
DNA Microarrays

Assessment

Instructor Guide

Notes to Instructor

The DNA Microarray Assessment can be used to determine the participant's knowledge of DNA microarrays, their applications, operation, interpretation and fabrication. This assessment could be used as both a pre-test and post-test. This would provide information on what was learned as a result of completing the supporting PK and activities. This assessment 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. The order a kit, please visit the SCME website (<http://scme-nm.org>)

Introduction

The purpose of this assessment is to determine your understanding of the applications, operations, interpretation, and fabrication of DNA microarrays.

There are 16 assessment questions.

1. Which of the following is NOT a nitrogenous base of a DNA molecule?
 - a. Cytosine
 - b. Guanine
 - c. Uracil
 - d. Adenine
 - e. Thymine

Answer: c. Uracil (The uracil base is found in RNA)

2. What is the term for a nitrogenous base with a sugar and phosphate?
 - a. Oligonucleotide
 - b. Nucleotide
 - c. Polymorphism
 - d. Genome

Answer: b. Nucleotide

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

Answer: c.

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?
 - a. Replication
 - b. Transcription
 - c. Reverse Transcription
 - d. Hybridization

Answer: d. Hybridization

6. Which of the following applications do NOT use DNA microarrays?
- a. Identification of specific antibodies for specific diseases
 - b. Identification of specific genes for specific diseases
 - c. Compare the gene sequences of various species
 - d. Study how genes react to specific drugs or drug dosages
 - e. All of the above applications use DNA microarrays

Answer: a. Identification of specific antibodies for specific diseases (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?
- a. Hybridization occurs between a synthetic oligo probe on the array and a complementary ssDNA from the control or test sample
 - b. Hybridization occurs between a ssDNA from the control sample and a complementary DNA from the test sample
 - c. DNA transcription divides a DNA molecule from the test sample into a ssDNA and RNA
 - d. 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 ...
- a. genes from a specific organism strategically placed on a glass or silicon substrate using an inkjet printing process
 - b. synthetic oligos that were fabricated using an inkjet printing process
 - c. synthetic oligos that were fabricated using a photolithography process
 - d. 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 used in DNA microarray fabrication requires which of the following components?
- a. Glass substrate, a set of masks, UV light, hundreds of oligonucleotide solutions
 - b. Silicon substrate, a set of masks, UV light, four nucleotide base solutions with blocking agent
 - c. Silicon substrate, a set of masks, UV light, hundreds of oligonucleotide solutions with blocking agent
 - d. 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, which of the following identifies and controls the placement of specific nucleotide bases on the array?
- Blocking agent
 - Ultraviolet (UV) light
 - Masks
 - Substrate atoms

Answer: c. Masks

12. In the photolithography process of a DNA microarray using masks, which of the following removes the blocking agent from the top of the oligo chain?
- UV light
 - Masks
 - Nucleotide base
 - mRNA

Answer: a. UV light

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?
- a. Yellow
 - b. Red
 - c. Green
 - d. 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?
- a. Positive control feature with both control and test sample genes
 - b. Positive control feature with both control and test sample genes AND negative controls with no hybrids shown
 - c. Positive control feature with targets only from the control sample
 - d. Negative control feature with genes from neither the control or test sample

Answer: c. Positive control feature with targets only from the control sample.

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