

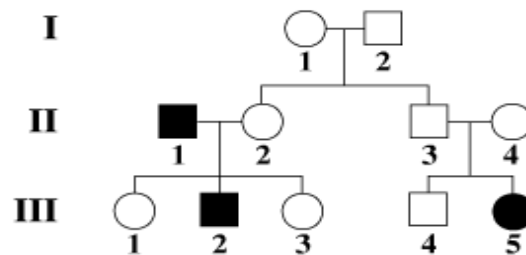
# Sample Diploma Problem

*Use the following information to answer questions 28 and 29.*

Phenylketonuria (PKU) is a genetic disorder caused by a change in the sequence of nitrogen bases in a particular gene. People with PKU cannot produce a particular enzyme.

*Use the following additional information to answer question 28.*

**Pedigree Chart for a Family with PKU**



28. Based on the above pedigree chart, the pattern of inheritance for PKU is **most likely**
- A. X-linked
  - B. Y-linked
  - ☒ C. autosomal recessive
  - D. autosomal dominant

Use the following information to answer question 24.

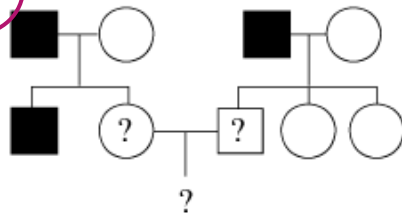
Two people decided to have a baby. Because they both have a family history of Huntington disorder, they seek genetic counselling.

### Some Information Used to Provide Genetic Counselling

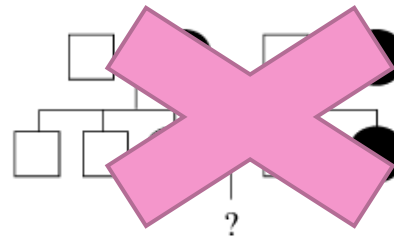
- Huntington disorder is an autosomal dominant disorder that develops later in life
- Neither the man's nor the woman's mothers have Huntington disorder
- The woman's father and brother have Huntington disorder
- The man's two sisters do not have Huntington disorder
- The man's father has Huntington disorder

24. Which of the following pedigree charts **best** represents the inheritance of Huntington disorder in the family described above?

A.

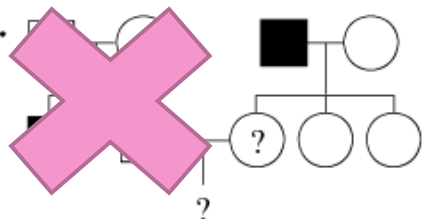


B.

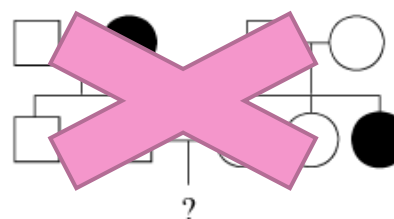


Mothers do not have it

C.



D.



Mans father has it



*Use the following information to answer question 31.*

Resistance to antibiotic drugs in bacterial populations has been observed over time.

31. One of the reasons that bacterial populations have developed resistance to antibiotics is because
- A. antibiotics biomagnify in the bacterial population
  - B. some bacteria develop tolerance to large amounts of antibiotics
  - ☒ C. plasmids with antibiotic-resistant genes are transferred between individual bacteria
  - D. the more bacteria are exposed to antibiotics, the less resistant the population becomes

Use the following information to answer question 32.

A researcher is studying the development of antibiotic resistance in *E. coli* bacteria. The researcher sets up four different experimental groups with Petri dishes filled with *E. coli*. *E. coli* from three of the four groups are then exposed to antibiotics as described below. The fourth Petri dish is the control group.

### Petri Dishes Used in the Study

- |                     |  |
|---------------------|--|
| <b>Petri dish 1</b> | Doses of increasing strength of an antibiotic are applied to the <i>E. coli</i> at equal time intervals. |
| <b>Petri dish 2</b> | Doses of different types of antibiotics are applied to the <i>E. coli</i> over time.                     |
| <b>Petri dish 3</b> | Doses of an antibiotic that kills all the <i>E. coli</i> are applied a number of times.                  |
| <b>Petri dish 4</b> | Control group. No antibiotics applied.   |

32. The responding variable in this study is the

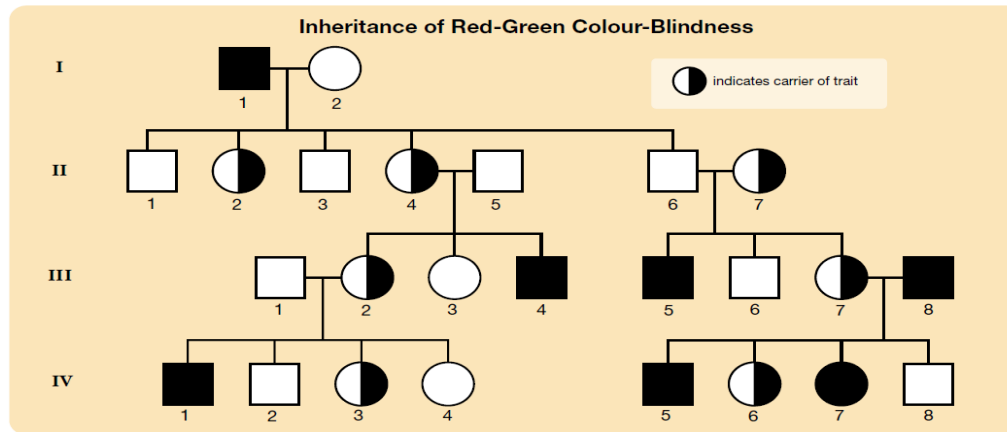
- ☒ A. percentage of surviving *E. coli*
- ☐ B. time between antibiotic doses
- ☐ C. strength of antibiotic dose
- ☐ D. type of bacteria

**Responding variable: what are you measuring?**

# Assignment

- ▶ Define mutation
- ▶ Explain how people who are carriers of the allele for cystic fibrosis do not have disease symptoms.

# Assignment



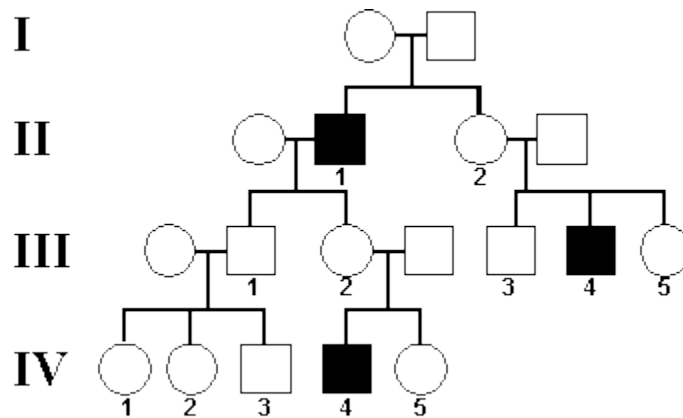
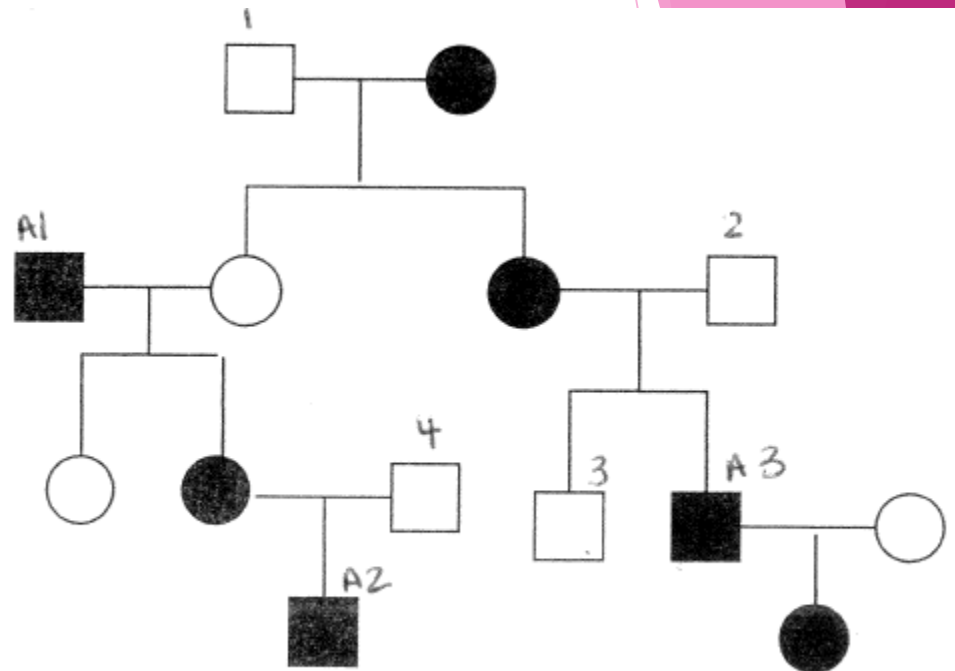
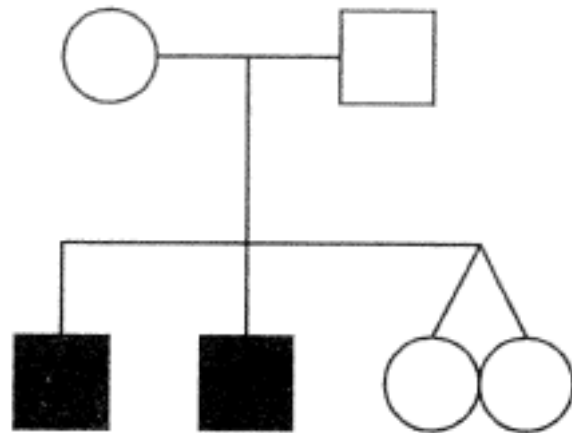
- ▶ In the first generation, is the father or the mother colour-blind?
- ▶ Determine the number of males and the number of females produced by the father and mother of the first generation.
- ▶ State the number of individuals in this pedigree who are carriers for colour-blindness.
- ▶ How many males and how many females have colour-blindness in this pedigree?

# Assignment

- ▶ Use a Punnett square to show the probable results of the cross between two people who are heterozygous for the sickle cell trait ( $Ss \times Ss$ ) and are malaria resistant.
- ▶ List the possible genotypes of the children from this couple.
- ▶ State the probability of a child of this couple being resistant to malaria.
- ▶ State the probability of a child of this couple developing sickle cell anemia.
- ▶ Explain why the sickle cell anemia allele is more common in areas infected with malaria

# Assignment

Is the following X linked?  
Dominate or recessive?



# Genetic Technologies



WE CAN'T BE SURE ABOUT THIS, BUT WE'VE ANALYZED GENES ON SEVERAL OF YOUR CHROMOSOMES, AND IT'S HARD TO AVOID THE CONCLUSION:



AT SOME POINT, YOUR PARENTS HAD SEX.

OH GOD!

STAY CALM! IT'S POSSIBLE IT WAS JUST ONCE!

I... I NEED TO BE ALONE.



# Curriculum

- ▶ describe, in general terms, genetic engineering and its application to gene therapy and the development of genetically modified organisms
- ▶ explain that decisions regarding the application of scientific and technological development involve a variety of perspectives, including social, cultural, environmental, ethical and economic considerations

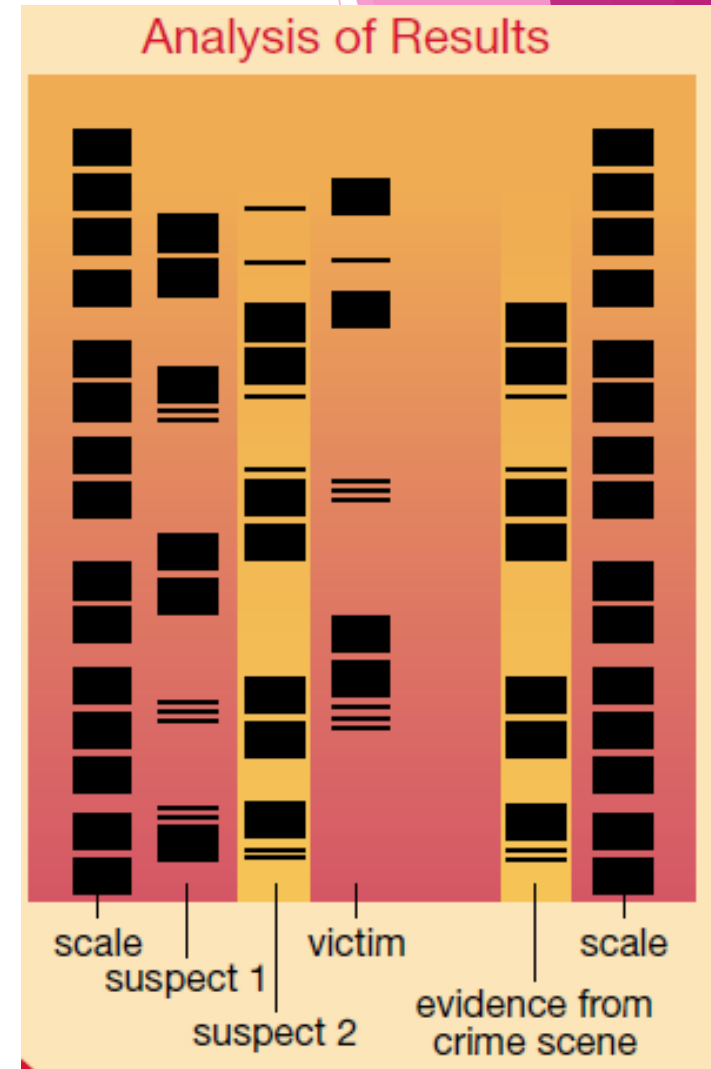


# Viewpoints

- ▶ Social and cultural- how does it affect a group of people as a whole? How does this affect our traditions?
- ▶ Environmental - how does it impact the environment?
- ▶ Ethical - is it good or bad to do?
- ▶ Economic - does this make us money or not?

# DNA Finger Printing

- ▶ **DNA fingerprinting** works on the idea that every cell in the human body has all 23 pairs of chromosomes in it
- ▶ So if you have a cell (blood, saliva, skin) you can map all of that person's DNA from it
- ▶ When DNA is collected they put it in a special gel and swirl it using an electric field and an image appears



# DNA Art



# Questions

- ▶ Should DNA for every person be collected in order to increase national security?
- ▶ Should parents test the DNA of an unborn baby using amniocentesis?
- ▶ Should a person be allowed to refuse a DNA sample to authorities?

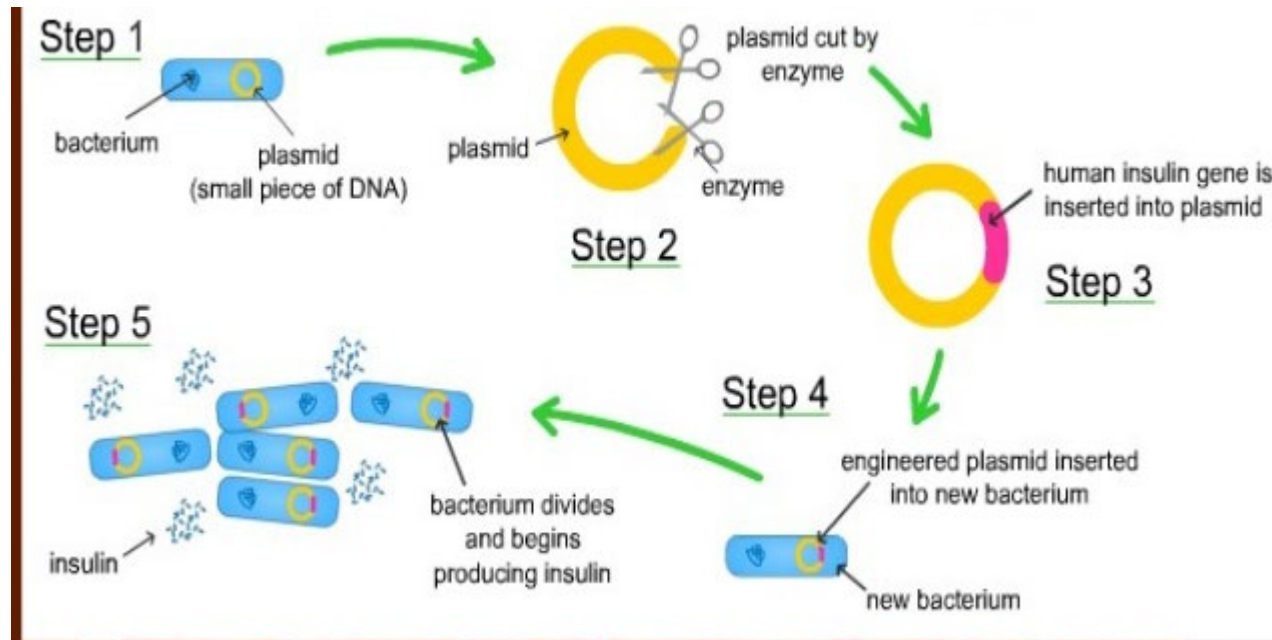
# Transgenics

- ▶ **Transgenics** is the process of intentionally altering the DNA of an organism by transferring DNA of one species to another species



# Producing insulin through Transgenics

- ▶ Insulin gene is obtained from pigs
- ▶ DNA segment is isolated and cut
- ▶ Gene is inserted into plasmid removed from bacteria
- ▶ New bacteria is grown and cultured
- ▶ Can now be given to people who have diabetes



# Genetic Engineering

- ▶ **Genetic engineering** is the modification of genetic material through actions of humans (selective breeding, transgenics)
- ▶ A genetically modified organism (GMO) is an organism that has had its genetic material deliberately altered through transgenics

# GMO's ( 6 minutes)





# Genetic engineering crops (5 minutes)



# Benefits of GMOs

- ▶ Crops can produce their own pesticides
- ▶ Bacteria containing a human gene of producing insulin can be given to diabetics
- ▶ Pig with human genes that produces antigens to make pig organs compatible with humans
- ▶ Goats can produce milk with spider silk in it for making very strong ropes
- ▶ An evergreen tree with jellyfish gene to make it glow

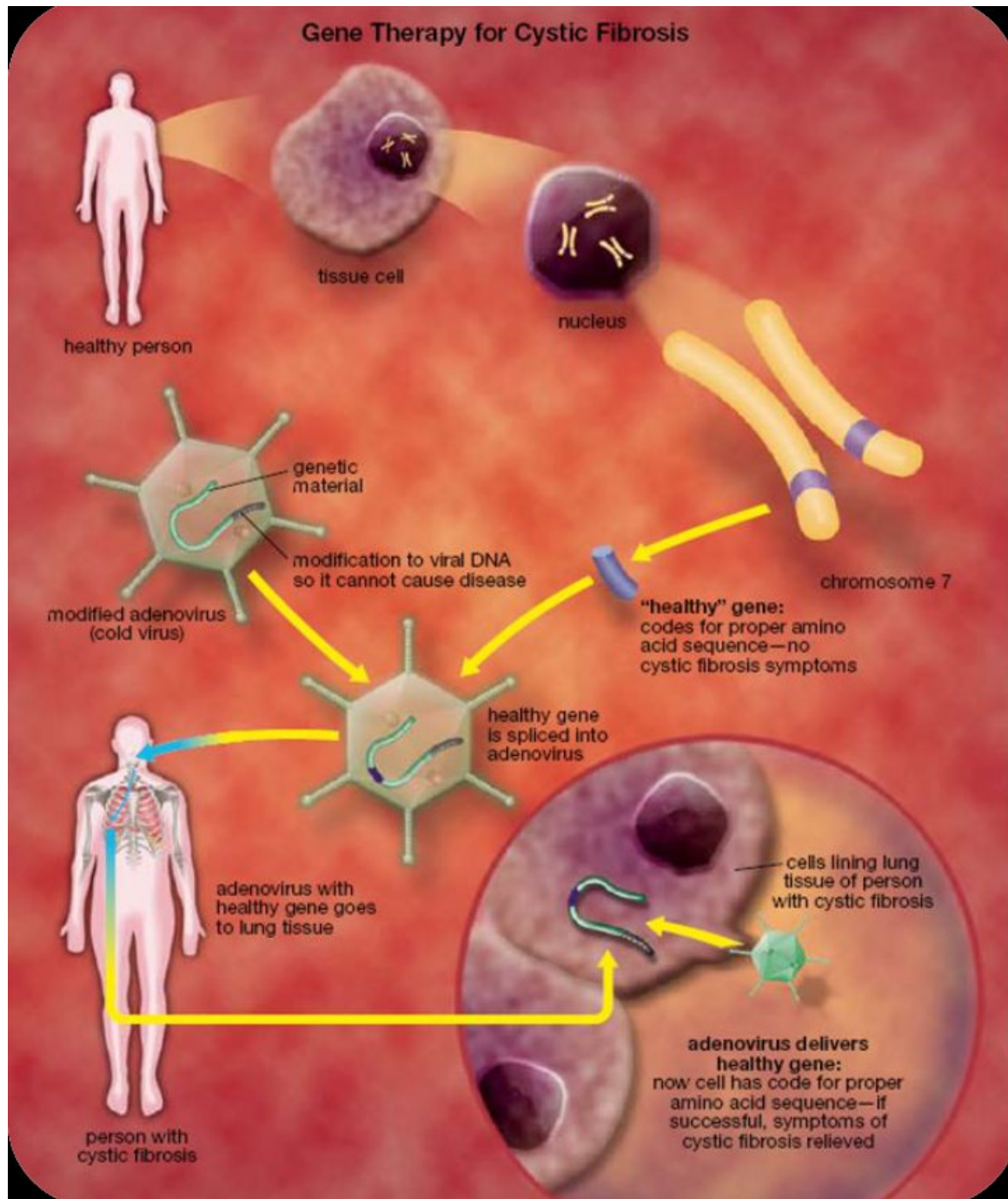
# Downside of GMOs

- ▶ Unknown effects on ecosystems
  - ▶ Herbicide tolerant canola can cross pollinate with weeds to make them herbicide tolerant
  - ▶ A corn that produces its own pesticide kills the monarch butterfly
- ▶ Bioweapons could be produced which are disease combining traits of two or three pathogens

# Gene Therapy

- ▶ Diabetics cannot produce insulin so they take injections of insulin multiple times a day
- ▶ **Gene therapy** is the technique of using a vector such as a virus to repair or replace genes and possibly cure genetic disorders
- ▶ Scientists take away the disease causing agents of a virus and use its ability to take over cells and reproduce using them
- ▶ Over time the virus would replace the faulty gene with the working one

## Gene Therapy for Cystic Fibrosis



# Gene Therapy



# Sample Diploma Problem

*Use the following information to answer questions 28 and 29.*

Phenylketonuria (PKU) is a genetic disorder caused by a change in the sequence of nitrogen bases in a particular gene. People with PKU cannot produce a particular enzyme.

*Use the following additional information to answer question 29.*

An experimental treatment for PKU involves the injection of a virus that contains a normally functioning gene into a patient. The virus inserts the normally functioning gene into the patient's cells, allowing the patient to produce a working enzyme.

29. The experimental treatment described above is called

- ☒ A. gene therapy
- ☐ B. transformation
- ☐ C. plasmid transfer
- ☐ D. natural selection

# Sample Diploma Problem

*Use the following information to answer question 30.*

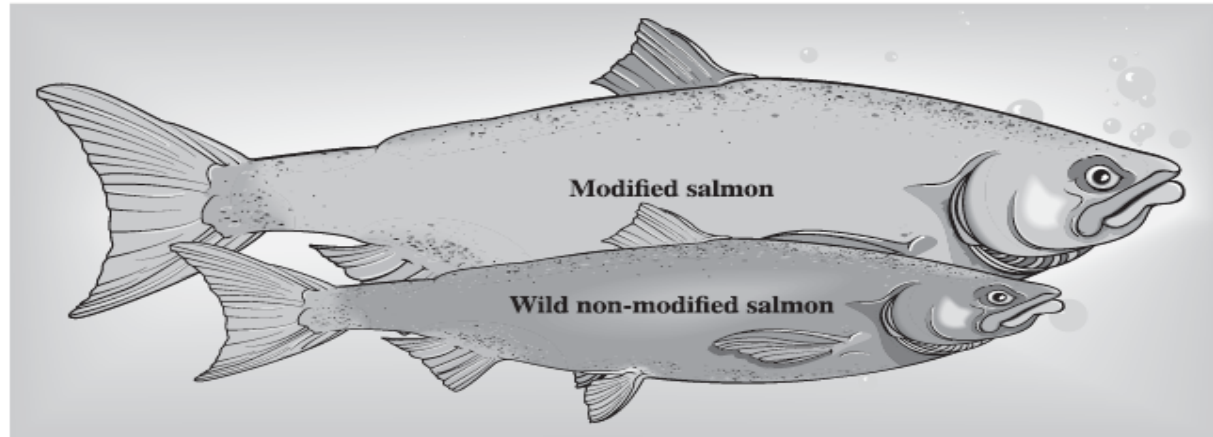
A type of transgenic mouse called the “Harvard mouse” is often used in cancer research. Harvard mice are born with a gene from another organism that makes them susceptible to developing cancer.

30. The process used to insert the foreign gene into the genome of the Harvard mouse is called
- A. gene therapy
  - B. gene mapping
  - C. genetic screening
  - ☒ D. genetic engineering



One type of genetically modified salmon has additional growth hormone genes. The additional genes cause the salmon to reach maturity quickly and grow to nearly twice the size of non-modified salmon.

### One-Year-Old Salmon



### Statements About Genetically Modified Salmon

- I Farming genetically modified salmon could increase food supplies.
- II Genetically modified salmon could escape into the wild, disrupting wild salmon populations.
- III Some people believe genetically modified salmon could trigger allergies in humans who consume it.
- IV Farming genetically modified salmon could reduce the overfishing of endangered wild salmon species.

9. The statement that **best** supports the production of genetically modified salmon, from an environmentally conscious perspective, is

- A. Statement I
- B. Statement II
- C. Statement III
- D. Statement IV**