Unit 6: Microgenetics	Date:
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Section 6: Biotechnology and Genetic Engineering - Notes

Objectives:

• Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture.

Biotechnology: any procedure or method that uses biological systems or _____

• Describe the processes of selective breeding, gene splicing, cloning, genetically modified organisms, and gene therapy.

Warm-up:

- Name one genetically modified organism (GMO) that you've heard of.
- Is this organism good or bad?

Bio	tο	ch	nol	اما	~ /
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	to develop or modify either	or
_	for specific use.	
	Includes genetic engineering, gene splicing,	, gene therapy,
	genetically modified organisms, and	.
Genetic E	ngineering:	
• <u>G</u>	enetic Engineering: a technology that includes the process of	
th	ne genetic material of a cell resulting in	functions or
0	utcomes that would not occur	RESTRICTION ENZYMES
	·	The gene of interest is located on a section of DNA from the donor species.
• On	nce a particular gene is located,	Gene of interest Source DNA
	are used to cut out and isolate	2 Restriction enzymes that target a particular base-pair sequence on either side of the gene
tha	at gene.	are introduced. Restriction enzymes ———
0	Restriction enzymes work by targeting a specific sequence.	In this example, the restriction enzymes recognize the sequence ATCGAT and cut between the first A and T.
0	After binding to their target, the restriction enzyme	The restriction enzymes bind to their target base-pair sequence and cut the strand of DNA.
	the strand of DNA and the gene of interest is	
	from the remaining DNA.	The gene of interest has now been separated from the donor's DNA.

_		any of the
gene using a DNA		chain reaction (PCR).
 This process can be 	e repeated over and over until t	there are of
identical copies.		
The gene of interest can no	ow be	into other strands of DNA to
begin making	·	
o Gene Splicing: a ty	pe of gene	in which the
DNA is intentional	y broken and recombined using	g laboratory techniques.
The isolated gene can be pla	aced into a bacterial cell's	INSERTING DNA BY USING PLASMID Bacte
		A target segment of source DNA is isolated
		using restriction enzymes. Using the same restriction enzyme, a single cut is made in a bacterial plasmid. Plasmid
	DNA molecules th	
can replicate independe		the segment of DNA and cut the plasmid, the two share complementary base pairs and fit perfectly together.
_	pe placed in other organisms to they did not previously have.	The plasmid—now including the gene of interest—is inserted back into the bacterial cell. Genes on the plasmid can be expressed in the bacterial cell and are replicated whenever the cell divides.
o Example:		
	Bacterium (Bacillus thuringies) Bt crystal gene	ensis)

By transplanting a _ _____from one organism into another, a organism is produced.

Corn plant destroyed by insect pests

2 Bacterial gene coding for Bt crystals, which are poisonous to the insect pests, is inserted directly into the corn plant's DNA.

Bt crystals—toxic to insect pests-are now produced by the corn plant itself, reducing the amount of pesticides the farmer must use.

	genetic material from	organisms.	
	■ Examples: Suntory "	″ Rose,	that produce a
	rare protein in their mil	lk to treat blood clotting disor	ders,
	that hel	lps people with vitamin A defi	ciency, tha
	express a jellyfish prote	ein that glows green under ult	raviolet light
Trans	genic organisms are a type of		
		().	
0	Genetically Modified Organism	<u>ı:</u> an organism whose genetic	material has been
	throu	ugh some genetic engineering	technology or technique.
	■ GMOs occur when the	DNA has been altered in a wa	y that wouldn't have
	happened	by mating or n	atural recombination.
Huma	ns began genetically modifying or	rganisms	of
	ago (and continue to do so today)		
	to se	elect for desirable traits.	
Advar	ntages of GMOs:		
0	Used in biological and medical		
	of pharmaceuticals, experimen	tal medicine, and	
	GMOs may provide	food avality, bishou	
0	cirios may provide	rood quality, nigher _	
0	yields, foods with a greater she		
	yields, foods with a greater she	elf-life, and less need for	
Disad	yields, foods with a greater she vantages of GMOs:	elf-life, and less need for	consequences.
Disad O	yields, foods with a greater she vantages of GMOs: Desired traits may have	elf-life, and less need for	consequences.
Disad O	yields, foods with a greater she vantages of GMOs: Desired traits may have Organisms may become	elf-life, and less need for	consequences. o genetically modified crop

Gene Therapy:

	Therapy: the intentional	, arceracio	O11, O1		
of ger	nes within an individual's cells and tissues for the		1. Cells harveste		2.
purpo	ose of treating a		from patient	alter ca	ib, vii ered s anno rodu
) In	the future, this may allow doctors to use	3387	7.		
	to treat disease instead of	60	Altered cells produ desired protein	ce	2000
	or surgery.	6 0-	Altered cells inj		E
> Th	e new gene would allow the patient to begin			4. Altered vir	irus
ma	aking the that they	$A \setminus A$		mixed will patient's co	ith
are	e missing or that is faulty.		5. Cells become genetically altered	ľ	
While	a promising area of research, gene therapy has r	not been m	astered and o	rarries	
	:	iot been iii	asterea ana t	arries	
0		cyctom	roaction		
O	Unwanted	system	reaction		
0	The	may be t	targeted		
0	The new gene may be inserted into the				
O			er harmful ef		d stem co
Cells:	■ This can lead to o	or have oth	er harmful ef	fects	id stem coome any
Cells: Stem C	■ This can lead to o	or have oth	er harmful ef	fects	id stem co
Cells: Stem C	■ This can lead to o	or have oth	er harmful ef	fects	d stem cc.
Cells: Stem C that ca	■ This can lead to o	or have oth	er harmful ef	fects	d stem come only
Cells: Stem C that ca	■ This can lead to of	or have othe	er harmful ef	fects	d stem o come conyo
Cells: Stem C that ca	■ This can lead to of	or have other	er harmful ef	Stem Cells Cohered ce become in the state of	id stem crowns any he body
Cells: Stem C that ca Stem c	■ This can lead to of of of ells are used in many areas of research to treat and and and	cells.	er harmful ef	Stem Cells Cohered ce become in the state of	id stem cr.
Cells: Stem C that ca Stem c	This can lead to of	cells.	er harmful ef	Stem Cells Chlored cen become	d stem or come eny me body
Cells: Stem C that ca Stem c	This can lead to	cells.	er harmful ef	Stem Cells Column Combane In the Cell Blood Cell Liver Cell the Cell Column Brook I Liver Cell C	d stem crome only he body
Cells: Stem C that ca Stem c	This can lead to	cells.	er harmful ef	Stem Cells Colored con become here in the state of bone the colored con become here in the state of bone	d stem cor come cryy

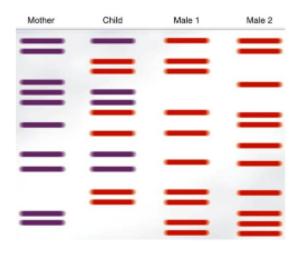
Cloning:

<u>C.I.</u>	oning: a process in which a cell, cell product, or organism is	CLONING
	from an original source	
0	cloning - the transfer of a DNA fragment from one	1 Isolate an egg cell from one sheep and a mammary
	organism to a self-replicating genetic element such as a bacterial	cell from another. Remove the
		nucleus from the egg cell.
		2 Fuse the mammary cell, including its nucleus,
0	cloning - the process of taking	with the egg cell.
	undifferentiated embryonic cells () for use	3 Initiate cell
	in medical research	division.
0	cloning - the transfer of genetic	Grow the embryo in culture.
	material from the nucleus of a donor adult cell to an	
	cell that has had its nucleus removed for the purpose of creating an	5 Transplant the embryo into the
	that can produce an exact genetic copy	womb of a surrogate mother sheep.
	of the donor organism.	
	of the donor organism.	6 Surrogate mother gives birth to
	Science: orensics: the science of tests and techniques used during the	cloned sheep. of
		of
<u>Fo</u>	orensics: the science of tests and techniques used during the	of
<u>Fo</u>	orensics: the science of tests and techniques used during the Includes many techniques and sub-categories, including ONA Fingerprint: a test to and evaluate general	of
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<u>Fo</u>	Orensics: the science of tests and techniques used during the	tic information. ING A DNA FINGERPRINT GEL and DNA sequences are then poured into a gelectrical charge is applied. Because DNA is a y charged molecule, the pieces of DNA move ne bottom of the gel. This process causes the DNA to be separated by size. Smaller
<u>Fo</u>	orensics: the science of tests and techniques used during the Includes many techniques and sub-categories, including DNA Fingerprint: a test to and evaluate generation using restriction into strips that have the science of tests and techniques used during the CREATION The isolate and an elementary into strips that have the science of the pieces of the piec	tic information. ING A DNA FINGERPRINT GEL and DNA sequences are then poured into a gelectrical charge is applied. Because DNA is a y charged molecule, the pieces of DNA move the bottom of the gel. This process causes the DNA to be separated by size. Smaller hose with a small number of repeats—move ckly than larger pieces and are found closer to m.
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	Includes many techniques and sub-categories, including ONA Fingerprint: a test to and evaluate gener The DNA in question is using restriction into strips that have different The DNA strips are then run through a Longer strips move through the	of ING A DNA FINGERPRINT GEL Ted DNA sequences are then poured into a gel ectrical charge is applied. Because DNA is a y charged molecule, the pieces of DNA move the bottom of the gel. This process causes the DNA to be separated by size. Smaller hose with a small number of repeats—move ckly than larger pieces and are found closer to m. Larger strand of DNA These band used to sho suspect's D matches DI
<u>D</u>	Includes many techniques and sub-categories, including ONA Fingerprint: a test to and evaluate genet The DNA in question is using restriction into strips that have different The DNA strips are then run through a Longer strips move through the gel and stay closer to the starting line. Shorter strips move and move the principle of the starting line.	tic information. ING A DNA FINGERPRINT GEL and DNA sequences are then poured into a gelectrical charge is applied. Because DNA is a y charged molecule, the pieces of DNA move the bottom of the gel. This process causes the DNA to be separated by size. Smaller those with a small number of repeats—move ckly than larger pieces and are found closer to m. Larger strang of DNA These band used to sho suspect's D matches DI at a crime s
<u>D</u>	O Includes many techniques and sub-categories, including ONA Fingerprint: a test to and evaluate general gener	of ING A DNA FINGERPRINT GEL Ted DNA sequences are then poured into a gel ectrical charge is applied. Because DNA is a y charged molecule, the pieces of DNA move the bottom of the gel. This process causes the DNA to be separated by size. Smaller hose with a small number of repeats—move ckly than larger pieces and are found closer to m. Larger strand of DNA These band used to sho suspect's D matches DI

DNA fingerprints cannot be used conclusively to prove someone _______ of a crime, but it can be used to prove someone ______.

DNA fingerprints can also be used to establish family

.



Human Genome:

The _______ was a project to decode the 3,000,000,000 base pairs in the human genome and identify all the ______ present.
 It started in ______ and was completed in ______.
 Helps us understand _______, what causes them, and how to treat them
 Led to advances in ______ science; ______ and other energy applications; _______, animal husbandry,

