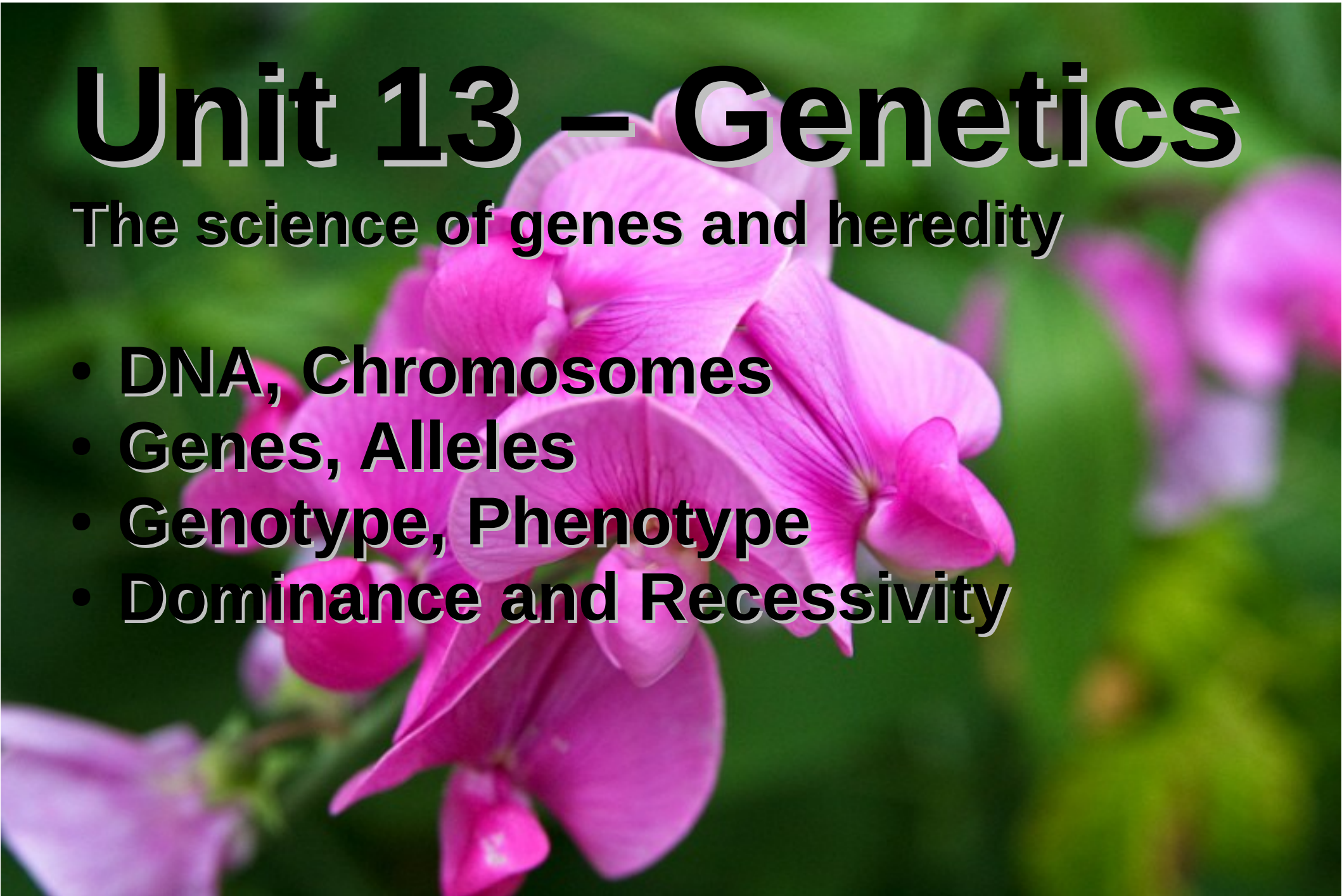


# Unit 13 – Genetics

The science of genes and heredity

- **DNA, Chromosomes**
- **Genes, Alleles**
- **Genotype, Phenotype**
- **Dominance and Recessivity**



# Competencies

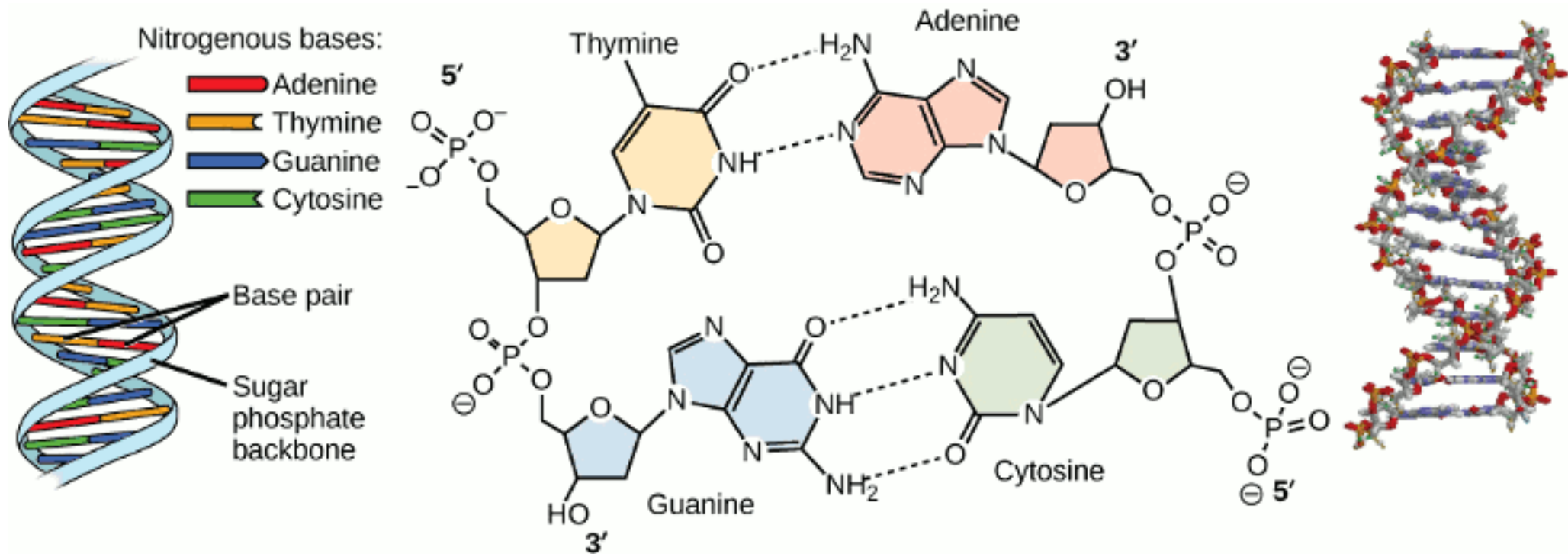
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The student will be able to:

- define Genes, Alleles, Character trait, Genotype and phenotype, Homozygote and heterozygote, Dominance and recessivity
- ~~describe Protein synthesis (transcription/translation)~~
- describe Heredity and Cross-breeding

# DNA and Chromosomes

- DNA:**
- Deoxyribonucleic acid
  - The blueprint of organisms



Images: Modification of image by  
**OpenStax, Biology. OpenStax CNX. 27. Mai 2016**  
[http://cnx.org/contents/GFy\\_h8cu@10.53:U7tPDRxK@7/DNA-Structure-and-Sequencing](http://cnx.org/contents/GFy_h8cu@10.53:U7tPDRxK@7/DNA-Structure-and-Sequencing)  
 Creative Commons 4.0 License <http://creativecommons.org/licenses/by/4.0/>

See also: <https://ghr.nlm.nih.gov/primer/basics/dna>

# DNA and Chromosomes

- Chromosomes:**
- Organized Structure of DNA
  - Humans typically have 46 Chromosomes : 22 pairs and two sex chromosomes (XX Female, XY Male)

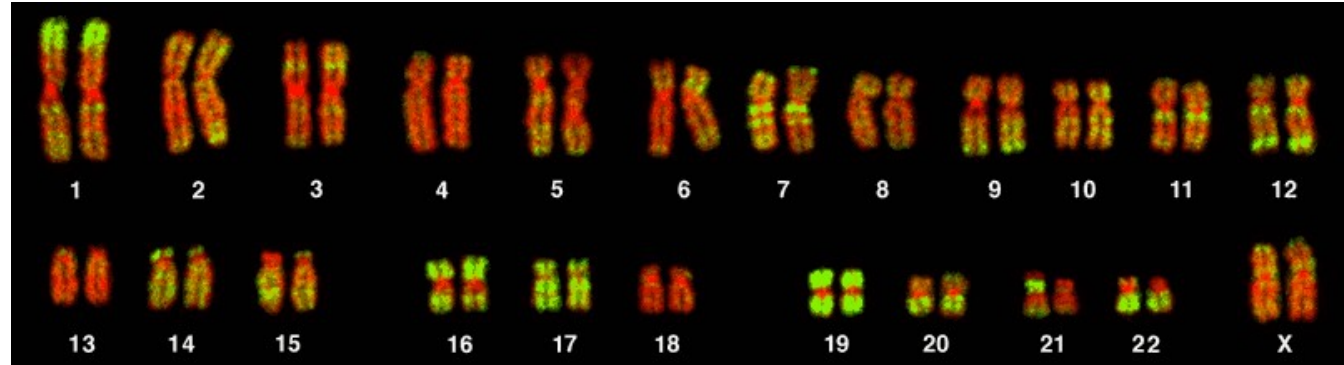
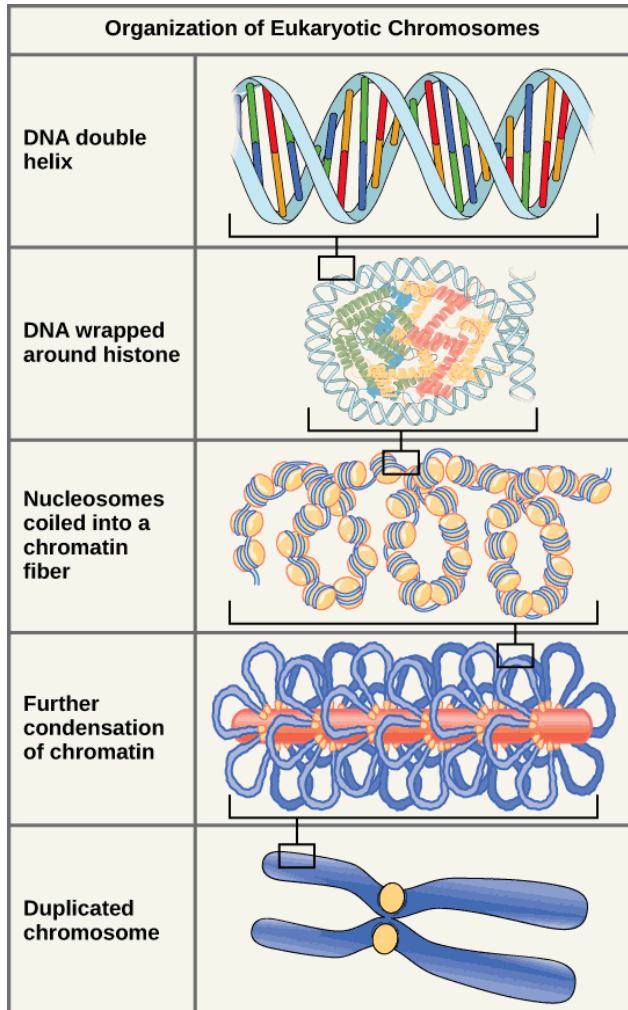


Image: Karyotype of a female human

**OpenStax, Biology. OpenStax CNX. 27. Mai 2016**

[http://cnx.org/contents/GFy\\_h8cu@10.53:kfWJNVv@7/Chromosomal-Basis-of-Inherited](http://cnx.org/contents/GFy_h8cu@10.53:kfWJNVv@7/Chromosomal-Basis-of-Inherited)  
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See also <https://ghr.nlm.nih.gov/primer/basics/chromosome>

Image: **OpenStax, Biology. OpenStax CNX. 27. Mai 2016**

[http://cnx.org/contents/GFy\\_h8cu@10.53:U7tPDRxK@7/DNA-Structure-and-Sequencing](http://cnx.org/contents/GFy_h8cu@10.53:U7tPDRxK@7/DNA-Structure-and-Sequencing)  
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# Genes and Alleles

**Gene:** Piece of of DNA containing the information for a character trait

**Allele:** Possible form of a gene

Example:

Gene for flower colour of bean plants → Possible Alleles: white, purple

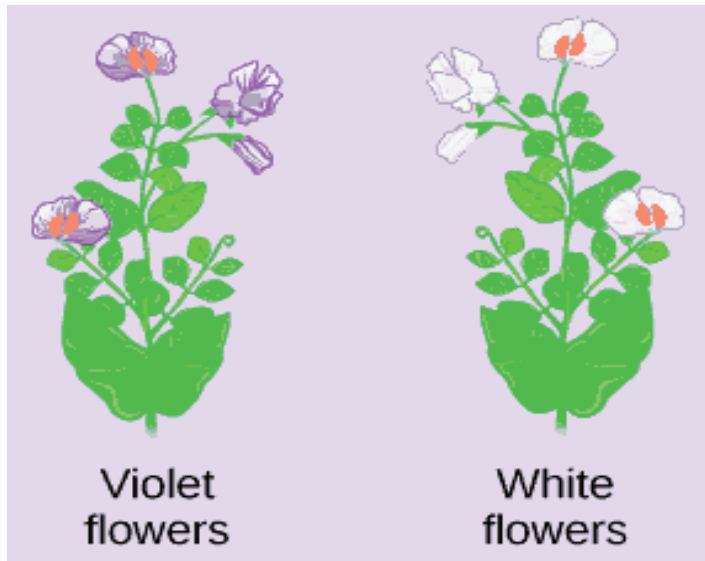


Image:

**Image:** OpenStax College, Biology. OpenStax CNX. 29. Sep. 2015  
<http://cnx.org/contents/185cbf87-c72e-48f5-b51e-f14f21b5eabd@9.87>  
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# Genotype and Phenotype

**Genotype:** Genetic makeup of an individual

**Phenotype:** Observable traits of an individual

→ It is not always possible to predict the genotype from the phenotype

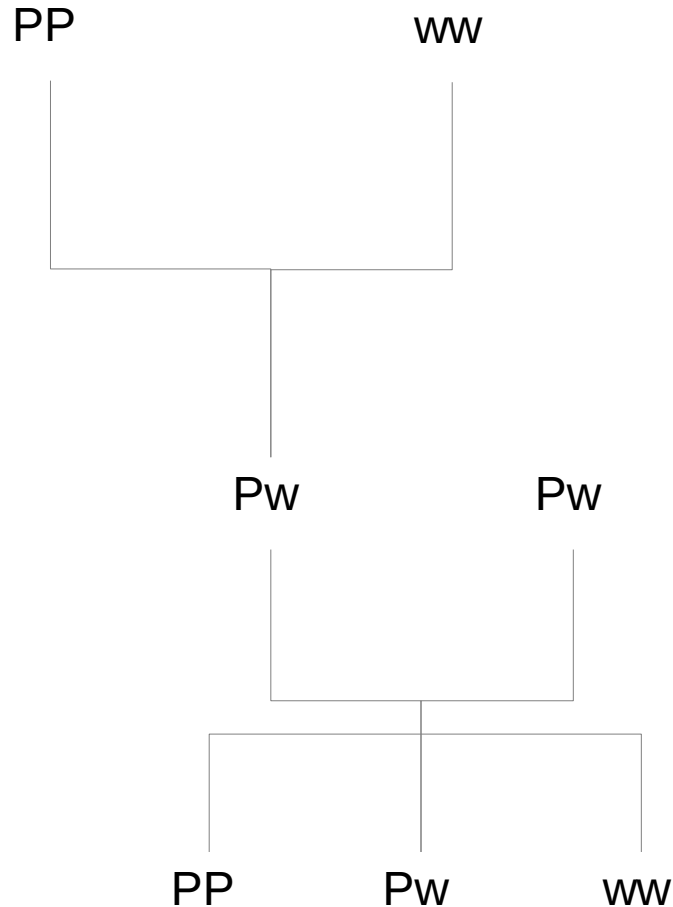
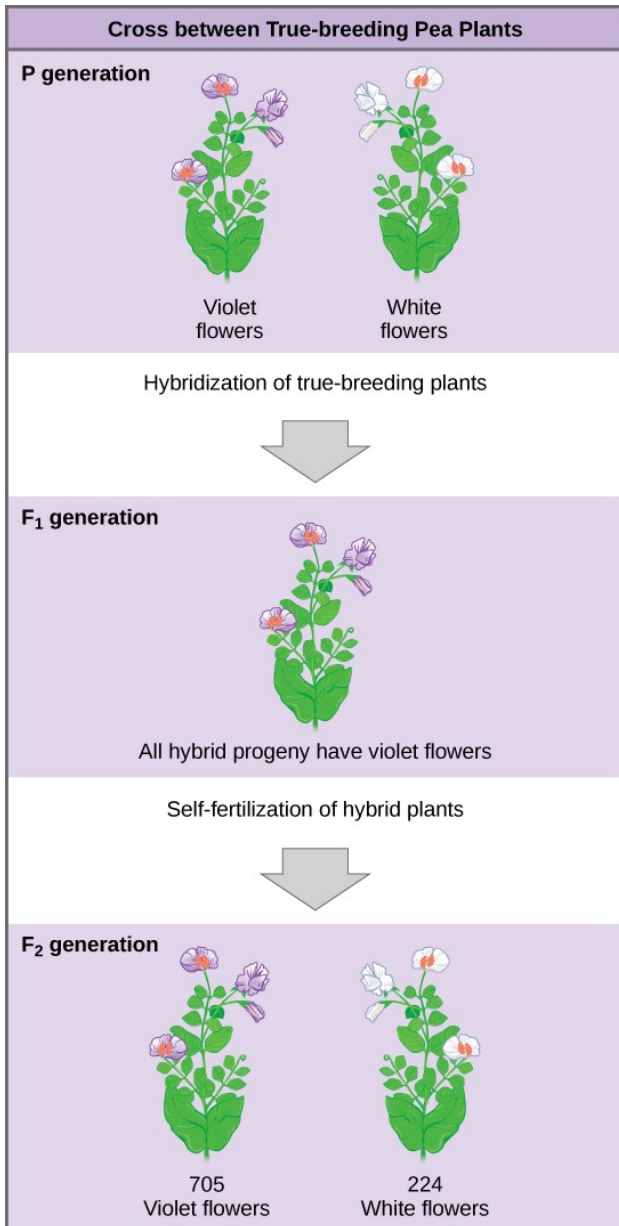


Image: Stefan Bracher

Image: "Leucistic Squirrel [30/366]" by Tim Sackton, via Flickr (<https://flic.kr/p/CGsnC3>)  
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# Dominance and Recessivity

## Mendel's Experiments



**Gregor Mendel**  
 1822-1884  
 Photographer: Unknown  
 (public domain)

**Image:** OpenStax College, Biology. OpenStax CNX. 29. Sep. 2015  
<http://cnx.org/contents/185cbf87-c72e-48f5-b51e-f14f21b5eabd@9.87>  
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# Dominance and Recessivity

## Some more vocabulary :

heterozygous: Having two different alleles for a character trait

homozygous: Having two identical alleles for a character trait

recessive : An allele that only expresses in the phenotype if present twice

dominant : An allele that always expresses in the phenotype, even if present only once

→ See list of recessive traits in problem set page 19



# Dominance and Recessivity

**Punnet Square** : Diagram to predict the outcome of cross-breeding

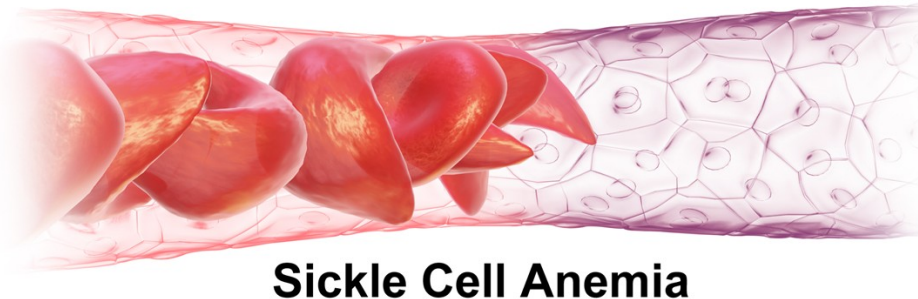
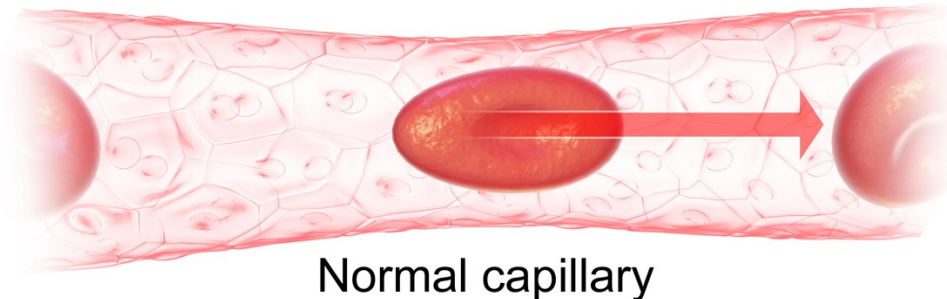
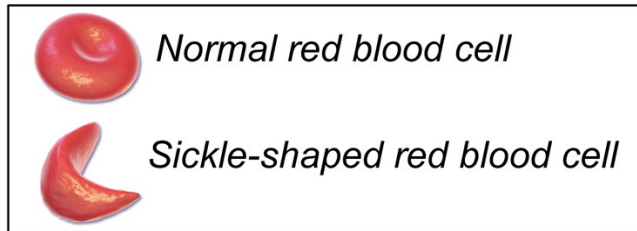
		Mother	
		P	W
Father	P		
	P		

**Warning:** This is a very simplified model. Some studies suggest that the inheritance is more complicated

→ Do Monohybrid problems in problem set page 25

# Interesting case: Sickle cell anemia

## Sickle cell anemia : Recessive trait



Genotypes	Phenotypes	
RR	Not carrying the gene	Not affected
Rr	Carrying the gene once	Not affected
rr	carrying the gene twice	Affected

→ Calculate the chances of the offspring of two unaffected carriers to be affected.

→ Look at maps and compare with Malaria

[http://www.understandingrace.org/humvar/sickle\\_01.html](http://www.understandingrace.org/humvar/sickle_01.html)

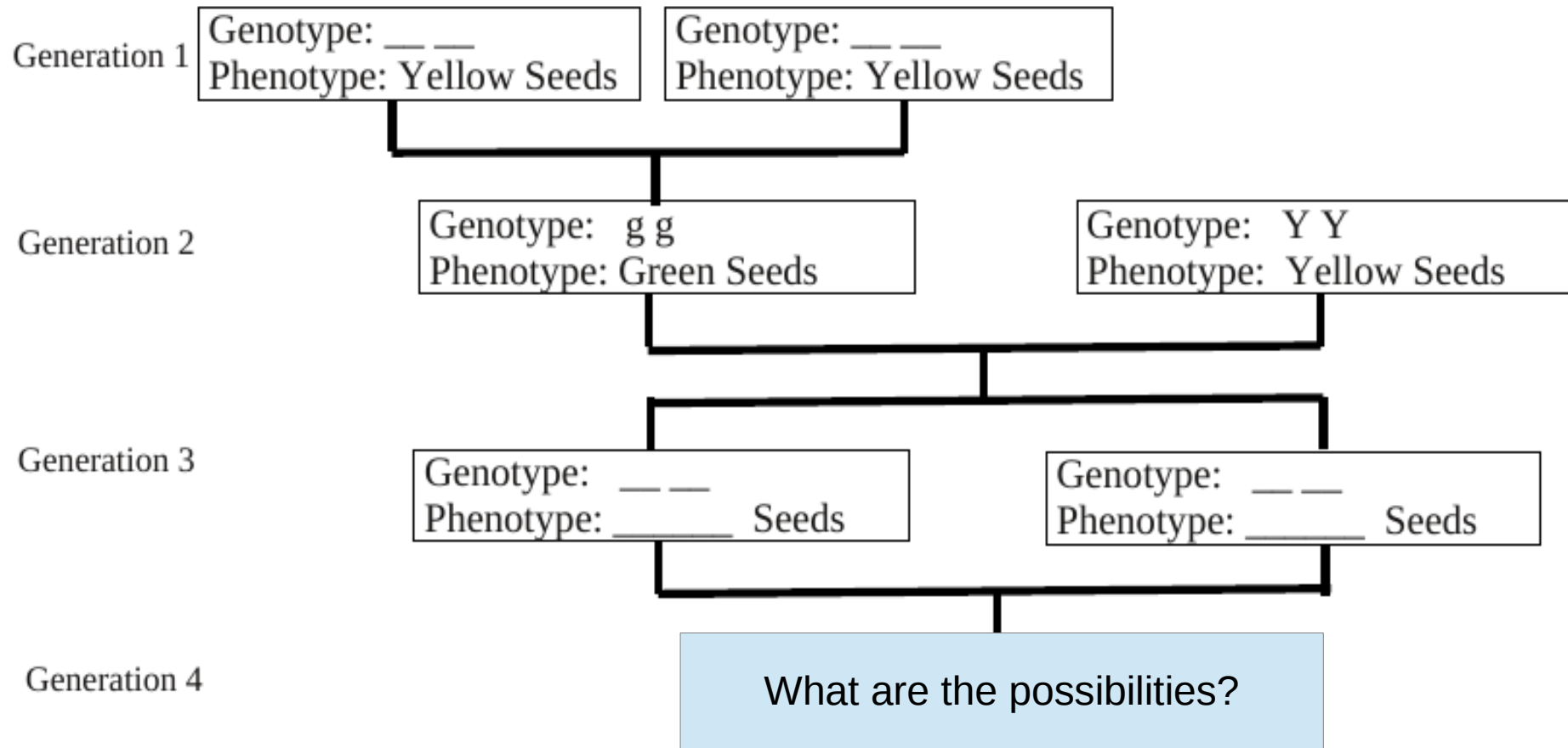
Image: Sickle Cell Anemia by BruceBlaus

[https://commons.wikimedia.org/wiki/File:Sickle\\_Cell\\_Anemia.png](https://commons.wikimedia.org/wiki/File:Sickle_Cell_Anemia.png)

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# Family tree



*Legend: Y : Gene for yellow seeds, g : Gene for green seeds*

Complete the family tree

# Additional Resources

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- “Genetics”, OpenStax „Biology“  
[http://cnx.org/contents/GFy\\_h8cu@10.53:ophk8xHf@2/Introduction](http://cnx.org/contents/GFy_h8cu@10.53:ophk8xHf@2/Introduction)