**5. The Development of the Chromosome Theory**

- Mendel's work and 3 Laws of Inheritance provided a basis for the development of the modern day Chromosome Theory:
  - 1882 → Edouard van Benden
    - : discovered that gametes are haploid
  - 1887 → Weisman
    - : discovered the process of Meiosis (22 years after Mendel)
  - 1902 →Walter Sutton and Theodor Boveri
    - : discovered that chromosomes come in pairs (homologs) which segregate during meiosis
    - : reasoned that genes are located on chromosomes & control heredity
    - : proposed each chromosome contains many different genes
- This all led to the Chromosome Theory which states:
  1) <u>Chromosomes carry genes which are the units of hereditary structure</u>
  2) <u>Each chromosome contains many different genes</u>
  3) <u>Chromosomes (and therefore genes) are paired.</u>
  4) <u>Chromosomes segregate during meiosis. Each gamete gets half the # of chromosomes found in somatic cells.</u>
  5) <u>Chromosomes sort independently during meiosis.</u>

**6. Exceptions to Mendel's Laws**

**Incomplete Dominance**

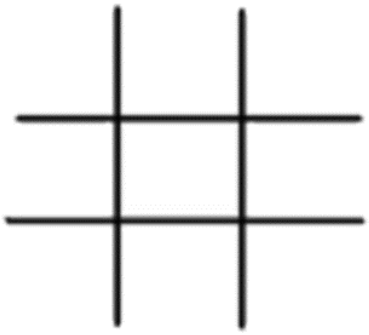
- In some traits, both alleles for the trait are <u>equally dominant</u> so one allele cannot completely mask the other
  - = The alleles then interact so that each allele displays <u>a portion of its trait</u>
  - = creates a new <u>phenotype</u> expressed by the <u>hybrid</u>

Ie. Four O'Clocks

Homozygous red flowered are crossed with plants homozygous for white flowers

R = Red W = White

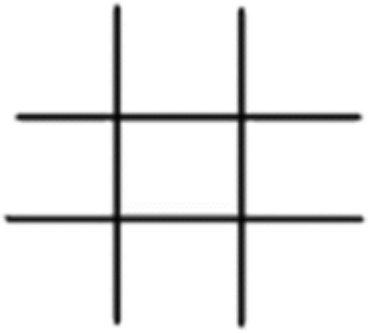
$P_1 = C^RC^R \times C^WC^W$



**Results**: Phenotype – 100 % Pink

Genotype – 100% $C^RC^W$ (heterozygous)

$F_1 = C^RC^W \times C^RC^W$



**Results:**

Phenotype –_____% red

_____% pink

_____ % white

Ratio – red : pink : white → _____

Genotype –_____ homozygous red ($C^RC^R$)

_____ heterozygous ($C^RC^W$) pink

_____ homozygous ($C^WC^W$) white

Ratio– pure : hybrid : pure → _____

**Codominance**

- in some pairs of contrasting traits, the 2 genes are both dominant and therefore they <u>both traits appear simultaneously</u>

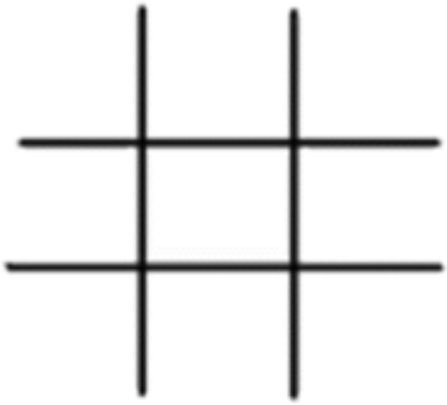
Ie. Cattle

Homozygous white cows crossed with homozygous red bulls will produce roan calves (red and white hair interspersed)

$P_1$ = rr x ww **Results:** Phenotype = 100% Roan

Genotype = 100% hybrid (rw)

$F_1$ = rw x rw



**Results:**

Phenotype = _____ red, _____ roan, _____ white

Ratio: _____

Genotype = _____ pure red (rr),

_____ roan (rw)

_____ pure white (ww),

Ratio: _____

**Pheonotypic and genotypic ratios for Incomplete Dominance and Co Dominance are the same because both alleles are expressed so each new <u>genotype</u> gives us a new <u>phenotype</u>.

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- This all led to the Chromosome Theory which states:

  1) _____.
  2) _____.
  3) _____.
  4) _____
  _____.
  5) _____.

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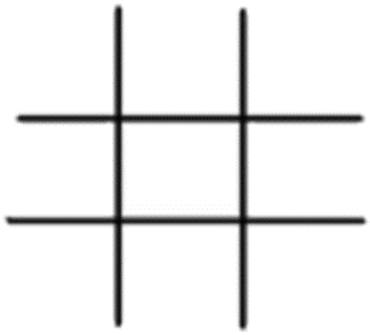

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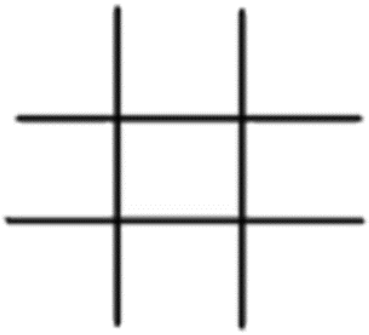

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Ratio - pure : hybrid : pure → _____

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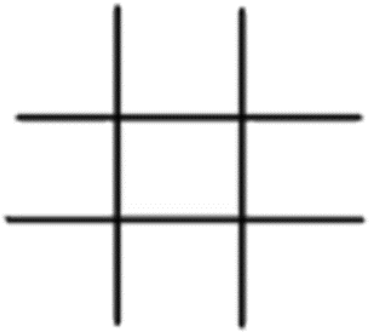

**Results:**

Phenotype = _____ red, _____ roan, _____ white

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Genotype = _____ pure red (rr),
_____ roan (rw)
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Ratio: _____

**Pheonotypic and genotypic ratios for Incomplete Dominance and Co Dominance are the same because both alleles are expressed so each new _____ gives us a new _____