

EXPERIMENTS

1. Mind Maps

Purpose: To test if making and reviewing mind maps with sketches helps me retain and understand information better than just reading, rereading, writing and rewriting notes about the topic.

Methods: Pick two different chapters in Intro Biology that focus on a different set of concepts of which are equally foreign to me. Flip a coin to determine which chapter to sketch a mind map for and which chapter to review written notes for. Spend 1 hour making each and 1 hour reviewing each on different days.

Analysis: The best method will be defined by how well I can answer the "Test Your Understanding", "You should be able to...", "Test Your Knowledge", and "Applying Concepts to New Situations" questions within and at the end of each chapter in the textbook. The correct answers to these questions are provided in the book and my performance will be based on the total correct (according to the correct answer in the textbook) out of the total number of questions.

Hypothesis: I will be able to answer more "Test Your Understanding" and "Applying Concepts to New Situations" questions for the chapter that I use the mind-map to review for.

Summary of Results:

I chose to conduct this experiment on Chapter 28 (Archaea and Bacteria) and Chapter 25 (Microevolution.) I chose these two because I felt they had the least amount of overlap of content, so if I learned the first chapter's material better than the other before I reviewed the second chapter, I couldn't apply the content learned by one method to the questions for the other. I flipped a coin which determined that I would write and read notes on Archaea and Bacteria and sketch and review a mind-map for Microevolution.

My results on the questions for Chapter 28 were 27/34 questions correct after reading and rewriting my notes I had taken on the chapter the day before. I outlined the chapter while writing out all vocabulary and definitions. However, I struggled with the "Applying Concepts to New Situations" and the "You should be able to..." questions a lot more than the "regurgitating facts" questions. Six of the Seven incorrect answers were from the "Applying Concepts to New Situations" and "You should be able to..." sections.

The results for Chapter 25 were a little different. I made a mind-maps in which I was able to include information from previous chapters and relate all of the information to one another through lines and arrows (Figure 1). My results for the questions throughout the chapter were 31/35 correct. Although I only got a few more right with the mind-mapped chapter, I got 6/8 correct from the "You should be able to..." and "Applying Concepts to New Situations" sections. I thought these questions drew upon application of material in the chapter which is based on actually understanding the concepts explored in the chapter as opposed to memorizing facts summarized in the chapter.

Conclusion: I felt that it was much easier to relate two concepts by graphically connecting them in a mind-map with sketches. Contrasting my hypothesis, the "Test Your Understanding" questions were answered with equivalent accuracy with both methods; however that is more a comment on the character of the questions than the merit of the methods. Furthermore, I noticed when I was answering questions about genetic drift, gene flow, natural selection, and evolution on the exam I was picturing the relationships between their sketches on my mind map in my head.

FIGURE 1.1: CHAPTER 25 MICROEVOLUTION MIND-MAP

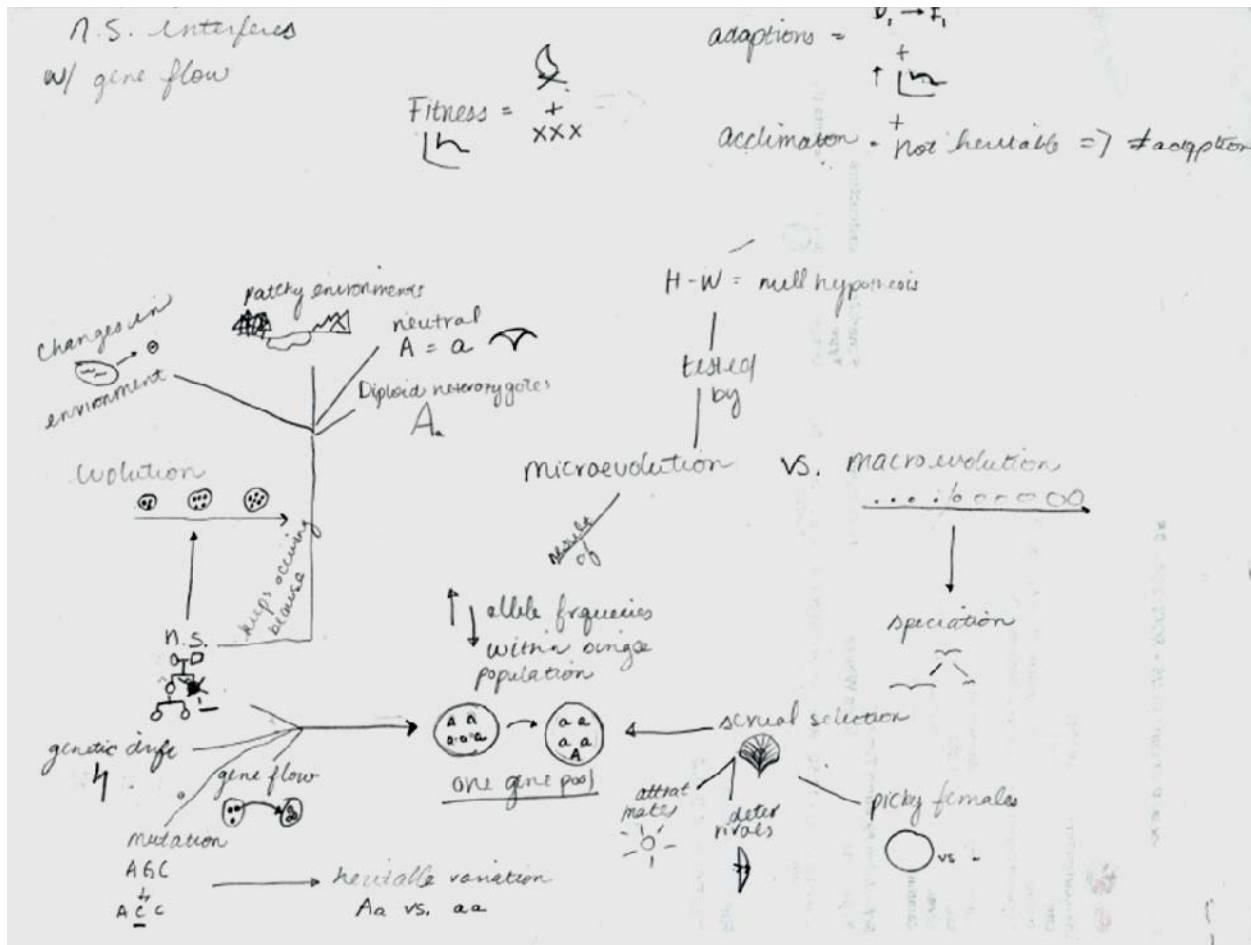


FIGURE 1.2: CHAPTER 28 NOTES SAMPLE

- I. **Why Do Biologists Study Bacteria and Archaea?**
 - A. **Biological impact**
 1. Bacteria and archaea are amazingly abundant.
 - a. Most cells in the human body are actually bacteria and archaea (living on the skin and in the gut).
 - b. The Group I marine archaea are so abundant that a teaspoon of seawater contains a population equivalent to that of a large human city.
 - c. If lined up end to end, all the bacteria and archaea alive today would make a chain longer than the Milky Way galaxy.
 2. They are found in every possible environment.
 3. They are very diverse, and we are still discovering entire new phyla.
 - B. **Medical importance**
 1. Some bacteria are pathogenic, meaning that they cause disease. (Table 28.2)
 2. Koch's postulates: Koch proposed that four criteria had to be met to prove that a specific microbe causes a certain disease.
 - a. The microbe must be present in individuals suffering from the disease and absent in healthy individuals.
 - b. The microbe must be isolated and grown in pure culture.

6. Interest

Purpose: To test which study method, reading *then* mind mapping or reading *while* mind mapping, keeps me interested longest and consequently increases my efficiency and productivity.

Method: Randomly assign two chapters to each method via coin toss. For the chapter assigned to reading then mind mapping, read the entire chapter in one sitting, then once complete, create a mind map of the chapter. You are allowed to go back and look through the chapter to make the mind map. For the second chapter create the mind map while reading the chapter.

Analysis: The more interested study method will be the method associated with the least amount of time to complete the study session while achieving the same quality in mind maps.

Hypothesis: The mind map after reading method will keep me more interested and therefore takes less time to get through the chapter.

Results: Chapter 11 on Cell Division and Sex was assigned to the read-then-mind map method and Chapter 13 on Mendelian Genetics was assigned to the read-while-mind map method. For Chapter 11 it took me 1 hour to get through the chapter and an additional 1 hour to go back through the chapter and create my mind map (Figure 6). For Chapter 13 it took me 1 hour and 40 minutes to complete the entire chapter and mind map (Figure 7) while doing them simultaneously.

Conclusions: I had originally hypothesized that the mind map while reading method would result in less interest because I wouldn't be able to focus my attention on just the reading and would have to switch my attention between reading and mind map. However, the mind mapping while reading kept me more interested because it made me more alert to the information I was obtaining while reading and allowed me to organize and connect the chunks as they entered my working memory, as opposed to going back to organize and connect them once they had left my working memory.

FIGURE 6: CHAPTER 11 MIND MAP – DONE AFTER READING

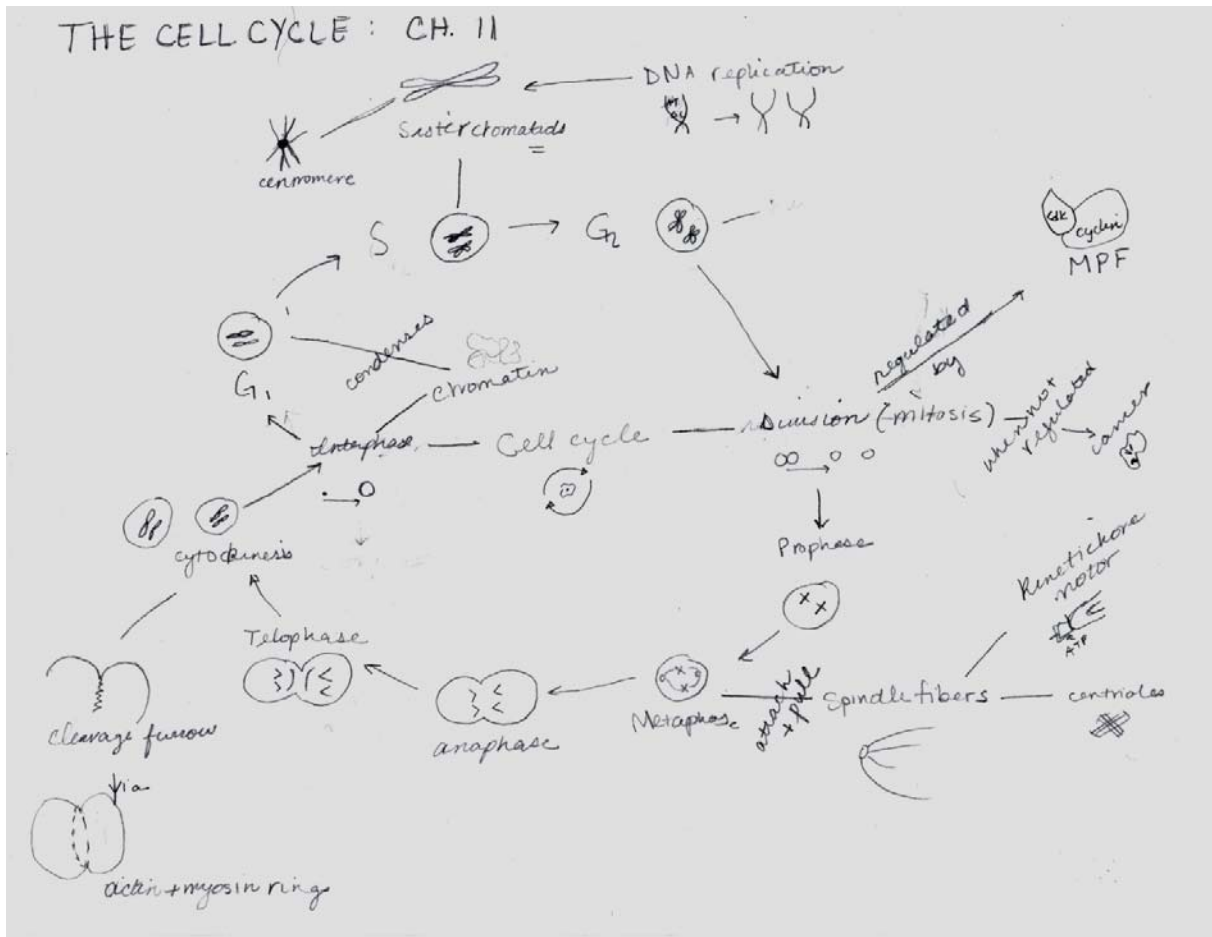
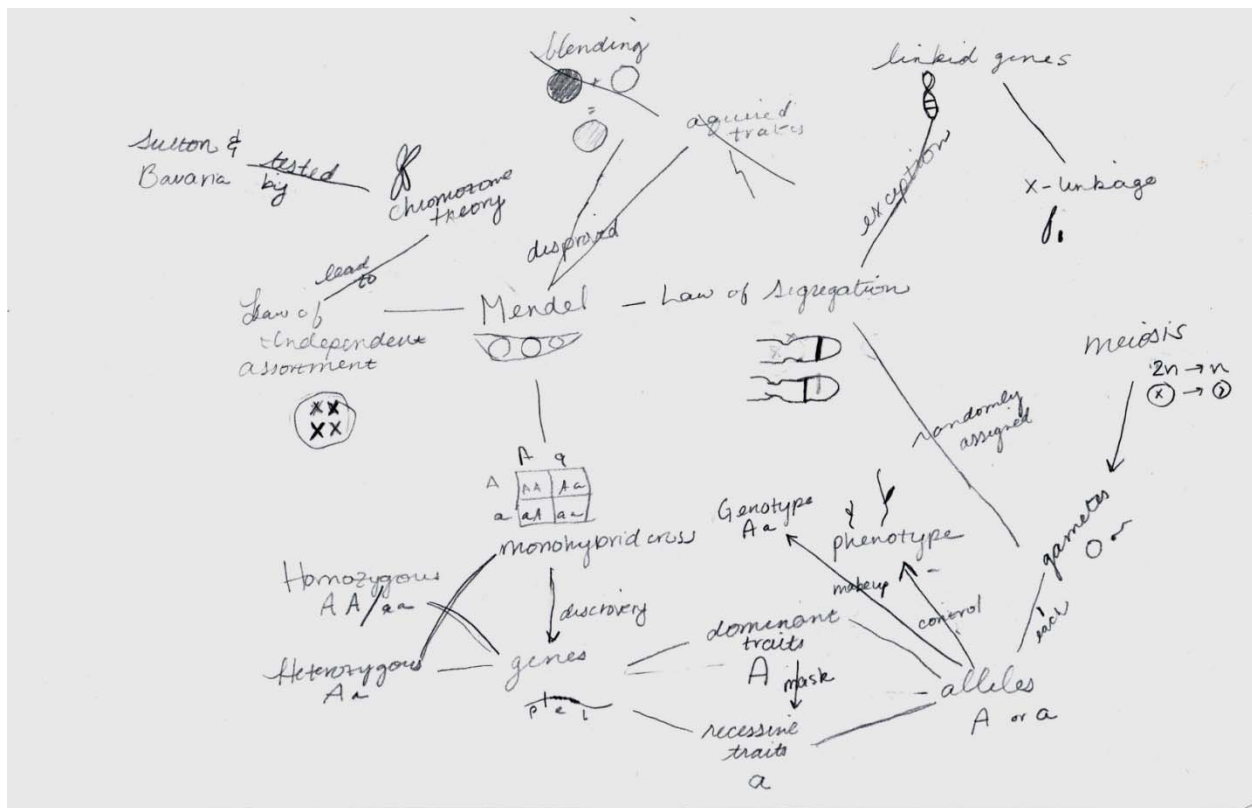


FIGURE 7: CHAPTER 13 MIND MAP – DONE WHILE READING



7. Guessing Effects on Learning

Purpose: to see if being allowed to guess during retrieval practice affects the amount of time required to learn the accurate information.

Method: While learning life cycles of different organisms using retrieval practice, for one life cycle, Basidiomycota in my case, only sketch the next step in the life cycle if I can fully visualize, understand, and feel FRUCO for that step. If not, return to the diagram in the textbook (Ch. 31) and restudy the next step with visualization. Repeat with each part of the life cycle until the entire life cycle is FRUCO meaning it can be fully sketched, explained, and visualized. For the other life cycle, Alternation of generations in a gymnosperm (Ch. 30), if I do not have FRUCO for the next step, I can still guess the next step and what happens in the life cycle. In fact, guess as much as possible until there are no more options to guess. Then, return to the diagram in the book and correct and restudy the incorrect information. Repeat until the life cycle is memorized with FRUCO. I ran this experiment again comparing: guessing the moss life cycle vs. not guessing the protist life cycle.

Analysis: The better study method, guessing vs. non-guessing, will be defined as the method that:

- Takes the least amount of study time to FRUCO the life cycle
- has the best retention after 1,2,or 3 days

Results: For all of the trials, the non-guessing method (Figures 8, and 10) yielded the most efficient study time. It consistently took less time to memorize the protist, and basidiomycota life cycles. When I tested for retention 1, 2 and 3 days later, I had about the same retention for all of the life cycles.

Conclusion: The main contributor of non-guessing studying is its efficiency. Despite going back and correcting all of the incorrect parts of my guessed sketches, I still made the same exact mistakes because incorrect chunks had already started to form when I guessed the first time. However, with the non-guessing sketches, I never wasted time creating those false chunks. Having equal retention is probably a result of me having equal amounts of FRUCO for all the life cycles after the learning was complete. This result will definitely be helpful the next time I need to memorize a process of any kind.

Trial 1

FIGURE 8: NON-GUESSING BASIDIOMYCOTA SKETCH

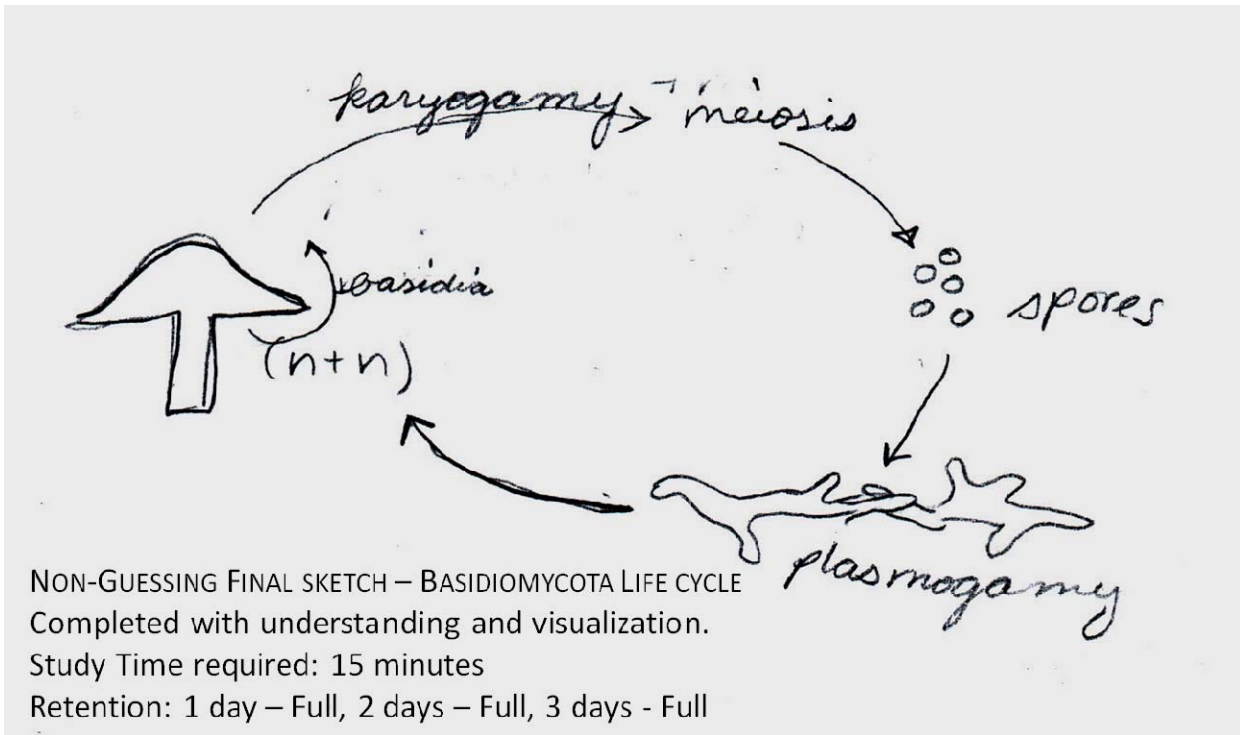
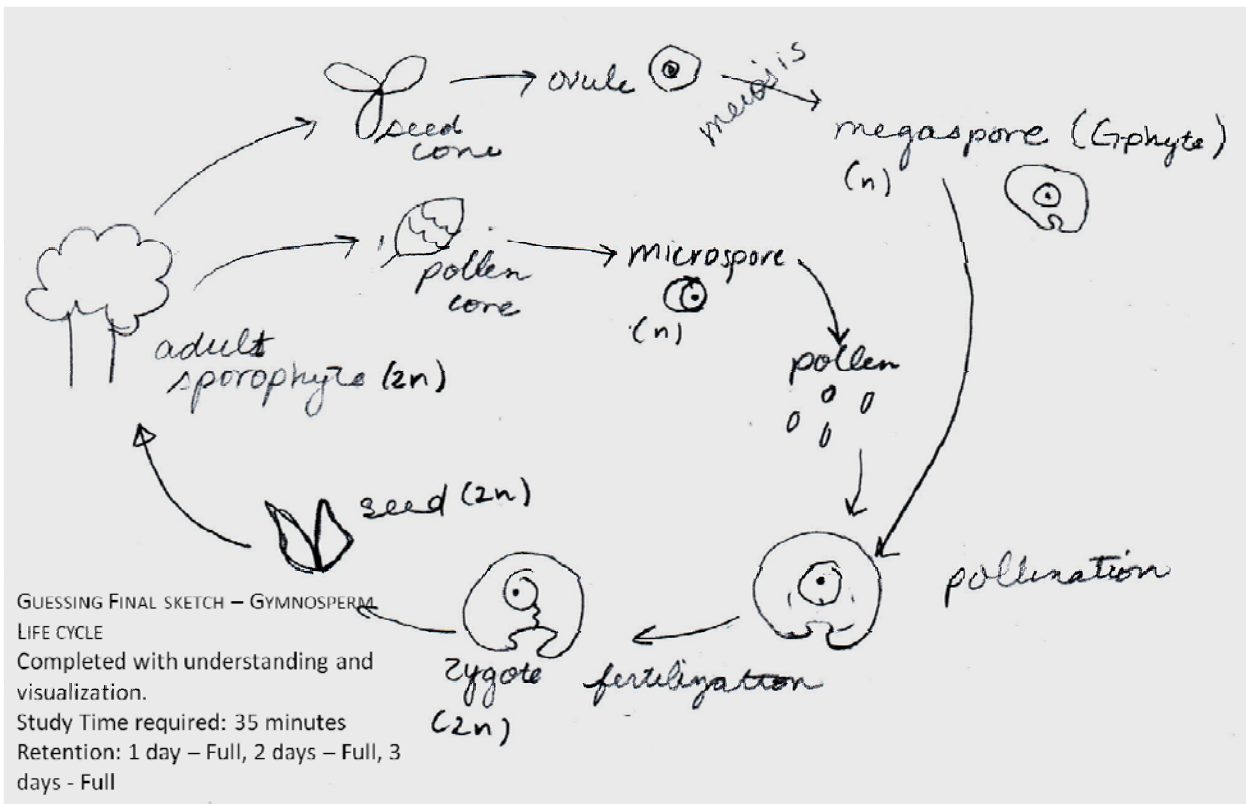


FIGURE 9: GUESSING GYMNOSPERM SKETCH



Trial 2

FIGURE 10: NON-GUESSING PROTIST SKETCH

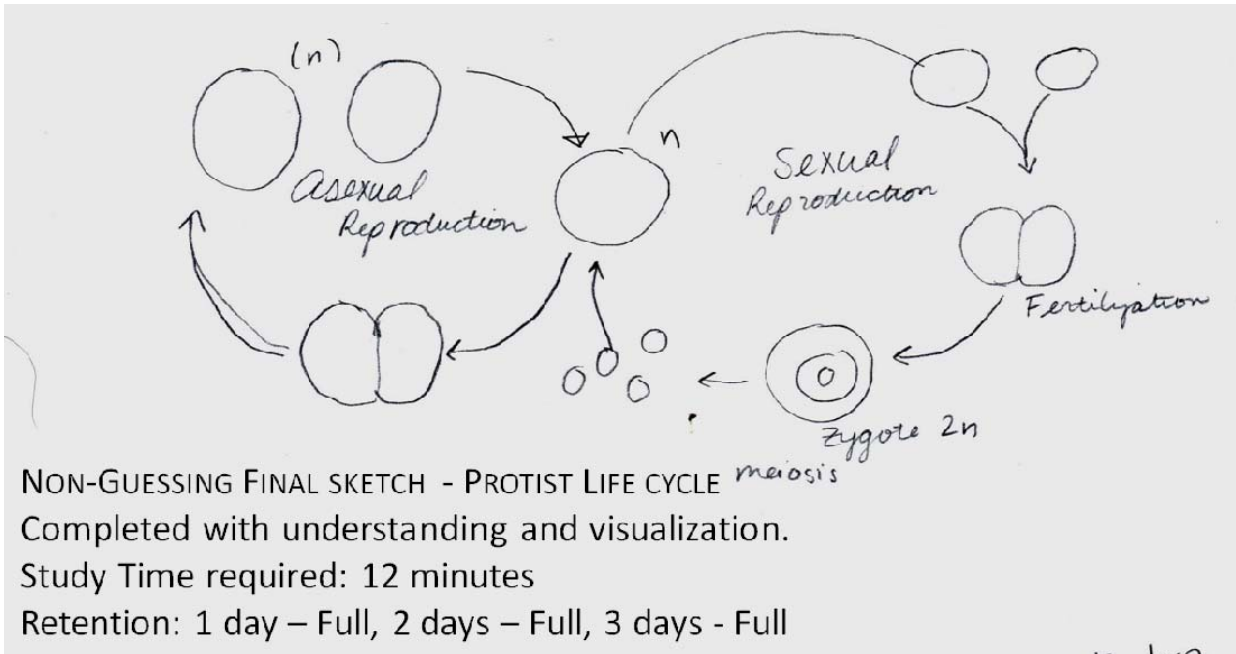


FIGURE 11: GUESSING MOSS SKETCH

GUESSING FINAL SKETCH – MOSS LIFE CYCLE

Completed with understanding and visualization.

Study Time required: 24 minutes

Retention: 1 day – Full, 2 days – Full, 3 days - Full

