**Science 10 Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Genetics 1 – From Genes to Proteins Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the study of how inheritable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ such as flower colour, eye colour are passed from one \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to another
   1. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ made by our cells determine a vast number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ contain the information needed to make the protein.
      1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ are what \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pass on to their \_\_\_\_\_\_\_\_\_\_\_\_\_\_ during reproduction
2. Molecular biologists study how \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ work
   1. In doing so, they have discovered the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ language that is used to transmit the genetic information – this is known as the genetic \_\_\_\_\_\_\_\_\_\_\_\_\_.
   2. A \_\_\_\_\_\_\_\_\_\_\_\_ is a location on our \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where genetic information is stored
      1. \_\_\_\_\_\_\_\_\_\_ are made of long strands of molecules called \_\_\_\_\_\_\_\_\_\_ (deoxyribonucleic acid)
   3. The information in a gene is used to determine which of the 20 different \_\_\_\_\_\_\_\_\_\_\_\_\_\_ acids are linked together into a chain
      1. The chain of \_\_\_\_\_\_\_\_\_\_\_ acids is called a polypeptide or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. Nearly every \_\_\_\_\_\_\_\_ contains all the genetic information necessary to produce a human being
      1. Human DNA contains enough genetic information to assemble about 100 000 different proteins
3. All known life forms use the same genetic \_\_\_\_\_\_\_\_\_\_\_ to create \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. This is why a \_\_\_\_\_\_\_\_\_\_\_\_\_ gene can be inserted into a \_\_\_\_\_\_\_\_\_\_\_\_\_ to produce the protein insulin.
   2. We share 98% of the same genes as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      1. We share 60% \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with a fruit fly
   3. Some \_\_\_\_\_\_\_\_\_\_\_\_\_\_ attack the cells in our body by substituting their own \_\_\_\_\_\_\_\_\_\_\_ into our cells.
      1. Instead of making normal \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ proteins, the infected \_\_\_\_\_\_\_\_\_ are altered to make \_\_\_\_\_\_\_\_\_\_\_\_\_ proteins instead.
      2. Because of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ similarities a flu virus can spread from a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Chromosomes are made of a special molecule called \_\_\_\_\_\_\_\_\_\_\_\_\_ that stores genetic information.
   1. There are 4 special chemicals that can be found in our DNA called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      1. Adenine, Thymine, Cytosine, Guanine - \_\_\_ \_\_\_ \_\_\_ \_\_\_
   2. A human strand of DNA can have several \_\_\_\_\_\_\_\_\_\_\_\_\_\_ bases joined together
      1. Opposite from every \_\_\_\_\_ on one strand will always be a \_\_\_\_\_ on the other strand
      2. Opposite from every \_\_\_\_\_ on one strand will always be a \_\_\_\_\_ on the other strand
   3. The two strands wind around each other which is why DNA is sometimes called a

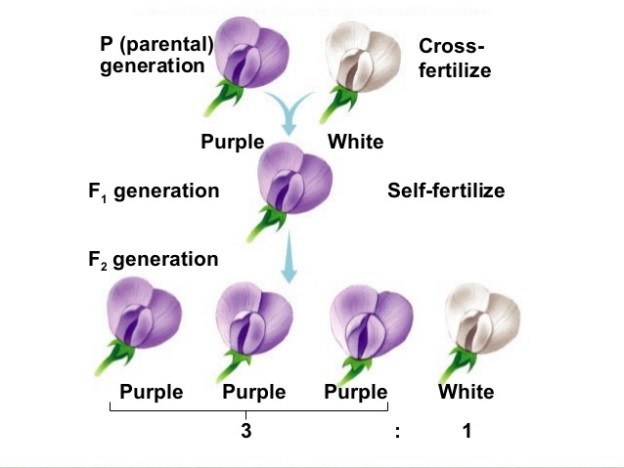
double \_\_\_\_\_\_\_\_\_\_

**Genetics 2 – Mendel and the Gene Hypothesis**

1. Gregor Mendel was an Austrian \_\_\_\_\_\_\_\_\_\_\_\_\_ whose job it was to cultivate \_\_\_\_\_\_\_\_ plants.
   1. He grew more than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plants over a \_\_\_\_\_\_\_\_\_ year period
      1. This allowed him to make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over a \_\_\_\_\_\_\_\_\_\_\_ sample size
2. The pea plants were a good \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for study for a number of reasons:
   1. Multiple \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of plants could be grown in one \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a pea plant have both \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_ reproductive parts
      1. If the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is transferred between the flowers of the \_\_\_\_\_\_\_\_\_\_ plant then it has \_\_\_\_\_\_\_\_\_\_ -pollinated
      2. If the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moves between the flowers of two \_\_\_\_\_\_\_\_\_\_\_\_\_ pea plants then it has \_\_\_\_\_\_\_\_\_\_\_ -pollinated
   3. Pea plants can be made to reproduce either by self -pollinating or cross -pollinating
      1. Male or female parts of the flower can be removed or covered to prevent \_\_\_\_\_\_\_\_\_\_\_\_\_
      2. Pollen can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by paintbrush from one flower to another.
   4. Pea plants have a number of easily observable inherited traits that have only two options

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Trait** | **Option 1** | | **Or** | **Option 2** | |
| Plant height | \_\_\_\_\_\_\_\_\_\_\_\_\_ |  | \_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Flower colour | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Flower location | grow in between the \_\_\_\_\_\_\_\_\_ on a branch |  | Grow at the \_\_\_\_\_\_\_\_\_ of a branch |  |
| Seed colour | \_\_\_\_\_\_\_\_\_\_\_\_ peas |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ peas |  |
| Seed skin | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ skin |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ skin |  |
| Pea pod colour | \_\_\_\_\_\_\_\_\_\_ pea pod |  | \_\_\_\_\_\_\_\_\_\_\_\_ pea pod |  |
| Pea pod structure | \_\_\_\_\_\_\_\_\_\_ pea pod |  | \_\_\_\_\_\_\_\_\_\_\_\_\_ pea pod |  |

1. At first Mendel would perform a crossbreeding experiment involving only \_\_\_\_\_\_\_\_\_\_\_ trait, called a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cross**.
   1. Mendel would follow the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of just one of the traits for \_\_\_\_\_\_ generations of plants
      1. He would often start with two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plants
   2. A \_\_\_\_\_\_\_\_\_\_\_\_\_ plant will always produce \_\_\_\_\_\_\_\_\_\_\_\_ plants with that trait \_\_\_\_\_\_\_ % of the time
      1. i.e. a \_\_\_\_\_\_\_\_\_\_\_\_\_ purple flower plant always produces \_\_\_\_\_\_\_\_\_\_\_\_ plants with purple flowers
2. **E.g. flower colour**
   1. First cross
      1. Mendel would begin with two purebred plants with \_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower colour and cross-breed them together
         1. He called these plants the \_\_\_\_\_\_ generation (for” \_\_\_\_\_\_\_\_\_\_\_\_\_” generation)
         2. i.e. Purple flower x White flower
      2. All of the \_\_\_\_\_\_\_\_\_\_\_\_ plants were called the \_\_\_\_\_\_ generation (for “first filial”) and they would only produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flowers
         1. The \_\_\_\_\_\_\_\_\_\_ flower trait had seemed to disappear
      3. Mendel called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ trait and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ trait
   2. Second cross
      1. Mendel would take the \_\_\_\_\_ plants and cross-breed them with each other or self-pollinate them
         1. Purple flower x Purple flower
         2. The resulting \_\_\_\_\_\_\_\_\_\_\_\_ plant were called the \_\_\_\_ generation (for “second filial” generation)
      2. About \_\_\_\_\_ of all of the F2 generation still had \_\_\_\_\_\_\_\_\_\_\_\_\_\_ flowers
         1. \_\_\_\_\_ of the F2 generation had \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flowers
         2. The F2 generation showed a ratio of \_\_\_ purple : \_\_\_ white flower
      3. Mendel determined that the \_\_\_\_\_\_\_\_\_\_\_\_\_ white flower trait had been present in the \_\_\_ generation plants but it had been masked by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ purple flower trait



* + 1. Mendel performed the same type of procedure with the different \_\_\_\_\_\_\_\_\_\_ of the pea plant and the results would always be the \_\_\_\_\_\_\_\_\_
    2. He determined that certain traits in the pea plant were \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the other trait was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    3. He hypothesized that some unknown factor was being transmitted from the parents to the offspring that controlled the characteristics of the plants

**Genetics 3 – Mendel’s Gene Hypothesis Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. Without any knowledge of chromosomes or DNA , Mendel generated the following ideas:
   1. A hereditary unit of information called a\_\_\_\_\_\_\_\_\_\_\_ is passed from \_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. An \_\_\_\_\_\_\_\_\_\_\_\_\_ is one of the possible versions of the \_\_\_\_\_\_\_\_\_\_\_\_
      1. E.g. the flower colour gene has two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,
         1. one for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flowers
         2. one for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flowers
2. Mendel took his ideas about genes and alleles and made the following hypotheses:
   1. The presence of different \_\_\_\_\_\_\_\_\_\_\_\_\_ is responsible for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an organism
   2. An organism always has two \_\_\_\_\_\_\_\_\_\_\_\_\_ present for each characteristic
      1. Each \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ donates one \_\_\_\_\_\_\_\_\_\_ to the offspring.
   3. If the \_\_\_\_\_\_\_\_\_\_\_ on both of the genes are the \_\_\_\_\_\_, then the organism is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      1. E.g. a plant’s genes for flower colour are both the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ allele
   4. If the two \_\_\_\_\_\_\_\_\_\_\_\_ are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then the organism is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the characteristic
      1. One trait will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the other trait will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and only the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ trait is expressed in the organism
      2. E.g. one of a plant’s genes for flower colour is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the other gene is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 The plant only produces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flowers!
3. Mendel studied \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different traits in pea plants and sometimes followed more than one trait at a time, e.g. short, purple flower plant crossed with tall, white flower plant
   1. He found that \_\_\_\_\_\_\_\_\_\_\_\_ of the traits were affecting the other
      1. i.e the \_\_\_\_\_\_\_\_\_\_\_\_\_ flower trait did not affect the \_\_\_\_\_\_\_\_\_\_\_\_ of the plant
   2. this is known as his \_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ assortment
4. We can look at the alleles in the generations created by crossing two \_\_\_\_\_\_\_\_ plants for flower colour
   1. We use letters to represent the two alleles for flower colour:
      1. \_\_\_\_ = the purple flower allele (capital letter for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
      2. \_\_\_\_ = the white flower allele (lowercase letter for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
   2. each plant has \_\_\_\_\_\_\_ genes for the flower colour trait and they are both \_\_\_\_\_\_\_\_\_\_\_\_\_\_
      1. \_\_\_\_\_\_\_\_ = purebred \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower plant
      2. \_\_\_\_\_\_\_\_= purebred \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower plant
   3. **First cross**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Purebred purple flower plant | | |
| Purebred white flower plant |  |  |  |
|  |  |  |
|  |  |  |

* + 1. All of the F1 generation are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, i.e. they have both alleles (\_\_\_\_\_\_\_)
    2. Since purple is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over white, the flower colour is always \_\_\_\_\_\_\_\_\_\_\_
  1. **Second cross** – two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ parents

|  |  |  |  |
| --- | --- | --- | --- |
|  | Hybrid purple flower plant | | |
| Hybrid purple flower plant |  |  |  |
|  |  |  |
|  |  |  |

* + 1. In the F2 generation
       1. Only \_\_\_ out of the four possible combinations will be \_\_\_\_\_\_\_\_\_\_\_ flower (\_\_\_)
       2. \_\_\_\_\_\_\_ out of the four possible combinations are \_\_\_\_\_\_\_\_\_\_\_\_ flower (\_\_\_\_\_ and \_\_\_\_\_)
       3. But even if they have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower they may still be genetically a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and carry the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ allele

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ refers to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a characteristic in an organism
   1. You **can** observe the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an organism
      1. E.g. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the flour is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the plant
   2. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ratio compares the number of each \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that is expressed in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      1. E.g. if in a particular cross, there are 30 tall offspring plants and 10 short offspring plants, the **phenotypic ratio** is \_\_\_\_\_: \_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ refers to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ makeup of the organisms
   1. You **cannot** easily observe the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the organism
      1. E.g. a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower plant may be \_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_
      2. E.g. a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ flower plant must be \_\_\_\_\_ however since it is the only way that the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ white allele can be expressed
   2. Organisms that have \_\_\_\_\_\_\_\_\_\_\_\_\_\_ alleles for a trait are said to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the trait
      1. E.g. \_\_\_\_\_ would be homozygous \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ while or \_\_\_\_ would be homozygous \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organisms have non-matching alleles and are said to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the trait
      1. E.g.\_\_\_\_\_ is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ genotype
   4. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ratio compares the number of each \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the offspring
      1. If the results of the pea height example were 10 homozygous dominant (TT), 20 (Tt) heterozygous and 10 homozygous recessive (tt), the **genotypic ratio** would be \_\_\_\_\_\_:\_\_\_\_\_\_:\_\_\_\_\_\_

**Practice Question:** *Use your class notes to help you answer the following questions in full sentences*

1. Another characteristic that Mendel observed in his pea plants was the shape of the pea. A pea seed was either smooth skinned or wrinkled. He found that the dominant trait was a smooth skin (R), and the recessive trait was a wrinkled skin (r).
   1. What is the phenotype of a plant whose genotype is heterozygous for pea shape?
   2. What is the phenotype of a plant whose genotype is homozygous recessive for pea shape?
   3. Complete the following Punnett square to show the cross between a heterozygous and a homozygous recessive for pea shape (Rr x rr)

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

* 1. Assume that 40 pea plants were produced
     1. How many plants will have smooth skin peas?
     2. How many pants will have wrinkled skin peas?
     3. What is the phenotypic ratio of smooth skin to wrinkled skin peas?
  2. Assume that 60 pea plants were produced
     1. How many plants are heterozygous?
     2. How many plants are homozygous dominant?
     3. How many plants are homozygous recessive?
     4. What is the genotypic ratio f heterozygous plants compared to homozygous recessive plants?