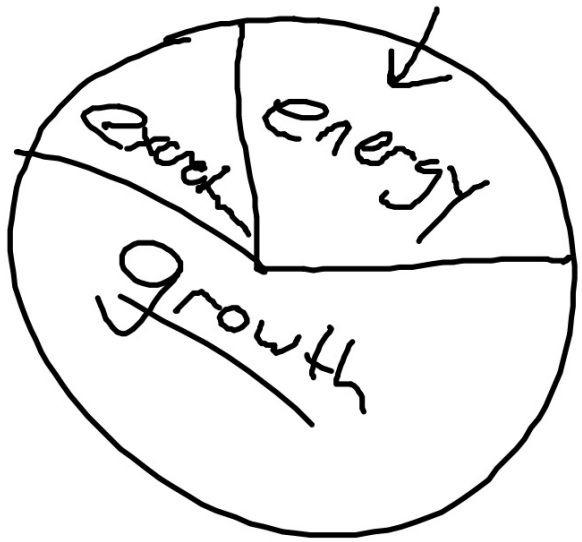
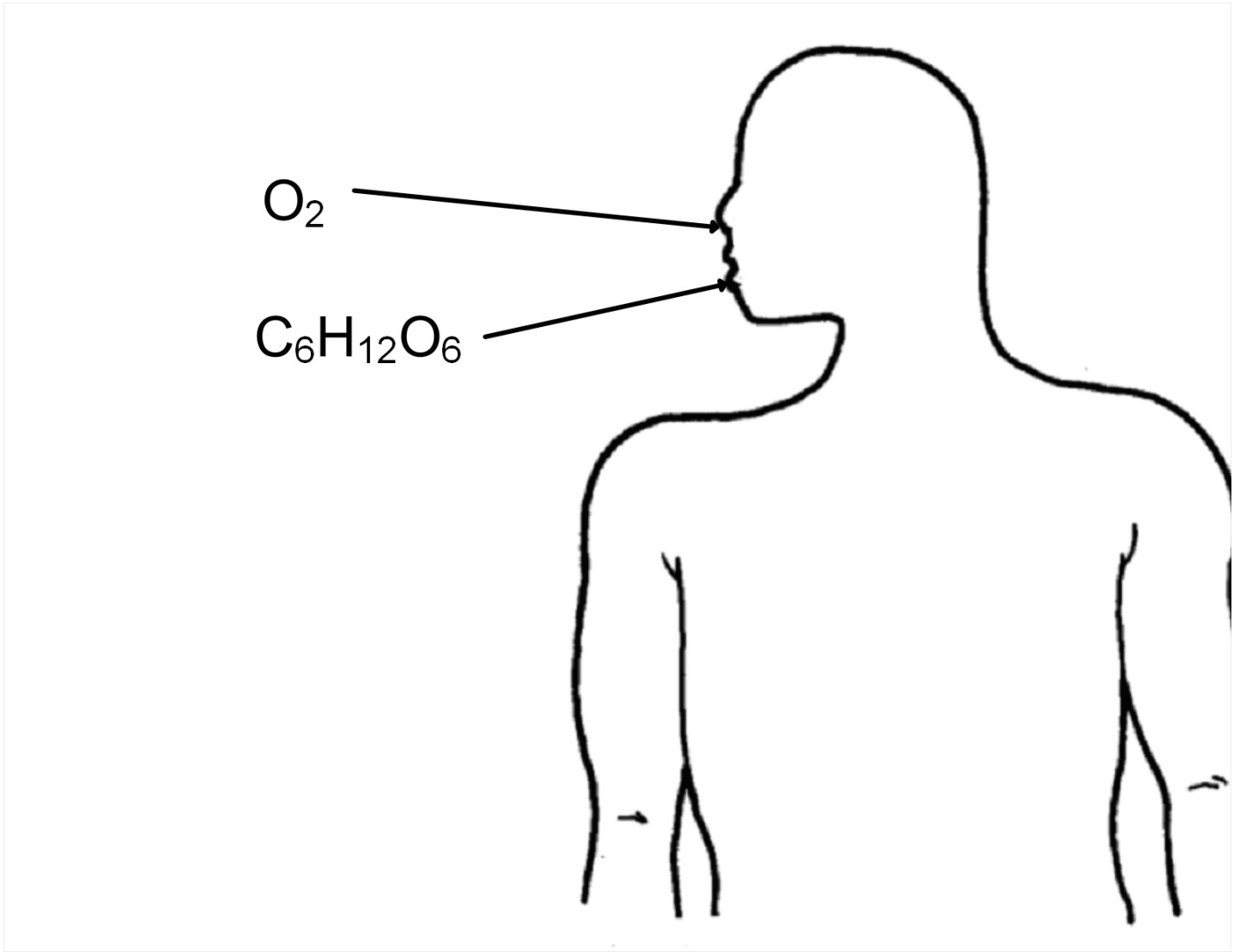
Kickoff:

1. Why is it important for humans to take in carbohydrates?

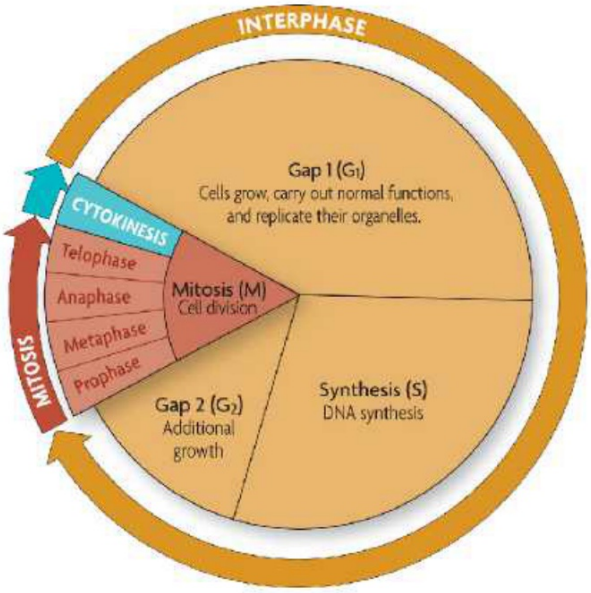


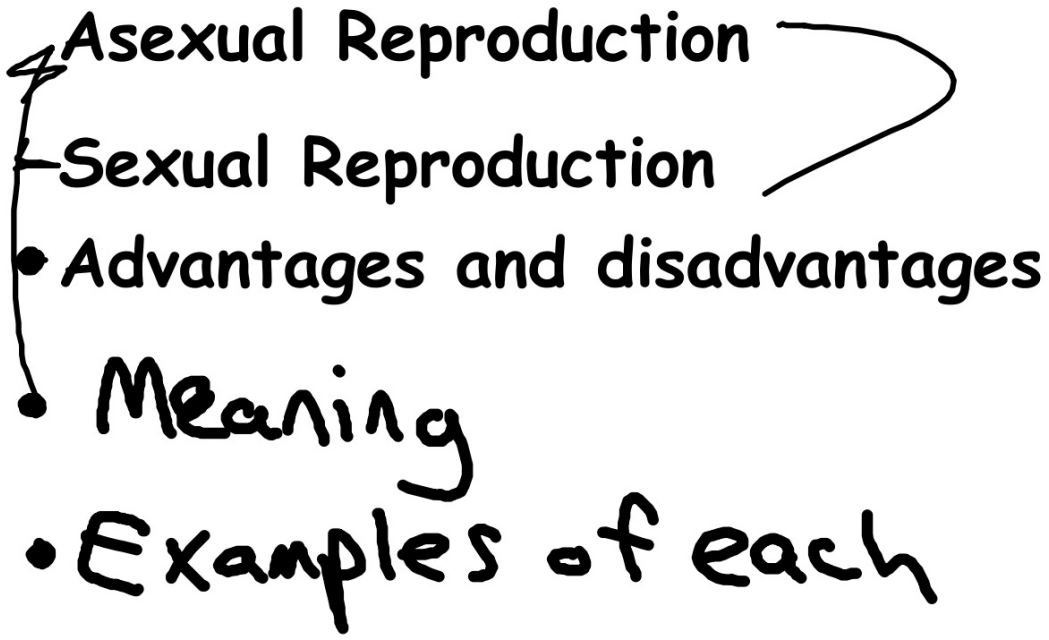

O_2
$C_6H_{12}O_6$

5.1 The Cell Cycle

The cell cycle has four main stages.

- The cell cycle is a regular pattern of growth, DNA replication, and cell division.




Asexual Reproduction
Sexual Reproduction
Advantages and disadvantages
Meaning
Examples of each

1 parent 2 parents

Asexual or Sexual Reproduction?

- How many parents?
- How much of the DNA comes from each parent?

A = 100%

S = 50%

Asexual reproduction

1. One parent
2. Offspring 100% genetically identical to parent's DNA
3. Involves Mitosis

Somatic cells = body cells

gametes = Sex cells

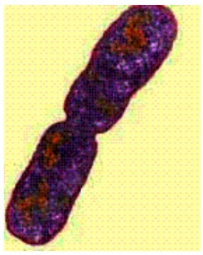
meiosis

Examples: cuttings

Pineapples (Ananas comosus)

Fission-splitting of one cell into two

Bacteria



binary fission in prokaryotes

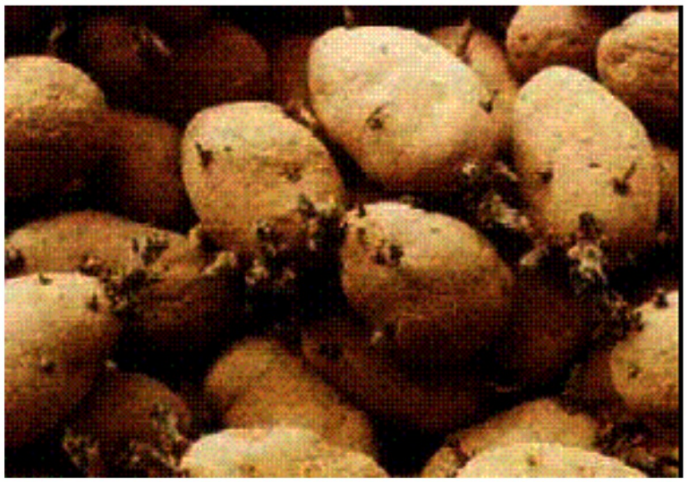
Sprouting

Potato Sprouting

Solanum tuberosum

Infer *how the genetic material in the small strawberry plant above compares to the genetic material in the large strawberry plant.*

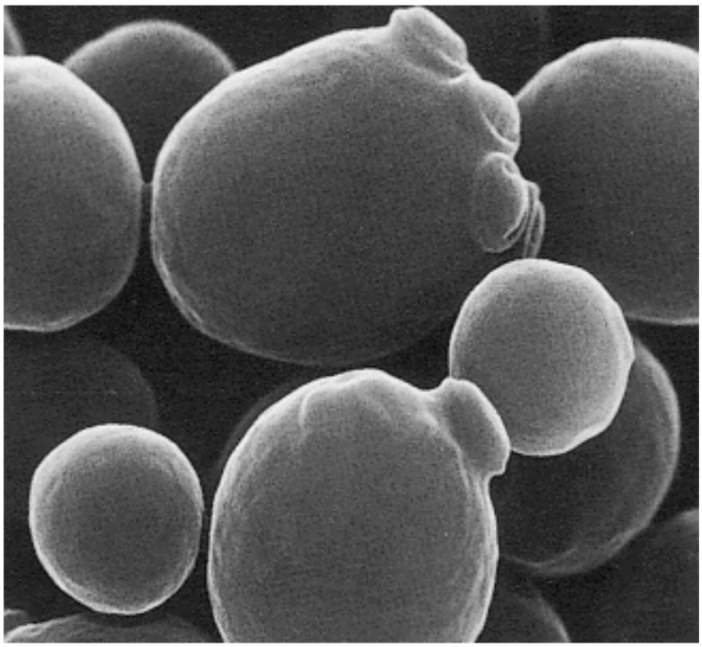
vegetative propagat



cloning

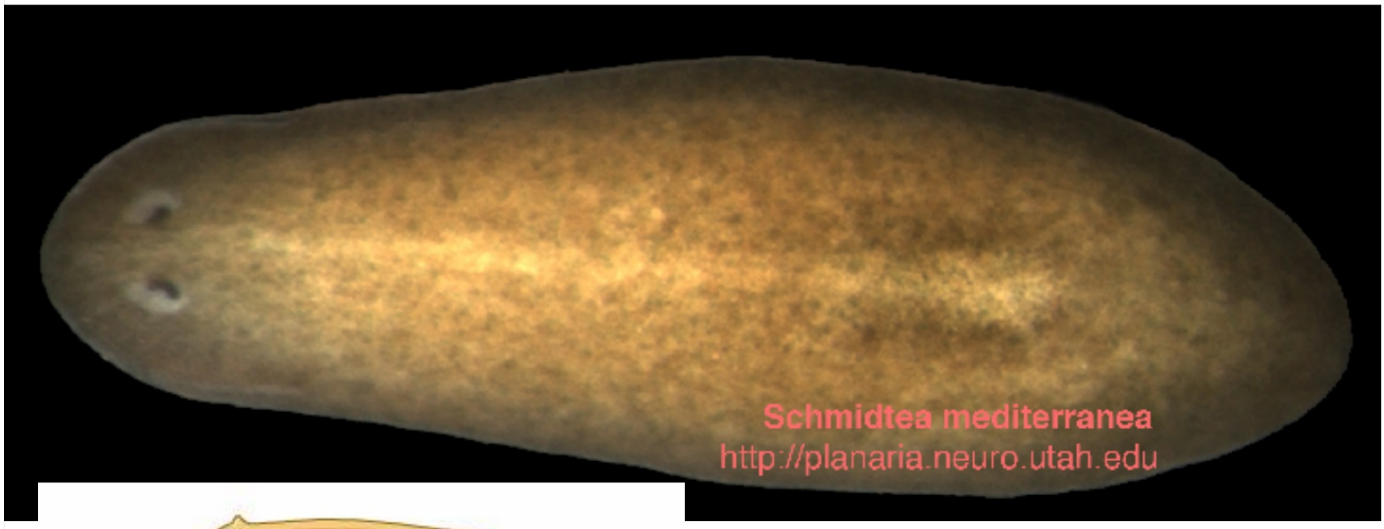
Budding

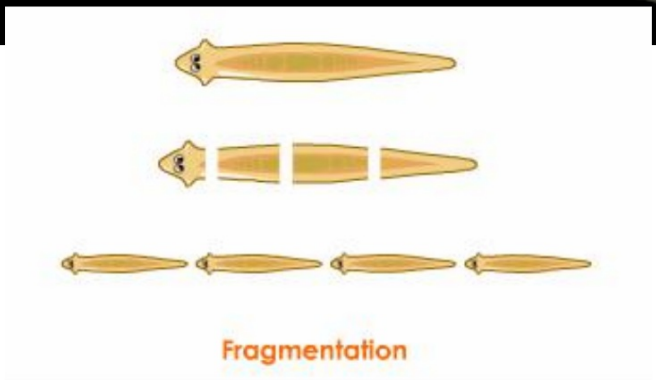
Hydra



Yeast

Regeneration





Advantages	Disadvantages
*Quick reproduction *No need to find a mate *Good genes passed on	*No genetic diversity. *No adaptations.

Sexual Reproduction

1. Two parents
2. Offspring gets half of DNA from each parent
3. Involves meiosis

gamete formation

Sexual Reproduction

Advantages	Disadvantages
Genetic diversity: some members could survive a changing environment or disease.	Reproduction is slow. Takes energy and time to find a mate.

SEXUAL VS. ASEXUAL
SCENARIO # 1

A strawberry plant has been growing for three seasons. It sends out "runners" along the ground. These runners take root and produce new strawberry plants.

SEXUAL VS. ASEXUAL
SCENARIO # 2

The DNA of a bacterium doubles. The cell divides in half in a process called fission. This process continues every 20 minutes until food for the bacteria becomes scarce. The population levels off.

SEXUAL VS. ASEXUAL
SCENARIO # 3

Two bacterium form a connecting bridge during conjugation. One cell donates material to the second cell. The two cells separate by dissolving t connecting bridge.

SEXUAL VS. ASEXUAL
SCENARIO # 4

A *Euglena* has reached its maximum size. The nucleus of the *Euglena* reproduces the DNA and then divides in half. The rest of the *Euglena* divides along its length.

SEXUAL VS. ASEXUAL
SCENARIO # 5

A yeast cell stretches its outer shell until a bump or "bud" appears. The genetic material divides in half and part of this material goes into the bud. The bud pinches in until it breaks off.

SEXUAL VS. ASEXUAL
SCENARIO # 6

Two gametes from protozoans come together or fuse. This fusion forms a zygote.

SEXUAL VS. ASEXUAL
SCENARIO # 7

The egg from a female dog is fertilized by the sperm of a male dog. This produces a fertilized egg.

SEXUAL VS. ASEXUAL
SCENARIO # 8

Pollen from a pine tree is released into the air when the wind blows. Some of the pollen is trapped in the seed cone of the pine. A year after pollination a winged seed is released.

SEXUAL VS. ASEXUAL
SCENARIO # 9

An avid rose gardener collects pollen from his prize red rose and deposits this pollen on the stigma of a white rose. He has hopes of a new rose that can name after his wife.

SEXUAL VS. ASEXUAL
SCENARIO # 10

A female perch has laid a long strand of eggs along the river bottom. A male deposits milt, a fluid containing sperm, over the eggs.

SEXUAL VS. ASEXUAL
SCENARIO # 11

A careless diver hits a sponge with his flippers. The sponge breaks off. The piece that was broken off grows back into an entirely new sponge through the process of regeneration.

SEXUAL VS. ASEXUAL
SCENARIO # 12

Grandmother Sue is visiting her home of fifty years ago. She notices that the ivy her mother planted by the porch is still growing profusely. She takes a twig from the ivy and places it in water to "root" it. After roots appear, she plants the twig in soil. She will transplant it later to an area by her front porch.

SEXUAL VS. ASEXUAL
SCENARIO # 13

Dr. Jones, the veterinarian, artificially inseminates the cattle of Farmer Smith's herd. Farmer Smith is trying to improve the offspring his cattle produce without the expense of buying a pedigreed bull.

SEXUAL VS. ASEXUAL
SCENARIO # 14

Mrs. Thomas is planting her garden in the spring. She has several large potatoes. She cuts each potato so that the pieces have an "eye." She plants the "eye" pieces in her garden. Later, she has many large potatoes.

SEXUAL VS. ASEXUAL
EXTRA CREDIT # 1

The medusa (bell) of a jellyfish produces sperm. Another medusa produces eggs. The sperm and egg unite to form a swimming larva. The larva swims to a "good" place and then attaches itself to the bottom. It is then a polyp. The polyp grows larger and larger by budding. Finally, the polyp divides by fission to produce a new medusa that detaches and swims away.

SEXUAL VS. ASEXUAL
EXTRA CREDIT # 2

An apple farmer wants to create a more viable apple. He uses the roots and trunk of an apple that he has found very strong. He grafts a stem piece from a second apple that has weak roots but produces very large apples. This grafting must match the cambium layers of both apple trees so that they will grow together and form the water and food vessels necessary for life of the plant.

6.1 Chromosomes and Meiosis

KEY CONCEPT

Gametes have half the number of chromosomes that body cells have.

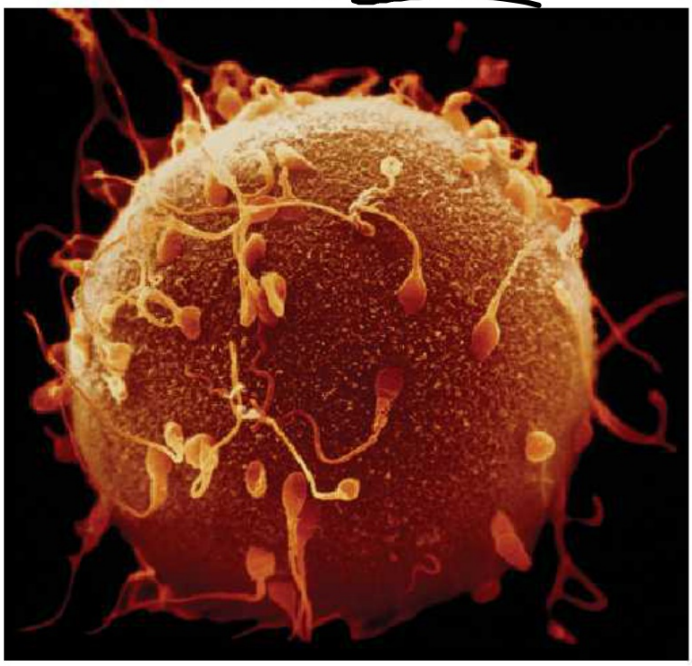
sex cells

n

(haploid

somatic cells - diploid)

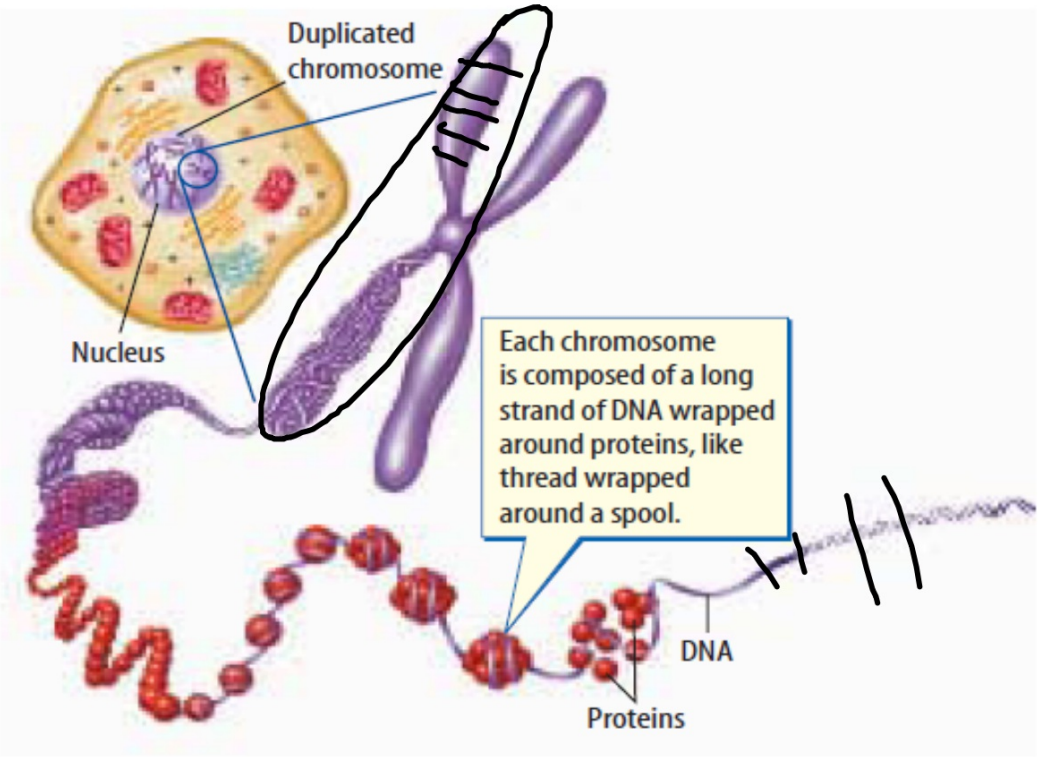
2n



5.2 Mitosis and Cytokinesis

46 c

- **Chromosomes condense at the start of mitosis.**
  - DNA wraps around proteins (histones) that condense it.



Kickoff:

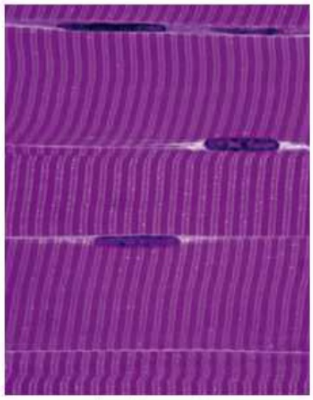
1. What are some differences (at least 2) betwee somatic cells and gametes?

2. What is a homologous chromosome?

6.1 Chromosomes and Meiosis

- **You have body cells and gametes.**
  - Body cells are also called somatic cells.
  - Germ cells develop into gametes.
    - Germ cells are located in the ovaries and testes.
    - Gametes are sex cells: egg and sperm.
    - Gametes have DNA that can be passed to offspring.

1/2



body cells

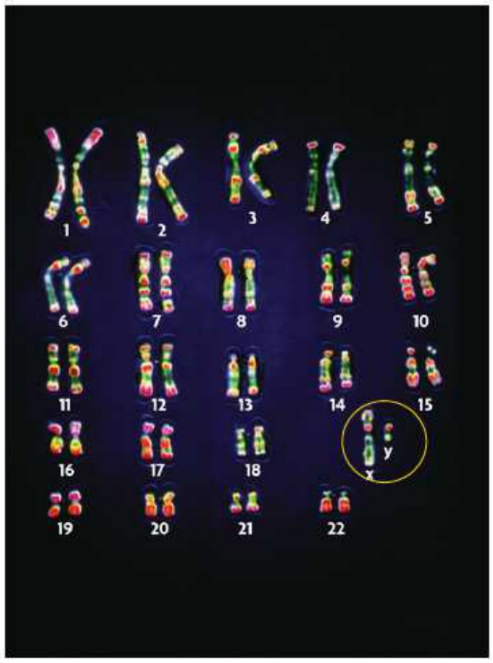
sex cells (sperm)

sex cells (egg)

6.1 Chromosomes and Meiosis

Your cells have autosomes and sex chromosomes.

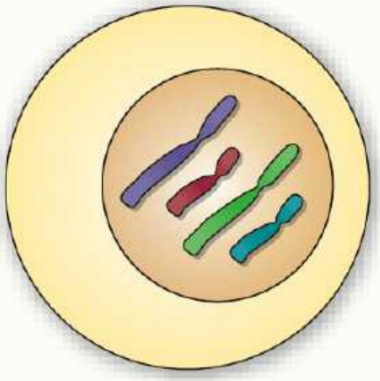
- Your body cells have 23 pairs of chromosomes.
  - Homologous pairs of chromosomes have the same structure.
  - For each homologous pair, one chromosome comes from each parent.
- Chromosome pairs 1-22 are autosomes.
- Sex chromosomes, X and Y, determine gender in mammals.



karyotype

6.1 Chromosomes and Meiosis

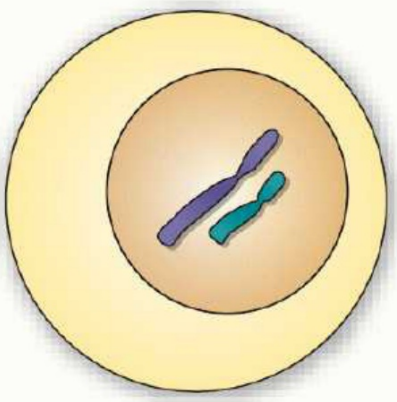
- **Body cells are diploid; gametes are haploid.**
  - Fertilization between egg and sperm occurs in sexual reproduction. forms a zygote.
  - Diploid ($2n$) cells have two copies of every chromosome. (one from mother, one from father) homologous
    - Body cells are diploid.
    - Half the chromosomes come from each parent.



Body cells are diploid ($2n$).

6.1 Chromosomes and Meiosis

- Haploid (*n*) cells have one copy of every chromosome.
  - Gametes are haploid.
  - Gametes have 22 autosomes and 1 sex chromosome.

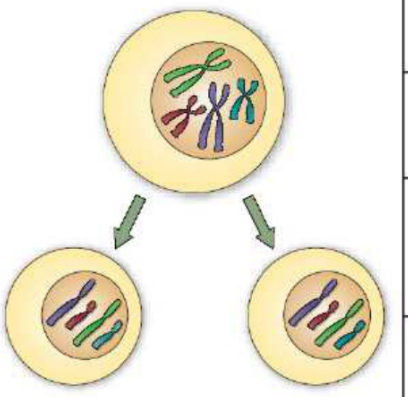


Gametes (sex cells) are haploid (*n*).

6.1 Chromosomes and Meiosis

- Chromosome number must be maintained in animals.
- Many plants have more than two copies of each chromosome.
- Mitosis and meiosis are types of nuclear division that make different types of cells.
- Mitosis makes more diploid cells.

MITOSIS



Produces genetically identical cells

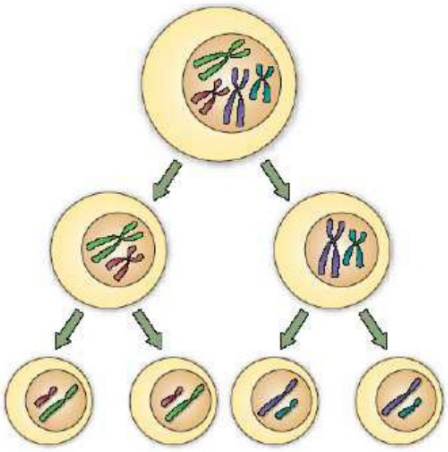
Results in diploid cells

Takes place throughout an organism's lifetime

Involved in asexual reproduction

6.1 Chromosomes and Meiosis

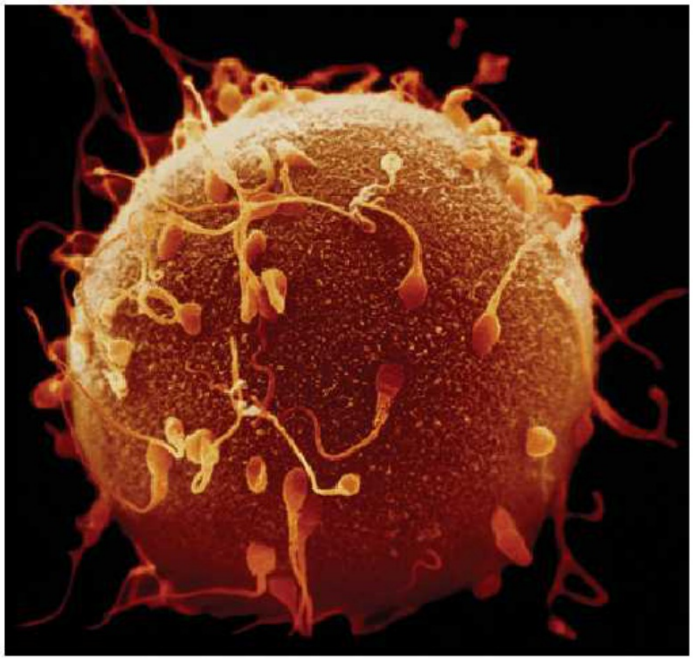
- Meiosis makes haploid cells from diploid cells.
  - Meiosis occurs in sex cells.
  - Meiosis produces gametes.

MEIOSIS	
Produces genetically unique cells	
Results in haploid cells	
Takes place only at certain times in an organism's life cycle	
Involved in sexual reproduction	

6.2 Process of Meiosis

KEY CONCEPT

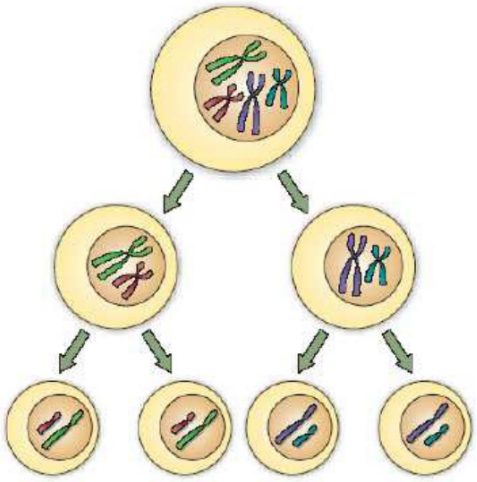
During meiosis, diploid cells undergo two cell divisions that result in haploid cells.



6.2 Process of Meiosis

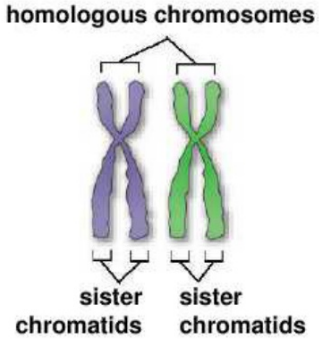
Cells go through two rounds of division in meiosis.

- Meiosis reduces chromosome number and creates genetic diversity.

MEIOSIS	
Produces genetically unique cells	
Results in haploid cells	
Takes place only at certain times in an organism's life cycle	
Involved in sexual reproduction	

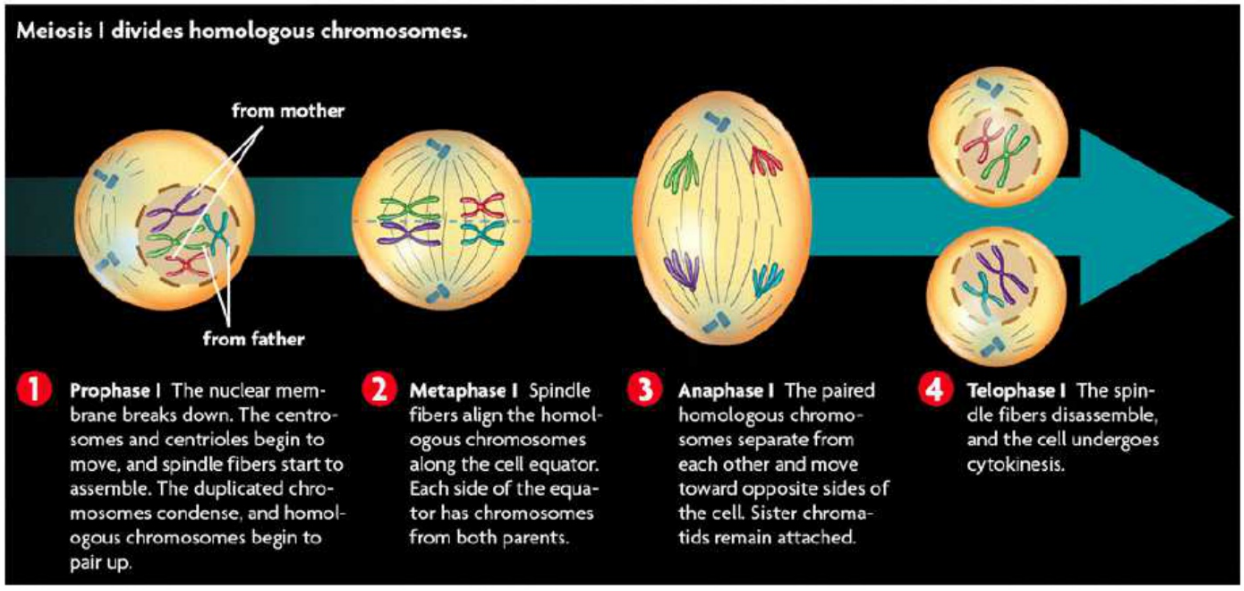
6.2 Process of Meiosis

- Meiosis I and meiosis II each have four phases, similar to those in mitosis.
  - Pairs of homologous chromosomes separate in meiosis I.
  - Homologous chromosomes are similar but not identical.
  - Sister chromatids divide in meiosis II.
  - Sister chromatids are copies of the same chromosome.



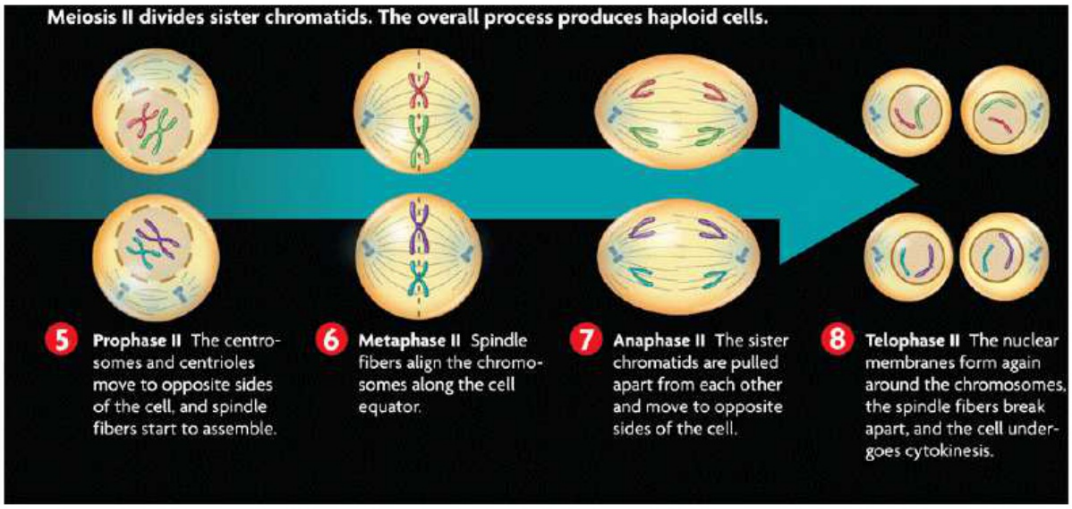
6.2 Process of Meiosis

- Meiosis I occurs after DNA has been replicated.
- Meiosis I divides homologous chromosomes in four phases.



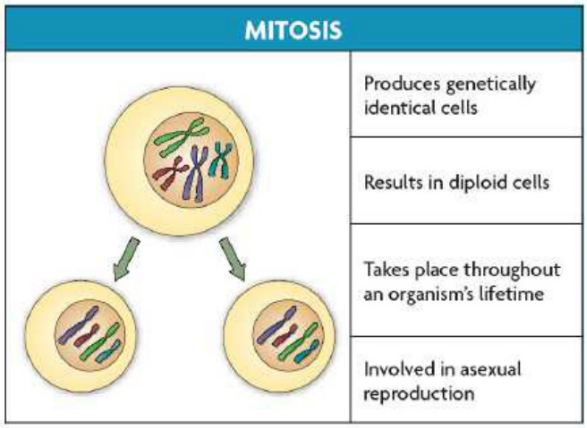
6.2 Process of Meiosis

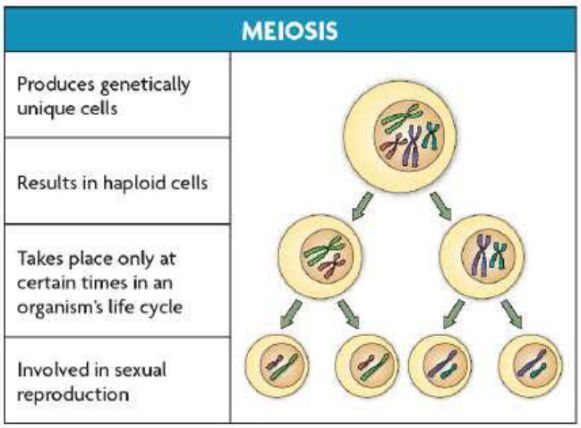
- Meiosis II divides sister chromatids in four phases.
- DNA is not replicated between meiosis I and meiosis II.



6.2 Process of Meiosis

- Meiosis differs from mitosis in significant ways.
  - Meiosis has two cell divisions while mitosis has one.
  - In mitosis, homologous chromosomes never pair up.
  - Meiosis results in haploid cells; mitosis results in diploid cells.

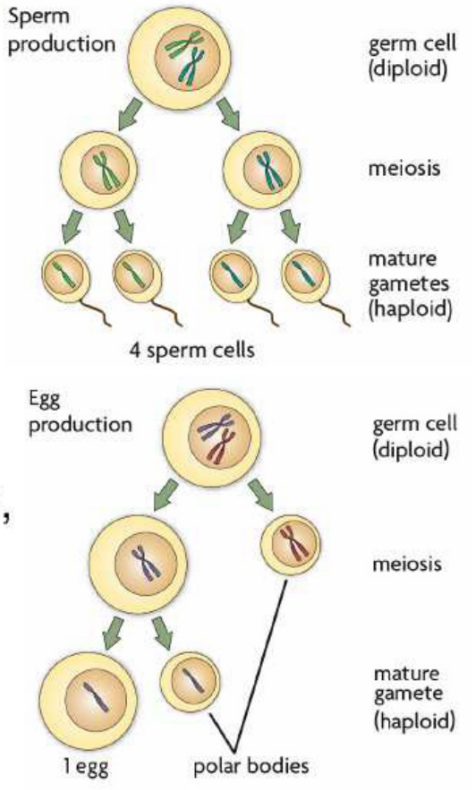




6.2 Process of Meiosis

Haploid cells develop into mature gametes.

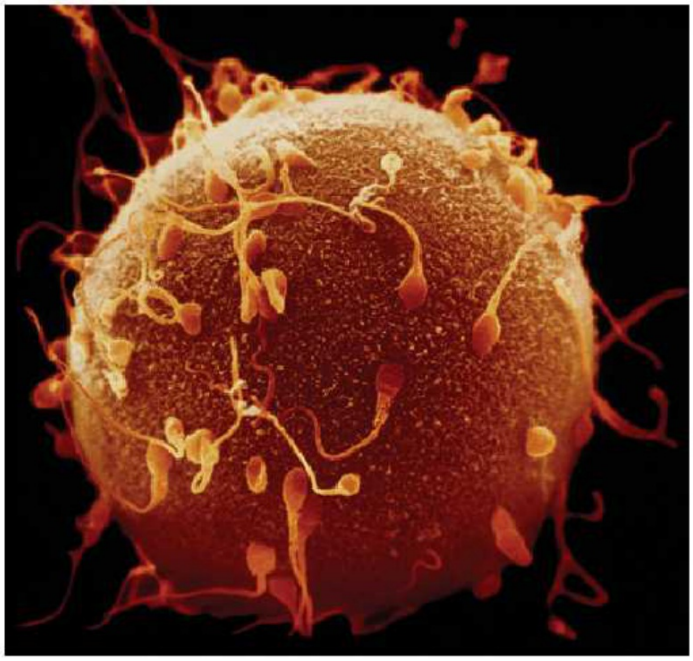
- Gametogenesis is the production of gametes.
- Gametogenesis differs between females and males.
  - Sperm become streamlined and motile.
  - Sperm primarily contribute DNA to an embryo.
  - Eggs contribute DNA, cytoplasm, and organelles to an embryo.
  - During meiosis, the egg gets most of the contents; the other cells form polar bodies.



6.6 Meiosis and Genetic Variation

KEY CONCEPT

Independent assortment and crossing over during meiosis result in genetic diversity.



6.6 Meiosis and Genetic Variation

Sexual reproduction creates unique combinations of genes.

- Sexual reproduction creates unique combination of genes.
  - independent assortment of chromosomes in meiosis
  - random fertilization of gametes
- Unique phenotypes may give a reproductive advantage to some organisms.

6.6 Meiosis and Genetic Variation

Crossing over during meiosis increases genetic diversity.

- Crossing over is the exchange of chromosome segments between homologous chromosomes.
  - occurs during prophase I of meiosis I
  - results in new combinations of genes

Crossing over exchanges segments of DNA between homologous chromosomes.

1. Two homologous chromosomes pair up with each other during prophase I in meiosis.
2. In this position, some chromatids are very close to each other and segments cross.
3. Some of these segments break off and reattach to the other homologous chromosome.

Synthesize **Draw the four chromosomes that would result after the above chromosomes go through meiosis.**

6.6 Meiosis and Genetic Variation

- Chromosomes contain many genes.
  - The farther apart two genes are located on a chromosome, the more likely they are to be separated by crossing over.
  - Genes located close together on a chromosome tend to be inherited together, which is called genetic linkage.
- Genetic linkage allows the distance between two genes to be calculated.

A and B are referred to as linked because they would likely be inherited together.

A and B are not linked to C and D because they are so far apart. Crossing over is likely to occur in the space between genes B and C, thereby separating A and B from C and D.

C and D are referred to as linked because they would likely be inherited together.