

Biomolecular Functions Activity

Instructor Guide

Notes to Instructor

This activity unit provides the participants with the opportunity to explore the function of biomolecules and the parallels to equivalent macroscopic components. This activity can be completed prior to, within, or after the primary knowledge unit for Biomolecular Applications for bioMEMS. The instructor may choose the order in which to use each of these units. One or more of the activities could be used as an inquiry activity prior to the primary knowledge unit.

This activity is part of *Mapping Biological Concepts* which contain the following learning modules:

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

This unit is one of four activities in the *Biomolecular Applications for bioMEMS Learning Module*:

- Biomolecular Applications for bioMEMS Primary Knowledge
- **Biomolecular Functions - Activity**
- The Scale of Biomolecules – Activities
- Biological Motors – Activity
- Biomolecular Applications for bioMEMS Assessment

Description and Estimated Time to Complete

This activity is one of three activities for the Biomolecular Application for bioMEMS Learning Module. This activity provides you with the opportunity to think about the functions of biomolecules by comparing them to macroscopic equivalent components. It would be helpful to review the Biomolecular Applications for bioMEMS PK prior to starting this activity.

Estimated Time to Complete

Allow at least 30 minutes to complete

Introduction

The three types of biomolecules that can be used in bioMEMS biological interfaces include the following:

- Nucleic acids, such as DNA. These are the molecules that cells use to carry genetic information.
- Proteins, such as enzymes, fibers, molecular motors, channels and pores, vesicles. These molecules are often referred to as the "work horses" of the cell because they perform so many of the jobs of cellular metabolism.
- Lipids, such as phospholipid vesicles and membranes. These are relatively small molecules that self-assemble into very thin membranes in order to make separate compartments in the cell. They also provide a membrane barrier on the outside of all cells.

Activity Objectives and Outcomes

Activity Objectives

- Demonstrate your understanding of biomolecule functions by comparing their functions to equivalent macroscopic components.

Activity Outcomes

In this activity you will make the connection between familiar functions and those of biomolecules. The keywords and referenced glossaries in the primary knowledge unit may be useful in completing this activity.

Activity: Biomolecules' Functions

In the following table, list a function(s) performed by each of the biological molecules and an equivalent macroscopic component.

Macroscopic components	Function	Molecular example(s)
struts, beams, casings		actin microfilament structures
cables		collagen
fasteners, glue		intermolecular forces
solenoids, actuators		conformation-changing proteins, actin/myosin, kinesin/microtubules
boat motors		flagellar motor
drive shafts		bacterial flagella
containers		vesicles
pipes		various tubular structures
pumps		flagella, transmembrane proteins
highways		microtubules
automobiles		kinesin
Clamps		enzymatic binding sites, cell surface receptors
Electric generators		ATP synthase

Table 1: Biomolecules and their Functions

Activity: Biomolecules' Functions (Answers)

In the following table, list a function(s) performed by each of the biological molecules and its equivalent macroscopic component.

Macroscopic components	Function	Molecular example(s)
struts, beams, casings	<i>Transmit force, hold positions</i>	actin microfilament structures
cables	<i>Transmit tension</i>	collagen
fasteners, glue	<i>Connect parts</i>	intermolecular forces
solenoids, actuators	<i>Move things</i>	conformation-changing proteins, actin/myosin, kinesin/microtubules
boat motors	<i>Turn shafts</i>	flagellar motor
drive shafts	<i>Transmit torque</i>	bacterial flagella
containers	<i>Hold fluids</i>	vesicles
pipes	<i>Carry fluids</i>	various tubular structures
pumps	<i>Move fluids</i>	flagella, transmembrane proteins
highways	<i>Tracts for transporting materials</i>	microtubules
automobiles	<i>Transporting cargo</i>	kinesin
Clamps	<i>Hold work pieces together</i>	enzymatic binding sites, cell surface receptors
Electric generators	<i>Transform energy into a useable form</i>	ATP synthase

Table 2: Biomolecules and their Functions

Summary

Biomolecules provide functional specificity useful for biosensing, chemical conversions, and separations in bioMEMS design. Most of these functions such as transducing and moving fluids are the same functions as macroscopic components.

Disclaimer

The information contained herein is considered to be true and accurate; however the Southwest Center for Microsystems Education (SCME) makes no guarantees concerning the authenticity of any statement. SCME accepts no liability for the content of this unit, or for the consequences of any actions taken on the basis of the information provided.

Support for this work was provided by the National Science Foundation's Advanced Technological Education (ATE) Program through Grants. For more learning modules related to microtechnology, visit the SCME website (<http://scme-nm.org>).

This Learning Module was developed in conjunction with Bio-Link, a National Science Foundation Advanced Technological Education (ATE) Center for Biotechnology @ www.bio-link.org.