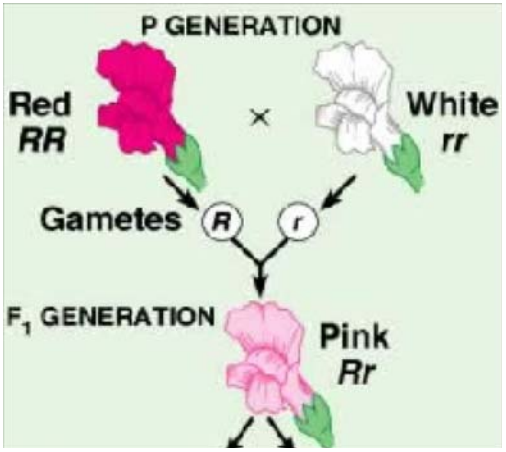
MENDELIAN ANALYSIS



revised 18July2016
gmslg, P 20-, Campbell 6th: 247-253, 7th: 251-270, Sadava: 206-213, Campbell 10th: 252-272

History of Inheritance: Since dawn of civilization, 10,000 yrs ago, **domestication = selective breeding**
Generally explained heredity as "**blending**"
Black x Caucasian = tan
Snapdragons: red x white = pink (p 218)

deGraaf: 1640 observed Graafian follicle, spawned those who thought females determined inheritance

Leeuwenhoek: 1644 examined semen, named **animalcules**, spawned those who thought they saw human form in sperm head, maternal role was through prenatal influence

But did not explain **variation of progeny** from parents

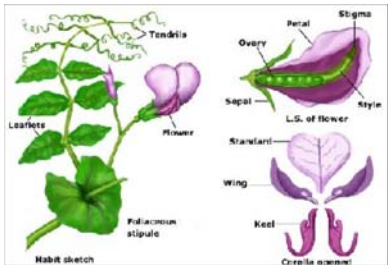
Genetics must explain **two contradictory phenomena**:
Why do progeny look like their parents: **HEREDITY**
Why do oprogeny look different from their parents: **VARIATION**

Gregor Mendel (1822-1884) Czech from Brno, trained to be teacher, failed teacher's test 2x, retreated to monastery. (P 208)
Got abbot to place him in charge of the garden. Took to breeding *Pisum sativum, 1857*.
An excellent choice for several reasons:
1) **Many varieties** were readily available commerically (produces pure lines)
2) They were **naturally self pollinating**, and therefore tended to breed true
3) Several crops could be grown in a single season, **got many progeny** (seeds)/cross

flower structure prevents much cross breeding, only opens up after fertilization
5 petals: two lower form **keel**, two side **wings**, one upper forms **banner or standard**

How to perform cross: 1) **emasculate** immature flower
(p. 209) 2) **cross pollinate:** brush on pollen to **stigma** of emasculated plant
3) save seeds, plant, record **phenotype** of progeny

MONOHYBRID CROSSES
LEARN ALL: **parental generation** = P (from pure lines) crossed to produce F_1
P phenotypes: *white* times *purple* flowered plants (also did reciprocal cross, purple x white)
(alternate forms of same trait = **allele**)
F_1 phenotype: **first filial generation** = F_1
all purple F_1 (purple is therefore the **dominant** allele, white the **recessive**)
F_1 self pollinates (selfed) to produce F_2 close to 3:1 ratio of progeny **(Round vs wrinkled) (p. 211)**
second filial generation:= F_2 phenotypes 7,324 seeds, planted: 5,474 Round 1,850 wrinkled (2.96:1 ratio)
Show with Punnett square: (p 213)
First, determine all possible genotypes of gametes. Write male gametes along top of square, female gamete along side, join each female gamete with each male gamete to fill in square.



repeated for other six pairs, same 3:1 ratio (p 210)
Blending is disproved: 1) F_1 showing **dominant** phenotype (heterozygous)
2) reappearance of **recessive** phenotype (homozygous)
("Skips generation")

Mendel's First Law of Equal Segregation: adults carry a pair of hereditary determinants for each trait, These pairs of alleles separate with equal probability when gametes are formed, 50:50 ratio
Each parent carries two copies of each hereditary determinant (gene) (**diploid**)
If two copies are identical, **homozygous** (true breeding)
If two copies are different, **heterozygous**
These were monohybrid crosses, for a single set of alleles.

WORDS TO LEARN: progeny, blending, emasculate, parental, filial, phenotype, genotype, dominant, recessive, allele, segregation, homozygous, heterozygous, diploid, ploidy, genome, gene pool, chromosomes, chromatid, centromere, gene

MENDEL'S SECOND RULE: segregation of one pair is independent of a second pair.

Genetic material must satisfy two principles:
1) carrier of information (genotype)
2) template for replication

(p. 210)

		pure-lined pairs of traits to cross:		**F_2 numbers of phenotypes:**	
PHENOTYPE		**Dominant**	**x Recessive**	**Dom**	**Recessive**
seeds	seed shape	round	wrinkled	5474	1850
	seed color	yellow	green	6022	2001
plants	flower color	purple	white	651	207
	pod shape	inflated	pinched	882	299
	pod color	green	yellow	428	152
	flower position	axial	terminal	705	224
	stem length	long	dwarf	787	277

PHENOTYPE		**Dominant**	**x Recessive**	**Dom**	**Recessive**
plants	flower color	purple	white	651	207