Genetics

Genetics is the study of how _____ , such as eye colour and flower colour, are passed on from generation to generation.

We have learned that the information needed to produce a

complete organism is located in a chemical called _____

(_____).

The “recipe” to make protein is located in sections of DNA called_____.

DNA is in all living things and uses the same _____ to record instructions. This is why we share similar genetic information with creatures which appear very different from us.

Humans have known for quite some time that there is an inheritance factor in genetics (farmers knew to breed the “best” animals together to get better offspring), however the way this was done was unclear for many years.

The “Grandfather of Genetics” is _____. He did work tracking traits passed along several generation of pea plants. It was his insight that led to the development of the

science of genetics. His experiments covered more than 50,000 pea plants over a 10-year period.

Pea plants were a great choice because of a number of things. One thing that made them a particularly good choice what that they have a number of easily observed traits that are "either/or" traits. This means there was no "in between" choice.

Ex. Flowers were either purple or white. There were no light purple flowers.

Every living thing has two copies of each gene: one from its

_____ and one from its _____. This means that every pea plant has two copies for the gene which codes for flower colour.

If both versions were purple, the plant had a purple flower.
If one version was purple and the other version was white, the flower was still purple
Only if both versions of the gene were the white versions would you get a white flower.

In genetics, this is called a _____ trait (the white colour would be a recessive trait).

A _____ purple flower would be a flower where both versions are the purple versions

A _____ white flower would be a flower where both versions are the white versions.

A _____ flower would be a flower where one version was purple and one versions was the white version. Please

note: a hybrid flower would still just _____

Another name for purebred is _____

Another name for hybrid is _____

It is important to remember that a dominant trait masks a

recessive trait. This is called _____ ***dominance***.

We will often use letters to represent particular traits. A

_____ letter represents a dominant trait while a

_____ letter represents a recessive trait. Let's look at Mendel's example:

Let's let capitol C represents the chromosome containing the flower colour trait. The dominant version (purple) will be a capitol P. The recessive version (white) will be lowercase p.

C^PC^P = _____ purple

C^PC^p = _____ purple

C^pC^P = _____ purple

C^pC^p = _____ white

Two important words used to describe an organism are

_____ and _____.

_____: a list of the specific genes within an organism.

_____ is what materials are available.

_____: what particular traits you see expressed.

C^PC^P The genotype of this flower is homozygous purple. The phenotype is purple.
C^PC^p The genotype of this flower is heterozygous purple. The phenotype is purple.
C^pC^P The genotype of this flower is heterozygous purple. The phenotype is purple
C^pC^p The genotype of this flower is homozygous white. The phenotype is white.

By using the concept of dominant and recessive traits, we can predict what type of offspring may be produced by looking at

the _____ of the parents. We can set up a grid to see what the possible combination of traits would be. This grid is

called a _____.

Let's look at a couple of crosses. Let's cross a homozygous purple flower with a homozygous white flower.

In this cross, every offspring has the same _____ : they

are all _____ purple. All of the offspring also have the same phenotype: they are all purple.

When looking at situations like this, we need to be able to describe which generation you are talking about. The original

parents are called the _____ generation, or sometimes just P generation. The first generation after the parents is called the F1 generation (first filial generation). In our example, the F1 generation are all hybrids (one dominant, one recessive).

In the above example, there is only 1 phenotype (purple) and 1 genotype (CPCp). This is the only result you can get from

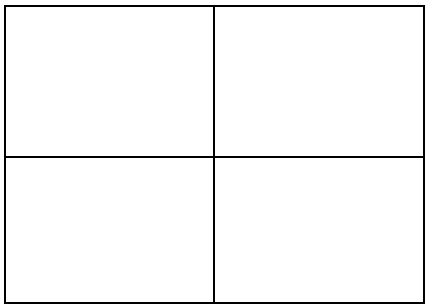
crossing two _____ (_____) plants.

With other combinations of parents, you can get different results. It is often useful to see the ratio of the offspring's genotype and phenotype. It can tell you a lot about the parents.

Let's look at a cross between two plants: a homozygous purple and a heterozygous purple.

All of the offspring are once again _____ in colour. But the genotype ratio is different. The genotype ratio tells you that you should see a 1:1 ratio of Heterozygous to homozygous purple.

Another cross worth our time to look at is a hybrid cross. We will cross two heterozygous flowers.



Now we can see some really interesting results. Our genotype

ratio is _____ that means 1 _____ purple, 2

_____ purple, and 1 _____white.

The phenotype ratio would be ____ purple to white.

This means that the rate or probability of having a purple offspring is 3:1. If you had 100 offspring, you would expect ___

of them to be purple and ___ of them to be white. In real life, you may have had slightly different numbers (ex 72 purple and

28 white). This is to be expected because _____ of chromosomes during replication.

Some types of genes don't express as complete dominance.

Another type is called_____ . In these situations, instead of one trait masking the other, both traits are blended together. For example, if we crossed a homozygous red flower with a homozygous white flower, you would expect all of the offspring to be heterozygous. However, in the case of incomplete dominance, the offspring flowers

wouldn't be red, they would all be _____ (a mix of both the red and white phenotypes).

Yet another example is called _____. In

_____, both traits are expressed equally but not blended together like in incomplete dominance. One easy example of this is blood type. There are 4 main blood types: type O, type A, type B, type AB.

There are two genes responsible for blood type. You inherit one from your mom and one from your dad, and both will be expressed. Let's use the capitol I to show the chromosome containing blood type, and small letters A, B, or O to show which version of the trait you have.

So if you are type A blood you could have two possible genotypes:

I^A and I^A in this case you got two copies of the A

antigen. This makes you blood type _____.

I^A and I^O in this case you have one copy of the A antigen and one copy of the O antigen. Type O means "no antigens on your blood". So as a result, you are still type A blood because of the other copy of the gene.

If you are blood type B, it is similar to above. I^B I^O or I^B I^B

IF you are blood type AB, it means you have one copy of each. I^AI^B or I^BI^A

If you are type O, you received two versions of the O antigen (which means no antigen) I^OI^O

The last example we are going to look at is a special case involving human sex chromosomes. These are the only chromosomes in the human genome which are not _____ pairs (translation: the x chromosome and the y chromosome contain different things.) Specifically, there are more types of genes on the x chromosome than the y chromosome. So you will find some traits that are only on one of the two chromosomes instead of both like with all of the other human chromosomes)

Because these traits are connected to the sex determining chromosomes, we call them _____ traits. Let's look at

red/green colour blindness, a trait associated with the x chromosome.

The ability to be able to tell the difference between red and green is thanks to a gene located on the X chromosome. It is important to note that there is not a second copy available on the Y chromosome.

Females are XX. There are three different female genotypes:

X^RX^R this is a homozygous dominant. They can see red/green normally
X^RX^r this is a heterozygous. They can see red/green normally
X^rX^r this is a homozygous recessive. They cannot see red/green normally.

Males are XY. They only have one copy of the X chromosome, so there is no way a recessive trait can be "masked". There are only two different male genotypes:

X^RY This is a male who has the normal copy of the trait. They can see red/green normally.
X^rY This is a male who has a recessive copy of the trait. They cannot see red/green normally.
Because males are at a disadvantage (they only have one opportunity to have the functional version of the gene) they get a different rate of "colour blindness" than females.

In this cross, we show a female who is colourblind crossing with a male who is not colourblind. The resulting offspring show that the female children are all carriers, but none of them are actually colourblind. With the male offspring, half are colourblind and half are not.

Sex linked traits effect males _____ more than females because of this. Other sex-linked traits include baldness and fragile x syndrome.

If you are into dogs, you may have heard of a pedigree. Genetics uses pedigrees to trace a gene as it is passed down from generation to generation.

Pedigrees use symbols to represent individuals in a family tree. They are often used to trace the phenotype of a particular trait and how frequent is shows up in the family.

The symbol for a male is a _____ and the symbol for a

female is a _____.

If the individual has the particular trait we are tracking then you

_____ their shape (so a black square or circle). If they do not show that trait, then they have an unfilled shape (so a white square or circle).

Using a pedigree is a great way to trace family history of genetic conditions. It can also help you better understand your genetic profile and predict if there could be any potential issues with your future offspring.