

Pennsylvania Department of Education  
Academic Standards for Science and Technology:  
Addressed in the PTEI Outreach Education Manual

**10<sup>th</sup> grade as benchmark year**

**Pennsylvania's public schools shall teach, challenge, and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .**

**Chapter 1: Tissue Engineering: An Introduction**

PA Standards Met: Refer to 3.8 Science, Technology, and Human Endeavors (3.8.10 A, B, and C)

**Chapter 2: Tissue Structure and Function**

PA Standards Met: Refer to 3.1 Unifying Themes (3.1.10 A, B, C and E) and 3.3 Biological Sciences (3.3.10 A and B)

**Chapter 3: Overview of Classroom Activities**

PA Standards Met: Refer to 3.2 Inquiry and Design (3.2.10 A, B, C and D – These standards are the basis of all classroom demonstrations and activities)

**Chapter 4: Bone Tissue Engineering**

PA Standards Met: Refer to 3.1. Unifying Themes (3.1.10 A, C, and E), 3.3 Biological Sciences (3.3.10 A and B) and 3.8 Science, Technology, and Human Endeavors (3.3.10 A, B, and C)

**Chapter 4.1: Bone Engineering Classroom Demonstrations and Activities**

PA Standards Met: Refer to 3.2 Inquiry and Design (3.2.10 A, B, C and D – These standards are the basis of all classroom demonstrations and activities)

Activity 1: Build a Tissue

PA Standards Met: 3.3 Biological Sciences (3.3.10 A.i, ii; and B.i, ii)  
3.4 Physical Science, Chemistry and Physics (3.4.10 A.i, vii)

Activity 2: Bone Strength

PA Standards Met: 3.3 Biological Sciences (3.3.10 A.ii and B.i, ii, iv)  
3.4 Physical Science, Chemistry and Physics (3.4.10 A.i, vii. B. iv, v, C. iv, vi, vii, viii) 3.6 Technology Education (3.6.10 A. ii, iv and C. i, ii, iii, iv, v)

Activity 3: Scaffold Diffusion Assay

PA Standards Met: 3.3 Biological Sciences (3.3.10 A. ii and B. i)  
3.6 Technology Education (3.6.10 A. ii and C. iii, iv)

Activity 4: Biochemical Assay

PA Standards Met: 3.3 Biological Sciences (3.3.10 B. i)  
3.6 Technology Education (3.6.10 A. ii)  
3.7 Technological Devices (3.7.10 A. ii and B. i, v)

Activity 5: Cell Survival Assay

PA Standards Met: 3.3 Biological Sciences (3.3.10 B. iv)  
3.6 Technology Education (3.6.10 A. ii)

Activity 6: Scaffold Synthesis and Characterization

PA Standards Met: 3.3 Biological Sciences (3.3.10 A. ii)  
3.4 Physical Science, Chemistry and Physics (3.4.10 A. v, viii)  
3.6 Technology Education (3.6.10 A. ii, iv and C. iii, iv, vi)

Activity 7: The Precarious Balance

PA Standards Met: 3.3 Biological Sciences (3.3.10 A. ii)  
3.6 Technology Education (3.6.10 C. iii, iv)

## **Ch 4.2: Bone Tissue Engineering Student Assessment**

### **Chapter 5: Immunology and its Relationship to Tissue Engineering**

PA Standards Met: Refer to 3.1. Unifying Themes (3.1.10 A, B, C, D, E)  
3.3 Biological Sciences (3.3.10 A and B) 3.6 Technology Education  
(3.6.10 A, C) 3.7 Technological Devices (3.7.10 A, B) 3.8 Science,  
Technology, and Human Endeavors (3.3.10 A, B, and C)

#### **Chapter 5.1: The Immune System**

PA Standards Met: Refer to 3.3 Biological Sciences (3.3.10 A, B) and  
3.1 Unifying Themes (3.3.10 A.)

#### **Chapter 5.2: Current Laboratory Techniques in Immunology**

PA Standards Met: Refer to 3.3 Biological Sciences (3.3.10 A, B, C)  
3.6 Technology Education (3.6.10 A, C)  
3.7 Technological Devices (3.7.10 A, B)  
3.8 Science, Technology and Human Endeavors (3.8.10 C)

#### **Chapter 5.3: Systemic Lupus Erythematosus**

PA Standards Met: Refer to 3.3 Biological Sciences (3.3.10 A, B)

## **Chapter 5.4: Immunology Classroom Demonstrations and Activities**

PA Standards Met: Refer to 3.2 Inquiry and Design (3.2.10 A, B, C and D – These standards are the basis of all classroom demonstrations and activities)

Activity 1: Cells of the immune system

PA Standards Met: 3.3 Biological Sciences (3.3.10 A. ii and B. i, ii)  
3.6 Technology Education (3.6.10 C. iv)

Activity 2: Immunohistology

PA Standards Met: 3.3 Biological Sciences (3.3.10 A. ii and B. i, ii);  
3.7 Technology Devices (3.7.10 A. i)

Activity 3: Complement

PA Standards Met: 3.3 Biological Sciences (3.3.10 B. iv)  
3.6 Technology Education (3.6.10 A. v)  
3.7 Technological Devices (3.7.10 A. ii and B. i, v)

Activity 4: The Chemotactic Response

PA Standards Met: 3.3 Biological Sciences (3.3.10 A. ii and B. i, iii and iv)

Activity 5: Immunogenetics of Autoimmune Diseases

PA Standards Met: 3.3 Biological Sciences (3.3.10 B. i, iii and C ii, v, vi, vii)  
3.6 Technology Education (3.6.10 A. ii and C. iv)  
3.7.10 Technological Devices (3.7.10 A. ii and B. i, v)

## **Ch. 6 Muscle Tissue Engineering (pp 183-200)**

PA Standards Met: Refer to **3.1 Unifying Themes and 3.3 Biological Sciences**

(All of the standards listed in these sections apply to the chapter as a whole)

### **Ch. 6.1 Current Laboratory Techniques in Muscle Tissue Engineering (pp 201-210)**

PA Standards Met: Refer to **3.1 Unifying Themes and 3.7 Technological Devices**

## **Ch. 6.2 Muscle Tissue Engineering Classroom Demonstrations and Activities (pp 211-242)**

PA Standards Met: Refer to **3.2 Inquiry and Design**

**(These standards are the basis of all classroom demos and activities)**

Activity 1: Chicken Little

PA Standards Met: 3.3 Biological Sciences A.i, B.i,ii,iv  
3.4 Physical Science, Chemistry, and Physics A.i,vi,vii,viii

Activity 2: Muscle Repair

PA Standards Met: 3.3 Biological Sciences A.i, B.iii,  
3.4 Physical Science, Chemistry, and Physics B.iv, C.vi

Activity 3: Cell Culture and Differentiation

PA Standards Met: 3.3 Biological Sciences A.i., B.ii,iii, C. i, iii  
3.4 Physical Science, Chemistry and Physics A.i,

Activity 4: Stem Cell Potential

PA Standards Met: 3.3 Biological Sciences A.i, B.i, C.i,iii,v,vii  
3.4 Physical Science, Chemistry, and Physics A.i,vi,vii,viii  
B.iii

Activity 5: Stem Cell Seeding

PA Standards Met: 3.3 Biological Sciences A.i, B.i,ii C.vi,vii  
3.4 Physical Science, Chemistry, and Physics A.i,B.i,ii, C.vi,vii

### **Supplemental Sections:**

A-1: Intro to Bioethics and Ethical Systems (1A-10A)

A-2: Ethical Dilemmas and case Studies for the Classroom (11A-20A)

PA Standards Met: 3.8 Science, Technology and Human Endeavors (all)