2015 State Biotechnology CDE Questions

1. _____ is made in the nucleus while _____ build proteins in the cytoplasm.
    a. DNA, amino acids
    b. Amino acids, DNA

2. The _____ and _____ of the protein will determine the function that protein will have inside the body.
    a. Length and sequence
    b. Shape and size
    c. Weight and location

3. RNA moves through the ribosome where it is
    a. Read to build DNA.
    b. Read to build a protein.
    c. Read to build an amino acid.

4. The Promoter region
    a. Determines where the gene turns on.
    b. Signals how much protein to produce.
    c. Both A and B
    d. None of the above

5. How many nucleotides make up a codon?
    a. One
    b. Two
    c. Three
    d. Four

6. CAA is the code for the placement of the amino acid…
    a. Serine
    b. Glutamine
    c. Threonine

7. Each gene has three regions called
    a. Starter region, coding region, Ending sequence
    b. Termination sequence, coding region, prompter
    c. Coding region, Promotor, termination sequence

8. The _____ and _____of a gene determine the size and shape of the protein it builds
    a. Length and sequence
    b. Shape and size
    c. Weight and location
9. The first steps in making a Genetic Engineered crop that makes a new protein in specific part of the plant are:
    a. Identify a termination sequence and a proper coding region and put them together.
    b. Identify a promoter and a proper coding region and put them together.
    c. Identify a proper promoter and termination region and put them together.

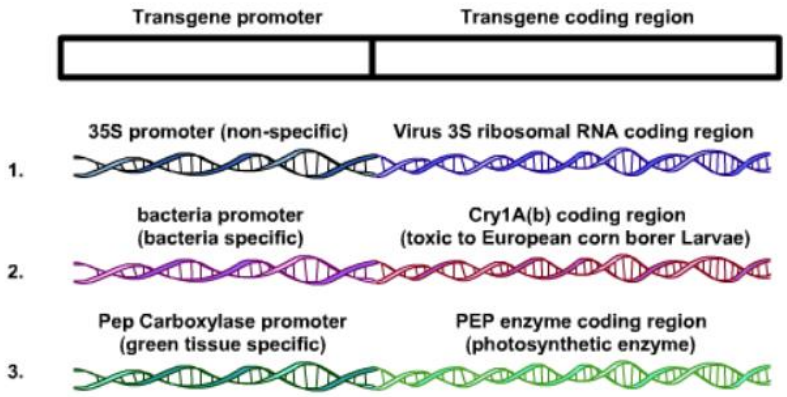
10. Amino acids, referred to as the building blocks of life, each
    a. Have their own shape
    b. Have similar shapes, but are the same size
    c. Have a very different shape

11. The termination sequence
    a. Signals the gene finishes being read during expression.
    b. Determines what is actually copied and gives the trait.
    c. Prevents the cell from reading the next gene on the chromosome.
    d. Both A and C.
    e. Both B and C.

12. Each codon codes for a specific
    a. Amino acid
    b. Protein
    c. Gene
    d. Nucleus

13. If the goal is to create a transgene that will work to fight an infection of the soilborne fungus Fusarium virguliforme, should the gene be active all the time?
    a. No, the promoter should trigger the expression of the gene only when the infection is present.
    b. Yes, the promoter should always be active so that it is ready to be expressed at any time the infection shows up.

14. If my genetic engineering goal is to create a corn plant which will target European Corn Borer at all stages of growth, which gene is a better choice for providing the promoter for the transgene?
    a. Gene #1, cloned from that cauliflower mosaic virus. This gene is expressed in all plant tissues and encodes the '35S' ribosome that the virus needs to replicate in plant tissues.
    b. Gene #2, cloned from a bacillus Thuringiensis (Bt) bacteria and encodes a protein the bacteria uses to kill some caterpillars such as European cornborer larvae.
    c. Gene #3, cloned from a corn plant. The gene encodes a protein the plant needs for photosynthesis and the gene is only expressed in green tissue that has active photosynthesis.



15. A cut plasmid has “sticky end” where:
    a. The broken nucleotide pairs have a slight charge.
    b. The broken nucleotides pairs have a tape like feel which naturally stick together.
    c. The broken nucleotides pairs will stick together when a chemical is applied.

16. List the steps in creating a transgenic plant in the correct order:

    i. Take the toxin gene from a stretch of Bt DNA and combine it with a vector.
    ii. Add the vector to the bacterium.
    iii. Move the plant cells to the growth medium for plants.
    iv. Add pieces of the desired plant’s leaf to the bacteria.
    v. Move the bacteria to the growth medium.

    a. Steps i, iii, v, iv, ii
    b. Steps iii, ii, iv, v, i
    c. Steps i, ii, iii, iv, v
    d. Steps i, ii, v, iv, iii

17. When you take the toxin gene from a stretch of Bt DNA and combine it with a vector:
    a. The DNA of the gene and the DNA of the vector now form a continuous loop of DNA.
    b. The DNA from the Bt gene overtakes the DNA of the vector.
    c. The DNA from the vector overtakes the DNA of the Bt gene.

18. Agrobacteria is attracted by:
    a. Chemical pheromones general by the plant.
    b. Electrical charges of the plant.
    c. Compounds generated by wounded plant cells.
    d. All of the above.

19. Agrobacterium is a bacterium that:
    a. Causes disease in plants.
    b. Has the ability to transfer a portion of its DNA into most cells.
    c. Destroys the cells.
    d. Both A and B.
    e. Both B and C.

20. Agrobacteria is
    a. Soil bacteria found in nature.
    b. Inserts its DNA into plant cells.
    c. Modify the plant to make food for the bacteria.
    d. All of the above.

21. Pollen moves from the _____ and lands on the _____.

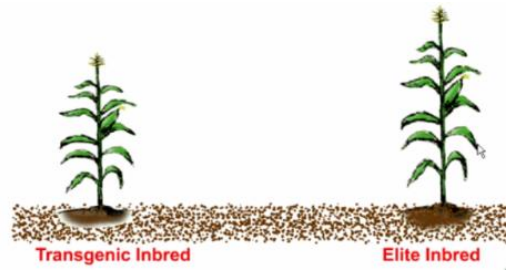
    a. Filament and Stamen
    b. Anther and Stigma
    c. Anther and Style
    d. Filament and Ovary

22. Pollen combines with the egg in the
    a. Stigma
    b. Ovule
    c. Style
    d. Ovary

23. Soybeans have a perfect flower which means
    a. The flowers are beautiful
    b. They have both male and female plant parts.
    c. They are able to naturally cross with a variety of other species.

24. Elite lines are those which
    a. have one or two traits that, in research, have shown the potential to be big yielding producers.
    b. have many traits that both producers and breeders are looking for.
    c. have been very expensive to produce.

25. When the transgenic inbred and the elite inbred plants reach the proper stage, they are:
    a. Dual-pollinated
    b. Cross-pollinated
    c. Backcross-pollinated
    d. None of the above

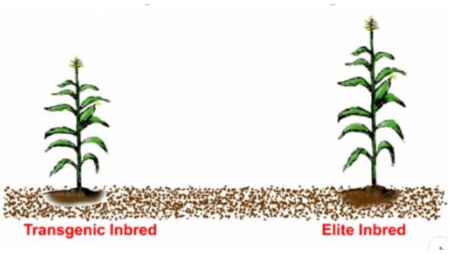


26. The first cross of the donor parent and the recurrent parent is known as the
    a. Initial generation
    b. F1 generation
    c. F2 generation
    d. BC1 generation

27. Transgenic crops, that have not been backcrossed, are not desired by farmers because
    a. They do not have the desired genes that are found in elite lines.
    b. They contain genes that have not been proven safe by the USDA.
    c. They will not produce a second generation.
    d. None of the above.

28. The progeny of the backcross 1 generation (F1 plant and the elite line) will have 75% elite genes. _____ of the seeds will carry the transgene.
    a. 25%
    b. 50%
    c. 75%
    d. 100%

29. In the first harvest of the backcrossing, the F1 seed will have one copy of the desired gene with _____ elite genes and _____ non-elite genes.
    a. 50% and 50%
    b. 25% and 75%
    c. 75% and 25%
    d. The percentages will be unknown until the seed is tested.



30. Approximately how many generations are needed in backcrossing before the plants have at least 98% of elite genes and the transgene?
    a. 2-3
    b. 3-4
    c. 4-5
    d. 5-6
    e. 6-7

31. In the final stage of backcrossing, plants are screened to select against:
    a. Negative mutations.
    b. Plants that are too tall.
    c. Plants that are too short.
    d. Plants that susceptible to disease.
    e. All of the above.

32. The final product, after backcrossing, is a marketable, high yielding transgenic line with _____% elite genes.
    a. Less than 87
    b. 87 to 93
    c. At least 98
    d. Unknown – it is different with each backcross.

33. Yield lag results because while backcrossing the transgenic lines,
    a. The lines lose their yield potential.
    b. Breeders are improving the yield potential of other non-transgenic lines.
    c. Non-transgenic lines traditionally yield more than non-transgenic lines.

34. In each generation of backcrossing, the breeder will gain _____% more of the genes in the recurrent parent.
    a. 15
    b. 25
    c. 50
    d. 65
    e. 75

35. A breeder may use DNA information to
    a. Track the individual gene that was inserted.
    b. Track desired genes from the elite line.
    c. Both A and B.
    d. All of the above.

36. The elite line is also known as the
    a. Recurrent parent
    b. Donor parent
    c. Best parent

37. Heat helps with the DNA extraction process because
    a. Warm DNA is easier to find.
    b. Heat helps to disrupt the cells.
    c. When the equipment is warm, it is easier for the scientist to work with.

38. Chloroform is used to wash away unwanted cellular components such as
    a. Protein molecules.
    b. Pigment molecules
    c. Lipids
    d. All of the above.

39. The processes of polymerase chain reaction, or PCR, allows scientists to
    a. Heat up the cells, in order to disrupt them.
    b. Make lots of copies of the gene in order to detect it.
    c. Track the individual gene that was inserted.
    d. Recreate compounds generated by wounded plant cells.
40. The chromosome contains
    a. Protein molecules.
    b. DNA for coding genes and protein for making it stable
    c. Lipids.
    d. None of the above.

41. In PCR, the goal is to make copies of
    a. A specific segment of the DNA that is extracted.
    b. All of the DNA in the extracted sample.
    c. The largest sections of the DNA strands copied.

42. DNA primer
    a. Is purchased as a specific sequence of nucleotides, designed to match up to a part of the gene being replicated.
    b. Is naturally occurring within the DNA sample, assisting in the replication of the gene.
    c. All of the above.

43. Every round of heating and cooling, during PCR,
    a. Quadruples the amount of DNA in the test tube.
    b. Triples the amount of DNA in the test tube.
    c. Doubles the amount of DNA in the test tube.

44. The primers will bind according to
    a. Electrical charges omitted from the genetic code.
    b. Normal DNA pairing
    c. The instructions given to the DNA sample by the researcher.

45. After PCR, DNA can be see through processes such as
    a. Looking under a microscope
    b. Gel Electrophoresis
    c. Computer imaging
    d. Both A and C
    e. Both B and C

46. In gel electrophoresis, electricity is run through a gel in order to
    a. Separate molecules based upon their size.
    b. Separate molecules based on their function.
    c. Separate molecules based on their shape.

47. What role does isopropyl, or rubbing, alcohol play in DNA extraction?
    a. Precipitate the DNA.
    b. Cool the DNA.
    c. Separate the solid components from the liquid DNA.

48. The role of a primer in PCR is to
    a. Amplify a small amount of DNA.
    b. Pinpoint certain parts of the DNA.
    c. Copy the gene.
    d. Read the gene in gel electrophoresis.

49. What role does the electricity play in gel electrophoresis?
    a. The electricity encourages the DNA to move through the gel faster.
    b. The DNA backbone is negatively charged, so the electricity pulls the DNA through the gel.
    c. Both A and B.

50. Which of the following statements is most true when dealing with gel electrophoresis?
    a. Smaller PCR products move faster than larger bands.
    b. Larger PCR products move faster than small bands.
    c. The shape of the PCR products determines the speed at which they move through the gel.

Answer Key

1 – a
2 – b
3 – b
4 - c
5 – c
6 – b
7 – c
8 – a
9 – b
10 – a
11 – d
12 – a
13 – a
14 – a
15 – a
16 – d
17 – a
18 – c
19 – d
20 – d
21 – b
22 – a
23 – b
24 – b
25 – b
26 – b
27 – a
28 – b
29 – a
30 – d
31 – e
32 – c
33 – b
34 – c
35 – c
36 – a
37 – b
38 – d
39 – b
40 – b
41 – a
42 – a
43 – c
44 – b
45 – e
46 – a
47 – a
48 – b
49 – b
50 - a

Biotechnology CDE Identification Sheet

Student Name: _____

Student Number: _____ Chapter: _____

Place the number of the correct word on the blank of the letter of the corresponding item.

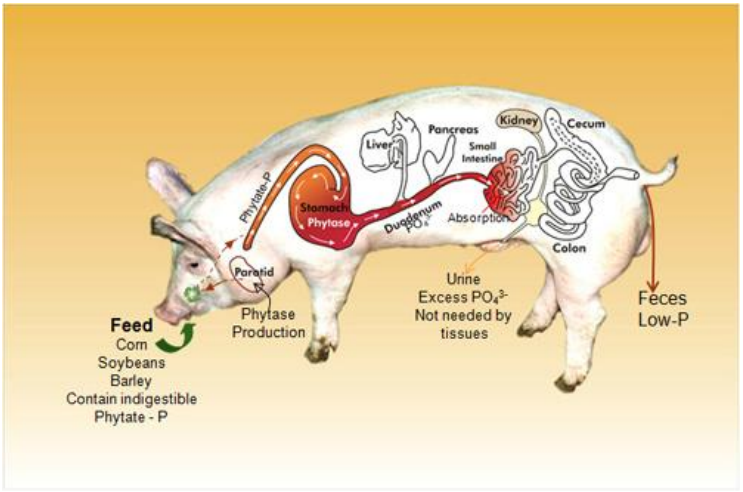
A. _____
B. _____
C. _____
D. _____
E. _____
F. _____
G. _____
H. _____
I. _____
J. _____
K. _____
L. _____
M. _____
N. _____
O. _____
P. _____
Q. _____
R. _____
S. _____
T. _____
U. _____
V. _____
W. _____
X. _____
Y. _____

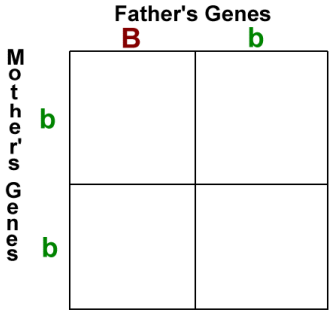
Word bank

1. Micro-Pipet
2. DNA strand
3. Micropipetter
4. Electrophoresis casting tray
5. Water Bath
6. Electrophoresis
7. Agar gel
8. Beaker
9. Graduated cylinder
10. Protein test strip
11. Forceps
12. Thermal cycler
13. Petri dish
14. Incubator
15. Micro-Centrifuge Tubes
16. Centrifuge
17. Hand planter
18. Pipet Tips
19. Microscope Slides
20. Microscope
21. Hot plate
22. Balance Scale
23. Sepal
24. Anther
25. Filament
26. Stamen
27. Pistil
28. Style
29. Stigma
30. Ovary
31. Ovule
32. Silk
33. Tassel
34. Pollen
35. Tassel bag
36. Shoot bag
37. Central Vacuole
38. Nucleus
39. Cell wall
40. Chromosomes
41. Loading Gel Electrophoresis
42. Mortar and pestle
43. Punnett square to predict F2
44. Punnett square to predict F1
45. Gene gun
46. Gene gun ammunition
47. Pollen
48. Tissue Culture Plant
49. Detasseling crew
50. Pollinating stigmas
51. Removing Anthers
52. Transgene design
53. Hybrid Seed Production field
54. Genetic material structure
55. Isolated DNA

Biotechnology CDE Practicum **(75 pts/individual; 300 pts/team)**

Pig producers and farmers who use pig manure as a fertilizer anticipate the need to better manage nutrient levels in pig manure in the future. To prepare for the future, your biotechnology company has decided to incorporate a new trait into either a Duroc or a Hampshire line that breeds true for the genetically engineered trait introduced into pigs by animal scientists at the University of Guelph in Canada. This transgenic line of pigs was called Enviropigs.





Your team has 60 minutes to complete the following and present the following information on poster(s) for judging:

1. Create a name for your biotechnology company.

2. Research via the Internet "Enviropig" to learn specific details about the gene that was introduced and the method of gene introduction and the motivation for developing this genetically controlled trait.

3. Outline the steps the University of Guelph scientists performed to develop the genetically engineered Yorkshire line of Envirpigs.

4. Outline a plan to use backcrossing to develop an Enviropig line of either Duroc or Hampshire pigs. (NOTE: you can purchase frozen semen from Yorkshire Enviropigs).

5. Indicate in our outline diagram where where DNA testing can be used in your plan to help in the selection of the desired offspring.

6. Anticipate potential scientific and non scientific challenges to your projects success and list how your research team or your biotechnology company will address these challenges.

NOTE: Assume these are the three main genetic differences among the pig lines.

Yorkshire Enviropigs: **PPbbdd**
Duroc (not transgenic): **ppbbDD**
Hampshire (not transgenic): **ppBBDD**

'P' is the transgene introduced by the Unversity of Guelph scientists, 'p' means there is no transgene in the pig chromosome.
BB and **Bb** pigs have a belt of colorless hair on their body **bb** pigs have no belt
DD and **Dd** pigs make a dark black or brown pigment **dd** pigs are white

Punnet squares SHOULD be used to predict the inheritance of all genes and included as a part of your poster.

Team points (300 possible)

1. 10 points: Biotechnology company name
2. 20 points: Promote the benefit of this new trait for people.
3. 100 points: Genetic Engineering steps
4. 100 points: Backcross Breeding steps
5. 30 points: DNA testing plan
6. 20 points Scientific and non scientific challenges you will address
7. 20 points Clarity, organization and appeal of your outlines

Team work checklist:

____ Company name

____Research important facts

____Organize and draw your steps for GE outline

____Organize and draw your backcross breeding process to get your final true breeding line of Enviropig. Use appropriate Punnet squares.

____Indicate where DNA testing will be done to help the process

____Benefits of your successful project

____ Issues and concerns and how you will address them