Lab Report:

Cell Division: Mitosis and Meiosis

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Background/Introduction

The **cell cycle** is a meticulously orchestrated biological symphony where a cell tempos its way through a series of regulated phases, warranting its growth, DNA replication, and division. This musical masterpiece, controlled by its molecular checkpoints, helps sustain the continuity of life. Think of the cell cycle as a grand musical composition, with each phase playing a distinct role in the symphony of cellular life. The cell cycle starts with **interphase**, its first feature being the **G1 phase**, which, in musical terms, would be classified as the prelude since it is the introductory to this ensemble. During the G1 phase, the cell grows in size and volume, similar to how before an opera starts, people are trying to get in and find their seats in the theater. As people enter the opera house, its volume increases in size, just like in G1. As the cell prepares for the grand progression ahead, the tempo is steady, like a controlled andante, fostering a well-orchestrated growth phase. The **G0** phase, or the cadence of the musical, is when the cell is resting and not actively dividing. A cell may enter this phase when it's not ready for division, or it reached its full differentiation. The **S phase** of interphase can be documented as the crescendo where DNA replication happens. With each chromosome duplicating in perfect harmony, every note of genetic information is transcribed. Furthermore, the pace then quickens to an allegro, ensuring that every DNA has been replicated corrected. If not, then errors can occur in the genetic code which ultimately leads to mutations that can affect the functions of the cell. An arpeggio cell is what we can call that. Moving on to the **G2 phase**, which is the rehearsal before the finale. This stage is important because it is where the cell reviews its performance, corrects any errors, and makes sure that all necessary proteins and structures are where they need to be. In comparison to an opera, this is the "intermission" part of the cell cycle, making sure it is ready for the grand performance of mitosis. The rhythm slows to a moderato, allowing for final adjustments before the dramatic shift to cellular division. Tension now builds as the cell readies itself to enter the **M phase** of the cell cycle. **Mitosis** is the thrilling climax, where the orchestra meets a dramatic fortissimo. Mitosis can be divided into 4 to 5 stages, each stage being a distinct chorus that happens also in meiosis 1 and 2. The mitosis chorus that takes place during **meiosis** repeats twice, as the orchestras create a diverse and dynamic range of sounds. What is meant by this is that meiosis introduces genetic variation via crossing over and independent assortment. Just like how an opera tells a unique story through different characters and scenes- reflecting variations in performance and expression- meiosis produces genetically distinct offspring. Moreover, **prophase**, the first part of mitosis, is when the chromatin condenses and chromosomes become visible. The nuclear envelope disintegrates amidst prometaphase. **Metaphase**, occurring after prophase, is when all the chromosomes, or ballerina dancers, meet up in the middle before they are separated and pulled away towards opposite poles, which happens during **anaphase**. The most crucial event in anaphase is the separation of the sister chromatids at the centromere, where they were previously attached together. The last part of mitosis, which is subsequent to anaphase, is **telophase**, where the nuclear envelope reforms and the chromosomes arrive and decondense at the spindle poles. Lastly, the grand finale and resolution of the cell cycle is **cytokinesis**. Cytokinesis is the physical process that splits the parent cell in half, or into two daughter cells. As the cell completes its division, the music moves to a soft decrescendo, like the final chords charming into a peaceful cadence. The two daughter cells separate, each carrying an identical melody to give to its audience. And at last, they can conduct and begin their own symphony of life. In conclusion, much like in music, precision, timing, and regulation are key in the cell cycle. With a smooth DNA replication and division happening within each cell, the section members can all come together to create a masterpiece of cellular continuity.

The purpose of the mitosis lab is to study the different stages of mitosis using the slides of an onion root tip and whitefish blastula. The protocol in place for the meiosis lab is to be able to distinguish the different processes of meiosis. Lastly, the goals placed in these labs are to be able to note the different stages that are occurring on the slides, and to properly use and configure a microscope.

Methods

Our goal was to carefully examined each slide (1 and 2: Mitosis in Onion Root Tip Cells and Squash Cells, 3: Whitefish Blastula, 4: Lily Ovulary Megasporocyte, 5: Lily Ovulary Secondary Megasporocyte, 6: Lily Ovulary First Meiotic Division, and slide 7: Lily Ovulary Second Meiotic Division) and describe the image that was produced. We began our cellular investigation journey by placing the slide onto the microscope and looking at it through the 4x lens, then the 10x, moving onto the 40x and 100x while adjusting the microscope to properly see the stages that occurred on that particular slide. We then snapped a photo of each slide on *almost* every lens, hence, sometimes 10x was unclear to see, and wrote what we saw into our lab notebook. When reaching the 40x and 100x lens, we dropped a small dab of oil onto the specimen to improve the clarity of the image. The experiment was pretty much repetitive, completing the same steps for each slide and marking down the different phases we saw happening in that cell. When finished, we cleaned up the oil and carefully placed all items (microscope, slides, oil) back to its original spot.

Results

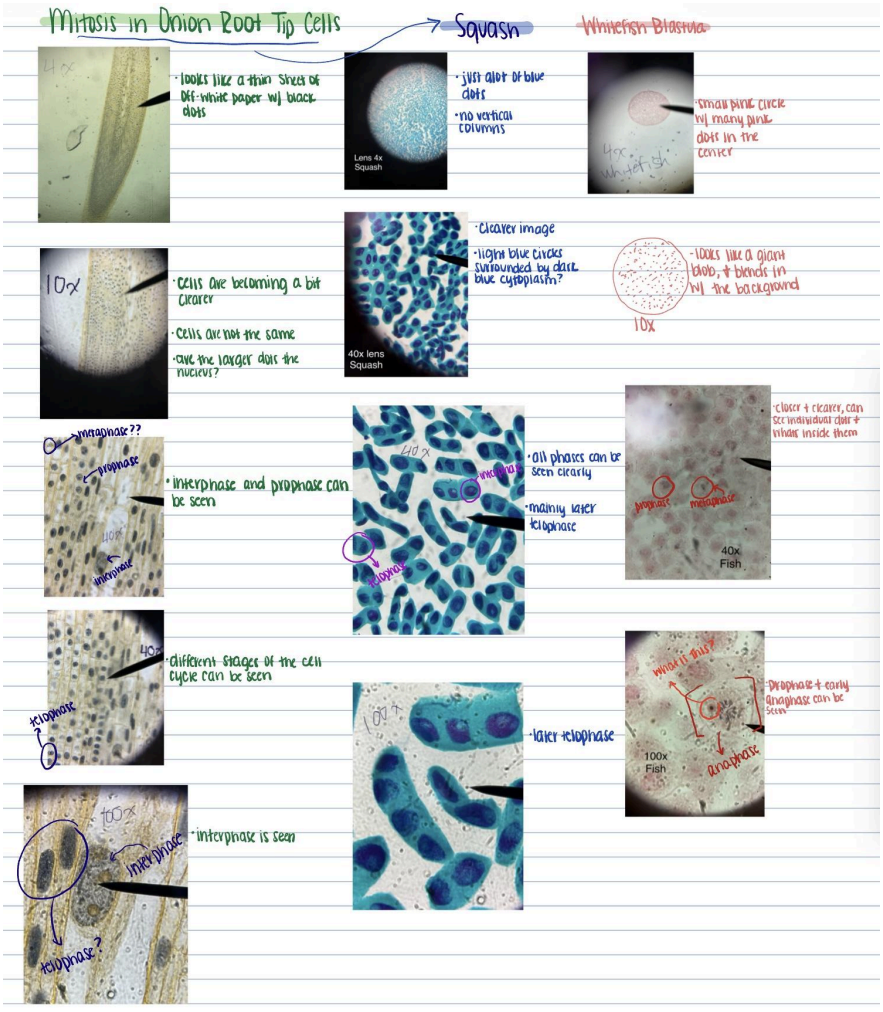

Image 1 shows the pictures taken of the undergoing mitosis slides and descriptions of what we observed from each slide.

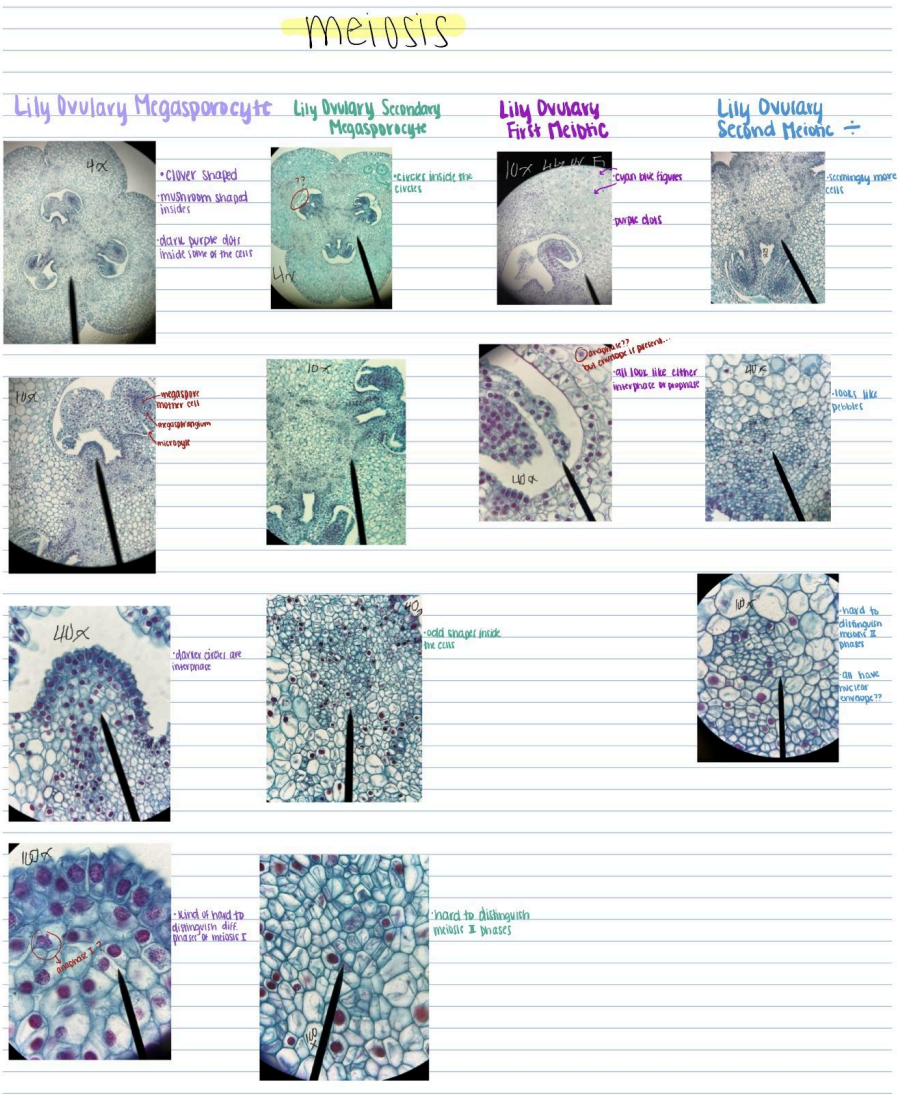

Image 2 shows the results from the pictures taken of the slides undergoing meiosis and a small description of each photo.

Fig 1: Onion Squash

Stage of Cell Cycle	**Number of Cells in the Stage**
Prophase	7
Anaphase	1
Telophase	24
Cytokinesis	2

Fig 1 describes the number of cells we saw happening in each stage on the 40x screenshot of the Onion Squash.

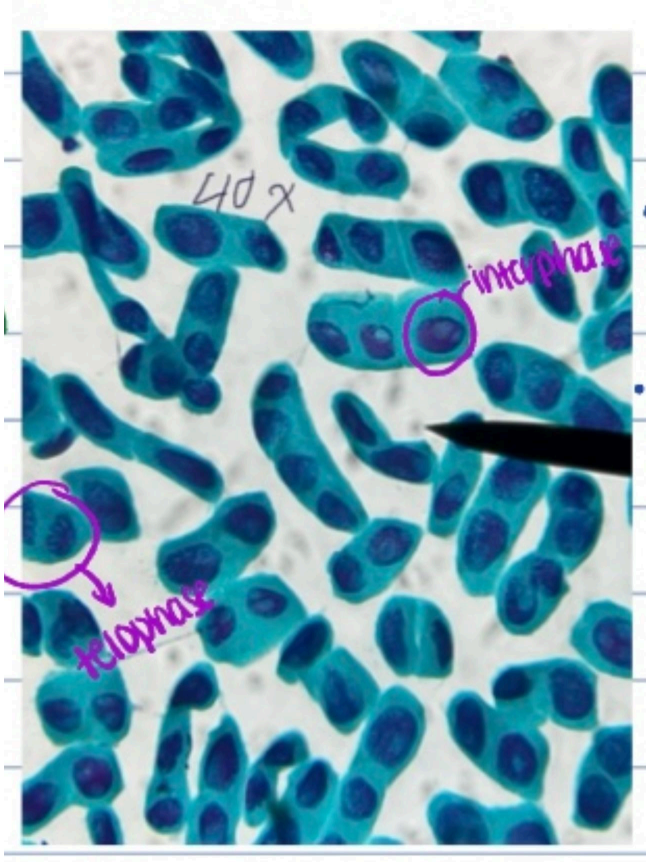

Image 3 shows two cell cycle phases, interphase and telophase, observed through the 40x lens of the Onion Squash.

Discussion

During this experiment, we were observing what stages of mitosis were present on each slide. By using a microscope on the 40x lens, we were able to see the detailed structures of the cell cycle, for instance, the mainly interphase happening in the onion squash. A change we made during the lab was the continuous need of adjusting the microscope. After several tries, we designated one person to be the "lens coordinator" and adjust the lighting so that the images don't come out blurry. This fixed the need of having to constantly adjust the stage's height according to my lab group's personal vision.

Possible sources of error in the experiments include inaccurate identification of mitotic stages, inconsistent root tip/slide selection, and magnification errors. Some mitotic stages looked pretty similar, making it sometimes difficult for us to accurately classify each stage. By inaccurately classifying a stage, it can spew our data of the number of cells undergoing each stage for the slides. Furthermore, if the wrong part of the root is used, there is a possible chance that there could be less dividing cells, ultimately affecting data accuracy. Lastly, having access oil on the lens can blur some of the images, making the identification process trickier.

Conclusion

From the lab experiments, we drew several key conclusions about how cells divide and maintain genetic continuity. In the mitosis part of the experiment, we observed onion root tip cells and identified the different phases of mitosis, prophase, metaphase, anaphase, and telophase, showing how a single diploid cell divides to create two identical daughter cells. On the other hand, the meiosis part of the lab, focused on the process of gamete formation through two rounds of division, meiosis I and meiosis II. The results highlighted key features of meiosis, such as homologous chromosomes pairing up. Watching the stages of meiosis demonstrated how four non-identical haploid cells are produced from one diploid parent cell, a process vital for sexual reproduction and ensuring that chromosome numbers remain stable across generations. By comparing mitosis and meiosis, we gained a clearer understanding of their different roles: mitosis ensures genetic stability, while meiosis promotes genetic variation.

Citations

Online Onion Root Tips. (2004, August). Biology.arizona.edu. https://biology.arizona.edu/cell_bio/activities/cell_cycle/cell_cycle.html
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