Psych 3102
Introduction to Behavior Genetics

Background

Vocabulary

Concepts

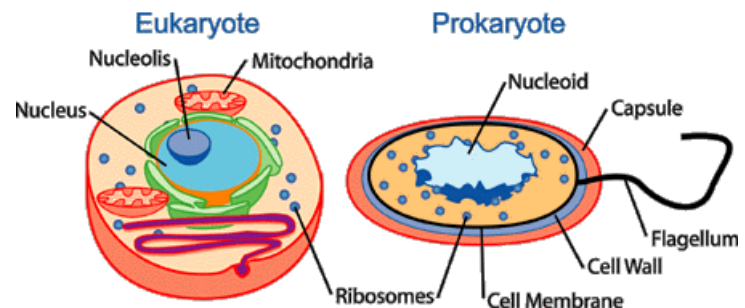# Vocabulary

- 'prokaryote'

  - no internal membrane-bound structures

  - single, circular chromosome

  bacteria   Archaea   (mitochondria)

- eukaryote

  - internal, membrane-bound cell structures

  - multiple, linear chromosomes

  all other life-forms

- **somatic cells**

- body cells
  - diploid
  - divide by mitosis

If changes are made to the DNA of somatic cells, do the changes have potential to become part of the human genome?

- **germ line cells**

- only found in gonads
  - diploid
  - divide to form reproductive cells by meiosis

Will the person whose germline cells undergo DNA sequence changes be affected by those changes?

- **gametes**

- reproductive cells
  - haploid
  - fuse in pairs at fertilization

- **DNA**
  - nucleic-acid, genetic material found in chromosomes

- **chromosomes**
  - condensed DNA visible during cell division
  - at start of division consist of 2 chromatids held together at centromere

- **chromatin**
  - most common, un-condensed form chromosomes take during interphase
  - genes able to be expressed

Chromosome complement in eukaryotes

- multiple, linear, species-specific number
- 2 of each type of chromosome in diploid cells

Humans 2n = 46   diploid species

Drosophila 2n = 8

mice 2n = 40   rats 2n = 42

horse 2n = 64   dog 2n = 78

sweet potato 2n = 90

bread mold n = 7   haploid species

genome - haploid chromosome complement

karyotype – visual display of diploid chromosome complement, arranged in homologous pairs

- **sex chromosomes**

    - determine biological sex of organism
    - genes coded by their DNA are known as sex-linked
    humans   XX = female
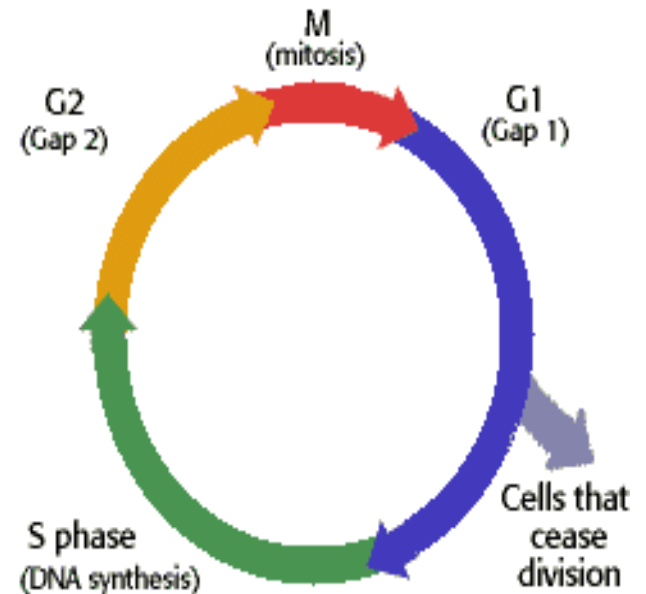   XY = male

- **autosomes**

    - all other chromosomes
    - genes encoded are known as autosomal

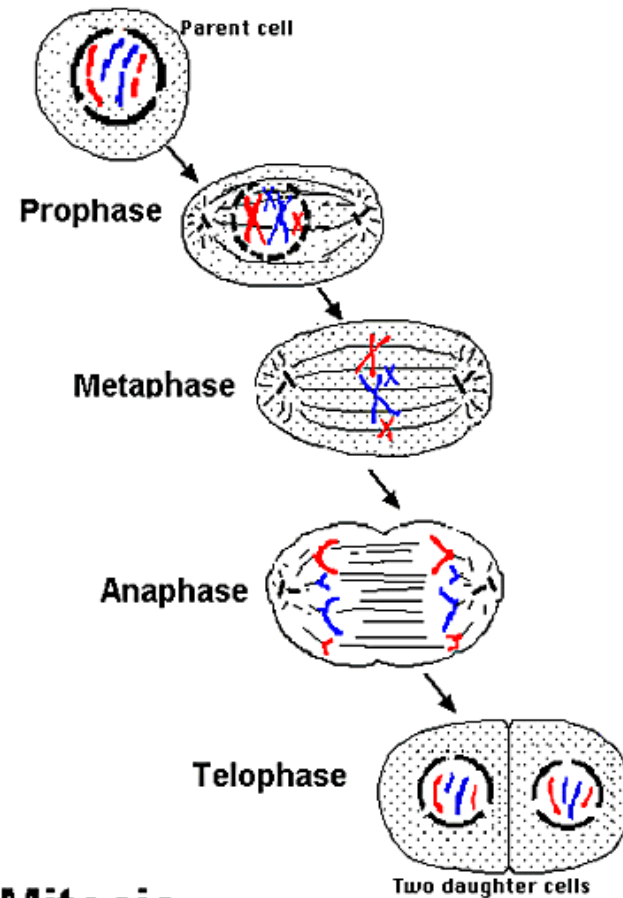# Cell cycle

- Interphase (G1, S, G2)

    - normal cell functioning

    - genes expressed

- M (mitosis) phase

    - division of cell nucleus

- cytokinesis division of cell cytoplasm

Mitosis

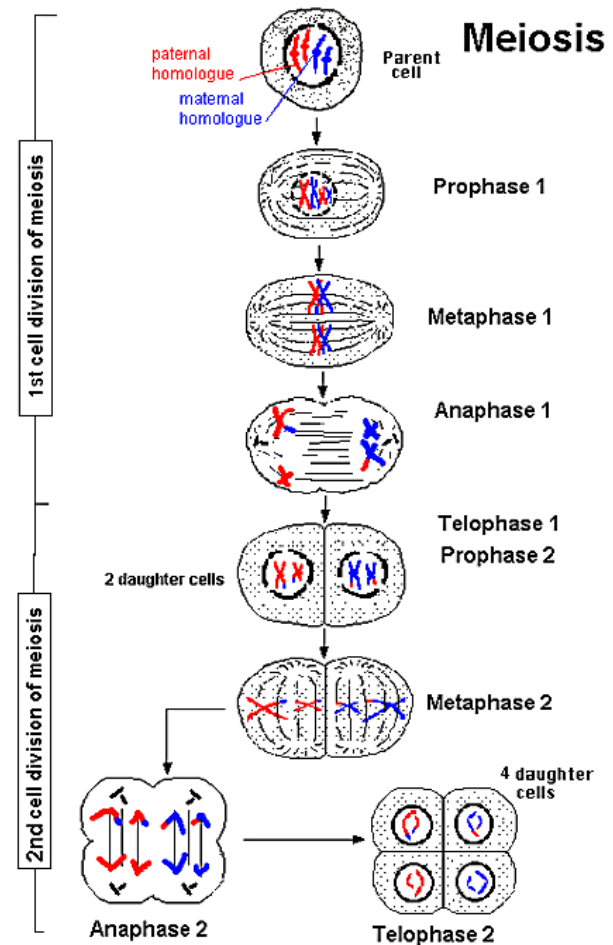- produces identical diploid somatic cells
- separation of sister chromatids

Animation

Parent cell

Prophase

Metaphase

Anaphase

Telophase

Two daughter cells

Mitosis

Meiosis

- produces non-identical haploid gametes
- 2 divisions
- meiosis I separates homologous pairs
- meiosis II separates sister chromatids

Animation

Sources of genetic variation during sexual reproduction
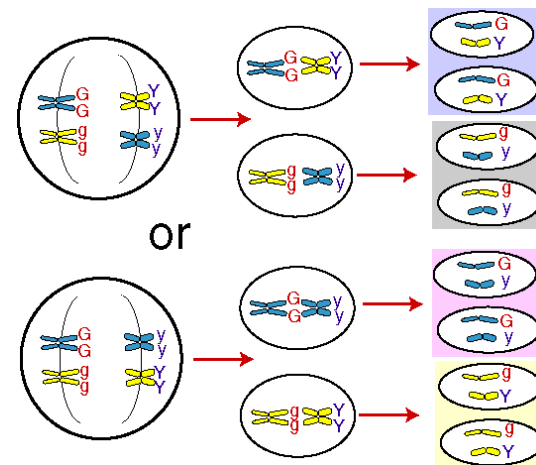
1. Fertilization

   combination of male and female chromosomes

2. Independent segregation

   8 m possible gametes

3. Recombination

   crossing-over between non-sister chromatids of homologous pairs

More vocabulary

- **gene** fundamental unit of inheritance, segment of DNA found at a particular location, but functionally very difficult to define

"A gene is a union of genomic sequences encoding a coherent set of potentially overlapping functional products"   ENCODE (Gerstein et al 2007 Genome Res)

- **locus** location of a particular DNA sequence in the genome eg 6p22.1

- **allele** alternative form of the sequence at a locus

- **polymorphism** a region of DNA that commonly varies person to person (ie. alleles exist in that region)

simplest variation = 1 base-pair difference between alleles

= **SNP** single nucleotide polymorphism

heterozygous - alleles are different on the homologous pair $(A_1 A_2)$

homozygous -   alleles are same on the homologous pair $(A_1 A_1)$

- **genetic markers** loci known to be polymorphic within a species

most humans are heterozygous at about 20 million sites on the human genome

about 11 million of these sites are SNPs (used as markers)

Example of a SNP (single nucleotide polymorphism)

allele A_1 …. TGCGTCGTCGGT……
               ACGCAGCAGCCA……

allele A_2 ….TGCGTCGCCGGT…..
               ACGCAGCGGCCA….