Life Science Chapter 3 Genetics:

3.1 Mendel's Work
3.2 Probability and Genetics
3.3 The Cell and Inheritance
3.4 The DNA Connection

Section 3-1 – Mendel's Work with Pea Plants

Gregor Mendel = Father of Genetics
Traits – different physical characteristics (tall, short, green or yellow)
Heredity – the passing of traits from parents to offspring
Purebred = always produces offspring with the same form of a trait as the parent
* Crossed purebred tall with purebred short.
* **P** Generation = parental generation
* **F1** Generation = first filial (son) generation
* All of F_1 generation were tall.
* Then he bred the F_1 to F_1 and the F_2 were a mixture of traits (tall and short)

Genes = factors that control traits. (Example: plant height)
Alleles = different forms of a gene. (Examples: tall or short)
* **Dominant** allele = one whose trait always shows up if it is in the genes.
* **Recessive** allele = is masked or covered up, if a dominant allele is in the genes.

- Tall is dominant in pea plants, so a plant with one short and one tall allele, will be a tall plant.
- Purebreds have two identical alleles (either tall/tall, or short/short).

Hybrids = have two different alleles for a trait (tall / short).
* When hybrids F_1 are crossed (tall/short) X (tall/short), some of the offspring were (tall/tall) and others were (tall/short), and some were (short/short).

Symbols in Genetics:
* **Capital** letter = dominant (T = tall)
* **Lowercase** letter = recessive (t = short)
TT = purebred with two dominant alleles (tall plant)
tt = purebred with two recessive alleles (short plant)
Tt = hybrid with one dominant and one recessive (tall plant)

Section 3-2 Probability and Genetics

Principles of Probability
* Tossing a coin = 1 in 2 chance of "heads".
* Each of the two possible events is equally likely.

Mendel and Probability
* He was the first to recognize probability principles can be used to predict the results of genetic crosses.
* If he crossed two hybrids (Tt) x (Tt) = three fourths Tall,
so probability for tall plants was 3 in 4.

Punnett Squares

* Punnett Square = a **chart** showing all the possible combinations of alleles that can result from a genetic cross.
* Geneticists use these charts to show all the possible outcomes of a genetic cross and to determine the probability of a particular outcome.

Predicting Probabilities –

Example of crossing a black guinea pig and a white guinea.
So the P Generation (parental generation) is BB x bb (purebred Black x purebred white)

B = Black (dominant) b = white (recessive)

Crossing BB x bb

	B	B
b	Bb	Bb
b	Bb	Bb

F_1 Generation Offspring
(First Filial Generation)
100% of them are black

= 4 black (100 %)
= zero white
= zero purebred
= 4 hybrids

Crossing Bb x Bb

	B	b
B	BB	Bb
b	Bb	bb

F_2 Generation Offspring
(Second Filial Generation)
75% are black, and 25% are white

= 3 black 75%
= 1 white (bb) 25%
= 2 purebred (BB, bb) 50%
= 2 hybrids (Bb, Bb) 50%

Phenotype = physical appearance (visible traits)

* Tall or short is a an example of phenotype

Genotype = its genetic makeup (allele combination)

* Tt and TT are examples of a genotype for tall.

Homozygous = organism with two identical alleles (TT) or (tt) at a gene site.

* Purebred

Heterozygous = organism with two different alleles (Tt) at a gene site.

* Hybrid

Codominance = the alleles are neither dominant or recessive.

* So, both alleles are expressed in the offspring
* A hybrid with have a mixture of the alleles, not just one over the other.
* Symbols for codominant alleles are special
* Example of chicken feather color
  (**F^B** = black feathers) (**F^W** = white feathers)

Section 3-3 The Cell and Inheritance

Dr. **Sutton**, a geneticist, 1903 studied grasshopper sex cells.

* Grasshopper body cells have 24 chromosomes,
  but their sex cells have only 12 chromosomes (exactly half)
* Sutton wanted to see how they were formed.
* **Sperm** = male sex cell (12 chromosomes)
* **Egg** = female sex cell (12 chromosomes)
* So a new baby grasshopper gets 12 from each parent = 24 total

Chromosome Theory of Inheritance = genes are carried from parents to their offspring on chromosomes.

Meiosis = the process by which the number of chromosomes is reduced by half to form sex cells (sperm and eggs).

* Punnett Squares show what happens during meiosis to separate the alleles in each parent, and then combine them to form offspring.

Chromosomes – Humans have 46 (23 from each parent)

* Over 60,000 genes together on these 23 pairs of chromosomes.

Comparing Mitosis and Meiosis:
Mitosis = 1 body cell divides into 2 body cells with the same number of chromosomes.
Meiosis = 1 body cell divides into 4 sex cells, with half the chromosomes of a body cell.

Section 3-4 The DNA Connection

* The Morse Code uses two symbols to code information (dots and dashes)
* Computer codes use two numbers to do it (0's and 1's) (000011100111)

The Genetic Code: uses four nitrogen bases (molecules) along a gene to form a code, that specifies (tells) which kind of protein will be produced for the cell.

- A group of three bases codes for the attachment of a specific amino acid.
- These are like three letter code words.
- The order of the bases determines the order of amino acids put together to form a protein.

Protein Production (Protein Synthesis)

- The cell uses information from a gene on a chromosome to produce a specific protein.
- Messenger RNA (mRNA) copies the coded message from the DNA in the nucleus, and carries the message to ribosomes in the cytoplasm.
- Protein synthesis takes place on the ribosomes in the cytoplasm.
- Transfer RNA (tRNA) carries amino acids to the ribosomes.
- The tRNA and mRNA matchup and this links the amino acids into a chain to form a protein.

Mutations = any change (error) that occurs in a gene or chromosome.

- If an A mistakenly replaces a G, this would be a mutation.
- Mutations cause incorrect proteins to be formed.
- So, the phenotype (trait) will show up different and even destructive.
- Mutations in body cells will only affect that cell that carries it.
- If mutations occur in sex cells, it can be passed on to offspring and show up in the offspring's phenotype.
- Another mutation error occurs if chromosomes don't separate correctly during meiosis, and so

the offspring has too many or too few chromosomes.

- Some mutations are harmful, some are beneficial, and some have no effect.