# *UNIT V Genetics and Biotechnology*

## Genetics

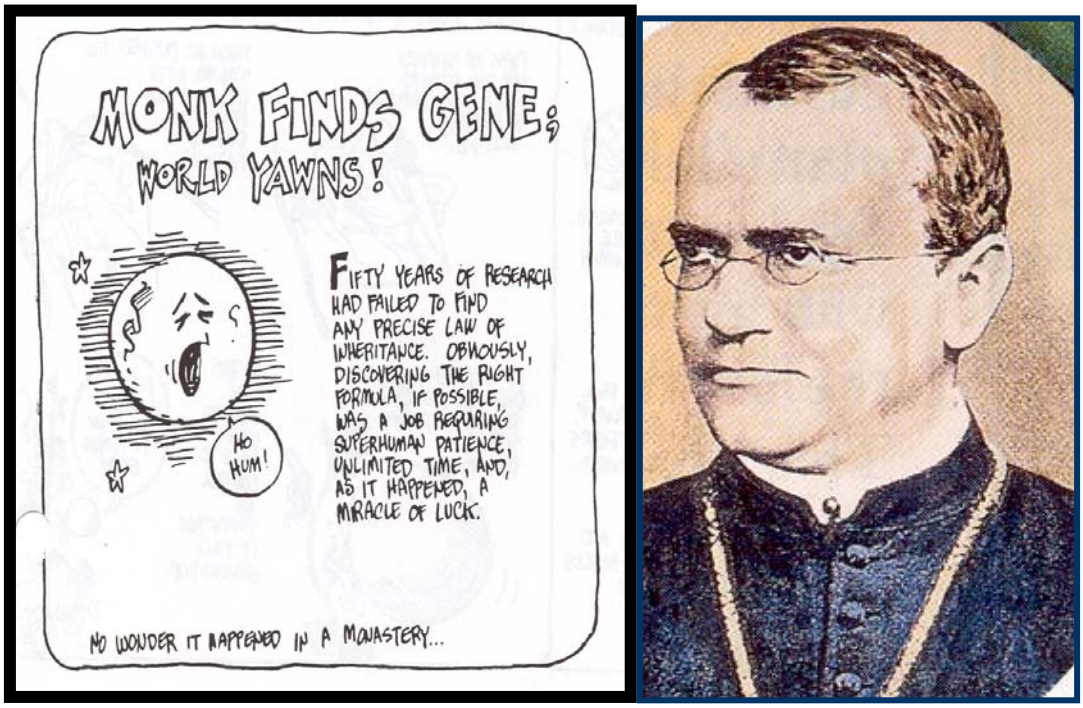
■Scientific study of _____ inheritance

–How characteristics are passed from _____ to _____

2

## Mendel's Laws of Heredity

**Chapter 11: Introduction to Genetics 11.1 The work of Gregor Mendel** *(Page 262)*




3

## Sexual Reproduction of the Floral Kind!

- Flowers have _____ and _____ parts which produce sex cells (sperm in pollen and eggs in an ovule)

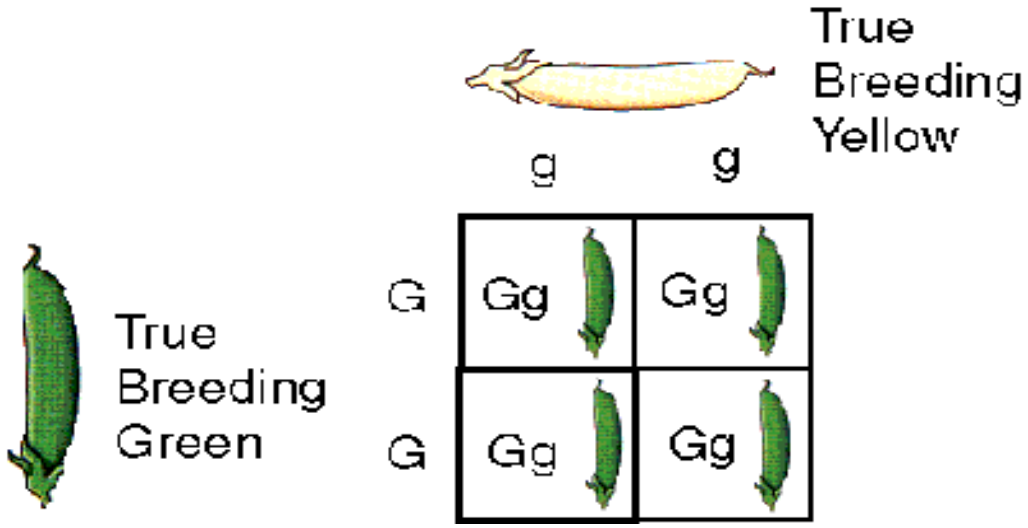
- This allowed Mendel to _____ _____ plants with different traits and see what happened
- Lab: Mendel Minds His Meiosis

5

## What Made Mendel Wonder???

## Mendel's Law of Segregation

What disappeared in the cross below?




7

## Mendel Discovers Dominance

■Mendel found that some _____ in pea plants _____ over others and were therefore, _____

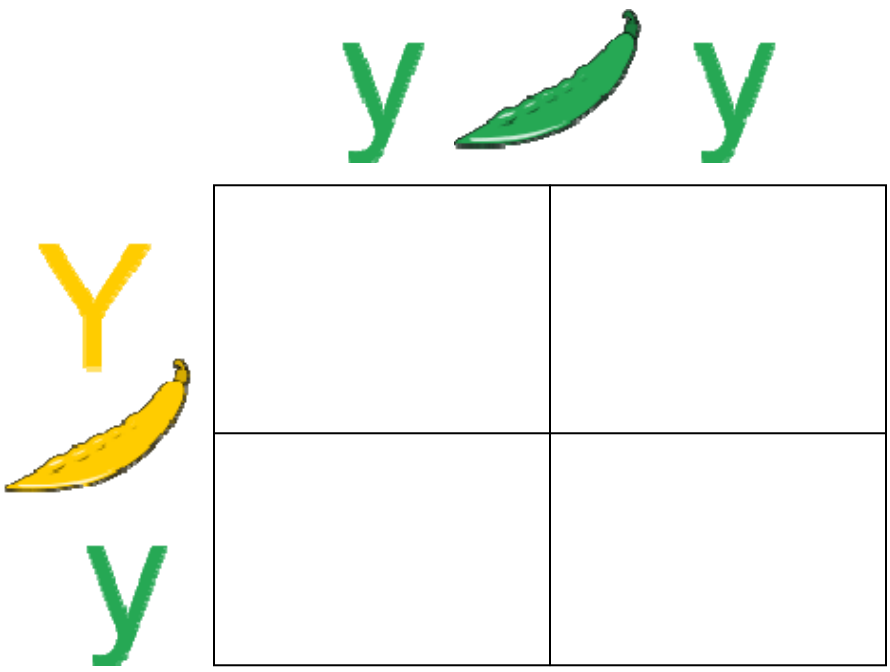
9

## Applying Mendel's Principles

**11.2 Applying Mendel's Principles** *(page 266)*

■How can you find the likelihood of the genetic makeup of offspring?

–_____




11

## Phenotype and Genotype

- **Phenotype** is the physical _____ of a trait. It is determined by.....____

- **Genotype** which is the _____ makeup of the _____.

12

# Most Inheritance is not that Simple!

## Other Patterns of Inheritance

**11.3 Other Patterns of Inheritance** *(page 271)*

- Heredity is more complicated than Mendel once thought

–Most _____ have more than one _____

–Sometimes there is no _____

–Sometimes inheritance results in _____ _____ of characteristics

–Genetic inheritance can be influenced by the _____

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## Passing on Traits

- Organisms inherit _____ information in a variety of ways that result in continuity of _____ and _____ between parents and offspring.

17

## As a result of...MEIOSIS

**11.4 Meiosis** *(page 275)*

- _____ is cell division that results in the production of sex cells

- Sex cells have _____the number of _____as the parents body cells

18

## **Production of Sex Cells** 19

## Passing of Traits from Parents to Offspring 20

Every _____ requires a set of coded instructions for specifying its traits. For offspring to resemble their parents, there must be a reliable way to _____information from one generation to the next. Heredity is the passage of these instructions from one generation to another. (2.1b)

## Chromosome Number

■Chromosomes
–Strands of DNA and _____ inside the cell nucleus that are carriers of _____
■Offspring
–One set of _____ comes from father and one from mother through the production and fertilization of _____ cells

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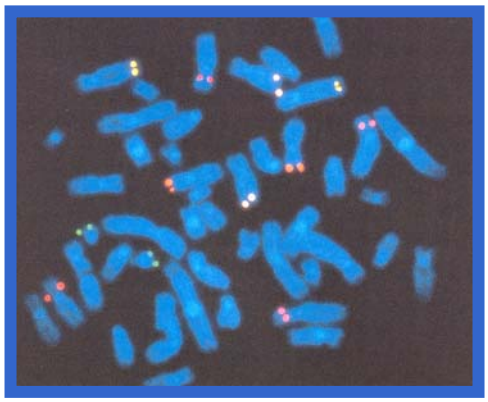
Organisms from all kingdoms possess a set of instructions (_____) that determines their _____. These instructions are passed from _____ to _____ during reproduction. Students are familiar with simple mechanisms related to the inheritance of some physical traits in offspring. (KI2)



22

## Fertilization

In _____ _____ organisms, the new individual receives _____of the _____ information from its mother (via the egg) and half from its _____ (via the sperm). Sexually produced offspring often resemble, but are _____ identical to, either of their parents. (2.1e)

24

Genetic Information is combined to produce an offspring which will have a variety of traits

26

## So....What about Asexual Reproduction?????

### The End Result....Asexual....

In _____ reproducing organisms, all the genes come from a single parent.

Asexually produced offspring are normally genetically _____ to the parent.

28

■Explain how the structure and replication of genetic material result in offspring that resemble their parents (PI 2)

30

# DNA

**Chapter 12: DNA8**

Structure and Function 31

# How do genes work?

12.1 Identifying the Substance of Genes *(page 288-291)*

A man named Frederick _____ studied bacteria in mice to find out what caused pneumonia. During his research, he learned about a process called _____ _____and concluded that _____ was a transforming molecule.

32

# Griffith's Experiment

■First he injected the mouse with a live strain of disease causing bacteria

What happened? _____

33

# Griffith's Experiment

■Second, he injected the mouse with a live strain of harmless bacteria

What happened? _____

34

# Griffith's Experiment

■Third, he injected the mouse with a live strain of disease causing bacteria

What happened? _____

35

## Griffith's Experiment

■Lastly, he injected the mouse with a live strain of disease causing bacteria

What happened? _____|

36

## The Role of DNA

**How could DNA do all the things that genes were known to do?**

■_____ Information

–DNA makes up _____ which store all the information necessary to make up an organism

■_____ Information

–Cells must copy genetic information before they divide

■_____ Information

–DNA molecules must be sorted and _____ down when cells divide

–Valuable information cannot be lost

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# Discovery of DNA

**12.2 The Structure of DNA**

Hereditary _____ is contained in _____, located in the chromosomes of each cell. An inherited _____ of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of _____ genes in its nucleus. (2.1c)

41

## Components of DNA include

- Nucleotide

–_____

–_____

-_____

43

The inherited _____ that are passed from parent to offspring exist in the form of a _____. This code is contained in DNA _____. (KI 2)

44

## Make a Model of DNA

- Imagine that you are working in a Laboratory and you need to know information about the 3-D structure of DNA. Your job is to make a model of DNA using the molecular model kit provided.

- DNA Structure Lab

45

In all organisms, the coded instructions for specifying the characteristics of the organism are carried in _____, a large molecule formed from subunits arranged in a sequence with bases of four kinds (represented by _____, **G,** _____, and _____). The chemical and structural _____ of _____ are the basis for how the genetic information that underlies heredity is both encoded in genes (as a string of molecular bases) and replicated by means of a template.

46(2.1f)

# DNA Replication

12.3 DNA Replication *Page 296-87*

■Copying the Code

–DNA must be _____ for Cell Division

•DNA separates into two strands (unzips) forming **replication** _____

–**Enzymes** pulls the DNA apart

–The enzyme _____ _____ connects new DNA molecules to make a new strand of DNA

•Base pairing results in two new strands

–_____ (**A**denine to **T**hymine) AT

–_____ (**G**uanine to **C**ytosine) **G**ates **C**hili

47

■The DNA molecules must be accurately replicated before being passed on. 48

Why can bacteria cells reproduce so quickly?

Replication in Living Cells: Prokaryotes (Bacteria) *Page 298 49*

# RNA and Protein Synthesis

Chapter 13 Information and Heredity

Offspring _____ their parents because they _____ similar genes that code for the production of _____ that form similar structures and perform similar functions. (2.1j)

50

## What are the steps in making a protein?

13.1 RNA

| DNA | RNA |
|---|---|
| Sugar: _____ | Sugar: _____ |
| _____Stranded Helix | _____ Stranded |
| Bases: A___CG | Bases: A____CG |
| _____ the code for proteins | _____ the code in order to make proteins |

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## How does this Happen?

**13.2 Ribosomes and Protein Synthesis**

_____ is formed from the DNA

_____

RNA _____ the nucleus through pores in the nucleus

RNA provides a code for _____ in the cell to link amino acids together in a chain which forms a protein 55

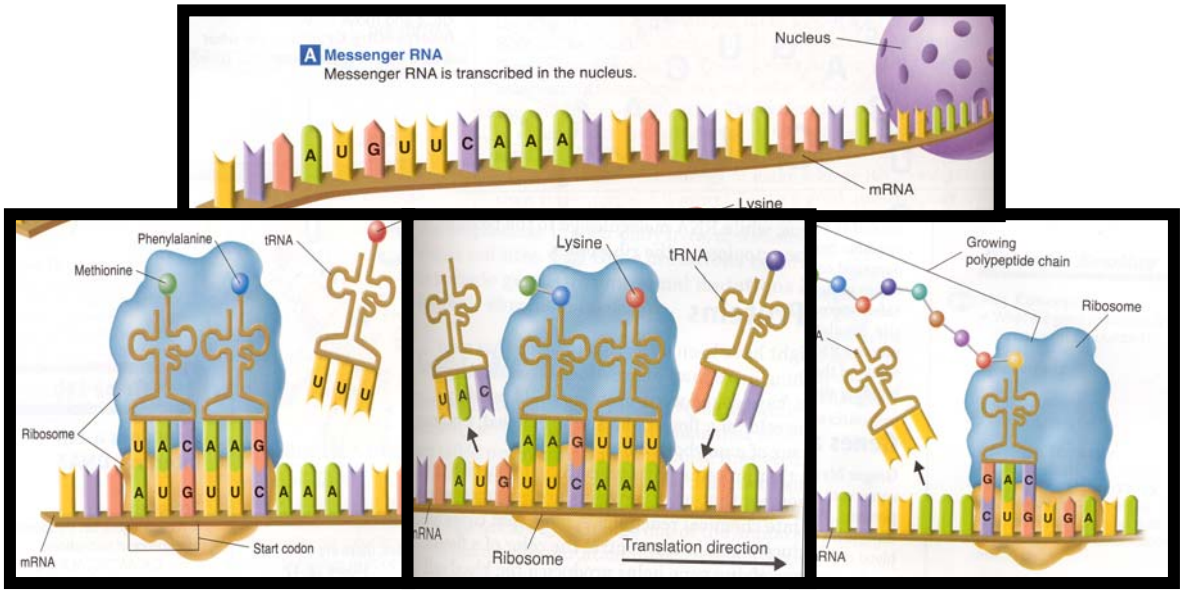
## The Genetic Code

- The _____ for proteins is held in **DNA** in the nucleus
  - **RNA** _____ this code
  - **RNA** _____ the code out of the nucleus to ribosomes in the cell
- Ribosomes
  - _____ are formed in the ribosome as tRNA carrying _____ _____ connect to the **mRNA** _____
  - 20 different amino acids can join together in many different arrangements to form proteins
- The _____ **of amino acids** is controlled by the **DNA code**

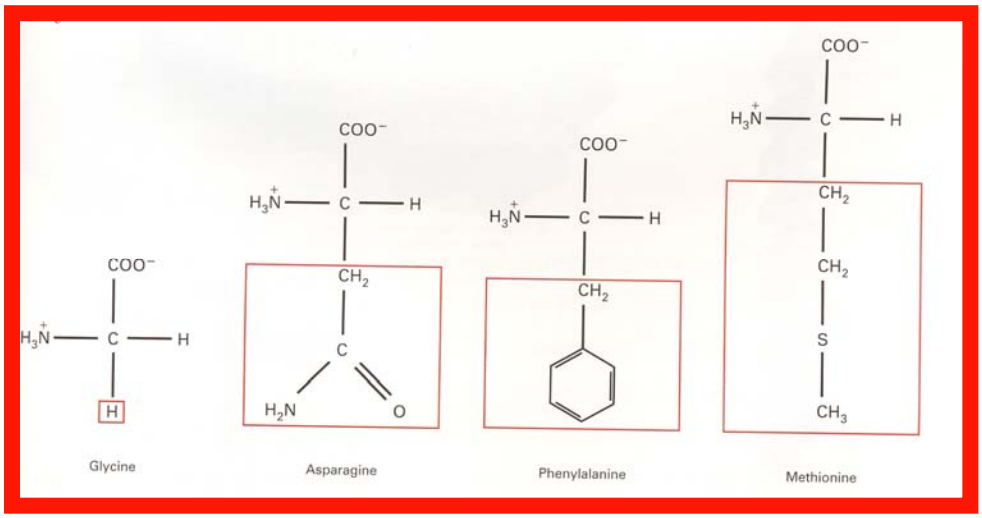
56

## A Picture of Messenger RNA traveling through a Ribosome


Once the _____ information is passed on, it is used by a cell to make _____. The proteins that are made become cell _____ and carry out most functions of the cell. 58



_____ are formed from small building blocks called Amino Acids 60




## How to read the code……

- Start and _____ codons are like punctuation
  - –Codon _____ Start
  - –Could have three different stop codons
- What _____ would be coded for from the DNA molecule below?

TACCTTGCATACCATGGGCTATCAAAA

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**The sequence of nitrogenous base triplets determines the amino acid sequence which makes a protein.**

TACCTTGCATACCATGGGCTATCAAAA
AUGGAACGUAUGGUACCCGAUAGUUUU

What is the AA? _____

## The Molecular Basis for Genetics

- _____, _____ and _____ put genetic information into action in a living thing
- Genetic code is nearly universal in all _____
  - –If two organisms have the same protein, the code for that particular protein will be the _____
  - –i.e. Code for insulin in dogs and humans

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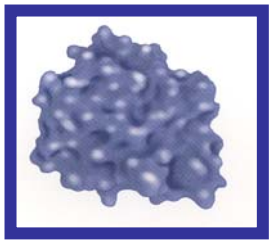
## Hemoglobin is a molecule in Red Blood Cells that carries oxygen.



What do the diagrams represent?

65

The work of the cell is carried out by the many different types of molecules it assembles, mostly _____. Protein molecules are long, usually folded chains made from 20 different kinds of _____ **acids** in a specific sequence. This sequence influences the shape of the protein. The shape of the protein, in turn, determines its function. (2.1i) 66

# Build a Large Scale Model of DNA

- Using the materials provided, build a large scale model of DNA to hang in the room.
- Build a model of the enzyme that will separate DNA.
- Build a model of the RNA Nucleotides that will connect to the DNA strand in the room.
- Build a nucleus with a pore large enough for only the RNA to exit into the cell.
- Build a ribosome which will allow tRNA's to enter and result in the synthesis of a protein.
- Connect Amino Acids into a chain which represent a protein.
- Fold your protein in a way that demonstrates different shapes proteins make.

70

The many body cells in an individual can be very _____ from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. This is because different parts of these instructions are used in different types of cells, and are influenced by the cells environment and past history (2.1k)

71

# What happens when the code is changed?

A change in the genetic code that can be inherited, may result in changes in the organism

72

■OK…So the Teenage Mutant
■Ninja Turtles aren't real!

## Mutations in Genes of Body Cells

■Changes in _____ (genetic information may be passed on to offspring or they may cause _____ to behave differently


77

Mutations in Genes of Sex Cells Result in Traits Being Passed Down

What type of mutation causes "tailles" manx cats?

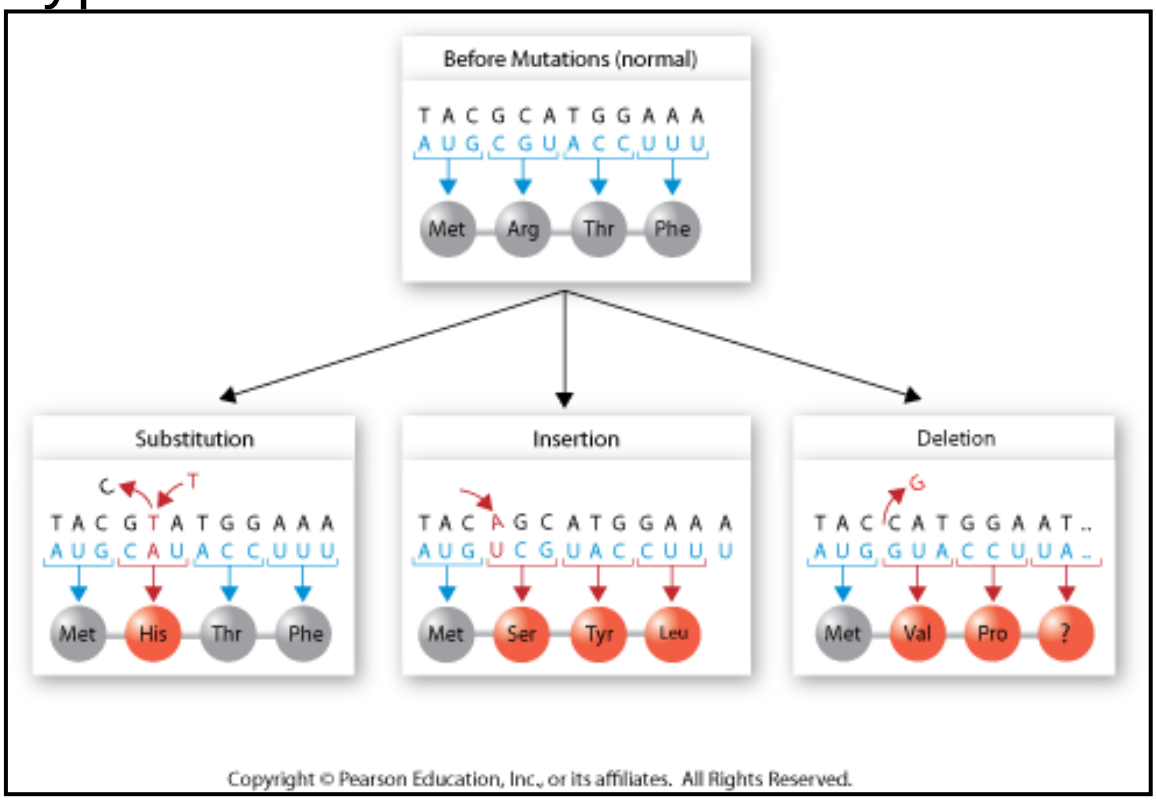
_____

78

Inserting, _____, or _____ DNA segments can alter genes. An _____ gene may be passed on to every cell that develops from it (2.2d)

80

# Types of Mutations 13.3 Mutations

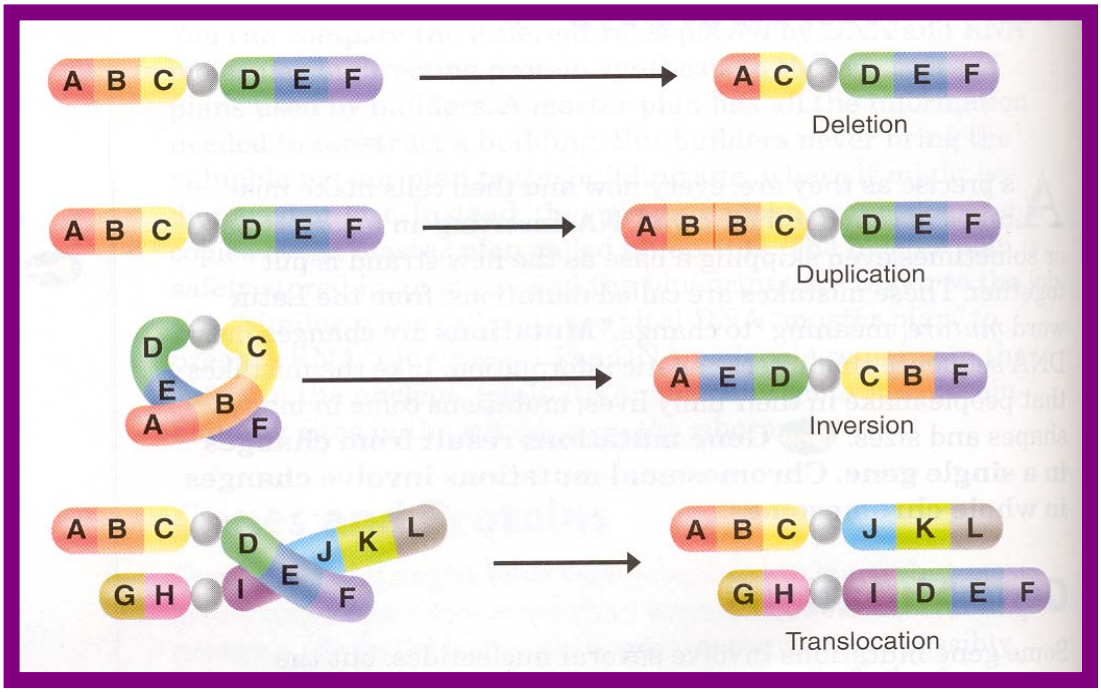



81

New _____ characteristics can result from new _____ of existing _____ or from _____ of genes in reproductive cells (3.1c)

82

## Mutations in Chromosomes
## Mistakes in Meiosis can Cause Even More Abnormalities

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# Effects of Mutations

**▪Mutagen**

–_____or physical agents in the environment like pesticides, tobacco or smoke

| Helpful Effects | Harmful Effects |
|---|---|
| ■ May make _____ function in useful ways | ■ Change in _____ that alter function in organism |
| ■ In plants some mutations result in _____ fruit i.e. polyploidy | ■ _____ may result from mutations i.e. some cancers |

## How are genes expressed?

13.4 Gene Regulation and Expression

Each of the _____ cells contain all the DNA necessary for all _____. Only certain parts of the DNA molecule will be _____. There is a sort of "switch" that turns genes on and off.

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## Environmental Influences on Gene Regulation

- _____ production can control gene expression
- For Example, in metamorphosis
  - Hormones control _____ of genes that regulate moving through various stages
  - Factors can alter hormone production
    - _____
    - Scarcity of food
    - Population _____

87

## Genes are inherited, but their expression can be modified by interactions with the environment

(2.1a)

87

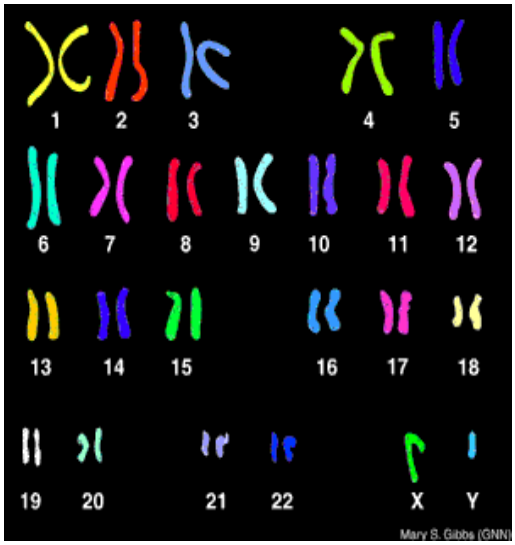
Throughout recorded history, humans have used _____ breeding and other _____ methods to produce products or organisms with desirable traits. Our current understanding of DNA extends this to the _____ of genes leading to the development of new combinations of traits and new varieties of organisms. (KI 2)

90

# Human Heredity

Chapter 14

- Species have different number of chromosomes
  - Humans have _____ pairs (46)
- Karyotype
  - _____ of the chromosomes

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# Human Inheritance

## What does it mean, “it runs in the family?”

14.2 Human Genetic Disorders

■Some diseases are controlled by genes, others may involve genetics but also may be influenced by the environment

| _____ Cell Anemia | Huntington’s Disease | _____ Fibrosis |
|---|---|---|
| Change in the DNA code for the gene that codes for _____ | Caused by a _____ gene that _____ for a protein in the brain (CAG repeats) | Caused by the _____ of three bases in one gene resulting in changes in the folding of protein |

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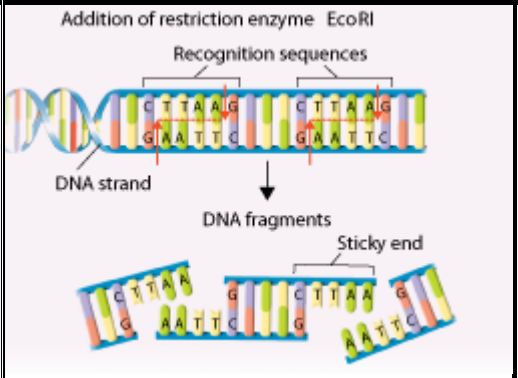
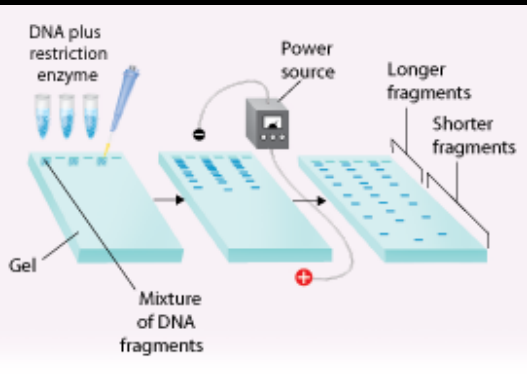
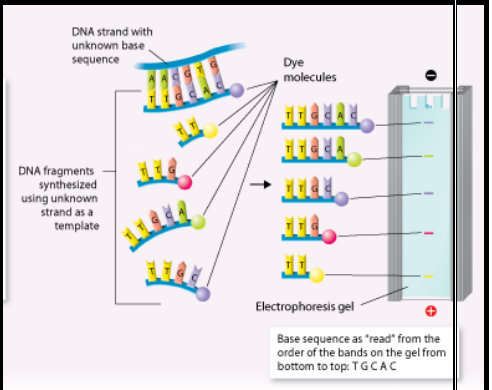
## Analyzing DNA

14.3 Studying the Human Genome

| Cutting DNA | Separating DNA | Reading DNA |
|---|---|---|
| adding enzymes to break bonds in certain locations of the DNA molecule | Fragments put into gel wells and electrical current is run through a buffer to move different sized fragments in gel | DNA fragments of different lengths move across the gel with the smallest moving furthest away from well |
|   |   |   |

## …..The Tomato…and more?

In recent years _____ _____ of farm plants and animals have been engineered by manipulating their genetic instructions to produce new characteristics (2.2b)

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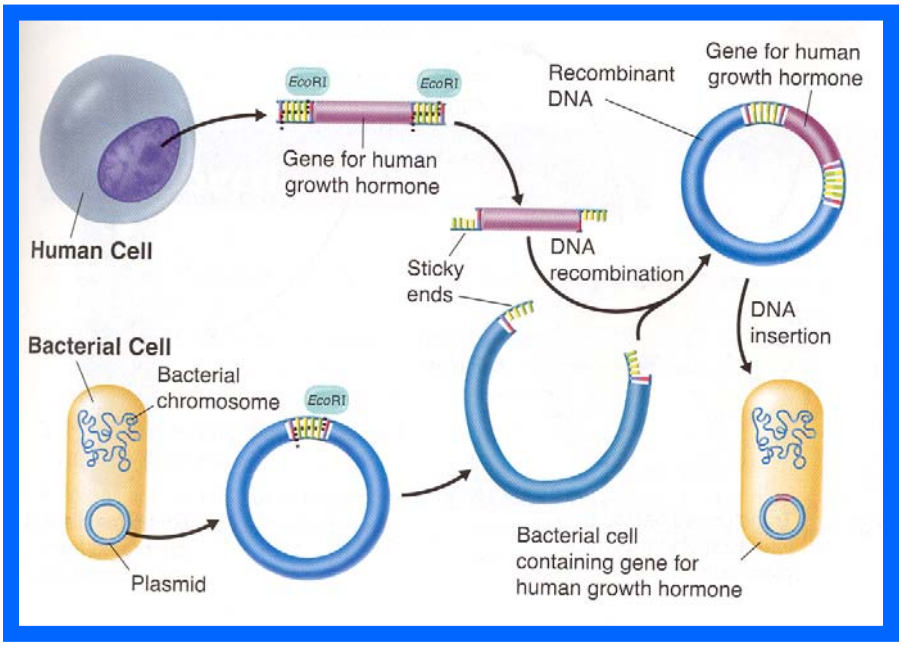
## Transfer of a Gene into a Bacterial Cell (Recombinant DNA)

Different _____ can be used to _____, copy, and move _____ of DNA.

Characteristics produced by the segments of DNA may be expressed when these segments are inserted into new organisms, such as bacteria (2.2c)




100

Knowledge of genetics is making possible new fields of _____ care; for example, finding genes which may have _____ that can cause disease will aid in the development of preventive measures to fight disease. Substances, such as _____ and _____, from genetically engineered organisms may reduce the cost and side effects of replacing missing body chemicals. (3.1b)

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- Biotechnology and preserving endangered species
  - 60 minutes cloning video

They are now able to begin to understand the _____ basis of _____ and how this set of instructions can be changed through _____, _____, and genetic engineering.

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Mom, Dad and Clogged Arteries

- Some proteins in the blood pick up cholesterol molecules
- High Density Lipoproteins (HDL's) carry cholesterol to the liver where it is broken down.
- Low Density Lipoproteins (LDL's) normally end up in cells that store or use cholesterol
- Sometimes too many LDL's form and end up in the arteries forming plague like in the picture in the last slide.
- How well you handle dietary cholesterol depends on genes from your parents 108