transport?

Hydrogen

How does ATP synthase work to make ATP?

Hydrogen follows the pressure through ATP Synthase - which grabs a low-energy ADP + attaches a phosphate forming high energy ATP

What is creatine and what does it do?

„ energy buffer to keep ATP/ADP ratio high

- Moves ATP from where created to where needed

4/8

Phosphate shuttle
-gives phosphate to ADP to make ATP

Should Creatine Supplements be Banned?

gives you energy
hydrales musels

← used before lactic acid fermentation / found in muscels naturally - meat fish have it

Biology-1; Chapter 9.2

Name: Michael Plasmeier

Performance Enhancing Drugs (PEDs) Preconceptions: give you an advantge

What do you know about them? Make a list.

Cause depression, can be used medically or legally, cause aggresson

Do you know anyone who takes them?

No - Caffeine is one so Yes

What are the pros and cons of PEDs?

pros - stronger, more buff

Cons; can contain dangerous ingredients could cause acne, kidney problems, reproductive difficulties

Are they all illegal/banned?

banned in sports - some illega

---

1. Define at least two major issues in the controversy.

increases phosphate 10-20% energy levels 2.5-10% / banned in many competitions

Possibly death

higher blood pressure

no risks if follow directions

2. Analyze the view points of proponents and critics.

no serious risks if follow directions
natural substances in food
can help winning

can be abused
if abused cause water loss
safe dose never established

3. Gather data : Each person will be responsible for reading one article and presenting it to their group. (Take notes below.)

~1.1 million tried PED
74% said could be health problem
39% parents #1 sports concern
Creatine most used (38% of PED takers)
71% of kids disapprove of it
say should be more regulation

Your opinion now? Has it changed?

Questions you might ask members of our community:

ISSUES IN BIOLOGY

Should Creatine Supplements Be Banned?

Many athletes now use a dietary supplement called creatine to enhance their performance. Creatine may improve athletic performance but critics point to potentially serious side effects as a reason to control its use.

Although muscle cells contain only enough ATP for a few seconds of intense activity, most have a reserve nearly twice as large in the form of a molecule called creatine phosphate. When the muscle goes to work and starts to use up its available ATP, phosphates are transferred from creatine phosphate directly to ADP, regenerating ATP in a matter of milliseconds. The more creatine phosphate a muscle contains, the longer it can sustain intense activity. Hoping to increase their capacity for strong, short-term muscle contractions, many athletes have added creatine to their diets. Should athletes be allowed to use creatine supplements?

The Viewpoints

Creatine Supplements Should Be Allowed

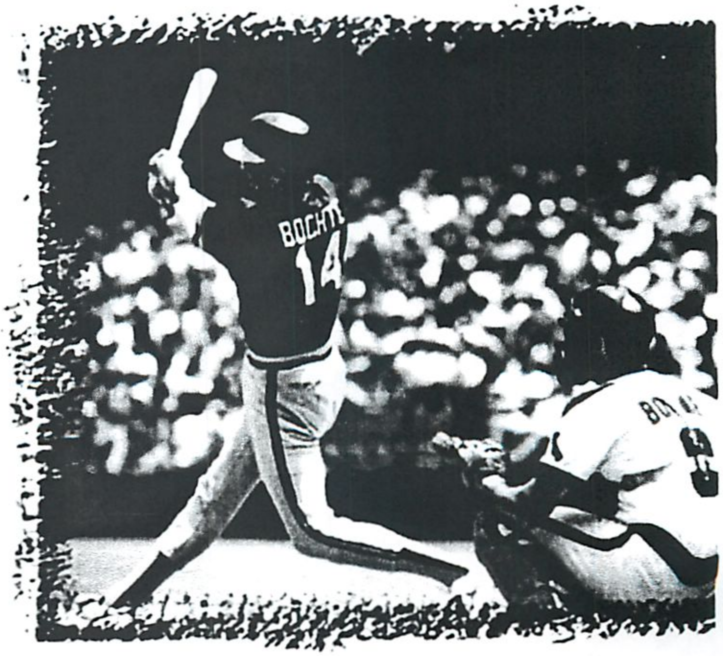
Creatine is a natural substance found in human cells and in foods such as meat. Taken in recommended doses, creatine helps build muscle strength and performance, which can mean the difference between winning and losing. When athletes have followed instructions on container labels, no serious side effects have been reported. The risks are small and the rewards of winning are large enough to justify its use.

Creatine Supplements Should Be Banned

Like any natural substance, creatine can be abused. Creatine is known to cause water loss, putting the athletes who use it at risk for dehydration, muscle injury, diarrhea, kidney failure, and perhaps even death. Because creatine is considered a dietary supplement and not a drug, the Food and Drug Administration (FDA) has never determined its safety. Until a truly safe dose has been determined by careful scientific studies, athletes should not be allowed to use creatine.

You Decide

1. **Defining the Issue** In your own words, describe at least two major issues involved in the controversy surrounding the use of creatine to enhance athletic performance.
2. **Analyzing the Viewpoints** List the key arguments expressed by the proponents and critics of using creatine as a dietary supplement. What is known? What is not known? What are the benefits? What are the risks?
3. **Forming Your Opinion** Should athletes be allowed to take creatine to enhance performance? Weigh the pro and con arguments. Research to find out if some professional sports have banned the use of creatine by athletes. What were the reasons for this decision? Do some arguments outweigh others? Which arguments? Explain your answer.
4. **Writing an Editorial** Write an editorial for a sports magazine that takes a stand on creatine. Your editorial should persuade your readers that your opinion is justified.



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Headline news

Blue Cross/Blue Shield Says 1.1 Million Teens Have Used Performance Enhancing Sports Supplements and Drugs

Chicago IL, 31 October 2003

Based on projections from a nationally representative survey released today by the Blue Cross and Blue Shield Association (BCBSA), approximately 1.1 million young people between ages 12 and 17 have taken potentially dangerous performance-enhancing supplements and drugs. Just as alarming, 76 percent could not identify any negative side effects that might result from using steroids, ephedra and other similar substances.

"Blue Cross and Blue Shield Plans are committed to the health of America's young people," said Allan Korn, MD, BCBSA chief medical officer. "Five years ago when we launched the Healthy Competition program, people thought performance-enhancing drugs were only a problem for elite athletes. But today, 74 percent of the people surveyed agree that these substances pose a significant public health problem."

The survey highlights just how seriously parents view the potential health threat, with 39 percent rating the use of performance-enhancing supplements and drugs as their number one concern in youth sports—far more than aggressive behavior (16 percent), competitiveness (15 percent) and injury (10 percent). Yet, 81 percent of young people said they had never had a conversation with their parents about performance-enhancing substances, and 69 percent said they had received no information from their sports teams.

"This survey should serve as a wakeup call to parents, teachers, coaches, and the public health community about the need to educate our young people regarding the dangers associated with performance-enhancing drugs and supplements," Dr. Korn added.

Other key survey results:

- Use of ephedra appears to be on the rise, with 7 percent of youth responding that they knew someone using it compared to zero percent in 2001.
- Among all youths surveyed (ages 10-17) who knew someone

using performance-enhancing substances, the most common substance identified was creatine (38 percent). Steroids (34 percent) were the second-most cited.

- Among the youth who knew someone using performance-enhancing supplements, 27 percent said these teens were taking the substances to "look better," an increase from 19 percent in 2001.
- While 71 percent of youth thought football players were more likely to use performance-enhancing substances, the perception that baseball players used them increased substantially over the last two years (27 percent vs. 22 percent in 2001).
- Seventy-one percent of youth strongly disapprove of athletes who use performance-enhancing substances, an increase from 66 percent of young people with this view in 2001.
- The vast majority of adults believe there should be greater regulatory oversight of the industries responsible for developing and marketing performance-enhancing substances.

"Adults need to protect the bodies and minds of young people from the harmful effects of all drugs, including performance enhancing substances," said John Walters, director of National Drug Control Policy. "Athletes of all ages must contend with the pressures of competition and can sometimes be tempted to take dangerous shortcuts. Parents and coaches can help young athletes make healthy decisions by educating them on these harmful drugs."

In addition to illegal performance-enhancing substances, such as steroids and human growth hormones, many dietary supplement products available over- the-counter or on the Internet contain potentially dangerous ingredients, including androstenedione (andro) and ephedra. These products are not regulated nor tested by the Food and Drug Administration, and some have been reported to cause negative health consequences, including acne, kidney problems, reproductive difficulties and even death. People of all ages should consult with their doctors before taking any sports supplement.

"BCBSA urges young athletes to abstain from using performance-enhancing drugs and supplements and reminds athletes, coaches and parents that skill, dedication and hard work are the most important qualities for success in sports and in life," said Dr. Korn. For more information, visit www.healthycompetition.org.

The survey was conducted for BCBSA by C&R Research Services, Inc. via telephone among a nationally representative sample of adults, 21 to 64 years of age, and youths, 10 to 17 years of age. A total of 1,803 interviews were completed—1,000 among adults and 803 among youths—between April 4 and 23, 2003. The data provides a reliable and accurate representation of both the US adult and youth populations.

Results based on these samples are projectable to the national population and have a sampling error of 3.1 percentage points for the adult sample and 3.5 percentage points for the youth sample. Results based on the subgroups may have a larger sampling error.

The Blue Cross and Blue Shield Association is comprised of 41 independent, locally operated Blue Cross and Blue Shield Plans that collectively provide healthcare coverage for more than 88.7 million—nearly one in three—Americans.

Source

Blue Cross and Blue Shield Association (www.bcbs.com).

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✓

Name: Michael Plasmeier **Class:** ______________ **Date:** 4/9/08 **ID: B**

92/100

Nice Michael!

Photosynthesis and Respiration

Multiple Choice

Identify the choice that best completes the statement or answers the question.

d ____ 1. Photosynthesis is to chloroplasts as cellular respiration is to
- a. nucleus.
- b. chloroplasts.
- c. cytoplasm.
- [✓ d. mitochondria.]

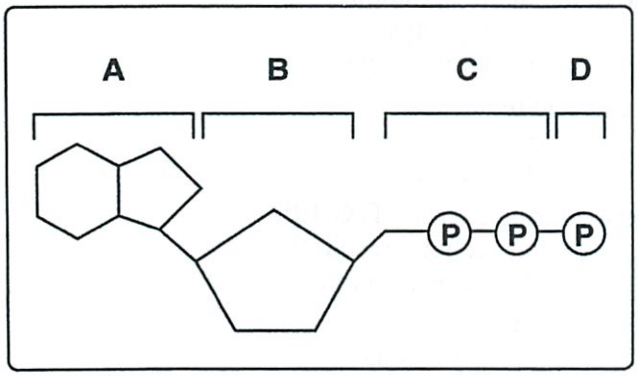


Figure 8–1

d ____ 2. Which structures shown in Figure 8-1 make up an ATP molecule?
- a. C and D
- b. A, B, and C
- c. A and B
- [✓ d. A, B, C, and D]

a ____ 3. Look at Figure 8-1. All of the following are parts of an ADP molecule EXCEPT
- [✓ a. structure D.]
- b. structure C.
- c. structure A.
- d. structure B.

a ____ 4. Plants cannot release energy from glucose using
- [✓ a. photosynthesis.] makes glucose
- b. glycolysis.
- c. the Krebs cycle.
- d. cellular respiration.

d ____ 5. Which of the following are used in the overall reactions for photosynthesis?
- a. water
- b. light
- c. carbon dioxide
- [✓ d. all of the above]

c ____ 6. Which of the following is an autotroph? makes own food - photosynthesis
- a. dog
- b. monkey
- [✓ c. tree]
- d. mushroom

a ____ 7. A granum is a(an)
- [✓ a. stack of thylakoids.]
- b. membrane enclosing a thylakoid.
- c. photosynthetic pigment molecule.
- d. stack of chloroplasts.

c ____ 8. If carbon dioxide is removed from a plant's environment, what would you expect to happen to its production of high-energy sugars?
- a. Carbon dioxide does not affect the production of high-energy sugars in plants.
- b. The same number of sugars will be produced but without carbon dioxide.
- [✓ c. No sugars will be produced.]
- d. More sugars will be produced. photosynthesis stops

-4

Name: ____________________ **ID: B**

__d__ 9. One cause of muscle soreness is
a. the Krebs cycle.
b. alcoholic fermentation. not in humans
c. glycolysis.
[✓ d. lactic acid fermentation.]

__C__ 10. The starting molecule for glycolysis is
a. citric acid.
b. pyruvic acid.
[✓ c. glucose.]
d. ADP.

__d__ 11. The light-collecting units of a chloroplast are the
a. high-energy sugars.
b. electron carriers.
c. stroma.
[✓ d. photosystems.]

C ½ __b__ 12. Which of the following is NOT a stage of cellular respiration?
a. electron transport
[✓ b. fermentation]
c. glycolysis
d. Krebs cycle

__b__ 13. The conversion of pyruvic acid into lactic acid requires
a. oxygen.
[✓ b. NADH.]
c. ATP. produces +ADP
d. alcohol. no

__a__ 14. All of the following are sources of energy during exercise EXCEPT
[✓ a. alcoholic fermentation.]
b. stored ATP.
c. cellular respiration.
d. lactic acid fermentation.

__d__ 15. Which process is used to produce beer and wine?
a. the Krebs cycle
b. lactic acid fermentation
c. glycolysis
[✓ d. alcoholic fermentation]

?? ✗ __c__ 16. The Calvin cycle takes place in the
a. chlorophyll molecules.
b. stroma.
[✓ c. thylakoid membranes.]
d. photosystems.

__b__ 17. Which organism is NOT likely to carry out cellular respiration?
a. mushroom
[✓ b. anaerobic bacterium]
c. tiger breaking
d. tree also do it

__C__ 18. Which step is the beginning of photosynthesis?
a. Pigments in photosystem I absorb light.
b. ATP synthase allows H+ ions to pass through the thylakoid membrane.
[✓ c. Pigments in photosystem II absorb light.]
d. High-energy electrons move through the electron transport chain.

__C__ 19. Most plants appear green because chlorophyll
a. reflects violet light.
b. absorbs green light.
[✓ c. does not absorb green light.]
d. none of the above

✗ __b__ 20. What are the products of the light-dependent reactions?
a. ATP
[✓ b. NADPH] – "charging"
c. oxygen gas
d. all of the above

__b__ 21. Cellular respiration uses one molecule of glucose to produce
a. 2 ATP molecules.
[✓ b. 36 ATP molecules.]
c. 34 ATP molecules.
d. 38 ATP molecules.

__C__ 22. During one turn, the Krebs cycle produces
a. oxygen.
b. glucose.
[✓ c. electron carriers.] + CO^2
d. lactic acid.

✓

d 23. Which process does NOT release energy from glucose?
a. fermentation c. cellular respiration
b. glycolysis [✓ d.] photosynthesis

b 24. Which of the following passes high-energy electrons into the electron transport chain?
a. ATP and ADP c. citric acid
[✓ b.] NADH and FADH2 d. acetyl-CoA

a 25. What are the reactants in the equation for cellular respiration?
[✓ a.] glucose and oxygen c. carbon dioxide and water
b. oxygen and lactic acid d. water and glucose
Oxy + glu

b 26. Which of the following is NOT an example of a heterotroph?
a. human c. leopard
[✓ b.] grass d. mushroom

a 27. If you continue to increase the intensity of light that a plant receives, what happens?
[✓ a.] The rate of photosynthesis increases and then levels off. max point
b. The rate of photosynthesis does not change.
c. The rate of photosynthesis decreases with light intensity.
d. The rate of photosynthesis increases with light intensity.

c 28. Breathing heavily after running a race is your body's way of
a. making more citric acid.
b. recharging the electron transport chain.
[✓ c.] repaying an oxygen debt.
d. restarting glycolysis.

b 29. Energy is released from ATP when
a. ATP is exposed to sunlight. c. adenine bonds to ribose.
[✓ b.] a phosphate group is removed. d. a phosphate group is added.

Completion (2pts ea.)
Complete each statement.

30. A high level of lactic acid in the blood is a sign that lactic acid fermentation has occurred.

Name: ____________________ -2 **ID: B**

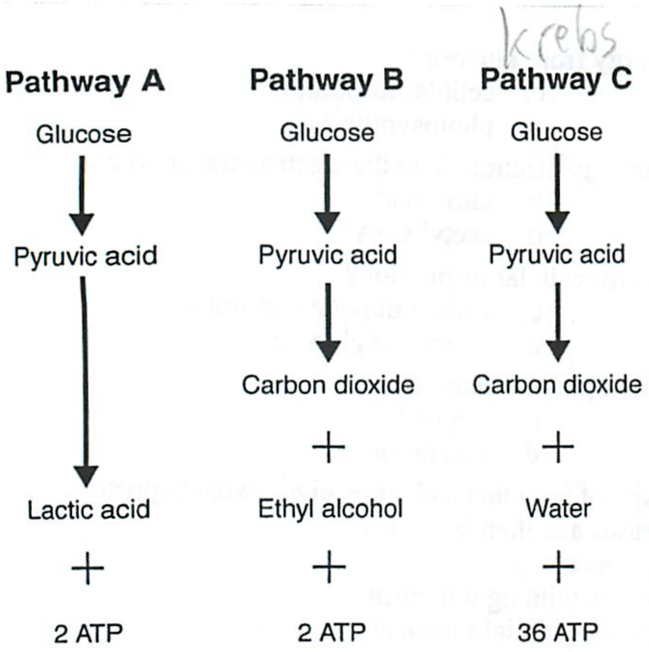


Figure 9–1

31. The pathway labeled B in Figure 9-1 is called alcoholic fermentation.

32. In Figure 9-1, only the pathway labeled C requires oxygen.

33. The NADH/FADH$_2$/ high energy electrons is a series of carrier proteins.

34. In many plants, the rate of photosynthesis slows/stops when the weather becomes very cold.

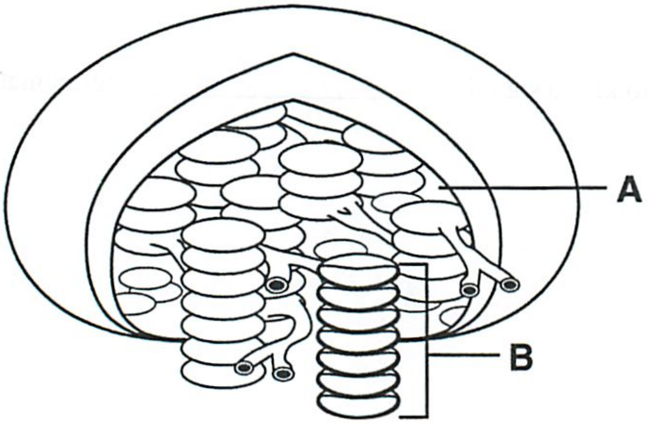


Figure 8–2

? 35. Photosystems I and II are found in the structure labeled B in Figure 8-2.

36. Without oxygen, a cell can extract a net gain of only 4 molecules of ATP from each glucose molecule.

Name: ______________________ **ID: B**

37. Glycolysis converts glucose into two molecules of ATP.
38. The body gets rid of lactic acid in a chemical pathway that requires Oxygen.
39. Thylakoids are a(an) green color because they contain chlorophyll.
40. If you separate the pigments found in a typical plant cell's chloroplasts, you will find green, orange, and red pigments.
41. Cellular respiration occurs only in the presence of Oxygen.

Short Answer

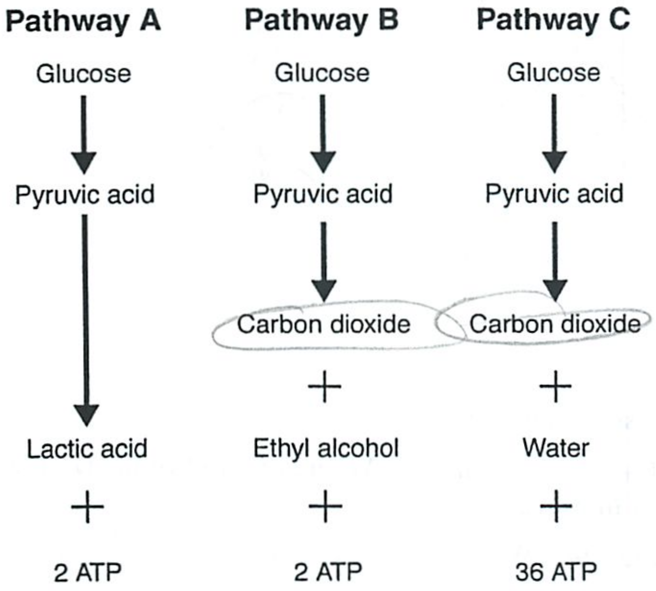


Figure 9–1

42. Based on Figure 9-1, which type of fermentation does NOT give off carbon dioxide? Explain your answer. Pathway A - it's not listed here but on B+C
43. What role does oxygen play in the electron transport chain? It is the final electron acceptor
44. What three sources of ATP does your body use during a long aerobic exercise session?

- celluor resporation
- stored ATP
- lactic acid fermentation) at the start

Name: ______________________ **ID: B**

Other

USING SCIENCE SKILLS

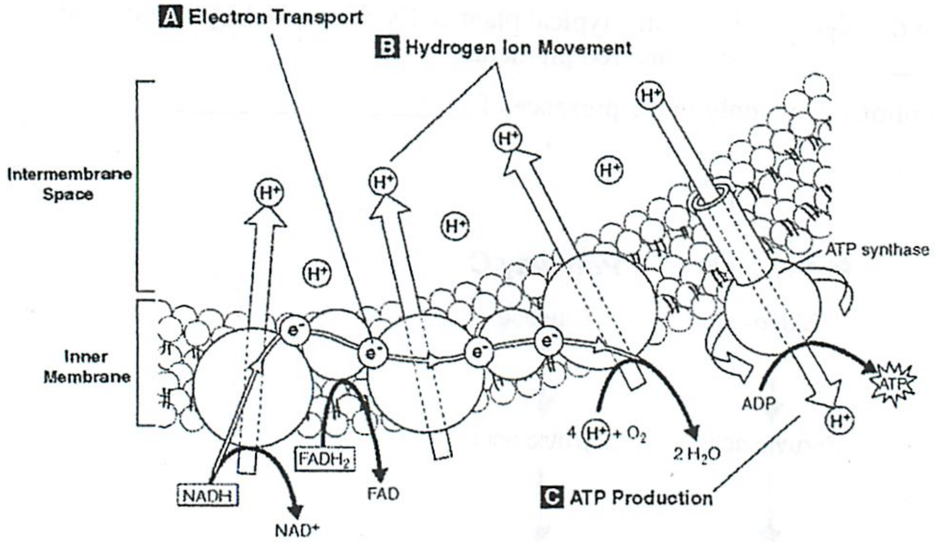


Figure 9–3

45. **Interpreting Graphics** What process does Figure 9-3 show? Cellcor resporation electron transport chain
46. **Inferring** Look at the arrows and H+ ions in Figure 9-3. Where do most of the H+ ions accumulate? What is the result of this movement? Inside the mitocondra creating a concentration gradiant which is greator in the mitocondra, causing ATP Syntnase to happen turning ADP into ATP.
47. **Interpreting Graphics** Look at Figure 9-3. Where do the electrons moving along the inner membrane come from? High energy electron carriers NADH+ $FADH_2$
48. **Interpreting Graphics** ATP synthase is an enzyme. Find ATP synthase in Figure 9-3. What reaction does ATP synthase catalyze when an H+ ion passes through its channel?
49. **Interpreting Graphics** Where do the electrons moving along the inner membrane in Figure 9-3 end up?

48. Adding a phosphate to create ATP from ADP

49. Joining with Oxygen and Hydrogen to make water.

✓

The Cell Cycle Webworksheet **Names:** Michael Plasmeier

The cell cycle is the process by which cells are created, grow, and finally die. The purpose of this activity is to review the stages of the cell cycle and mitosis. In this investigation, you will go to each web site and answer the questions (type directly on this sheet and print when you're done

A. Cells Alive! :
http://www.cellsalive.com/cell_cycle.htm

Answer the following questions:

1. **What are the 4 stages of the cell cycle? What happens during each stage?**

Gap 1: Cells increase in size producing RNA and synthesizing protein.

S Phase: DNA Duplication

Gap 2: Continues to grow and generate protein.

Mitosis: Cell growth stops and nucleus splits. Finally the cytoplasm splits and there are 2 cells.

2.. Which stage is the longest? Why?
The interphase as the cell grows. Gap 1 phase is the longest part of interphase. This is because the cell needs to grow and produce important organelles.

4. Which stage is the shortest? Why?
Mitosis is the shortest phase because it does not take much time for the cell to actually split.

Click on "Animal cell Mitosis" at the bottom of the page.
Hit play to view the animation.
Notice the real cell in the red box in the upper left corner of animation.

6. Mitosis is the splitting of the nucleus.

7. Name the 6 stages of mitosis and describe the important events of each stage.

Interphase: The cell grows and replicates its DNA, as well as synthesize proteins.

Prophase: The centrioles split and a spindle begins to form. The chromatin condenses into chromosomes. The nuclear envelope begins to break down.

Prometaphase: Nuclear envelope begins to break down. The spindle fibers get longer.

Metaphase: The spindle fibers join together at the center of the cell. Each chromosome is connected to a spindle fiber at its centromere.

Anaphase: Chromatids separate into individual chromosomes and begin to move apart.

Telophase: The daughter chromosomes arrive at the poles and the spindle fibers that have pulled them apart disappear.

Cytokinesis: The spindle fibers break down so no overlap is left. The cytoplasm pinches in half.

B. The Cell Cycle & Mitosis Tutorial:
http://www.biology.arizona.edu/cell_bio/tutorials/cell_cycle/main.html

Take a look at the DNA basics section.
8. How does the structure of DNA change during the cell cycle?
When the cell divides chromatin fibers become visible since they are highly folded. Cromatin is more extended to best express genetic information.

Look at the Cell Cycle section.
9. List some protein factors that regulate the cell cycle:

Cdk (cyclin dependent kinase, adds phosphate to a protein), along with cyclins, are major control switches for the cell cycle, causing the cell to move from G1 to S or G2 to M.

MPF (Maturation Promoting Factor) includes the CdK and cyclins that triggers progression through the cell cycle.

p53 is a protein that functions to block the cell cycle if the DNA is damaged. If the damage is severe this protein can cause apoptosis (cell death).

1. p53 levels are increased in damaged cells. This allows time to repair DNA by blocking the cell cycle.
2. A p53 mutation is the most frequent mutation leading to cancer. An extreme case of this is Li Fraumeni syndrome, where a genetic a defect in p53 leads to a high frequency of cancer in affected individuals.

p27 is a protein that binds to cyclin and cdk blocking entry into S phase. Recent research (*Nature Medicine* 3, 152 (1997)) suggests that breast cancer prognosis is determined by p27 levels. Reduced levels of p27 predict a poor outcome for breast cancer patients.

10. Critical thinking question: Why does the cell cycle need to be regulated? Predict what would happen if regulation broke down.
It needs to be regulated or else cells will rapidly reproduce. This is called cancer and is a big problem because it takes resources away from cells which are needed. Also internal regulators are needed or else the cell will split before all of the DNA is properly replicated.

Look at the Mitosis section.
11. Which phase is often included in the mitosis list, but is not technically part of mitosis? (Did you include this phase in question 7 above?)
Cytokinesis – The nucleus has split already and now the cell membrane is splitting.

Play the "Mitosis Animation" (in Blue) at the bottom of the page.
Enjoy

C. Create a foldable book on a separate sheet of paper.
12. Draw pictures of the 6 main phases of mitosis in your foldable book – one picture/ page. Include a description of the major events of each phase.

Name: Michael Plosmeier ✓ Date:______________ Block:________

Dragonfly Biology

Chapter 10

Cell Growth and division

Section 10.1: Cell Growth

How do living things grow? What happens to an animal's cells when it grows?

Grows by splitting cells to make more

Why do cells divide rather than continuing to grow larger indefinitely? Explain the two main reasons:

larger demands put on DNA
trouble moving nutrients + wastes across cell membranes
- larger distance to center + much smaller surface area : volume raito

Why is surface area to volume important? How does the ratio of surface area to volume change as a cell gets larger? gets smaller - this puts a larger demand on the membrane which does not grow in relation - cell is not able to function efficently

What is cell division?

a cell divides forming 2 daughter cells
DNA splits in 2 and each one gets a copy

Section 10.2: Cell Division:

Define the following:

chromatid- 2 identical arms of a chromatid
centromere- center (usually) of chromatid - connecting each pair
interphase- time in a cell's life between cell division
cell cycle- series of events a cell goes through as they grow and divide
1 mitosis- step 1 of cell division, splitting the nucleus in 2
prophase- see pg 2
centriole- 2 tiny structures in cytoplasm near nuclear envelope
spindle- fan like microtubule structure that helps seperate the chromosome
metaphase-
anaphase- See pg 2
telophase-
2 cytokinesis- step 2 of cell division - splitting the cytoplasm in 2

asexual reproduction for unicelluar organisms : just mitosis

Chromosomes:

What are chromosomes made of?

DNA and protien

What is the function of chromosomes?

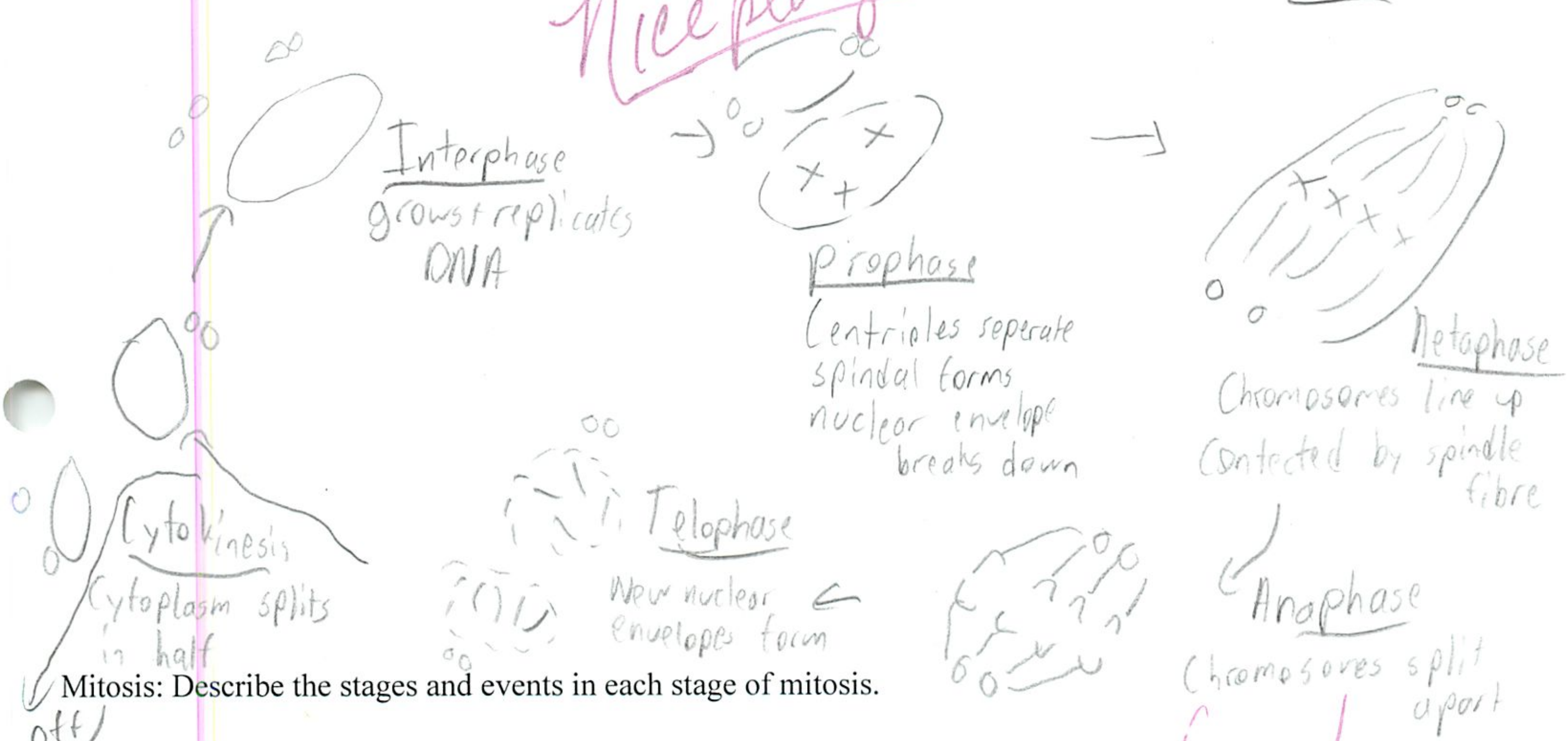
to carry genetic information which is passed on from 1 generation to another

Why must a cell replicate its DNA before it divides?

So each daughter cell can have a copy

Draw the cell cycle and include the 4 phases of the cell cycle and also the phases of mitosis. Animal

Nice play



Mitosis: Describe the stages and events in each stage of mitosis.

Nice

Prophase - 1st + longest phase (50-60% of time)
Chromosomes become visible
Chromosome attach to fibres of the spindle near the centromere of each chromatid
Chromosome coils more tightly
nucleolus disappears + nuclear envelope breaks down

Metaphase - chromosomes line up at the center of each cell
Microtubes connect centromere of chromosome to the 2 poles of the spindle →

Anaphase - Centromeres that join sister chromatids split, allowing
Sister chromatids to seperate + become individule chromosome
Centinues to move to the poles of the spindle

Telophase - Chromosome disperses into dense material
Nuclear envelope reforms
Spindle breaks apart
Nucleolus becomes visible again
Mitosis finished

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

What is the purpose of mitosis?

division of cell nucleus to give each daughter DNA

Describe cytokinesis, and compare animal to plant cell cytokinesis.

Division of cytoplasm itself into 2 cells

Animal	Plants
Cell membrane drawn inword until pinches into 2 ports	Cell plate forms midway between the nuclei, developing into a cell membrane, A cell wall appears

Michael Plasmeier 4/16

DragonBio 07/08: 10-3 Cell Cycle Regulation and 11-4 Meiosis:

✓

10-3 Regulating the Cell Cycle p250-252:

Vocabulary:

Cyclin – a protein (and later a family of proteins) which regulates the cell cycle
Cancer – uncontrolled growth of cells (they do not respond to signals regulating cell growth)

Why do cells need to divide (At least 3 reasons)?
Cells need to divide to allow organisms to grow and reproduce as well as replace damaged cells

List several cell types that almost never divide.
Cardiac (heart) cells as well as skeletal muscle

List several cell types that are constantly dividing and turning over (replacing themselves).
The cells lining the esophagus, small intestine, and the large intestine.

Describe the factors that control cell division.
Contact Inhibition: Cells will start growing when neighboring cells are removed, for example skin cells will reproduce next to a cut

Cell Cycle Regulators – Cyclins (what did early experiments show?) – regulates the timing of the cell cycle in eukaryotic

-Internal Regulators – Allows cell cycle to proceed only after certain processes have happened inside the cell. For example some proteins halt mitosis until the chromosomes have been regulated

-External regulators – direct the cell to speed up or slow down the cell cycle – important during embryonic development and wound healing – cells signal each other to start and stop to prevent tissue from disrupting each other

Uncontrolled Cell Growth:

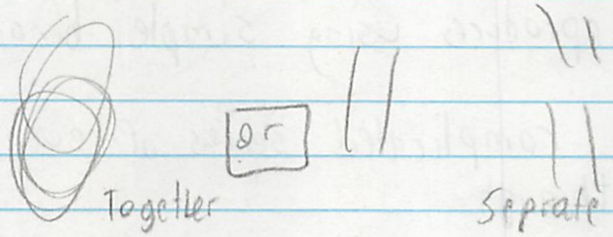
Cancer: Cause? – Smoking, radiation, viral infections. Different cancers have different causes.

What protein is often mutated in cancer cells? What is the normal function of this protein? – Defects occur in protein p53 which normally halts the cell cycle until all of the chromosomes have been replicated

Stem Cells: What are they? Stem cells are unspecialized cells that have the potential to differentiate into a variety of cell types.
How can they be used? – They can potentially be used to create many different types of cells.
Where do they come from? - Some come from human embryos but potentially also bone marrow cells
What are the ethical issues? – Some people are worried that babies may be produced and then “thrown out” just to harvest the stem cells. Others worry that it is the gateway to cloning, which would devalue human life.

10.2 Cell Division

4/11



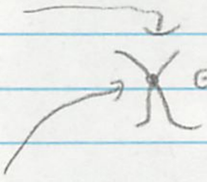
Chromatin Chromosomes

prokaryotes - DNA attached to cell membrane
-one chromosome
-circular

eukaryotes - rod shape
many pairs
in nucleus

chromosomes divided into genes
- which define the traits

chromatids - after replication
2 identical arms



Centromere - holds chromatids

homologous pairs - 2 of each chrosomes (one from mom + one from dad)
- same size + shapes
- carry genes for the same trait
- but not identical
-don't need to have the same values

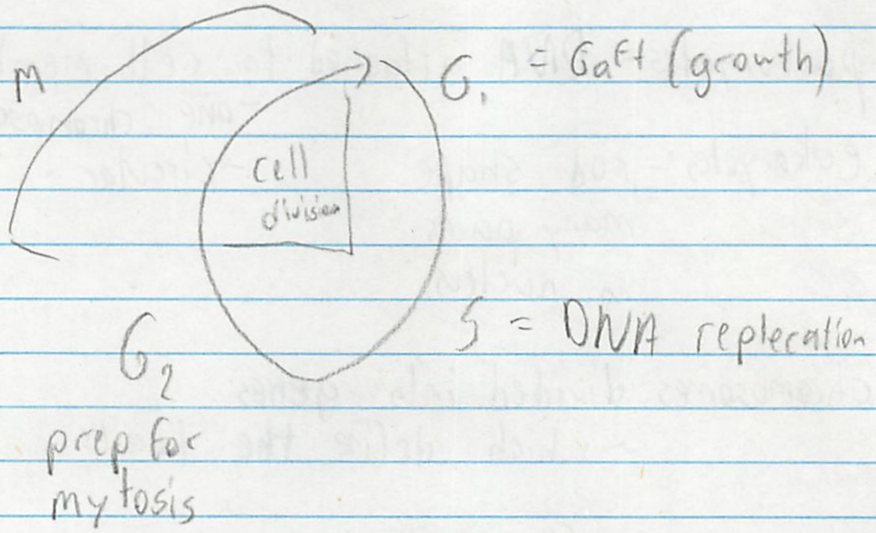
23 types of chromosomes · 2 = 46

karyotypes - chromosomes laid out
-ordered according to lenght (except #21+22)

Bacteria reproduces using simple binary fission

Cell cycle - complicated series of events a cell goes through

Each cell gets a copy of the cromosome



Name: Michael Plasmeier **Class:** ______________ **Date:** 4/21 **ID: A**

96/100

12

Cell Growth and Division

Multiple Choice

Identify the choice that best completes the statement or answers the question.

X C ___ 1. Which of the following is NOT a way that cell division solves the problems of cell growth?

???
| | |

- ~~a.~~ Cell division provides each daughter cell with its own copy of DNA. ✓ solved a problem
- b. Cell division increases the mass of the original cell.
- c. Cell division increases the surface area of the ~~original~~ overall cells.
- d. Cell division reduces the original cell's volume., does it - would solve problem

C ___ 2. During which phase of mitosis do the chromosomes line up along the middle of the dividing cell?

- a. prophase
- b. telophase
- [✓ c. metaphase]
- d. anaphase

pro
meta
ana
telo

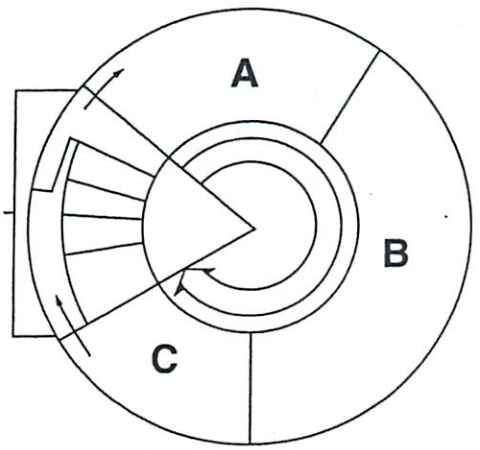


Figure 10–2

A ___ 3. The cell cycle is the

- [✓ a. series of events that cells go through as they grow and divide.]
- b. period of time between the birth and the death of a cell.
- ~~c.~~ time from prophase until cytokinesis.
- ~~d.~~ time it takes for one cell to undergo mitosis.

9/8

D ___ 4. Cell division is represented in Figure 10-2 by the letter?

- a. A.
- b. B.
- c. C.
- [✓ d. D]

B ___ 5. What is a tumor?

- a. an accumulation of cyclins
- [✓ b. a mass of cancer cells]
- c. the rapidly dividing cells found at the site of a wound
- d. a defective p53 gene

? created by

Name: ____________________ **ID: A**

✓

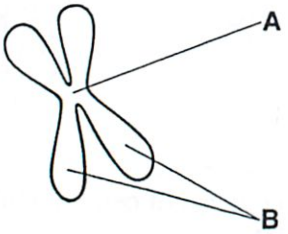


Figure 10–3

A 6. The structure labeled A in Figure 10-3 is called the
[✓ a.] centromere. c. sister chromatid.
b. centriole. d. spindle.

C 7. The structures labeled B in Figure 10-3 are called
a. centromeres. [✓ c.] sister chromatids.
b. centrioles. d. spindles.

A 8. Cyclins are a family of closely related proteins that
[✓ a.] regulate the cell cycle. c. cause cancer.
b. produce p53. d. work to heal wounds.

A 9. Which event occurs during interphase?
[✓ a.] The cell grows.
b. Centrioles appear.
c. Spindle fibers begin to form.
d. Centromeres divide.

C 10. Which of the following is a phase of mitosis?
a. cytokinesis [✓ c.] anaphase
b. interphase d. S phase

C 11. Cancer is a disorder in which some cells have lost the ability to control their
a. size. [✓ c.] growth rate.
b. spindle fibers. d. surface area.

B 12. In eukaryotic cells, the timing of the cell cycle is regulated by
a. the centrioles. c. the spindle.
[✓ b.] cyclins. d. all of the above

A 13. As a cell becomes larger, its
[✓ a.] volume increases faster than its surface area.
b. surface area increases faster than its volume.
c. volume increases, but its surface area stays the same.
d. surface area stays the same, but its volume increases.

A 14. The first phase of mitosis is called
[✓ a.] prophase. c. metaphase.
b. anaphase. d. interphase.

B 15. Which pair is correct?
a. G1 phase, DNA replication c. S phase, cell division
[✓ b.] G2 phase, preparation for mitosis d. M phase, cell growth

Name: ______________________ **ID: A**

C 16. Which of the following explains why normal cells grown in a petri dish tend to stop growing once they have covered the bottom of the dish?
- a. The cells lack cyclin.
- b. The petri dish inhibits cell growth.
- [✓ c.] Contact with other cells stops cell growth. contact inhibition
- d. Most cells grown in petri dishes have a defective p53.

A 17. What is the role of the spindle during mitosis?
- [✓ a.] It helps separate the chromosomes. closer
- b. It breaks down the nuclear membrane.
- c. It duplicates the DNA.
- d. It divides the cell in half.

A 18. The process by which a cell divides into two daughter cells is called
- [✓ a.] cell division.
- b. metaphase.
- c. interphase.
- d. mitosis.

In #4 cell division = mitosis + cytokinesis

C 19. When during the cell cycle is a cell's DNA replicated?
- a. G1 phase
- b. G2 phase
- [✓ c.] S phase
- d. M phase

B 20. All of the following are problems that growth causes for cells EXCEPT
- a. DNA overload.
- [✓ b.] excess oxygen.
- c. obtaining enough food.
- d. expelling wastes.

A 21. Which of the following is a factor that can stop normal cells from growing?
- [✓ a.] contact with other cells
- b. growth factors
- c. a cut in the skin
- d. cyclin that has been taken from a cell in mitosis

starts

C 22. Compared with small cells, large cells have more trouble
- a. dividing.
- b. producing daughter cells.
- [✓ c.] moving needed materials in and waste products out.
- d. making copies of their DNA.

D 23. As a cell grows, it
- a. places more demands on its DNA.
- b. uses up food and oxygen more quickly.
- c. has more trouble moving enough materials across its cell membrane.
- [✓ d.] all of the above

D 24. The two main stages of cell division are called
- a. mitosis and interphase.
- b. synthesis and cytokinesis.
- c. the M phase and the S phase.
- [✓ d.] mitosis and cytokinesis.

rel.

C 25. When during the cell cycle are chromosomes visible?
- a. only during interphase } same
- b. only when they are being replicated
- [✓ c.] only during the M phase mitosis - in book drawing
- d. only during the G1 phase

A 26. Which of the following represents the phases of mitosis in their proper sequence?
- [✓ a.] prophase, metaphase, anaphase, telophase
- b. interphase, prophase, metaphase, anaphase, telophase
- c. interphase, prophase, metaphase, telophase
- d. prophase, metaphase, anaphase, telophase, cytokinesis

Name: ____________________ **ID: A**

Completion (1pt ea.)
Complete each statement.

27. Before a normal cell becomes too large to carry out normal activities, it will usually divide to form two daughter cells.

28. The process by which a cell divides into two daughter cells is called cell division.

#4 29. Another name for cell division is the M phase.

30. The larger a cell becomes, the less efficiently it is able to function.

31. Together, the G1 phase, S phase, and G2 phase are called interphase.

32. Proteins that regulate the cell cycle based on events inside the cell are called Internal regulators.

33. Look at Figure 10-4. The process shown occurs directly following mitosis. This process is called Cytokinesis of a plant cell

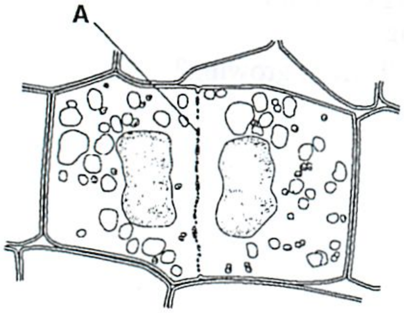


Figure 10–4

Short Answer

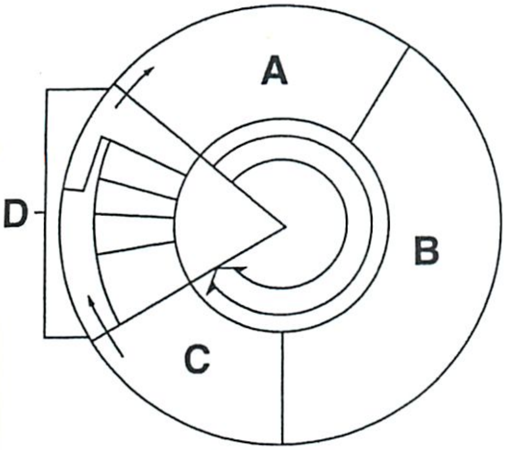


Figure 10–2

34. The main events of the cell cycle are labeled A, B, C, and D in Figure 10-2. Name these events. Then, briefly state what happens during each event.

A) G_1 Phase - Cell grows and makes more organells, this is where the actual purpose of the cell is carried out (protiens synthized)

B) S Phase - The DNA is replicated.

C) G_2 Phase - The cell produces the organells needed for replication

D) M Phase - The cell's nucleus splits (mitosis) and then the actual cell splits (cytokinesis)

-2

Other

USING SCIENCE SKILLS

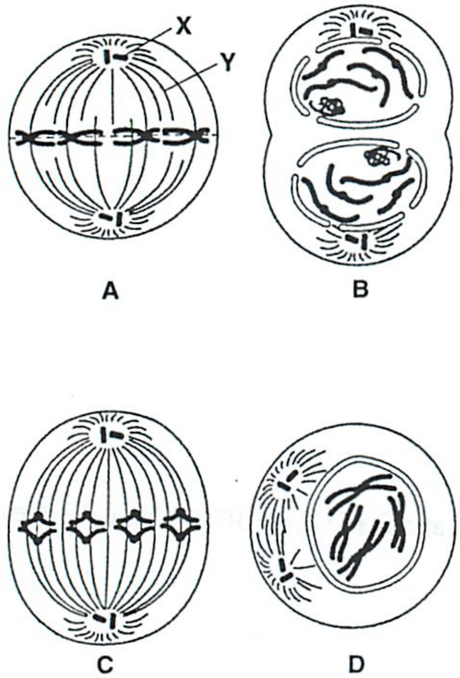


Figure 10–5

diploid

35. **Inferring** What is the chromosome number of the cell shown in Figure 10-5? ~~4~~ 2

36. **Predicting** After the steps shown in Figure 10-5 have been arranged in the correct order, what would a diagram of a final step show? Cytokinesis - the cell's membrane splitting in 2

37. **Applying Concepts** List the correct order for the diagrams in Figure 10-5. D, A, C, B

38. **Inferring** Identify the structures labeled X and Y in Figure 10-5. X: Centriole ; Y: spindle fibers

39. **Interpreting Graphics** What does Figure 10-5 represent? How do you know if this is an animal cell or a plant cell?

Mitosis of a animal cell - since a plant cell would have a rigid cell wall and cytokinesis would happen like in figure 10-4 - not like in 10-5 b where the membrane is pinched into 2 parts

Cell plate

↑ Plus you told it was an insect

Mitosis of the Onion Root Tip

50/50

Michael Plasmeier 4/15/2008

1. Why do we study the root tip to find mitosis instead of any other part of the onion plant?

The root tip is the part which grows so it is more likely to contain cells which are dividing.

2. Based on you data what can you infer about the relative length of time an onion root-tip cell spends in each stage of the cell cycle?

- 66% of the time on Interphase
- 10% Prophase
- 4% Metaphase
- 7% Anaphase
- 13% Telophase

3. Based on your understanding of the structure of the chromosome, why might it take longer to complete prophase than the other phases of nuclear division?

Because the centrioles need to separate, the spindle needs to form, and the nuclear envelope breaks down. All of these functions take time and occur concurrently in the prophase.

4. How do you account for variability in the data collected from different lab groups?

You use a large enough sample and possibly discard data which falls outside a significant numbers of standard deviations.

5. If you examined cells in the Zone of Differentiation (Zone of Maturation) would you expect to get similar results? Why or why not?

No, in a different zone there may be more or less cells dividing at one time, meaning there may be more cells in the interphase.

6. Why did you choose the type of graph you chose?

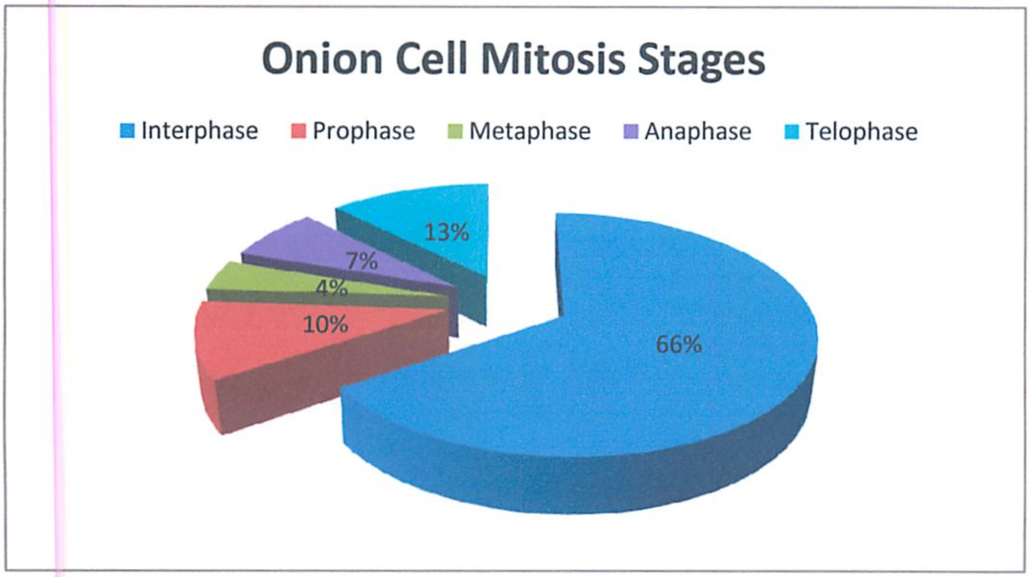
The spreadsheet calculated the percentage of each segment of mitosis. The percentages add up to 100%. A pie chart shows the breakdown when percentages add up to 100%.

Michael Plasmeier + Melanie Sotano

Data Table Step 3

4th Period Biology

Stage	Total # of Cells	% of Time	Field 1	Field 2	Field 3
Interphase	63	65.6	37	15	11
Prophase	10	10.4	0	7	3
Metaphase	4	4.2	2	2	0
Anaphase	7	7.3	1	3	3
Telophase	12	12.5	0	8	4
Total Observed	96		40	35	21



Nice!! ✓

11.1 Mendel

4/23

misosis
- 1 cell to 4
- only replecate DNA once

sexual reproduction creates genetic diversity
- why we go through the trouble

heredity - transfering traits from one generation to another

similarity + variation
- both occur

genitics is study of genitics + variation

genes = hereditory units
↑ segments of DNA

Gametes - reproductive cells
- transmit genes

locus - gene's location on the cromosome

2 types of reproduction

<u>asexual</u> - cell just splits (mitosis)
genetically identical (clones)
fast + effective
but no diversity

→

sexual reproduction
- new organism combo of 2 haploid sex cells (gametes)
- usually come from different parents
- new organism = zygote w/ 2 sets of chromosomes (diploid)

Mendel's Peas
- father of genetics
- failed teacher exam
- professors: Christian Doppler
  Franz Unger
- had lots of help - not just him alone in a garden

character - heritable feature
- each varient is called a trait

could control maiting of plants

started with pure breeding plants

removed plant's ability to self fertalize
- so he could manually bread them

Cross bread → hybrids

P = pure bread ← only get what start w/
F_1 = first offspring

Others though Purple + White would make light purple
- But it was Purple every time in F_1 generation
  - ↑ the dominate trait that was masking the white
    - dominate ≠ most common in generation
    - dworfism for example

In F_2 - the white flower <u>reappeared</u>
- he thought were units of hereditary

Looked at 7 different traits of peas
- this also happens in different plants
- always gets 3:1 ratio dominate trait : recessive trait

	P	p
P	PP	pP
p	Pp	pp

PP = homozygous dominate
Pp
pP) = heterozygous
pp = homozygous recessive

Phenotypically - what you look like
Genotypically - what genes you have
1:2:1 probability

Chapter 11: Introduction to Genetics Study Guide NAME: Michael Plasmeier ✓

VOCAB

- Genetics – The scientific study of heredity
- Fertilization – When the male and female reproductive cells join during sexual reproduction
- Trait – A specific characteristic (seed color or plant height) which varies from one individual to another
- True-breeding – Organisms which, if allowed to self pollinate, would produce identical offspring every time.

- Gene – Chemical factors which determine traits.
- Allele - one of two or more alternative forms of a gene, occupying the same position locus on paired chromosomes and controlling the same inherited characteristic
- Segregation – Separation of alleles during the formation of sex cells (gametes). Each parent produces on of each trait.
- Gametes - a specialized male or female cell with half the normal number of chromosomes that unites with a cell of the opposite sex in the process of sexual reproduction. Ova and spermatozoa are gametes that unite to produce a cell zygote that may develop into an embryo.

- Dominant – An organism with a dominate allele (1 or 2) will always portray the dominate trait
- Recessive – An organism without a dominate cell will portray the recessive trait – only pokes through without a recessive trait (used to describe a gene that produces an effect in an organism only when its matching allele is identical. The effect is masked when the matching allele is nonidentical.)

- Punnett Square – a diagram that is used to predict and compare the genetic variation that will result from a cross
- Homozygous – organisms with two identical alleles for a certain trait (TT or tt)
- Heterozygous – organisms with two different alleles for a certain trait (Tt or tt)

- Phenotype – physical characteristics
- Genotype – genetic makeup

- independent assortment – Alleles for different traits segregate independently of those for another trait. Accounts for the variation of genetic info in plants, animals, and other organisms.
- incomplete dominance – Cases where one allele is not completely dominate over one another and the trait exhibited appears to be somewhere in between the 2 parent phenotypes
- Codominance – Both alleles contribute to the phenotype. For example white + black = speckled
- Multiple allele trait - more than 2 possible alleles exist in a population (but still only 2 in one organism)
- Polygenic trait – Traits controlled by two or more genes

11.1 The Work of Mendel:

Describe Mendel's education and influences:

Mendel studies breeding in pea plant. He wanted to figure out the reasons why certain traits showed up in children where both parents do not exhibit the trait.

How did the structure of flowers allow Mendel to perform his experiments.

The plants self-fertilization could be disabled, and the plants could be manually cross fertilized by Mendel.

Describe Mendel's experiments (traits he studied, generations, P, F1, F2 generations, etc.)

7 traits (dominate first):

- Seed Shape: Round vs Wrinkled
- Seed Color: Yellow vs Green
- Seed Coat Color: Gray vs White
- Pod Shape: Smooth vs Constricted
- Pod Color: Green vs Yellow

- Pod Color: Green vs Yellow
- Flower position: Axial vs Terminal
- Plant height: Tall vs Short

He first let a population reproduce several times to make sure that it was true-breading (P Generation). He then cross bred plants with different traits (in the same category) with each other. This was the F1 generation. He then crossed some F1 with each other to produce the F2 generation. Some plants (about ¼) in the F2 generation showed traits not exhibited by any plants before them.

Does dominant mean that an allele is more abundant in a population? Explain.
No. It only means that when an organism has at least 1 of that gene, the organism will exhibit that trait.

How does segregation explain the F1 cross results?
Alleles for each of the traits separate during the formation of sex cells (gametes) randomly. Each plant randomly place one of the 2 alleles into a gamete.

11.2 Probabilities and Punnett squares – What are they? – They are ways of explaining the chanch that a certain plant will exhibit a certain phenotype or genotype.

(penny probability lab)
(Monohybrid and dihybrid cross worksheets….)

11.3 What are Mendel's Principles:

- Inheritance of biological characteristics is determined by individual units called genes. Genes are passed from parents to their offspring.
- In cases in which two or more forms (alleles) of the gene for a single trait exist, some forms of the gene may be dominate and some may be recessive
- In most sexually reproducing organisms, each adult has two copies of each gene – one from each parent. These genes are segregated from each other when gametes are formed
- The alleles for different genes usually separate independently of one another

Laws of Probability: Coin Toss Lab

Name(s) Michael Plasmeier + Melanie Solano
Period 4

Few concepts have had greater effect on the science of genetics than the laws of probability. Probability refers to the chance of something happening. Under normal conditions, probability calculations can give us good ideas of what to expect from different genetic combinations. A thorough understanding of probability was instrumental in leading Gregor Mendel to his basic conclusions about genetics, and these same laws of probability play an essential role in genetics today.

Objectives:

- Explain the role of sample size in estimating probability
- Calculate the probability of occurrence of a single event. Calculate the probability of simultaneous occurrence of two independent events.
- Compute a percent deviation from expected values for data gathered
- Apply the fundamental principles of probability to genetic problems

Materials:

- 2 coins (same size)
- lab write-up
- calculator
- textbook

Procedure:

This lab involves coin flipping. The two sides of a coin could also be thought of as dominant and recessive alleles for a given trait.

1. Fill in the EXPECTED results for each side of the coin AND for both the 10 and 50 tosses in Chart 1 (next page). Expected results can be determined based on probability.
2. **Toss a single coin 10 times**. Record the number of heads AND tails that result from the 10 tosses in Chart 1 under OBSERVED (keep tally marks on separate sheet of paper and place only the total in Chart 1).
3. **Toss the coin 50 times and again record the results**. Record the number of heads AND tails in Chart 1 under OBSERVED (keep tally marks on separate sheet of paper and place only the total in Chart 1).
4. After predictions are made for a given event and actual data are gathered, ***the deviation***, or difference between observed and expected, can be figured. This is usually expressed as a percentage and is an indication of the degree of error. If the percent deviation is small (approximately 10 % or less), we can say it is due to chance. If the value is large, other unknown factors may have entered into the experiment.
5. Use the formula to compute the percent deviation for each trait. What is the relationship between sample size and the degree of error for a chance occurrence?
6. Write your results from the tosses on the board. Once totals are calculated, write totals in Chart 1 in the row for "Class."

Degree of error ↓ when sample size ↑ - this is an inverse relationship

How to compute % deviation

$$\% \text{ deviation} = \frac{\text{Sum of differences from expected}}{\text{Total occurrences}} \text{ X } 100$$

Example: A coin is tossed 10 times producing 7 heads and 3 tails. The deviation is computed as follows

	Observed	Expected	Difference from expected
Heads	7	5	2
Tails	3	5	2 (disregard negative value}
Total Occurrences	10	10	4 (sum of differences)

Deviation $\frac{4}{10}$ **= .4 X 100 40%**

Chart 1: Tossing One Coin

Number of tosses	Heads			Tails			% Deviation
	Expected	Observed	Difference	Expected	Observed	Difference	
10	5	6	1	5	4	1	$\frac{1}{10}$ = 10
50	25	26	1	25	24	1	$\frac{2}{50}$ = 4
Class 10	96	99	3	96	93	3	$\frac{6}{192}$ = 3.13
Class 50	475	465	10	475	485	10	$\frac{20}{950}$ = 4.21

Independent Events Occurring Simultaneously

How does chance operate with two independent events occurring simultaneously, such as two coins being flipped at once? Will the chance of flipping two heads at once be greater or less than ½ (50-50)?

1. Complete the EXPECTED results of Chart 2.
   The expected results can be generalized in the following manner
   a. The probability of two independent events occurring at the same time is the product of their individual probabilities.
2. Using your book as a backstop, **flip two coins 40 times**, recording the results under OBSERVED in the table below. Write your results on the board. ALSO record class results, once they have been totaled.
3. For the class results, what approximate fraction of the tossed turned out both heads (1/2, 1/4, 1/8)?______________ both tails?______________ heads and tails?______________ If the chance of flipping one head with a coin is 50%, then the probability of flipping two heads at once is achieved by (adding or multiplying)________________ the separate probabilities.
4. Which comes closer to the expected- the class or the individual results? ____________
5. If the probability of flipping a head or tail on a coin is ½, why did approximately ½, rather than ¼, of the tosses result in a heads-tails combination?

____

____

____

1=HH
2=Ht
3=TH
4=Tt

2	4	4	4
1	4	4	4
2	2	1	2
2	3	1	4
4	4	4	2
3	3	4	2
4	1	3	3
4	1	2	
4	4	3	
2	4	2	
1	2	4	

$\frac{1}{6}$ $\frac{2}{11}$ $\frac{3}{6}$ $\frac{4}{17}$

Chart 2: Tossing Two Coins

Tosses	Individual		Class	
	Observed	Expected	Observed	Expected
Heads-Heads	6	10		
Heads-Tails	17	20		
Tails-Tails	17	10		
Total Tosses	40	40		

Probability and Genetics:

1. The result of flipping two coins is much like the situation in a monohybrid cross when both parents have the genotype Aa. When Aa produces gametes (Sex cells) by meiosis, ½ will be A and ½ will be a.
2. Fill out the Punnett squares below to see the similarity between the results of the coin flips and the results of the monohybrid cross. What fraction of the offspring should receive the alleles aa? 1/4
3. It there is only one offspring, what are its chances of receiving the alleles Aa? 1/2

	Heads (H)	Tails (T)
Heads (H)	HH	HT
Tails (T)	HT	TT

	1/2 A	1/2 a
1/2 A	AA	Aa
1/2 a	Aa	aa

Analysis

1. Do the Punnett squares in genetics problems tell you what must happen or what might happen? Explain?
   They tell you what can happen in an individual but what will happen in a poupulation
2. Why was it important to calculate the class data in a coin toss experiment?
   To have a lorger sample size
3. Would a small deviation in an experiment mean that something was wrong with the experiment? Explain.
   No, it could just be a chanch probability that it didn't work out.
4. If three coins are flipped simultaneously, what is the probability that all three will be heads?
   1/8

HHH THH
HHT THT
HTH TTH
HTT TTT

$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

5. A man and a woman have five children, all girls. Is it correct to assume that, if they have another child, probability would favor it being a boy? Explain.

No. Each event is seperate.

6. A penny tossed 120 times results in 62 heads and 58 tails. In the space below, calculate the expected number of heads and tails and determine the percent deviation.

Expected 60 heads
60 tails

$\frac{4}{120} = \frac{1}{30} = 3.33\%$

7. In a monohybrid cross involving dominance, two purple flowers (Ff) are crossed producing 160 offspring. Of the offspring, 115 are purple (FF and Ff) and 45 are white (ff). Determine the expected results and, in the space below, calculate the percent deviation. The experimental hypothesis is that the purple color is dominant to white and that both parents are hybrid for purple color. Based on your work, do you feel the actual results are close enough to the expected results to make the experimental hypothesis acceptable? Explain.

FF	Ff
fF	ff

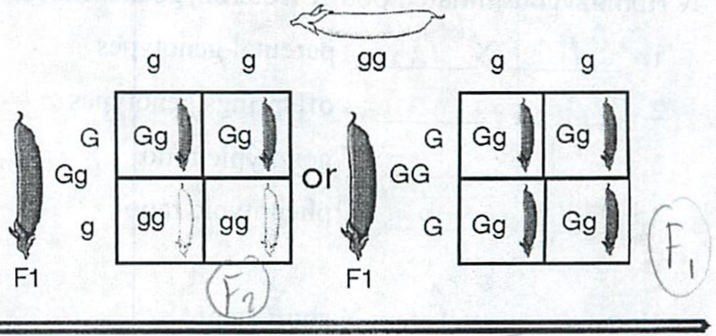
40
46
46 } purple 120
40 white

$\frac{10}{160} = 6.25\%$

Yes this is close. The hypothesis is confirmed by the results. However they should expand their sample sizes.

Name Michael Plasmeier 10/10 Date 4/24 Period ___

Monohybrid Crosses



Similar to

Objectives:

1. To determine genotype when given the phenotype.
2. To construct Punnett Squares predicting the offspring from parents given.
3. To deduce the genotypic & phenotypic ratios for offspring.

Outcomes:

1. Completed worksheet &
2. Illustration of solution process by accompanying Punnett Squares

dominate ↓ A a ↓ recessive

I. Simple Dominance

a. Pea plants

i. Heterozygous axial flower X terminal flower

1. Aa X aa parental genotypes
2. Aa ; aa offsprings genotypes
3. 1 : 1 genotypic ratio
4. 1 : 1 phenotypic ratio

axial Terminal

	A	a
a	Aa	aa
a	Aa	aa

✓

ii. Homozygous green pod X yellow pod

1. AA X aa parental genotypes
2. Aa offsprings genotypes
3. Every hetero green genotypic ratio
4. ↓ phenotypic ratio

green

	A	A
a	Aa	Aa
a	Aa	Aa

✓

iii. Heterozygous round seed X Heterozygous round seed

1. Aa X Aa parental genotypes
2. AA : Aa ; aa offsprings genotypes
3. 1 : 2 : 1 genotypic ratio
4. 3 : 1 phenotypic ratio

round wrinkled

	A	a
A	AA	Aa
a	Aa	aa

✓

iv.Homozygous inflated pod X Heterozygous inflated pod

1. AA X Aa parental genotypes
2. AA ; Aa offsprings genotypes
3. 1 : 1 genotypic ratio
4. All Same inflated phenotypic ratio

✓

	A	A
A	AA	AA
a	Aa	Aa

v.Heterozygous tall stem X short stem

1. Aa X aa parental genotypes
2. Aa ; aa offsprings genotypes
3. 1 : 1 genotypic ratio
4. 1 : 1 phenotypic ratio

tall short

✓

	A	a
a	Aa	aa
a	Aa	aa

b. Guinea pigs

i.Homozygous rough fur X smooth fur

1. AA X aa parental genotype
2. Aa offspring genotypes
3. same hetero genotypic ratio
4. Same rough phenotypic ratio

✓

	A	A
a	Aa	Aa
a	Aa	Aa

ii.Heterozygous rough fur X Heterozygous rough fur

1. Aa X Aa parental genotype
2. AA ; Aa ; aa offspring genotypes
3. 1 : 2 : 1 genotypic ratio
4. 3 : 1 phenotypic ratio

rough smooth

✓

	A	a
A	AA	Aa
a	Aa	aa

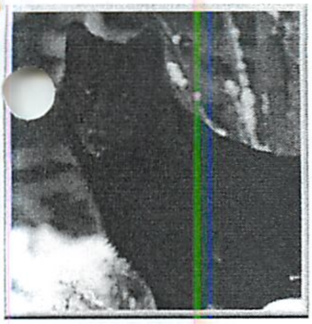
c. Rabbits

i.Homozygous black fur X heterozygous black fur

1. AA X Aa parental genotypes
2. AA ; Aa offspring genotypes
3. 1 : 1 genotypic ratio
4. Same -black phenotypic ratio

✓

	A	A
A	AA	AA
a	Aa	Aa



Dihybrid Crosses:

In wolves, grey coat color is dominant to black coat color. Also in wolves, blue eyes are recessive to brown eyes.

10/10

Name: Michael Plasmeier

Show Your Work Below:

1. Develop a "key" showing the letters for the two traits. (Each trait should have a different letter). Show the phenotypes of your letters as well. Ex: GG = grey coat; bb = blue eyes

GG = Grey coat
gg = black coat
BB = brown eyes
bb = blue eyes

✓

2. A male wolf with grey coat and blue eyes is crossed with a female that is heterozygous for both traits. Show the genotypes of these two parents: GGbb vs. GgBb ✓

3. Draw a punnet square showing the resulting offspring

	Gb	Gb	Gb	Gb	
GB	GGBb	GGBb	GGBb	GGBb	grey, brown
Gb	GGbb	GGbb	GGbb	GGbb	grey, blue
gB	GgBb	GgBb	GgBb	GgBb	grey, brown
gb	Ggbb	Ggbb	Ggbb	Ggbb	Grey, blue

✓

4. Show the ratios of the resulting phenotypes, use fractions.

Grey brown $\frac{1}{2}$
Grey blue $\frac{1}{2}$

✓

5. A female that has a black coat and blue eyes is crossed with a male that is homozygous dominant for both traits. Show the genotypes of the parents.

ggbb vs GGBB ✓

6. Draw a punnet square showing the resulting offspring

	gb	gb	gb	gb	
GB	GgBb	GgBb	GgBb	GgBb	grey brown
GB	GgBb	GgBb	GgBb	GgBb	
GB	GgBb	GgBb	GgBb	GgBb	
GB	GgBb	GgBb	GgBb	GgBb	

✓

7. Show the ratios of the resulting phenotypes, use fractions

All grey brown ✓

8. A male wolf that is heterozygous for both traits is crossed with a female wolf that is heterozygous for both traits. Show the genotypes of the two parents.

GgBb vs. GgBb ✓

9. Draw a punnet square showing the resulting offspring.

back

10. Show the ratios of the resulting phenotypes, use fractions.

GgBb vs GgBb

	GB	Gb	gB	gb
GB	GBGB	GGBb	GgBB	GgBb
Gb	GGBb	GGbb	GgBb	Ggbb
gB	GgBB	GgBb	ggBB	ggBb
gb	GgBb	Ggbb	ggBb	ggbb

✓

9 : 3 : 3 : 1 ✓

grey brown : grey blue : black brown : black blue

Michael Plasmeier 4/28

Constructing a Pedigree

Introduction

A pedigree is a special chart or family tree that uses a particular set of standardized symbols. Pedigrees are used to show the history of inherited traits through a family. In a pedigree, males are represented by squares ☐and females by circles ○. An individual who exhibits the trait in question, for example, someone who suffers from hemophilia, is represented by a filled symbol ■or ●. A horizontal line between two symbols represents a mating ☐-○ . The offspring are connected to each other by a horizontal line above the symbols and to the parents by vertical lines. Roman numerals (I, II, III, etc.) symbolize generations. Arabic numerals (1,2,3, etc.) symbolize birth order within each generation. In this way, any individual within the pedigree can be identified by the combination of two numbers (i.e., individual II3).

Objective

Inherited traits can be traced through a family's history by constructing a pedigree chart.

Materials

Large sheet of paper or poster board
Markers
Ruler
Protractor

Procedure

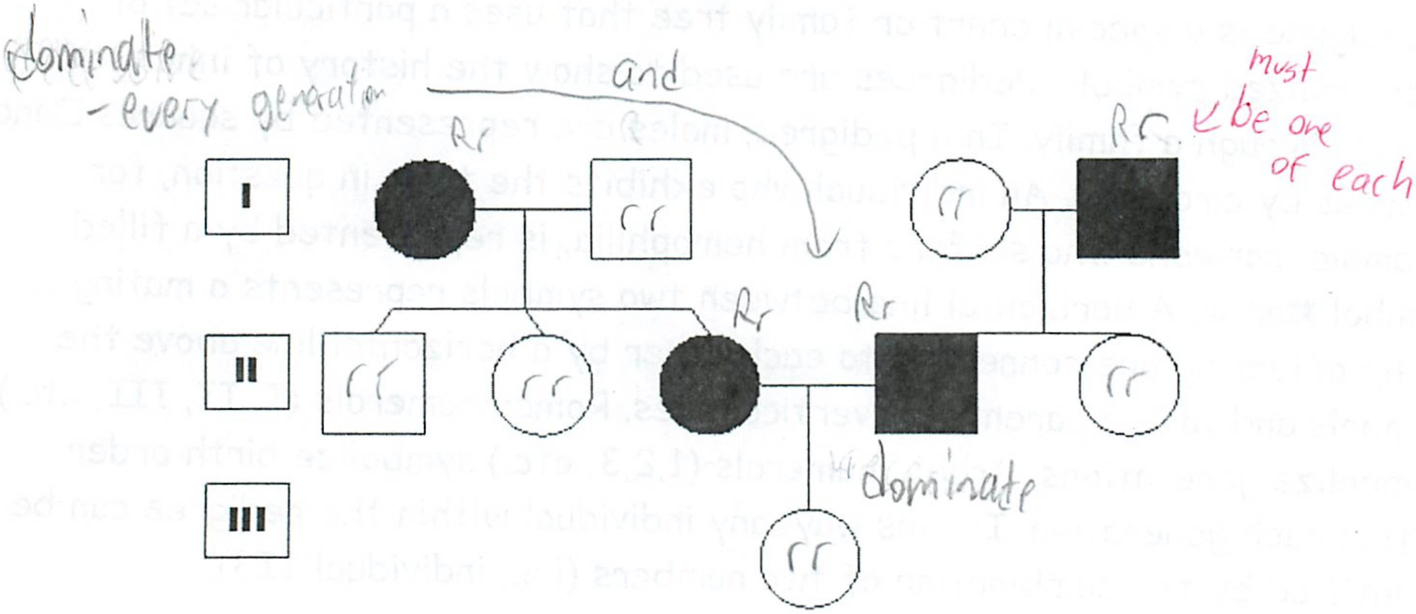
Part 1

1. Examine Figure 1 that traces the ability to roll your tongue through

three generations in a family. **Remember: Blackened circles show the trait and circles are females and squares are male.**

2. Determine which parents and which offspring would be able to roll their tongue.

FIGURE 1



Part 2

3. Read the Passage 1 about the Smith family and their inherited trait of dimples.

4. After reading the passage, construct a pedigree showing all family members in each generation that does and does NOT have dimples.

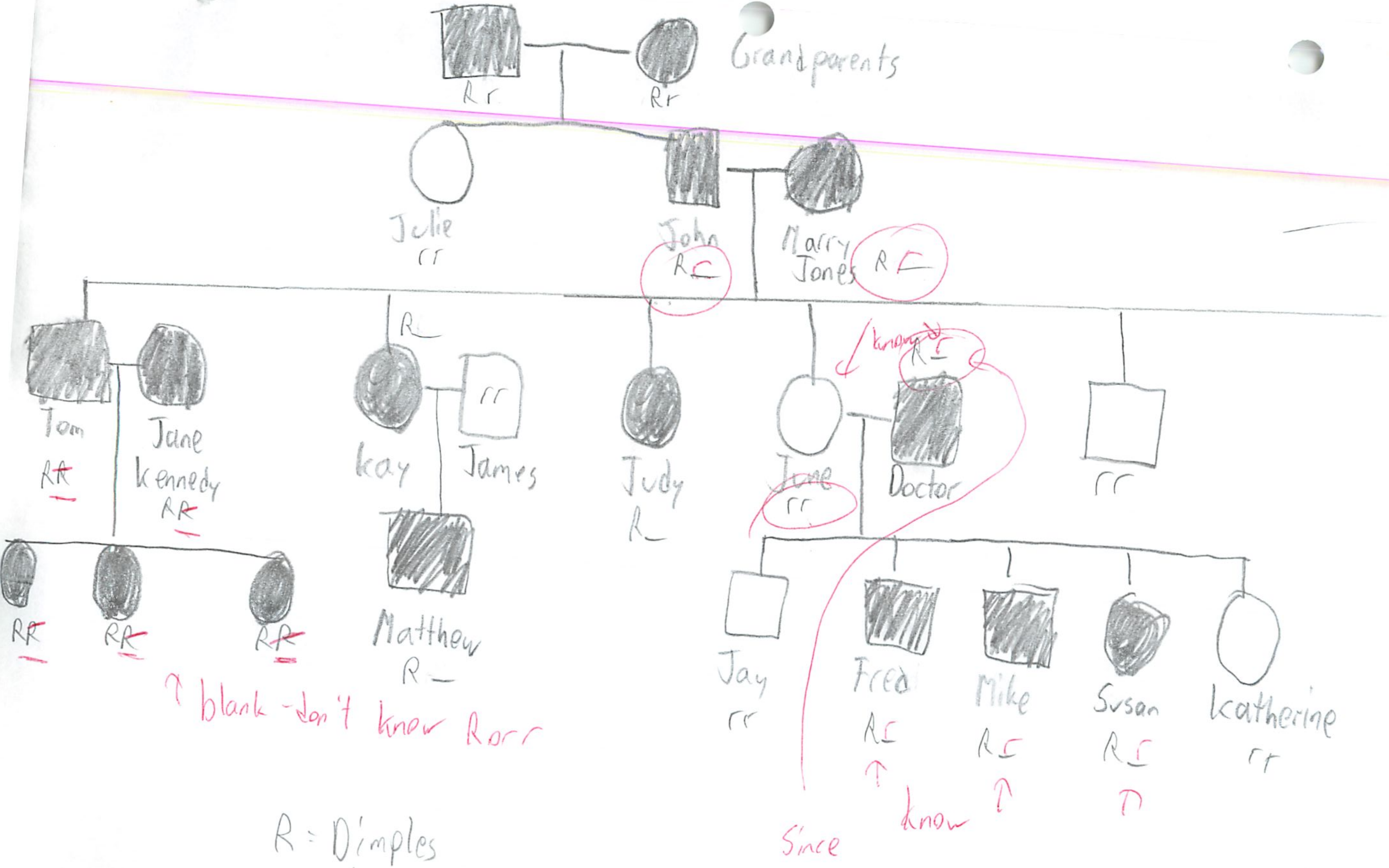
5. Once the pedigree is constructed, **write the correct genotype by each person in the family.**

Passage 1

Grandfather and Grandmother Smith smiled a lot and showed off their dimples each time. They had a son named John, who had dimples, and daughter named Julie, who did not. Julie died at an early age, but her brother John Smith met and married Mary Jones because she had the most beautiful dimples when she smiled. They had 5 children, 2 boys and 3 girls. Only one of their sons, Tom, had dimples, but both girls, Judy and Kay, had dimpled smiles. Their sister June lacked dimples. After college, Tom met and married Jane Kennedy who also had dimples. They had 3 children, all girls, who shared their parent's dimpled smile. Tom's sister Kay married a lawyer named James who seldom smiled and didn't have dimples. Their only son Matthew was like his mother when he smiled. Judy never married. Tom's sister, June, married a doctor and had 5 children. Three of the children were boys, Jay, Fred, and Mike. Mike and Fred had dimples like dad, but Jay's smile was like his mom's lacking dimples. One sister, Susan, had dimples, but the other, Katherine, didn't.

Questions

1. What type of information does a pedigree contain?
   family history of a certain phenotype
2. How do you show the presence of a trait in a pedigree?
   A filled in square or circle
3. How do you denote males & females in a pedigree?
   ☐ ○
4. From your pedigree, is the presence of dimples a dominant or recessive trait? Dominant
5. How could examining a family pedigree be helpful to a couple wanting to have children? It wold tell them how likely their child will have the specifed phenotype based on their family history



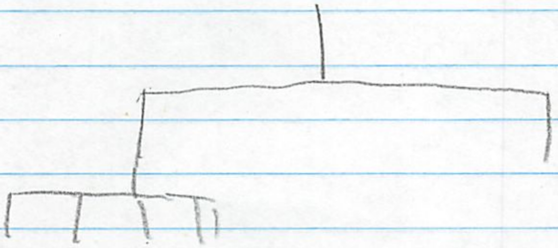
R = Dimples
r = clear faced

8/8

Pedigrees

4/28

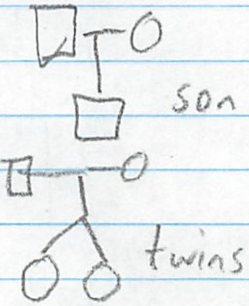
-diagram like a Punnet square



□ = male
○ = female

■ have
● have
□○ not have

□—○ married
□═○ married in family



Autosomal = not on X or Y

dominate traits - show up in every generation
some diseases are gender dominated

recessive trait - does not show up in the parents (parents = carriers)

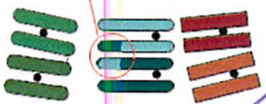
Meiosis - Internet Lesson **Name: Michael Plasmeier**

In this investigation, you will view sites that illustrate the process of meiosis. For each site answer the questions associated.

Site 1 - Lew-Port's Meiosis Page

http://www.lewport.wnyric.org/jwanamaker/animations.htm -->
click on Meiosis

1. How many chromosomes does the cell in this animation start with ? 3
2. The homologous pairs are represented by similar colors
3. Copies of chromosomes are held together by the centromere
4. Each chromosome finds its partner
5. Draw "crossing over" - using your pencil to shade in the areas that exchange parts. (yes, you have to draw it….).



Nice

6. How many chromosomes are at each pole of the cell? Half
7. During meiosis 2, chromosomes line up again along the cell's equator.
8. Only one copy of each chromosome moves toward the poles. Which means only 3 chromosomes of the original six.
9. New membranes form around each new nucleus of a gamete cell
10. Each cell divides, forming a total of 4 cells.

Site 2 - Sumanas Inc., Animation of Meiosis

http://www.sumanasinc.com/webcontent/anisamples/majorsbiology/
---> click on Meiosis

11. Read the introduction. Explain the difference between sexual and asexual reproduction.

Asexual reproduction just involved mitosis and creates an identical copy of the cell (genetically identical diploid cell). On the other hand meiosis produces 4 genetically different haploid cells. These cells must then mate with another gamete (from another parent perhaps) in order to create an offspring which is genetically different.

(Click to Animation)

12. DNA replication takes place when? During interphase I before meiosis
13. Meiosis consists of two cell divisions: meiosis I & meiosis II
14. Centrosomes migrate to opposite poles of the cell
15. The pairing of homologous chromosomes is called: synapsis
16. Crossing over points are called chiasmata
17. What happens in metaphase I: homologous chromosomes have lined up on the equatorial plate in a pair wise fashion, with one chromosome on each plate
18. What happens during anaphase I chromosomes from each pair move to opposite poles of the cell. The centromeres do not divide, so each chromosome still consists of 2 sister chromatids (may not be identical)
19. What is interkinesis? A short interphase period which occurs in some organisms after the cell has split in two during meiosis I – no DNA replication!
20. In prophase II, each cells is haploid
21. In metaphase II, chromosomes line up in single file on the equatorial plate.
22. What happens during telophase II? Chromosomes again decondense and nuclear membranes re-form. Depending on the species, cytokinesis may occur.

23. **(Click to Conclusion).** Each of the four daughter cells produced by meiosis is unique

(Click to Quiz)
24. With respect to meiosis, when does DNA replication occur? Before meiosis I only
25. When does crossing over occur? Prophase 1
26. During which phase do chromosomes line up along the equator? Metaphase I and II
27. During which phase does the nuclear membrane form around the chromosomes? Telophase II

Site 3 - Biology in Motion - Meiosis

Go to
http://www.biologyinmotion.com
--> click on "Cell Division Exercise" --> Click on "Practice Meiosis" did not work

28. There are two ways in which the chromosomes can end up after meiosis. Sketch the two ways and indicate by color the chromosomes (use the following color codes: Purple, Dark Purple, Green, Dark green)

Site 4: PBS: Mitosis vs. Meiosis

http://www.pbs.org/wgbh/nova/baby/
Click on "How Cells Divide" --> Click on "Mitosis vs. Meiosis"
29. After viewing the animation, fill out the chart below, by placing a check in the box or boxes to indicate which the event occurs in (some events might have checks for both mitosis and meiosis).

	Mitosis	**Meiosis**
Two cell divisions	x	~~?at first~~
Centrioles appear	x	x
Homologous chromosomes pair		x ??
Spindle fibers form	x	x
Homologous chromosomes split		x ??
Cytokinesis	x	x
Four daughter cells		x
Sister chromatids split		x

Name: ____________________ **Class:** ________________ **Date:** ________ **ID: A**

Classical Genetics

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Organisms that have two identical alleles for a particular trait are said to be
a. hybrid.
c. dominant.
b. homozygous.
d. heterozygous.

____ 2. Chromosomes form tetrads during
a. metaphase of meiosis I.
c. prophase of meiosis II.
b. metaphase of meiosis II.
d. prophase of meiosis I.

____ 3. The failure of chromosomes to separate during meiosis is called
a. X-chromosome inactivation.
c. nondisjunction.
b. Down syndrome.
d. Turner's syndrome.

____ 4. Which of the following combinations of sex chromosomes represents a female?
a. XXXY
c. XXY
b. XX
d. XY

____ 5. A cross of a white hen with a black rooster produces erminette-color offspring. This type of inheritance is known as
a. codominance.
c. polygenic inheritance.
b. multiple alleles.
d. incomplete dominance.

____ 6. How many chromosomes are shown in a normal human karyotype?
a. 44
c. 2
b. 23
d. 46

____ 7. Situations in which one allele for a gene is not completely dominant over another allele for that gene are called
a. codominant alleles.
c. multiple alleles.
b. multiple genes.
d. incomplete dominance.

____ 8. Sex-linked genes are located on
a. the autosomes.
b. the X chromosome only.
c. both the X chromosome and Y chromosome.
d. the Y chromosome only.

____ 9. Which of the following genotypes result in the same phenotype?
a. IBIB and IBi
c. IBIB and IAIB
b. IAIA and IAIB
d. IBi and ii

____ 10. A Barr body is
a. an activated X chromosome.
b. a condensed Y chromosome that is inactive.
c. a condensed X chromosome that is inactive.
d. an activated Y chromosome.

____ 11. What is the approximate probability that a human offspring will be female?
a. 50 percent
c. 25 percent
b. 10 percent
d. 75 percent

____ 12. Colorblindness is more common in males than in females because
- a. the allele for colorblindness is recessive and located on the X chromosome.
- b. fathers pass the allele for colorblindness to their sons only.
- c. the allele for colorblindness is located on the Y chromosome.
- d. males who are colorblind have two copies of the allele for colorblindness.

____ 13. Gametes are produced by the process of
- a. meiosis.
- b. mitosis.
- c. crossing-over.
- d. replication.

____ 14. In humans, a male has
- a. one X chromosome only.
- b. two Y chromosomes.
- c. two X chromosomes.
- d. one X chromosome and one Y chromosome.

____ 15. When Mendel crossed true-breeding tall plants with true-breeding short plants, all the offspring were tall because
- a. they were true-breeding like their parents.
- b. the allele for tall plants is dominant.
- c. the allele for tall plants is recessive.
- d. the allele for short plants is dominant.

____ 16. In the P generation, a tall plant was crossed with a short plant. Short plants reappeared in the F2 generation because
- a. the allele for shortness and the allele for tallness segregated when the F1 plants produced gametes.
- b. some of the F2 plants produced gametes that carried the allele for shortness.
- c. the allele for shortness is dominant.
- d. they inherited an allele for shortness from one parent and an allele for tallness from the other parent.

____ 17. How many different allele combinations would be found in the gametes produced by a pea plant whose genotype was RrYY?
- a. 8
- b. 2
- c. 16
- d. 4

____ 18. Two plants with the genotypes TT and Tt
- a. have all dominant alleles.
- b. would have the same phenotype.
- c. have all recessive alleles.
- d. would have different phenotypes.

____ 19. In a pedigree, a circle represents a(an)
- a. child.
- b. male.
- c. female.
- d. adult.

____ 20. Unlike mitosis, meiosis results in the formation of
- a. diploid cells.
- b. body cells.
- c. haploid cells.
- d. 2N daughter cells.

____ 21. A Punnett square shows all of the following EXCEPT
- a. the alleles in the gametes of each parent.
- b. the genotypes of the offspring.
- c. all possible results of a genetic cross.
- d. the actual results of a genetic cross.

____ 22. A pedigree CANNOT be used to
a. determine whether a trait is inherited.
b. show how a trait is passed from one generation to the next.
c. determine whether an allele is dominant or recessive.
d. none of the above

____ 23. Offspring that result from crosses between true-breeding parents with different traits
a. make up the F2 generation.
b. are true-breeding.
c. are called hybrids.
d. make up the parental generation.

____ 24. Human females produce egg cells that have
a. one X chromosome.
b. two X chromosomes.
c. one X and one Y chromosome.
d. one X or one Y chromosome.

____ 25. Unlike mitosis, meiosis results in the formation of
a. four genetically identical haploid cells.
b. four genetically different haploid cells.
c. two genetically different diploid cells.
d. two genetically identical diploid cells.

____ 26. What is the probability that a human sperm cell will carry an X chromosome?
a. 25 percent
b. 0 percent
c. 50 percent
d. 100 percent

____ 27. The principle of dominance states that
a. all alleles are recessive.
b. all alleles are dominant.
c. some alleles are dominant and others are recessive.
d. alleles are neither dominant nor recessive.

____ 28. Because the X chromosome contains genes that are vital for normal development, no baby has been born
a. with three X chromosomes.
b. with four X chromosomes.
c. with one X chromosome.
d. without an X chromosome.

____ 29. Linked genes
a. are always recessive.
b. assort independently.
c. are on the same chromosome.
d. are never separated.

Name: ______________________ **ID: A**

____ 30. What is shown in Figure 11-1?

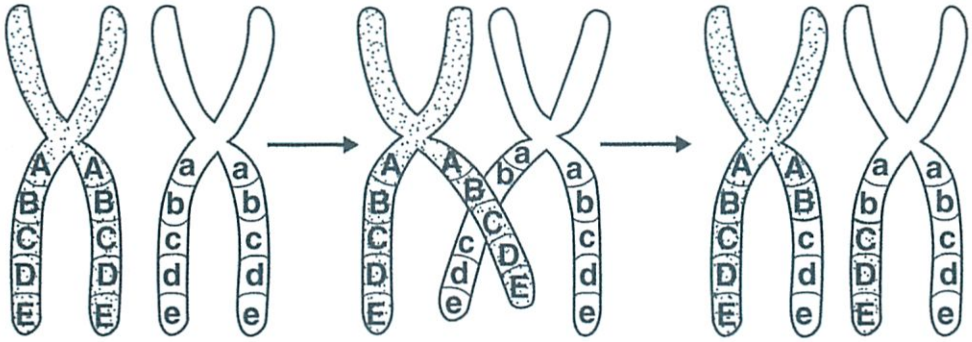


Figure 11–1

a. incomplete dominance
b. independent assortment
c. anaphase I of meiosis
d. crossing-over

Essay

31. You wish to determine whether a tall pea plant is homozygous or heterozygous for tallness. (Tall (T) is dominant to dwarf (t)) What cross should you perform to arrive at your answer? Explain your choice of cross.

Name: ______________________ **ID: A**

Other

USING SCIENCE SKILLS

Heterozygous male guinea pigs with black, rough hair (BbRr) are crossed with heterozygous female guinea pigs with black, rough hair (BbRr). The incomplete Punnett square in Figure 11-4 shows the expected results from the cross.

BbRr

		BR	***Br***	***bR***	***br***
BbRr	***BR***	***BBRR***	***BBRr***	***BbRR***	***BbRr***
	Br	***BBRr***	***BBrr***	***BbRr***	***Bbrr***
	bR	***BbRR***	***BbRr***	**?**	***bbRr***
	br	***BbRr***	***Bbrr***	***bbRr***	***bbrr***

Hair Color
***B* = Black**
***b* = White**

Hair Texture
***R* = Rough*r* =**
Smooth

Figure 11–4

32. **Using Tables and Graphs** Identify the genotype of the offspring that would be represented in the square labeled X in Figure 11-4.

33. **Analyzing Data** In Figure 11-4, what are the different phenotypes of the offspring?

34. **Using Tables and Graphs** Identify the phenotype of the offspring represented in the square labeled X in Figure 11-4.

35. **Analyzing Data** In Figure 11-4, what are the genotypes of the offspring that have black, rough hair?

36. **Calculating** What fraction of the offspring in Figure 11-4 is expected to have white, smooth hair?

USING SCIENCE SKILLS

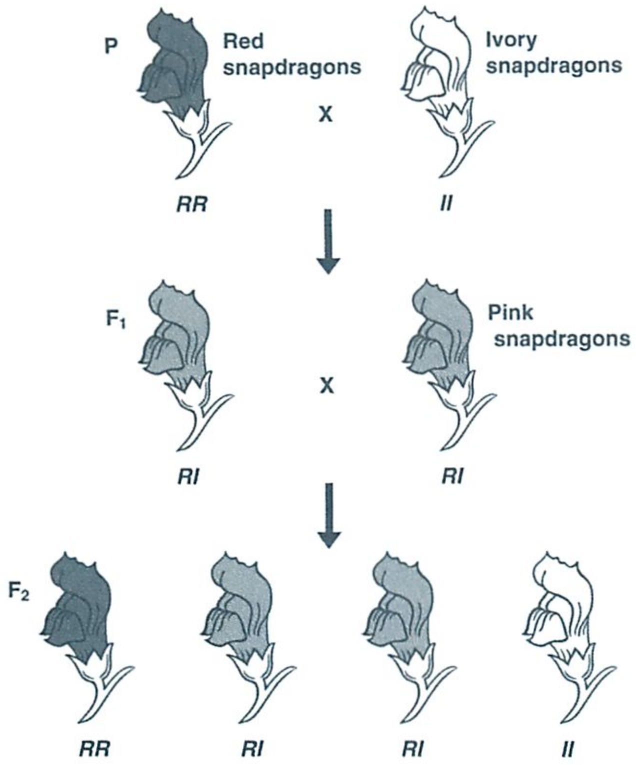


Figure 11–7

37. **Interpreting Graphics** In Figure 11-7, what is the genotype of the pink-flowered snapdragons?
38. **Inferring** What do the letters *R* and *I* represent in Figure 11-7?
39. **Inferring** According to Figure 11-7, if red-flowered snapdragons and ivory-flowered snapdragons are crossed, what percent of their offspring are expected to be pink-flowered?
40. **Inferring** Explain whether the alleles in Figure 11-7 show dominance, incomplete dominance, or codominance.
41. **Inferring** According to Figure 11-7, if two pink-flowered snapdragons are crossed, what percent of their offspring are expected to be pink-flowered?

USING SCIENCE SKILLS

The pedigree shows the inheritance of free earlobes and attached earlobes in five generations of a family. Attached earlobes is caused by a recessive allele (f).

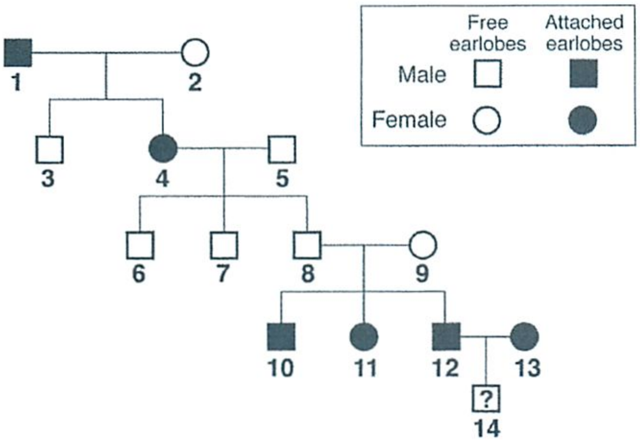


Figure 14–1

42. **Predicting** Predict the genotype and phenotype of individual 14 in Figure 14-1.
43. **Interpreting Graphics** In Figure 14-1, how many children of individuals 4 and 5 have attached earlobes?
44. **Inferring** Is individual 2 in Figure 14-1 homozygous or heterozygous for free earlobes? Explain.
45. **Inferring** Can you be certain of the genotype of individual 5 in Figure 14-1? Explain.
46. **Inferring** In Figure 14-1, are any of the descendents of individuals 1 and 2 homozygous for free earlobes? Explain your answer.

Genetics Test

5/7

Michael Plasmeier

5/~~6~~7/2008

Test A

88/100

1. B
2. ???C – no clue
3. C
4. B
5. D
6. D
7. D
8. C? - (though since everyone has at least one X, some traits on that gene will appear in both genders. However genes on the Y chromosome appear only in males) Also, from the dragon breeding, sex linked genes are also located on the autosomes)

-8

9. A
10. C
11. A
12. ??C (D does not make sense)
13. A
14. D (not always – the best answer would be at least one X chromosome and at least one Y chromosome)
15. B
16. A
17. C (4X4=16)
18. B
19. C (you gave us the answer on the last page!)
20. C
21. D
22. D (determine who the actual father or mother was)
23. C
24. A
25. B
26. C
27. C (and some are both or neither)
28. D
29. ?C
30. D
31. You should cross that plant with a short pea plant (tt) and produce a statistically valid number of offspring. If all of the offspring are tall, the plant you are trying to determine is homozygous for tall (TT). If about half of the offspring are tall and the other half are short, the plant you are trying to determine is heterozygous for tallness (Tt).

-4

32. bbRR ✓
33. Black hair, rough skin; Black hair, smooth skin; White hair, rough skin; White hair, smooth skin ✓
34. White hair, rough skin ✓
35. BBRR, BbRR, BbRr ✗ ?
36. 1 out of 16 ✓
37. RI ✓
38. R is dominate for red-flowered; I is dominate for ivory-flowered ✓
39. 100% or all of them ✓
40. ✗ Codominance – In the presence of both dominate alleles, the phenotype would be a combination (not a mix like the speckled cat's incomplete dominance) of the traits for both dominate alleles ✓
41. One half ✓
42. It will be ff since 14's parents are ff and ff. ✓
43. None of them ✓
44. Individual 2 is heterozygous for the dominate allele (Ff) since 2 's offspring exhibit both dominate and recessive traits. Since 1's mate is homozygous for the recessive trait (ff), one half of 1 and 2's offspring is predicted to exhibit the dominate phenotype and the other half are expected to exhibit the recessive phenotype. ✓
45. ✗ Individual 5 is likely to be homozygous for the dominate allele (FF) since all of his offspring exhibit the dominate phenotype.
46. No, since 1 is ff and 2 is Ff, that means that every descendent of 1 and 2 have at least one f allele, thus none of them can be homozygous for the dominate trait (FF) of free earlobes.

5/5

Mitosis	Meiosis
1 round	2 rounds
identical	unique
no diversity	Creates genetic diversity
asexual reproduction	used in sexual reproduction
no crossing over	crossing over
2 diploid cells created	4 hapliod cells created
* homologus cells split	* homologus chromosomes pair ↑tetrid

p 278

5/6

WARD'S

Simulated ABO & Rh Bood Typing Lab Activity

Student Study Guide

BACKGROUND

Around 1900, Karl Landsteiner discovered that there are at least four different kinds of human blood, determined by the presence or absence of specific agglutinogens (antigens) on the surface of red blood cells (erythrocytes). These antigens have been designated as A and B. Antibodies against antigens A or B begin to build up in the blood plasma shortly after birth, the levels peak at about eight to ten years of age, and the antibodies remain, in declining amounts, throughout the rest of a person's of life. The stimulus for antibody production is not clear; however, it has been proposed that antibody production is initiated by minute amounts of A and B antigens that may enter the body through food, bacteria, or other means. Humans normally produce antibodies against those antigens that are not on their erythrocytes: A person with A antigens has anti-B antibodies; a person with B antigens has anti-A antibodies; a person with neither A nor B antigens has both anti-A and anti-B antibodies; and a person with both A and B antigens has neither anti-A nor anti-B antibodies (Figure 1). Blood type is based on the antigens, not the antibodies, a person possesses.

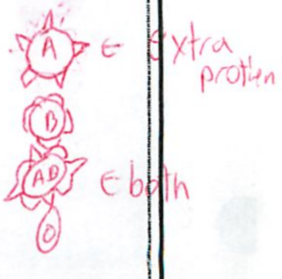
The four blood groups are types A, B, AB, and O. Blood type O, characterized by the absence of A and B agglutinogens, is the most common in the United States and is found in 45% of the population. Type A is next in frequency, and is found in 39% of the population. The frequencies at which types B and AB occur are 12% and 4% respectively.

Agglutinogens (Antigens): Agglutinogens are substances found on the surface of erythrocytes.

Agglutinins (Antibodies): Agglutinins are antibodies found in plasma.

Figure 1

Blood Type	Antigens on Erythrocytes (Agglutinogens)	Antibodies in Plasma (Agglutinins)	Can Give Blood To	Can Receive Blood From
A	A	Anti-B	A, AB	O, A
B	B	Anti-A	B, AB	O, B
AB	A and B	Neither Anti-A nor Anti-B	AB	O, A, B, AB
O	Neither A nor B	Both Anti-A and Anti-B	O, A, B, AB	O



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DID YOU KNOW?
The average life span of a red blood cell is about 120 days.

ABO System
Process of Agglutination

There is a simple test performed with antisera containing high levels of anti-A and anti-B agglutinins to determine blood type. Several drops of each kind of antiserum are added to separate samples of blood. If agglutination (clumping) occurs only in the suspension to which the anti-A serum was added, the blood type is A. If agglutination occurs only in the anti-B mixture, the blood type is B. Agglutination in both samples indicates that the blood type is AB. The absence of agglutination in any sample indicates that the blood type is O (Figure 2).

Figure 2
Agglutination Reaction of ABO Blood-Typing Sera

Reaction		Blood Type
Anti-A Serum	**Anti-B Serum**	
Agglutination	No Agglutination	A
No Agglutination	Agglutination	B
Agglutination	Agglutination	AB
No Agglutination	No Agglutination	O

Importance of Blood Typing

As noted in the table above, people can receive transfusions of only certain blood types, depending on the type of blood they have. If incompatible blood types are mixed, erythrocyte destruction, agglutination and other problems can occur. For instance, if a person with type B blood is transfused with blood type A, the recipient's anti-A antibodies will attack the incoming type A erythrocytes. The type A erythrocytes will be agglutinated, and hemoglobin will be released into the plasma. In addition, incoming anti-B antibodies of the type A blood may also attack the type B erythrocytes of the recipient, with similar results. This problem may not be serious, unless a large amount of blood is transfused.

DID YOU KNOW?
Donor blood contains only packed red blood cells. There is no plasma in donor blood, thus there are no antibodies present.

The ABO blood groups and other inherited antigen characteristics of red blood cells are often used in medico-legal situations involving identification of disputed paternity. A comparison of the blood groups of mother, child, and alleged father may exclude the man as a possible parent. Blood typing cannot prove that an individual is the father of a child; it merely indicates whether or not he possibly could be. For example, a child with a blood type of AB, whose mother is type A, could not have a man whose blood type is O as a father.

If have A type blood - have B antibodies
^ will clot the B type blood
+ white blood cells attack → aglutination

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if Rh (−) than can't use (+) blood

hard for ⊖ woman who have ⊕ ↑ most are babies - used to reject them, now it can deal w/ the medicine

The Genetics of Blood Types

The human blood types (A, B, AB, and O) are inherited by multiple alleles, which occurs when three or more genes occupy a single locus on a chromosome. Gene I^A codes for the synthesis of antigen (agglutinogen) A, gene I^B codes for the production of antigen B on the red blood cells, and gene i does not produce any antigens. The phenotypes listed in the table below are produced by the combinations of the three different alleles: I^A, I^B, and i. When genes I^B and I^A are present in an individual, both are fully expressed. Both I^A and I^B are dominant over i so the genotype of an individual with blood type O must be ii (Figure 3).

DID YOU KNOW?
Camels and their relatives are the only mammals having oval red blood cells.

Figure 3

Phenotype	Possible Genotypes
A	I^AI^A I^Ai
B	I^BI^B I^Bi
AB	I^AI^B
O	ii

Use I^A for antigen A, I^B for antigen B, and i for no antigens present.
Genes I^A and I^B are dominant over i.
AB blood type results when both genes I^A and I^B are present.

Rh System

In the period between 1900 and 1940, a great deal of research was done to discover the presence of other antigens in human red blood cells. In 1940, Landsteiner and Wiener reported that rabbit sera containing antibodies for the red blood cells of the Rhesus monkey would agglutinate the red blood cells of 5% of Caucasians. These antigens, six in all, were designated as the Rh (Rhesus) factor, and they were given the letters C, c, D, d, E, and e by Fischer and Race. Of these six antigens, the D factor is found in 85% of Caucasians, 94% of African Americans, and 99% of Asians. An individual who possesses these antigens is designated Rh^+; an individual who lacks them is designated Rh^-. seperate from blood type ABO

DID YOU KNOW?
Rh is so named because the initial study was done with Rhesus monkeys.

The genetics of the Rh blood group system is complicated by the fact that more than one antigen can be identified by the presence of a given Rh gene. Initially, the Rh phenotype was thought to be determined by a single pair of alleles. However, there are at least eight alleles for the Rh factor. To simplify matters, consider one allele: Rh^+ is dominant over Rh^-; therefore, a person with an Rh^+/Rh^- or Rh^+/Rh^+ genotype has Rh^+ blood.

+ or −

simplifed

The anti-Rh antibodies of the system are not normally present in the plasma, but anti-Rh antibodies can be produced upon exposure and sensitization to Rh antigens. Sensitization can occur when Rh^+ blood is transfused into an Rh^- recipient, or when an Rh^- mother carries a fetus who is Rh^+. In the latter case, some of the fetal Rh antigens may enter the mother's circulation and sensitize her so that she begins to produce anti-Rh antibodies against the fetal antigens. In most cases, sensitization to the Rh antigens takes place toward the end of pregnancy, but because it takes some time to build up the anti-Rh antibodies, the first Rh^+ child carried by a previously unsensitized mother is usually unaffected. However, if an Rh^- mother, or a mother previously sensitized by a blood transfusion or a previous Rh^+ pregnancy, carries an Rh^+ fetus, maternal anti-Rh antibodies may enter the fetus' circulation, causing the agglutination and hemolysis of fetal erythrocytes and resulting in a condition known as erythroblastosis fetalis (hemolytic disease of the newborn). To treat an infant in a severe case, the infant's Rh^+ blood is removed and replaced with Rh^- blood from an unsensitized donor to reduce the level of anti-Rh antibodies.

Blood Components

The formed elements in blood include erythrocytes, or red blood cells (RBCs); various types of leukocytes, or white blood cells (WBCs); and platelets.

Erythrocytes are circular, biconcave disks of 5 to 8 micrometers. Their chief function is to transport oxygen (O_2) and carbon dioxide (CO_2). The transport of O_2 and CO_2 depends largely on the hemoglobin present in the erythrocytes. The biconcave shape is also related to the erythrocytes function of transporting gases, in that it provides an increased surface area through which gases can diffuse.

The number of circulating RBCs is closely related to the blood's oxygen-carrying capacity. Any changes in the RBC count may be significant. RBC counts are routinely made to diagnose and evaluate the course of various diseases.

Leukocytes range in size from approximately 9 to 25 micrometers and function primarily to control various disease conditions. Leukocytes can move against the current of the bloodstream through amoeboid movement, and pass through the blood vessel walls to enter the tissues. The total WBC count normally varies from 5,000 to 10,000/mm^3. Certain infectious diseases are accompanied by an increase in WBCs. If the number exceeds 10,000/mm^3, the person has an acute infection. If it drops below 5,000/mm^3, the person may have a condition such as measles or chicken pox. The percentage of the different types of leukocytes present in the blood may also change in particular diseases, this number is important for diagnostic purposes and is called a differential count.

DID YOU KNOW?

Leukocytes are capable of amoeboid movement and are sometimes called amoebocytes.

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OBJECTIVES

- Define agglutinogen and agglutinin
- Perform an actual blood typing procedure
- Observe the antigen/antibody reaction in simulated blood
- Determine the ABO and Rh blood type of four unknown samples
- Prepare a wet mount of simulated blood
- Estimate the number of erythrocytes and leukocytes in normal blood
- Understand requirements for blood transfusions

MATERIALS

MATERIALS NEEDED PER GROUP

4	Blood typing slides
12	Toothpicks
1	Microscope slide
1	Coverslip
	Compound microscope (400X magnification)
	Marker

SHARED MATERIALS

4	Unknown blood samples:
	Simulated Anti-A Serum
	Simulated Anti-B Serum
	Simulated Anti-Rh Serum

PROCEDURE

Although WARD'S Simulated Blood is completely safe, non-biological, and non-toxic, you should wear the proper personal protective equipment to mimic the experience of an actual hematology laboratory.

PART A: ABO and Rh BLOOD TYPING

1. Label each blood typing slide:
   Slide #1: Mr. Smith
   Slide #2: Mr. Jones
   Slide #3: Mr. Green
   Slide #4: Ms. Brown

DID YOU KNOW?
Prior to the mid-1500s, no one had any conception of blood circulating through the organs in the body.

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2. Place three to four drops of Mr. Smith's blood in each of the A, B, and Rh wells of Slide #1.

3. Place three to four drops of Mrs. Smiths blood in each of the A, B, and Rh wells of Slide #2.

4. Place three to four drops of GABE ı's blood in each of the A, B, and Rh wells of Slide #3.

5. Place three to four drops of Betsy's ı's blood in each of the A, B, and Rh wells of Slide #4.

6. Place three to four drops of the simulated anti-A serum in each A well on the four slides.

7. Place three to four drops of the simulated anti-B serum in each B well on the four slides.

8. Place three to four drops of the simulated anti-Rh serum in each Rh well on the four slides.

9. Obtain three toothpicks per blood typing slide. Stir each well with a separate clean toothpick for 30 seconds. To avoid splattering the simulated blood, do not press too hard on the typing tray.

10. Observe each slide and record your observations in Table 1 of the Analysis section. To confirm agglutination try reading text through the mixed sample. If you cannot read the text, assume you have a positive agglutination reaction.


Agglutination


No Agglutination

11. Dispose of all materials according to your teacher's instructions.

WARD'S Simulated blood is non-biological and nontoxic and may be flushed down the drain.

Be sure to wash and save the blood typing trays and toothpicks for future use.

DID YOU KNOW?
WARD'S Simulated Blood contains components that simulate red and white blood cells; they are similar in proportion and size to those found in real human blood and can be seen under the microscope without staining.

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WARD'S
Simulated ABO and Rh
Blood Typing Lab Activity

Name: Michael Plummer
Group:
Date: 5/6/08

Possible
A = $I^A i$ or $I^A I^A$
B = $I^B i$ or $I^B I^B$
O = ii

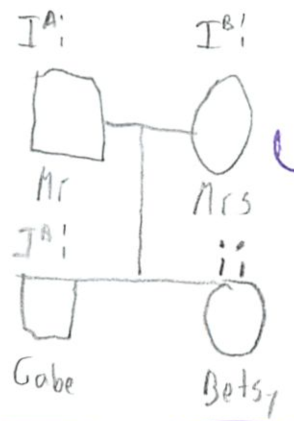
ANALYSIS

Table 1

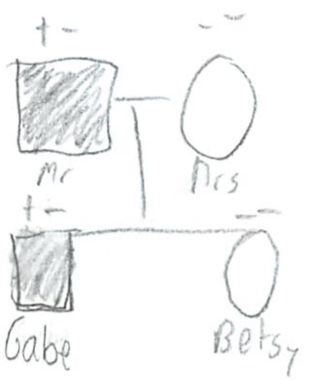
	Anti-A Serum	Anti-B Serum	Anti-Rh Serum	Blood Type
Slide #1 Mr. Smith	Clump +	–	+	A+
Slide #2 Mrs. Smith	–	+	–	B–
Slide #3 GABE	–	+	+	B+
Slide #4 BETSY	–	–	–	O–

"Biological family"

MAKE A FAMILY PEDIGREE BELOW:
SHOW THE GENOTYPES –



A+B are codominate



④ is dominate

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Michael Plasmeier

Chromosome 14 contains the maker for Alzheimer disease.

Alzheimer disease is the fourth leading cause of death in adults, and the likelihood of getting it increases with age.

Observed symptoms: progressive inability to remember facts and events and, later, to recognize friends and family.

Mutation on chromosomes 1, 14, 19, and 21 are believed to play a role. Alzheimer runs in the family. A mutation is PS1 (or AD3) on chromosome 14.

Fragments brain around amyloid-family proteins – somewhat similar to Down Syndrome

Research in mice identified an enzyme that may be responsible for the increase in amyloid production characteristic of AD. If a way to regulate this enzyme could be found, then AD may be slowed or halted in some people.

Basic shape: double
helix

protions + nucletides

it can unwine and
be read down
base paring
S phase
michael Plasmeier

12.1

DNA

5/8

$\overset{\text{↓ the sugar}}{\text{Deoxyribo}}$ nuclear acid

↑ no oxygen (under Deoxy); ↑ in the nucleus (under nuclear)

- stored in the nucleus
- found in hair +blood
- double helix
  - like 2 slinkies
- Watson + Crick discovered dable helix
- carries genetic information
- used in crime scene investigations
  - to identify people
- everyone's is different
  - except perhaps twins
  - but they start to differ expressed as life goes on
- made up of nuclotide (monomers)
- hereditary molecule
- replicated during S phase
- prokarotes not in nucleus
- deoxyribos sugar
- linear DNA is very long
- in all cells
- random sequence
- histones
- moculorual biology
- genetic information
- 4 different nuclotides in a monomer

Guanine
Cytosine
Thymine
Adenine

Pair on opposet side of ladder
G - C
A - T

Promoter Sequences tells what side to read

122

3 Important Questions- 5/9

1) What is a neudeotide composed of ?

- a 5-carbon sugar called deoxyribose
- a phosphate grap
- a nitrogenous base

2) What are the 4 kinds of nitrogenous bases?

- adenine (AD-uh-neen) = A > Belong to a grap called purines
- guanine (GWAH-neen) = G which contain 2 rings in their structure.

- cytosine (SY-tuh-zeen) = C > Known as primidines which
- thymine = T contain 1 ring in their structure.

3) How are they different?

Adenine + Guanine belong to a grap called purines
which contain 2 rings in their structure. (big)
Cytosine and thymine belong to a grap called primidines which
contain 1 ring in their structure. (small)

1 Purine is always paired with 1 Primidine.

More information on page 291.

Powerpoint notes on how DNA was found-

- Chargaff's Rule-

After studying the DNA from different organisms he found that the % C = % G and that the % A = % T

- Franklin and Wilkins Helix (1952)-

Rosalind Franklin and Maurice Wilkins used x-rays on DNA crystals. Franklin was the 1st person to crystalyze active DNA.

- Watson and Crick's Double Helix (1953)-

Watson and Crick were modelers. They used Chargaff's published work and Franklin's unpublished data (without her knowledge) to solve the puzzle.

- DNA double helix: a twisted ladder-

Sugar-phosphates form the sides of the ladder (called the backbone) Nitrogeneous bases form the rungs.

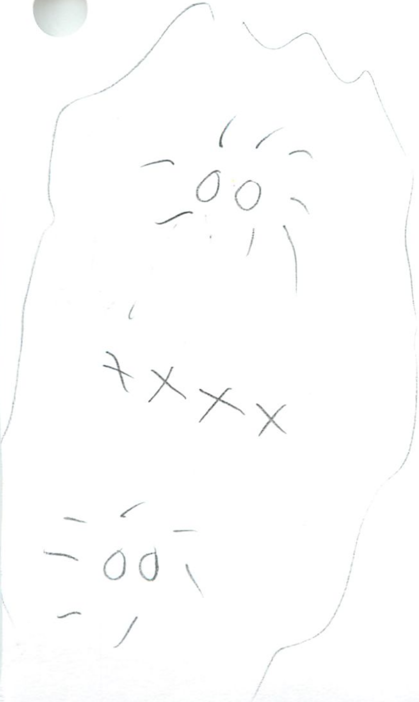
More information on pages 292-294.

Interphase

- grows and replicates DNA and centrioles
- makes protiens

Prophase

- Chromatin condenses into chromosomes
- centrioles seperate
- spindle forms



Prometaphase

chromosomes line up

Metaphase

- Chromosomes line up at the center of the cell connected to spindle fiber at the centromere

Anaphase

- Chromatids seperate and move apart

Telophase

- chromosomes gather at oppset ends + lose their shape
- 2 new nucleur envelopes form

Cytokinesis

- cytoplasm pinches in half
- each cell has duplicate set of chromosones

the cycle starts
again

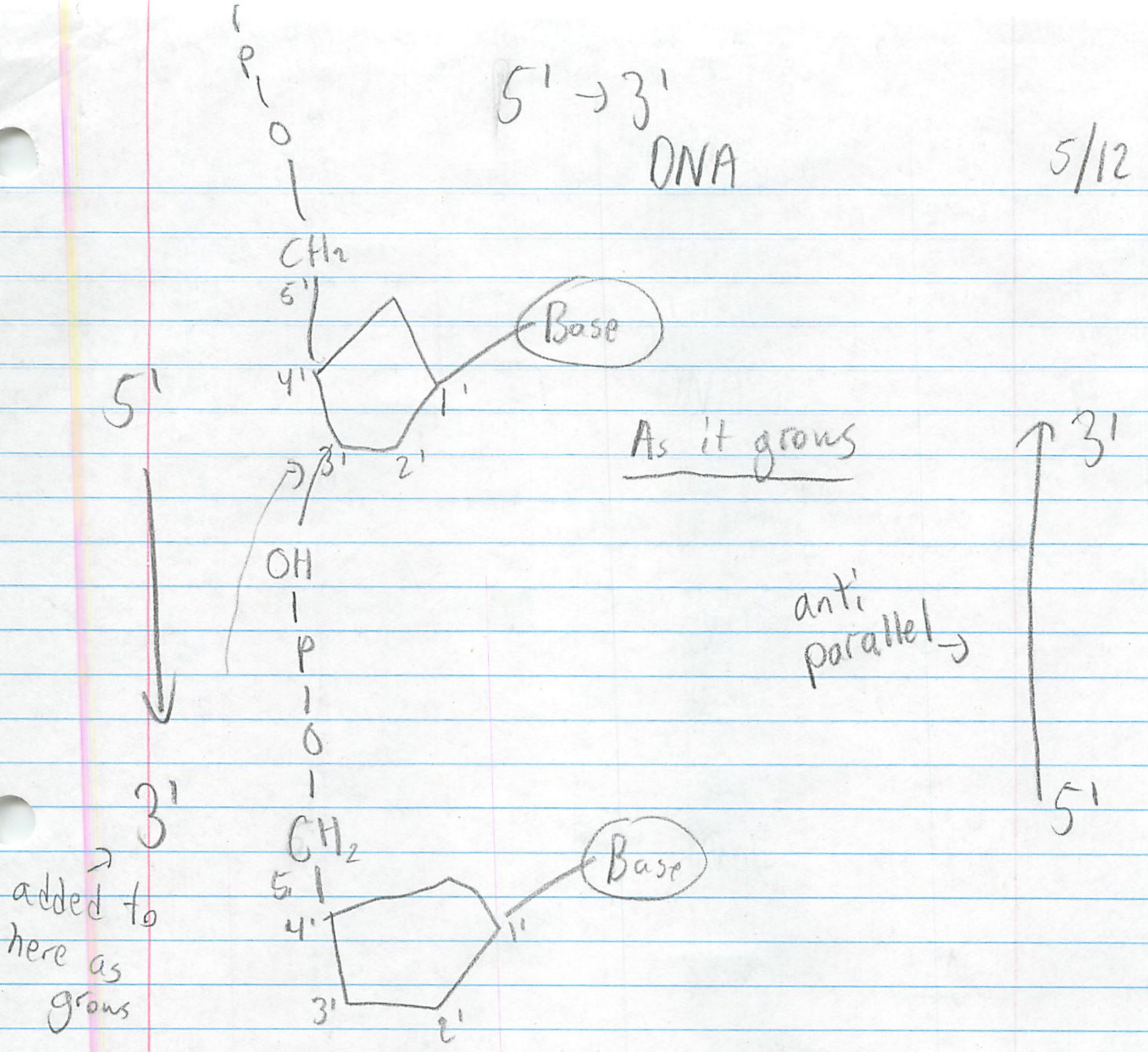
Nice Plot!

Michael lasmeier

5' → 3'

DNA

5/12



As it grows

anti parallel →

added to here as grows

important when transcribe to protien (RNA)

- Don't have to know

12-3

RNA

Lecture + Book

5/14

Ribonucleic acid
contains coded info to make protiens

Differences
- sugar = ribose not deoxyribose
- single stranded
- contains uracil instead of thymine

DNA is just info
- how do you become out of that info

RNA is a disposable copy
working copy of a single gene

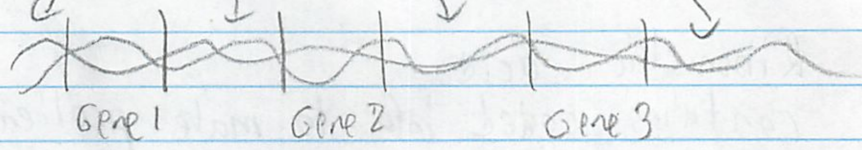
Messenger RNA (mRNA)
- contains info to assemble amino acids' into protiens
- transfers info out of nucleus into rest of cell

RNA	DNA
- single	- double
- CG	- CG
- AU	- AT
- ribose	- deoxyribose

- DNA is the "master" Book of Life
- so RNA is the copy you use

before Translation

Reglatory Functions -don't code for protiens



10-1000 base pairs

Translation

Read in sets of 3

Each codes for a different amino acid

-codon

-64 possibilties } some are repeats

-20 Amio acids } more than 1 possibility

Transfor RNA (tRNA) transfers amino acid to the ribosome as specified by RNA

AUG = start codon + produces Methionine

UAA
UAG } stop
UGA

Transcription is like DNA duplication

-opens, RNA made, it closes

1. Initiation at the promoter
2. Elongation
3. Termination

~~Editing~~/(Processing) ← Not editing

DNA is not perfect

Viruses have split up + broke up DNA

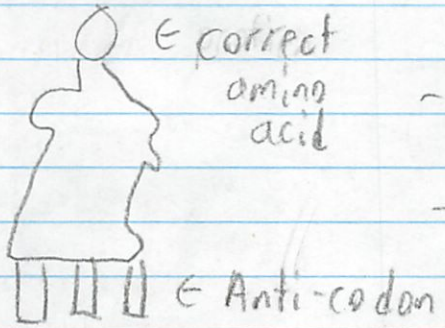
introns - extra parts not needed - regulatory - only needed in 1 process or other

exons - Code for protiens you need

before translation.

- add a cap + tail
- drop introns
- Connect + splice together Exons
- before ^or as mRNA is made

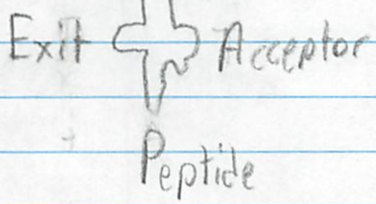
tRNA is how codons are read

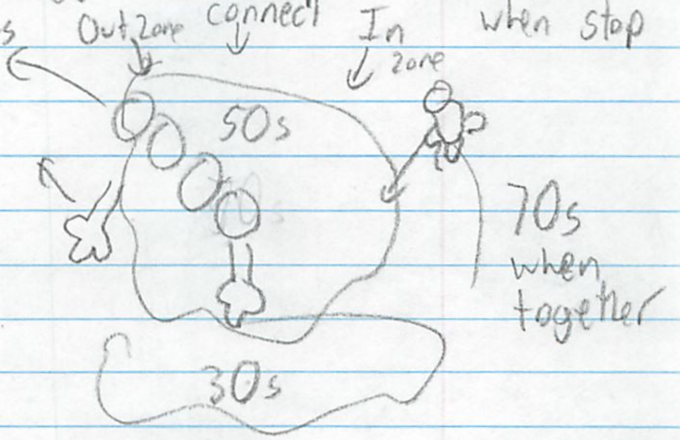


- different one for each 61 codon pairs
- has correct amino acid attached at top

- the amino acids bond with the ones that are there all ready ← polypeptide chain
- the tRNA leaves
- chain of amino acids builds up

↑ elongation stopped when stop

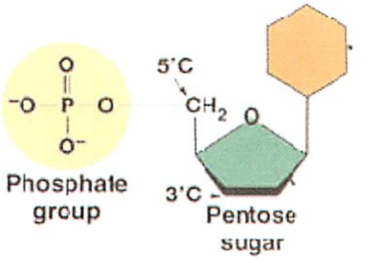




✓

5/26

Michael Plasmeier

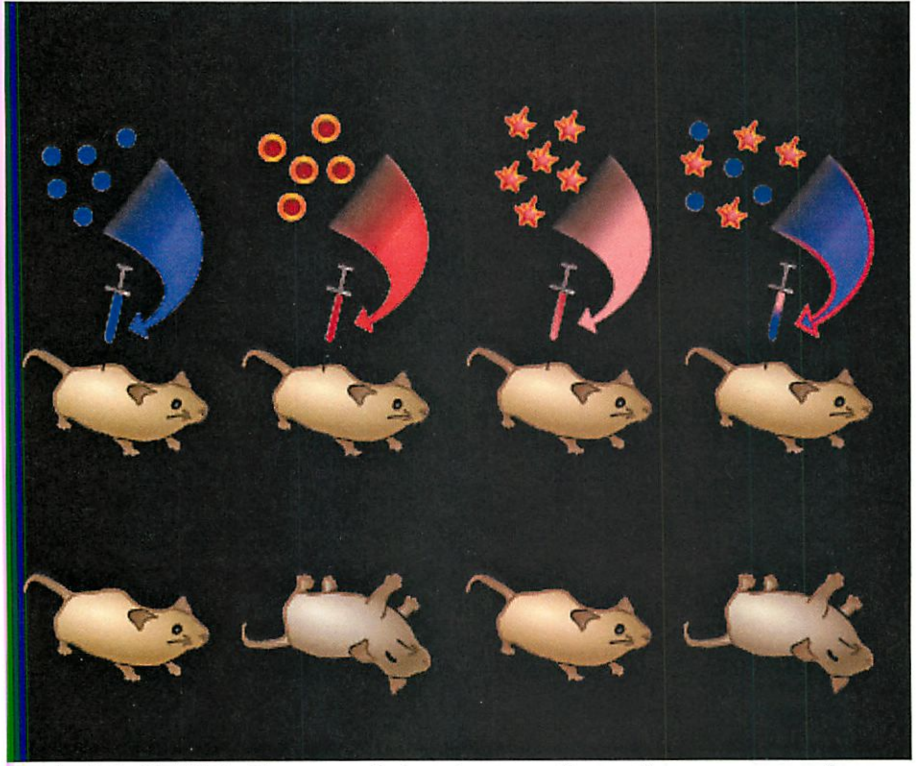


DNA Structure
Michael Plasmeier
DragonflyBio 2007-2008

Chapter 12.1: Define:

Nucleotide – A long molecule DNA is made of.
Helix – The shape of DNA is a double helix (something in the form of a spiral or coil, e.g. a corkscrew or a coiled spring)
Purine – Nitrogenous base with 2 rings – adenine and guanine
Pyrimidine - Nitrogenous base with 1 ring – cytosine and thymine
base pairing – The was DNA pairs so that adenine always pairs with guanine and that cytosine always pairs with guanine

1.Describe the experiments which lead to the discovery of:
a. DNA as the molecule of heredity



Frederick Griffith discovered that the transformative property of genes might be inherited. He set up an experiment with mice. He had a strain of disease carrying bacteria and a strain of harmless bacteria. If he heated the disease carrying bacteria, it would become harmless. So independently both strains were harmless. However one day he injected both strains together and the mice became sick. The heat killed bacteria had passed their disease causing ability on to the harmless strain – its offspring became harmful.

Oswald Avery, seeking to find the source of the "transformation" killed parts of the cell one by one. When they killed the DNA, the transformation did not occur.

b. the structure of DNA,
Hershey-Chase put marker into the DNA of a Bacteriophage. A Bacteriophage is a virus which injects its DNA into a cell in order for the cell to make more Bacteriophage.

2. What are the 3 functions of genes (DNA)?
-Carry information from one generation to the next
-Put that information to work by determining the heritable characteristics of organisms
-Had to be easily copied every time a cell divides.

3. What three components make up a nucleotide?

- 5 carbon sugar deoxyribose
- A Phosphate group
- A Nitrogenous base
  - Purines (two rings)
    - Adenine
    - Guanine
  - Pyrimidines (one ring)
    - Cytosine
    - Thymine

4. What makes up the "backbone" of the DNA molecule?
The sugar and phosphate groups of each nucleotide.

5. What specifies the genetic "code"?.
The 4 different nucleotides can be strung together like letters in an alphabet.

6. What enzyme unzips genes?
Helicase

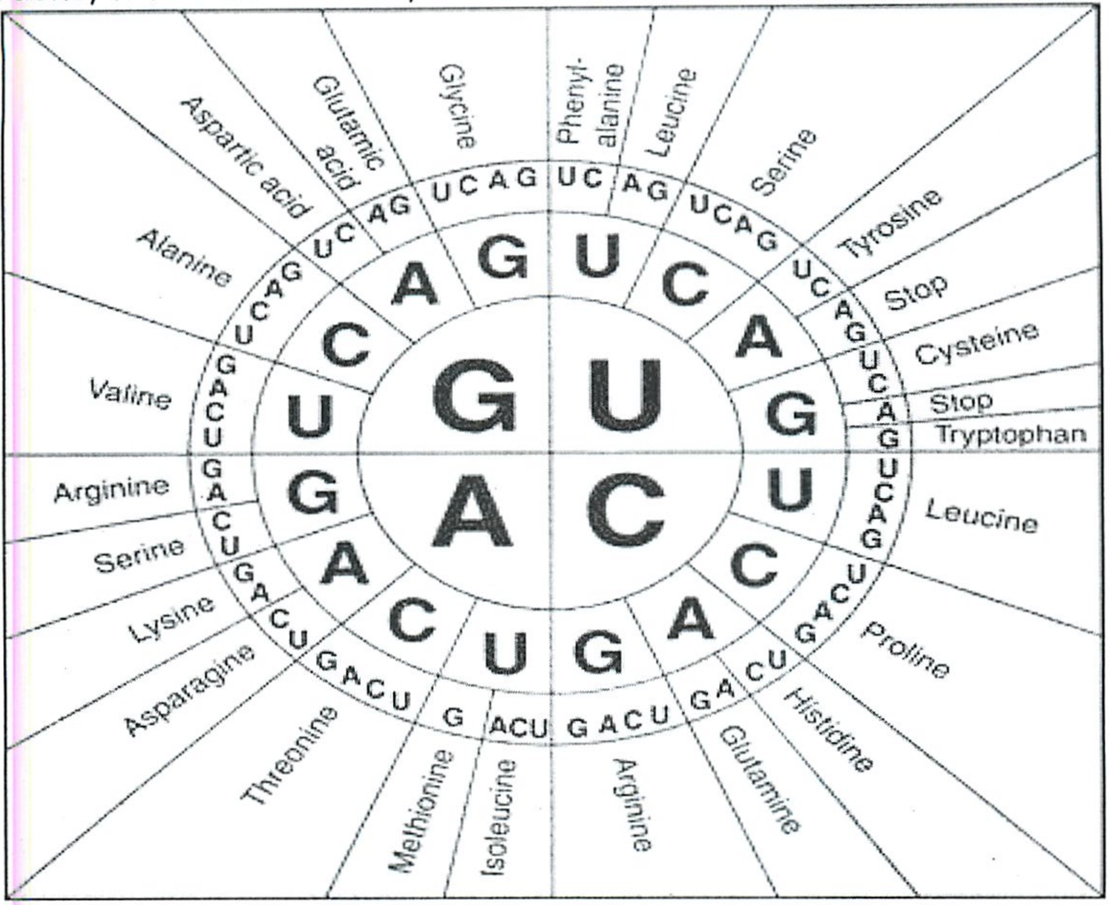
7. Which bases are "complementary" (pair) with each other?
A=T
C=G

Michael Plasmeier ✓ 5/29

Codon Worksheet

Use the circular codon table to complete the DNA triplets, mRNA codons, tRNA anticodons, and amino acids in the table below.

A-T(U)
C-G



DNA triplet	mRNA codon	tRNA anticodon	Amino Acid
TTC	AAG	UUC	Phenyl alanine
GGC	CCG	GGC	Glycine
GTC	CAG	GUC	Valine
TTA	AAU	UUA	Levcine
AAA	UUU	AAA	Asparagine
GTA	CAU	GUA	Valine
CTC	GAG	CUC	Leucine
TGT	ACA	UGU	Cysteine
TAT	AUA	UAU	Tyrosine
TCG	AGC	UCG	Serine
ATT	UAA	AUU	Isoleucine
CCA	GGU	CCA	Proline
GGC	CCG	GGC	Glycine

Questions:

1. What 3 codons act as termination signals?

UAA UGA
UAG

2. What codon means start?

AUG

3. List ALL of the codons for leucine.

CUU CUG
CUC UUA
CUA UUG

Name ALL the codons for these amino acids:

4. Phenylalanine -

UUU
UUC

5. Serine -

UCU UCA AGC
UCC UCG AGU

6. Isoleucine -

AUA AUU
AUC

7. Valine -

GUG GUC
GUA GUU

9. Glycine -

GGG GGC
GGA GGU

10. Alanine -

GCG GCC
GCA GCU

11. If the DNA sequence is --- AAA TAT CCG TAG CAA ATG, write the mRNA sequence, tRNA anticodon sequence, and the six amino acids for this.

DNA: AAA TAT CCG TAG CAA ATG

mRNA: UUU/AUA/GGC/AUC/GUU/UAC

tRNA: AAA/UAU/GCC/UAG/CAA/AUG

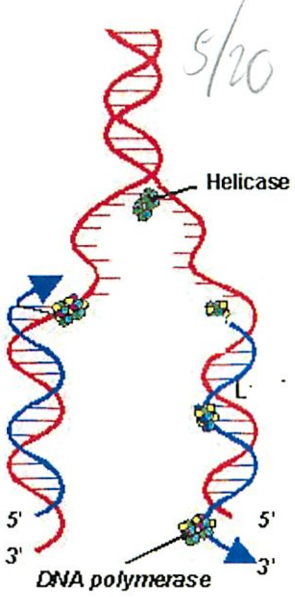
Amino acids: Lysine/Tyrosine/Alanine/Stop/Glutamine/Methonine

↑??

DNA Replication & Transcription and Translation
Michael Plasmeier
DragonflyBio 2007-2008

Michael Plasmeier

5/20



Chapter 12.2: DNA Replication

Define/what do these mean?:

Replication-The copying of DNA to make a new cell.

DNA polymerase-the principle enzyme involved in replication which joins individual nucleotides to produce a DNA molecule (a polymer)

Helicase- an enzyme that breaks the bonds between base pairs in DNA, leaving two rows of bases with free-ends, on which new complementary strands can form

Template strand-The original strand of DNA

Daughter strand-The strand of DNA which is created during DNA replication

Semi-conservative Replication- the method by which DNA is replicated in all known cells - produces two copies that each contained one of the original strands and one entirely new strand.

1. When is DNA copied?
When the cell divides.

2. Explain the concept of copying DNA.
-The DNA molecule splits into 2 at the replication points, unzipping due to the enzymes breaking the hydrogen bonds. The DNA polymerase then produces 2 new complementary strands following the rules of base paring by joining individual nucleotides to produce a DNA molecule. Each strand serves as a template for another one.

3. What enzymes are involved in DNA replication and what reactions do they catalyze?
DNA polymerase joins individual nucleotides to produce a DNA molecule (a polymer). It also proofreads each new DNA strand.

Helicase unzips the DNA in order for it to be replicated.

4. How do eukaryotes copy such long stretches of DNA quickly and efficiently?
The DNA is copied from multiple places at once and is copied on both sides at once.

Chapter 12.3: Transcription and translation – Introduction…

Define or explain:

transcription-Copying part of the nucleotide sequence from DNA into RNA

messenger RNA-RNA molecules made from the DNA and transported out of the cell's nucleus

translation-Converting the mRNA into strings of amino acids which can be used to make protiens

RNA polymerase-enzyme which starts transcription

codon-A three letter "word" in RNA which codes for 1 amino acid

amino acid- a compound belonging to a class that contains an amino group. Amino acids make up proteins and are important components of cells.

ribosome- a submicroscopic cluster of proteins and RNA, occurring in great numbers in the cytoplasm of living cells, that takes part in the manufacture of proteins – Combines 50s and 30s to make 70s where the RNA translation takes place

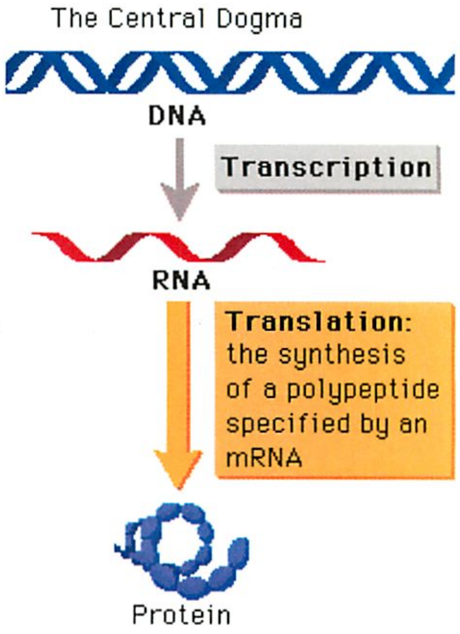
5. What is the "central dogma"? How does this relate to gene expression?
DNA is the basis for all living things and is the store of heredity information; it is transcribed into RNA; which through translation is turned into proteins which perform cell functions

6. How does RNA differ from DNA structurally?
The sugar is ribose instead of dioxide ribose
Generally single stranded
Contains uracil instead of thymine

7. How is RNA functionally different from DNA?
RNA is a disposable copy of DNA which is transferred outside of the cells and is used to make proteins which actually "do" the code of life.

8. Explain Transcription:
RNA polymerase separates the DNA stands and then uses one strand as the template to make a strand of RNA. RNA polymerase only binds to "promoters" which have base sequences telling the RNA where to start.

9. How is the genetic code read?
The genetic code is read by dividing it the sequence of base pairs up into 3 section "codons." Each codon section codes for a specific amino acid. The amino acids make up proteins which complete the functions of the cell



Name: Michael Plasmeier **Class:** Bio 4 **Date:** 5/18/08 **ID: A**

Makeup

52/60

DNA 2008

-4

Multiple Choice

Identify the choice that best completes the statement or answers the question.

d 1. Which of the following is a nucleotide found in DNA?
- a. ribose + phosphate group + thymine
- b. ribose + phosphate group + uracil
- c. deoxyribose + phosphate group + uracil
- [✓ d.] deoxyribose + phosphate group + cytosine

C 2. DNA replication results in two DNA molecules,
- a. each with two new strands.
- b. one with two new strands and the other with two original strands.
- [✓ c.] each with one new strand and one original strand.
- d. each with two original strands.

B 3. Unlike DNA, RNA contains
- a. adenine.
- [✓ b.] uracil.
- c. phosphate groups.
- d. thymine.

✓ C 4. How many codons are needed to specify three amino acids?
- a. 3
- b. 6
- [✓ c.] 9
- d. 12

A 5. DNA is copied during a process called
- [✓ a.] replication.
- b. translation.
- c. transcription.
- d. transformation.

A 6. RNA contains the sugar
- [✓ a.] ribose.
- b. deoxyribose.
- c. glucose.
- d. lactose.

B 7. Which RNA molecule carries amino acids?
- a. messenger RNA
- [✓ b.] transfer RNA
- c. ribosomal RNA
- d. RNA polymerase

A 8. What is produced during transcription?
- [✓ a.] RNA molecules
- b. DNA molecules
- c. RNA polymerase
- d. proteins

C 9. A mutation that involves a single nucleotide is called a(an)
- a. chromosomal mutation.
- b. inversion.
- [✓ c.] point mutation.
- d. translocation.

D 10. During transcription, an RNA molecule is formed
- a. that is complementary to both strands of DNA.
- b. that is complementary to neither strand of DNA. one
- c. that is double-stranded.
- [✓ d.] inside the nucleus.

Completion

Complete each statement.

✓ 11. Chromatin contains proteins called DNA. 1/2

-1

Name: ____________________ **ID: A**

12. The order of nitrogenous bases in DNA determines the order of the sequence/codons/amino acids in proteins.

13. There is no amino acid that is specified by a stop codon on an mRNA molecule.

14. In Figure 12-7, A, B, and C are three types of RNA.

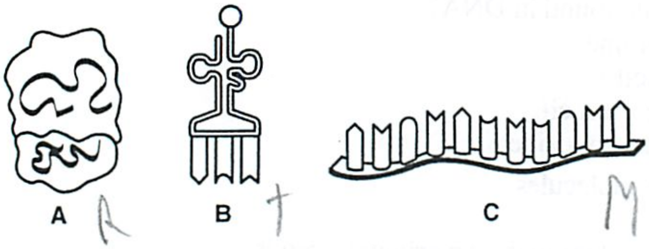


Figure 12–7

15. After introns are cut out of an RNA molecule, the remaining exons are spliced back together to form the final messenger RNA.

Short Answer

16. According to Figure 12-3, what codons specify the amino acid arginine?

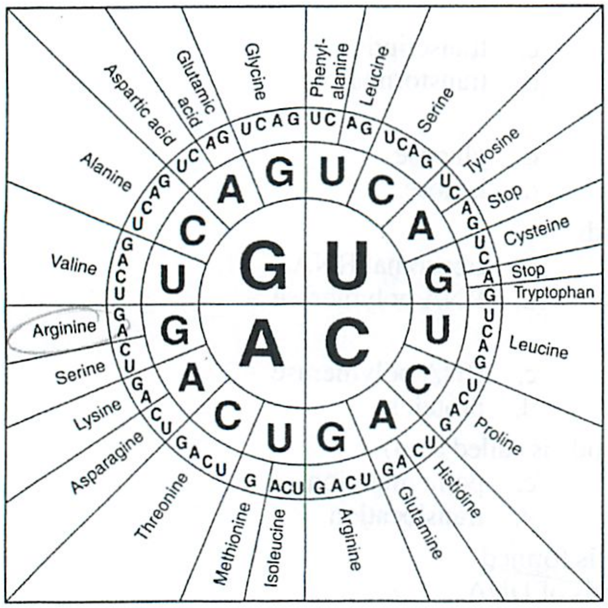


Figure 12–3

AGG
AGA

✓1

Name: ____________________ **ID: A**

17. Describe the structure of a DNA molecule, including the general shape, the monomer types and their components, what holds the strands together, etc.

-double helix ✓ ← phosphate group

✓ ← deoxyribose

← 4 groups ← nitrogous bases ✓ held together by weak electrical bond to other strand

18. How does the structure of DNA allow it to function?

It can be eaisly unzipped to be read or copied. ✓ 2 sides provide a way to verify ✓ and allow it to be copied faster

USING SCIENCE SKILLS

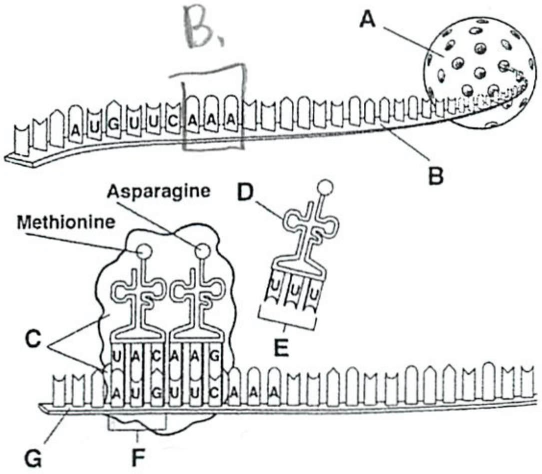


Figure 12–4

19. **Interpreting Graphics** What process is illustrated in Figure 12-4?

Translation ✓

20. **Interpreting Graphics** Identify structure C, the large globular structure, in Figure 12-4.

Ribosomal RNA ✓

21. **Interpreting Graphics** Which labeled structure in Figure 12-4 is a codon?

B, ~~E~~ 3 sections on B or F ✓

22. **Inferring** What is the relationship between the codons and anticodons in Figure 12-4? How is this relationship important?

They fit together because they are opposet, This brings the amino acids together to create protien ✓ in a certain order.

23. **Predicting** In Figure 12-4, what will happen after the ribosome joins the methionine and asparagine?

It will start a poly-peptite chain to create a protien. ✓

12.4

Thursday, May 15, 2008 Biology Notes-

No Warm-Up Today

Important Notes (from section 12.4, page 307):

- A point mutation is when a change occurs at a single point in the DNA sequence (ex. GGG **A**TG AAA GGG changes to GGG **T**TG AAA GGG)
- A frame shift mutation occurs when amino acids get shifted down (which may change every amino acid that follows the pint of the mutation)
- During insertion a base is added in (a single nucleotide change)
- During deletion a base is left out (a single nucleotide change) and almost every time you have a deletion there is an insertion somewhere
- Duplication occurs when there are two letters in a row (ex. ABB CDE) and usually occurs with insertions
- Inversion takes place when it flips itself (ex. ABC EDF, D and E are flipped)
- ATG is always the start code

Other Random Notes:

- An amino acid change creates sickle cell anemia (which can save victims of malaria)
- Sickle cell is an example of a single point mutation
- In the example GGG TTG AAA GGG: ATG is missing which means that no protein will be produced.

Class work:

- Complete the Codon Worksheet (where you use the circular codon table to complete the DNA triplets, mRNA codons, tRNA anticodons, and amino acids)
- Complete make-up work, study, or work on study guides

Homework:

- Hand in study guides 12.1, 12.2, and 12.3
- **Study for test TOMORROW!!!!**

  On sections 12.1, 12.2, 12.3, and 12.4 (section 12.5 is not on the test)

Michal Plasmeier 5/20

✓

Biology-1 Chapter 15: Darwin and Evolution

Lecture/study guide 07/08

15.1: The puzzle of life's diversity.

Understand these words:
Evolution – Change over time; the process by which modern organisms have descended from ancient organisms
Theory (scientific) – A well-supported tested explanation of phenomena that has occurred in the natural world
Fossil – preserved remains of ancient organisms

What is biological diversity?
The variety and abundance of species that make up a biological community.

Darwin's Life and travels - video questions:

1.Why did Darwin's ideas clash with Victorian Culture?
The Bible said in "Genesis" believe that god created each species and these species stay fixed
Went across all of natural history
Would break established link of science, politics, and the church
>God selected the kings and queens to be in power
>>If this idea is broken it could cause (gasp) democracy
>People were like animals

2. What is the "mystery of mysteries"?
The original appearance of species.

3. What habits made Darwin especially suited to be a scientist?
Hardwork
23 years of work
Observative skills
Interest in science

4. Did Darwin work completely alone, "in a vacuum"?
Worked pretty much alone, except with his brother
No, he read the work of other famous scientists of Malthus and is shown in the video talking to other scientists

5. What were some of Darwin's observations?
An ancient common ancestor
Similar traits
Same environment does not equal same species
Animals are all fit to their habitat

6. Why were the islands a great place to make these observations?
They were close together, but had different climates.

Michael Plasnier ✓ 5/20

Bio Chapter 15:
Darwin and Evolution

Lecture/study guide 07/08

15.1 : The puzzle of life's diversity.

Understand these words and how they are related:

Evolution – Change over time; the process by which modern organisms have descended from ancient organisms
Theory (scientific) – A well-supported tested explanation of phenomena that has occurred in the natural world
Fossil – preserved remains of ancient organisms
Biological diversity – The variety and abundance of species that make up a biological community.

Darwin's observations: how did these contribute to Darwin's theory?

1. Patterns of Diversity – Plants and animals well suited for environment which they live in. But similar environments on different continents did not equal the same species.

2. Living organisms and fossils – Some fossils looked very similar to living species but some looked like nothing else which was alive

3. The Galapagos Islands – 1000km west of South America – Very different climates on each island – Some low, hot, and dry – others had more rainfall and a richer vegetation

15.2 Ideas that shaped Darwin's thinking:

Describe the contributions of the following scientists to Darwin's thinking:

- Hutton and Lyell – Earth changes slowly over millions of years (rocks, rivers, erosion) – World is older than a few thousand years old (which was current thought) – Science must explain past events in the context of observable events – Could life change over time like the earth had?

- Malthus – economist who said that the Earth's population was growing too fast for the scarce resources on Earth – War, starvation and disease would lessen the problem – Darwin thought the same thing went for organisms

- Lamarck – theory of evolution by acquired traits (giraffe – kept stretching its neck to get food, so that its offspring would be born taller) [By this logic humans could develop offspring which could fly; or that a baby born to cyclers would have good legs] **WRONG**
    - 1. Tendency towards perfection
    - 2. Use and Disuse
    - 3. Inheritance of Acquired Traits

15.3 Darwin's case: how did the following contribute to what he proposed?

- Natural variation –Variations occur due to random mutations in genes

- Artificial Selection – breeding animals which have the traits you wanted – continue to breed the plants and animals of traits you want (Broccoli was breed from wild mustard)

Evolution by Natural Selection: what do each of the following mean?

- The Struggle for Existence – Members of each species compete regularly to obtain food, living space, and other necessities of life
- Survival of the Fittest – Organisms who are best adapted for the environment will survive to produce many offspring
- fitness - The ability of organisms to survive and reproduce in its environment
- adaptation (physical or behavioral) – Any inherited characteristics that increase an organism's chance of survival
- natural selection - Life is ruled by a struggle for existence where the strongest or organisms best suited for the environment survive and reproduce – weak organisms or those without the best traits die off, producing little to no offspring – thus the offspring that are left are the strongest (Variations occur due to random mutations)
- Descent with Modification – Over long periods of time, natural selection produces organisms that have different structures, establish different niches, or occupy different habitats so that organism look different than their distant organisms
- common descent – Over an extremely long period of time, there is a common ancestor for all living things

Evidence of Evolution:

1. The Fossil Record – From studying the different fossils contained in different levels of rock, we can see that life on Earth has changed over time and is older than a few thousand years
2. Geographic Distribution of Living Species – Although organisms were separated, they evolved to be different but share similar structures. Also the fact that different organisms live on different continents even though the climate is the same.
3. Homologous Body Structure – The body parts of animals with backbones are very similar. The limbs of reptiles, birds, and mammals (arms, wings, legs, and flippers) are very similar. Some vestigial organs are still there even though they have no use since they provide no advantage or disadvantage for the organism.
4. Similarities in Embryology – The early embryo stages in animals with backbones are very similar.

Summary of Darwin's Theory: What are the 8 points? p386

1. Individual organisms differ, and some of this variation is heritable
2. Organisms produce more offspring than can survive, and many that do survive do not reproduce
3. Because more organisms are produced than can survive, they compete for limited resources
4. Each unique organism has different advantages and disadvantages in the struggle for existence. Individual best suited to their environment survive and reproduce most successfully. These organisms pass their heritable traits to their offspring. Other individuals die or leave fewer offspring. The process of natural selection causes species to change over time.
5. Species alive today are descended with modification from ancestral species that lived in the distant past. The process by which diverse species evolved from common ancestors, unites all organisms on Earth in a single tree of life.

Evolution Chap Notes

5/30

Concept Map

- Darwin
- Natural Selection
  - change over time to favorable characteristics
- Artifical Selection
  - breading
- Adaptation to surrondings
- Natural Selection
  - any one who does not fit dies off

Favorble traits → offspring
Unfavorable traits → extinction

Everything came from the same source

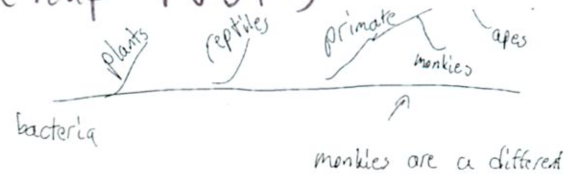
"The Origin of Species"

Controversal from religious POV

Change due to mutation

Became clear in Galapagous Island
- similar but different traits

Are we decendents of monkeys?



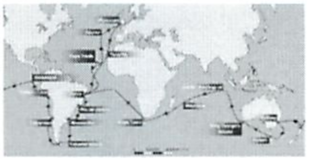
monkies are a differend branch - not that we evolved from them

Evolution Basics (15.1 and 15.2)

Darwin

- Felt like a blind man given sight
- collected detailed specimins + notes
- worked on "Mysteries of mysteries"
  - original appearence of species
- mithological + careful
- other things had natural explinations
- said why Biology makes sense
  - Unites the facts
- revolutionary
- broke established church docterine
- and also said that kings + queens were selected by God
  - broke the political order
- people are just as good as cows

Not just Galapagos but he goes arand the world



http://en.wikipedia.org/wiki/Charles_Darwin

Different species live in same environments on different continents

Biodiversity
- needed for food chain, disease resistance

★ 99% of organisms ever around are extinct
↑
up to 15 million species we think existed

Fossils - preserved records in the rock

Galapagos Islands
- great climate diversity
- some green
- some brown from Volcanoes

[illegible]

3 types of turtels
Many types of finches
- different types of bills for different food sources
- each has own niche

See Study Guide 2 for important other people in Evolution

Natural variations
- Colombines
- Within a <u>species</u> → can see + not see
'' '' ''

- dogs   - blood type
- come from variations + mutations

Species - when 2 organisms can interbreed and can produce healthy organisms
- Mules) sterile
- Ligers)

Niche - habitat
↑ everything about it
2 populations can not occupy same niche
- they would fight

<u>Artifical selection</u> - breeding
- broccoli was breed from wild mustard

Other Scientists

- Hutton
    - Earth is millions of years old
    - Geological changes took millions of years
- Lyell
    - Science can only explain things which can be observed
    - *Principles of Geology*
    - Volcanoes release gas
    - Water erodes streams
    - Darwin's conclusions
        - If earth could change over time; could life?
        - The earth was really old
- Lamarck
    - Selective use or disuse has organisms acquire traits during their lifetimes
    - These traits are passed to their offspring
    - Tendency towards perfection
        - Urge to be more complex
    - Animals could alter their bodies during their life
        - Slowly grow wings to be able to fly
    - Inherit acquired traits
        - If you were a body builder, your children would too
    - Wrong!: Behavior has nothing to do with it
- Malthus
    - If human population left unchecked, their would be not enough space or food for everyone
    - People would die out
    - Darwin: this applies to humans as well

Core Theories

Everything is a fight for survival -> a **struggle for existence**
- Compete for food, water, space
- Those who are faster are less likely to be eaten

Variation -> different varieties of a trait or characteristic
Adaptation -> the characteristic itself that increases survival ← Different than "to adapt"

Fitness -> the ability to survive and <u>reproduce</u>
Survival -> Not dying
↑ mostly

An adaptation is a variation that increases a fitness and survival of an organism

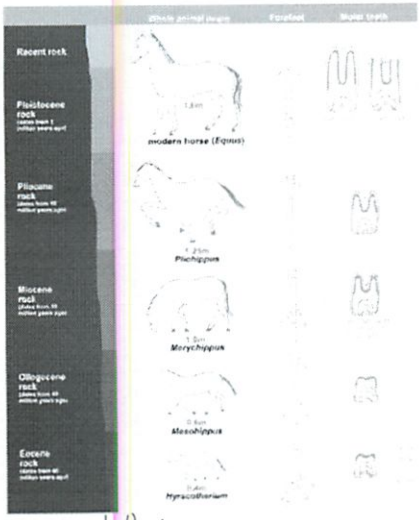
Survival of the fittest -> Individuals that are best suited for the environment survive and reproduce more successfully
This is **natural selection**
This results in changes in the inherited characteristics of the population. These changes increase a species' fitness in its environment

Each living thing has descended, with changes, from other species over time. This is called **decent with modification**
He thinks that all organisms descended from a common ancestor

How do we know?

- Fossils
  - evolution of a horse

Pasted from <http://en.wikipedia.org/wiki/Image:Horseevolution.png>



- Whales
  - similar ears
  - nostrols moved to top f head

- it swims like humans

Geographic Distribution

- Different species lived on different continents even though they had the same climates
- Darwin thinks they descended from different ancestors
- Evolved separately similar features

- Structures
  - homogolgus
    - all came from same ancestor

Pasted from <http://en.wikipedia.org/wiki/Homology_(biology)>

- vestigical
  - unused parts
  - or have different functions
  - gets smaller and smaller
- Analogous

- similar function
- different structure
- distanly related

-

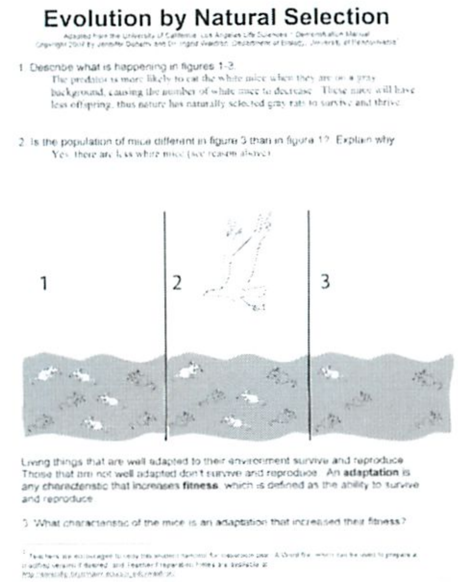
Pasted from <http://en.wikipedia.org/wiki/Embryo>

Embrology + Biochemistry

- very similar in most organisms
- then they diverge

- All orgonisms have DNA
  - same start codon

Button Lab



Evolution by Natural Selection

Adapted from the University of California, Los Angeles Life Sciences 1 Demonstration Manual
Copyright 2007 by Jennifer Doherty and Dr. Ingrid Waldron, Department of Biology, University of Pennsylvania[1]

1. Describe what is happening in figures 1-3.
   The predator is more likely to eat the white mice when they are on a gray background, causing the number of white mice to decrease. These mice will have less offspring, thus nature has naturally selected gray rats to survive and thrive.

2. Is the population of mice different in figure 3 than in figure 1? Explain why.
   Yes, there are less white mice (see reason above)

Living things that are well adapted to their environment survive and reproduce. Those that are not well adapted don't survive and reproduce. An **adaptation** is any characteristic that increases **fitness**, which is defined as the ability to survive and reproduce.

3. What characteristic of the mice is an adaptation that increased their fitness?

---

[1] Teachers are encouraged to copy this student handout for classroom use. A Word file (which can be used to prepare a modified version if desired) and Teacher Preparation Notes are available at http://serendip.brynmawr.edu/sci_edu/waldron/.

Their gray color

The table below gives descriptions of four female mice that live in a beach area which is mostly tan sand with scattered plants.
4. According to the definition given for fitness, which mouse would biologists consider the fittest?

The tan mouse

5. Explain why this mouse would be the fittest

It not only lives the longest (does not matter) but has the **most offspring**

Color of fur	Black	Tan	Tan and Black	Cream
Age at death	2 months	8 months	4 months	2 months
# pups produced by each female	0	11	3	0
Running speed	8 m/min.	6 m/min.	7 m/min.	5 m/min

6. If a mouse's fur color is generally similar to its mother's color, what color fur would be most common among the pups?

Tan

A more complete definition of fitness is the ability to survive and produce offspring who can also survive and reproduce. Below are descriptions of four male lions.
7. According to this definition of fitness, which lion would biologists consider the "fittest"? Explain why.

Dwayne since it had the most offspring

Name	George	Dwayne	Spot	Tyrone
Age at death	13 years	10 years	12 years	10 years
# cubs fathered	19	25	20	20
# cubs surviving to adulthood	15	14	14	19
Size	10 feet	8.5 feet	9 feet	9 feet

*Adapted from Michigan State University, Occasional Paper No. 91, Evolution by Natural Selection: A Teaching Module by Beth Bishop and Charles Anderson, 1986.

Suppose that Tyrone had genes that he passed on to his cubs that helped his cubs to resist infections, so they were more likely to survive to adulthood. These genes would be more common in the next generation, since more of the cubs with these genes would survive to reproduce. A characteristic which is influenced by genes and passed from parents to offspring is called **heritable.**

Over many generations heritable adaptive characteristics become more common in a population. This process is called **evolution by natural selection**. Evolution by natural selection takes place over **many, many** generations.

Evolution by natural selection leads to adaptation within a population. The term evolution by natural selection does not refer to individuals changing, only to changes in the frequency of adaptive characteristics in the population as a whole. For example, for the mice that lived in the beach area with tan sand, none of the mice had a change in the color of their fur, however, due to natural selection, tan fur was more common for the pups than for the mother mice.

In summary, a heritable characteristic that helps an animal or plant to have more offspring which survive to reproduce will tend to become more common in a population as a result of evolution by natural selection.

Questions

8. Explain why a characteristic which helps an animal to live longer will generally tend to become more common in the population as a result of evolution by natural selection.

The animals without that trait will die out, and the ones with the trait will live on and reproduce.

9. Not all characteristics which contribute to longer life become more common in the population. Some characteristics contribute to long life, but not more offspring. For example, a female cat which is sterile and cannot have any offspring may live longer because she will not experience the biological stresses of repeated pregnancies. Explain why a characteristic like this which contributes to a long life, but with few or no offspring, would not become more common as a result of evolution by natural selection.

In order for the trait to continue, the trait must be passed on to offspring. If the cat has no offspring the trait does not live on

Simulation of Natural Selection

We will now play a **simulation** game to demonstrate how natural selection works.

A simulation is a good way to simplify the problem in such a way that we can observe how evolution by natural selection may work in a real population. This simulation involves buttons that can reproduce. These buttons live out their lives on different fabric habitats in the middle of the classroom. The only concern our button creatures have is the presence of ravenous hunters (that's you!). All we need is a system that has three necessary conditions for evolution by natural selection.

1. **Variation in characteristics**: For natural selection to occur, different individuals in a population must have different characteristics. In our simulation, buttons vary in color; they are black, red, and white, etc. The hunters vary as well; hunters have three distinct types of feeding structures: forks, knives, and spoons.
2. **Differences in fitness**: For natural selection to occur, the different characteristics of different individuals must contribute to differences in fitness (i.e. differences in ability to survive and reproduce). It seems possible that variation in button color and size will influence the probability that a button is snatched up by a hungry hunter. It also seems possible that different feeding types may vary in their success in capturing buttons. These differences contribute to survival and therefore success in reproducing.
3. **Heritability of characteristics**: For natural selection to occur, the characteristics that affect fitness must be heritable (i.e. passed by genes from one generation to the next). In our simulation, a button that is born into the button population is the same color and relative size as its parent and a hunter that is born into the hunter population has the same feeding structure as its parent.

Here is exactly what we will do:
1. Your class will be split into six groups which will carry out the simulation using different habitats.

2. Buttons come in three main colors: black, red, and white. You will "plant" an equal number (5) of each color on the habitat at the beginning of the simulation. Which color button do you think will be more likely to survive in each habitat?

Blue habitat so blue buttons are most likely to survive

Now it is time to arm the hunters. There are four different feeding types: forks, knives, spoons, and forceps. Your teacher will distribute the feeding structures so that there are equal numbers of each. You will also be given a cup. This cup will serve as your "stomach". To capture a button, you must use only your fork, knife or spoon to lift the button from the habitat and put it into your cup. Which feeding structure do you think will do better?

3. At your teacher's signal, start feeding. Don't be shy about competing with your fellow hunters. However, once a button is on a fork, knife or spoon it is off limits. When your teacher calls time, **STOP** feeding.

4. Now count how many buttons you have eaten and line up with your classmates who were feeding on the same habitat, from fewest buttons eaten to most buttons eaten. Only the top half of the hunters will survive and reproduce. Your teacher will tell you who lives and who dies. Those who die

will be reborn as the children of the survivors and will now have the same type of feeding structure as their parents had.

5. Your teacher will count how many buttons of each color were eaten, calculate how many buttons survived, and help the surviving buttons reproduce. Only the buttons that were not eaten will reproduce.

<u>**Round 1**</u>
Knife: 16 buttons
Fork: 7
Spoon: 14
Forceps: 5
1 left (pink)
3 died of natural causes (on the floor)

6. You will run through the simulation one more time. Post on the board the numbers of buttons of each color and hunters of each type at the beginning of the simulation (generation 1) and at the end of each cycle (generations 2 and 3).

<u>**Round 2**</u>
Knife 1: 10
Knife 2: 13
Spoon 1: 8
Spoon 2: 11
0 left
2 died of natural causes (floor)
3 stillborn (not in game)

Knife: 23
Spoon: 19

16: Variation

[illegible]

Evolution - any change in the relitive frequency of an allele

---

Gene Pool - all of genes (including all of the different alleles) that are present in the entire population

- if not big enough - not enough variation to avoid stress + challange

Relative frequency - The number of times an allele appears in a gene pool, compared with number of times other alleles for the same gene occurs

  Expressed as a percentage
  Nothing to do with dominate or recessive
    A recessive trait may occur more frequently in a population

---

Sources

Mutations -
- mistakes
- radiation
- some have effect on phenotype

not just during → reproduction

Gene Shuffling

-crossing over

- crossing over
  - meiosis/prophase I
- independent assortment
- different gametes used
  - random fertilization

gametes meiosis

does not change the relative frequencies of allelels in poup.

↑ Pollard: unless population is very small

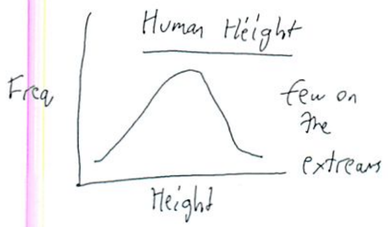
Mutation changes the gene itself + creates an allele

Single-gene trait
- 2 alleles
- 2 phenotypes
- widow's peak hair line

* allele freq. ≠ Mendelian freq.
- dominate trait does not ^have to occur the most often

the most often ^have to

- Polygenic trait
  - each gene has 2 or more alleles
  - many geno + pheno types



Remember

* Natural selection happens on organisms not each trait

* Peupulations not organisms evolve over time

	Inital	10	20	30
~	80%	80%	70%	40%
~	10%	—	—	—
~	10%	20%	30%	60%

↗

Single Gene

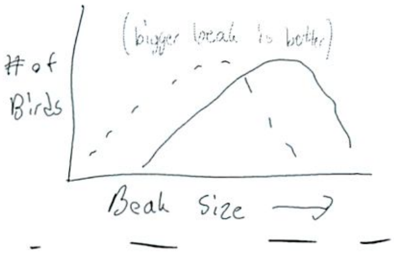
Natural selection → evolution (Blue increased in relitive freq.)

Polygenic Traits - more complex

16.2

Directional Selection

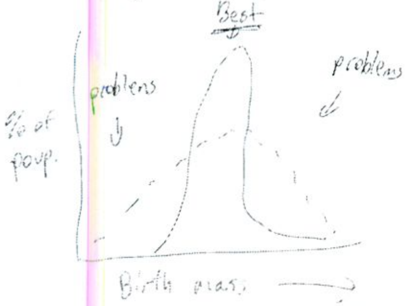
- when individuals at one end of the curve have a higher fitness



Stabilizing Selection

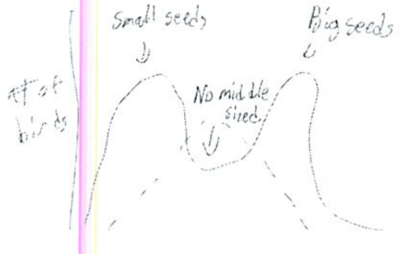
- individuals near the center

of the curve have a higher fitness



Disruptive Selection

- individuals at top + bottom do better than intermediate (middle) type
- can cause curve to split in 2



Genetic Drift

- small populations may see change in representive quantity randomly
  ↑ by chanch

in new habitats

Over time a series of chance occurrences of this type can cause an allele to become common in a population

Founder effect

- small populations in new habitats (founders) create a subset of the original population

Hardy-Weinberg Principle

- allele frequency in a population remains constant unless 1 or more factors present to change it
  "genetic equalibrium"

required conditions

- random mating
  - each has = chance to pass on offspring
- large population
  - no genetic drift
- no movement in or out of population
  - gene pool together + seperate
- no mutations
  - no new alleles
- no natural selections
  - must have = chance

Anti-Biotics

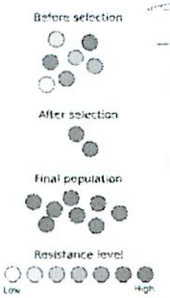
Tuesday, May 27, 2008
[illegible]

- only againts bacteria

not a virus (takes over cell + uses it
can't poison it - or you would poison you

Restrict

- cause a resistant strain to evolve



- used to be able to find new drugs
  - step ahead
  ↑ but slowing down

Pasted from <http://en.wikipedia.org/wiki/Antibiotic_resistance>

- break natural selection

Not restricted
- Only Doctors can decide
  ↑ personal choice

- fight / prevent / cure diseases
- animals healthy

16.3 Speciation

→ foundation of new species due to isolation

Founders Arrive
- took part of old gene pool ↑ start w/ only a piece

Geographic Isolation
↑ locked in small gene pool ↲ can't mate w/ original
- rivers, mountains, bodies of water
  ↑ differed for different organisms
- if can still interbread
  — same species

Changes in the Gene Pool
Reproductive Isolation — can not be interbread ↙ different species now
- finches only mate with animals that have a similar sized beak as they do
  ↑ so remain seperate
  - even in same environment

- even in same environment

- Behaviorial isolation
  - capable of interbreading
  - but have different rituals which keeps them apart

- Temporal isolation
  - species reproduce at different times
  - ex; plants release pollen on different days

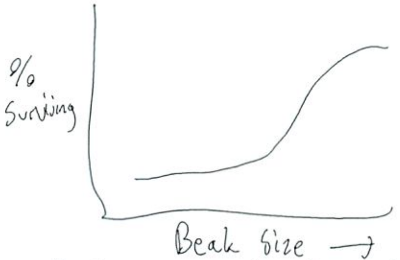
Ecological Competition
- for same Niche in the environment

* individuals with the higest fitness survive

Contined Evolution

Examples
Darwin's Finches
- Peter + Rosemary Grant tested
- Caught every bird on te island

- measured charactoristics
- Special Adaptations come into play during the dry season



* So over time there will be more birds with large beaks

↑ So natural selection was proven in just a decade

New Research

Grant did not show creation of new species

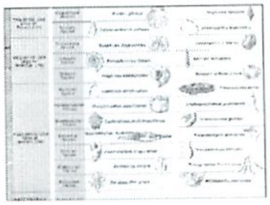
Questions still remain about

evolution

---

17 ; Life on Earth

Chap 17 history%2...



different layers
Over time

mass extinction

older

Permian extinction

a few seconds

very small

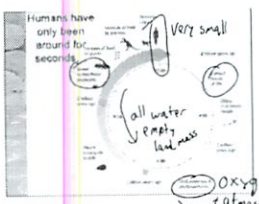
index fossils - tell how old that strata is

Compares the relative age of fossils
Estimate a fossil's age compared with that of other fossils

A species must be:

- Easily recognized
- Existed for a short period of time
- Have a wide geographic range

Found in different layers of rock
But these specific layers will be found in different geographic locations


Humans have only been around for seconds

Very small

all water
empty land mass

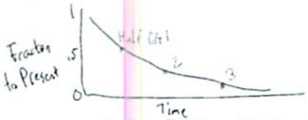
Oxygen new + atmosphere

moss first land plant

relative dating -

Comparing a fossil's placement with that of other fossils in a layer of rock
Rock layers form by age

Radioactive dating - uses radioactive half-lives to determine the age of a sample
A half life is the length of time radioactive material (some of which is found in rock) needs for half of the radioactive atoms in a sample to have decayed
Counts the number of radioactive isotopes the sample contains
Compares the amount of Carbon-14 (half-life = 5730 years) with the amount of Carbon 12 (does not decay)
So the more carbon-12 there is to carbon-14 the older the sample is
Useful only for fossils younger than 60,000 years
Other elements used for older samples



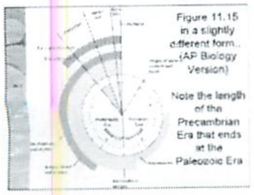


Figure 11.15 in a slightly different form... (AP Biology Version)

Note the length of the Precambrian Era that ends at the Paleozoic Era

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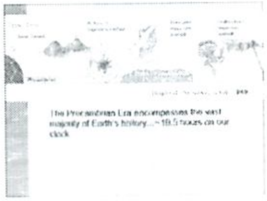

The Precambrian Era encompasses the vast majority of Earth's history...~18.5 hours on our clock

no backbone

backbone

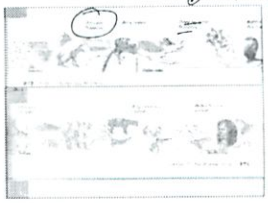
need water + land
reproduce in water (eggs don't have a shell)

explosion of life

can stay out of the water

Big extinction
- meteorite hitting earth

to attract pollinators



Discovery Channel movie

- meditorite clouded Earth
- too hot or too cold
- allowed mamels to grow + florish
- why we are here today

History of Life Timeline:
(put these in order . . .)

1. (start) earth formed
2. (end) modern humans
3. birds evolve
4. multicellular organisms
5. first shelled invertebrates
6. land plants evolved
7. first vertebrates evolved
8. prokaryotic organisms
9. amphibians
10. mammals evolved
11. eukaryotic organisms
12. dinosaurs flourish
13. large mammals evolved
14. reptiles evolve

History of Life Time Line:

Correct order 1, 8,11,4,5,7,6,9,14,10,12,3,13,2

Mass Extinction

Human Evolution

17.4 Patterns of Evolution

17.4

Inserted from: <[illegible]>

Biology

Prentice Hall

Section 17-4

Section Outline

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17–4 Patterns of Evolution

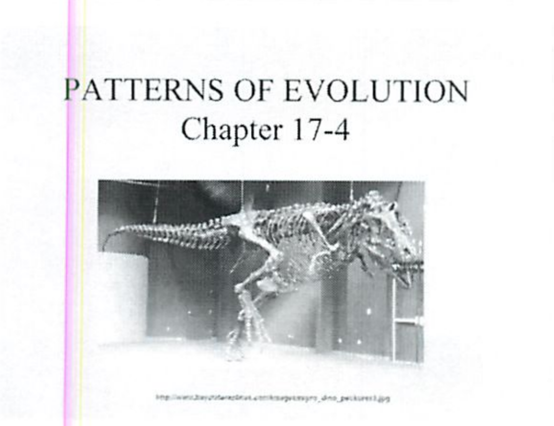
A. Extinction

B. Adaptive Radiation

C. Convergent Evolution

D. Coevolution

E. Punctuated Equilibrium



PATTERNS OF EVOLUTION
Chapter 17-4

[illegible]

Large scale evolutionary patterns and processes that occur over long periods of time = Macroevolution

1. Mass extinction
2. Adaptive radiation (Divergent evolution)
3. Convergent evolution
4. Coevolution
5. Punctuated equilibrium

Mass Extinctions

At several times in Earth's history large numbers of species became extinct at the same time

Caused by several factors:

all at once

- erupting volcanoes
- Plate tectonics (continents were moving)
- Sea levels were changing
- Asteroids hitting the Earth
- Global climate change

Example:

At the end of the MESOZOIC Era-

More than HALF of all plants and animals were wiped out… including the dinosaurs

Make ~~new~~ habitats Open up

Effects of mass extinctions:

Opens habitats and provides opportunities for remaining species

After mass extinctions there is often a burst of evolution that produces many new species Opposed to Darwin's gradualism

EX: Cenozoic era that followed = "Age of Mammals"

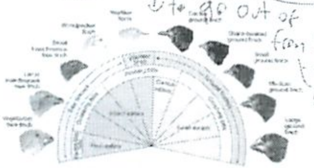
Mammals species increased dramatically

Image from: BIOLOGY by Miller and Levine; Prentice Hall Publishing©[illegible]

When a single species or small group of species has evolved through natural selection into diverse forms that live in different ways =

adaptive radiation OR divergent evolution

↓ to go out of from single point



Ex: Galápagos finches

More than a dozen species evolved from one species

✓ **Name:** Michael Plasmeier **Class:** 4 **Date:** 5/30/08 **ID: A**

97/100

Evolution

Multiple Choice

Identify the choice that best completes the statement or answers the question.

b 1. Darwin began to formulate his concept of evolution by natural selection after
- a. experimentation with animals.
- [✓ b.] observations of many species and their geographical locations.
- c. reading the writings of Wallace. — ?
- d. agreeing with Lamarck about the driving force behind evolution.

c 2. The idea that only famine, disease, and war could prevent the endless growth of human populations was presented by
- a. Darwin.
- b. Lamarck.
- [✓ c.] Malthus.
- d. Lyell.

c 3. When Darwin returned from the voyage of the Beagle, he
- a. immediately published his ideas about evolution.
- b. realized his ideas about evolution were wrong.
- [✓ c.] wrote about his ideas but waited many years to publish them.
- d. copied the evolutionary theory of Wallace.

c 4. When lions prey on a herd of antelope, some antelope are killed and some escape. Which part of Darwin's concept of natural selection might be used to describe this situation?
- a. acquired characteristics
- b. reproductive isolation
- [✓ c.] survival of the fittest
- d. descent with modification

d 5. According to Darwin's theory of natural selection, the individuals that tend to survive are those that have
- a. characteristics their parents acquired by use and disuse.
- b. characteristics that plant and animal breeders value.
- c. the greatest number of offspring.
- [✓ d.] variations best suited to the environment.

b 6. Darwin's concept of evolution was NOT influenced by
- a. the work of Lyell.
- [✓ b.] knowledge of the structure of DNA.
- c. his collection of specimens.
- d. his trip on the H.M.S. Beagle.

b 7. Darwin viewed the fossil record as hundreds of
- a. evidence that Earth was thousands of years old.
- [✓ b.] a record of evolution. —
- c. interesting but unrelated to the evolution of modern species.
- d. evidence that traits are acquired through use or disuse.

a 8. Darwin's theory of evolution is based on the idea(s) of
- [✓ a.] natural variation and natural selection.
- b. use and disuse.
- c. a tendency toward perfect, unchanging species.
- d. the transmission of acquired characteristics.

Name: ______________________ **ID: A**

C 9. Which of the following statements describes what all members of a population share?
- a. They are temporally isolated from one another.
- b. They are geographically isolated from one another.
- [✓ c.] They are members of the same species.
- d. They have identical genes.

C 10. Gene shuffling includes the independent movement of chromosomes during meiosis as well as
- a. mutations from radiation.
- b. changes in the frequencies of alleles.
- [✓ c.] crossing-over.
- d. mutations from chemicals.

a 11. The Galápagos finch species are an excellent example of
- [✓ a.] speciation.
- c. stabilizing selection.
- b. genetic equilibrium.
- d. selection on single-gene traits.

C 12. What proportion of all species that ever lived has become extinct?
- a. less than 1 percent
- [✓ c.] more than 99 percent
- b. approximately one-half
- d. 100 percent

C 13. To be useful as an index fossil, a species must have existed for a
- a. long period over a wide geographic range.
- b. long period over a small geographic range.
- [✓ c.] short period over a wide geographic range.
- d. short period over a small geographic range.

d 14. Which of the following was NOT characteristic of Earth before the oceans formed?
- a. volcanic activity
- b. bombardment by comets and asteroids
- c. an atmosphere of poisonous gases
- [✓ d.] an atmosphere containing oxygen gas

d 15. Two gases that probably existed in Earth's early atmosphere are
- a. oxygen and hydrogen sulfide.
- b. water vapor and oxygen.
- c. oxygen and carbon monoxide.
- [✓ d.] hydrogen cyanide and carbon monoxide.

X C 16. The Cambrian Explosion resulted in the evolution of the first
- a. dinosaurs and mammals.
- b. representatives of most animal groups.
- [✓ c.] bacteria.
- d. land animals.

Precambrian = start

d 17. In 1859, Darwin published his revolutionary scientific ideas in a work entitled
- a. Principles of Geology.
- b. Essay on the Principle of Population.
- c. Evolution in Malaysia.
- [✓ d.] On the Origin of Species.

b 18. When a farmer breeds only his or her best livestock, the process involved is
- a. natural selection.
- c. artificial variation.
- [✓ b.] artificial selection.
- d. survival of the fittest.

b 19. Darwin called the ability of an organism to survive and reproduce in its environment
- a. diversity.
- c. adaptation.
- [✓ b.] fitness.
- d. evolution.

✓

Name: ____________________ **ID: A**

b 20. In humans, the pelvis and the femur, or thighbone, are involved in walking. In whales, the pelvis and femur shown in the figure below are an example of ?

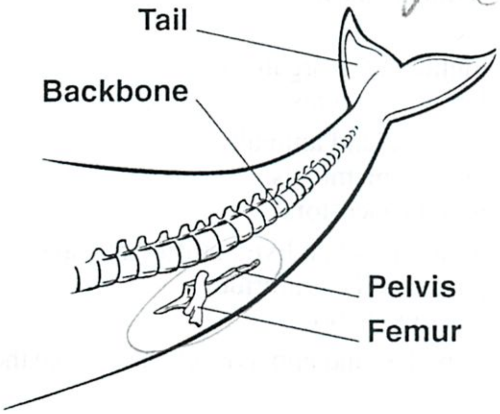


Figure 15–2

a. examples of fossils. ✓ needed c. acquired traits.
[✓ b.] vestigial structures. d. examples of natural variation.

a 21. Darwin's theory of evolution suggests that
[✓ a.] species change over time.
b. extinct species are not related to living species.
c. different species can interbreed.
4? d. animals that look alike are the most closely related.

a 22. Which statement is in agreement with Darwin's theory of evolution?
[✓ a.] More offspring are produced than can possibly survive.
b. The organisms that are the fittest are always the largest and strongest.
c. The number of offspring is not related to fitness.
d. Acquired characteristics that are inherited are the cause of evolution.

d 23. The combined genetic information of all members of a particular population is the population's
a. relative frequency. c. genotype.
b. phenotype. [✓ d.] gene pool.

d 24. A change in a sequence of DNA is called a
a. recombination. c. single-gene trait.
b. polygenic trait. [✓ d.] mutation.

b 25. The two main sources of genetic variation are
a. genotypes and phenotypes.
[✓ b.] gene shuffling and mutations.
c. single-gene traits and polygenic traits.
d. directional selection and disruptive selection.

d 26. Which is the first step that occurred in the speciation of the Galápagos finches?
a. establishment of genetic equilibrium c. ecological competition
b. behavioral isolation [✓ d.] arrival of the founding population

c 27. To compare the relative ages of fossils, scientists sometimes use an easily recognized species called a(an)
a. carbon fossil.
b. radioactive fossil.
[✓ c.] index fossil.
d. sedimentary fossil.

a 28. The first organisms on Earth were most like today's
[✓ a.] bacteria.
b. eukaryotes.
c. multicellular organisms.
d. DNA molecules. — not organisms

b 29. During the Jurassic and Cretaceous periods, the dominant land animals were
a. amphibians.
[✓ b.] dinosaurs.
c. grazing mammals.
d. human ancestors.

a 30. A single species that has evolved into several different forms that live in different ways has undergone
[✓ a.] adaptive radiation.
b. coevolution.
c. punctuated equilibrium.
d. mass extinction.

b 31. Sharks, dolphins, and penguins all have streamlined bodies and appendages that enable them to move through water. These similarities are the result of
a. coevolution.
[✓ b.] convergent evolution.
c. asexual reproduction.
d. adaptive radiation.

Completion (1pt ea.)
Complete each statement.

32. Crossing-over can occur during the meiotic divisions that produce cells called meiosis.

33. In a species that has become existinct, all members have died, and the species has ceased to exist.

34. As the Paleozoic Era closed, a(an) extinction, which is the dying out of many types of living things at one time, occurred.

35. A gene pool typically contains two or more alleles for each gene.

Short Answer (4 pts each)

36. Why might a geographic barrier such as a large river cause the formation of a new species of small rodents but not a new species of birds?

The river is a geographic boundry or isolator for the rodents - but not birds (who fly over it). Rodents can not cross the river to breed eaisly. The founder splits off a subset of the population which adapts to best survive in the new environment.

37. What was the source of the oxygen gas that began to accumulate in the atmosphere over 2 billion years ago?

The first plant-like organisms who used photosynthsis for energy and released oxygen into the ocean - which escaped into the atmosphere.

Name: ______________________ ID: A

38. Why were fossils important to Darwin's theory of evolution?

Fossils are our only view into the past-where we belive that 99% of species lived (and are now extinct) they provide time-indexed records of changes over time,

39. Suppose that selective breeding has produced a population of very similar chickens. Would that population survive if it were released into the world? Explain.

No. It' has been artifically selected to produce certain traits (like plumpness) which are not "fit" for the "real world". Organisms with a better fitness for that environment would survive.

Other (2 pts each)

USING SCIENCE SKILLS

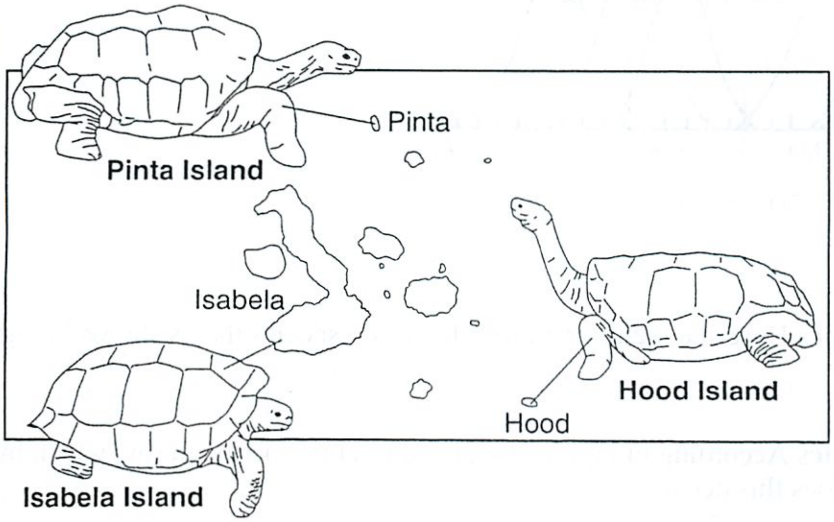


Figure 15–1

40. **Interpreting Graphics** What differences are apparent in the bodies of the three tortoise species shown in Figure 15-1?

The shape of the segments on their back

41. **Applying Concepts** Can you tell from Figure 15-1 how closely the three tortoise species resemble the ancestral species? Why or why not?

Not really. No information is provided about the ancestral species (would need fossils). Although their simmilarities suggest a common ancestor.

42. **Inferring** Vegetation on Hood Island is sparse and sometimes hard to reach. How might the vegetation have affected the evolution of the Hood Island tortoise shown in Figure 15-1?

It has a longer neck allowing it to reach more, harder to reach - vegitation.

43. **Forming Hypotheses** Considering the body structures of the tortoises shown in Figure 15-1, which tortoises—a population from Pinta Island or a population from Isabela Island—might survive more successfully on Hood Island? Why?

The Pinta paupulation appears to have longer necks and appears to be a better fit for Hood Island's hard to reach vegitation

USING SCIENCE SKILLS

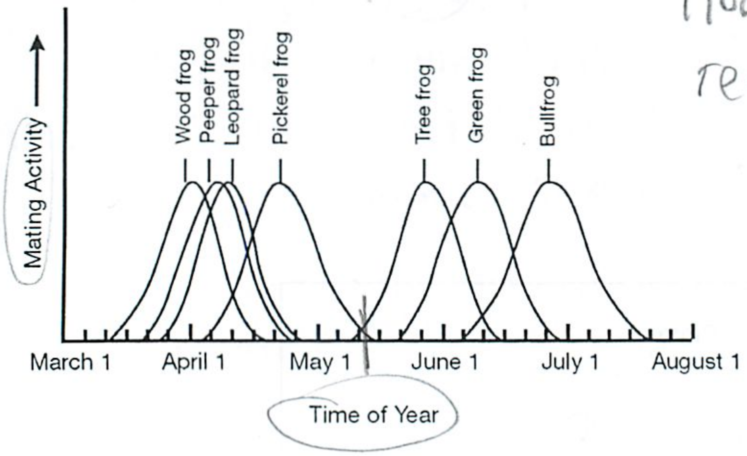


Figure 16–2

44. **Interpreting Graphics** Describe the information about frog species that is shown in Figure 16-2.

This shows that the frogs are temporally isolated. - reproduce at different times

45. **Interpreting Graphics** According to Figure 16-2, there is a brief period during which frog mating nearly stops. When does this occur?

The 2nd week of May
^About

46. **Inferring** Based on Figure 16-2, what mechanism appears to keep bullfrogs reproductively isolated? Would that mechanism necessarily be the only isolating mechanism? Explain.

Temporal isolation. No they may also be geographically

Next page

47. **Inferring** Peeper frogs and leopard frogs do not interbreed even when they share a habitat. Use the information in Figure 16-2 to determine what mechanism probably keeps the two species reproductively isolated.

isolated - the chart does not indicate if they all live in the same location. They could be reproductivly isolated and not want to mate with other frogs - and they won't because they are a different species.

48. **Predicting** Frog mating does not occur in cold weather. Assume that the mating times shown in Figure 16-2 are for frogs in the northern part of the United States. How might these curves change for frogs in the southern part of the United States? Explain. Below

.

.

47. Well first of all they are different species so by definition they can not inter breed. There must be Reproductive Isolation similor to how finches will only mate with other finches with a similor sized beak.

48. The mating days may be based on and indexed off of the day of the last frost, or the first day the temprature, humitity, etc. passes a certain threshold. There is not enough information to conclusivly deterimine when certain frogs will mate. However it is most likely based off of the weather, not the name of the calender month.

6/1

Name (s): Michael Plasmeier
Date: ____________ Block: __________

Ecosystem Study and Analysis

Purpose:
You will be working with a group of your peers to analyze the organisms found in and around a specific terrestrial or aquatic ecosystem. You will collect some specimen samples at the site to return to the classroom for analysis; other samples will be observed and sketched at the site.

Procedure:
Before traveling to the site, assign specific roles for each member of your lab group. You will need a clear idea of what your jobs are BEFORE heading down to the stream to ensure that you can complete all of the necessary tasks efficiently. Each person in your group can assume more then one role; some will be more time consuming then others.

Jobs to Complete at the Site:

Plaz

1. ***Sketches*** of your study area and the ecosystem. You should include a cross-sectional sketch illustrating the major features of both banks and the stream in between (trees, boulders, areas of shallow and deep water).

~~katie~~
Molly

2. ***Protist Samples***: Using your one of your sample jars (you have two per lab group), collect approximately 1 inch of substrate from the creek bottom, filling the rest of the bottle with water to the top. You will be using the protist field guides in the classroom to identify two different members of Kingdom Protista. For each identified sample, you should include with your sketch the **name of the organism**, the **name of the field guide** used to identify it, and the **page number** of the field guide you found it on. For each identified organism, you will be responsible to research diet and habitat information.

setiment
moss
algee
scrape off
rocks

Molly

3. ***Fungi Sample***: You will need to locate one member of Kingdom Fungi from the area around your study site. Sketch your fungus, noting quantitative information (about how large is it?) and qualitative information (color, texture, pattern of growth, etc.).

Melanie

4. ***Plant Sample***: Using your collection envelope, collect **seven** different leaf specimens. You will be responsible to identify **five** of these plants using the field guides in the lab; you will tape the leaf sample to computer paper to turn in with the lab. For each identified sample, you should include the **name of the organism**, the **name of the field guide** used to identify it, and the **page number** of the field guide you found it on. You should include additional information on the growth range of the plant with your reference. (This can often be found in the field guide.)

trees
Edisel

CAUTION: Be careful NOT to collect Poison Ivy samples! Trees are easier to identify then shrubs/bushes.

5. ***Animal Sample:*** You will need to observe and/or collect at least five different macro- or microorganisms from Kingdom Animalia. You may use the collection nets to collect aquatic organisms (crayfish, minnows, etc.) or insects (use caution); you may NOT use them to collect macro-organisms (i.e. birds, your lab partners, squirrels, dogs, etc.) Larger organisms such as these should be sketched into your notebook. Smaller ones may potentially be brought back to the classroom for further study in the sample jars. In the classroom, you will be responsible to identify your organisms down to the "Phylum" level (use Chapters 23 to 32 as a guide from your text). You will also research the characteristics that distinguish these specimens from other phyla, diet, and habitat requirements of the five organisms to be included in your report.

kate

minnow
Nematode
Vaterstride

Jobs to Complete in the Lab:

1. All analysis from the previous day's research at the site.

what it eats
+
what eats
it

2. Food Web Construction- Using a piece of computer paper, show the trophic relationships between the organisms you studied, using correct food web form. Include a picture or sketch of the organism with its name. (Hint: Arrows should point the direction energy flows to, the sun should be present, and all organisms should be labeled by their role (herbivore, producer, carnivore) and trophic level (primary consumer, secondary consumer, etc.). You may have gaps in your research from the field. Fill in those gaps as appropriate, placing the organisms you did not study in parentheses in your web.

Final Exam Study Guide
DragonBio Block 1, 07/08

-For each chapter, pay special attention to the "key" concepts and bold words in the text.

Chapter 1: The Science of Biology

Designing an experiment: variable, controlled experiment, hypothesis, theory
Studying life: biology, the characteristics of life, metabolism, homeostasis

Chapter 2: The Chemistry of Life

Matter: atom, nucleus, electron, proton, neutron, element, compound
Water: structure of molecule, polarity, solutions, suspensions
Carbon compounds: carbohydrates, proteins, lipids, nucleic acids

Ecology - Chapter 3: The Biosphere and Chapter 4: Ecosystems and Communities

Ecology: levels of organization, ecological methods
Energy Flow: producers, photosynthesis, chemosynthesis, consumers - types
Feeding relationships: food chain, trophic levels, pyramids – energy & biomass
Cycles: carbon, nitrogen, water
The major biomes

Chapter 7: Cell Structure and Function

Basic cell structures: cell membrane, cell wall, nucleus, cytoplasm
Prokaryotes and Eukaryotes
Cell structures: cell wall, nucleus, cytoskeleton, ribosomes, ER, golgi, chloroplast, mitochondria
Cell specialization and levels of organization

Chapter 8: Photosynthesis

Autotrophs and Heterotrophs
Chemical energy: ATP and ADP, releasing and using energy
Overall equation, pigments, location, reactions: reactants and products, factors

Chapter 9: Cellular respiration

Overall equation
Glycolysis and fermentation: alcoholic, lactic acid
Krebs cycle and electron transport - overview

Chapter 10: Cell growth and division

Limits to cell growth
The cell cycle: phases and events
Mitosis: phases and events
Cancer

Chapter 11: Introduction to genetics

Mendel's peas: true breeding, traits, hybrids, genes, alleles, dominant, recessive
Segregation: P, F1, F2, crosses, Punnett squares, gametes, independent assortment – dihybrid
Meiosis: chromosome number, haploid, diploid, phases, crossing over

Chapter 12: DNA and RNA

Structure: nucleotide, shape, backbone, RNA vs DNA differences
DNA replication, transcription, types of RNA, translation

Chapter 14: Human Genetics

Human Chromosomes: karyotype, sex chromosomes, autosomes

Human traits: pedigrees, dominant alleles, recessive alleles, sex-linked genes, nondisjunction

Chapter 15: Darwin's theory of evolution

Darwin's observations: Patterns of diversity, Fossils, Galapagos islands

Ideas that influenced Darwin: Lyell, Lamarck, Hutton, Malthus

Natural selection: variation, adaptation, struggle, survival of the fittest, descent with mod.

Summary of Darwin's theory

Chapter 16: Evolution of populations

Single-gene and polygenic traits, isolating mechanisms

Chapter 18: Classification

Linnaeus' system of classification; binomial nomenclature

Global warming….what is it?