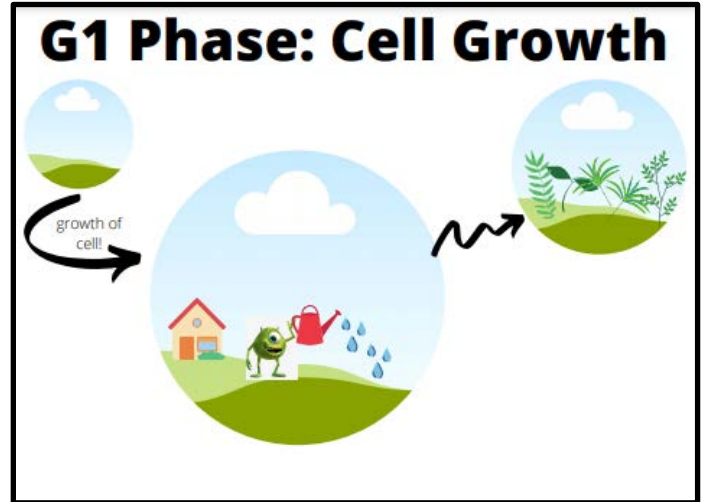


# Biology Project: Comic Strip

## Scene Captions

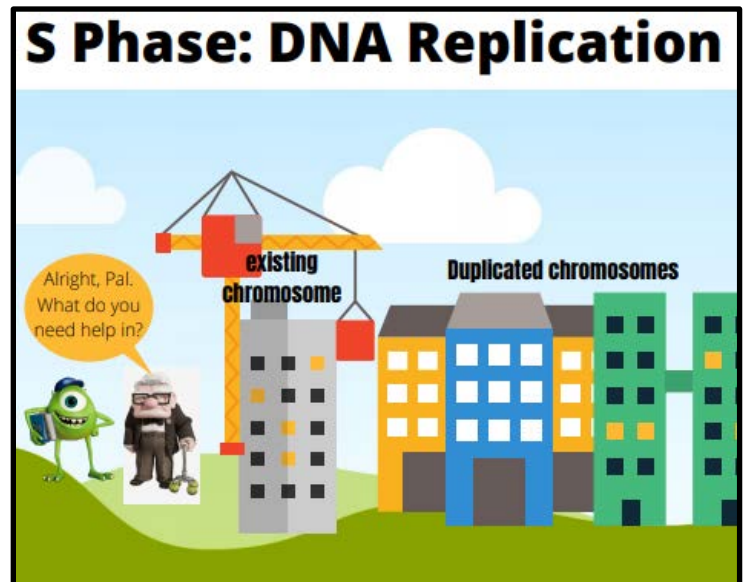
### Scene 1 (G1 Phase: Cell Growth) -

Mike Wazowski (the nucleus) waters the vast grass fields in his backyard everyday in order for them to gradually develop into plants (organelles). Once the synthesis process is complete, the grown plants are now specialized organelles of the cell with particular roles. Those plants (organelles) require proteins as an essential element of life, so they will constantly keep constructing more proteins inside of them.

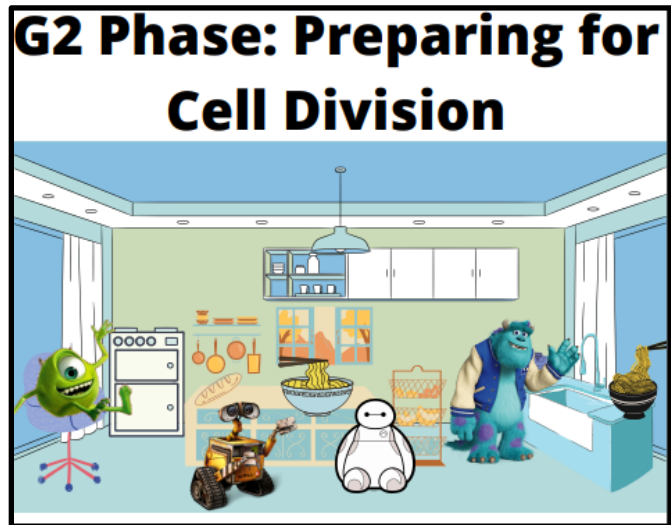


### Scene 2 (S Phase: DNA Replication) - Mike Wazowski (the nucleus)

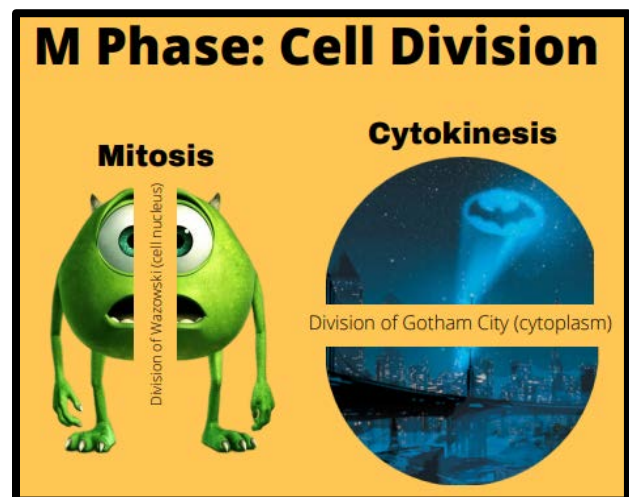
consults Carl Fredricksen (from the movie "Up"), an experienced architect whose career spans over 45 years, to assist him in taking accurate measurements and in preparing the blueprints for a public building project (replicating DNA; the buildings are chromosomes). As you can see, Wazowski started by building one tower (existing chromosome), but he struggled in constructing more towers (duplicating DNA), and that is why Carl used his impeccable knowledge to make the city (cell) flourish by building numerous towers (chromosomes). There are twice as many towers (chromosomes) than there was in the beginning.



[Scene 3 \(G2 Phase: Preparing for Cell Division\)](#) - In the house (the cell), Mike Wazowski (the nucleus) is once again commanding his servants/assistants (organelles) while he sits and watches after a long day of work. He (Mike; the nucleus) recently built Wall-E, a robot (rough ER) and orders him to rapidly cook/produce grilled steak (protein) from the small oven that's located right under his belly. The outcome is James Sullivan, the blue hairy monster (a big load of protein molecules), who then promptly heads to prepare the noodles (spindles) for lunch (cell division). However, Baymax (golgi apparatus) sits and waits to receive a dish (molecules and other substances) to deliver them to the table (other parts of the cell). All of those organelles (Mike Wazowski, leader/nucleus; Wall-E, rough ER; James Sullivan, protein who makes noodles; and Baymax, the golgi apparatus) all collaboratively work together to produce food (organelles and molecules) and prepare for a necessary part of the day: lunch (lunch is cell division).



[Scene 4 \(M Phase: Cell Division\)](#) - By the splitting of Mike Wazowski and Batman's Gotham City, the result is 2 of each (2 daughter cells produced). The nucleus (Mike) is separated into half (mitosis), and so is the cytoplasm (Gotham City; cytokinesis). The M Phase is a combination of 2 partings (mitosis and cytokinesis). They were both forced to take different paths and stay away from each other by the GCPD (Gotham City Police Department) for precautionary reasons and for the sake of the innocent citizens. Or else, Batman and his rivals might wage an unprecedented war that could alter the fate of humanity...

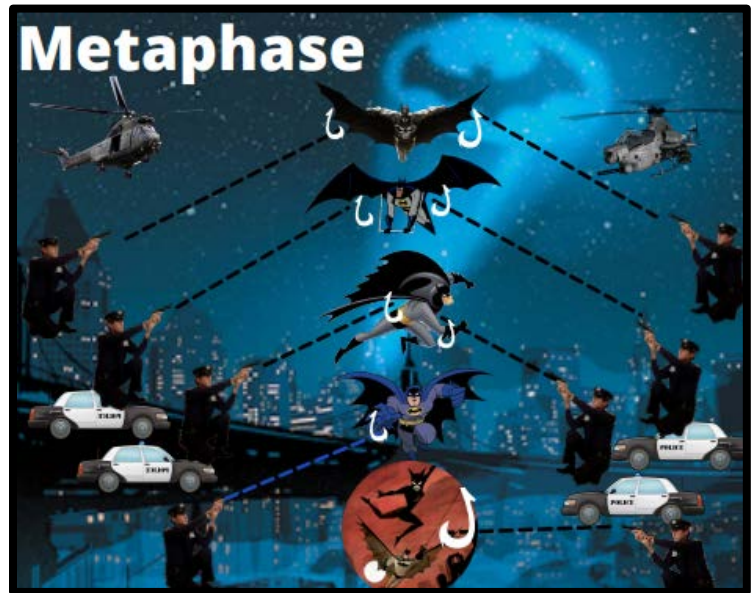


Scene 5 (Prophase) - After the tragic death of his parents, Batman (chromosome) rises to avenge his parents' death and to put an end to all of the corruption, disasters, and insecurities in his local hometown, Gotham City (cytoplasm). To do that, he needs allies to help him in this tough battle. Therefore, Batman (chromosome) heads to the bat cave (nucleus) to put himself through some cloning

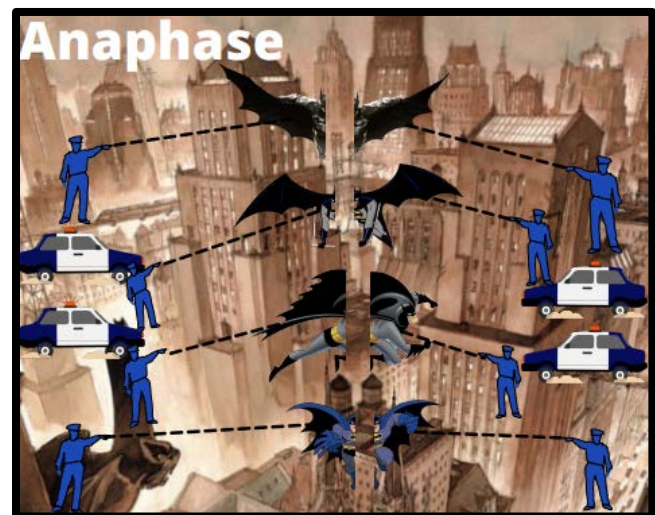


experiments, in the hope of duplicating himself. Luckily, he successfully made some copies of himself, as well as Robin and Catwoman (replicated chromosomes; allies). Outside the bat cave (nucleus), a long line of cops, choppers, S.W.A.T team shooters, and armed forces (spindles) start to form and surround the area after hearing some loud noises and bangs coming from the laboratory of the bat cave (nucleus). According to the original batman (original chromosome), he stated that his clones (duplicated chromosomes) were becoming visible when their bodies started forming along their length at the torso, near the hip area (centromere). Batman also added that each of their arms and legs is a chromatid. The 4 cop cars on the right acted as the base/fort (centrioles) from where the long line of federal forces (spindles)—which were listed above—extended. As prophase ends, the cop cars (centrioles) spread out to completely secure the area (moving towards opposite ends), Batman and his friends (chromosomes) become extremely pressurized (coiling tightly) due to the agencies (spindles) standing outside the bat cave (nucleus) and whose numbers of men (more spindles) are rapidly increasing to secure the area. Consequently, the only right thing for Batman to do was to self-destruct/destroy his bat cave and laboratory (nuclear envelope breaks down) to cause a distraction and to act as a decoy for them to swiftly escape. P.S - Batman and his allies are actually trying to save Gotham and its people, but the police aren't aware of that; they think that they are a bunch of masked vigilantes who were up to no good...

Scene 6 (Metaphase) - After the explosion that occurred in the bat cave (nucleus broken down), Batman and his fleet of partners (chromosomes) managed to use their handy artificial wings to fly away safely. They all lined up and flew in the same direction in the center (chromosomes lining up at the center of the cell) of Gotham (cytoplasm) like a flock of birds. However, to their surprise, the police (spindles) took cover with their strong shields and with bomb squad suits and were still lurking outside in the dark streets of Gotham to pounce. There are 2 cop cars (centrioles) on each side (4 in total) that are filled with officers, ropes, and hooks (spindle fibers). The officers shoot the ropes that have strong hooks (spindle fibers extending) from their tactical weapons to grab the wings of Batman and his allies (chromosomes)...



Scene 7 (Anaphase) - The cops and the SWAT teams securely hooked their ropes (spindle fibers) to the Batmen (chromosomes) and they used all their strength and power to forcefully pull them apart in opposite directions to separate them. Each half of the Batmen's bodies (chromosomes) is now considered an individual, despite the half-split bodies. Now, let's recall that the Batman's allies were created by replication of DNA (duplicated chromosomes; clones) in the laboratory of the bat cave (nucleus). Batman (original chromosome) made a huge mistake when cloning himself... Stay tuned for the resuming of anaphase on the next slide...



### Scene 8 (Anaphase Continued) -

Miraculously, one part of the Batmen's bodies (on the left) reformed itself and rapidly recovered from the splitting caused by the police's hooks (spindles), while the other (on the right) somehow experienced a genetic disorder! This was due to the fact that Batman



combined/mixed 2 incompatible substances that—when ripped—caused an unexpected reaction that resulted in the generation of the psychopathic criminal mastermind known as 'The Joker', who was hired by the mob to go on a deadly mission of demolishing Gotham and its people. Batman was expecting this, and that's why he cloned himself multiple times and formed a team to help him out, because he knows that Gotham will remain dangerous and peace will not come if those criminals are out there somewhere! The Batmen wanted to bring The Joker to justice and stop the destructive frenzy and bloodlust that he's on. Not surprisingly, from the recovering/growing parts of the Batmen (on the left) that were pulled by the police's ropes and hooks (spindles), and the newly transformed Batmen (on the right) that faced unfortunate genetic mutations that created the lunatic Jokers, A WAR STARTED! The Joker and his allies used lethal explosives, rocket launchers, and machine guns; while Batman and his allies used fists, hefty blades on their forearms, and batarangs (bat-shaped boomerangs that are thrown on enemies). Buildings collapsed, puddles of blood on the streets, skilled military shooters on top of buildings, people's lives lie in grave danger, debris spread everywhere (aftermath of war), and Gotham isn't in relief! After hearing the commotion, the police and their trained K-9 dogs got involved and stood alongside the Batmen after realizing how much damage the Joker has done to the city.

### Scene 9 (Telophase) -

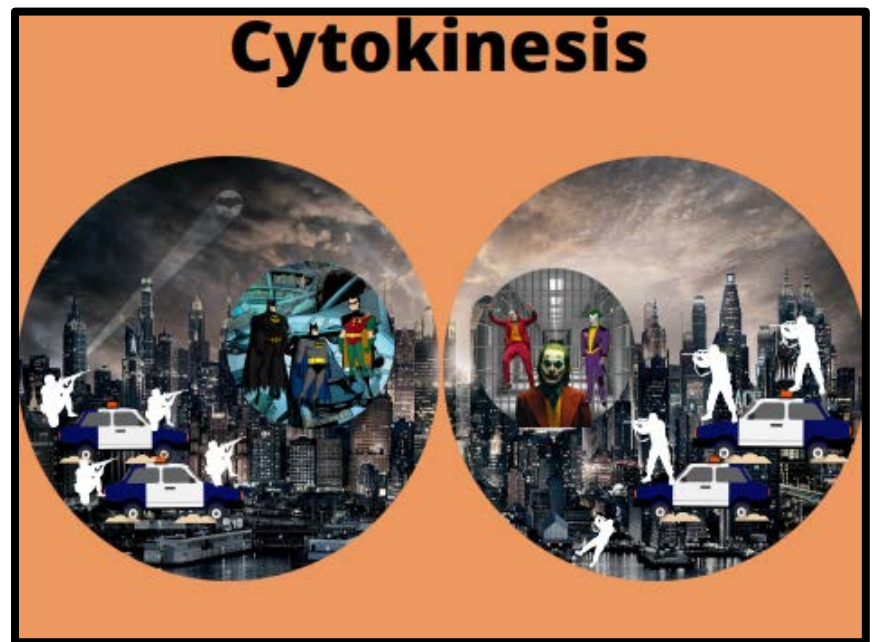
During the course of the police interference, they managed to capture The Joker and his team of delinquents. And, to reward Batman and his fellow allies for all the protection and safety that they offered for the city, the GCPD (Gotham City Police Department) generously decided to build and reform The Batmen's headquarters (nuclear



envelope reforming on each cluster of chromosomes; the chromosomes are the Batmen)—a new bat cave (on the left)—since the previous one was shattered into pieces due to fatal bombs in prophase. There, The Batmen can assist the police in solving crimes and bringing felons to custody, so Batman and his friends are regarded as consultants for the GCPD. On the other hand, the police escorted The Jokers into a temporary prison while the police also suggested to execute a building project in which the government builds The Joker and his accomplices (also chromosomes) a private prison (second nuclear envelope reforming) just for them (on the right), since their level of madness and their maniac brains exceed the limits of ordinary inmates; that's how crazy they are. Overall, The Batmen and The Jokers (chromosomes) gather at opposite ends of Gotham (cell); two nuclei form (bat cave on the left and prison on the right), each with a duplicate set of chromosomes (Batmen and Jokers). They are now fully prepared to stay away from each other and to take different paths (cell division).

### Scene 10 (Cytokinesis) -

Cytokinesis is the division of Gotham City (cytoplasm). Cytokinesis allows Gotham City (cytoplasm) to split itself into two at times of great danger/crisis, such as when the Joker and his accomplices appeared in town and caused chaos. Gotham City (cytoplasm) contains a special, unique catalyst that allows it to split the city into half



quickly—in the hope of avoiding danger from criminals as much as possible—by forcing the outline of the city to pinch inwards until separated. There, each "new" city (cell) contains its own bat cave and prison (nuclei) , 2 cop cars (centrioles), a shooter squad (spindles), and other components (organelles). That's why it divided into 2 parts: the one on the left is the safe/ordinary Gotham (for the good people and citizens), while the one on the right is the part that is filled with crime, felony, violation of laws, insecurity, and criminals; hence, the bat cave (nucleus) and the Batmen (chromosomes)—who are the good guys—are on the left side. Whereas, prison (nucleus) and The Jokers (chromosomes)—who are the bad guys—are on the right side. Both cells (cities) are being watched by cops and cop cars (centrioles) who are located just outside the bat cave (nucleus) to protect it (because the police know the precious value of the Batmen in helping them complete their operations and cases), and who are also parked just outside the prison (nucleus) to keep a close eye on the madmen inside who might be planning on fleeing.

Scene 11 (Cyclin) - Goblin's breath—the green gas—(cyclin) regulates the activities of The Batmen (cell cycle), meaning that it controls/directs The Batmen (cell cycle) by telling them when to divide, when to replicate themselves by cloning (duplicating chromosomes), or when to enter another phase of protecting the city (cell cycle). When the goblin's breath (cyclin) was pumped into the bat cave (cell) by a long lead pipe, The Batmen inhaled it and became stronger, faster, invigorated, and sharper. In addition, a line of batarangs (mitotic spindles) also formed. Batman used these honed bat-shaped objects to throw on his enemies. Goblin's breath (cyclin) would also speed up or slow down the rate of cell division and cloning (duplicating chromosomes; chromosomes are The Batmen). The Goblin's breath (cyclin) regulates the timing of the Batmen's activities (cell cycle).

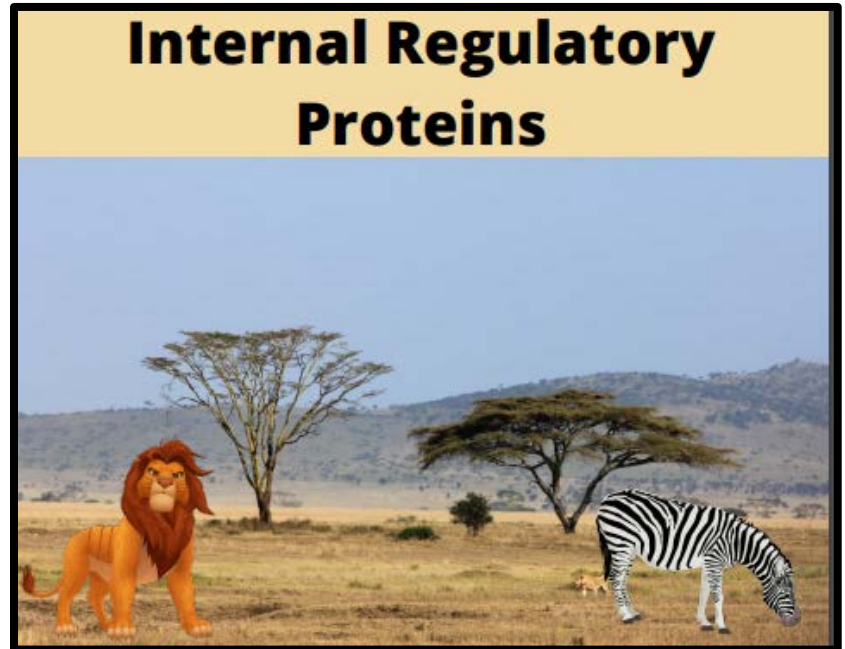




## Scene 12 (Internal Regulatory Proteins)

- These proteins respond to events occurring inside of the Savannah (cell). Simba (organelle) grew up and is now in charge of feeding the family due to the tragic passing of his father, Mufasa (an organelle that died/outlived its purpose or function). Therefore, Simba's mother (internal regulatory protein) ordered Simba to hunt a prey and bring its chunky flesh to feed the hungry cubs. Simba's

mother also commanded him to not come back until he catches a prey. So, he can only return back home only if he brought a meal to feed on; if he didn't, he must search all day long in the wilderness (cell) until he finds one and attacks it. Obviously, Simba's mother (internal regulatory protein) is allowing the cell cycle (a day in the wildlife) to proceed only when certain events (such as hunting animals) have taken place in the cell itself (savannah). She is not allowing Simba to return back home unless he has food for the family with him.



Scene 13 (External Regulatory Proteins) - I will be demonstrating this scene by showing an example of what happens when there is cut in the skin (wound healing). These proteins respond to events occurring outside of the underground mine (inside the human body). Mr. Incredible (external regulatory protein) is directing/commanding/leading his team (cells; the incredibles) to speed up or slow down the operation of saving the city (skin). The underminer on the bottom right (the thing causing damage to the skin) is planning on destroying/bombarding the city (cutting the skin) and making buildings collapse with underground explosions (causing blood to start leaking), and it's The Incredibles' family's job (composed of Mr. Incredible, Elastigirl, Dash, Jack-Jack, and Frozone) to stop him before it's too late (Mr. Incredible is an external regulatory protein, Frozone is a growth factor, and the rest are cells). Unfortunately, the underminer (guy causing chaos) got away with the first bomb and exploded the underground mine, causing a big hole in the ground (he cut the skin open and it started bleeding). Frozone (growth factor) fits in perfectly with the team as he distracts the underminer (the thing that cuts the skin open) by shooting frozen, sharp icicles at him, as well as building ice walls to make it harder for the underminer to reach them (trying to stop blood leakage). He also scans his team's bodies (cells) with his visor and makes them grow 10% with every minute that passes. In addition, he tells his team—The Incredibles family— when to separate and spread out (division of cells) so that they can move to different parts of the underground mine (inside the skin) and stop multiple bombs from exploding at the same time; these heroic acts are saving the city (saving the wound in the skin from being more damaged, they are trying to avoid damaging it more). Therefore, with the help of Frozone (growth factor), the team (cells) start to gradually grow and split up (divide) quickly to stop bombs from exploding (to avoid more cuts to the skin), and they start to cover up and repair the hole in the ground (the cut) that the explosion caused. The city (skin) is now safe

thanks to The Incredibles (cells, external regulatory proteins, and growth factors).

