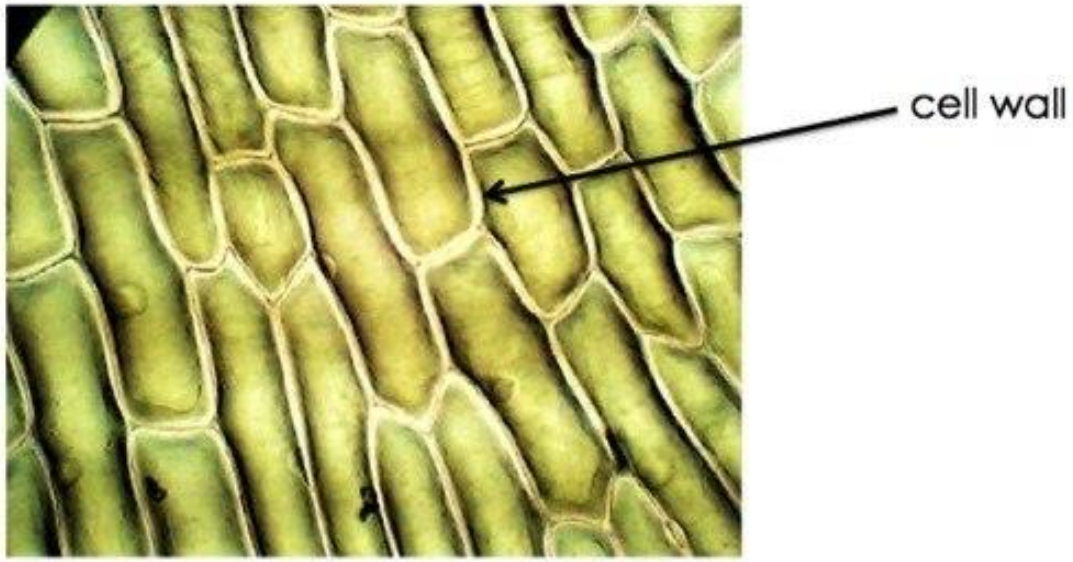
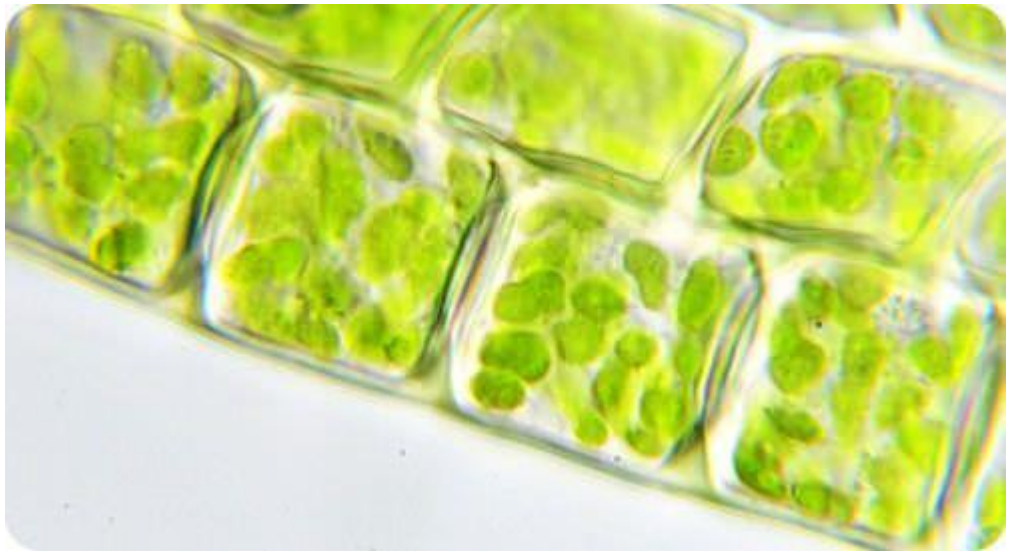
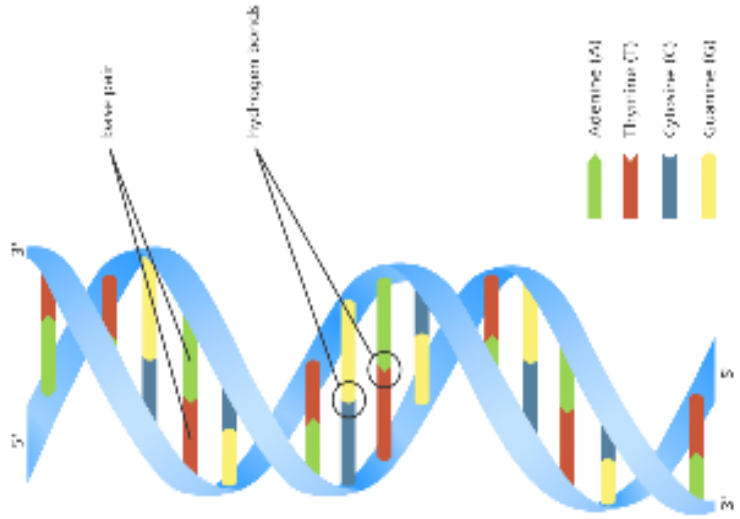
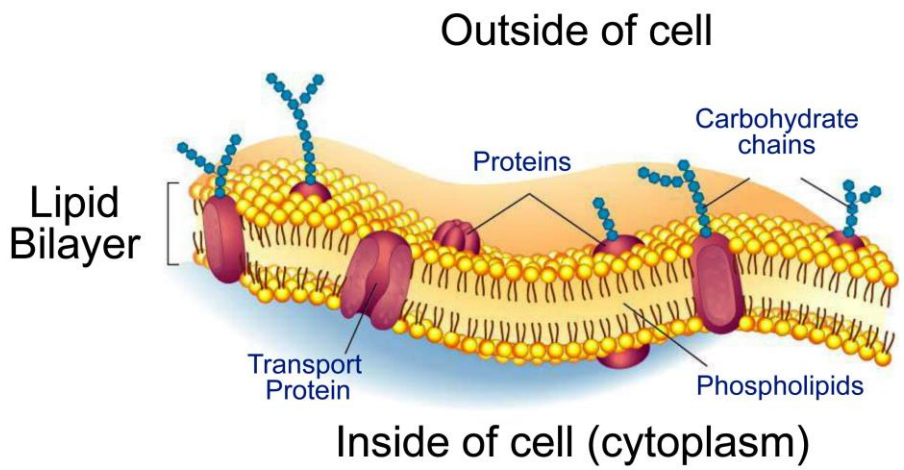
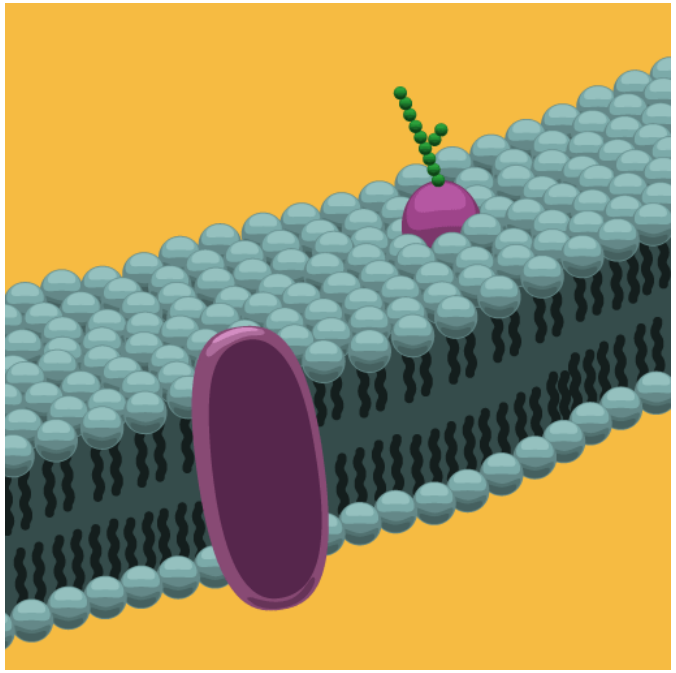

cell wall




Base pair
Hydrogen bonds
Adenine (A)
Thymine (T)
Cytosine (C)
Guanine (G)
3'
5'
5'
3'

Structure of the Cell Membrane





Nucleus

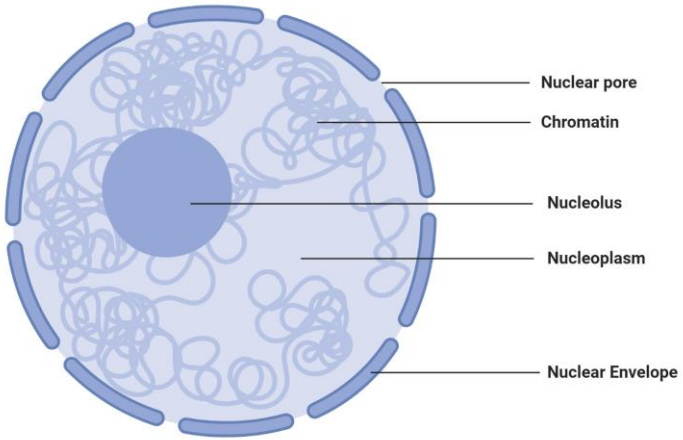
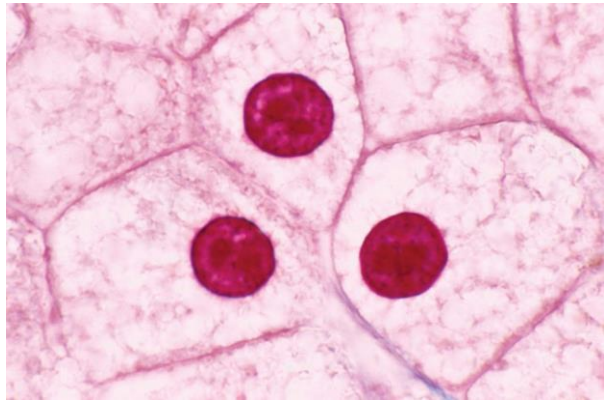
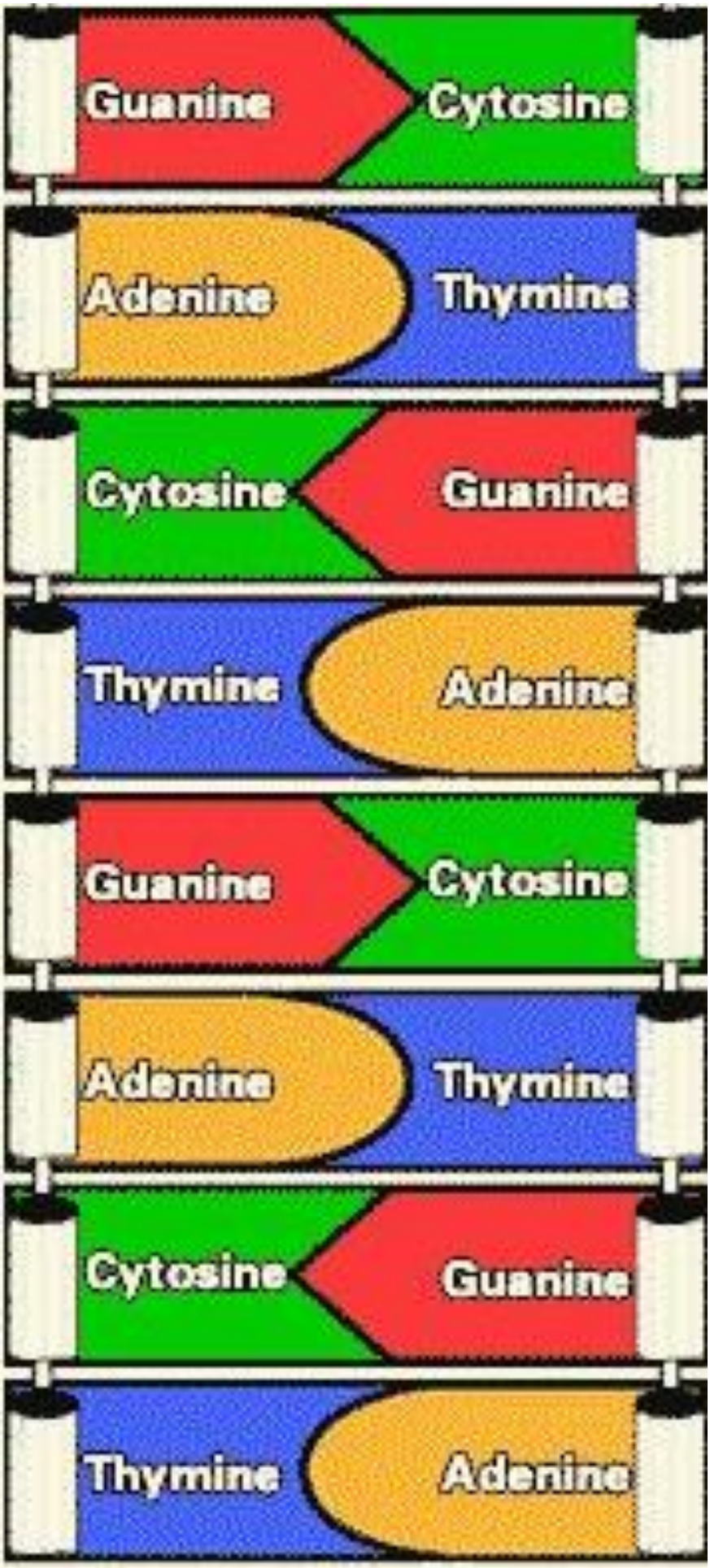


Figure: Nucleus, Image Copyright © Sagar Aryal, www.microbenotes.com




Guanine
Cytosine
Adenine
Thymine
Cytosine
Guanine
Thymine
Adenine
Guanine
Cytosine
Adenine
Thymine
Cytosine
Guanine
Thymine
Adenine

Create A Dog Lab

Create a new species of dog by randomly assigning its **genes**.

For each trait, flip a coin twice and track the results. Each coin flip represents one **allele** for that **trait**: *heads = dominant, tails = recessive*. Write down the **genotype** for that trait. Based on the genotype, list whether the dog is **heterozygous**, **homozygous dominant**, or **homozygous recessive**. Then determine whether or not the dog will have the dominant or recessive **phenotype**.

When you have established all of the dog's phenotypes, draw a picture of what your new species would look like.

Helpful Hints:
For gene *A*, these are the possible allele combinations with their genotype names and resulting phenotypes:

Allele Pair	AA	Aa	aa
Genotype	Homozygous dominant	Heterozygous	Homozygous recessive
Phenotype	Dominant	Dominant	Recessive

Remember that dominant alleles (uppercase) mask recessive alleles (lowercase).

Useful Vocabulary

Gene: a specific sequence of nucleotides that has the the ability to completely or partially control the expression of one or more traits in every type of living organism
Trait: a specific characteristic of an organism
Allele: a specific variation of a gene
Genotype: the chemical composition of an organism's DNA (EG. nucleic acids that code for brown eyes)
Phenotype: the physical expression of DNA (EG. brown eyes)
Heterozygous: an organism with two alleles, each of a different type
Homozygous: an organism with two of the same alleles (EG. two dominant or two recessive alleles)

Definitions courtesy of biologydictionary.net & genome.gov

Create A Dog Lab

Remember: heads = dominant allele, tails = recessive allele

Trait	Coin Flips	Allele Pair	Genotype	Phenotype
Body size Gene *B* Dominant: large body Recessive: small body	1st flip: H / T 2nd flip: H / T			
Leg length Gene *L* Dominant: long legs Recessive: short legs	1st flip: H / T 2nd flip: H / T			
Snout length Gene S Dominant: long snout Recessive: short snout	1st flip: H / T 2nd flip: H / T			
Tail Length Gene *T* Dominant: long tail Recessive: bobbed tail	1st flip: H / T 2nd flip: H / T			
Ear type Gene *E* Dominant: pointed ears Recessive: floppy ears	1st flip: H / T 2nd flip: H / T			
Eye color Gene *C* Dominant: brown eyes Recessive: blue eyes	1st flip: H / T 2nd flip: H / T			

Create A Dog Lab

Remember: heads = dominant allele, tails = recessive allele

Trait	Coin Flips	Allele Pair	Genotype	Phenotype
Fur color Gene *F* Dominant: brown fur Recessive: yellow fur	1st flip: H / T 2nd flip: H / T			
Fur type Gene *X* Dominant: curly fur Recessive: straight fur	1st flip: H / T 2nd flip: H / T			
Spots Gene *Y* Dominant: no spots Recessive: spots	1st flip: H / T 2nd flip: H / T			

Based on the phenotypes you got, draw a picture of your dog below!

Murder Mystery Lab

Using your new knowledge of genetics, solve this fictional murder! You will have to use your pedigree tracing skills, as well as the information you learned about dominant vs. recessive alleles, genotypes, and phenotypes.

The Story:

It was a dark and stormy night at Mendel Manor. The wind was so furious that the shutters were slamming to and fro. The thunder shook the grounds of the manor like an earthquake. Lightning pierced the air and created images of shattered sky. The storm did not seem out of the ordinary, in fact, the weather was never too kind around Mendel Manor.

Suddenly, the sound of a vase shattering woke Madame Mendel, the matriarch of the household. She silently crept down the stairs to the room that held the Mendel's most prized possessions, the gallery. Madame Mendel was horrified at what she saw by the dim light of her candle.

There, on the floor, lay her husband of 45 years, Monsieur Mendel, bleeding from a large gash in his head! There was shattered vase spread all across the floor, as if it had been used as a weapon. Madame Mendel let out a shriek that startled the other members of Mendel Manor from their chambers.

The remaining members of the house ran into the gallery and most were too astonished to utter a word. Sir Marcus was the only one who was able to open his mouth and dial 911 to summon the police. While there were many questions surrounding what exactly had happened that stormy night, one thing was certain. This was a cold-blooded murder.

Once the police arrive on the scene they begin to gather evidence. A blood sample is taken from Monsieur Mendel as well as fingerprints from the vase, which the police have confirmed is the murder weapon. The police also acknowledge that nobody broke into the house that night, as they found no footprints or tire tracks on the muddy drive. The murderer was a member of the Mendel household!

Can you use the police evidence and family history to solve the murder and bring justice to Monsieur Mendel? Turn to the next page to get started.

Murder Mystery Lab

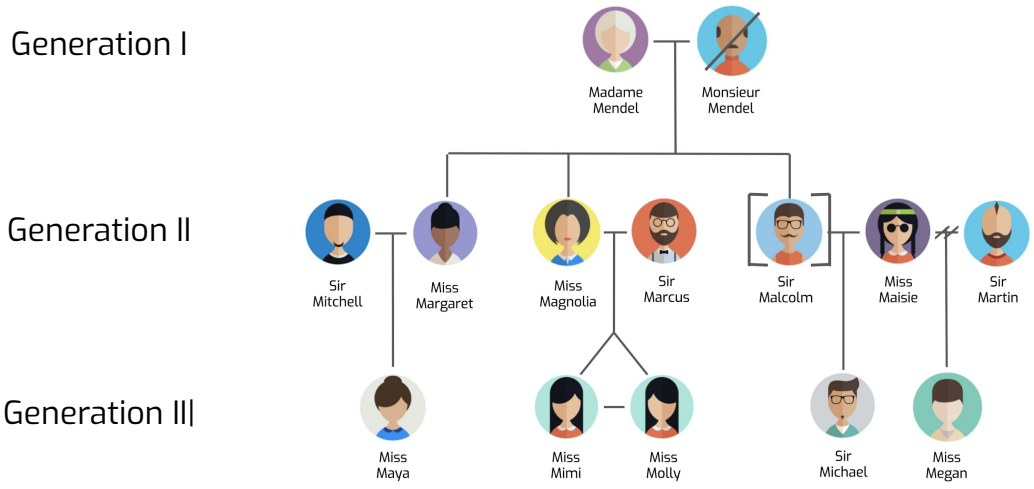
The Evidence:

Police were able to gather fingerprints from the scene of the crime. It was known that Monsieur Mendel had looped fingerprints and a homozygous dominant genotype. The fingerprints found on the vase were also loops, but they came from a heterozygous genotype. The other expression of the fingerprint phenotype is arched fingerprints, which police know is an autosomal recessive trait.

In addition to fingerprints. police collected blood samples from the scene of the crime. From past medical reports, the police know that Monsieur Mendel's blood type was A, and that he had a heterozygous genotype. However, there was also type B blood found at the crime scene, meaning the murderer likely cut their hand on the glass from the vase. Police were unable to determine if the type B blood had a heterozygous or a homozygous genotype- so the murderer may have either genotype.

The police gathered as much data as they could from the Mendel family history, but are still missing some pieces of the puzzle. Can you trace these two pedigrees to find the suspect, who has type B blood and a heterozygous fingerprint genotype? There is only one suspect that matches these traits, and if you can trace the family tree it should lead you right to the murderer.

Here is the Mendel family tree to help you get started in identifying the murderer.



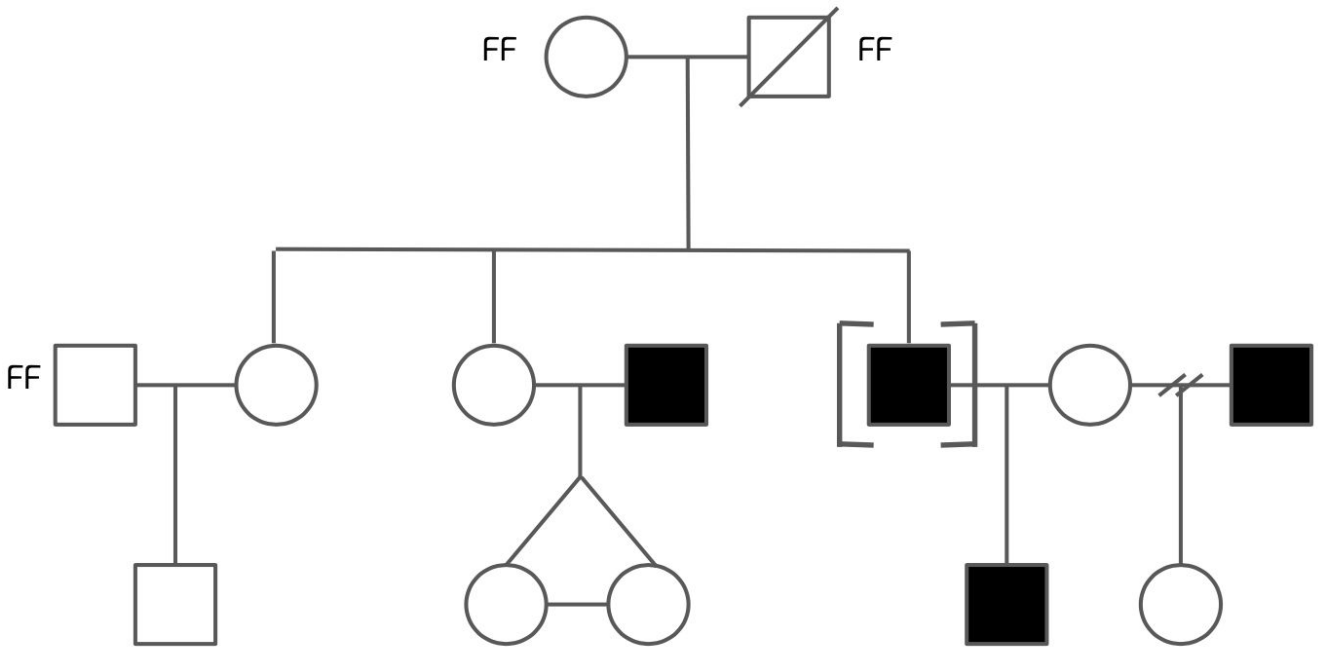
Images courtesy of: People vector created by freepik - www.freepik.com

Helpful Hints:

Look across multiple generations to figure out the unknown traits and remember that *each child randomly receives one allele from each parent.* **Also, identical twins will always have the same genotype and phenotype.**

Murder Mystery Lab

Fingerprint Pedigree
Determine all of the missing fingerprint genotypes and phenotypes in the Mendel family tree.



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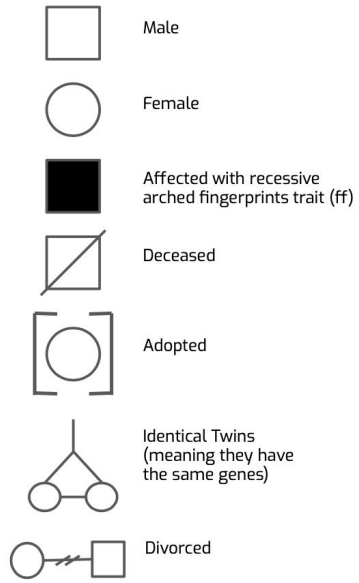
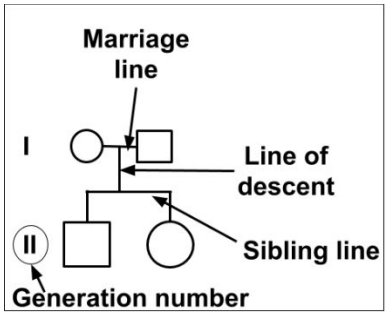
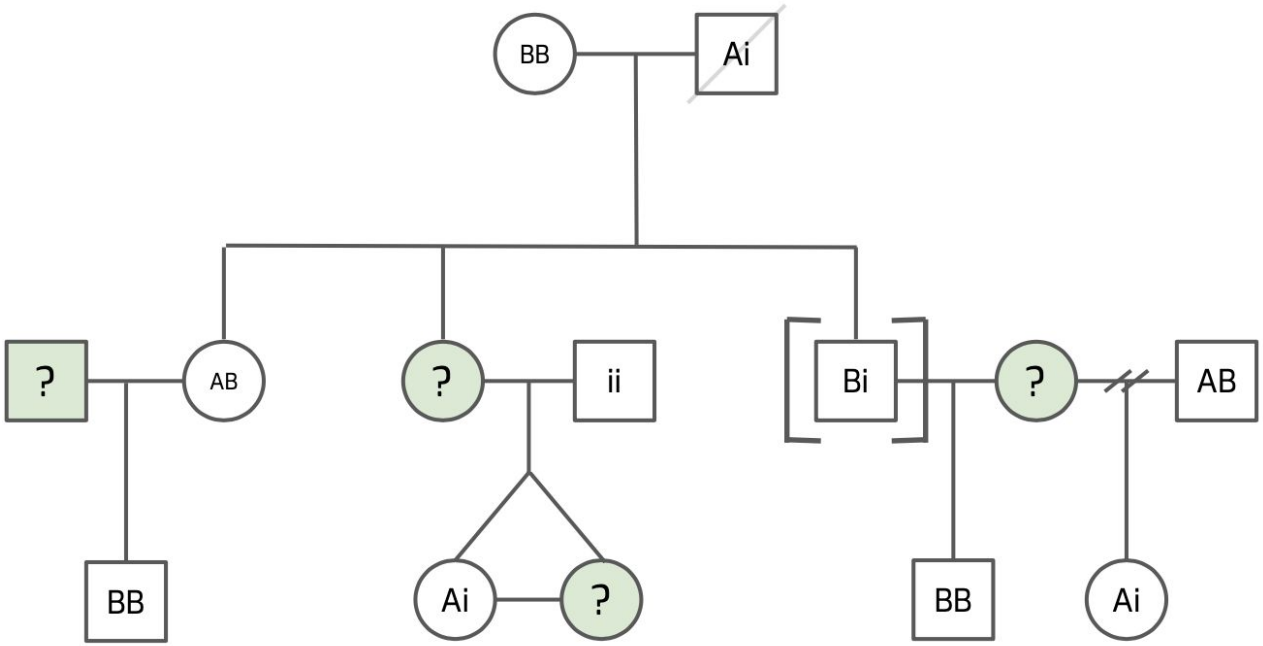




Murder Mystery Lab

Blood Type Pedigree

Determine the phenotype and genotype of the missing suspects (marked with a '?'). If you cannot narrow down a person's trait to one genotype or phenotype, simply write down all of their genetic possibilities.



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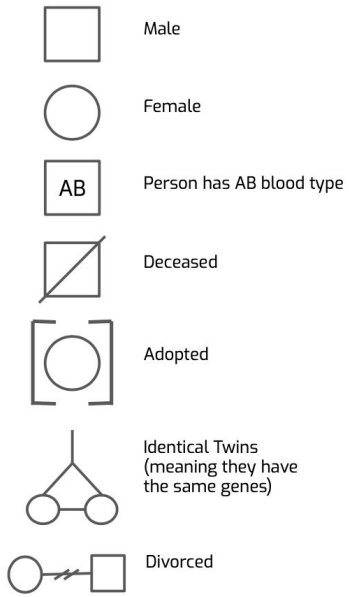
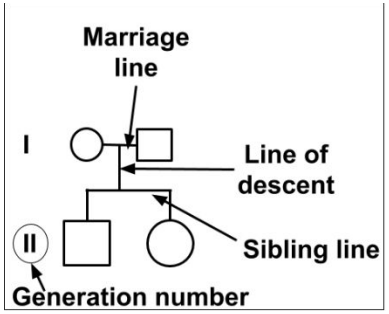




Murder Mystery Lab

Mystery Solved:

Now that you have figured out the missing phenotypes from the Mendel family tree, you should be able to solve the murder.

Which suspects have a heterozygous fingerprint genotype?

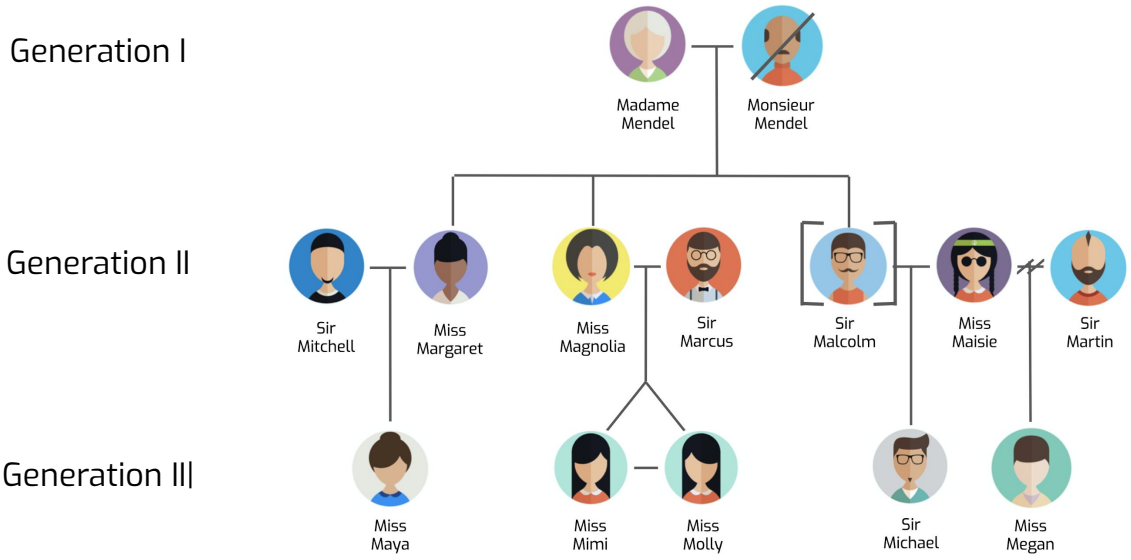
_____

Which suspects have Type B blood?

_____

Who is the ONE suspect that has type B blood and a heterozygous fingerprint genotype, and therefore must be the murderer?

_____



Images courtesy of: People vector created by freepik - www.freepik.com

Watch the end of the Discovering DNA video to review your answers and see if you were right!