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GENETICS TEST II

REVIEW

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E-mail: ASC@DaytonaState.edu • Phone: (386) 506-3673

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BE ABLE TO DEFINE

- Linkage
 - The condition in which genes are present on the same chromosome, causing them to be inherited as a unit, provided that they are not separated by crossing over during meiosis.
- Complete Linkage
 - A condition in which two genes are located so close to each other that no recombination occurs between them.
- Unlinked
 - Condition in which two genes are located so far apart that recombination occurs.
- Independent Assortment
 - The independent behavior of each pair of homologous chromosomes during their segregation in meiosis I. The random distribution of maternal and paternal homologs into their gametes.
- Recombination
 - The process that leads to the formation of new allele combinations on chromosomes.
 - The reshuffling of alleles between homologs.
 - Increases genetic variation during meiosis I. Two types of recombination.
 - Crossing over – exchange of DNA between homologous chromosomes.
 - Random separation – (assortment/segregation) of homologous chromosomes.
 - Independent assortment – orientation of homologous pairs to poles is random.
 - All possible combinations of gametes should be formed in equal frequency
 - Formula for number of combinations is 2^n
- Interlocus distance
 - The distance between any two loci on a single chromosome.
 - The interlocus distance is proportional to the frequency of crossing over between any two loci on a single chromosome.

BE ABLE TO DEFINE

- Centimorgan or map unit
 - One map unit (mu) or centimorgan (cM) is defined as 1 percent recombination between two genes on a chromosome. Centimorgans are relative distances not exact distances.
- Crossover
 - A single crossover (SCO) alters linkage between two genes only if the crossover occurs between those two genes.
- Chiasma
 - Synapsed homologous chromosomes, in meiosis, wrap around each other, creating chiasmata, which are X-shaped intersections that are points of genetic exchange.
- Somatic cell hybridization
 - The fusion of two cells to form a single hybrid cell, called a heterokaryon.
- Heterokaryon
 - A somatic cell containing nuclei from two different sources.
- Synkaryon
 - The fusion of two gametic or somatic nuclei.
 - In somatic cell genetics, the product of nuclear fusion.
 - Upon continue culturing of a heterokaryon, chromosomes from one of the two parental species are gradually lost until only a few chromosomes of one species remain and most chromosomes are from the other species, creating what is termed a synkaryon.

BE ABLE TO DEFINE

- Synteny testing
 - In somatic cell genetics, a method for determining whether two genes are on the same chromosome.
 - A panel of cell lines, each containing just a few human chromosomes, can be used for synteny testing in which the presence or absence of a specific gene product is correlated with the presence or absence of each chromosome.
- Adaptation Hypothesis
 - Proposes that the interaction of the bacteriophage and bacterium is essential to the bacterium's acquisition of immunity to the phage.
- Spontaneous Mutation
 - A mutation that is not induced by a mutagenic agent.
 - Spontaneous mutation that occurs in the presence or absence of phage is considered the primary source of genetic variation in bacteria.
- Luria-Delbruck Experiment
 - Proved that spontaneous mutation occurs prior to exposure to selective agent.
 - Referred to as the fluctuation test.
 - Example - 100 tubes grown
 - Many have zero mutants
 - Few mutant colonies – cells had a mutation late in cell culture growth
 - Few have lots of mutant colonies – mutation occurred early in cell culture growth.

BE ABLE TO DEFINE

- Prototroph
 - A prototroph can synthesize all essential organic compounds, and therefore can be grown on minimal medium.
 - A strain usually of a microorganism that is capable of growth on a defined, minimal medium. Wild-type strains are usually regarded as prototrophs and contrasted with auxotrophs.
- Auxotroph
 - Through mutation, an auxotroph has lost the ability to synthesize one or more essential compounds, and must be provided with them in the medium if it is to grow.
 - A mutant microorganism or cell line that requires a nutritional substance for growth that can be synthesized and is not required by the wild-type strain.
- Conjugation
 - Temporary fusion of two single-celled organisms for the sexual transfer of genetic material.
 - Bacteria undergo conjugation, in which:
 - Genetic information from one bacterium is transferred to another.
 - It recombines with the second bacterium's DNA
- Fertility Factor
 - An episomal plasmid in bacterial cells that confers the ability to act as a donor in conjugation.
 - F⁺ cell : A bacterial cell that contains a fertility factor and acts as a donor in bacterial conjugation
 - F⁻ cell : A bacterial cell that does not contain a fertility factor and acts as a recipient in bacterial conjugation.
 - F⁻ cells become F⁺ cells after conjugation.

BE ABLE TO DEFINE

- Merozygote
 - A partially diploid bacteria cell containing, in addition to its own chromosome, a chromosome fragment introduced into the cell by transformation, transduction, or conjugation.
- Plasmids
 - Extrachromosomal, circular DNA molecule that replicates independently of the host chromosome.
 - Contain one or more genes and replicate independently of the bacteria chromosome.
 - Three types to know
 - F Factors – confer fertility
 - R plasmids – confer antibiotic resistance
 - Col plasmids – encode colicins that can kill neighboring bacteria
- Hfr
 - High-frequency recombination
 - An Hfr strain has the F factor intergrated into its chromosome.
 - An Hfr strain can donate genetic information to an F- cell, but the recipient does not become F+
 - F+ x F- → Recipient becomes F+ : Low rate of recombination
 - Hfr x F- → Recipient remains F- : High rate of recombination

BE ABLE TO DEFINE

- Lysogeny
 - The process by which the DNA of an infecting phage becomes repressed and integrated into the chromosome of the bacterial cell it infects.
 - Lysogeny occurs when:
 - The phage DNA integrates into the bacterial chromosome.
 - It is replicated along with the chromosome.
 - It is passed to daughter cells
- Lysogenic
 - When a bacteria cell carries the DNA of a temperate bacteriophage integrated into its chromosome.
 - Bacteria containing a prophage are lysogenic and can grow and divide stably until viral reproduction is induced.
- Prophage
 - A bacteriophage genome integrated into a bacterial chromosome that is replicated along with the bacterial chromosome.
- Plaque
 - On an otherwise opaque bacteria lawn, a clear area caused by the growth and reproduction of a single bacteriophage.
 - Areas clear of bacteria on a plate which can be counted to determine the number of phages in the original culture.

BE ABLE TO DEFINE

- Transduction
 - Virus-mediated bacteria DNA transfer
 - Virally mediated bacterial recombination. Also used to describe the transfer of eukaryotic genes mediated by a retrovirus.
- Generalized Transduction
 - The transfer of any gene from bacterial host to a bacterial recipient in a process mediated by a bacteriophage.
 - In generalized transduction bacterial DNA instead of phage DNA is packaged in a phage particle and transferred to a host.
 - Generalized transduction results in transfer of a large number of bacterial genes.
- Specialized Transduction
 - Genetic transfer of specific host genes by transducing phages.
 - In specialized transduction, a small piece of bacterial DNA is packaged along with the phage DNA.
 - Specialized transduction results in transfer of only a few bacterial genes.

BE ABLE TO DEFINE

- Transformation
 - In transformation, small pieces of extracellular DNA are taken up by a living bacterial cell and integrated stably into the chromosome.
 - Heritable change in a cell or an organism brought about by exogenous DNA. Known to occur naturally and also used in recombinant DNA studies.
- Cotransformation
 - Genes that are close enough to each other to be cotransformed are linked.
 - When two or more genes are integrated together into a cell.
- Interrupted mating technique
 - Interrupted matings demonstrated that specific genes in an Hfr strain are transferred and recombined sooner than others.
 - Experimentation by Wollman & Jacob that explained the difference between Hfr cells and F+ cells and showed how Hfr strains would allow genetic mapping of the E. Coli chromosome.

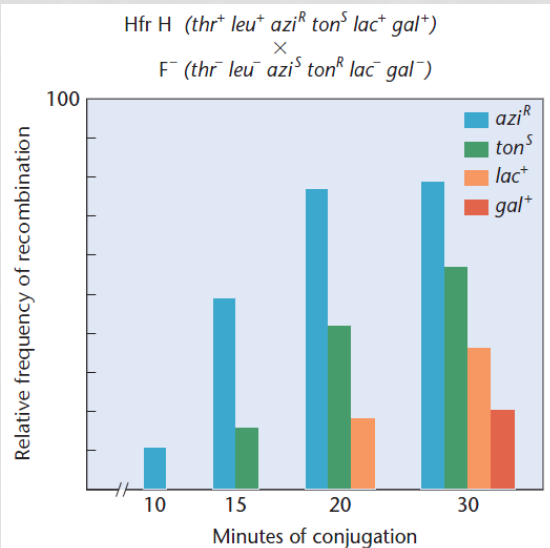


FIGURE 6-6

The progressive transfer during conjugation of various genes from a specific Hfr strain of *E. coli* to an F⁻ strain. Certain genes (*azi* and *ton*) transfer sooner than others and recombine more frequently. Others (*lac* and *gal*) transfer later, and recombinants are found at a lower frequency. Still others (*thr* and *leu*) are always transferred and were used in the initial screen for recombinants but are not shown here.

INTERRUPTED MATINGS

- **Interrupted matings** demonstrated that specific genes in an Hfr strain are transferred and recombined sooner than others
- The chromosome of an Hfr strain is transferred linearly.
- Gene transfer by Hfr strains led to the understanding that the *E. coli* chromosome is circular
- The origin is determined by the point of integration of the F factor into the chromosome, and direction of transfer is determined by the orientation of F factor integration.

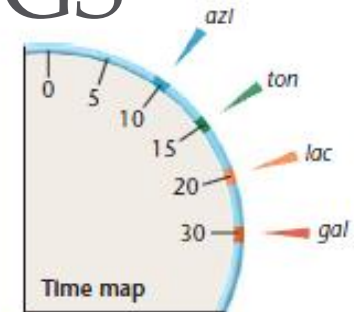


FIGURE 6-7 A time map of the genes studied in the experiment depicted in Figure 6-6.

Hfr H (*thr⁺ leu⁺ azi^R ton^S lac⁺ gal⁺*)
 ×
 F⁻ (*thr⁻ leu⁻ azi^S ton^R lac⁻ gal⁻*)

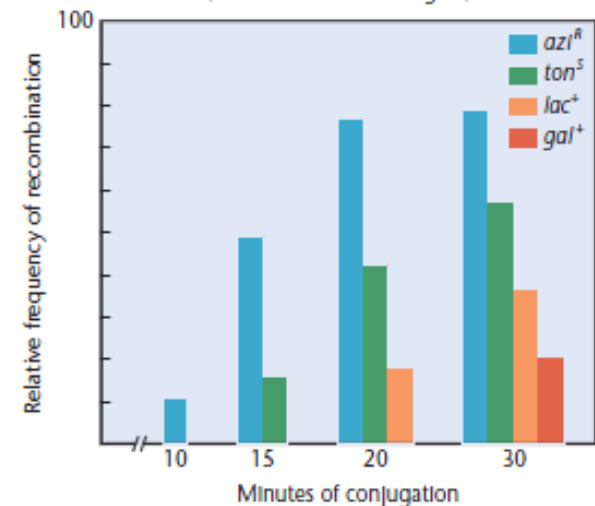
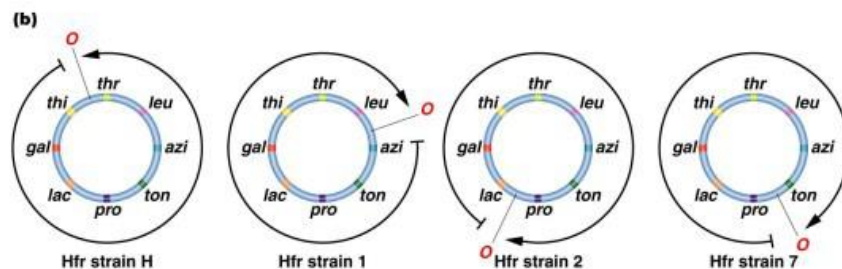


FIGURE 6-6 The progressive transfer during conjugation of various genes from a specific Hfr strain of *E. coli* to an F⁻ strain. Certain genes (*azi* and *ton*) transfer sooner than others and recombine more frequently. Others (*lac* and *gal*) transfer later, and recombinants are found at a lower frequency. Still others (*thr* and *leu*) are always transferred and were used in the initial screen for recombinants but are not shown here.

(a)

Hfr strain	(earliest)	Order of transfer	(latest)
H	<i>thr</i>	<i>thr - leu - azi - ton - pro - lac - gal - thi</i>	<i>thi</i>
1	<i>leu</i>	<i>leu - thr - thi - gal - lac - pro - ton - azi</i>	<i>azi</i>
2	<i>pro</i>	<i>pro - ton - azi - leu - thr - thi - gal - lac</i>	<i>lac</i>
7	<i>ton</i>	<i>ton - azi - leu - thr - thi - gal - lac - pro</i>	<i>pro</i>



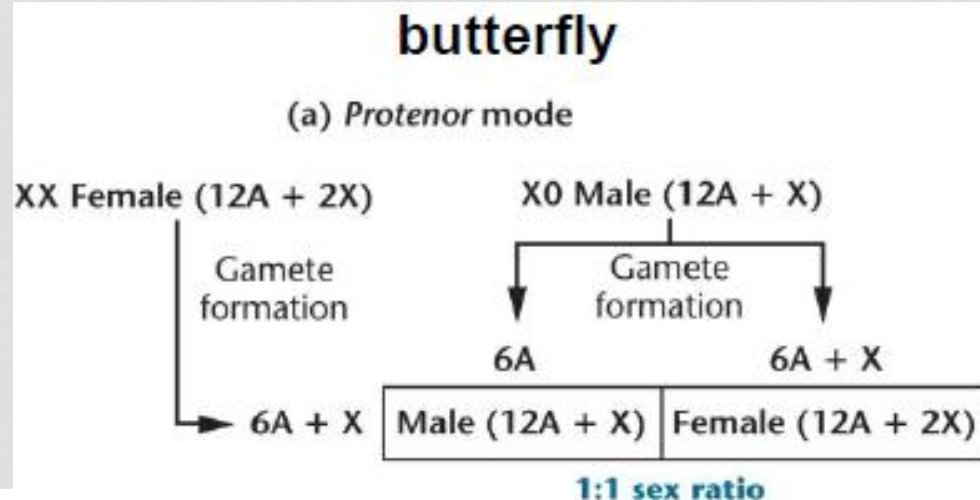
BE ABLE TO DEFINE

- Heteroduplex
 - A double-stranded nucleic acid molecule in which each polynucleotide chain has a different origin. It may be produced as an intermediate in a recombinational event or by the in vitro reannealing of single-stranded, complementary molecules.
 - In transformation, once the extracellular DNA is integrated into the chromosome, the recombinant region contains one host strand and one mutant strand. This region is referred to as a heteroduplex.
- Bacteriophage
 - Bacterial viruses.
 - A virus that infects bacteria, using it as the host for reproduction.
- Sex chromosomes
 - Dissimilar, or heteromorphic chromosomes such as the XY pair in mammals, characterize one sex or the other in a wide range of species, resulting in their label as sex chromosomes.

BE ABLE TO DEFINE

- XX/XO

- The mode of determination used by the *Protenor* (butterfly) and some other insects.
- Depends on the random distribution of the X chromosome into half of the male gametes.
- The presence of two X chromosomes (XX) in the zygote results in female offspring.
- The presence of one X chromosome (XO) results in male offspring

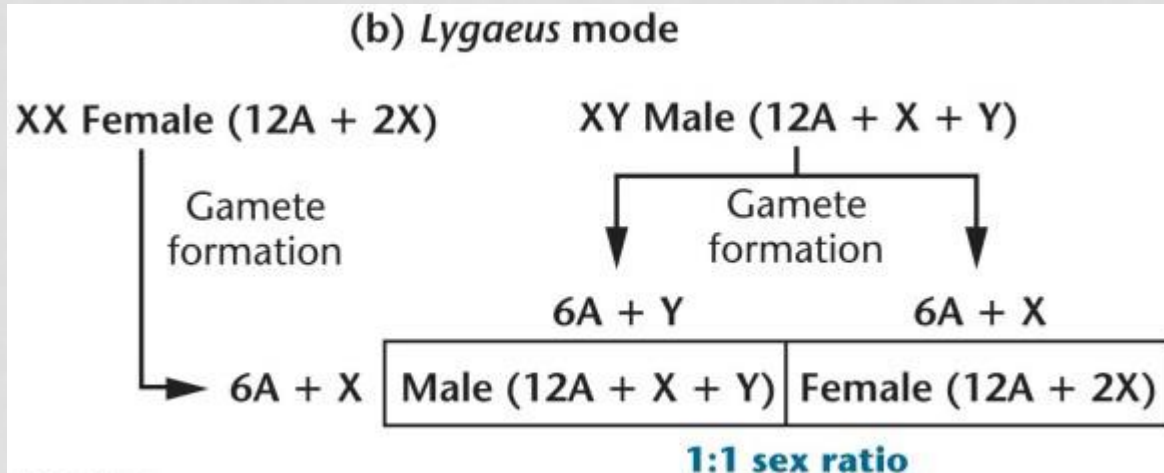


BE ABLE TO DEFINE

- **ZZ/ZW**
 - The mode of determination used by most birds and some moths/butterflies, fish, reptiles, and amphibians.
 - The presence of one Z chromosome and one W chromosome (ZW) results in female offspring. (heterogametic)
 - The presence of two X chromosomes (ZZ) in the zygote results in male offspring (homogametic).
 - All male gametes have an Z chromosome, female gametes have either Z or W.

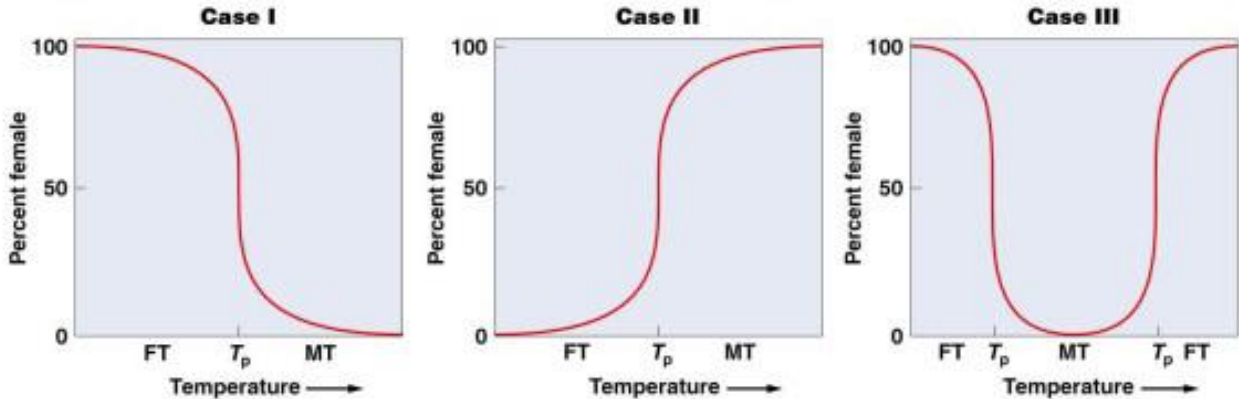
BE ABLE TO DEFINE

- XX/XY
 - The mode of determination used by *Lygaeus* (milkweed/seed eating bugs) and most mammals.
 - The presence of two X chromosomes (XX) in the zygote results in female offspring (homogametous).
 - The presence of one X chromosome and one Y chromosome (XY) results in male offspring (heterogametous)
 - All female gametes have an X chromosome, male gametes have either X or Y.

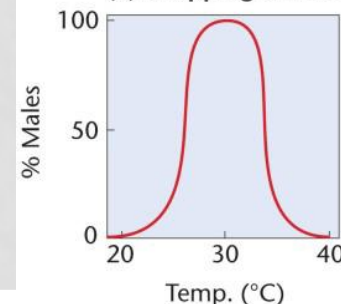


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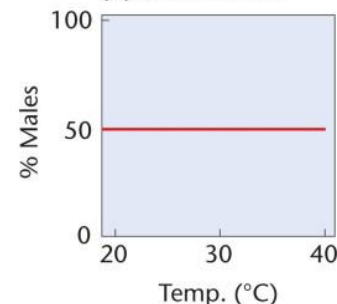
- Sex determination by temperature
 - For all crocodiles, most turtles, and some lizards, sex determination is achieved according to the incubation temperature of eggs during a critical period of embryonic development
 - Three different patterns of temperature sex determination in reptiles is shown below.



(a) Snapping turtles



(b) Most lizards



SEX-DETERMINING SYSTEMS

Table 4.1 Some sex-determining systems

System	Mechanism	Heterogametic Sex
XX-XO	Females XX Males X	Male
XX-XY	Females XX Males XY	Male
ZZ-ZW	Females ZW Males ZZ	Female
Genic sex determination	No distinct sex chromosomes Sex determined by genes on undifferentiated chromosomes	Varies
Environmental sex determination	Sex determined by environmental factors	None

BE ABLE TO DEFINE

- Klinefelter Syndrome

- A genetic disorder in human males caused by the presence of one or more extra X chromosomes. Klinefelter males are usually XXY instead of XY. This syndrome often includes enlarged breasts, small testes, sterility, and mild mental retardation.
- Persons with Klinefelter syndrome have:
 - Male genitalia (therefore have Y)
 - More than one X chromosome (usually XXY, or a 47, XXY karyotype, also can be XXXY or XXXXY. 47,XXY)

- Turner Syndrome

- A genetic disorder in human females caused by a 45,X genotype. Such individuals are phenotypically female but are sterile because of undeveloped ovaries.
- Persons with Turner syndrome usually have (XO where O is absence of a chromosome):
 - A single X chromosome
 - No Y chromosome (45, X karyotype) 45,X
 - Female genitalia
- Such syndromes provide evidence that the Y chromosome determines maleness.

- Down Syndrome

- Results from trisomy of chromosome 21.
- Down syndrome has 12 to 14 characteristics, and affected individuals express 6 to 8 on average.
- Down syndrome is usually a result of the nondisjunction of the maternal chromosome 12 during meiosis, only 5% of the time is it caused by the nondisjunction of the paternal chromosome.
- Increased incidence with increasing maternal age.
- 47,XX,+21

BE ABLE TO DEFINE

- Familial Down Syndrome
 - Heritable down syndrome that runs in families.
 - Involves a translocation of chromosome 21 with chromosome 14
 - Example of Robertsonian translocation
- Patau Syndrome
 - Results in trisomy of chromosome 13
 - 47,XX+13
- Edwards Syndrome
 - Results in trisomy of chromosome 18
 - 47,XX,+18
- Cri-du-chat
 - A clinical syndrome produced by a deletion of a portion of the short arm of chromosome 5 in humans. Afflicted infants have a distinctive cry that sounds like a cat.
 - 46, 5p-

BE ABLE TO DEFINE

- Y-pseudoautosomal regions (PARs)
 - Present on both ends of the Y chromosome are the pseudoautosomal regions that share homology with regions on the X chromosome and synapse and recombine with it during meiosis.
- Y-SRY encodes TDF
 - SRY (Sex Determining Region) has a gene that encodes for a protein called testis-determining factor (TDF) that triggers testes formation.
- Barr bodies
 - Densely staining DNA-positive mass seen in the somatic nuclei of mammalian females. Discovered by Murray Barr, this body represents an inactivated X-chromosome.
 - The inactive X is highly condensed, can be observed in stained interphase cells.
- Lyon hypothesis
 - The proposal describing the random inactivation of the maternal or paternal X chromosome in somatic cells of mammalian females early in development. All daughter cells will have the same X chromosome inactivated as in the cell they descended from, producing a mosaic pattern of expression of X chromosome genes.
- X-inactivation center (Xic)
 - Is active on the inactive X chromosome.
 - A region of the mammalian X chromosome that is the major control unit of inactivation. Located on the proximal end of the p arm in human. Its genetic expression occurs only on the X chromosome that is inactivated.
 - It consists of the X-inactive specific transcript (XIST) gene which is critical for X chromosome inactivation
 - Two noncoding genes in Xic locus, Tsix and Xite play important roles in X chromosome inactivation

BE ABLE TO DEFINE

- Aneuploidy
 - Variations in chromosome number, when an organism gains or loses one or more chromosomes and has other than an exact multiple of the haploid set.
 - A condition in which the chromosome number is not an exact multiple of the haploid set.
- Euploidy
 - Complete haploid sets of chromosomes are present.
 - Euploid – Polyploid with a chromosome number that is an exact multiple of basic chromosome set.
- Haploid (n)
 - A cell or organism having one member of each pair of homologous chromosomes. Also refers to the gametic chromosome number.
- Diploid ($2n$)
 - A condition in which each chromosome exists in pairs; having two of each chromosome.
- Polyploidy
 - Occurs when more than two sets of chromosomes are present. (extra complete sets of chromosomes)
 - Polyploid – A cell or individual having more than two haploid sets of chromosomes.
 - Triploid ($3n$) – Possessing three haploid sets of chromosomes.
 - Tetraploid ($4n$) – Possessing four haploid sets of chromosomes.
 - Pentaploid ($5n$) – Possessing five haploid sets of chromosomes.

BE ABLE TO DEFINE

- **Allopolyploidy**
 - When polyploidy originates by the combination of chromosome sets from different species as consequence of interspecific matings.
 - Allopolyploid – polyploid condition formed by the union of two or more distinct chromosome sets with a subsequent doubling of chromosome number.
- **Autopolyploidy**
 - When polyploidy originates by the addition of one or more sets of chromosomes identical to haploid complement of the same species.
 - Polyploid condition resulting from the duplication of one diploid set of chromosomes.
- **Endopolyploidy**
 - The increase in chromosome sets with somatic nuclei that results from endomitotic replication.
 - The condition in which only certain cells in an otherwise diploid organism are polyploid.
 - In these cells, replication and segregation of chromosomes occur without nuclear division.
- **Nondisjunction**
 - A cell division error in which homologous chromosomes (in meiosis) or the sister chromatids in (mitosis) fail to separate and migrate to opposite poles; responsible for defects such as monosomy and trisomy.
 - When chromosomes or chromatids fail to disjoin and move to opposite poles during meiosis I or II
- **Deletions**
 - Missing regions of chromosomes.
 - When a chromosome breaks in one or more places and a portion is lost, the missing piece is referred to as a deletion.
 - Terminal deletion – deletion near end
 - Intercalary deletion – deletion from the interior of the chromosome

BE ABLE TO DEFINE

- Duplications
 - Repeated segments of genetic material
 - Duplications arise as the result of unequal crossing over during meiosis or through a replication error prior to meiosis.
- Inversions
 - Inversion – a chromosomal aberration in which a chromosomal segment has been reversed
- Translocations
 - A movement of a chromosomal segment to a new location in the genome.
 - Translocations alter the location of chromosomal segments in the genome
- Nonreciprocal translocations
 - The transfer of genes from one chromosome to another nonhomologous chromosome.
- Reciprocal translocations
 - The exchange of segments between two nonhomologous chromosomes.
 - Have unusual synapsis configuration during meiosis.
- Chromosome banding techniques
 - Allow identification of the exact origin of the translocation and correlate the presence of a chromosomal segment in hybrid cells with specific gene expression. In this way, its possible to compile gene maps of human chromosomes.

Be able to form a three gene map given percent recombination between genes d-e; e-x, and d-x (not alphabetical...plug in example percentages).

(1) <i>yellow, white</i>	0.5%
(2) <i>white, miniature</i>	34.5%
(3) <i>yellow, miniature</i>	35.4%

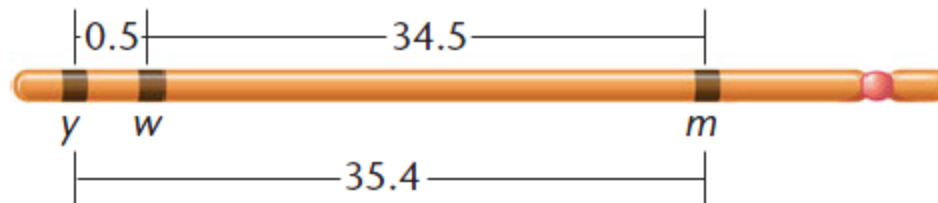
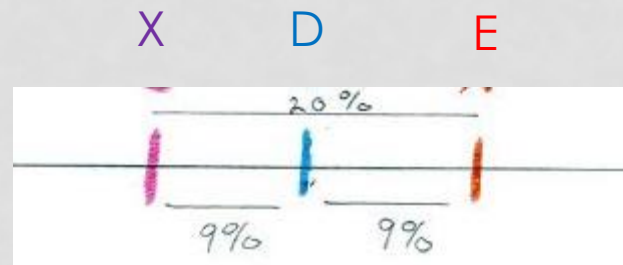


FIGURE 5-4 A map of the *yellow* (*y*), *white* (*w*), and *miniature* (*m*) genes on the X chromosome of *Drosophila melanogaster*. Each number represents the percentage of recombinant offspring produced in one of three crosses, each involving two different genes.

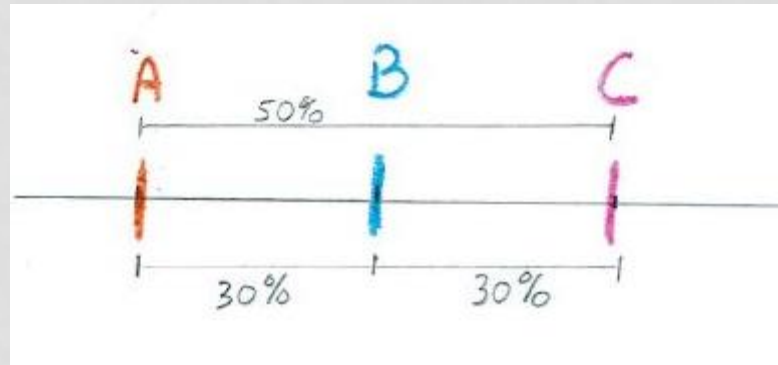
Be able to form a three gene map given percent recombination between genes d-e; e-x, and d-x (not alphabetical...plug in example percentages).

- 1) d-e 9%
- 2) e-x 20%
- 3) x-d 9%



Be able to form a three gene map given percent recombination between genes d-e; e-x, and d-x (not alphabetical...plug in example percentages).

- 1) a-b 30%
- 2) b-c 30%
- 3) a-c 50% (recall 50% is maximal recombination)



If AaBb is crossed to aabb the resulting phenotypic ratio should be 25% of all four phenotypes if the genes are unlinked (1:1:1:1 ratio). If however the data shows 90:10:10:90 individuals then what is the percent recombination?

- $(10 + 10) / (10 + 10 + 90 + 90) = 10\%$

- Equations is

$$\text{Recombinant} / \text{Total}$$

$$\text{Sum of two smaller numbers} / \text{Total}$$

Note the two largest numbers would be “parental phenotypes and the two smaller numbers would be the recombinant phenotype (so this could be reported 90:90:10:10 if researcher recorded data differently; with variations in data 88:92:9:11 is also the same percent recombination.

Be able to determine which product is on which chromosome using synteny testing. Gene Product A is on chromosome?

Hybrid cell lines	Human chromosomes present								Gene products expressed			
	1	2	3	4	5	6	7	8	A	B	C	D
23									-	+	-	+
34									+	-	-	+
41									+	+	-	+

FIGURE 5-14 A hypothetical grid of data used in synteny testing to assign genes to their appropriate human chromosomes. Three somatic hybrid cell lines, designated 23, 34, and 41, have each been scored for the presence, or absence, of human chromosomes 1 through 8, as well as for their ability to produce the hypothetical human gene products A, B, C, and D.

Gene Product A:

- Cell line 23: not in chromosome 1-4
- Cell line 34: in 5 or 6 (but not 1 or 2 cause cell line 23 and not 7 because 7 not in this line)
- Cell line 41: confirms gene product is in chromosome 5 and not 6

Be able to determine which product is on which chromosome using synteny testing. Gene Product B is on chromosome?

Hybrid cell lines	Human chromosomes present								Gene products expressed			
	1	2	3	4	5	6	7	8	A	B	C	D
23									-	+	-	+
34									+	-	-	+
41									+	+	-	+

FIGURE 5-14 A hypothetical grid of data used in synteny testing to assign genes to their appropriate human chromosomes. Three somatic hybrid cell lines, designated 23, 34, and 41, have each been scored for the presence, or absence, of human chromosomes 1 through 8, as well as for their ability to produce the hypothetical human gene products A, B, C, and D.

- Gene Product B is on chromosome 3

Be able to determine which product is on which chromosome using synteny testing. Gene Product C is on chromosome?













Hybrid cell lines	Human chromosomes present								Gene products expressed			
	1	2	3	4	5	6	7	8	A	B	C	D
23									-	+	-	+
34									+	-	-	+
41									+	+	-	+

FIGURE 5-14 A hypothetical grid of data used in synteny testing to assign genes to their appropriate human chromosomes. Three somatic hybrid cell lines, designated 23, 34, and 41, have each been scored for the presence, or absence, of human chromosomes 1 through 8, as well as for their ability to produce the hypothetical human gene products A, B, C, and D.

- Gene Product C is not on chromosomes 1 thru 7. Although it could be on chromosome 8, there is not enough information to prove that it is on chromosome 8

Be able to determine which product is on which chromosome using synteny testing. Gene Product D is on chromosome?

Hybrid cell lines	Human chromosomes present								Gene products expressed			
	1	2	3	4	5	6	7	8	A	B	C	D
23									-	+	-	+
34									+	-	-	+
41									+	+	-	+

FIGURE 5-14 A hypothetical grid of data used in synteny testing to assign genes to their appropriate human chromosomes. Three somatic hybrid cell lines, designated 23, 34, and 41, have each been scored for the presence, or absence, of human chromosomes 1 through 8, as well as for their ability to produce the hypothetical human gene products A, B, C, and D.

Gene Product D is positive in all cell lines and only chromosome 1 is in common to all cell lines so it is on chromosome 1.

Example of a XX/XY cross

- A red-green colorblind woman marries a man with normal vision what are the genotypes and phenotypes of the children?

Allele key

X^n = Normal Allele

X^b = Color blind Allele

Y = Y chromosome

Genotypes of

Woman - X^bX^b

Man - X^nY

	X^n	Y
X^b	X^nX^b	X^bY
X^b	X^nX^b	X^bY

- Genotypes - 2 X^nX^b : 2 X^bY
- Phenotypes - 2 normal females : 2 color blind males
 - In both genotype and phenotype the ratio reduces to 1:1

Example of a XX/XY cross

- A woman who is heterozygous for hemophilia marries a man with hemophilia. What are the genotypes and phenotypes of the children?

Allele key

X^n = Normal Allele

X^h = Hemophilia Allele

Y = Y chromosome

Genotypes of

Woman - X^nX^h

Man - X^hY

	X^h	Y
X^n	X^nX^h	X^nY
X^h	X^hX^h	X^hY

- Genotypes - 1 X^nX^h : 1 X^hX^h : 1 X^nY : 1 X^hY
- Phenotypes - 1 normal female : 1 hemophilic female:
1 normal male : 1 hemophilic male

Example of a ZW/ZZ cross

- In chickens, congenital baldness results from a Z-linked recessive gene. A bald rooster is mated with a normal hen. The F₁ from this cross are interbred to produce the F₂. Give the genotypes and phenotypes, along with their expected proportions, among the F₁ and F₂ progeny.

Allele key

Zⁿ = Normal Allele

Z^b = Baldness Allele

W = W chromosome

Genotypes of P generation

Female - ZⁿW

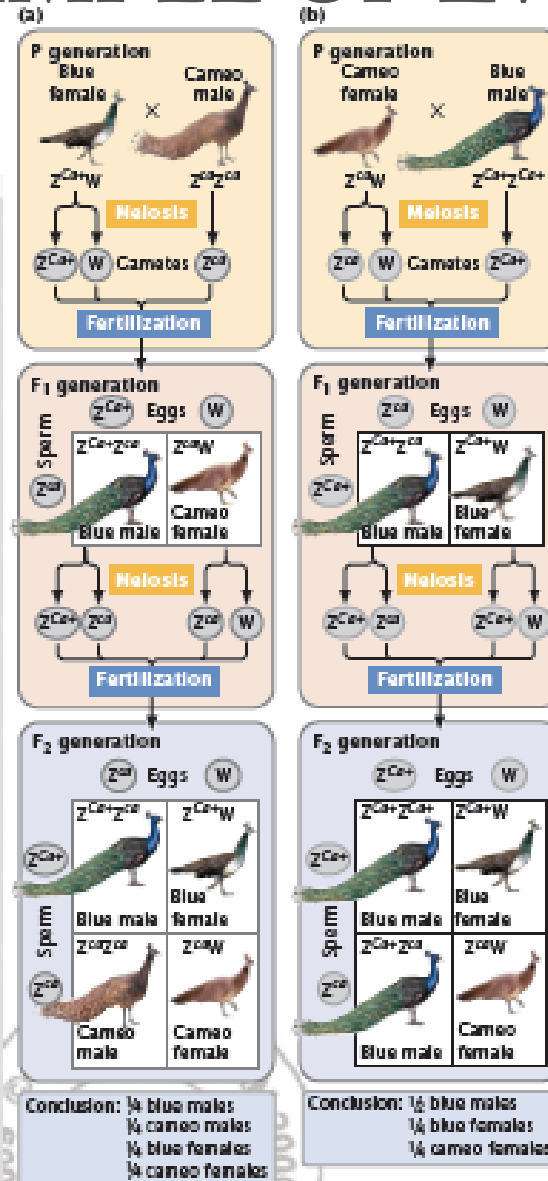
Male - Z^bZ^b

F1	Z ^b	Z ^b
Z ⁿ	Z ⁿ Z ^b	Z ⁿ Z ^b
W	Z ^b W	Z ^b W

F2	Z ⁿ	Z ^b
Z ^b	Z ⁿ Z ^b	Z ^b Z ^b
W	Z ⁿ W	Z ^b W

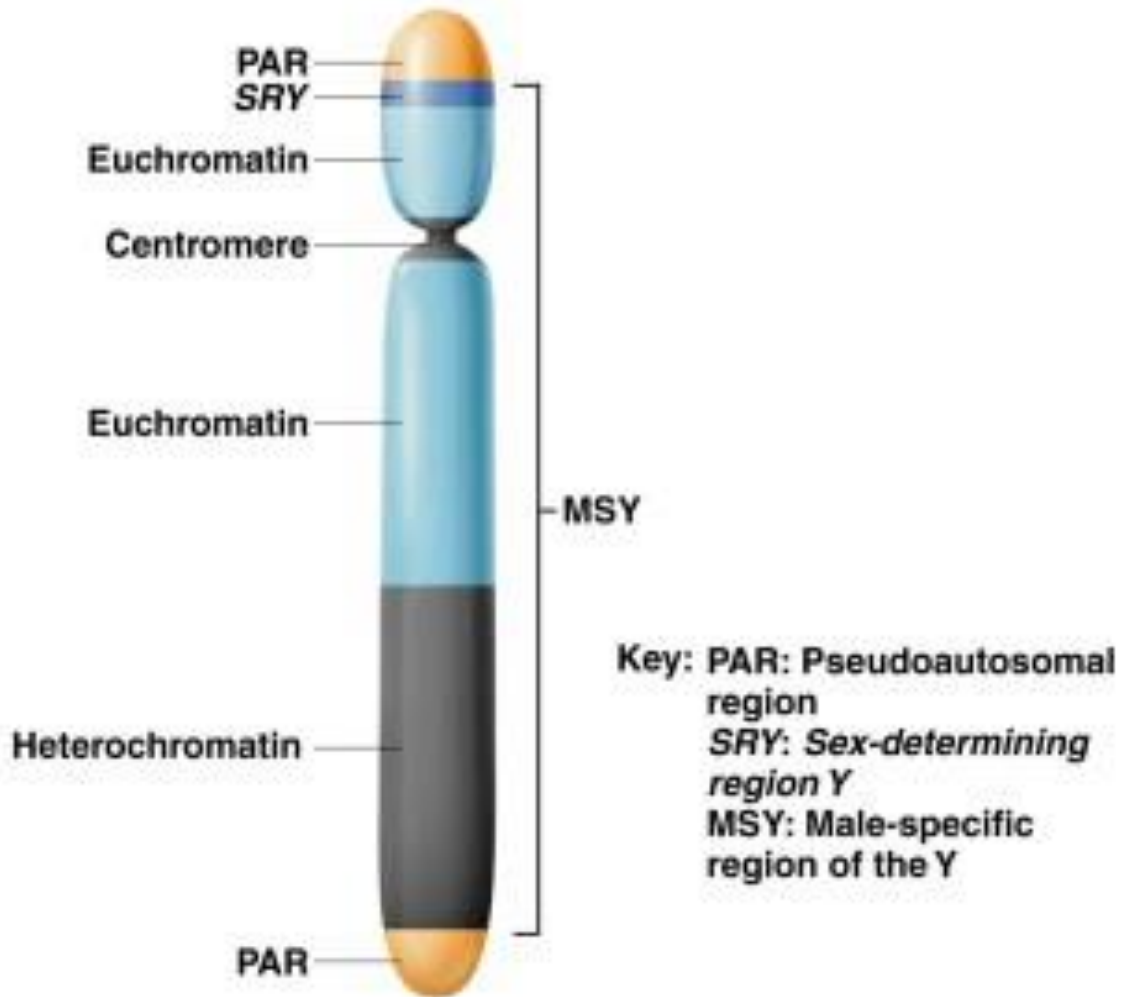
- F1 Genotypes - 1 ZⁿZ^b : 1 Z^bW (note ratio already reduced)
- F1 Phenotypes - 1 normal male : 1 bald female
- F2 Genotypes - 1 ZⁿZ^b : 1 Z^bW : 1 Z^bZ^b : 1 ZⁿW
- F2 Phenotypes - 1 normal male : 1 bald female :
1 bald male : 1 normal female

EXAMPLE OF ZW/ZZ



4.16 The cameo phenotype in Indian blue peafowl is inherited as a Z-linked recessive trait. (a) Blue female crossed with cameo male. (b) Reciprocal cross of cameo female crossed with homozygous blue male.

Y - CHROMOSOME



PAR – Pseudoautosomal regions that share homology with regions on X chromosome

SRY – encodes TDF for testes formation

Euchromatin – gene containing region

Heterochromatin – region without genes.

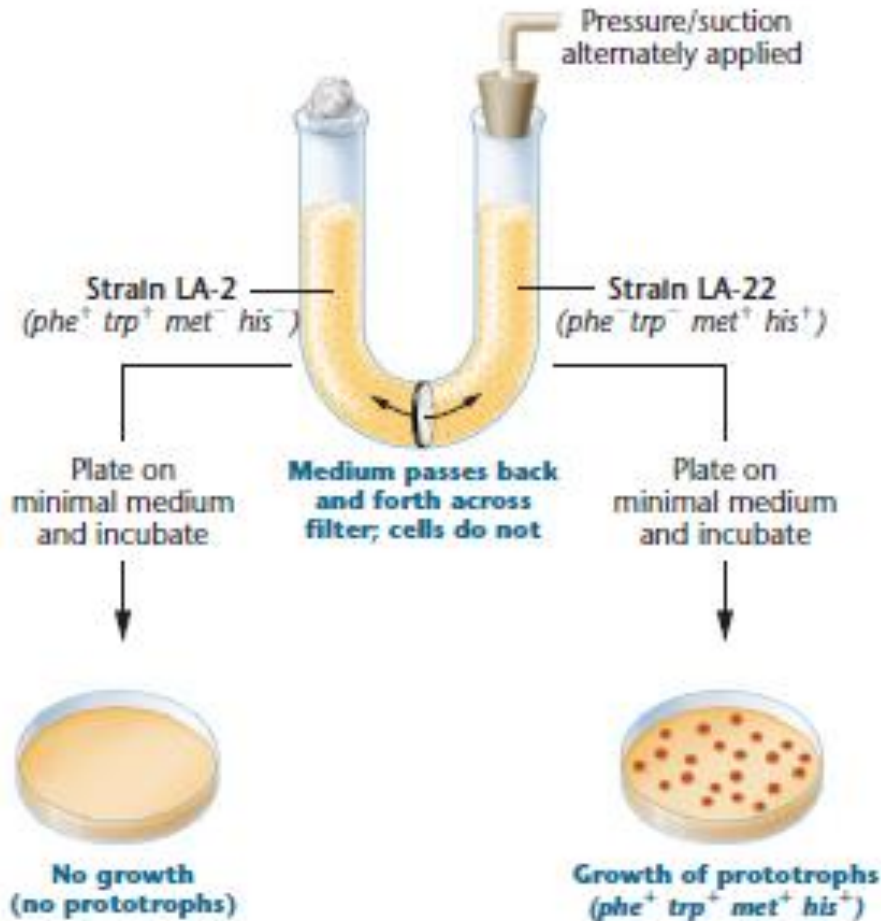
MSY has three regions

- X-transposed region
- X-degenerative region
- Ampliconic region

CONCEPT QUESTIONS / DEFINITIONS

- Does recombination occur in mitosis or meiosis?
 - Recombination occurs during crossing over of Meiosis I.
- What are the three growth phases of bacteria
 - Lag phase, log phase (exponential growth), stationary phase
- Lederberg-Zinder Experiment
 - Led to the discovery of phage transduction in bacteria.
- Dosage compensation.
 - Prevents excessive expression of X-linked genes in humans and other mammals.
 - Balances the dose of X chromosome gene expression in males and females.

THE LEDERBERG-ZINDER EXPERIMENT



- The Lederberg-Zinder experiment led to the discovery of phage transduction in bacteria

FIGURE 6-16 The Lederberg-Zinder experiment using *Salmonella*. After placing two auxotrophic strains on opposite sides of a Davis U-tube, Lederberg and Zinder recovered prototrophs from the side with the LA-22 strain but not from the side containing the LA-2 strain.

CROSSWORD

Across

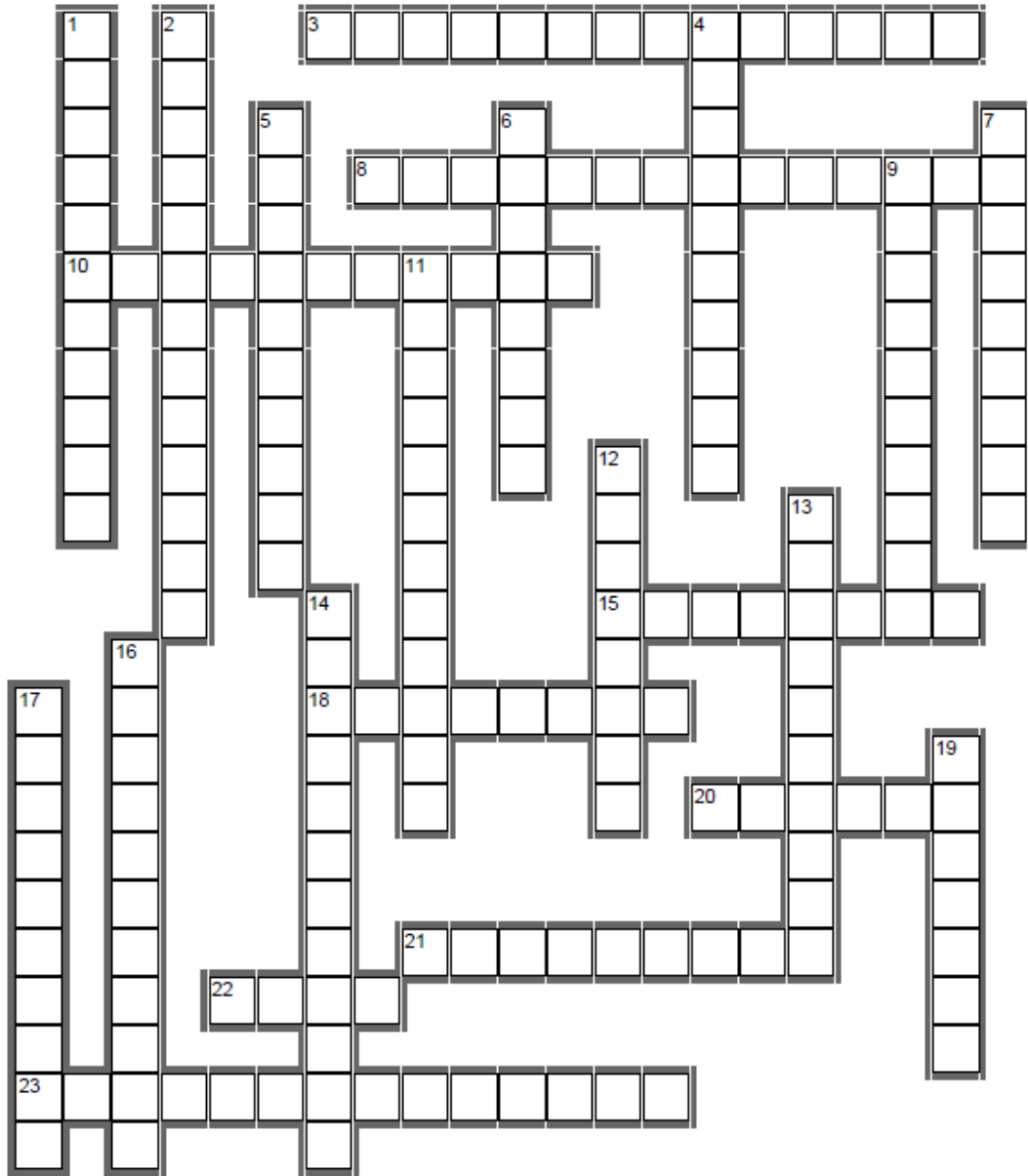
3. Polyploidy with all chromosome sets from the same species,
8. Polyploidy with all chromosome sets from the different species,
10. When bacteria from F+ cell donates DNA to an F- cell it is called ____.
15. Having true (normal) set or number of chromosomes.
18. Having three complete sets of chromosomes.
20. A person with one X chromosome (XO) is female with a condition called ____ syndrome.
21. Organism that can not synthesize all organic compounds from inorganic nutrients is called a ____.
22. More than one X chromosome is condensed and can be seen in interphase cells and is called a ____ body.
23. Small pieces of DNA taken up by living bacteria cell and integrated stably into the bacterial genome.

CROSSWORD

Down

1. Extra copies of gene(s) in a chromosome due to mistake in recombination.
2. ___ is process when genes can be transformed together
4. More than two full sets of chromosomes.
5. When an organism has gained or lost one or more chromosomes.
6. Loss of one chromosome is called ___.
7. After fusing cells of two different species chromosomes are lost until a ___ is formed.
9. An Hfr cell has the F+ factor ___ into the bacterial genome.
11. Bacteriophages can be involved in moving genes from one bacterium to another through a process call ___.
12. When gene(s) are lost from a chromosome.
13. Organism that can synthesize all organic compounds from inorganic nutrients is called a ___.
14. When two cells of different species are fused it forms a ___?
16. Name of unit for one percent recombination.
17. A partial diploid in bacteria which is result of F' (F prime) mated to F-.
19. Down syndrome for example.

CROSSWORD



CONCEPT QUESTIONS

- Polyploidy with all chromosome sets from the same species.
 - Autopolyploidy
- Polyploidy with all chromosome sets from the different species
 - Allopolyploidy
- When bacteria from F⁺ cell donates DNA to an F⁻ cell it is called _____.
 - Conjugation
- Having true (normal) set or number of chromosomes.
 - Euploidy

CONCEPT QUESTIONS

- Having three complete sets of chromosomes
 - Triploid
- A person with one X chromosome (XO) is female with a condition called _____ syndrome.
 - Turner
- Organism that can not synthesize all organic compounds from inorganic nutrients is called a _____.
 - Auxotroph
- More than one X chromosome is condensed and can be seen in interphase cells and is called a _____ body.
 - Barr

CONCEPT QUESTIONS

- Small pieces of DNA taken up by living bacteria cell and integrated stably into the bacteria genome.
 - Transformation
- Extra copies of gene(s) in a chromosome due to mistake in recombination
 - Duplication
- More than two full sets of chromosomes.
 - Polyploid
- _____ is a process when genes can be transformed together
 - Cotransformation

CONCEPT QUESTIONS

- Lost of one chromosome is called _____.
 - **Monosomy**
- After fusing cells of two different species chromosomes are lost until a _____ is formed.
 - **Synkaryon**
- An Hfr cell has the F+ factor _____ into the bacteria genome.
 - **Integrated**
- Bacteriophages can be involved in moving genes from one bacterium to another through a process call _____.
 - **Transduction**

CONCEPT QUESTIONS

- When gene(s) are lost from a chromosome.
 - Deletion
- Organism that can synthesize all organic compounds from inorganic nutrients is called a _____.
 - Prototroph
- When two cells of different species are fused it forms a _____?
 - Heterokaryon
- Name of unit for one percent recombination.
 - Centimorgan

CONCEPT QUESTIONS

- A partial diploid in bacteria which is result of F' (F prime) mated to F-.
 - Merozygote
- Down syndrome for example.
 - Trisomy



DAYTONA STATE COLLEGE

Questions



Prepared by

D. Leonard (Learning Specialist)

The Academic Support Center @ Daytona State College