

Supplemental Material

CBE—Life Sciences Education

Heideman *et al.*

Supplemental Material

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EXPERIMENT 1: Script for treatment group “Visual Review”

Script-Visual Review

Slide 1

- Hello
 - Take a Language Packet
 - Sign in
 - Read and Sign the consent form

Slide 2

- Thank you for participating in our Studying on learning
 - My name is Lu Sevier and I am working with Professor Heideman and Kelsey Trouton on this independent study
 - To keep all session constant I will be reading off of this script
 - Excuse my more measured reading

Slide 3

- Before we begin the actual experiment, I am going to walk you through some important details
 - First
 - Is anyone familiar with the language in their packet – you’ll have either Arabic or Korean?
 - [usually silent]
 - No problem if you don’t know the language
 - [I usually don’t have to say this]
 - If you already know something about the alphabet you have, then
 - Switch packets & check sign in if so

Slide 4

- Next
 - The time commitment for this experiment is straight forward
 - You will participate in two sessions
 - Today you will receive information about the experiment
 - In the next days you will practice on your own on three separate days
 - 5 minutes a day
 - You will keep a study log of your activities and check off each day as you complete it

Slide 5

- Next session you will have a 10 minute quiz and survey
 - Here are the session times
 - If you need to change your session time please let me know

- Contact me if you need an alternative time

Slide 6

- The quiz that you take here will remain confidential
- Your names will be replaced by a number so the researchers don't know which test is which

Slide 7

- Great, now that we have completed everything we can move on to the actual experiment
- The goal of this experiment is to
 - Learn 12 characters and sounds of a non European language
 - We are having you learn either Arabic [PAUSE] or Korean [PAUSE] under a time constraint

Slide 8

- You will use Visual Review

Slide 9

- Let's do an example
- We will use a made up language to practice
 - **Notice the phonetic column and the symbol column, just like in your alphabets**
 - **In the first column of your practice sheet visually review**
 - **the phonetic spellings and then the symbols with the spellings**
 - Do this for all 6 – I'll give you 30 seconds (?) to look through it
 - Remember, direction and accents matter

Ah	\$
Bah	μ
Pah	¥
Lah	€
Sah	Ω
Dah	₹

Slide 11

- Now think about how you normally do visual review
 - That's how you'll practice on your own
 - You'll tell us in the next session how you do visual review

Slide 12

- [after they have finished]
 - You have now practiced doing visual review

- This is what you will be doing for 5 minutes over three days with your non European languages

Slide 13

- Let's practice
 - You will spend the next 3 minutes (this was different in the slide) learning as much of your non european alphabet as possible
 - Lets take out the first page of our practice packet and write down the date and start time (PAUSE) for day 0
 - Please raise your hand if you have any questions
 - You will start when I say go
 - GO!
 - **Added: Now turn to your daily log and fill out your end time and check the box.**

Slide 14

- Final Instructions
 - Don't guess
 - Accents Matter
 - Please add all of them
 - Record if you make any mistakes
 - No practice on the day of your next session
 - **To keep all things constant-we ask that you not talk with friends who are also participating**
 - If you forget and do talk about it, that's OK, and you'll have a chance to tell us next week.
 -

Slide 16

- Looking forward to seeing you at the next session
- Remember to practice on 3 separate days
- Your quiz will be short next session!

EXPERIMENT 1: Script for treatment group “Folded Memory Method” [Note: for this experiment, the terminology was altered to remove the reference to ‘minute sketches’ in order to deliberately obscure connections to the study method.]

Script- **Folding Memory Method**

[Fold the practice sheets]

[Put a check mark after each slide]

[Don't get flustered if things go differently]

Slide 1

- Hello
 - Take a Language Packet
 - Sign in
 - Read and Sign the consent form

Slide 2

- Thank you for participating in our Studying on learning
 - My name is Lu Sevier and I am working with Professor Heideman and Kelsey Trouton on this independent study
 - To keep all session constant I will be reading off of this script
 - Excuse my more measured reading

Slide 3

- Before we begin the actual experiment, I am going to walk you through some important details
 - First
 - Is anyone familiar with the language in their packet – you'll have either Arabic or Korean?
 - [usually people are quiet at this point]
 - Its not problem if there is
 - If someone has a problem
 - If you already know something about the alphabet you have, then
 - Switch packets & check sign in if so
 - [didn't have to say this part]

Slide 4

- Next
 - The time commitment for this experiment is straight forward
 - You will participate in two sessions
 - In the first session(today) you will receive information about the experiment
 - In the next days you will practice on your own on three separate days
 - 5 minutes a day

- You will keep a study log of your activities and check off each day as you complete it

Slide 5

- Next session you will have a 10 minute quiz and survey
 - Here are the session times
 - If you need to change your session time please let me know
 - Contact me if you need an alternative time

Slide 6

- The quiz that you take here will remain confidential
- Your names will be replaced by a number so the researchers don't know which test is which

Slide 7

- Great, now that we have completed everything we can move on to the actual experiment
- The goal of this experiment is to
 - Learn 12 characters and sounds of a non European language
 - We are having you learn either Arabic [PAUSE] or Korean [PAUSE] under a time constraint

Slide 8

- You will use the folding and memory method to do this
- The folding and memory method
 - Allows you to hide one column to practice while looking at another column
 - Hiding a column forces us to practice recalling **what's in that** column

Slide 9

- Example
 - Please take out your practice sheet
 - **[I will already have folded the columns!]**

Slide 10 [Next slide]

- We will use a made up language to demonstrate the folding memory method
 - Notice the phonetic column and the symbol column, just like in your alphabets
 - In the first two columns of your practice sheet write the sound and then the symbol
 - Put in what I have on the screen this for all 6 (Added some accents on ah and dah)

Ah(accent)	\$
------------	----

Bah	μ
Pah	¥
Lah	€
Sah	Ω
Dah(accent)	€

Slide 11 **[Next Slide]**

- Now fold the column over so you only see the symbols, write the sounds as you remember them!
- Don't guess, if you don't remember, just check back –
- Actually, at first, you won't remember,
 - So for each, look at the phonetic sound, then hide it again while you rewrite or redraw it
 - It's OK if you have to look and hide it multiple times!
 - For example, you'll remember the shape, but as you start to draw you'll be unsure if it's backwards
 - Just check again
- Look up when you are done

\$
μ
¥
€
Ω
€

Slide 12 **[Next Slide]**

- Now fold the column over so you can only see the sounds
- Write the symbols
- Remember, direction and accents matter
- Again, at first, you won't remember,
 - So for each, check when you need to, then hide them again while you write
 - Again, it's OK if you have to look and hide it multiple times!
-
- [after they have finished]
 - Congrats you have done your first [folding memory practice](#), this is what you will be doing for 5 minutes over three days with your non European [languages](#)

Ah
Bah
Pah
Lah
Sah

Slide 13

- Let's practice [Next Slide]
 - Please take out your day 0 practice sheet
 - Take out the first page of our practice packet and write down the date and start time (PAUSE) for day 0
 - You will spend the next 3 minutes learning as much of the alphabet as possible
 - Please raise your hand if you have any questions
 - You will start when I say go
 - GO!
 - Now write the end time in your daily log and check the box and check the box that you have completed this

Slide 14

- Final Instructions
 - Don't guess
 - Accents Matter
 - Please add all of them
 - Record if you make any mistakes
 - No practice on the day of your next session
 - **To keep all things constant-we ask that you not talk with friends who are also participating**
 - If you forget and do talk about it, that's OK, and you'll have a chance to tell us next week.

Slide 15

- Looking forward to seeing you at the next session
- Remember to practice on 3 separate days
- Your quiz will be short next session!

Folded Memory Method Practice Sheet: Non European Alphabets (practice)

Name:

Date:

Start time:

End time:

.....

Folded Memory Method Practice Sheet: Non European Alphabets (practice) **Day A**

Name:

Date:

Start time:

End time:

.....

Folded Memory Method Practice Sheet: Non European Alphabets (practice) **Day B**

Name:

Date:

Start time:

End time:

.....

Folded Memory Method Practice Sheet: Non European Alphabets (practice) **Day C**

Name:

Date:

Start time:

End time:

.....

INSTRUCTIONS -- Group "Arabic A":

Key Steps

- Practice the study method, for 5 minutes over three days
- Record the date, start and end time for each page
- Save all Materials They will be turned in.
- Record any missed days or changes in your studying

Day 0	Day A	Day B	Day C	Day D
Practice Session <input type="checkbox"/>	5 minutes practice <input type="checkbox"/>	5 minutes practice <input type="checkbox"/>	5 minutes practice <input type="checkbox"/>	Next Session DO NOT STUDY!

Daily Log

- | | | |
|---|---|---|
| ▪ <u>Day 1</u>
Date: 04/___/15
Start time:
End Time: | ▪ <u>Day 2</u>
Date: 04/___/15
Start time:
End Time: | ▪ <u>Day 3</u>
Date: 04/___/15
Start time:
End Time: |
|---|---|---|

Group Arabic A:

há ح

djim ج

rró خ

rá ر

lâm ل

kâ ك

sin س

shin ش

tó ط

dá ظ

iâ ی

mim م

INSTRUCTIONS -- Group "Korean A":

Key Steps

- Practice the study method, for 5 minutes over three days
- Record the date, start and end time for each page
- Save all Materials They will be turned in.
- Record any missed days or changes in your studying

Day 0	Day A	Day B	Day C	Day D
Practice Session <input type="checkbox"/>	5 minutes practice <input type="checkbox"/>	5 minutes practice <input type="checkbox"/>	5 minutes practice <input type="checkbox"/>	Next Session DO NOT STUDY!

Daily Log

- | | | |
|---|---|---|
| ▪ <u>Day 1</u>
Date: 04/___/15
Start time:
End Time: | ▪ <u>Day 2</u>
Date: 04/___/15
Start time:
End Time: | ▪ <u>Day 3</u>
Date: 04/___/15
Start time:
End Time: |
|---|---|---|

Group "Korean A":

a ㅏ

ya ㅑ

eo ㅓ

yeo ㅕ

eu ㅡ

k,g ㄱ

k' ㅋ

d,t ㄷ

r,l ㄹ

m ㅁ

b,p ㅂ

f,p' ㅍ

Experiment 1: Quiz

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

- Reproduce from memory, as well as you can, the characters you learned.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

Q3. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered "Yes", then please describe what you did. There's no penalty! We just want to know so that we can use your data accurately, plus we'll contact you for coaching on the method if you need it.

Experiment 1: Survey after Quiz – [[Visual Review](#) Treatment Group].

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I am:
 17 or younger 18 19 20 21 22 23 24 or older
2. I am a:
 Freshman Sophomore Junior Senior Other
3. I would describe myself as (Please mark ALL that apply):
 African American/Black
 American Indian/Alaska Native
 Asian American/Asian
 Native Hawaiian/Pacific Islander
 Mexican American/Central American
 Puerto Rican
 Other Latino
 White/Caucasian
 Other
 No Response
4. I consider myself:
 Male Female Other No Response
5. I understand the concept of 'learning styles'.
 Strongly Agree;
 Agree;
 Neither Agree nor Disagree;
 Disagree;
 Strongly Disagree
6. I consider myself a – (Mark any that apply):
 No preference/ No style that I know
 Visual Learner
 Auditory Learner
 Reading-Writing Learner
 Kinesthetic or 'Tactile' Learner (learning by movement and activity)
 Other: _____
7. Right now, my most likely major in college is:
 Biology
 Chemistry
 Geology
 Kinesiology and Health Sciences

- Physics
- Mathematics
- Neuroscience
- Computer Science
- Other: _____

8. I have experience learning multiple languages and alphabets (*English, Greek and Chinese would be “three”, while English and Spanish use the same alphabet, so even together they would be “one”*):

- I have learned 1-2 alphabets (or character sets)
- I have learned 3-4 alphabets (or character sets)
- I have learned 5-6 alphabets (or character sets)
- I have learned seven or more alphabets (alphabets or character sets)

9. I think that I study:

- Much more than most students
- More than most students
- About the same amount as other students
- Less than most students
- Much less than most students

12. In my studying now, I use different study methods and I match my methods carefully to the material and the skills I need to learn.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

13. I am reluctant to change my study habits, because they have worked very well for me so far.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

14. When you study by “visual review”, what do you do?

(Please check THE CLOSEST description to what you do. In the next question, you may add more description if necessary)

- I start reading or looking at the beginning and read through to the end. If I have time, I repeat.

- I pick and choose what to read or look at. I try to identify the most important parts, and I spend more time looking at those parts and trying to hold it or fix it in my mind. Then I look at the next part and repeat.
- After looking at or rereading, I look away or close my eyes and try to recall it. If I cannot recall it, I glance at that part again, close my eyes or look away, and try again. Once I succeed in recalling it from memory, I look at the next part and repeat.
- NONE of the above fits what I do.

15. If your method for visual review differs from the check boxes above, please add a description of how you study by “visual review”.

16. Over the Past week I chatted with people about this experiment.

- Yes
- No

a. If yes, can you describe briefly what you talked about and with how many others?

Experiment 1: Survey after Quiz – [Folding Memory Method Treatment Group].

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I am:
 17 or younger 18 19 20 21 22 23 24 or older
2. I am a:
 Freshman Sophomore Junior Senior Other
3. I would describe myself as (Please mark ALL that apply):
 African American/Black
 American Indian/Alaska Native
 Asian American/Asian
 Native Hawaiian/Pacific Islander
 Mexican American/Central American
 Puerto Rican
 Other Latino
 White/Caucasian
 Other
 No Response
4. I consider myself:
 Male Female Other No Response
5. I understand the concept of 'learning styles'.
 Strongly Agree;
 Agree;
 Neither Agree nor Disagree;
 Disagree;
 Strongly Disagree
6. I consider myself a – (Mark any that apply):
 No preference/ No style that I know
 Visual Learner
 Auditory Learner
 Reading-Writing Learner
 Kinesthetic or 'Tactile' Learner (learning by movement and activity)
 Other: _____
7. Right now, my most likely major in college is:
 Biology
 Chemistry
 Geology
 Kinesiology and Health Sciences

- Physics
- Mathematics
- Neuroscience
- Computer Science
- Other: _____

8. I have experience learning multiple languages and alphabets (*English, Greek and Chinese would be “three”, while English and Spanish use the same alphabet, so even together they would be “one”*):

- I have learned 1-2 alphabets (or character sets)
- I have learned 3-4 alphabets (or character sets)
- I have learned 5-6 alphabets (or character sets)
- I have learned seven or more alphabets (alphabets or character sets)

9. I think that I study:

- Much more than most students
- More than most students
- About the same amount as other students
- Less than most students
- Much less than most students

12. In my studying now, I use different study methods and I match my methods carefully to the material and the skills I need to learn.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

13. I am reluctant to change my study habits, because they have worked very well for me so far.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

14. Over the Past week I chatted with people about this experiment.

- Yes
- No

b. If yes, can you describe briefly what you talked about and with how many others?

EXPERIMENT 2: Script

1. Slide- Pre Title [To individuals as they arrive]
 - Welcome and Thank you for coming
 - There is a sign in form going --
 - o could everyone write their name please?
 - Has everyone received a consent form?
 - o If you could please read and sign and return it.
 - o Remember you can opt out of this experiment with no penalty.
 - If you complete both sessions we will we provide a \$20 gift card as a thank you
 - As we wait for people to come in please fill out the survey provided
2. Slide 2-Title [once the majority of people have come in]
 - Welcome to session one of a Study Method comparison. My name is Lu Sevier and I am working with Professor Heideman on this experiment for my independent study.
 - We really appreciate you being here
 - Today, I will be following this script to make sure that each session we hold is consistent
 - o Please bear with me and my measured reading
3. Slide 3 –Details
 - The time commitment for this experiment is straightforward.
 - o You will be here for your session today
 - o Then you will practice on your own for 3 days, 10 minutes a day
 - o Next week you will come back for session 2
4. Slide 4- Details
 - If you need to change your session time, feel free to show up for another one of these times.
 - o If this doesn't work, please contact me
 - o we will try and set up a meeting,
 - o If you change, email me for the location
5. Slide 5- Details
 - Please make sure you have two packets of paper
 - o One for instructions with non Eu characters
 - o Sheets for practice
 - Turn to the last page please
 - The last page is instructions for this experiment
6. Slide 6-Details
 - Note your quiz results and surveys will be confidential.
 - o All of your names will be transformed into numbers
 - o The results will be between you and the us, the researchers
7. Slide 7- Comparison of Study
 - We are comparing study methods.
 - One of the two is visual review.
 - o This is probably the most common study method used by college students
 - That appears to be true at WM based on a survey we did last Fall.

- There are many differences in the way people use visual review
 - Some people look at a page and reread it
 - Some people focus on all or parts and try to fix it in their mind
 - Some people look at it and look away and try to remember it
 - Some people focus on the most important parts
- We consider all of these visual review
 - We are interested in how effective it is
- **Again** – *pause* – As long as you are not writing, **ALL** of these methods are visual review-*pause*- in this experiment

8. Slide 8-Study Methods

- We need a comparison method and
 - We are going to use something called Minute Sketches with folded lists
- We will refer to this mostly as (MSFL)
 - So, what's a minute sketch?
 - **Minute sketch is a sketch done in less than a minute.**
 - **It captures the essentials of a concept, structure or events you want to remember**
 - What's a Folded list?
 - Folded list is a piece of paper folded so you can hide one column to practice while looking at another column
 - The idea is to go back and forth practicing your memory
 - That takes time
 - And it isn't clear whether visual review or minute sketches with folded lists might do better in a head to head competition
 - To test this we need to show you how to do Minute Sketches with folded lists and
 - You already know how to do visual review

9. Slide 9-Using content you know

- I will walk you through it using content you know
 - The water cycle
 - If you look at the materials of your packet, the first page of your materials is a practice sheet
 - Write the start time which is
 - Write your name [this is to get them used to writing everything]
 - Gently pull this off and fold along the five vertical lines
 - [this step will take time, the first time]
 - [demonstrate] I'll do one. Now flatten it out
 - [at board] the first column includes terms from your concept
 - for the water cycle that might include
 - evaporation, condensation [write on board]

- if you were using these for studying can you give me some more terms
 - precipitation, ground water, surface water, impervious layer
- now we have a list of terms and that is one of the two columns
 - next is a column for sketches,
 - I'll draw a sample sketch
 - Here is an ocean, water evaporates off the ocean, rises and condenses to form clouds
 - Clouds over land, I like to represent land as a mountain and a hill land submerging under the sea
 - Clouds produce precipitation which can form surface water that into streams and lakes and rivers eventually back to the sea
 - [finish sketch] now do a version for yourself on your paper
- At this point you should have one column of terms and one sketch
 - Check and add whatever is missing
 - If you were studying a series of this, each one would have a list of terms and a sketch
- Now fold under your terms column
 - I will erase mine
 - From memory write down the terms while thinking through that part of the sketch
 - If you are not sure DO NOT guess, just check
 - Ill time you, start now, look up when you are done
- With this example, usually it takes about 15 to 35 seconds for this first time
 - This was pretty normal
- Next, we will hide the sketch [erase] now thinking about the terms, redraw the sketch in the next column
 - Fold your sketch under
 - I will time you, start now, look up when done
- With this example, usually it takes about 15 to 35 seconds for this first time
 - Check back and make sure nothing is missing
 - Again, don't guess, check back
- Now hide your terms column, we are going to rewrite the terms
 - This time, abbreviate your words
 - Don't write down words you will remember like clouds, lakes
 - Next when you do your sketch you will simply it
 - Don't draw 10 raindrops when 3 will do, or two clouds if one will do
 - You just need reminders
- Fold under your terms and I will time you
 - Look up when done
 - [write time in 5th column]
- Fold under your sketch and I will time you
 - Look up when done
 - [write time in 5th column]
- Congratulations. You have just finished your first minute sketch
 - Lets look back at the work we did

- The first two columns took us about 2 minutes to write the terms and come up with a sketch
 - The next two columns took us about 1 minute to write the terms and sketch again
 - The next two took about 30 seconds, when we abbreviated our terms and script. That's the idea of minute sketches
 - That's the idea,
 - Both methods could work
 - But if you spent the same amount of time on each, which might work better?
 - That is what we are testing

10. Slide 10-This study: a comparison

- This experiment is a time matched comparison of visual review and MSFL
 - We are using non European alphabets so that we can match the difficulty precisely (and its fast)
 - Also, a persons interest affects how quickly they learn
 - It is likely that non of you have any particular interest in these alphabets

○

11. Slide 11- Error Check

- a. Please hold up your language packet.
 - i. Check your language
 - ii. Is it A or B
 - iii. Please circle this
- b. Identify if your first page is Visual review or MSFL
 - i. Please circle
- c. We are doing this because there were a lot of mistakes in the last study. Thank you for bearing with us.
 - [if they are looking frustrated or bored say "*I'm sorry we have to do this but the first time we did this there were so many mistakes with both methods that we realized we have to walk people through it*"]

Slide 12

Now we are going to try this with your experiment.

We will be doing much simpler minute sketches

We will just be memorizing a symbol and its phonetic sound.

- We will run through your minute sketch page and your visual review page to make sure its clear
 - Now gently tear the page practice packet,
 - Fold it
 - Name and note the start time

- Please turn to your MSFL page in your instruction packet
 - Gently tear it out
 - Fold the paper so you can only see the phonetic column
- In the first column, write the first phonetic term in the first column
 - Turn your sheet over and write the matching symbol
- Do the same thing for the next term, for time sake we will only do this for 4 terms, however you will do this for the entire column.
 - Do this until you finish the entire column of words
 - I will time you
- [when they are done]
 - the group spent approximately 4 minutes doing this
 - we are now going to spend 4 minutes doing visual review
 - turn to the non European language visual review page
 -

You will practice this on three separate days in the coming week. Spend 5 minutes on visual review and 5mins on minute sketches.

Slide 14- Practicing

- You are going to practice MSFL and visual review on 3 separate days.
 - You will do each method for 5 mins
 -

Slide 15- Practicing

- Please Put your name on the papers
 - Name (pause) we need to be able to track them
 - Them date them and write down the time
 - [pull out paper]
 - There is also room to write your VS time

Slide 16- Next Session

- you will have a quiz next session
 - it will look like this,
 - you will write the terms from MSFL or visual review in order
 - **the way the accents and dots go is important**
 - there is space for you to write if you think you made a mistake during the study

Slide 17- FAQs

This is my professor's favorite slide

The take away is to record if you think you made a mistake

- The greatest take away from this slide
 - just record it
 - record anything that you think is a mistake
 - we want to know and we will still be able to use your data

1. Slide 18-Final instructions

- Rules to remember, in no particular order
 - No words on sketches
 - Don't guess during practice

- This is really important
- No studying on the day of the session
 - We want to see if a method works even if you don't have time to study the day of the exam
- Study time is 30 minutes in TOTAL
 - 5 minutes on the page for each method over 3 days

No words on sketches

Don't guess during practice

- 5 minutes on each method for 3 day (total of 30 minutes)
- No studying on day of next session

Experiment 2: Survey

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I am:
 17 or younger 18 19 20 21 22 23 24 or older
2. I am a:
 Freshman Sophomore Junior Senior Other
3. I would describe myself as (Please mark ALL that apply):
 - African American/Black
 - American Indian/Alaska Native
 - Asian American/Asian
 - Native Hawaiian/Pacific Islander
 - Mexican American/Central American
 - Puerto Rican
 - Other Latino
 - White/Caucasian
 - Other
 - No Response
4. I consider myself:
 Male Female Other No Response
5. I understand the concept of ‘learning styles’.
 - Strongly Agree;
 - Agree;
 - Neither Agree nor Disagree;
 - Disagree;
 - Strongly Disagree
6. I consider myself a – (Mark any that apply):
 - No preference/ No style that I know
 - Visual Learner
 - Auditory Learner
 - Reading-Writing Learner
 - Kinesthetic or ‘Tactile’ Learner (learning by movement and activity)
 - Other: _____
7. I have experience learning multiple languages and alphabets (*English, Greek and Chinese would be “three”, while English and Spanish use the same alphabet, so even together they would be “one”*):
 - I have learned 1-2 alphabets (or character sets)
 - I have learned 3-4 alphabets (or character sets)
 - I have learned 5-6 alphabets (or character sets)
 - I have learned seven or more alphabets (alphabets or character sets)
8. Right now, my most likely major in college is:

- Biology
- Chemistry
- Geology
- Kinesiology and Health Sciences
- Physics
- Mathematics
- Neuroscience
- Computer Science
- Other: _____

9. I think that I study:

- Much more than most students
- More than most students
- About the same amount as other students
- Less than most students
- Much less than most students

10. Which study methods do you use before a challenging test: Please check all that you use. If you think you haven't heard of a particular study method, please line it out by making a horizontal line through the words.

- Rereading my notes
- Rereading power-points or presentations
- Rereading the textbook
- Rewriting my notes
- Summarizing
- Highlighting
- Flashcards
- Drawing or sketching
- Redrawing sketches for practice
- Practice tests
- Self-testing
- Writing my own questions
- Mnemonics (or memory aids) for key words
- Distributed practice (studying or practicing the same things over more than one day)
- Chunking
- Retrieval practice
- Mind maps or concept maps
- Folded lists
- Minute sketches
- Other (a) _____
- Other (b) _____
- Other (c) _____

11. Please indicate the approximate amount of time in which you use these study methods before a challenging test (just an approximation). Your numbers should add up to 100%, but if they do not, we will adjust them to total 100%. (Example: 40% Rereading my notes, 30% rereading Powerpoints or presentations, 30% rereading the textbook. The total = 100%)

- ____ % Rereading my notes
- ____ % Rereading power-points or presentations
- ____ % Rereading the textbook
- ____ % Rewriting my notes
- ____ % Summarizing
- ____ % Highlighting
- ____ % Flashcards
- ____ % Drawing or sketching
- ____ % Redrawing sketches for practice
- ____ % Practice tests
- ____ % Self-testing
- ____ % Writing my own questions
- ____ % Mnemonics (or memory aids) for key words
- ____ % Distributed practice (studying or practicing the same things over more than 1 day)
- ____ % Chunking
- ____ % Retrieval practice
- ____ % Mind maps or concept maps
- ____ % Folded lists
- ____ % Minute sketches
- ____ % Other (a) _____
- ____ % Other (b) _____
- ____ % Other (c) _____

100%: Total

12. In my studying now, I use different study methods and I match my methods carefully to the material and the skills I need to learn.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

13. I am reluctant to change my study habits, because they have worked very well for me so far.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

INSTRUCTIONS -- Group "Arabic A":

On three different days this week:

1. Practice 12 characters on one page using minute sketches with folded lists & practice the **OTHER PAGE** of 12 characters using visual review.
 - For visual review, look at the characters and sounds and try to get them into your memory in the way you would normally do when using visual review
2. On three different days (doesn't matter which day of the week), spend
 - Five minutes on the 12 characters & sounds with visual review
 - Five minutes on the 12 characters & sounds with MS-FL
 - As you write/sketch, think about the shapes of the letters and the sounds
3. Please write each date and the start and end times for both Visual Review and the MS-FL on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
4. Please try to remember to **alternate** the order in which you study (in other words, one day do visual review first, and on the next do MS-FL)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
5. **NO PRACTICE ON THE DAY OF NEXT SESSION!**
 - Come to your next session without having practiced that day – **no practice on the day of your next session.**

This is intended to be similar to an exam for which you don't have time to study on the day of the exam.
6. If you follow these instructions carefully, your results will give you information on how well these methods work for you.
 - Please try to make your effort a fair test of each method – you want to know what works!
7. The quiz will be a sheet of paper on which you reproduce the characters with their sounds

Group "Arabic A": **Page 1** practice with Minute Sketches and Folded Lists

há ح

djim ج

rró خ

rá ر

lâm ل

kâ ك

sin س

shin ش

tó ط

dá ظ

iâ ی

mim م

Group "Arabic A": **Page 2** practice this page with Visual Review

bâ ب

nun ن

tâ ت

thâ ث

hâ ه

uau و

sód ص

dód ض

áin ع

gháin غ

fâ ف

qóf ق

INSTRUCTIONS -- Group "Arabic B":

On three different days this week:

1. Practice 12 characters on one page using minute sketches with folded lists & practice the **OTHER PAGE** of 12 characters using visual review.
 - For visual review, look at the characters and sounds and try to get them into your memory in the way you would normally do when using visual review
2. On three different days (doesn't matter which day of the week), spend
 - Five minutes on the 12 characters & sounds with visual review
 - Five minutes on the 12 characters & sounds with MS-FL
 - As you write/sketch, think about the shapes of the letters and the sounds
3. Please write each date and the start and end times for both Visual Review and the MS-FL on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
4. Please try to remember to **alternate** the order in which you study (in other words, one day do visual review first, and on the next do MS-FL)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
5. **NO PRACTICE ON THE DAY OF NEXT SESSION!**
 - Come to your next session without having practiced that day – no practice on the day of your next session.
This is intended to be similar to an exam for which you don't have time to study on the day of the exam.
6. If you follow these instructions carefully, your results will give you information on how well these methods work for you.
 - Please try to make your effort a fair test of each method – you want to know what works!
7. The quiz will be a sheet of paper on which you reproduce the characters with their sounds

Group "Arabic B": **Page 1** practice this page with Visual Review

há ح

djim ج

rró خ

rá ر

lâm ل

kâ ك

sin س

shin ش

tó ط

dá ظ

iâ ی

mim م

Group "Arabic B": **Page 2** practice with Minute Sketches and Folded Lists

bâ ب

nun ن

tâ ت

thâ ث

hâ ه

uau و

sód ص

dód ض

áin ع

gháin غ

fâ ف

qóf ق

INSTRUCTIONS -- Group "Korean A":

On three different days this week:

1. Practice 12 characters on one page using minute sketches with folded lists & practice the **OTHER PAGE** of 12 characters using visual review.
 - For visual review, look at the characters and sounds and try to get them into your memory in the way you would normally do when using visual review
2. On three different days (doesn't matter which day of the week), spend
 - Five minutes on the 12 characters & sounds with visual review
 - Five minutes on the 12 characters & sounds with MS-FL
 - As you write/sketch, think about the shapes of the letters and the sounds
3. Please write each date and the start and end times for both Visual Review and the MS-FL on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
4. Please try to remember to **alternate** the order in which you study (in other words, one day do visual review first, and on the next do MS-FL)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
5. **NO PRACTICE ON THE DAY OF NEXT SESSION!**
 - Come to your next session without having practiced that day – no practice on the day of your next session.
This is intended to be similar to an exam for which you don't have time to study on the day of the exam.
6. If you follow these instructions carefully, your results will give you information on how well these methods work for you.
 - Please try to make your effort a fair test of each method – you want to know what works!
7. The quiz will be a sheet of paper on which you reproduce the characters with their sounds

Group "Korean A": **Page 1** practice with Minute Sketches and Folded Lists

a ㅏ

ya ㅑ

eo ㅓ

yeo ㅕ

eu ㅡ

k,g ㄱ

k' ㅋ

d,t ㄷ

r,l ㄹ

m ㅁ

b,p ㅂ

f,p' ㅍ

Group "Korean A": **Page 2** practice this page with Visual Review

ee |

o ㅏ

Yo ㅑ

u ㅓ

yu ㅕ

n ㄴ

ng ㄹ

ch, j ㅈ

ch' ㅊ

k' ㅋ

t' ㅌ

h ㅎ

INSTRUCTIONS -- Group "Korean B":

On three different days this week:

1. Practice 12 characters on one page using minute sketches with folded lists & practice the **OTHER PAGE** of 12 characters using visual review.
 - For visual review, look at the characters and sounds and try to get them into your memory in the way you would normally do when using visual review
2. On three different days (doesn't matter which day of the week), spend
 - Five minutes on the 12 characters & sounds with visual review
 - Five minutes on the 12 characters & sounds with MS-FL
 - As you write/sketch, think about the shapes of the letters and the sounds
3. Please write each date and the start and end times for both Visual Review and the MS-FL on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
4. Please try to remember to **alternate** the order in which you study (in other words, one day do visual review first, and on the next do MS-FL)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
5. **NO PRACTICE ON THE DAY OF NEXT SESSION!**
 - Come to your next session without having practiced that day – no practice on the day of your next session.
This is intended to be similar to an exam for which you don't have time to study on the day of the exam.
6. If you follow these instructions carefully, your results will give you information on how well these methods work for you.
 - Please try to make your effort a fair test of each method – you want to know what works!
7. The quiz will be a sheet of paper on which you reproduce the characters with their sounds

Group "Korean B": **Page 1** practice this page with Visual Review

a ㅏ

ya ㅑ

eo ㅓ

yeo ㅕ

eu ㅡ

k,g ㄱ

k' ㅋ

d,t ㄷ

r,l ㄹ

m ㅁ

b,p ㅂ

f,p' ㅍ

Group "Korean B": **Page 2** practice with Minute Sketches and Folded Lists

ee |

o ㅏ

Yo ㅑ

u ㅓ

yu ㅕ

n ㄴ

ng ㄹ

ch, j ㅇ

ch' ㅈ

k' ㅋ

t' ㅌ

h ㅎ

Experiment 2: Instructions for Studying

Instructions for Practice (Research Experiment on Studying)

FOR MINUTE SKETCHES IN FOLDED LISTS

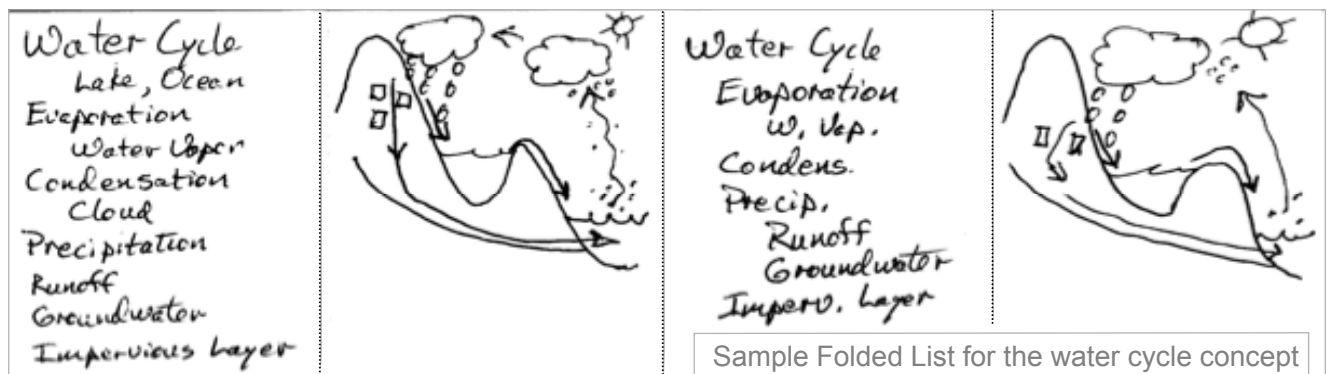
1. **Hide the sounds column** by folding it under. While looking at each shape and thinking about it, rewrite the letters of the sound in the next column.

If you can't remember the sounds, that's normal. Never guess, though. Just quickly turn the page back over to check the letters, and once you've checked, hide the sounds column and then write letters from memory.

2. **Hide the sketch column** so that you can see only the letters. As you look at only the sounds (in column 3), redraw the characters.

If you don't remember part or all of a character (which is normal), don't guess. Just quickly turn the character column back up to check. Then hide that column again, and draw the character from memory. If you have to check twice, that's OK! (Again, that's normal when you're starting.) Just don't guess.

3. **When you run out of space**, get a new sheet of paper and keep going. Below is a sample minute sketch in which someone has completed four columns for the water cycle. The columns alternate between words and an image of something.



FOR VISUAL REVIEW

1. Spend the same amount of time (5 minutes on three different days) practicing the OTHER page (the one that says "For Visual Review" at the top).

Practice however you normally study by visual review. In other words, whatever you normally do when you're looking at things you want to learn and remember.

On each day, practice this page by visual review for 5 minutes.

MSFL Practice Sheet: Water Cycle

Name:

Date:

Start time:

End time:

(Visual Review Start Time:

Vis Review End Time:)

MSFL Practice Sheet: Non European Alphabets (practice)

Name:

Date:

Start time:

End time:

(Visual Review Start Time:

Vis Review End Time:)

MSFL Practice Sheet: Non European Alphabets **Day A**

Name:

Date:

Start time:

End time:

(Visual Review Start Time:

Vis Review End Time:)

MSFL Practice Sheet: Non European Alphabets **Day B**

Name:

Date:

Start time:

End time:

(Visual Review Start Time:

Vis Review End Time:)

MSFL Practice Sheet: Non European Alphabets **Day C**

Name:

Date:

Start time:

End time:

(Visual Review Start Time:

Vis Review End Time:)

Experiment 2: Quiz

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

- Reproduce from memory, as well as you can, the characters you learned.
- In the first column: write the characters & sounds you learned by visual review, and those with minute sketches and folded lists in the other.
- If you attempt one column first, please mark that column as “First” (if you go back and forth, choose “neither”).

Q1. *Characters & Sounds learned using **Visual Review** below*

*Characters & Sounds learned using **Minute sketches with Folded Lists** below*

Q2. (Attempted First or Second or Neither)

(Attempted First or Second or Neither)

1.

1.

2.

2.

3.

3.

4.

4.

5.

5.

6.

6.

7.

7.

8.

8.

9.

9.

10.

10.

11.

11.

12.

12.

Q3. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered “Yes”, then please describe what you did. There’s no penalty! We just want to know so that we can use your data accurately, plus we’ll contact you for coaching on the method if you need it.

Experiment 3: Session 1: Script

Session 1 Plan

As participants come in:

- “Do you know the Korean or Arabic Alphabet?”
 - Random assignment to treatment, but if a participant knows one alphabet, they must follow the other
 - Anyone know both? (... then Tamil characters)

Detailed Script

1. SLIDE – Title

- Welcome and thank you
 - Introductions
 - Consent form – please read, sign, & turn in. (May wait until the end of the session, if you prefer!)
 - If you are under 18, you may still participate in all the activities (including 2 Discussion Points for BIOL 220), but I will not use your data in the research study.
 - You may opt out at any time with no penalty.

2. SLIDE – Survey form –

[For those who arrive late and complete the survey only after the presentation, we noted this on their survey.]

3. SLIDE – Reminders: 1 – Duration, # sessions, & time

[Walk participants through the text on the slide.]

4. SLIDE – Reminders: 2 – Discussion points & thoughts

[Walk participants through the text on the slide – 2 pts, but not necessarily fastest way to earn the points; perhaps more important to learn about learning & studying.]

5. SLIDE – Reminders: 3 – Multiple session times; options for make-up times, & opting out.

[Walk participants through the text on the slide.]

6. SLIDE – Reminders: 4 – Confidentiality; BIOL 220 Profs only receive list of those who complete the study.

[Walk participants through the text on the slide.]

7. SLIDE – Participants Gain: 1

- Effectiveness of study methods.
[Information from research on student study methods.]

8. SLIDE – Participants Gain: 2

- Reasons why some methods may be better than others.
9. SLIDE – Participants Gain: 3
 - A new study method – minute sketches with folded lists
 10. SLIDE – Participants Gain: 4– A skill: a way to compare two study methods for effectiveness.
 11. SLIDE – Participants Gain: 5 – Information – Min Sk & Fold Lst useful to you?
 - A. Amount learned in the same amount of time?
 - B. Does your level of interest matter to your learning with these methods?
 12. SLIDE – Study Goals
 1. When you compare two methods in ways that you might actually use before an exam,
 - Does one method work better in a way you truly might study?
 - How many of you have studied using visual review?
 - Just looking at something and trying to get it into your head?
[typically, all or nearly hands raised]
 - So that’s a method that nearly all of us use (me too)
 - We’ll compare it to the new method – minute sketches with folded lists
 - spending the same amount of study time on each – just 5 minutes a day
 - On three different days
 2. When you have the information from this study, and when you’ve tested the method,
 - Will some of you change the ways you study?
 13. SLIDE – Why does this need 12 weeks and 7 sessions?
 1. To hear the information and learn the method (Sessions 1 & 4)
 - The study has two parts
 - In the first you’re going to learn the method and try it on something you don’t care about (I think)
 - Letters and their sounds from the Korean alphabet or Arabic alphabet
 - How many of you have had to learn in a class something you didn’t care at all about?
(Usually nearly all or all raise their hands)
 - Would it be useful to have a method that worked fast and well for learning even when you don’t care?
[Allow time for thought – most people nodding.]
 - In the second part, in Session 4, you’ll be learning some material related to biology
 - I’m hoping that it is something that you care about, at least a little
 - This material isn’t critical for BIOL 220, but it could matter in later courses
 14. SLIDE – To practice the method so that you do it correctly – the practice sessions

- The method takes time to learn to do well
- In the first part of study, you'll learn the method on something very simple (the alphabets)

15. SLIDE – To learn:

A. How well you remember (Sessions 2 & 5)

- After three times practicing the alphabet,
 - Half the alphabet using minute sketches and folded lists; half with visual review
 - In a realistic way – studying just a short time on three different days
 - As if you were studying on three different days for a test or quiz
 - You will not study on the day of the quiz?
 - Why not?
 - Think about it – would it be useful to have a study method that didn't make you practice again on the day of the quiz?
 - If you know that even without studying on that day, you would still know what you need to know?
- [TIME to reflect]*

- In session 4, you'll learn the new material
 - And practice it on three different days –
 - Half of the material using minute sketches with folded lists
 - And half by visual review
 - Again, you'll take a test, and you won't study on that day
- The question is how well will you remember with two different study methods?

B. How quickly you forget (Sessions 3 & 6)

- You have to learn things all the time for a test
 - You take the test ...
 - ... and start to forget
 - SO how quickly do you forget?
 - We're going to give you three weeks to forget before Session 3 (You won't do anything for the project for those three weeks.)
 - And you'll find out how much you forget in those three weeks

C. How much you need to review (Sessions 4 & 7)

- Often, you learn something for a test,
 - and later you have to know it again for a bigger test, or a final exam
- How much do you need to review in order to remember what you've forgotten?
 - To find out, you'll wait a couple of weeks after Session 3 and 6, doing nothing,
 - And then you'll practice just once, the night before the test (Again, this is supposed to be realistic – just like you might study for a final exam.)

- D. Does it matter how much you care?
- Did you learn the same amount when you studied an alphabet or biology-related material?

16. SLIDE – Strengthening memory and skills

- Now you need some facts
 - What strengthens memory?
 - What does the research tell us?

17. SLIDE – Memories strengthen when we recall them

- When we practice remembering – trying to recall something from memory
 - It's called retrieval practice or recall practice
 - That should make sense to you;
 - If you want to improve something, you practice it
 - Retrieving a memory, recalling a memory
 - Strengthens it!

18. SLIDE – Memories strengthen when we recall them

- And that seems to be true
 - Just looking at something again doesn't seem to help build a memory
- Memories strengthen when we recall them
 - You HAVE TO practice remembering it

19. SLIDE – When you learn things, you don't just learn that one thing

- You learn a term with an image, or with events, or with a structure
- So you need to practice the words with an image of what the thing is: events, structures, or actions

20. SLIDE – Memories strengthen when we recall them in association with their connections

- In biology, math, history, or whatever, you need to practice procedures, facts, concepts, and problem-solving methods from memory
- That's what the research suggests.
 - BUT – is it true for you?
 - We're not all identical.
 - It's important to test for yourself

21. SLIDE – Dunlosky et al., 2013

- What does research tell us about the methods students use to study?
 - In this paper from 2013, researchers tried to find all the well-done research on study methods
 - This is a “meta-analysis” – an analysis of many other analyses

Read the title ...

- It's a long paper – 54 pages – but they sum it all up nicely

- What did they find?

22. SLIDE – They grouped the study methods into 10 categories

- Listed in this table (and in your handout)
- I want to talk about just five (and you can look at the others on your own)
 - Summarization – writing a summary of something you need to learn
 - Highlighting/Underlining – no explanation needed
 - How many of you have highlighted/underlined?
 - Rereading – rereading a book, your notes, a powerpoint, ...
 - Practice testing – any time you test yourself on what you know
 - Doing practice problems, taking an old version of a test or a practice test, flashcards, and any other test of your memory or your skill
 - Distributed practice – If you have one hour to study,
 - You could study all at once for that our
 - Or you could study for 15 minutes on four different days
 - That would be distributed practice
 - Practice on more than one day

23. Slide - So what did they find?

- They explain what they found in the text
 - And they summarized it in one table
 - and for each, rated it low, medium, or high for effectiveness

24. SLIDE – Let's look at the first three I talked about

- One surprised me:
 - Summarization – Low; but I think that's because most people just summarize, and then reread their summary.
 - They aren't practicing recalling their summary
- Two more:
 - Highlighting/Underlining – Low
 - You learn very little for the time you put in
 - Rereading – Low
 - You learn very little for the time you put in
- Why? Well, you tell me:
 - When you review a summary, look at your highlighted text, or reread your notes or a powerpoint,
 - Are you actively recalling it?
 - Are you actually practicing the memory?

TIME TO THINK – Student answers here

25. SLIDE – What about the other two?

- Practice testing – High
 - Does that make sense?
 - Are you practicing your memories and skills when you do this?
 - *TIME TO THINK*
- Distributed Practice – High
 - Why might this be?
 - Research shows something interesting
 - When you practice something over and over on one day,
 - You gain the most from the first times you practice
 - and less over time
 - So if you practice six times, you'll do better if you spread it ...
 - To two times each on three days → 6 total
 - If you practice it six times in a row, you won't learn as much

26. SLIDE – Now the new method

- Here's a minute sketch
 - It's the water cycle
 - With a list of terms on the left side (NEVER ON the sketch)
 - Notice:
 - Here's the ocean on the right
 - Heat from the sun causing evaporation
 - The water vapor rising
 - I could have added some dots to show the water molecules
 - It condenses into tiny droplets (I didn't show them)
 - That combine into clouds
 - The clouds over land cool
 - Water precipitates as rain drops
 - On land, the water either becomes run-off (see these arrows)
 - Into streams or rivers
 - Or the water seeps into the ground as groundwater
 - And goes down between these rocks or soil particles
 - Until it reaches an impervious layer
 - Then it goes down along the impervious layer to the ocean
- So a minute sketch
 - Is a simple sketch that captures an event, a structure, or a concept
 - What do you think? Does it?
 - Close your eyes (yes – close your eyes) and think about the water cycle, and think through it
 - Does this sketch work to capture it?

27. SLIDE – There are rules, and the rules are important

1. You have to be able to redraw it from memory in about 30 seconds (less than a minute)

- That's why it's a "minute sketch"

- Why?

- It turns out that any sketch you can redraw that fast is also one you can hold in your mind

- You can close your eyes, or look away, and picture it in your mind

- That means something important!

- You can practice it by recalling it

- And if you can't hold something in your mind,

- You can't easily recall it for practice

- This rule also means that you can redraw it for practice very quickly!

- In fact, most people can redraw a minute sketch about as fast they can practice the memory of what the sketch means

2. No words on the sketch

- There's a reason for this, too

- There is research showing that humans have one center of visual attention

- You can read something,

- Or you can process the image

- You can't do both at the same time

- When you have an image with labels on it, it's visually confusing

- I've timed many students in my office thinking through their own sketches with labels, and without labels – with the words in a list on the side

- They're usually faster with the words on the side

3. No unnecessary lines or dots! (AND abbreviate the terms you can)

- Extra lines, dots, and letters waste time!

- It takes you longer to practice

- It may not seem like much,

- But imagine that instead of five hours of studying, you could learn just as much and do just as well with 4 and half hours of studying

- Wouldn't you like to have those 30 minutes to do something else? (And get the same grade?)

- The simpler the sketch, the better, as long as it reminds you of everything that matters

- Does my sketch need three rows of raindrops?
 - Would two rows be enough?

[VOTE: hands for three versus two rows...]

- Does my sketch need two clouds?
 - Would one cloud be enough?
- Does my list of terms really need “Cloud”?
 - Would you ever forget that these fuzzy things are clouds?
- DON'T put anything you don't need on a minute sketch (or in the terms)!

28. Folded Lists

- Folded lists are a way to practice your memory
 - From the terms, redrawing the sketch as you think through what it means
- And from the sketch, rewriting the terms while thinking about what they mean?

LET'S TRY

- Take your blank piece of paper
 - Looking only at the words, try to redraw the sketch from memory
 - Don't guess – go ahead and start, and in about 10 seconds I'll show the sketch again, and you can check when you need to check

[PDH counting seconds in his head – announcing 30 seconds, 40 seconds, 50 seconds, and 60 seconds]

- Why not guess?
 - Think about it: If you guess, and you're wrong
 - Do you strengthen the WRONG memory?
- TIME to THINK
- There's research that says yes
 - Guessing wrong makes you worse!
 - No guessing – just check when you can't remember,
 - THEN HIDE IT AGAIN so that you are drawing from memory

29. SLIDE – Here's our sketch

30. SLIDE -- Now fold under your terms (or hide them) -

- the folding makes it a “folded list”

- Now, looking only at your sketch, rewrite the terms from memory
 - Again, don't guess – check if you need to!

- You may abbreviate, or skip terms you don't need

- Don't guess – go ahead and start, and in about 10 seconds I'll show the terms again, and you can check whatever you need to check
- But look away so that you are writing the term from memory

[PDH counting seconds in his head – announcing 30 seconds, 40 seconds, 50 seconds, and 60 seconds]

31. SLIDE – Here's my list of terms

- Notice my list
 - I left off clouds
 - I abbreviated a whole bunch of terms I knew I would remember
 - And the terms are in order
 - This is the sequence of events

32. SLIDE -- Now fold under your sketch (or hide them) -

- and redraw the sketch
- Go ahead and start – check your old sketch when you need to (no guessing)

[PDH counting seconds in his head – announcing 30 seconds, 40 seconds, 50 seconds, and 60 seconds]

33. SLIDE – Here's my sketch

- Notice that I simplified it
 - Is my one cloud enough?
 - Only one arrow for evaporation
 - Two lines of raindrops
- If that saves me 10% of the time on every sketch,
 - Then I'll learn it in less time

34. SLIDE – Folded Lists (the rules)

- Reminder IF NEEDED – probably not needed, after the practice session

35. SLIDE – Could minute sketches with folded lists be effective?

1. They make you do retrieval practice of memories
2. They make you connect the terms to the events and structures
3. They use multiple ways of learning
 - Visual reading
 - Visual imaging
 - Kinesthetic (movement) learning
 - If speaking and hearing helps, you can talk and listen as well

36. SLIDE – Instructions for your practice sessions (this is in your packet)

- Take a look
 - Page 4: instructions
 - Page 5 & 6 – each have 12 characters with their sounds
 - Each of you have either Korean or Arabic
 - Again – an alphabet you don't know! (& hopefully don't care about)
 - The top of the page tells you to practice that page with EITHER
 - Visual Review
 - or Minute Sketches with Folded Lists
 - Next week, on three different days
 - You'll practice these for 10 minutes
 - Five minutes on each!
 - 5 min with folded list
 - Start with a new piece of paper
 - Look at only one column in your handout
 - While thinking of the shape,
 - Write the letters for that sound (phonetic pronunciation)
 - Keep looking and hiding
 - You always want to draw the shape of the letter while you're not looking at it (but it is in your memory)
 - Once you've done all the shapes
 - Fold your paper, and do the sounds from memory
- What you'll turn in: Your folded list with the date and start & end times of each practice session; also mark the date and start and end times of your visual review practice session.
 - It is important to follow the rules and instructions exactly!
 - Important not just for the validity of our results, but
 - also for your own self-evaluation of the method
 - How can you know if one or the other method is better (and how much better) if
 - You haven't been careful to do a complete and fair test without biases.
- What if you forget to practice?
 1. We'll send reminders
 2. We can have you attend a make-up session

37. SLIDE – Any final questions?

Experiment 3: Session 1: Pre-Survey on study methods for participants

1. I am:
 18 19 20 21 22 23 24 or older
2. I am a:
 Freshman Sophomore Junior Senior Other
3. I would describe myself as (Please mark ALL that apply):
 African American/Black
 American Indian/Alaska Native
 Asian American/Asian
 Native Hawaiian/Pacific Islander
 Mexican American/Central American
 Puerto Rican
 Other Latino
 White/Caucasian
 Other
 No Response
4. I consider myself:
 Male Female Other No Response
5. I understand the concept of ‘learning styles’.
 Strongly Agree;
 Agree;
 Neither Agree nor Disagree;
 Disagree;
 Strongly Disagree
6. I consider myself a – (Mark any that apply):
 No preference/ No style that I know
 Visual Learner
 Auditory Learner
 Reading-Writing Learner
 Kinesthetic or ‘Tactile’ Learner (learning by movement and activity)
 Other: _____
7. I have experience learning multiple languages and alphabets (*English, Greek and Chinese would be “three”, while English and Spanish use the same alphabet, so even together they would be “one”*):
 I have learned 1-2 alphabets (or character sets)
 I have learned 3-4 alphabets (or character sets)
 I have learned 5-6 alphabets (or character sets)
 I have learned seven or more alphabets (alphabets or character sets)

8. Right now, my most likely major in college is:

- Biology
- Chemistry
- Geology
- Kinesiology and Health Sciences
- Physics
- Mathematics
- Neuroscience
- Computer Science
- Other: _____

9. I think that I study:

- Much more than most students
- More than most students
- About the same amount as other students
- Less than most students
- Much less than most students

10. Which study methods do you use before a challenging test: (Please check all that you use; in the next question, please rank the most important methods you use. If you think you haven't heard of a particular study method, please mark line it out: Mark a horizontal line through that entry.)

- Rereading my notes
- Rereading power-points or presentations
- Rereading the textbook
- Rewriting my notes
- Summarizing
- Highlighting
- Flashcards
- Drawing or sketching
- Redrawing sketches for practice
- Practice tests
- Self-testing
- Writing my own questions
- Mnemonics (or memory aids) for key words
- Distributed practice (studying or practicing the same things over more than one day)
- Chunking
- Retrieval practice
- Mind maps or concept maps
- Folded lists
- Minute sketches
- Other (a) _____
- Other (b) _____
- Other (c) _____

11. Please indicate the approximate proportion of time in which you use these study methods before a challenging test (just an approximation) Your numbers should add up to 100%, but if they do not, we will adjust them to total 100%. (Example: 40% Rereading my notes, 30% rereading Powerpoints or presentations, 30% & rereading the textbook. The total = 100%)

- ___ % Rereading my notes
- ___ % Rereading power-points or presentations
- ___ % Rereading the textbook
- ___ % Rewriting my notes
- ___ % Summarizing
- ___ % Highlighting
- ___ % Flashcards
- ___ % Drawing or sketching
- ___ % Redrawing sketches for practice
- ___ % Practice tests
- ___ % Self-testing
- ___ % Writing my own questions
- ___ % Mnemonics (or memory aids) for key words
- ___ % Distributed practice (studying or practicing the same things over more than 1 day)
- ___ % Chunking
- ___ % Retrieval practice
- ___ % Mind maps or concept maps
- ___ % Folded lists
- ___ % Minute sketches
- ___ % Other (a) _____
- ___ % Other (b) _____
- ___ % Other (c) _____

100%: Total

12. I am reluctant to change my study habits, because they have worked very well for me so far.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

13. I am expecting to change my study habits, because I think I could learn in better ways.

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

14. I use different study methods and match them carefully to the skills and content I need to learn:

- Strongly Agree;
- Agree;
- Neither Agree nor Disagree;
- Disagree;
- Strongly Disagree

1. This is my first survey for Professor Heideman's study in BIOL 220.

Yes (Please continue with the survey.)

No -- I have already completed a survey for Professor Heideman
(Then please do not continue.)

2. I am

17 or
younger

18

19

20

21

22

23

24 or
older

3. I am a:

Freshman

Sophomore

Junior

Senior

Other

4. I would describe myself as (Please mark ALL that apply):

African American/Black

American Indian/Alaska Native

Asian American/Asian

Native Hawaiian/Pacific Islander

Mexican American/Central American

Puerto Rican

Other Latino

White/Caucasian

Other

No Response

5. I consider myself:

Male

Female

Other

No Response

6. I understand the concept of 'learning styles'.

Strongly Agree

Agree

Neither Agree nor Disagree

Disagree

Strongly Disagree

7. I consider myself a -- (Mark any that apply)

- No preference / no style that I know
- Visual Learner
- Auditory Learner
- Reading-Writing Learner
- Kinesthetic or 'Tactile' Learner (learning by movement and activity)

Other (please specify)

8. I have experience learning multiple languages and alphabets (English, Greek, and Chinese would be "three", while English and Spanish use the same alphabet, so even together they would be "one"):

- I have learned 1-2 alphabets (or character sets)
- I have learned 3-4 alphabets (or character sets)
- I have learned 5-6 alphabets (or character sets)
- I have learned seven or more alphabets (or character sets)

9. Right now, my most likely major in college is:

- Biology
- Chemistry
- Geology
- Kinesiology and Health sciences
- Physics
- Mathematics
- Neuroscience
- Computer Science

Other (please specify)

10. I think that I study:

- Much more than most students
- More than most students
- About the same amount as other students
- Less than most students
- Much less than most students

11. Which study methods do you use before a challenging test: Please check all that you use.

- Rereading my notes
- Rereading power-points or presentations
- Rereading the textbook
- Rewriting my notes
- Summarizing
- Highlighting
- Flashcards
- Drawing or sketching
- Redrawing sketches for practice
- Practice tests
- Self-testing
- Writing my own questions
- Mnemonics (or memory aids) for key words
- Distributed practice (studying or practicing the same things over more than one day)
- Chunking
- Retrieval practice
- Mind maps or concept maps
- Folded lists
- Minute sketches

Other (please specify) you may include up to three additional methods:

12. Please indicate the approximate amount of time in which you use these study methods before a challenging test (just an approximation). Your numbers should add up to 100%, but if they do not, we will adjust them to total 100%. (Example: 40% Rereading my notes, 30% rereading PowerPoints or presentations, 30% rereading the textbook. The total = 100%.)

Rereading my notes	<input type="text"/>
Rereading power-points or presentations	<input type="text"/>
Rereading the textbook	<input type="text"/>
Rewriting my notes	<input type="text"/>
Summarizing	<input type="text"/>
Highlighting	<input type="text"/>
Flashcards	<input type="text"/>
Drawing or sketching	<input type="text"/>
Redrawing sketches for practice	<input type="text"/>
Practice tests	<input type="text"/>
Self-testing	<input type="text"/>
Writing my own questions	<input type="text"/>
Mnemonics (or memory aids) for key words	<input type="text"/>
Distributed practice (studying or practicing the same things over more than one day)	<input type="text"/>
Chunking	<input type="text"/>
Retrieval practice	<input type="text"/>
Mind maps or concept maps	<input type="text"/>
Folded lists	<input type="text"/>
Minute sketches	<input type="text"/>

13. In my studying now, I use different study methods and I match my methods carefully to the material and the skills I need to learn.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

14. I am reluctant to change my study habits, because they have worked very well for me so far.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

15. Please develop a unique identifier for this survey:

This will enable the Principal Investigator (PI) to evaluate your answers anonymously. There are three parts to your unique identifier. Set up your unique identifier as follows:

- 1. The first three letters of your mother's maiden name**
- 2. The fifth and sixth numbers in your William and Mary University ID**
- 3. The first three letters of your father's name.**

An example of a unique identifier would be "SOU24VIN". You will be asked to provide your unique identifier on the two surveys for this study. You may stop participating at any time, simply by not completing a survey. The instructors of BIOL 220, Introductory Biology, will not know which students do not participate and which students agreed to participate in the study.

First three letters of Mother's maiden name

Fifth & Sixth digits of your WM ID

First three letters of Father's first name

Study methods handout: Results of research on what works (and doesn't)

Improving Students' Learning With Effective Learning Techniques: Promising Directions From Cognitive and Educational Psychology

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University of Wisconsin–Madison; and ⁴Department of Psychology, University of Virginia

Table 4. Utility Assessment and Ratings of General

Technique	Utility
Elaborative interrogation	Moderate
Self-explanation	Moderate
Summarization	Low
Poor Highlighting	Low
The keyword mnemonic	Low
Imagery use for text learning	Low
Poor Rereading	Low
Practice testing	Great High
Distributed practice	Great High
Interleaved practice	Moderate

Table 1. Learning Techniques

Technique	Description
1. Elaborative Interrogation	Generating an explanation for why an explicitly stated fact or concept is true
2. Self-explanation	Explaining how new information is related to known information, or explaining steps taken during problem solving
3. Summarization	Writing summaries (of various lengths) of to-be-learned texts
4. Highlighting/underlining	Marking potentially important portions of to-be-learned materials while reading
5. Keyword mnemonic	Using keywords and mental imagery to associate verbal materials
6. Imagery for text	Attempting to form mental images of text materials while reading or listening
7. Rereading	Restudying text material again after an initial reading
8. Practice testing	Self-testing or taking practice tests over to-be-learned material
9. Distributed practice	Implementing a schedule of practice that spreads out study activities over time
10. Interleaved practice	Implementing a schedule of practice that mixes different kinds of problems, or a schedule of study that mixes different kinds of material, within a single study session

Important insights:

1. Memory traces are built by your retrieval (recall).
2. Memory traces become enduring from retrieval practice on multiple days (twice/day).
3. Unless recalled, memory traces fade away.
4. Experiment on yourself; collect evidence for what works.

Important insights (expanded):

1. Memory traces are built by recall, and *NOT* by re-reading, re-seeing, or re-hearing.
 - Practicing recall – retrieving your memory – is an essential part of “Practice Testing”

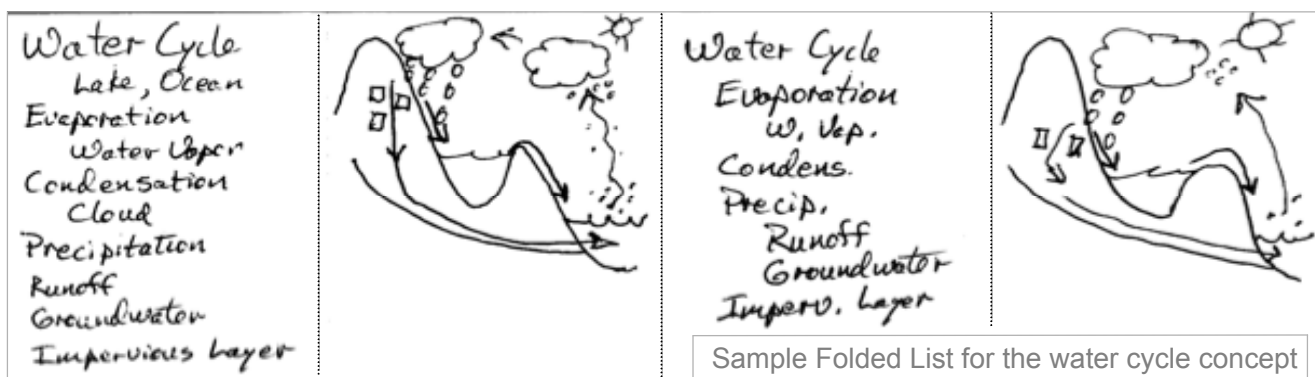
For problem solving without error (on exams)

 - (A) Memorize the steps by recall practice
 - (B) Practice solving problems using your memorized steps
 - These are kinds of *Practice Testing*.
2. Memory traces become enduring because you recall them on multiple days.
 - Rule of thumb: practice recall twice/day for each thing (chunk) you want to remember
 - Over multiple days, practice twice/day
 - (ALWAYS check if you don't remember—don't guess)
 - Practice recall of something 6, 8 or 10 times in one day? *Rarely worth it!*
 - (Most of the extra practice time on that day will be wasted)
 - Is three times/day better than twice/day? *Maybe: test yourself doing both and find out.*
3. Unless recalled, memory traces fade away: *what we don't think about, we lose.*
 - For some things, make clear study materials for fast review for future recall practice
4. Experiment to find what works for you.
 - Make sure you understand a new study method, & compare with your usual method

Using Folded Lists and Minute Sketches (short instructions)

To learn anything important to you:

1. **List** the events or terms that are part of an idea, concept, or set of events you want to remember.
2. **Sketch** the idea you want to remember. You must be able to recopy the final version of your sketch in less than a minute, even if your first try takes longer. Your 'minute sketch' should have only the simplest reminders of whatever you need to remember, so simplify your sketch. Words are not allowed on the sketch. Symbols are allowed--you may put 'H₂O' on your sketch, but not 'water'. How do you know a good sketch? If you know that you can give a good definition or explanation from the sketch as you recopy it, then you have a good sketch. A good image in a book can help. Often you can simplify the book image so that you can redraw it quickly, easily, and in less than 30 seconds. (For my water cycle example, you can probably redraw the sketch in 25 seconds even while thinking through exactly how the cycle happens.)
3. **Fold** a piece of paper into about four or five or six columns. The first column is a terms column. List your terms or events there. You are not allowed to put sentences or phrases in the terms column, just the important words (or dates). The explanation is supposed to be in your sketch, NOT in the words. The words are just the terms you use to describe or explain the sketch. Next, draw your sketch in the second column.
4. **Review** your sketch and your terms, with a book or your notes in front of you. Do you have all of the important words and dates? Do you have all the important parts in your sketch? Take out what you don't need. Add anything you do need. The sketch doesn't need to look pretty. All that matters is that you understand it.
5. **Hide the word column** by folding it under. While looking at the sketch and thinking through the sketch, rewrite all of the terms, in the 3rd column. If you can't remember some terms, that's normal. Never guess, though. Just quickly turn the words back up to check, and then write the missing words. Say the words aloud as you write them. In a place where you may not talk, just say the words silently in your mind as you write them. You may abbreviate terms, as long as you know the whole term.
6. **Hide the sketch column**. As you look at only the terms (in column 3), redraw your sketch. Make sure you can draw it in less than 60 seconds. If you don't remember part of the sketch (which is normal), don't guess. Just quickly turn the first sketch back up to check, and then finish your new sketch. If you have to check twice, that's OK. Just don't guess. Describe or explain the sketch while you draw, either aloud or silently to yourself. When you run out of columns, get a new sheet of paper and keep going.



7. **On your first day**, go through the whole folded list two times (back and forth from terms to sketch to terms to sketch, four columns in all). On the next day, draw and write your folded list twice again, and then again on another day. Even in a car or on a bus, you can practice by drawing on paper, in your mind, or on imaginary paper. Whenever it all comes easily, you're done (for now). Practice when you need it.
8. **Test your understanding** by changing one part of the sketch, and predicting what would happen.

Why does this work? Because in less than two minutes you can review an entire concept using vision, hearing, and movements of your hands and fingers (for sketching) and mouth (for speech). Using vision, hearing, and movement together keeps you from being distracted. Using all three makes you practice three different forms of memory. Repetition of all three fixes the memory in place, and any one brings back the others. Hearing or seeing a word will recall the terms and sketch. Drawing the sketch will recall the explanation.

Experiment 3: Session 2: Script

Instructions before Quiz 1 and Survey 2

1. First, please take Quiz 1. You will write out as many characters with their sounds as you remember. Please also answer the questions that have check-boxes. Please ask us if you have any questions!

2. After taking the quiz, please self-score it. Please get one of the answer sheets. Each sheet has Korean characters and sounds on one side, and Arabic Characters and sounds on the other. You'll notice that one column has the characters that you practiced using visual review. The other column has the characters that you practiced using minute sketches with folded lists.

At the top of the page are rules you can use for self-scoring your quiz. We want you to know your results. Please write down your total for each column near that column. You may place X's and 1's and ½'s next to wrong, right, or half-credit answers.

Please do NOT add any corrections to your quiz! ONLY MARK QUESTIONS RIGHT OR WRONG! All we need is your total self-score for each section! We will be scoring your quizzes later, and we don't want to be confused by any additions.

3. Please take the survey after self-scoring your quiz.

Ask us if you have any questions.

Experiment 3: Session 2: Quiz 1

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

Study Method – **Quiz 1**

- Reproduce from memory, as well as you can, the characters you learned.
- In the first column: write the characters & sounds you learned by visual review, and those with minute sketches and folded lists in the other.
- If you attempt one column first, please mark that column as “First” (if you go back and forth, choose “neither”).

Q1. *Characters & Sounds learned using **Visual Review** below*

*Characters & Sounds learned using **Minute sketches with Folded Lists** below*

Q2. (Attempted First or Second or Neither)

(Attempted First or Second or Neither)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

Q3. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered “Yes”, then please describe what you did. There’s no penalty! We just want to know so that we can use your data accurately, plus we’ll contact you for coaching on the method if you need it.

Scoring Rubric (Arabic)

Scoring: Part 1: 12 points possible. PART 2: 12 points possible (score them separately & compare.)

Shape & Sound are Completely correct = 1 pt; MOSTLY correct (only a minor error) = ½ pt; & MORE than a MINOR error = 0 pts

Arabic: Part 1

há ح

diim ج

rró خ

rá ر

lâm ل

kâ ك

sin س

shin ش

tó ط

dá ظ

iâ ي

mim م

Arabic: Part 2

bâ ب

nun ن

tâ ت

thâ ث

hâ ه

uau و

sód ص

dód ض

áin ع

gháin غ

fâ ف

qóf ق

Scoring Rubric (Korean)

Scoring: Part 1: 12 points possible. PART 2: 12 points possible (score them separately & compare.)

Shape & Sound are Completely correct = 1 pt; MOSTLY correct (only a minor error) = ½ pt; & MORE than a MINOR error = 0 pts

Korean: Part 1		Korean: Part 2	
a	ㅏ	ee	ㅣ
ya	ㅑ	o	ㅓ
eo	ㅓ	Yo	ㅕ
yeo	ㅛ	u	ㅜ
eu	ㅡ	yu	ㅠ
k,g	ㄱ	n	ㄴ
k'	ㅋ	ng	ㅇ
d,t	ㄷ	ch, j	ㅈ
r,l	ㄹ	ch'	ㅊ
m	ㅁ	k'	ㅋ
b,p	ㅂ	t'	ㅌ
f,p'	ㅍ	h	ㅎ

Scoring Rubric (Tamil)

Scoring: Part 1: 12 points possible. PART 2: 12 points possible (score them separately & compare.)
Shape & Sound are Completely correct = 1 pt; MOSTLY correct (only a minor error) = ½ pt; &
 MORE than a MINOR error = 0 pts

Tamil: Part 1		Tamil: Part 2	
<u>ra</u>	ர	pa	ப
ṭ	஠	<u>é</u>	ஏ
<u>ṭa</u>	ட	u	உ
<u>ra</u>	ற	i	இ
<u>va</u>	வ	e	ெ
la	ல	<u>ja</u>	ஐ
<u>va</u>	வ	o	ஓ
<u>śa</u>	ஷ	<u>tu</u>	டு
a	அ	ta	த
<u>ā</u>	ஆ	<u>tu</u>	து
<u>ka</u>	க	<u>na</u>	ந
<u>za</u>	ழ	la	ள

Experiment 3: Session 2 Survey.

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I was surprised by how much (or how little) I recalled from minute sketches and folded lists.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

2. I was surprised by how much (or how little) I recalled from visual review of the study materials.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

3. Based on what I have learned about study methods in these sessions, I am thinking seriously about changing my study methods.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

4. Based on what I have learned up to now, I feel likely to use minute sketches with folded lists as a study method in the future.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

5. Do you have any suggestions for us that might improve this study or a future study?

- No
- Yes -- *Please explain your thoughts below.*

(A) Suggestions about the first two sessions?

(B) Suggestions about the instructions and your practice time studying the characters

Experiment 3: Session 3: Script

Instructions before Quiz 2 and Survey 3

1. First, please take Quiz 2. You will write out as many characters with their sounds as you remember. Please also answer the questions that have check-boxes. Please ask us if you have any questions!

2. After taking the quiz, please self-score it. Please get one of the answer sheets. Each sheet has Korean characters and sounds on one side, and Arabic Characters and sounds on the other. You'll notice that one column has the characters that you practiced using visual review. The other column has the characters that you practiced using minute sketches with folded lists.

At the top of the page are rules you can use for self-scoring your quiz. We want you to know your results. Please write down your total for each column near that column. You may place X's and 1's and ½'s next to wrong, right, or half-credit answers.

Please do NOT add any corrections to your quiz! ONLY MARK QUESTIONS RIGHT OR WRONG! All we need is your total self-score for each section! We will be scoring your quizzes later, and we don't want to be confused by any additions.

3. Please take the survey after self-scoring your quiz.

Ask us if you have any questions.

Experiment 3: Session 3: Quiz 2

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

- Reproduce from memory, as well as you can, the characters you learned.
- In the first column: write the characters & sounds you learned by visual review, and those with minute sketches and folded lists in the other.

Q1. I'm not sure which characters I practiced with visual review. Yes - **OR** - No (I know which I learned each way)

*Characters & Sounds learned using **Visual Review** below*

*Characters & Sounds learned using **Minute sketches with Folded Lists** below*

Q2. (Attempted First or Second or Neither) (Attempted First or Second or Neither)

- | | |
|-----|-----|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| 5. | 5. |
| 6. | 6. |
| 7. | 7. |
| 8. | 8. |
| 9. | 9. |
| 10. | 10. |
| 11. | 11. |
| 12. | 12. |

Q3. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered "Yes", then please describe what you did. There's no penalty! We just want to know so that we can use your data accurately, plus we'll contact you for coaching on the method if you need it.

Experiment 3: Session 3: Survey

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I was surprised by how much I had forgotten from minute sketches and folded lists.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
2. I was surprised by how much I had forgotten from visual review of the study materials.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
3. Based on what I have learned about study methods in these sessions, I am thinking seriously about changing my study methods.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

4. Based on what I have learned up to now, I feel likely to use minute sketches with folded lists as a study method in the future.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

5. Do you have any suggestions for us that might improve this study or a future study?
 No
 Yes -- *Please explain your thoughts below.*

(A) Suggestions about the first three sessions?

(B) Suggestions about the instructions and your practice time studying the characters?

Experiment 3: Session 4: Script before quiz and survey

1. Please take the quiz.
2. Self-score it, and write your total for each portion on the quiz.
 - *(Please don't add corrections! We need to score the quiz ourselves later.)*
3. Fill out the survey.

Experiment 3: Session 4: Quiz 3

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

- Reproduce from memory, as well as you can, the characters you learned.
- In the first column: write the characters & sounds you learned by visual review, and those with minute sketches and folded lists in the other.

Q1. I'm not sure which characters I practiced with visual review. Yes - **OR** - No (I know which I learned each way)

*Characters & Sounds learned using **Visual Review** below*

*Characters & Sounds learned using **Minute sketches with Folded Lists** below*

Q2. (Attempted First or Second or Neither)

(Attempted First or Second or Neither)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

Q3. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered "Yes", then please describe what you did. There's no penalty! We just want to know so that we can use your data accurately, plus we'll contact you for coaching on the method if you need it.

Experiment 3: Session 4: Survey

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I was surprised by how much I had forgotten from minute sketches and folded lists.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
2. I was surprised by how much I had forgotten from visual review of the study materials.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
3. Based on what I have learned about study methods in these sessions, I am thinking seriously about changing my study methods.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

4. Based on what I have learned up to now, I feel likely to use minute sketches with folded lists as a study method in the future.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

Experiment 3: Session 4: Script for Beginning of Part 2

- As we start part 2 of the experiment, I want to go over what you've learned so far.
 - You've reviewed some information on study methods, and
 - I hope you remember study methods that do or don't tend to work
 - You've learned about retrieval or 'recall' practice
 - You remember, I hope, that the way we build our memories is practice recalling them
 - We don't build memories by looking at things again
 - Even people who KNOW that (me), still use visual review
 - It's easy. And,
 - We never make a mistake:
 - We are never confronted with our failures
 - That's a trap – a learning trap.
- You've learned a new study method: minute sketches with folded lists.
- When you took Quiz 1, most of you found that when your study time was perfectly even,
 - You remembered more when you studied with minute sketches and folded lists
- In Quiz 2, a couple of weeks ago, most of you realized that you had forgotten almost everything (or everything)
- Today, with Quiz 3, you've learned how much you can get back by five minutes of review.
 - You've also learned whether the way you studied made a difference
- Today I'll take you through some new content.
 - On purpose, there's a lot in here
 - probably too much to master with just the short time you're going to have to learn and study it!
 - I have to do that, because I want to see how much of the total you can learn.
 - It has to be challenging
 - You'll learn about how the thyroid hormones are regulated, and
 - How thyroid hormones adjust your metabolic rate
 - and affect things like body weight
 - This is content that is part of Zoology (Biology 302), Physiology, and some other courses
 - Some of this is information that you'll need if you take BIOL 225 this spring
 - In your life, all of you will know people who have imbalances of thyroid hormone

(one of my friends nearly died of excess thyroid hormone production; her heart rate was above 120 when she was just sitting still, and she lost body weight dangerously quickly)

- In other words, this information could matter to ALL of you.

- After going through the Content, we'll spend 5 minutes in which you develop your first minute sketches

- Then also 5 minutes of visual review.

- In your practice sessions, you can add more minute sketches if you have time.

- YOUR TASK

- Learn as much of this as you can

- (I'll be astonished if anyone learns it all in the time available! I tried to put in too much for that.)

- SO: START WITH THE MOST IMPORTANT PARTS FIRST.

- On Page 1, the most important parts are boxes 2, 3, & 4

- On page 2, the most important parts are boxes 8, 9, & 10 (in the same location)

- You might want to mark them now!

1. The brain, from the side, showing the hypothalamus in the brain, the pituitary gland beneath the brain, and thyroid gland in the throat
2. Thyroid hormones are controlled by neurons in the hypothalamus.
 - These TRH neurons (TSH-Releasing Hormone, or TRH) are affected by food, cold, and many other things
 - large amounts of food (lots of energy) causes more TRH secretion
 - So does cold, because the extra thyroid hormones generate heat energy to keep you warm
3. TRH neurons in the hypothalamus release TRH into the blood, and
 - TSH Cells in the pituitary have surface receptor proteins that bind the TRH,
 - TSH is "Thyroid Stimulating Hormone"
 - Binding of TRH causes secretion of TSH into the blood
 - Cells in the thyroid gland have surface receptor proteins that bind the TSH
 - TSH causes cells in the thyroid gland to release two thyroid hormones:
 - T₄ (Tetraiodothyronine), which is an inactive form that can be converted into:
 - T₃ (Triiodothyronine), which is the major active form of the hormone
4. In more detail, binding of TSH to TSH receptor proteins on cells in the thyroid gland causes a chain of molecular changes in the cell
 - Because of that chain of changes, T₃ and T₄ are secreted.
 - These cells have a cellular transporter that concentrates iodine

- Sodium will move into the cell because it is more concentrated outside the cell
 - The transporter protein moves an iodine in with the sodium
 - The high concentration of iodine is necessary to put the iodine on the core of each thyroid hormone molecule
 - This is the reason that radioactive iodine from the environment destroys the thyroid, even when the concentration is too low to affect any other cells
5. What happens if thyroid hormone concentrations get too high (or too low)?
- Sometimes, serious disease
 - However, in a healthy normal person, too-high levels of T_4 inhibit TRH neurons
 - The high T_4 causes less TRH to be secreted
 - With less TRH, there is less TSH secreted
 - With less TSH, less T_3 and T_4 is secreted
 - The levels drop back toward normal
 - If T_4 is too low, then this inhibition is removed
 - In that case, there's more TRH, so more TSH, so more T_3 and T_4
 - The result: negative feedback helps keep the amount of thyroid hormone stable from minute to minute and hour to hour
6. How does negative feedback occur?
- An enzyme in the hypothalamus, de-iodinase (DIO), converts inactive T_4 into active T_3
 - The T_3 moves into TRH neurons
 - and inhibits release of TRH
7. In the blood, T_3 and T_4 are carried attached to "Thyroid Hormone Binding Proteins"
- These binding proteins are synthesized in the liver
 - Secreted into the blood, where they encounter T_3 and T_4 to bind
8. Tissues that have received signals to increase their activity convert inactive T_4 into active T_3
- They do that by producing an enzyme called Deiodinase 2, DIO2
 - After T_4 enters a cell through a T_4 membrane transport protein
 - DIO2 removes one iodine from T_4 to make the active T_3
 - Active T_3 is then used in that cell or released to nearby cells
9. T_3 causes changes in any cell in the body by changing gene transcription to make different mRNA's and, therefore, new proteins
- If a cell has T_3 membrane transport proteins and T_3 receptor proteins
 - Then T_3 will enter and bind the T_3 receptor.
 - The T_3 -with-receptor is moved into the nucleus
 - In the nucleus, it binds only to specific, precise sequences of bases on DNA
 - When it binds, it changes transcription of messenger RNA (mRNA)
 - The new mRNA is moved out of the nucleus and to a ribosome
 - In ribosomes, the sequence of mRNA is used to attach amino acids in sequence in order to make new proteins

- Here, I've called these proteins P1, P2, P3, and so on

10. These new proteins cause changes in metabolism

- T3 with its receptor can cause many, many changes, but three are particularly important in most cells

(1) Proteins (I'm calling these "P1) cause glycogen, a polymer chain of glucose molecules, to be broken down into individual glucose molecules

- This extra glucose stimulates cells to use more energy in chemical reactions.

- Causing: Heat production as well as supporting movement, synthesis of molecules, and all other cell activity

(2) Proteins "P2" cause fats (triglycerides made of three fatty acids and a glycerol molecule) to be broken down

- into Glycerol

- and "Free Fatty Acids" (FFA)

- The extra Free Fatty Acids stimulate cells to use more energy in chemical reactions.

- Causing (again): Heat production as well as supporting movement, synthesis of molecules, and all other cell activity

(3) Proteins "P3" cause increased protein synthesis of ANY (or at least many) proteins currently being made

- The result is more cell activity because of all the new proteins

- Also, adding each amino acid requires several ATP, which uses the energy made available by glucose and FFA

11. If hormones are not removed from the blood, they would just accumulate and cause faster and faster effects – in this case, higher and higher activity of P1, P2, P3, etc

- All hormones need to be cleared from the blood, so that activity can be adjusted from minute to minute or hour to hour

- The liver has this job for many hormones. To do it, the liver produces another enzyme (actually another de-iodinase)

- This de-iodinase converts active T_3 to inactive T_2

- It also converts inactive T_4 into a new kind of T_3 called "reverse T_3 "

- T_2 and $revT_3$ (or ' rT_3 ') are not converted back

- Once thyroid hormone is rT_3 or T_2 , it will never again be active.

12. Any of the thyroid hormones, inactive or not, are excreted from the kidneys into the urine

- At the start of the excretory tubules of the kidney (nephrons)

- Water and small molecules are forced out of the blood by pressure

- They leave through small gaps in the blood vessels into the excretory tubule

- All of the thyroid hormones are small enough to fit easily through these gaps

- Once in the excretory tubule (nephron), the thyroid hormone is not recovered – the various forms of thyroid hormone are carried in the urine to the bladder and released with the urine
- The blood leaving the kidney has lost most (but not all) of its thyroid hormone
- To maintain a normal metabolic rate, TRH, TSH, T₄, and T₃ must be produced

Content Notes for Comparison of Study Methods – Metabolism and Thyroid Hormone

- YOUR TASK is to learn as much of this as you can in the time you are allowed
 - (I'll be impressed if anyone learns it all in the time available! I tried to put in too much for that.)
 - SO: START WITH THE MOST IMPORTANT PARTS FIRST.
 - On Page 1, the most important parts are boxes 2, 3, & 4
 - On page 2, the most important parts are boxes 8, 9, & 10 (in the same location)
 - You might want to mark them now!

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- 2. Thyroid hormones are controlled by neurons in the hypothalamus.
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 - Because of that chain of changes, T₃ and T₄ are secreted.
 - These cells have a cellular transporter that concentrates iodine
 - Sodium will move into the cell because it is more concentrated outside the cell
 - The transporter protein moves an iodine in with the sodium
 - The high concentration of iodine is necessary to put the iodine on the core of each thyroid hormone molecule
 - This is the reason that radioactive iodine from the environment destroys the thyroid, even when the concentration is too low to affect any other cells

- 5. What happens if thyroid hormone concentrations get too high (or too low)?
 - Sometimes, serious disease
 - However, in a healthy normal person, too-high levels of T₄ inhibit TRH neurons

- The high T_4 causes less TRH to be secreted

Content Notes for Comparison of Study Methods – Metabolism and Thyroid Hormone (Pg 2)

- With less TRH, there is less TSH secreted
 - With less TSH, less T_3 and T_4 is secreted
 - The levels drop back toward normal
 - If T_4 is too low, then this inhibition is removed
 - In that case, there's more TRH, so more TSH, so more T_3 and T_4
 - The result: negative feedback helps keep the amount of thyroid hormone stable from minute to minute and hour to hour
6. How does negative feedback occur?
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 - The T_3 -with-receptor is moved into the nucleus
 - In the nucleus, it binds only to specific, precise sequences of bases on DNA
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 - The new mRNA is moved out of the nucleus and to a ribosome
 - In ribosomes, the sequence of mRNA is used to attach amino acids in sequence in order to make new proteins
 - Here, I've called these proteins P1, P2, P3, and so on
10. These new proteins cause changes in metabolism
- T_3 with its receptor can cause many, many changes, but three are particularly important in most cells
 - (1) Proteins (I'm calling these “P1) cause glycogen, a polymer chain of glucose molecules, to be broken down into individual glucose molecules
 - Extra glucose, so cells to use more energy in chemical reactions.

- Causing: Heat production as well as supporting movement, synthesis of molecules, and all other cell activity

Content Notes for Comparison of Study Methods – Metabolism and Thyroid Hormone (Pg 3)

- (2) Proteins “P2” cause fats (triglycerides made of three fatty acids and a glycerol molecule) to be broken down
 - into Glycerol and “Free Fatty Acids” (FFA)
 - Extra FFA, so cells use more energy in chemical reactions.
 - (similar to effect of glucose)
- (3) Proteins “P3” cause increased protein synthesis of ANY (or at least many) proteins currently being made
 - More cell activity because of all the new proteins
 - Adding each amino acid requires several ATP, using energy from P1 & P2

11. The liver produces another de-iodinase

- Which converts active T_3 to inactive T_2
- And inactive T_4 into an inactive form of T_3 called “reverse T_3 ”

12. Thyroid hormones are excreted from the kidneys into the urine

- At the start of the excretory tubules of the kidney (nephrons)
 - Water carrying small molecules, including all of the thyroid hormones are forced through small gaps out of the blood by pressure and into the nephron
- The thyroid hormones leave the body with the urine

INSTRUCTIONS -- Group "A":

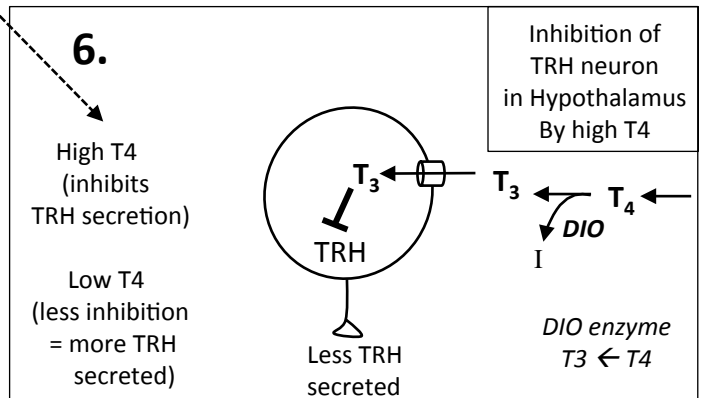
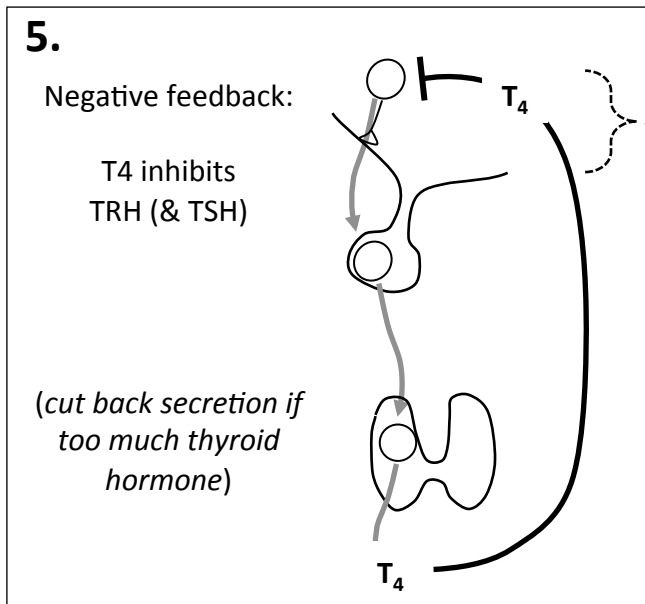
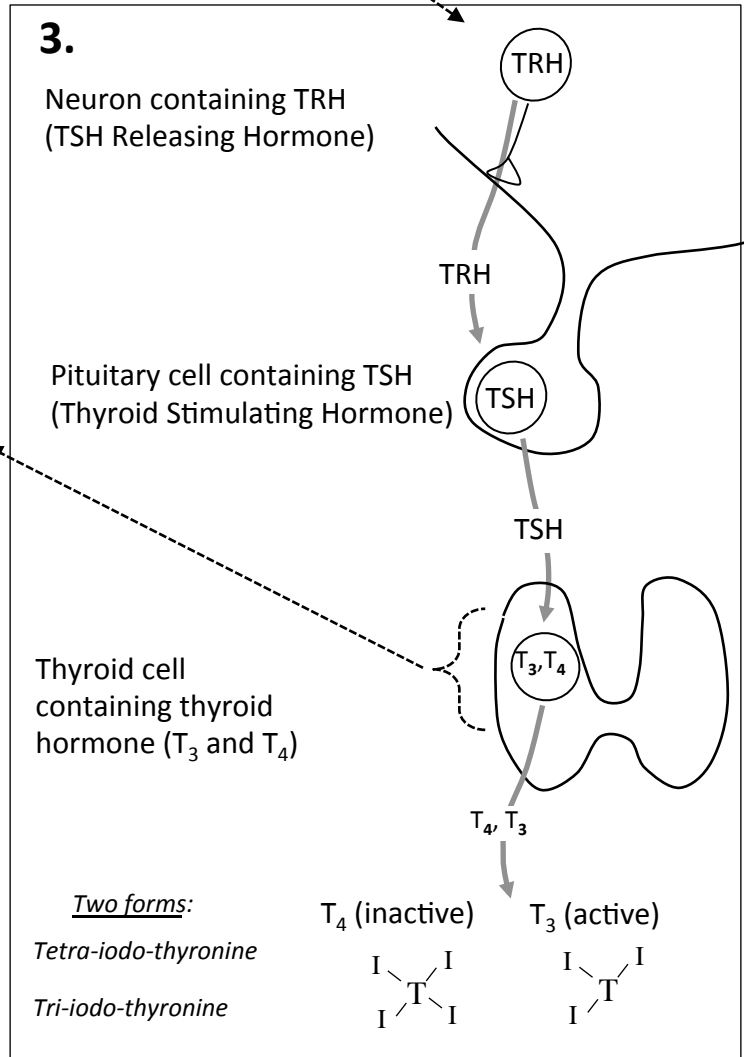
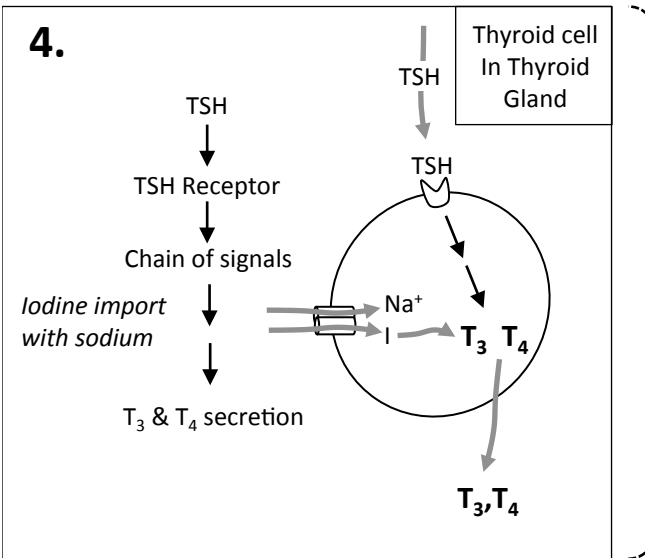
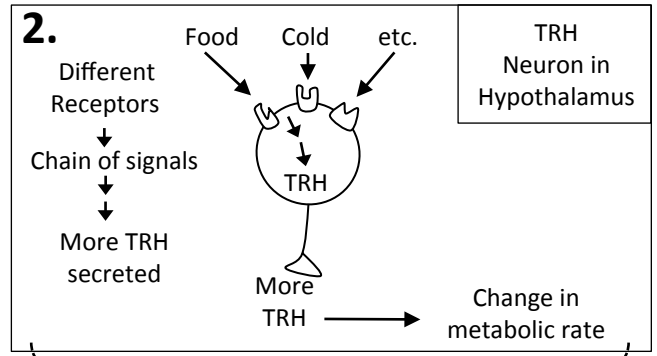
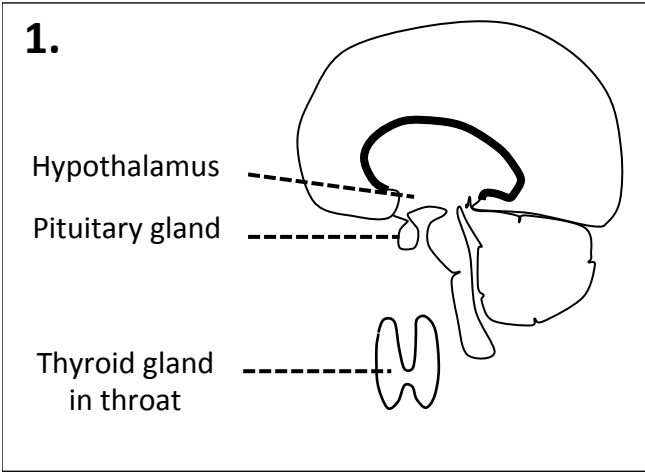
On three different days this week:

1. Practice one page using minute sketches with folded lists **for 5 minutes**
 - As you write/sketch, think about the terms and sketches mean.
 - If you can, add a new minute sketch each day (but stay within the 5 minutes of practice time!)
 - Total time: 5 minutes of sketching & practicing folded lists on each day

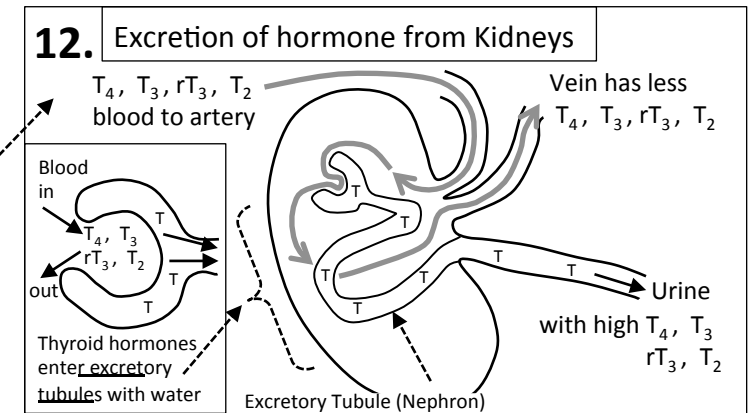
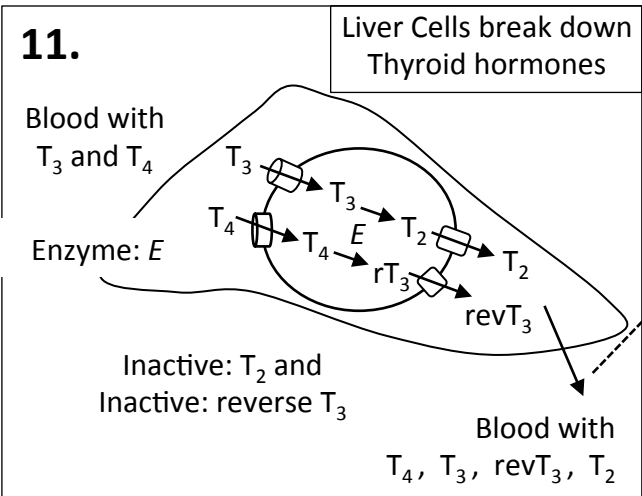
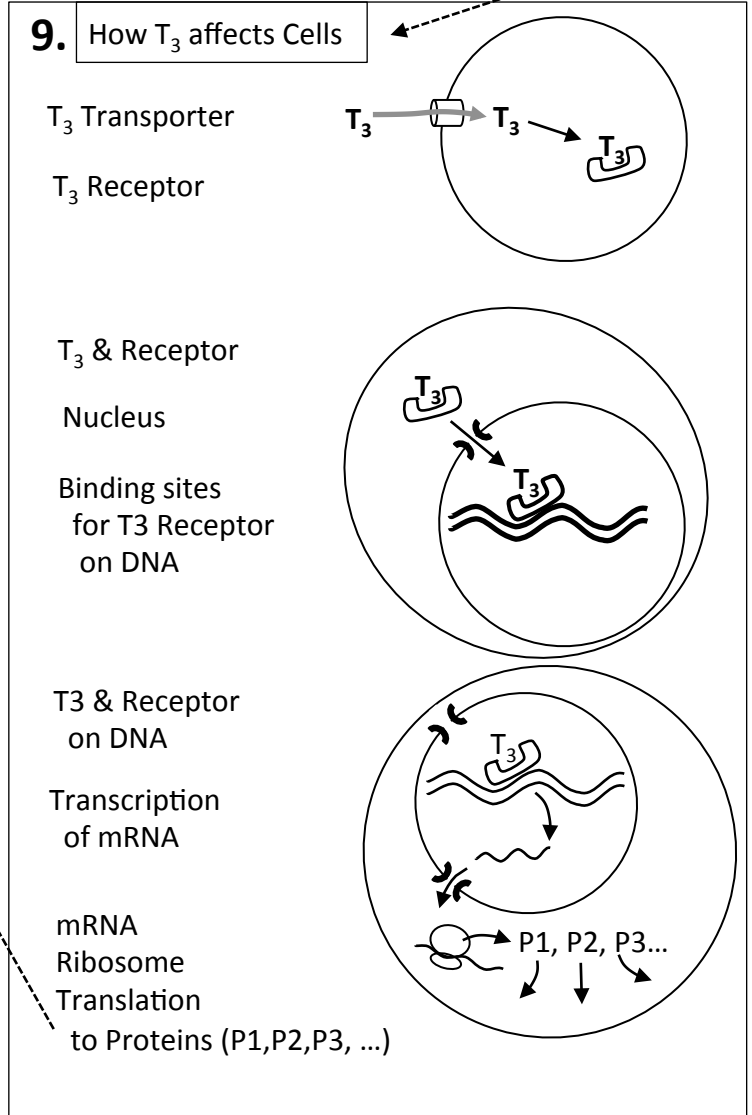
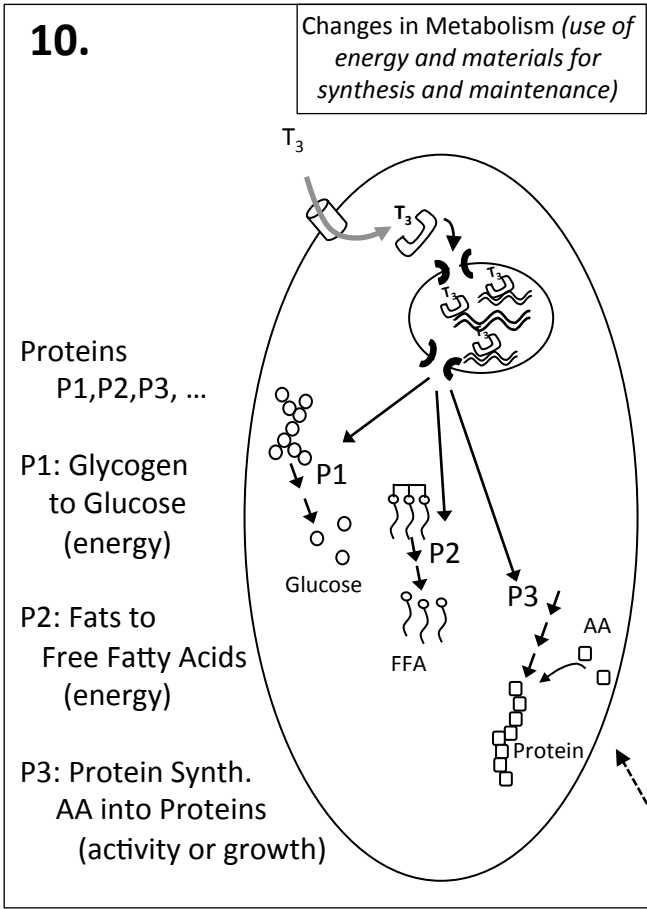
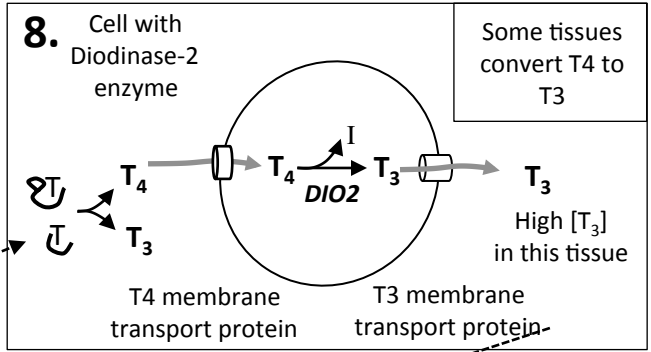
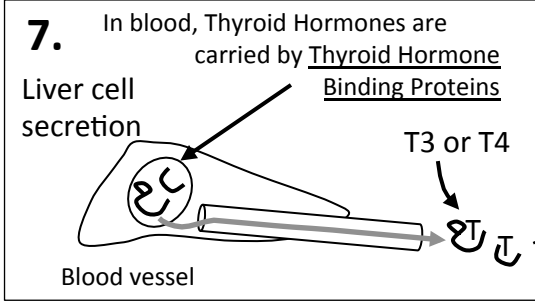
Practice the other page using visual review **for 5 minutes**.

- For visual review, look at the content and try to get it into your memory in the way you would normally do when using visual review
2. Please write each date and the start and end times for both Visual Review and the MS-FL on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
 3. Please try to remember to alternate the order in which you study (in other words, one day do visual review first, and on the next do MS-FL)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
 4. PLEASE DO NOT PRACTICE ON THE DAY OF OUR NEXT SESSION!
 - Come to your Wed or Thurs session without having practiced that day – no practice on the day of your next session.
This is intended to be similar to an exam for which you don't have time to study on the day of the exam.
 5. If you follow these instructions carefully, your results will give you information on how well these methods work for you.
 - Please try to make your effort a fair test of each method – you want to know what works!

A -- Page 1: for Visual Review



A -- pg 2: Minute Sketch w Folded List



INSTRUCTIONS -- Group "B":

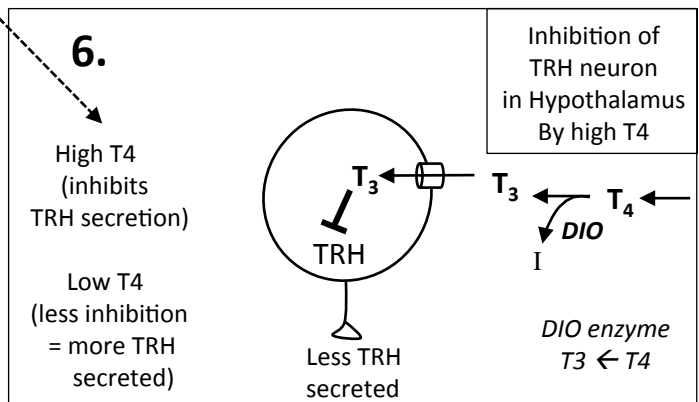
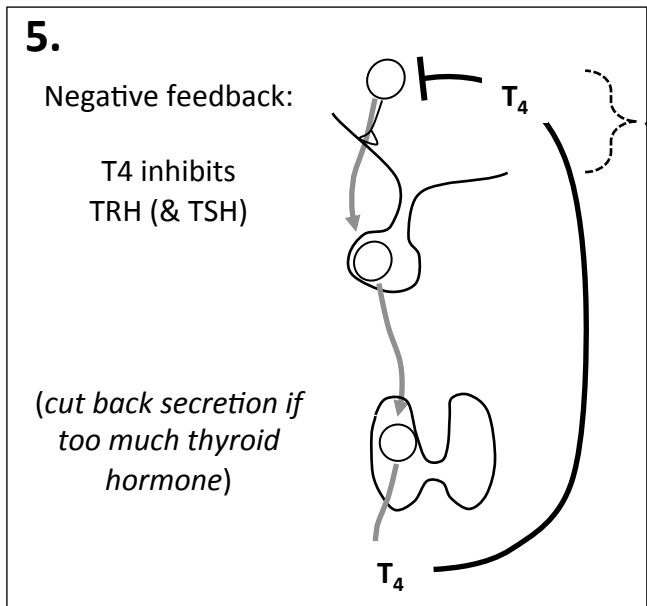
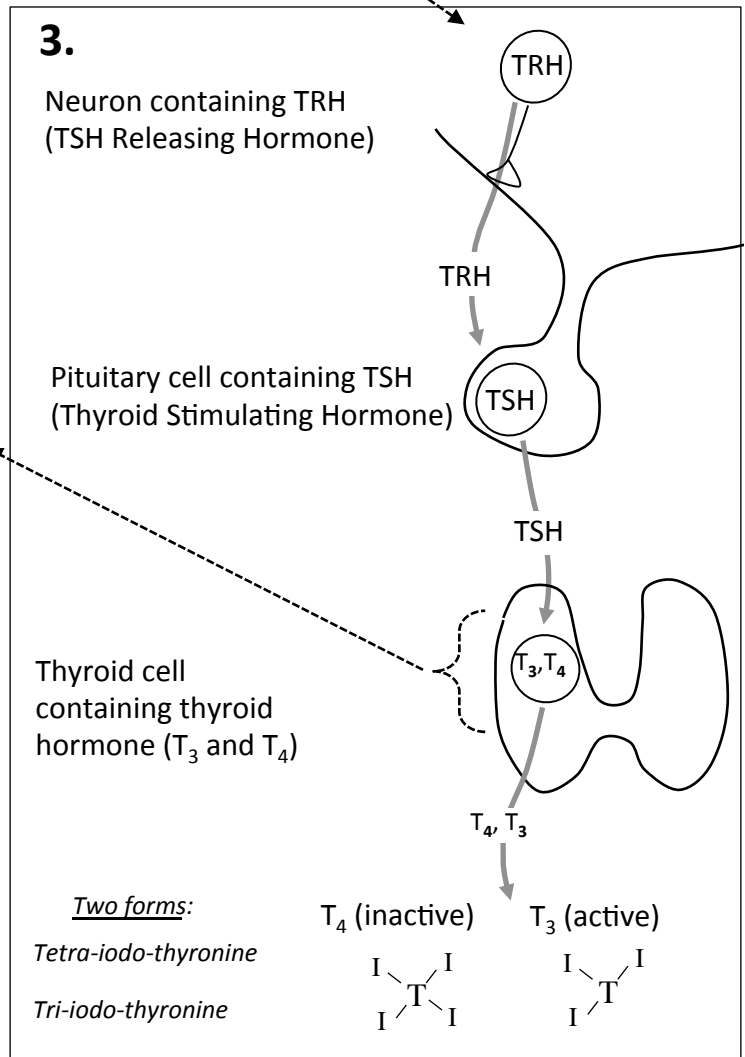
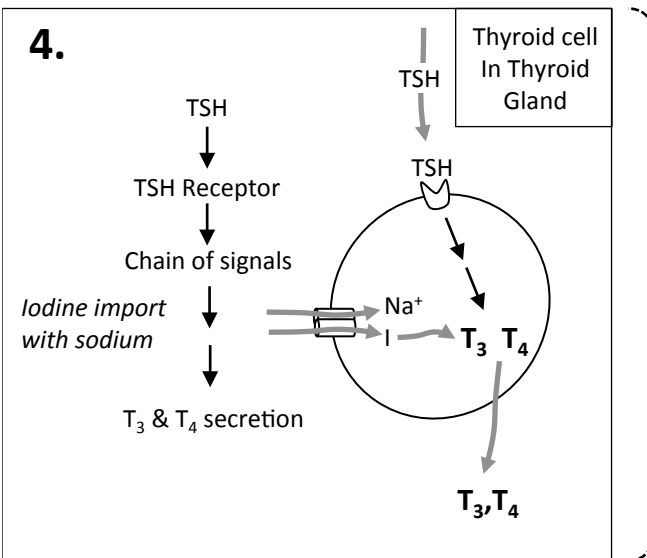
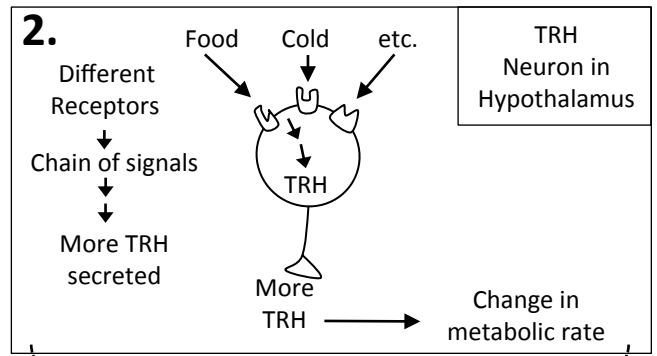
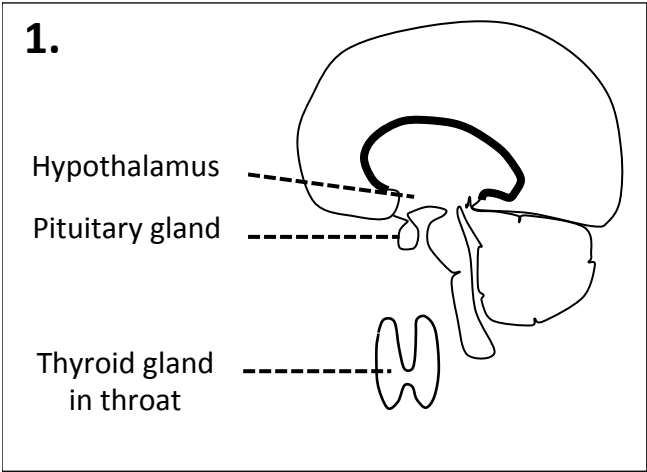
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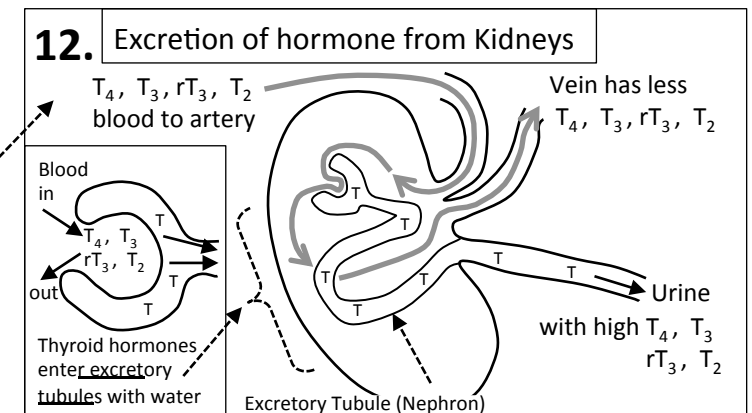
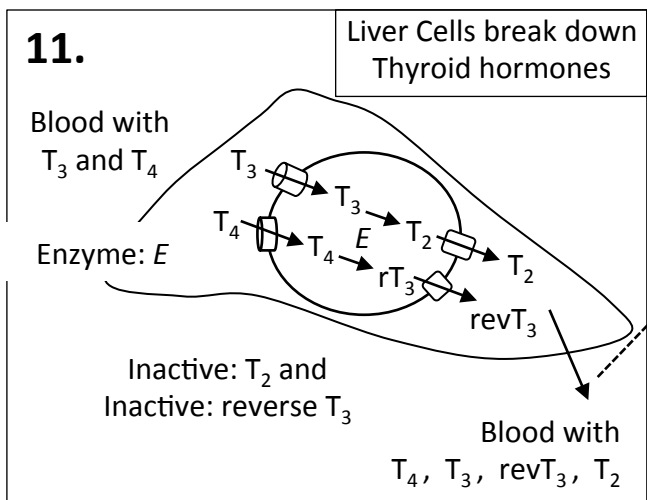
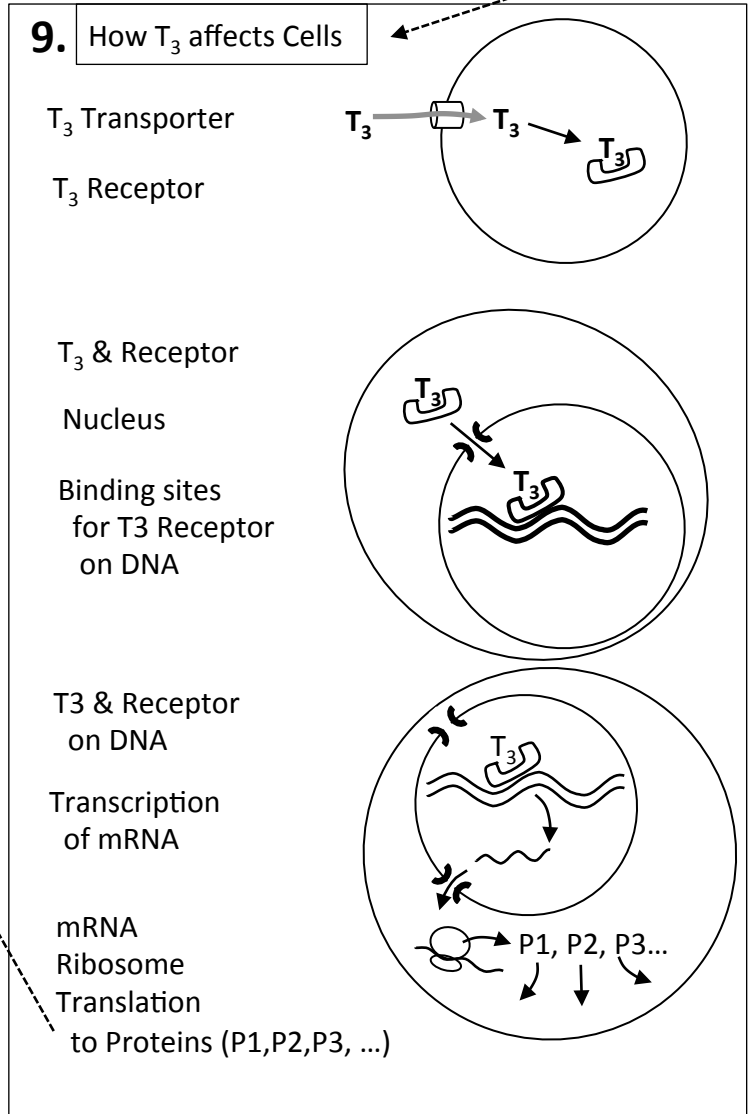
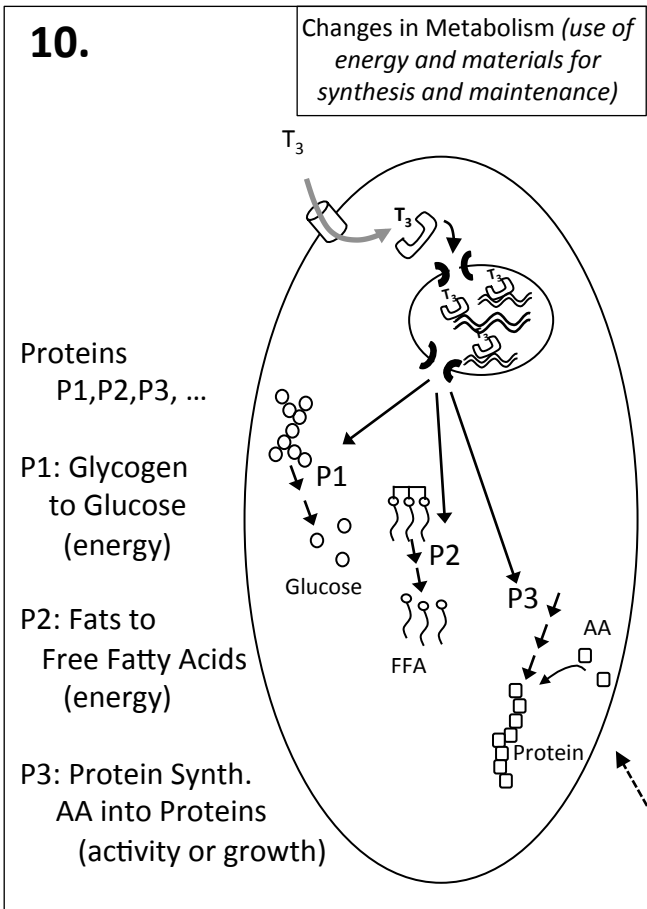
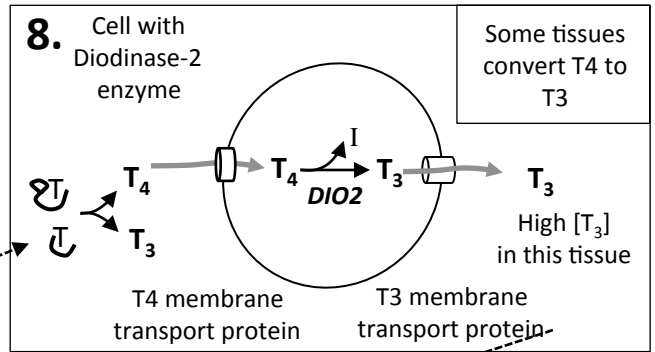
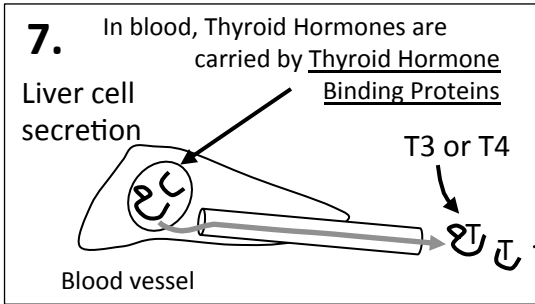
Practice the other page using visual review **for 5 minutes**.

- For visual review, look at the content and try to get it into your memory in the way you would normally do when using visual review
2. Please write each date and the start and end times for both Visual Review and the MS-FL on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
 3. Please try to remember to alternate the order in which you study (in other words, one day do visual review first, and on the next do MS-FL)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
 4. PLEASE DO NOT PRACTICE ON THE DAY OF OUR NEXT SESSION!
 - Come to your Wed or Thurs session without having practiced that day – no practice on the day of your next session.
This is intended to be similar to an exam for which you don't have time to study on the day of the exam.
 5. If you follow these instructions carefully, your results will give you information on how well these methods work for you.
 - Please try to make your effort a fair test of each method – you want to know what works!

B pg 1: Minute Sketch w Folded List



Group B page 2: for Visual Review



Session 5: Script (projected as a PowerPoint slide)

INSTRUCTIONS: BIOL 220 Study Method Research Project

1. Turn in your minute sketches and folded lists
 - Include your name! (& dates/times of Vis. Review)
2. Take the quiz:
 - For Q 1 & 3, just sketch/write all you recall ...
 - How to answer Q 2 & 4? A series of statements OR sketches (for example):
 - ⊖ There would be 4 times as much of hormone A (or Molecule B), and therefore there would be 4 times as much of product C.
 - ⊖ 4 times as much C, so 4 times as much of molecule D (or hormone E).
 - ⊗ 4 times as much D, so M would be inhibited 4 X as much = $\frac{1}{4}$ M,
 - ⊕ L will not change, because A, C, & M do not affect L
 - Ⓢ & so on for as many changes as you can think of.
 - Ⓢ
3. Self-score the quiz – Instructions on the back table
 - (The self score is for your own information; *we'll do our scoring later*)
 - Write a separate point score for each question.
 - We do not need a total, but you should notice your results from visual review & minute sketches with folded lists.)
 -
4. Fill out the survey and turn it in

Study Method – Quiz 4

Study Participant # _____ (Please leave blank)

YOU MAY START YOUR QUIZ ON PAGE 1 or PAGE 2

Please don't forget to check the boxes, including the last page!

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

Study Method – Quiz 4

1. Describe/explain as much as you recall of parts 1-6 of regulation of metabolism (including brain, glands, hormones, and events). **(Answer in words, labeled sketches, or both.)**

- A. I practiced this page as: Visual Review - **OR** - Minute sketches and Folded lists - **OR** - I don't remember
B. Attempted First or Second or Neither

2. A person had a disease that has killed half of the cells in their pituitary gland. How might this affect the secretion of any other hormones that regulate metabolism? **CIRCLE** the correct choice for each.

- A. Pituitary: **Half / Same / Twice** -- as much -- **T₃ / TRH / TSH** -- secreted (released).
B. Thyroid gland: **Half / Same / Twice** -- as much -- **T₃ / TRH / TSH** -- secreted.
C. Neurons in the brain: **Less / Same / More** -- secretion of -- **T₃ / TRH / TSH**.

Study Method – **Quiz 4**

3. Describe/explain as much as you recall of parts 7-12 of regulation of metabolism (hormones in the blood and tissues, hormone action in cells, and loss/removal of hormone) (**Answer in words, labeled sketches, or both.**)

- A. I practiced this section as: Visual Review - **OR** - Minute sketches and Folded lists - **OR** - I don't remember
B. Attempted First or Second or Neither

4. A person has a mutation that causes them to make half as many thyroid hormone receptors. How might the mutation change metabolic rate and other events? **CIRCLE** the correct choice for each.

- A. Cells throughout the body: **Half / Same / Twice** -- as much receptor holding -- **T₃ / TRH / TSH**.
- B. Cells throughout the body: **Half / Same / Twice** -- as much – **DNA / DIO / Protein** – made.
- C. Kidney: **Half / Same / Twice** – the amount of – **Thyroid Hormone Receptor / revT₃&T₂ / DIO** -- made and excreted

Study Method – **Quiz 4**

C. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered “Yes”, then please describe what you did. There’s no penalty! We just want to know so that we can use your data accurately, plus we’ll contact you for coaching on the method if you need it.

Grading Rubric -- PLEASE DO NOT ADD anything to your answers;
just indicate points earned.

WRITE a point total (your self-score) for EACH question.
(We do not need a total point score.)

For Questions 1 and 3

1. One point for each item correct. EXAMPLES: For Box 2, indicating food & cold as inputs would count +1 for each. Identifying the cell as a neuron would be one point, and the hormone as TRH would be 1 point. (If you decided to learn “TSH Releasing Hormone, that would be another 1 point.) The location as “Hypothalamus” (or “Hypothal.”) would be one point. Indicating the ‘chain of signals’ molecules would be 1 point. In other words, each correct thing you learned from this exercise would be 1 point.
2. **What if you already knew something, and didn’t learn it from this exercise?** What it, for example, you already knew about transcription and translation (some parts of panel 9 & 10)? Then don’t count those! You want to know what you learned and recalled that is **new** to you.

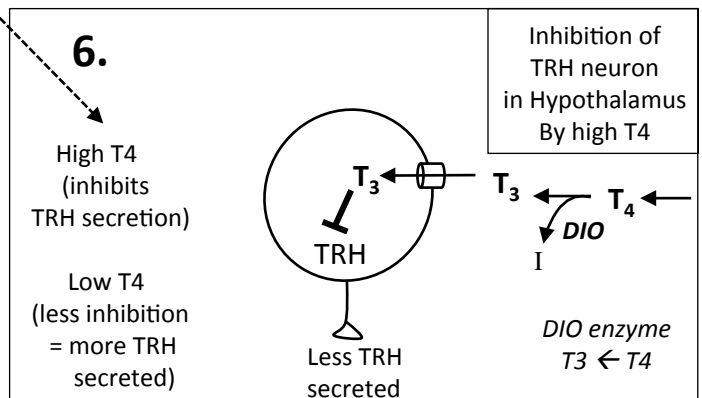
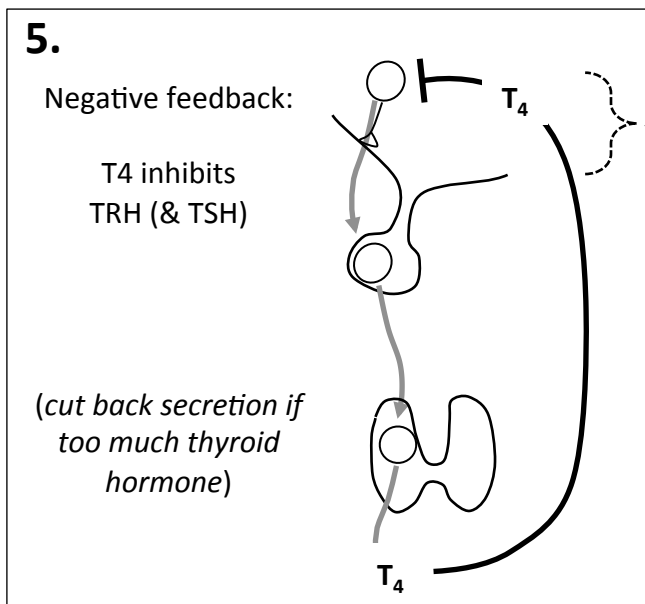
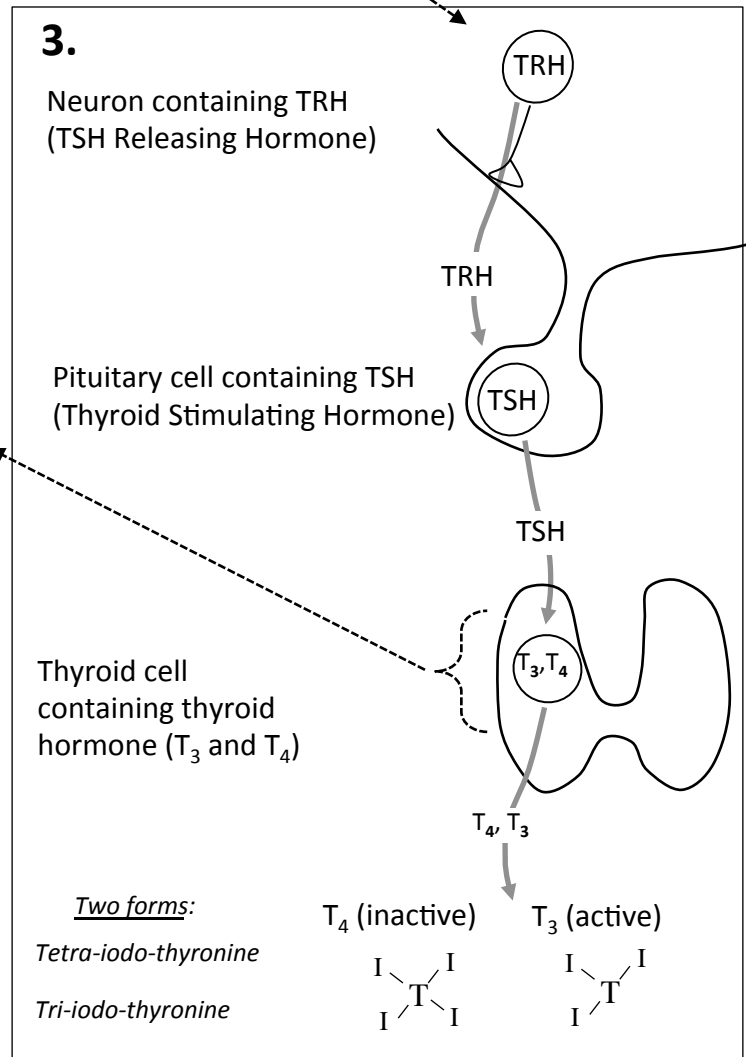
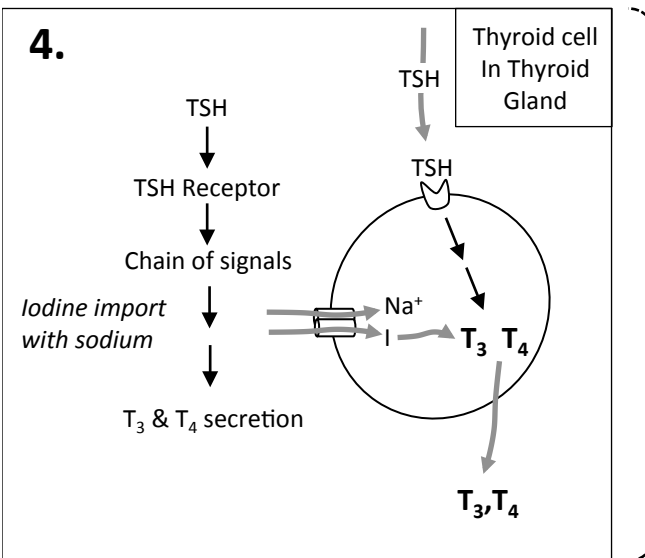
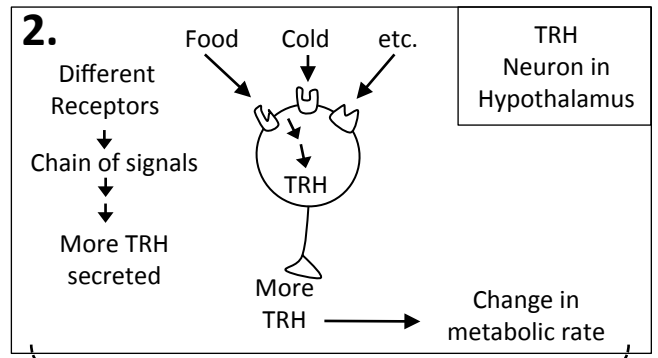
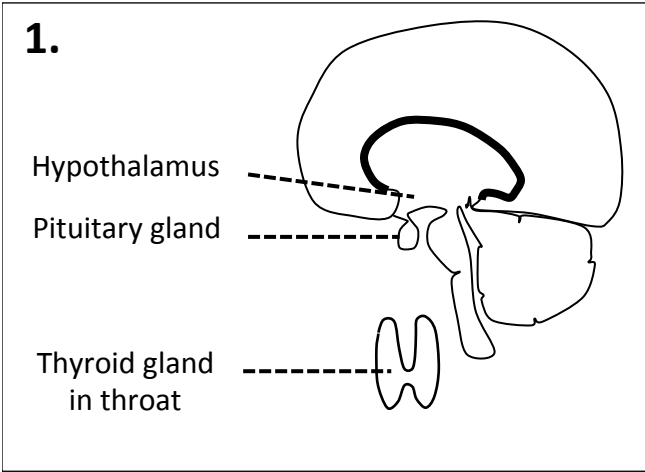
For the problem questions (Questions 2 & 4).

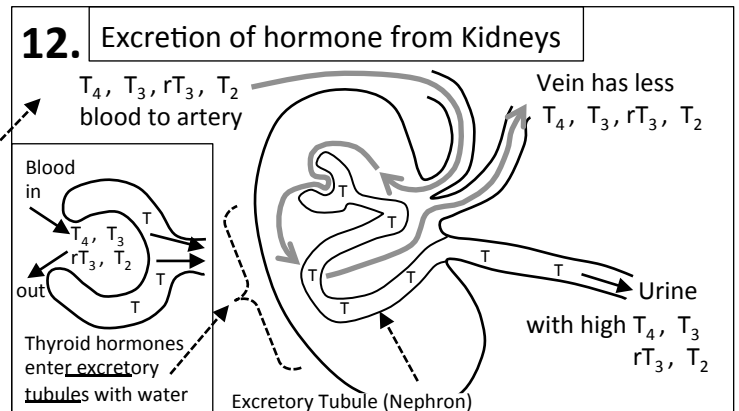
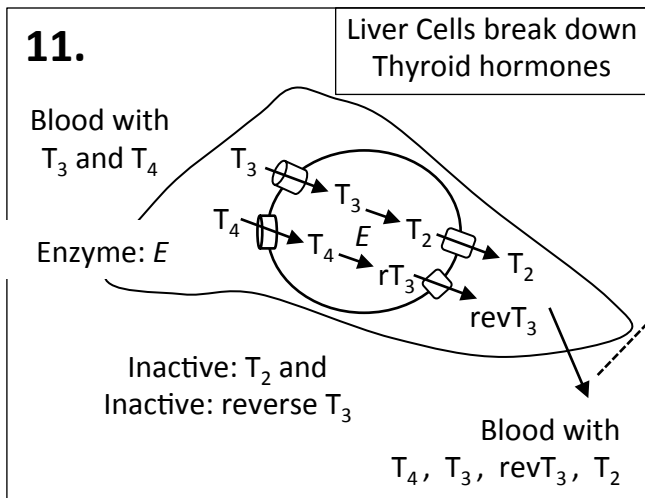
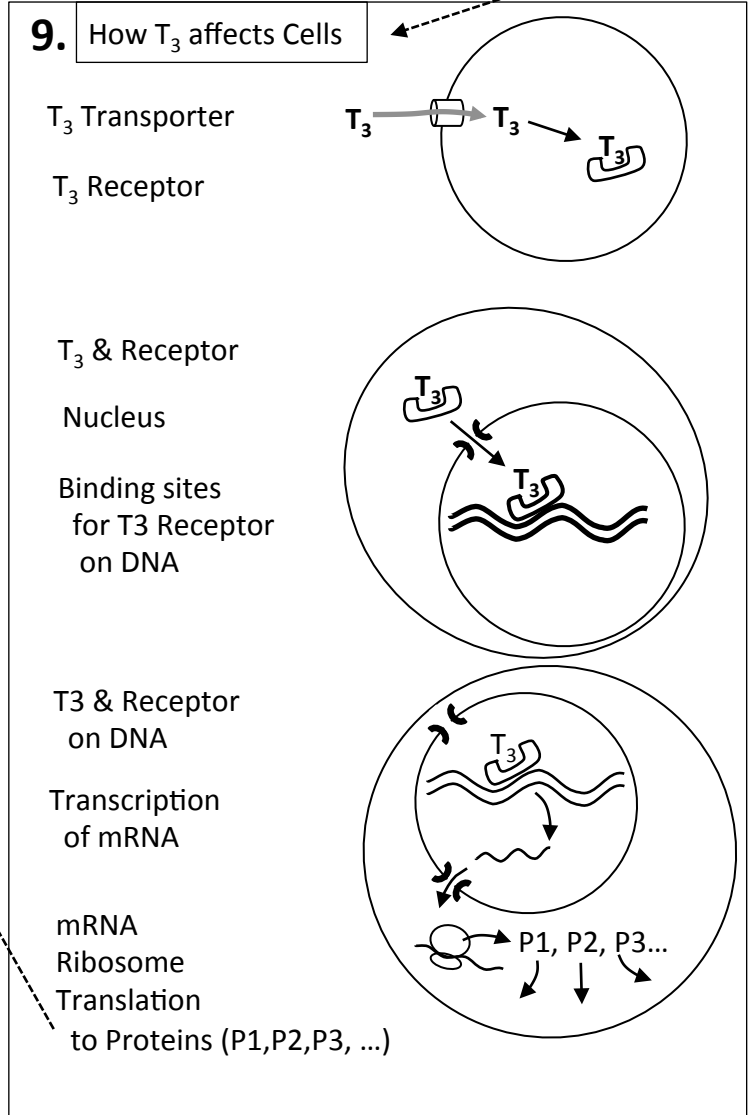
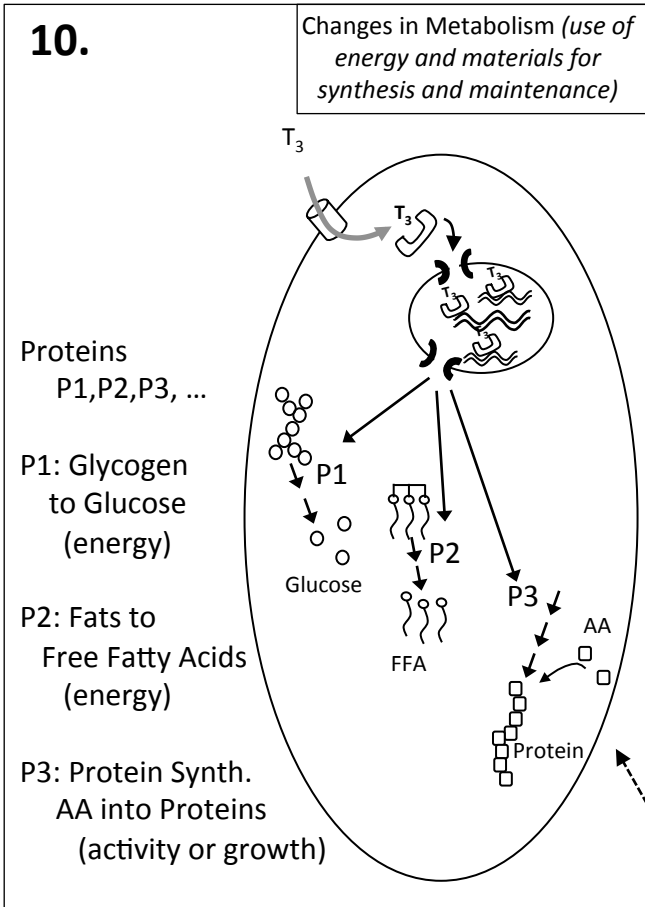
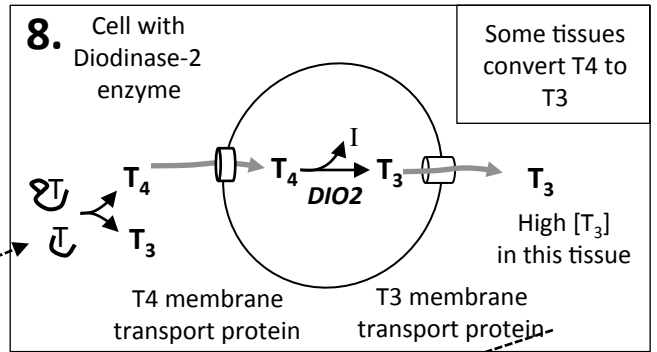
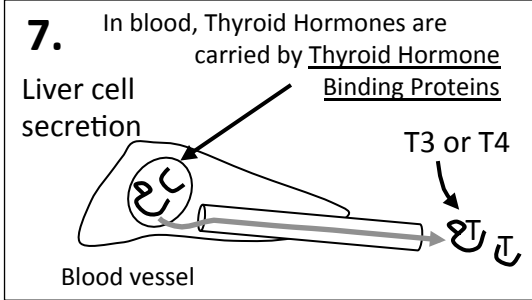
Question 2:

- A. Pituitary: **Half** -- as much -- **TSH** -- secreted (released).
- B. Thyroid gland: **Half** -- as much -- **T₃** -- secreted.
- C. Neurons in the brain: **More** -- secretion of – **TRH** (*because less inhibition of TRH by T₃*).

Question 4 Grading Rubric: One point each for:

- A. Cells throughout the body: **Half** -- as much receptor holding – **T₃**.
- B. Cells throughout the body: **Half** -- as much – **Protein** – made.
- C. Kidney: **Same** – the amount of revT₃, & T₂ made and excreted (*because the mutation does not change the amounts of hormone made and secreted*).





Session 5: Survey

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I was surprised by how much I had remembered from minute sketches and folded lists.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
2. I was surprised by how much I had remembered from visual review of the study materials.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
3. Based on what I have learned about study methods in these sessions, I am thinking seriously about changing my study methods.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you wish.)

4. Based on what I have learned up to now, I feel likely to use minute sketches with folded lists as a study method in the future.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you wish.)

5. Do you have any suggestions for us that might improve this study or a future study?
 No
 Yes -- *Please explain your thoughts below.*

(A) Suggestions about the thyroid hormone presentation and materials?

(B) Suggestions about the instructions and your practice time studying the content?

Session 6: Script (projected as a PowerPoint slide)

INSTRUCTIONS: BIOL 220 Study Method Research Project

1. Take the quiz:
 - For Questions 1 & 3, just sketch/write what you recall ...
 - Questions 2 & 4: PLEASE DON'T GUESS.
 - If you don't know, just leave them blank.
 - If you think you know (or have a good prediction), then circle the correct answer.
 - Don't get stressed! This is much more complicated than the first half of the study.
2. Self-score the quiz – Instructions on the back table
 - (Your self score is for your own information; *we'll do our scoring later*)
 - Write a separate point score for each question.
 - We do not need a total, but you should notice your results from visual review & minute sketches with folded lists.)
3. Fill out the survey and turn it in

Session 6: Quiz 5

Study Participant # _____ (Please leave blank)

YOU MAY START YOUR QUIZ ON PAGE 1 or PAGE 2

Please don't forget to check the boxes, including the last page!

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. Describe/explain as much as you recall of parts 1-6 of regulation of metabolism (including brain, glands, hormones, and events). **(Answer in words, labeled sketches, or both.)**

- A. I practiced this page as: Visual Review - **OR** - Minute sketches and Folded lists - **OR** - I don't remember
B. Attempted First or Second or Neither

2. A person had an injury that has killed cells in their hypothalamus [the brain]. Name **ONE** of the metabolic hormones secreted by a gland. How might this affect the amount of hormone secreted? Why?

Hormone: _____ Change in amount? _____

Reason for the effect:

3. Describe/explain as much as you recall of parts 7-12 of regulation of metabolism (hormones in the blood and tissues, hormone action in cells, and loss/removal of hormone) (**Answer in words, labeled sketches, or both.**)

A. I practiced this section as: Visual Review - **OR** - Minute sketches and Folded lists - **OR** - I don't remember

B. Attempted First or Second or Neither

4. A person has a mutation causing them to make half as many transport proteins in cell membranes. Pick **ONE** action or effect of metabolic hormones. How might this mutation alter the action or effect? Why?

Action or effect: _____ What is the change: _____

Reason for the effect:

C. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered “Yes”, then please describe what you did. There’s no penalty! We just want to know so that we can use your data accurately, plus we’ll contact you for coaching on the method if you need it.

Session 6: Survey

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I was surprised by how much I had forgotten from minute sketches and folded lists.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
2. I was surprised by how much I had forgotten from visual review of the study materials.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
3. Based on what I have learned about study methods in these sessions, I am thinking seriously about changing my study methods.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

4. Based on what I have learned up to now, I feel likely to use minute sketches with folded lists as a study method in the future.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you can.)

5. When you study by “visual review”, what do you do?
(Please check THE CLOSEST description to what you do. In the next question, you may add more description if necessary)
 - I start reading or looking at the beginning and read through to the end. If I have time, I repeat.
 - I pick and choose what to read or look at. I try to identify the most important parts, and I spend more time looking at those parts and trying to hold it or fix it in my mind. Then I look at the next part and repeat.
 - After looking at or rereading, I look away or close my eyes and try to recall it. If I cannot recall it, I glance at that part again, close my eyes or look away, and try again. Once I succeed in recalling it from memory, I look at the next part and repeat.
 - NONE of the above fits what I do.
6. If your method for visual review differs from the check boxes above, please add a description of how you study by “visual review”.

Session 7: Script (projected as a PowerPoint slide)

INSTRUCTIONS: BIOL 220 Study Method Research Project

1. Turn in your minute sketches and folded lists
 - Include your name! (& dates/times of Vis. Review)
2. Take the quiz:
 - For Questions 1 & 3, just sketch/write what you recall ...
 - Questions 2 & 4: PLEASE DON'T GUESS.
 - If you don't know, just leave them blank.
 - If you think you know (or have a good prediction), then circle the correct answer.
 - Don't get stressed! This is much more complicated than the first half of the study.
3. Self-score the quiz – Instructions on the back table
 - (Your self score is for your own information; *we'll do our scoring later*)
 - Write a separate point score for each question.
 - We do not need a total, but you should notice your results from visual review & minute sketches with folded lists.)
4. Fill out the survey and turn it in

Session 6: Quiz 6

Study Participant # _____ (Please leave blank)

YOU MAY START YOUR QUIZ ON PAGE 1 or PAGE 2

Please don't forget to check the boxes, including the last page!

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. Describe/explain as much as you recall of parts 1-6 of regulation of metabolism (including brain, glands, hormones, and events). **(Answer in words, labeled sketches, or both.)**

A. I practiced this page as: Visual Review - **OR** - Minute sketches and Folded lists - **OR** - I don't remember
B. Attempted First or Second or Neither

2. What could you do to make a mammal secrete the **MOST** possible TRH? (You may propose to add or remove specific hormones or other substances, or you may add or remove particular cells or glands.)

What would you do?

Reason for the effect?

3. Describe/explain as much as you recall of parts 7-12 of regulation of metabolism (hormones in the blood and tissues, hormone action in cells, and loss/removal of hormone) (**Answer in words, labeled sketches, or both.**)

A. I practiced this section as: Visual Review - **OR** - Minute sketches and Folded lists - **OR**
- I don't remember

B. Attempted First or Second or Neither

4. What could you do to make an animal save as much energy as possible? (You may propose to add or remove specific proteins or other substances, or you may add or remove particular cells or glands.)

What would you do?

Reason for the effect?

C. I think I may have followed the study instructions incorrectly. **Yes** or **No**

If you answered “Yes”, then please describe what you did. There’s no penalty! We just want to know so that we can use your data accurately, plus we’ll contact you for coaching on the method if you need it.

Session 6: Survey

Study Participant # _____ (Please leave blank)

*(Researchers will tear off the bottom of this page before any analysis.
Your results will be associated with the participant number in our analyses.)*

Name _____

1. I was surprised by how much I had remembered from minute sketches and folded lists.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
2. I was surprised by how much I had remembered from visual review of the study materials.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree
3. Based on what I have learned about study methods in these sessions, I am thinking seriously about changing my study methods.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you wish.)

4. Based on what I have learned up to now, I feel likely to use minute sketches with folded lists as a study method in the future.
 Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

(Please explain your thoughts, if you wish.)

Session 8 (Problem-solving): Script

1. Walk through/model problem-solving with something straightforward (such as the water cycle diagram)

1a. With a sketch in hand, predict what would happen if you make a change in your sketch

1b. First, give question – such as: Predict changes in the water cycle around a river and lake due to fracking and explain your predictions. [Fracking is injection of water/fluids into oil and gas-holding rock and causing expansion that cracks the rock.]

- Write down your answer – every change you can predict, however minor.
- What was in your mind when you answered?

1c. THEN, give water cycle minute sketch & walk through the sketch, and try again

- After brief time to think, maybe pair and share
- Walk through some answers (from students)

1b Alternative: Effect of deforestation in Amazon basin

2. Content – From thyroid hormone and metabolism earlier handout

2ai. Have them practice minute sketches – from one page – the page they studied as Minute Sketches

2a.ii. Have them do visual review the other page

3. Give 1-3 problems for students to solve with each page (& no materials – solve problems from memory)

- Tell them the point is not to do all three problems, but rather to think through the process and practice. Can do the problems in any order; skip problems that make no sense
- IF not sure/can't recall, then OK to look back at your notes, BUT THEN HIDE notes (& make own sketches) before trying again to solve a problem

4. Give new content and lecture (20 mins) on immune function – Approx. 24 items/page
- PRACTICE -- run through

5. Tell them: visual review for 1 page, 5 min/day on three days; MSFL for the other page, 5 min/day on three days

6. Next week, a quiz on the content – problem solving. Scoring will be: 50% for what you remember that is relevant to the question, and 50% for solving the problems (Common approach to grading in many classes that involve problem solving)

Session 8: Content notes for Immune Function

B-Cell and Antibodies – specific activation and ‘learned’ response to infection

1. B-cells of the immune system bind to antigens
 - They bind using membrane surface proteins (B-cell receptors)
 - During development, the DNA sequence coding for the tips of the B-cell receptors becomes different in each cell
 - Millions of B-cells; each genetically different for the tip (the binding region)
2. Species of bacteria all have different surface molecules – each with a different shape or charge
 - These surface molecules are antigens if they can bind to a B-cell receptor
 - Each B-cell differs (genetically) in the shape of the binding pocket at the tips
 - So a particular antigen will bind only to a B-cell receptor that matches its shape and charge
3. If an antigen binds to a B-cell receptor
 - The antigen and receptor are moved into the cell
 - The antigen is transferred to another protein: an MHC II protein
 - MHC II proteins do not have to have a matching shape to the antigen:
 - MHC II proteins hold many different shapes & structures of antigens
4. MHC II protein with antigen moves to the surface of the cell
 - If another immune cell, a Helper T Cell, has a surface receptor that can ALSO bind the antigen (in other words, with a tip of the receptor matching the charge and shape of the antigen)
 - That binding activates the Helper T Cell to release a chemical message
 - a cytokine (this is a general term for chemical signals from immune cells)
 - The cytokine activates the B-cell to divide many times and then mature
5. After many rounds of cell division, there are now thousands (or many more) copies of the same B-cell
 - Each of these is nearly identical, with the same B-cell receptor gene sequence
 - Most of the mature B-cells become plasma cells
 - Plasma cells make and secrete a shorter version of the B-cell receptor: an antibody
6. Antibodies bind the antigen
 - If the antigen is part of the surface of a bacterium, then the two arms of the Y-shape can stick two bacteria together
 - If the antigen is a toxin secreted by the bacterium, the antibody will bind and hold two of the toxin molecules
 - Immune cells called macrophages can bind to the base of an antibody
 - They move the antibody and anything attached into the cell and digest it
 - Removing harmful bacteria or toxins
7. After cell division of activated B-cells, some of the cells do not secrete antibody, but become memory cells – this is a ‘learned’ response to that specific bacterium
 - If memory cells encounter antigen months or years later, they can be activated quickly to produce antibody, without the wait for many rounds of cell division

Macrophages in non-specific attacks on bacteria

1. 'Gram-negative' (G-N) bacteria are a common group with many bacterial species
 - This group of bacteria all have as an essential part of their cell wall a molecule called lipopolysaccharide (LPS)
 - When G-N bacteria are in a new wound, LPS is a part of their bacterial cell surface
2. One type of the immune cells called macrophages have LPS receptors on their surface
 - LPS receptors bind LPS from G-N bacteria
 - The macrophages also have internal proteins that can change the shape of the macrophage
 - Some proteins can be lengthened
 - Some can be shortened
3. Binding of LPS to the LPS receptor causes changes in the internal proteins
 - Proteins near the surface become longer and cause cell extensions: pseudopods that stretch outward – around the bacterium
 - Proteins deeper in the cell shorten, pulling that part of the cell membrane inward
 - The result is a phagocytosis: a pocket that closes around the bacterium
4. When the pocket closes, enzymes and acid are added to the vesicle
 - The enzymes and acid digest and destroy the bacterium
 - The process of phagocytosis causes secretion of a chemical messenger molecule:
 - an 'inflammatory cytokine' released by the macrophage
5. The inflammatory cytokine diffuses away from the macrophage
 - Some of the inflammatory cytokine enters nearby capillaries
 - entering through the gaps between the endothelial cells of the capillary wall
 - or being moved across the endothelial cells
 - Inactive macrophages are a leucocyte (white blood cell) normally present in blood
 - Macrophages have receptors for the inflammatory cytokine
 - in addition to having receptors for LPS
6. Binding to an inflammatory cytokine causes macrophages to stick to the capillary wall
 - And become amoeboid
 - Amoeboid macrophages that have bound inflammatory cytokines squeeze between the capillary endothelial cells and move out of the blood vessel
 - Inflammatory cytokines have a second effect:
 - Inflammatory cytokines cause the gaps between capillary cells to become larger, allowing more fluid to leave the capillaries
7. More and more of these active macrophages accumulate in the region of the wound site
 - In turn, these new macrophages bind to LPS on bacteria, phagocytize the bacteria, and release even more inflammatory cytokine
 - The fluid and immune cells contribute to the swelling at the site of infection
 - The swelling from tissue fluids (which makes space for the macrophages and other immune cells) and the increasing numbers of macrophages continues until the infection ends
 - A major component of pus at an infection is the dead macrophages that have attacked and ingested many bacteria

INSTRUCTIONS -- Group "A":

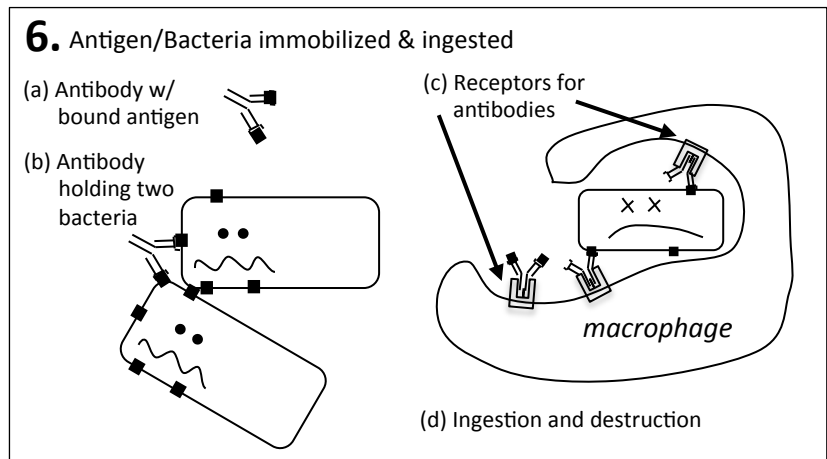
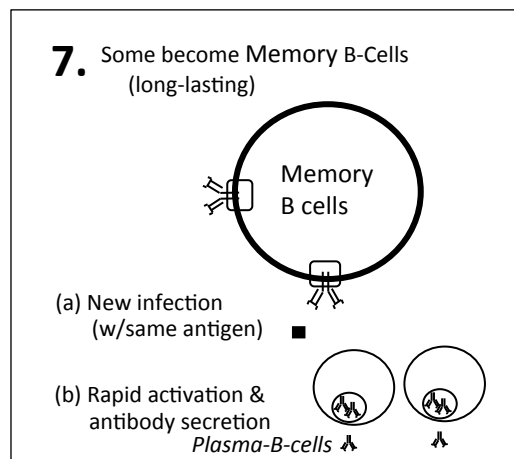
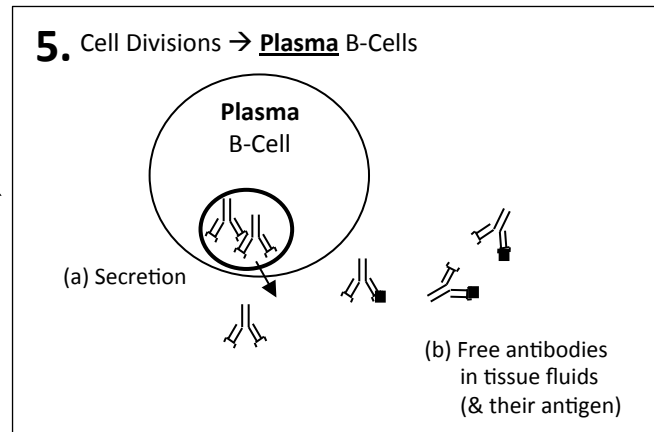
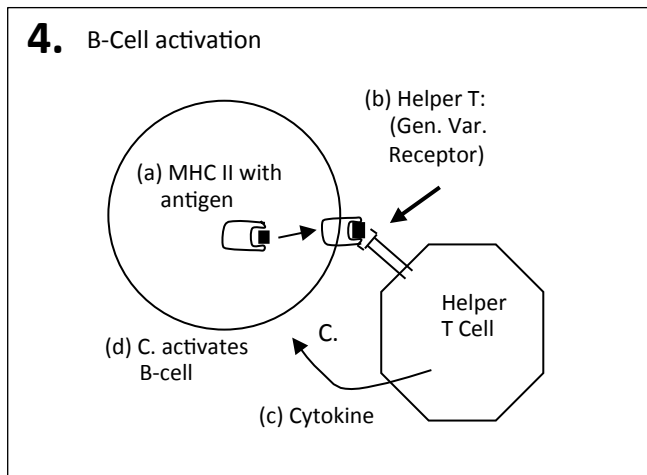
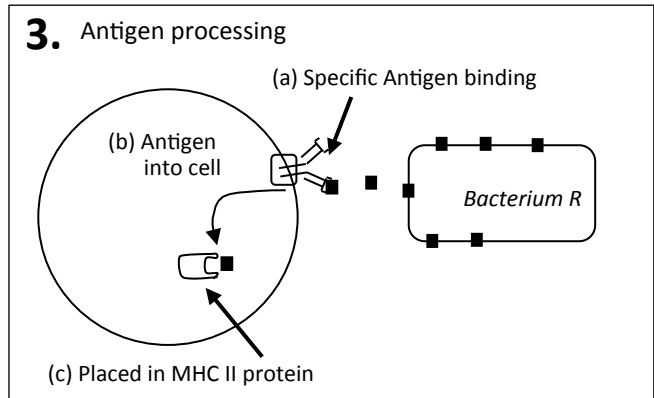
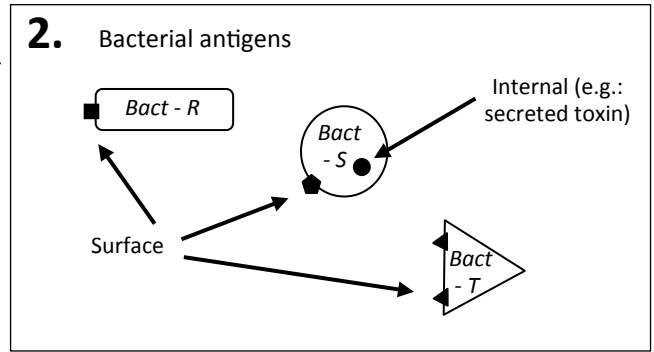
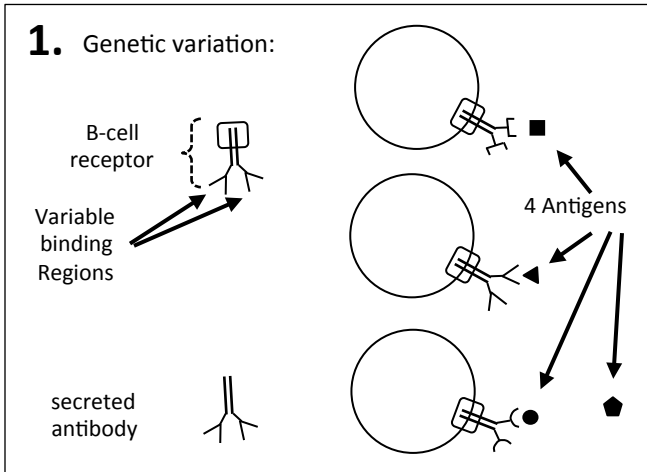
On three different days before the quiz next week:

1. Visual Review page (**10 min total**):
 - [Visual Review](#) for 5 minutes.
 - [Problem solving](#) for 5 minutes (invent your own problems)
 - (**Potential changes**: more of x , less of x , remove x , kill x , add a drug that attaches to x and blocks it [or activates it] ...)
 - Quiz will be: 1 Question from boxes 1-3, & a 2nd Question from boxes 4-5
2. Minute Sketch page (**10 min total**):
 - [Do Minute Sketches in Folded Lists](#) for 5 minutes.
 - [Problem solving](#) for 5 minutes (invent your own problems)
 - (**Potential changes**: more of x , less of x , remove x , kill x , add a drug that attaches to x and blocks it [or activates it] ...)
 - Quiz will be: 1 Question from boxes 1-3, & a 2nd Question from boxes 4-5
3. Please write each date and the start and end times for both Visual Review and the MSFL and minute sketches with changes on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
4. Alternate the order (Vis Rev or MSFL 1st or 2nd)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
5. DO NOT PRACTICE ON THE DAY OF OUR NEXT SESSION!

This is intended to be similar to an exam for which you don't have time to study on the day of the exam.

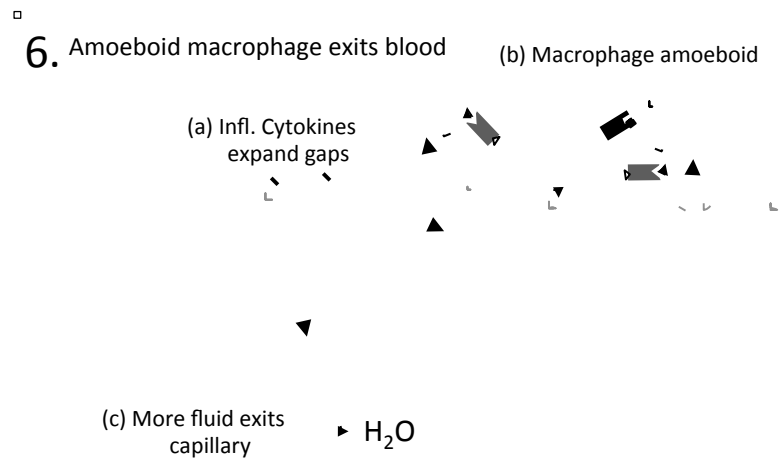
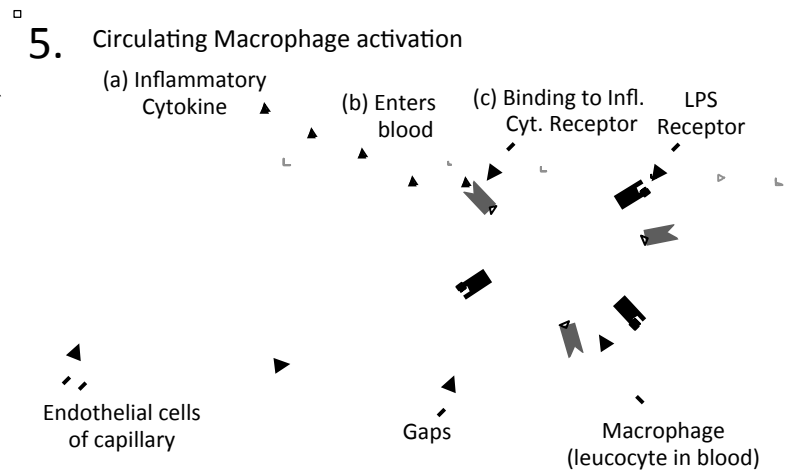
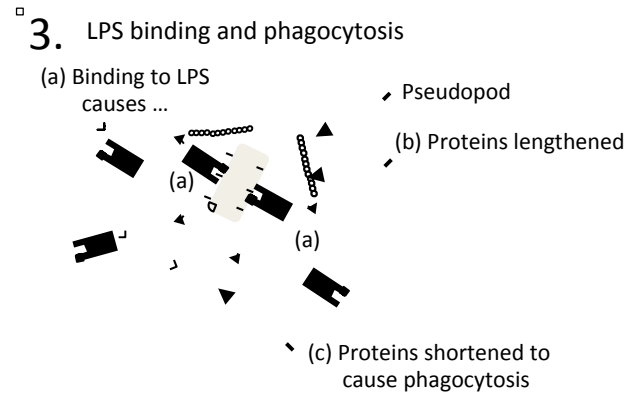
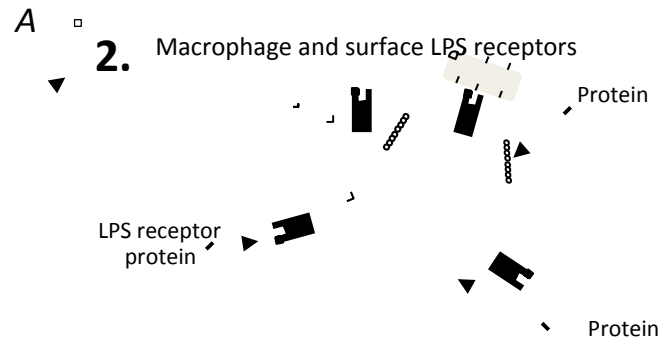
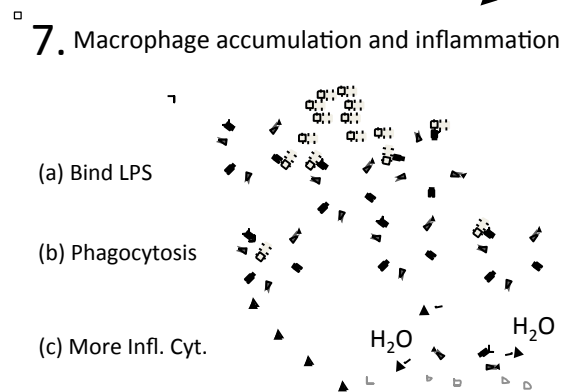
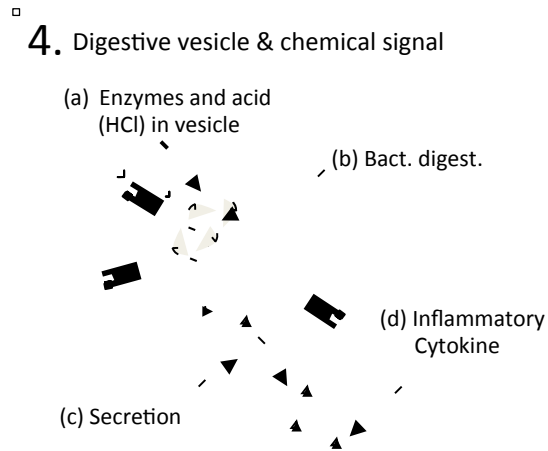
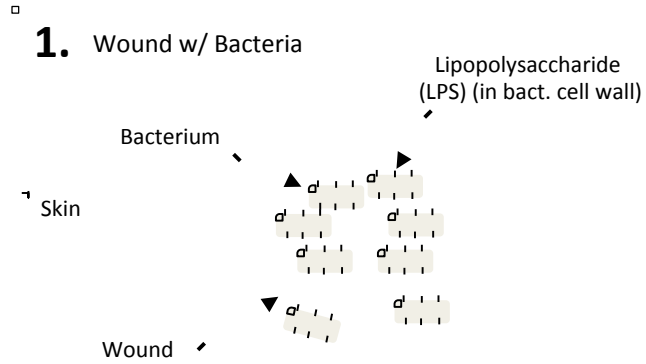
Page 1: for Visual Review

B-CELLS



Page 2: for Minute Sketches & FL

MACROPHAGES



INSTRUCTIONS -- Group "B":

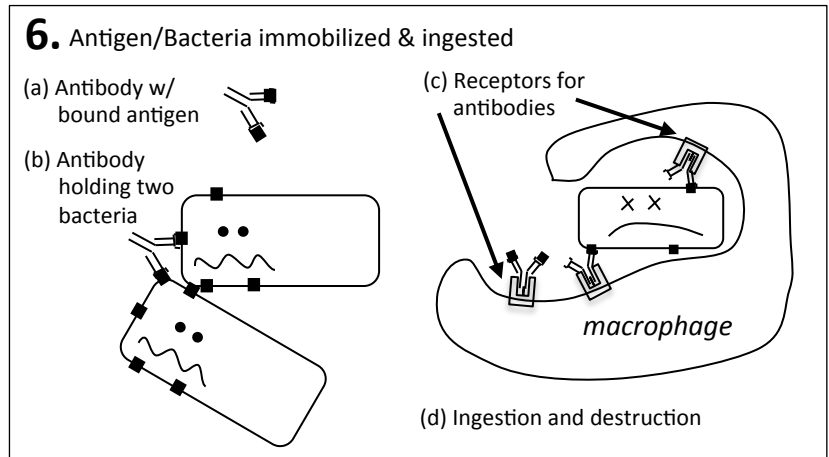
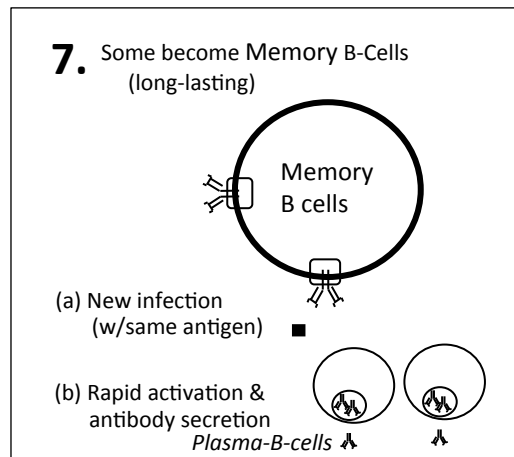
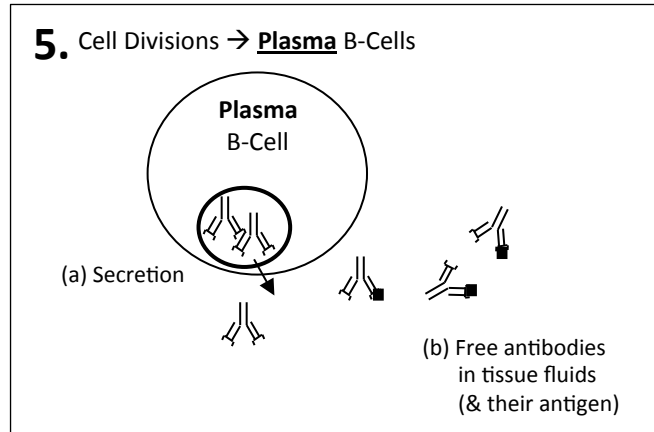
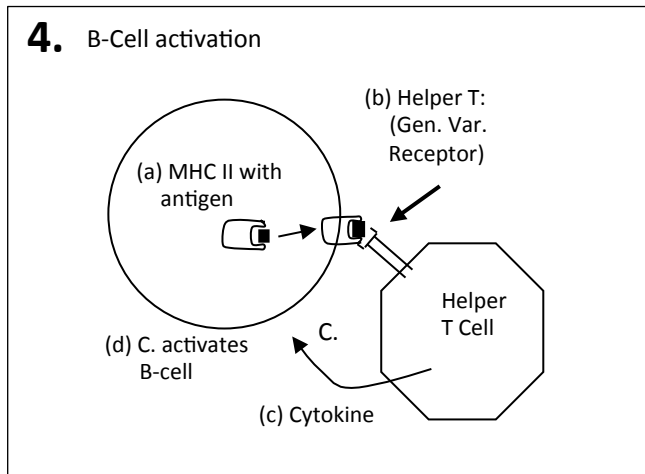
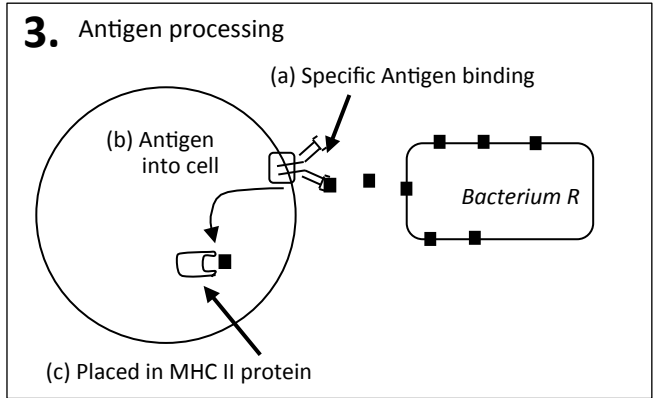
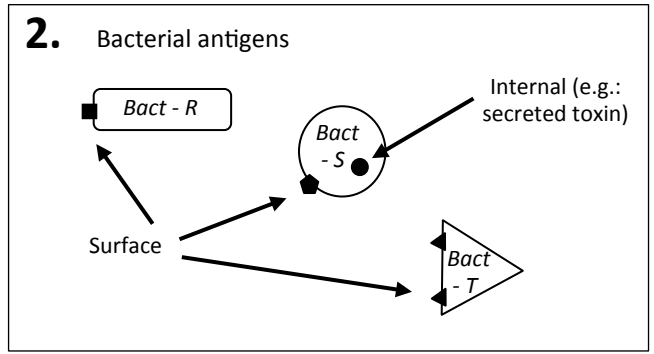
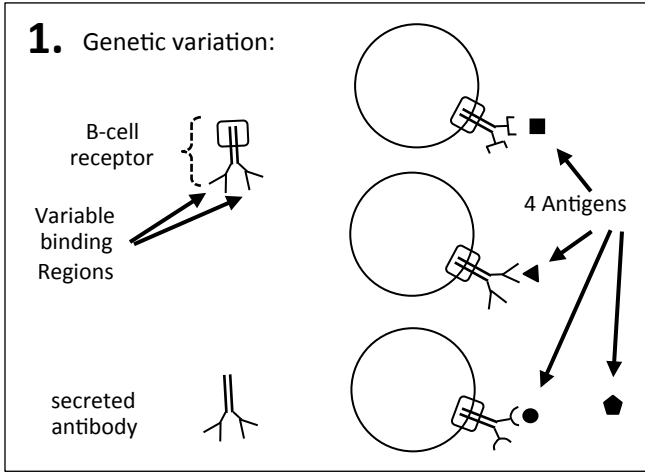
On three different days before the quiz next week:

1. Visual Review page (**10 min total**):
 - [Visual Review](#) for 5 minutes.
 - [Problem solving](#) for 5 minutes (invent your own problems)
 - (**Potential changes**: more of x , less of x , remove x , kill x , add a drug that attaches to x and blocks it [or activates it] ...)
 - Quiz will be: 1 Question from boxes 1-3, & a 2nd Question from boxes 4-5
2. Minute Sketch page (**10 min total**):
 - [Do Minute Sketches in Folded Lists](#) for 5 minutes.
 - [Problem solving](#) for 5 minutes (invent your own problems)
 - (**Potential changes**: more of x , less of x , remove x , kill x , add a drug that attaches to x and blocks it [or activates it] ...)
 - Quiz will be: 1 Question from boxes 1-3, & a 2nd Question from boxes 4-5
3. Please write each date and the start and end times for both Visual Review and the MSFL and minute sketches with changes on your papers
 - **IMPORTANT: You will turn your Folded List pages in to us!**
4. Alternate the order (Vis Rev or MSFL 1st or 2nd)
 - If you forget, that's OK, but please make sure your start and end times are recorded for both
5. DO NOT PRACTICE ON THE DAY OF OUR NEXT SESSION!

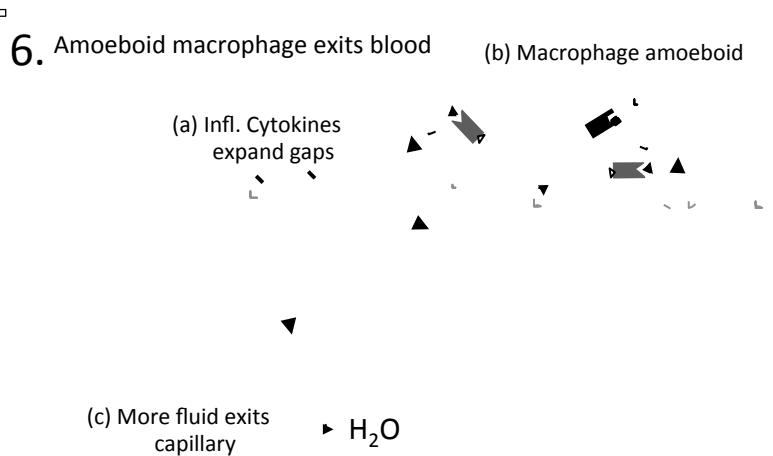
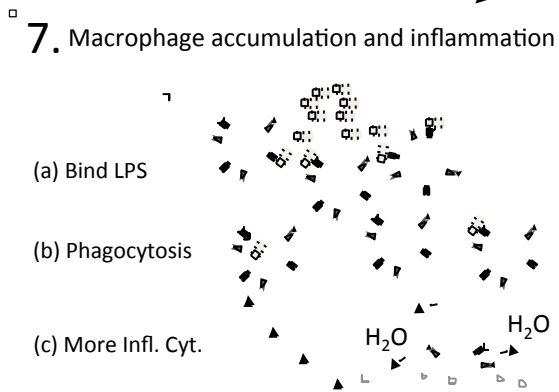
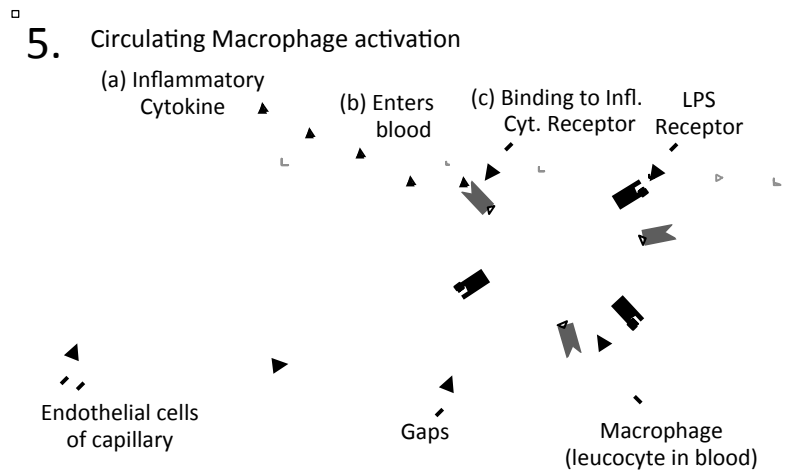
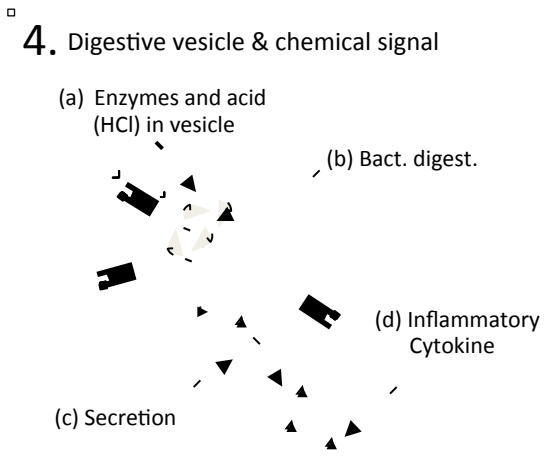
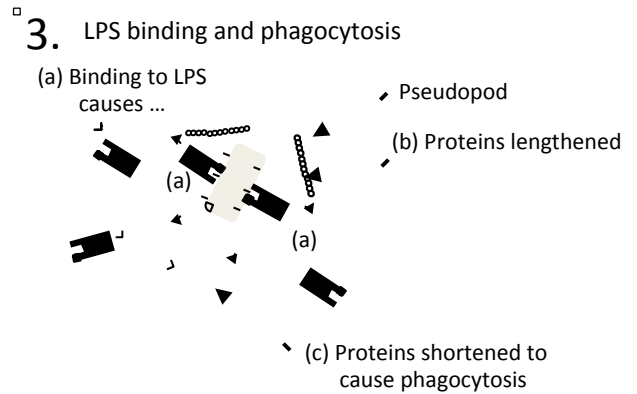
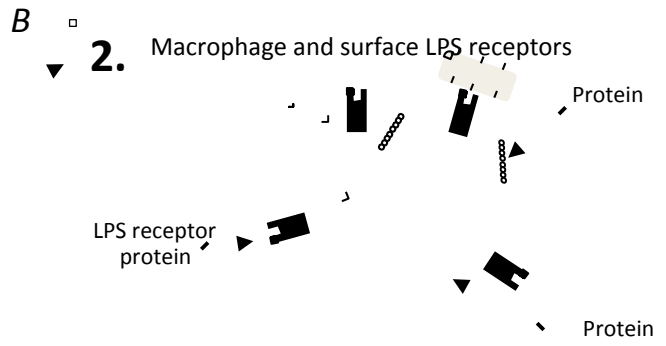
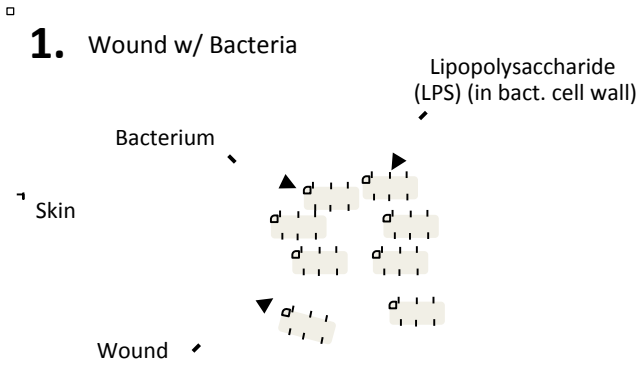
This is intended to be similar to an exam for which you don't have time to study on the day of the exam.

Page 1: for Minute Sketches & FL

B



Page 2: for Visual Review



Practice sheet: Immune Function

Name: _____ Date: _____
Start time: _____ End time: _____ (Visual Review Start Time: _____ Vis Review End Time: _____)

Day A: Immune Function

*(You may use a different sheet of paper [& **continue on blank sheets** if you finish these])*

Name: _____ Date: _____
Start time: _____ End time: _____ (Visual Review Start Time: _____ Vis Review End Time: _____)

Day B: Immune Function

*(You may use a different sheet of paper [& **continue on blank sheets** if you finish these])*

Name: _____

Date: _____

Start time: _____

End time: _____

(Visual Review Start Time: _____

Vis Review End Time: _____

)

Day C: Immune Function

*(You may use a different sheet of paper [& **continue on blank sheets** if you finish these*

Name:

Date:

Start time:

End time:

(Visual Review Start Time:

Vis Review End Time:

)

Session 9: Quiz on Problem Solving

Study Participant # _____ (Please leave blank)

There are four questions, two on B-cells and two on Macrophages.

On two blank pages, we've provided space for you to describe whatever else you recall.

If you wish, you may start the quiz by using those blank pages to describe and/or diagram whatever you recall for the processes, and then go to the problems.

(Researchers will tear off the bottom of this page before any analysis. Your results will be associated with the participant number in our analyses.)

- A. I practiced B-cells as: Visual Review - **OR** - Minute sketches & Folded lists - **OR** - I don't remember
- B. I practiced Macrophages as: Visual Review - **OR** - Minute sketches & Folded lists - **OR** - I don't remember

Name _____

4/2015

Please answer the two problems below.

(You may use words, sketches with labels, or any combination of words and sketches.)

1. The B-cells of an individual each produce **MORE** B-cell receptors than a normal individual. That individual becomes infected with a bacterium. *Explain how this might affect the sequence of subsequent events involving B-cells.*

2. A different individual has an infection that has progressed for a while. Then on one day, the individual's meals contain a molecule absorbed from the food that has a very similar shape to molecules from the bacterium. *Explain how this might affect the sequence of subsequent events involving B-cells.*

Please answer the two problems below.

(You may use words, sketches with labels, or any combination of words with sketches.)

3. The macrophages of an individual each produce **FEWER** LPS receptors than a normal individual. That individual becomes infected with a bacterium. *Explain how this might affect the sequence of events involving macrophages.*

4. A different individual has a bad fall and has a badly scraped forearm. Six hours later, the individual drinks very little fluid and becomes seriously dehydrated. *Explain how this might affect the sequence of events involving macrophages.*

C. I think I may have followed the study instructions incorrectly. Yes or No

If you answered “Yes”, then please describe what you did. There’s no penalty! We just want to know so that we can use your data accurately, plus we’ll contact you for coaching on the method if you need it.

D. Visual review method

5. When you study by “visual review”, what do you do?

(Please check THE CLOSEST description to what you do. In the next question, you may add more description if necessary)

- I start reading or looking at the beginning and read through to the end. If I have time, I repeat.
- I pick and choose what to read or look at. I try to identify the most important parts, and I spend more time looking at those parts and trying to hold it or fix it in my mind. Then I look at the next part and repeat.
- After looking at or rereading, I look away or close my eyes and try to recall it. If I cannot recall it, I glance at that part again, close my eyes or look away, and try again. Once I succeed in recalling it from memory, I look at the next part and repeat.
- NONE of the above fits what I do.

6. If your method for visual review differs from the check boxes above, please add a description of how you study by “visual review”.

B-cells. Additional Notes or Explanation

Macrophages. Additional Notes or Explanation

Experiment 3: Post-Survey on study methods for participants

1. Right now, my most likely major in college is:

- Biology
- Chemistry
- Geology
- Kinesthesiology and Health sciences
- Physics
- Mathematics
- Neuroscience
- Computer Science

Other (please specify)

2. I consider myself a -- (Mark any that apply)

- No preference / no style that I know
- Visual Learner
- Auditory Learner
- Reading-Writing Learner
- Kinesthetic or 'Tactile' Learner (learning by movement and activity)

Other (please specify)

3. I think that I study:

- Much more than most students
- More than most students
- About the same amount as other students
- Less than most students
- Much less than most students

4. I now use Minute Sketches in my studying:

- Never
- Rarely
- Occasionally

- Often
- Before every test

Can you tell us why you use or do not use Minute Sketches?

5. If you use Minute Sketches, in how many courses do you use them?

- I don't use Minute Sketches
- One course
- Two courses
- Three courses
- Four courses
- All of my courses

Do you have comments for us on courses in which you use Minute Sketches?

6. I now use Folded Lists in my studying:

- Never
- Rarely
- Occasionally
- Often
- Before every test

Can you tell us why you do or do not use Folded Lists?

7. If you use Folded Lists, in how many courses do you use them?

- I don't use Folded Lists
- One course
- Two courses
- Three courses

Four courses

All of my courses

Do you have comments for us on courses in which you use Folded Lists?

8. Which study methods do you use before a challenging test: Please check all that you use.

Rereading my notes

Rereading power-points or presentations

Rereading the textbook

Rewriting my notes

Summarizing

Highlighting

Flashcards

Drawing or sketching

Redrawing sketches for practice

Practice tests

Self-testing

Writing my own questions

Mnemonics (or memory aids) for key words

Distributed practice (studying or practicing the same things over more than one day)

Chunking

Retrieval practice

Mind maps or concept maps

Folded lists

Minute sketches

Other (please specify) you may include up to three additional methods:

9. Please indicate the approximate amount of time in which you use these study methods before a challenging test (just an approximation). Your numbers should add up to 100%, but if they do not, we will adjust them to total 100%. (Example: 40% Rereading my notes,

30% rereading PowerPoints or presentations, 30% rereading the textbook. The total = 100%.)

Rereading my notes

Rereading power-points or presentations

Rereading the textbook

Rewriting my notes

Summarizing

Highlighting

Flashcards

Drawing or sketching

Redrawing sketches for practice

Practice tests

Self-testing

Writing my own questions

Mnemonics (or memory aids) for key words

Distributed practice (studying or practicing the same things over more than one day)

Chunking

Retrieval practice

Mind maps or concept maps

Folded lists

Minute sketches

10. In my studying now, I use different study methods and I match my methods carefully to the material and the skills I need to learn.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

11. I am reluctant to change my study habits, because they have worked very well for me so far.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

12. Please provide the first three letters of your first name and last name as a TEMPORARY ID.

These will be used only so that we do not send reminder emails to those who have already completed the survey and to attach your participant number to your responses.

Your six-letter temporary ID will be removed before any review of your answers.

First three letters of FIRST name:

First three letters of your LAST name:

1. I am

- 17 or younger 18 19 20 21 22 23 24 or older

2. I am a:

- Freshman Sophomore Junior Senior Other

3. I would describe myself as (Please mark ALL that apply):

- African American/Black
 American Indian/Alaska Native
 Asian American/Asian
 Native Hawaiian/Pacific Islander
 Mexican American/Central American
 Puerto Rican
 Other Latino
 White/Caucasian
 Other
 No Response

4. I consider myself:

- Male Female Other No Response

5. I consider myself a -- (Mark any that apply)

- No preference / no style that I know
 Visual Learner
 Auditory Learner
 Reading-Writing Learner
 Kinesthetic or 'Tactile' Learner (learning by movement and activity)

Other (please specify)

6. Right now, my most likely major in college is:

- Biology
- Chemistry
- Geology
- Kinesesthesiology and Health sciences
- Physics
- Mathematics
- Neuroscience
- Computer Science

Other (please specify)

7. I think that I study:

- Much more than most students
- More than most students
- About the same amount as other students
- Less than most students
- Much less than most students

8. Which study methods do you use before a challenging test: Please check all that you use.

- Rereading my notes
- Rereading power-points or presentations
- Rereading the textbook
- Rewriting my notes
- Summarizing
- Highlighting
- Flashcards
- Drawing or sketching
- Redrawing sketches for practice
- Practice tests
- Self-testing
- Writing my own questions
- Mnemonics (or memory aids) for key words
- Distributed practice (studying or practicing the same things over more than one day)
- Chunking
- Retrieval practice
- Mind maps or concept maps
- Folded lists
- Minute sketches

Other (please specify) you may include up to three additional methods:

BIOL 220 Survey C 4.2015 for Prof. Heideman

9. Please indicate the approximate amount of time in which you use these study methods before a challenging test (just an approximation). Your numbers should add up to 100%, but if they do not, we will adjust them to total 100%. (Example: 40% Rereading my notes, 30% rereading PowerPoints or presentations, 30% rereading the textbook. The total = 100%.)

Rereading my notes	<input type="text"/>
Rereading power-points or presentations	<input type="text"/>
Rereading the textbook	<input type="text"/>
Rewriting my notes	<input type="text"/>
Summarizing	<input type="text"/>
Highlighting	<input type="text"/>
Flashcards	<input type="text"/>
Drawing or sketching	<input type="text"/>
Redrawing sketches for practice	<input type="text"/>
Practice tests	<input type="text"/>
Self-testing	<input type="text"/>
Writing my own questions	<input type="text"/>
Mnemonics (or memory aids) for key words	<input type="text"/>
Distributed practice (studying or practicing the same things over more than one day)	<input type="text"/>
Chunking	<input type="text"/>
Retrieval practice	<input type="text"/>
Mind maps or concept maps	<input type="text"/>
Folded lists	<input type="text"/>
Minute sketches	<input type="text"/>

10. In my studying now, I use different study methods and I match my methods carefully to the material and the skills I need to learn.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

11. I am reluctant to change my study habits, because they have worked very well for me so far.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

12. Please give us your unique identifier for this survey:

The unique identifier will enable the Principal Investigator (PI) to evaluate your answers anonymously. There are three parts to your unique identifier. Set up your unique identifier as follows:

- 1. The first three letters of your mother's maiden name**
- 2. The fifth and sixth numbers in your William and Mary University ID**
- 3. The first three letters of your father's name.**

An example of a unique identifier would be "SOU24VIN". You will be asked to provide your unique identifier on the two surveys for this study. You may stop participating at any time, simply by not completing a survey. The instructors of BIOL 220, Introductory Biology, will not know which students do not participate and which students agreed to participate in the study.

First three letters of Mother's maiden name

Fifth & Sixth digits of your WM ID

First three letters of Father's first name