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# **Biomolecular Applications for bioMEMS - Assessment Instructor Guide**

## **Notes to Instructor**

This assessment helps to evaluate the participants' knowledge of biomolecules and the characteristics that make biomolecules capable of being used in bioMEMS devices. This assessment could be compared to the Knowledge Probe (pre-test) to determine the effectiveness of this learning module in helping students better understand biomolecules and their role in microtechnology.

This assessment is part of *Mapping Biological Concepts* which contain the following learning module:

- DNA Overview
- DNA to Protein Overview
- Cells – The Building Blocks of Life
- Biomolecular Applications in bioMEMS

This is the assessment for the *Biomolecular Applications for bioMEMS Learning Module*:

- Knowledge Probe (KP or pre-test)
- Biomolecular Applications for bioMEMS Primary Knowledge
- Biomolecular Functions - Activity
- The Scale of biomolecules – Activities
- Biological Motors – Activity
- **Biomolecular Applications for bioMEMS Assessment**

## **Description**

This assessment should be completed after completing the *Biomolecular Applications for BioMEMS Learning Module*. There is a matching chart and ten questions.

### Matching (with answers)

Indicate the BEST type of biomolecules to perform each of the bioMEMS functions listed below.

		BioMEMS Function		Type of biomolecule
<b>B</b>	1	Recognizing the presence of a pathogen by a unique pathogen DNA sequence	A	Proteins
<b>A</b>	2	Filtering large macromolecules from smaller molecules in a complex solution	B	Nucleic acids
<b>C</b>	3	Forming a container for a water-soluble drug	C	Lipids
<b>A</b>	4	Sensing the presence of an environmental pollutant		
<b>A</b>	5	Moving a particle across the surface of a bioMEMS device		
<b>A</b>	6	Detection of changes in blood sugar levels in diabetic patients		
<b>B</b>	7	Detection of a disease state by changes in expression levels of key genes		
<b>A</b>	8	Catalyzing a specific chemical reaction		

**Table 1: BioMEMS Functions vs. Biomolecule**

1. **Which of the following has the smallest size?**

- a. distance across a lipid bilayer
- b. diameter of a microtubule
- c. diameter of a DNA double helix
- d. diameter across a liposome vesicle
- e. diameter of a bacterial flagellum

***Answer: c. Diameter of a DNA double helix***

2. **Which of the following has the largest size?**

- a. distance across a lipid bilayer
- b. diameter of a microtubule
- c. diameter of a DNA double helix
- d. diameter across a liposome vesicle
- e. diameter of a bacterial flagellum

***Answer: d. diameter across a liposome vesicle***

3. **Which type of protein has the largest channel diameter?**

- a. Bacterial membrane porins
- b. Bacterial S-layer proteins
- c. Microtubules
- d. Tobacco Mosaic virus

***Answer: c. Microtubules***

4. **Which of the following best explains the reason that biomolecules have such specific recognition properties?**

- a. Nonpolar and hydrophobic interactions
- b. Polar and hydrophilic interactions
- c. Both nonpolar/hydrophobic and polar/hydrophilic interactions
- d. A specific covalent bond in a lock and key type of position

***Answer: c. Both nonpolar/hydrophobic and polar/hydrophilic interactions***

5. **Which of the following properties of biological molecules is NOT an advantage in bioMEMS applications?**

- a. Ability to self-assemble, based on inherent chemical and surface interactions
- b. Ability to self-renew, providing a self-assembling and self-perpetuating property
- c. Precision in the structures that they form
- d. Their highly discriminating recognition properties
- e. Nanoscale size of their structures

***Answer: b. Ability to self-renew, providing a self-assembling and self-perpetuating property is NOT an advantage in bioMEMS applications***

6. **Which of the following proteins would be best suited for moving particles to different positions on a bioMEMS surface?**

- a. Kinesin and microtubules
- b. Kinesin and actin microfilaments
- c. Flagellin motor proteins and flagellin proteins
- d. Myosin and flagellin proteins
- e. ATP synthase and flagellin proteins

***Answer: a. Kinesin and microtubules***

7. **Which of the following requires a lipid membrane in order to function?**

- a. A glucose oxidase enzyme that binds to glucose molecules and oxidize them
- b. A DNA microarray
- c. A protein microarray
- d. ATP synthase
- e. Microtubules

***Answer: d. ATP synthase***

8. **Which of the following could be used for transfer of small molecules into or out of lipid vesicles?**

- a. Bacterial porin and transmembrane channel proteins
- b. Bacterial porin proteins only
- c. Transmembrane channel proteins only
- d. Transmembrane receptor and cell surface receptor proteins
- e. Cell surface receptors only

***Answer a. Bacterial porin and transmembrane channel proteins***

9. **Which of the following would be best suited for a protein microarray?**
- a. Single-stranded DNA molecules
  - b. Cell surface receptors
  - c. Antibodies
  - d. Bacterial S-layer proteins

**Answer: c. Antibodies**

10. **Which of the following stimuli could be used to provide power for synthesis of ATP by the enzyme ATP synthase?**
- a. Binding of a specific activator in the enzyme active site
  - b. A sudden shift in pH
  - c. Addition of a proton-carrier protein
  - d. Coupling this enzyme with another enzyme that makes ADP available

**Answer: b. A sudden shift in pH**

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