Name: _____ Date: _____ Class Period: Copy

Chapter 15 Section 2

Gene Technologies in our Lives

Before you begin reading...let's review!

1. Where in the cell is DNA located? NUCLEUS

2. What is a section of DNA that holds the information about a certain trait called? GENE

3. What type of molecule builds and repairs you? PROTEIN This molecule is responsible for giving you your genetic TRAITS.

4. Where in the cell do your proteins get made? RIBOSOME

5. Proteins are made of long chains of molecules called AMINO ACIDS.

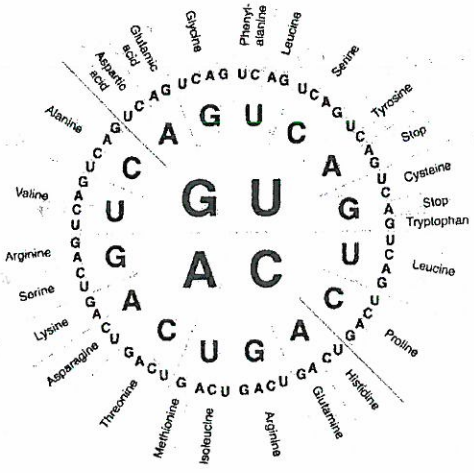
6. Due to the fact that DNA is locked in the nucleus and your specific proteins get made at the ribosome, the DNA molecule is first copied to a helper molecule which will carry your genetic message to the ribosome. This helper molecule is called MRNA.

. . Use the DNA strand below (only one side is used because mRNA is only one sided) to first transcribe the DNA to mRNA then using the genetic code wheel, translate the mRNA into a sequence of amino acids.

DNA Strand: T A C G G A T A C A A T

mRNA Strand: A U G C C U A U G U U A

amino acids: METHIONINE PROLINE METHIONINE LEUCINE



Manipulating Genes (p. 350-351)

1. Gene technologies include a wide range of procedures that ANALYZE, DECODE, or MANIPULATE genes from organisms.

2. What are the three ways that gene technologies are now used?

   - STUDY ORGANISMS IN NEW WAYS
   - ALTER ORGANISMS FOR HUMAN USE
   - IMPROVE HUMAN LIVES

3. Define **Genetic Engineering:** THE DELIBERATE ALTERATION OF THE GENETIC MATERIAL OF AN ORGANISM.

4. Define **Recombinant DNA:** DNA THAT HAS BEEN RECOMBINED BY GENETIC ENGINEERING; DNA OF 2 DIFFERENT ORGANISMS COMBINED.

5. What is the everyday term used to describe an organism that has been genetically modified?

GENETICALLY MODIFIED ORGANISM (GMO); RECOMBINANT, TRANSGENIC

6. Give one example of how genetic engineering has been applied to each industry.

Food Crops: CORN AND SOYBEAN PRODUCTS HAVE BEEN ENGINEERED WITH THE Bt GENE WHICH PRODUCES INSECTICIDES

Livestock: LIVESTOCK ARE BEING ENGINEERED TO GROW FASTER OR TO HAVE MORE MUSCLE.

Medical Treatment: BACTERIAL DNA HAS BEEN RECOMBINED WITH HUMAN GENES TO PRODUCE PROTEINS FOR HEMOPHILIA AND DIABETES.

Basic Research Tools: GLOWING GENES HAVE BEEN INSERTED INTO PLANTS AND ANIMALS AS A MARKER OF OTHER GENES BEING STUDIED.

7. Define **proteomics:** THE STUDY OF HOW PROTEINS INTERACT WITH CELLS.

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Genetic Transformation

The Genetic Creation of Glowing Bacteria

Introduction & Background

During this laboratory exercise you will perform a procedure known as genetic transformation. Remember that a gene is a piece of DNA which provides the instructions for making a specific protein through the process of protein synthesis (gene expression). This protein then gives the organism a particular trait. Genetic transformation literally means change caused by genes, and involves the insertion of a gene into an organism in order to change the organism's trait. Genetic transformation is used in many areas of biotechnology. In agriculture, genes coding for traits such as frost, pest, or spoilage resistance can be genetically transformed into plants. Bacteria have been genetically transformed with genes enabling them to digest oil spills.

You will be using a procedure to transform bacteria with a gene that codes for a Green Fluorescent Protein (GFP). The real-life source of this gene is the bioluminescent jellyfish *Aequorea victoria*. Green Fluorescent Protein (GFP) causes the jellyfish to glow in the dark. Following this procedure, the bacteria should express their newly acquired jellyfish gene and produce the fluorescent protein, which causes them to glow a brilliant green color under ultraviolet light.

Genetic Transformation:
CHANGE CAUSED BY GENES, THE INSERTION OF A GENE INTO AN ORGANISM IN ORDER TO CHANGE THE ORGANISM'S TRAIT.

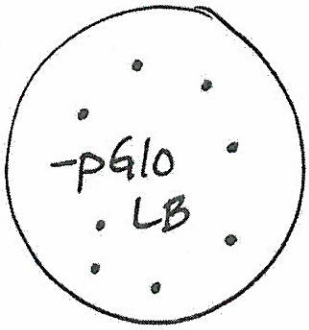
Green Flourescent Protein (GFP):
A PROTEIN THAT CAUSES THE JELLYFISH TO GLOW IN THE DARK.

In this activity, you will learn about the process of moving genes from one organism to another with the aid of a plasmid. In addition to one large chromosome, bacteria naturally contain one or more small circular pieces of DNA called plasmids. Plasmid DNA usually contains genes for one or more traits that may be beneficial to bacterial survival. In nature, bacteria can transfer plasmids back and forth allowing them to share these beneficial genes. This natural mechanism allows bacteria to adapt to new environment. The recent occurrence of bacterial resistance to antibiotics is due to the transmission of plasmids.

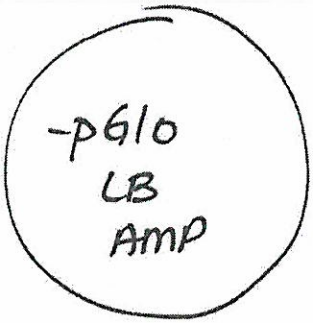
Plasmid:
CIRCULAR PIECE OF DNA IN A BACTERIA WHICH CONTAINS TRAITS THAT ARE BENEFICIAL TO SURVIVAL.

LB: → LURIA BROTH
FOOD FOR BACTERIA; NEEDED FOR BACTERIA TO SURVIVE AND ASEXUALLY REPRODUCE.

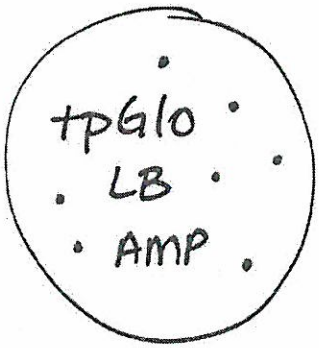
GENETIC TRANSFORMATION LAB



REGULAR BACTERIA
FOOD

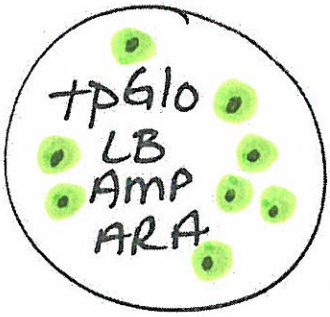


REGULAR BACTERIA
FOOD
ANTIBIOTIC CALLED AMPICILLIN



BACTERIA WITH 2 NEW GENES
- GFP (GLOWING) GENE
- ANTIBIOTIC RESISTANCE GENE

FOOD
ANTIBIOTIC CALLED AMPICILLIN



BACTERIA WITH 2 NEW GENES
- GFP (GLOWING) GENE
- ANTIBIOTIC RESISTANCE GENE

FOOD
ANTIBIOTIC CALLED AMPICILLIN
SUGAR CALLED ARABINOSE: TURNS ON GFP (GLOWING) GENE

Manipulating Bodies and Development (p. 352-353)

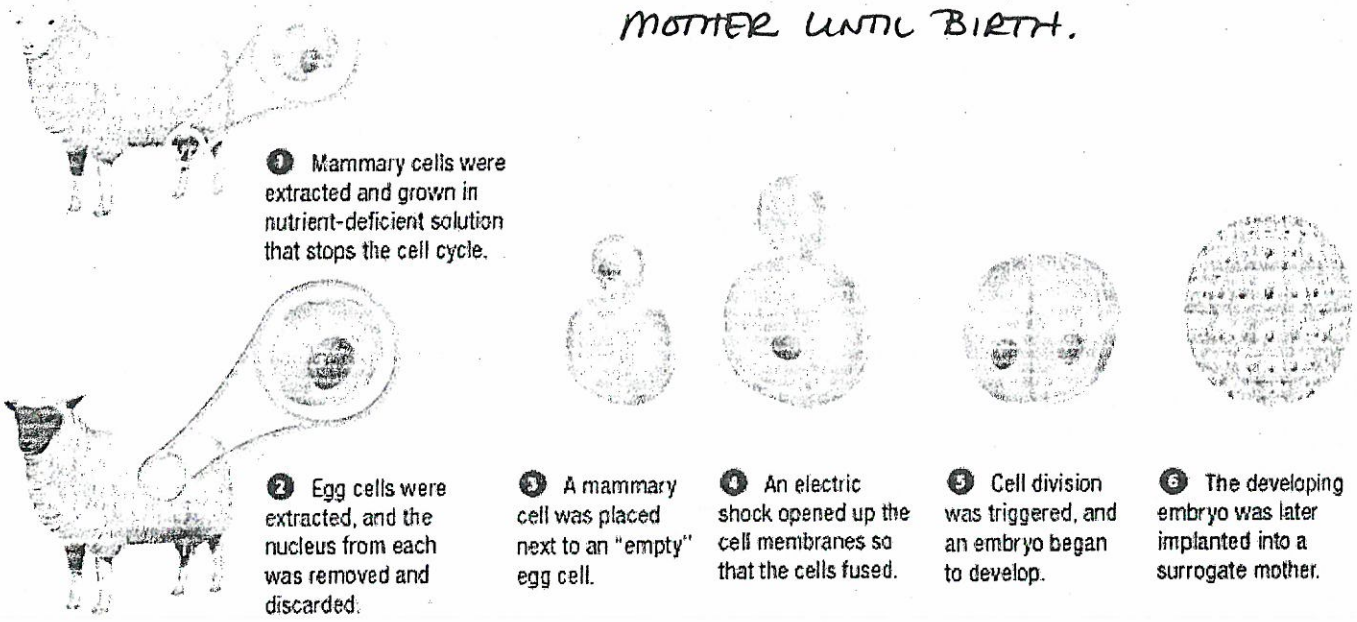
1. Define **Clone:** AN ORGANISM OR PIECE OF GENETIC MATERIAL THAT IS GENETICALLY IDENTICAL TO ONE THAT WAS PREEXISTING.

2. Does cloning occur in nature? YES

3. Give an example of an organism that clones naturally. BACTERIA - SELF-FERTILIZING PLANTS ORGANISMS THAT REPRODUCE ASEXUALLY

4. Why can't large animals clone themselves? ANIMALS HAVE A VERY COMPLEX FERTILIZATION AND EMBRYO DEVELOPMENT PROCESS.

5. Describe the process of **Somatic-Cell Nuclear Transfer.** THE NUCLEUS OF AN EGG CELL IS REPLACED WITH THE NUCLEUS OF AN ADULT CELL. THEN, THE EGG BEGINS TO DEVELOP INTO AN EMBRYO. * THE EMBRYO THEN FURTHER DEVELOPS IN A SURROGATE MOTHER UNTIL BIRTH.



6. What is one problem with cloning? ONLY FEW OFFSPRING SURVIVE (FETUSES HAVE GROWN ABNORMALLY). * A LOT OF MISTAKES!

7. **Genomic Imprinting** is when certain genes are turned ON or OFF during sperm and egg development. Genomic imprinting is altered when animals are CLONED in a lab so that different GENES may be activated early on, and the remaining development may be ALTERED.

Name _____ Period _____

Genetically Modified Organisms (GMO's)
GMO Webquest

What are GMO's?
Visit this website.
http://www.biology-online.org/dictionary/GMO

Define Genetically Modified Organism (GMO) / TRANSGENIC ORGANISM
ORGANISMS THAT HAVE BEEN CREATED USING NEW TECHNIQUES OF RECOMBINANT DNA TECHNOLOGY

What is Genetic Engineering?
Genetic engineering is the process of changing an organism's original genetic code by adding additional genes that create new traits for the organism. Go to the following website to see the steps that occur in a genetic engineering experiment.
Visit this website.
http://www3.iptv.org/exploremore/ge/
Click on "Uses" in red at the top left.

How is genetic engineering used?
For each of the listed uses, click on the picture.
List one genetically engineered organism or product. The pictures in the top right can be a big help.

Food/Traditional: TOMATOES; STAY RIPE LONGER
Food/Crops: CORN; Bt GENE THAT KILLS INSECTS
Food/Livestock: GOATS; PRODUCE SPIDER PROTEINS IN THEIR MILK
Medicine/DNA: HUMAN DNA → BACTERIA → HUMAN PROTEINS (MEDICINE) EX: INSULIN & ANTIBODIES
Medicine/Gene Therapy: "
Industry: COTTON; BLUE, DOESNT TWIST & WARMER
Environment: BACTERIA; DIGESTS OIL FROM WATER AFTER OIL SPILLS

Choose one of the products above and describe how it is useful?
CHOOSE ONE & EXPLAIN FURTHER

Guess What's Coming to Dinner?
Visit this website.
http://www.pbs.org/wgbh/harvest/coming/

Click on "Guess what's coming to dinner" then read the paragraph to the left. Click on "Guess what's coming to dinner" again.

Choose any 4 food products from the list below. Choose **one ingredient** and then list the trait that is being engineered for and why. In other words, what are scientists trying to **change in each food product and why?** I have done the first one for you.

GMO food or product	Engineered trait(s)
Bananas	Insert edible vaccines into bananas. This would help poor nations that cannot typically get vaccines.
Pizza (Cheese)	CHEESE; SPEEDS UP CHEESE MAKING PROCESS
Fruit (Strawberries, Pears, Melons, Apples, Grapefruits, Watermelons)	SUGAR IS ALTERED, ALTERS RIPENING CYCLES, PEST RESISTANCE
Sushi (Rice)	RICE- ALTERED STARCH CONTENT, PEST RESISTANCE; INCREASED NUTRIENTS
French Fries	POTATOES ABSORB LESS OIL
Corn	ENHANCED SEED COLOR, DROUGHT TOLERANCE
Fly	MALES ARE STERALIZED TO CONTROL THE POPULATION
Coffee	ALTERED CAFFINE
Tablecloth (Cotton)	MOTH RESISTANT DROUGHT TOLERANT
Flowers	PESTICIDE RESISTANCE

What is one BENEFIT to engineering genetically modified foods?

GROWS IN DIFFERENT CLIMATES, LOOKS BETTER, STAYS FRESH LONGER; DONT HAVE TO SPRAY WITH CHEMICAL INSECTICIDES.

What is one RISK of engineering genetically modified foods?

GENES COULD SPREAD UNCONTROLLED THROUGH CROSS-FERTILIZATION; UNKNOWN ALLERGIES, LONG TERM AFFECTS UNKNOWN.

8. Define **Stem Cell:** A CELL THAT CAN CONTINUOUSLY DIVIDE AND DIFFERENTIATE INTO VARIOUS TISSUES

9. Identify each type of stem cell.

- **Totipotent:** CAN GIVE RISE TO ANY TYPE OF CELL OR TISSUE TYPE
- Pluripotent: CAN GIVE RISE TO ALL TYPES EXCEPT GERM CELLS (CELLS THAT MAKE REPRODUCTIVE CELLS BY MEIOSIS)
- Multipotent: CAN GIVE RISE TO JUST A FEW CELL TYPES

10. Which type of potency do adult stem cells have? MULTIPOTENT embryonic stem cells? TOTIPOTENT

11. How can researchers get access to embryonic stem cells? IN FERTILITY CLINICS WHEN GAMETES ARE UNITED AND EMBRYOS ARE CULTURED, EXTRA EMBRYOS ARE STORED AND SOME ARE DONATED FOR STEM CELL RESEARCH.

12. What is an advantage to using stem cells that were made using SCNT? EMBRYOS MADE THROUGH SCNT DO NOT HAVE TRUE PARENTS AND THE EMBRYOS ARE EXPERIMENTED WITH EARLY ON BEFORE FURTHER DEVELOPMENT.

Ethical and Social Issues (p. 354)

1. Ethical issues involve DIFFERING VALUES AND PERSPECTIVES.

2. What is one danger of GMO foods? GMO GENES CAN ESCAPE DUE TO CROSS-POLLINATION.

3. Who do you think should make the decisions about whether human genes can be altered? SCIENTISTS, GOVERNMENT LEADERS, FARMERS, PUBLIC VOTE?

4. Is it possible to have legal rights to living organisms? YES

5. What GMO is currently under patent? AN OIL-EATING BACTERIUM

We will be discussing/debating the following issue. Please make any notes that will support your argument or refute the opposing side.

Suppose that genetic analysis could predict a person's ability in math. Should genetic screening be used to determine the course selections for every student in the school?

YES OR NO & WHY?