
DNA Microarrays

Knowledge Probe (Pre-Quiz)

Instructor Guide

Notes to Instructor

The *DNA Microarray Knowledge Probe (KP)* can be used to determine the participant's current knowledge of DNA microarrays, their applications, operation, interpretation and fabrication prior to complete this learning module. This results from this KP could be compared with the results from the final assessment (FA) to determine the participants' level of learning. This would provide information on what was learned as a result of completing the supporting PK and activities. This KP is part of the *BioMEMS DNA Microarray Learning Module*.

The *BioMEMS DNA Microarray Learning Module* consists of the following units:

- **Knowledge Probe (KP)**
- DNA Microarray PK
- DNA Hybridization Activity
- DNA Microarray Terminology Activity
- DNA Microarray Model Activity*
- The DNA Microarray - An Ethical Dilemma? Activity
- DNA Microarray Assessment

*A DNA Microarray Kit is available to support this learning module. The kit is required for the DNA Microarray Model Activity. To order a kit, please visit the SCME website (<http://scme-nm.org>)

Introduction

The DNA Microarray Learning Module provides an overview of DNA microarrays – types of arrays, applications, interpretation, design, and fabrication. Activities provide the opportunity for students to gain a better understanding of these concepts as well as to discuss the ethical questions surrounding some of the applications and possibilities of these arrays.

The purpose of this knowledge probe is to determine your current understanding of the applications, operations, interpretation, and fabrication of DNA microarrays. It is not a test. Answer each question to the best of your current knowledge.

1. Cytosine, Guanine, Adenine, and Thymine are the _____ of a DNA molecule.
 - a. Oligonucleotides
 - b. Nucleotides
 - c. Nitrogenous bases
 - d. Genomes

Answer: c. nitrogenous bases

2. A cytosine, guanine, adenine and thymine with a sugar and a phosphate is called _____.
 - a. Oligonucleotide
 - b. Nucleotide
 - c. Polymorphism
 - d. Genome

Answer: b. Nucleotide

3. Which of the following is NOT a valid base pair sequence?
 - a. A-T, T-A, C-G, A-T
 - b. T-A, C-G, C-T, T-A
 - c. T-A, T-A, G-C, A-T
 - d. C-G, G-C, C-G, A-T

Answer: b.

4. A DNA microarray uses synthetic _____ as probes to capture target molecules from test and control samples.
 - a. Oligonucleotides
 - b. Nitrogenous bases
 - c. Polymorphisms
 - d. Genomes

Answer: a. oligonucleotides

5. DNA microarrays depend on which of the following processes to occur on the surface of the microarray in order to accurately analyze the DNA of the control and test samples?
- Replication
 - Transcription
 - Reverse Transcription
 - Hybridization

Answer: d. Hybridization

6. Which of the following applications do NOT use DNA microarrays?
- Genome studies of various species
 - Identification of specific genes for specific diseases
 - Study how genes react to specific drugs or drug dosages
 - Identification of specific viruses or bacteria
 - All of the above applications use DNA microarrays

Answer: d. Identification of specific viruses or bacteria (These use dynamic or static sensor arrays, not DNA arrays)

7. Which of the following BEST explains the process that takes place on the surface of a DNA microarray?
- Hybridization occurs between a synthetic oligo probe on the array and a complementary ssDNA from the control or test sample
 - Hybridization occurs between a ssDNA from the control sample and a complementary DNA from the test sample
 - DNA transcription divides a DNA molecule from the test sample into a ssDNA and RNA
 - A copy DNA is made from the test sample's RNA using reverse transcription

Answer: a. Hybridization occurs between a synthetic oligo probe on the array and a complementary ssDNA from the control or test sample.

8. Which of the following BEST describes a GeneChip[®]? A grid or array consisting of thousands or millions of ...
- genes from a specific organism strategically placed on a glass or silicon substrate using an inkjet printing process
 - synthetic oligos that were fabricated using an inkjet printing process
 - synthetic oligos that were fabricated using a photolithography process
 - ssDNA from a control and a test sample strategically placed on a silicon substrate using a photolithography process

Answer: c. A grid or array consisting of thousands or millions of synthetic oligos that were fabricated using a photolithography process

9. The photolithography fabrication process of a DNA microarray using masks requires which of the following components?
- Glass substrate, a set of masks, UV light, hundreds of oligonucleotide solutions
 - Silicon substrate, a set of masks, UV light, four nucleotide base solutions with blocking agent
 - Silicon substrate, a set of masks, UV light, hundreds of oligonucleotide solutions with blocking agent
 - Glass substrate, a set of masks, UV light, a blocking agent, four oligo solutions

Answer: b. silicon substrate, a set of masks, UV light, four nucleotide base solutions with blocking agent

10. Which of the following BEST describes the process steps of the photolithography process used for DNA microarray fabrication?
- Coat, align, expose, develop
 - Protect, deprotect, develop
 - Protect, deprotect, addition
 - Coat, deprotect, addition

Answer: c. Protect, deprotect, addition

11. In the photolithography process of a DNA microarray using masks, each mask identifies the placement location of which of the following components?
- A specific oligonucleotide
 - A specific DNA sequence
 - A specific DNA hybrid
 - A specific nucleotide base

Answer: d. A specific nucleotide base

12. What is the purpose of the UV light in the photolithography process of a DNA microarray?
- To remove the blocking agent from the top of the oligo chain
 - To add the blocking agent to the top of the oligo chain
 - To add a nucleotide base to the top of the oligo chain
 - To block a specific position from the placement of a nucleotide base

Answer: a. To remove the blocking agent from the top of the oligo chain

13. Which of the following prevents the addition of a nucleotide base to specific features during the addition step of photolithography fabrication?
- Mask
 - Blocking agent
 - UV light
 - Fluorescent tag

Answer: b. Blocking agent

14. In the interpretation of a DNA microarray, what color would indicate the presence of cDNA from the control sample as well as the test sample?
- Yellow
 - Red
 - Green
 - Black

Answer: a. Yellow

15. In the interpretation of a DNA microarray, what color would indicate the presence of cDNA from only the test sample?
- Yellow
 - Red
 - Green
 - Black

Answer: b. Red

16. DNA microarrays are fabricated with “positive and negative control features”, features that verify the validity of the test. Which of the following would indicate an “invalid” test?
- Positive control feature with both control and test sample genes
 - Positive control feature with both control and test sample genes AND negative controls with no hybrids shown
 - Negative control feature with genes from neither the control or test sample
 - Negative control feature with a gene or genes from either the control or test sample

Answer: d. Negative control feature with a gene from either the control or test sample

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