Syllabus
Orthopaedic Regenerative Engineering and Mechanobiology
BIEN 234
Fall 2015

Course Time: Monday 1:10pm ~ 3pm and Wednesday 1:10pm to 3pm

Instructor
Dr. Jin Nam
Email: jnam@engr.ucr.edu
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Office Phone: 951 827 2064

Prerequisites
BIOL 005A&B, BIEN110, BIEN140A, or equivalents; graduate standing or consent of instructor

Course Description
Introduces advanced biomechanics and mechanobiology of skeletal tissues including bone and cartilage through an understanding of structure-function relationship in biological tissues. Focuses on bone and cartilage regenerative engineering approaches based on scaffolds, stem cells and mechanotransduction.

Learning Objectives
At the end of this course, students will be able to accomplish the following.
1. Understand the initiation and progression of skeletal diseases and syndromes
2. Understand structure-function relationship in skeletal tissues
3. Understand biomechanics and mechanobiology of skeletal tissues at the molecular level
4. Determine design criteria for bone and cartilage regeneration
5. Demonstrate current trends in orthopaedic tissue regeneration

Methodology
A variety of activities including lectures, discussion, up-to-date literature review, student presentations, proposal writing will be used to facilitate students’ learning.

Course Text
Textbook: None required; Lecture notes will be provided
This course bases on multidisciplinary fields that include biomechanics, mechanobiology, stem cells and tissue engineering. No comprehensive textbook is currently available.

Suggested Reference Books


**Evaluation and Grading**

Evaluation of Student Performance

- Midterm In-Class Exam: 30%
- Final In-Class Exam: 40%
- In class discussion: 30%

Total: 100%

In class discussion:
For a given research or review paper, you prepare 3 questions to be discussed (could be fundamental questions, peer-critiques, etc.).

**Grading Scale**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>95.00</td>
</tr>
<tr>
<td>88.00</td>
<td>&gt; B+</td>
</tr>
<tr>
<td>78.00</td>
<td>&gt; C+</td>
</tr>
<tr>
<td>70.00</td>
<td>&gt; D+</td>
</tr>
<tr>
<td>60.00</td>
<td>&gt; F</td>
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</tbody>
</table>

**Course Policies**

Make-up exams can only be requested prior to the exam date with valid proof of excuses. Cheating on exams and/or plagiarism in projects will result in an F grade given for the course.

**Exam/Report Schedule**

TBD

**EMERGENCIES:**

Who to call:
- In an Emergency: UC Police: (951) 827-5222 (from cell) or 911 (from campus phones)
- Department Lab Safety Officer phone: 951-403-0932
- Hazardous spills: EH&S: (951) 827-5528 or 2-5528 from campus phones
- Utility problems: Physical Plant: (951) 827-4214 (days) or (951) 827-4677 (evenings)
- If there is an emergency in the building such as a fire, pull one of the building fire alarm pulls.
- If the building alarm sounds go immediately to the building’s emergency assembly area (EAA) BUILDING ASSEMBLY AREA LOCATION: ______

If injured:
If life-threatening, call 911 (from a campus phone) or (951) 827-5222 (from cell)

If non-emergency treatment is needed:

- Undergraduate: go to the Campus Health Center (daytime) or your plan’s urgent care or emergency room (evenings)

- Graduate students should contact Bioengineering Department 951-827-5025 for medical center information
<table>
<thead>
<tr>
<th>Weeks</th>
<th>Lectures</th>
<th>Reading</th>
<th>Objectives</th>
<th>Assignments Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cartilage structure and function</td>
<td>Ref. Book 1 Chapter 2</td>
<td>Discuss structure-function relationship of cartilage, cellular components of cartilage</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Bone structure and function</td>
<td>Ref. Book 1 Chapter 2</td>
<td>Discuss structure-function relationship of bone, cellular components of bone</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Overview of skeletal diseases and syndromes</td>
<td>Articles</td>
<td>Introduce skeletal disease pathology such as osteoarthritis and osteoporosis</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>Cartilage biomechanics and mechanobiology</td>
<td>Ref. Book 1 Chapter 2 &amp; Ref. Book 2 Section II</td>
<td>Discuss cartilage biomechanics and cellular mechanobiology (cartilage homeostasis)</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>Bone biomechanics and mechanobiology</td>
<td>Ref. Book 1 Chapter 2 &amp; Ref. Book 2 Section II</td>
<td>Discuss bone biomechanics and cellular mechanobiology (bone remodeling)</td>
<td>None</td>
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<tr>
<td>6</td>
<td>Orthopaedic biomaterials and scaffolds</td>
<td>Ref. Book 1 Chapters 6, 9 &amp; Ref. Book 3 Part 3</td>
<td>Discuss natural and synthetic scaffolding biomaterials for orthopaedic applications</td>
<td>Midterm</td>
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<tr>
<td>7</td>
<td>Stem cell biology and therapy</td>
<td>Ref. Book 4 Parts 1, 2, 5 &amp; Ref. Book 2 Chapter 19, 20, 21</td>
<td>Discuss basic stem cell biology, mechanobiology and its therapeutic applications in orthopaedics</td>
<td>None</td>
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<tr>
<td>8</td>
<td>Cartilage regeneration approaches</td>
<td>Ref. Book 1 Chapters 3, 8, 10 &amp; Ref. Book 3 Chapter 42</td>
<td>Discuss various cartilage regeneration approaches</td>
<td>None</td>
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<tr>
<td>9</td>
<td>Bone regeneration approaches</td>
<td>Ref. Book 1 Chapters 3, 8, 10 &amp; Ref. Book 3 Chapter 40</td>
<td>Discuss various bone regeneration approaches</td>
<td>None</td>
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<tr>
<td>10</td>
<td>Osteochondral reconstruction</td>
<td>Ref. Book 1 Chapter 3</td>
<td>Introduce current trends in osteochondral tissue engineering</td>
<td>Final exam</td>
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