



Course Code-Name BTEC 642 Regenerative Biology and Biomedical Applications	
Instructor	Assist. Prof. Dr. Fatih Kocabaş , Department of Genetics and Bioengineering, Room B504 0-216-578 0618 fatih.kocabas@yeditepe.edu.tr
Course Schedule	Tuesday 09:00 – 11:50 @ B501
Office Hours	Monday 11:00 – 13:00 <i>by appointment only</i>
Course Description	An introduction to regenerative biology and medicine
Course Objectives	This course will cover the skin, hair, teeth, cornea, and central neural tissue regeneration. It will provide description of regenerative medicine in digestive, respiratory, urogenital, musculoskeletal, and cardiovascular systems. It will also include amphibians as powerful research models with discussion of appendage regeneration in amphibians and mammals. In addition, breakthroughs including the generation of iPSCs and transdifferentiation for regenerative biology will be discussed.
Required Textbook	<ol style="list-style-type: none"> Regenerative Biology and Medicine, Second Edition, by David L. Stocum, ISBN: 978-0-12-384860-4 Regenerative Medicine and Cell Therapy by Hossein Baharvand, Nasser Aghdami. 2012 Principles of Regenerative Biology, by Bruce M. Carlson, M.D., Ph.D. ISBN: 978-0-12-369439-3 Assigned readings
Grading	Presentation-1: 15% Presentation-2: 15 % Takehome Midterm: 20% Final Exam: 40% Class Participation: 10% TOTAL: 100% If you achieve less than 50% overall in the class, you will automatically get an “F”.
Make-up Exams	There is no planned make-up for any missing examination. You must demonstrate a valid excuse to re-take a missed exam. In addition, the school policies will be taken into account in cases when you miss a scheduled examination.
Homework / Quizzes	Students are expected to read assigned textbook sections in advance of class, and will be expected to participate actively in class discussion. Midterm and final exams will utilize written short essay format questions. <i>Each student is required to give two lecture presentations related to regenerative biology and medicine.</i>
Attendance	If you fail to attend less than 80% of the lectures from the beginning of the semester , you will get “FA” in the course and have no right to take BÜTÜNLEME exam.
Academic Integrity	Adherence to the University Academic Integrity policy is expected. No breach of this policy will be tolerated. Any offenders, explicit or complicit, will be dealt with in accordance with the established University procedures.



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Exam Schedule

Midterm Exam	Thursday, Apr. 12 th	Take home due date
Final Exam	May 24, 2015	10 AM. @ B501

Course Outline

Week	Lecture	Topics
Feb 9	1	An Overview of Regenerative Biology and Medicine
Feb 16	2	Repair of Skin by Fibrosis
Feb 23	3	Regeneration of Epidermal Structures
Mar 1	4	Regeneration of Neural Tissues
Mar 8	5	Regeneration of Digestive, Respiratory and Urinary Tissues
Mar 15	6	Regeneration of Musculoskeletal Tissues
Mar 22	7-8	Regeneration of Cardiac Muscle and Hematopoietic Tissues
Mar 29	9-10	Regeneration of Appendages; Strategies of Regenerative Medicine, Regenerative Medicine of Neural Tissues
Apr 5	11	Regenerative Therapies for Digestive Tissues
Apr 12	-	Take home Midterm due date
Apr 19	12	Regenerative Therapies for Respiratory and Urinary Tissues
Apr 26	13	Regenerative Therapies for Musculoskeletal Tissues
May 3	-	No planned lectures
May 10	14	Bioethics in Regenerative Medicine

Active Student Participation: This class emphasizes on active student participation. You are supposed to define a very specific research topic within the field of developmental biology and perform an exhaustive literature search. You will present the specific topic in as a presentation.

Research Paper Presentation: You will be given **2 research topics** related to regenerative biology and medicine, prepare powerpoint presentations and explain assigned papers along with relevant studies in detail in class. One or two slides should indicate the general theme of the paper. All used methods and potentially unknown terminology should be explained in detail. All results should then be explained and critically evaluated. The presentation should take approximately 25 minutes, followed by 5 minutes of discussion. Actual length of presentations and number of presented papers will depend on total number of participating students.

Powerpoint presentation and 1 question & answer will be submitted to the instructor. Due date for submission of presentations and questions is same as presentation date. Please email to Fatih.Kocabas@yeditepe.edu.tr.

Disclaimer: This syllabus provides a general plan and subject to change. The instructor reserves the right to make modifications in content and schedules as necessary to promote the best education possible within the prevailing conditions affecting this course. It is the student's responsibility to note the changes that may occur during the semester.

Topics and Assigned Readings: Assigned Readings will be discussed in class. Please read and be prepared to participate in class discussion.

1. Heart Regeneration

- Hatzistergos, Konstantinos E., et al. "S-Nitrosoglutathione Reductase Deficiency Enhances the Proliferative Expansion of Adult Heart Progenitors and Myocytes Post Myocardial Infarction." *Journal of the American Heart Association* 4.7 (2015): e001974.
- Polizzotti, Brian D., et al. "Neuregulin stimulation of cardiomyocyte regeneration in mice and human myocardium reveals a therapeutic window." *Science translational medicine* 7.281 (2015): 281ra45-281ra45.

2. Liver Regeneration

- Ma, Jie-Qiong, et al. "Quercetin protects mouse liver against CCl₄-induced inflammation by the TLR2/4 and MAPK/NF-κB pathway." *International immunopharmacology* 28.1 (2015): 531-539.



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- Cao, Yanna, et al. "PTHrP/PTHR1 and TGF- β Levels Are Inversely Associated in Liver Regeneration." *Gastroenterology and Hepatology* 2.1 (2015).
- 3. Digit (and Fingertip) regeneration**
 - Jazwińska, Anna, and Pauline Sallin. "Regeneration versus scarring in vertebrate appendages and heart." *The Journal of pathology* 238.2 (2016): 233-246.
 - Sammarco, Mimi C., et al. "Hyperbaric Oxygen Promotes Proximal Bone Regeneration and Organized Collagen Composition during Digit Regeneration." *PloS one* 10.10 (2015): e0140156.
- 4. Regeneration Approaches for Tooth**
 - Saoud, Tarek Mohamed, et al. "Treatment of Mature Permanent Teeth with Necrotic Pulp and Apical Periodontitis Using Regenerative Endodontic Procedures: A Case Series." *Journal of endodontics* 42.1 (2016): 57-65.
 - Cha, Yoonsun, et al. "Effects of In Vitro Osteogenic Induction on In Vivo Tissue Regeneration by Dental Pulp and Periodontal Ligament Stem Cells." *Journal of endodontics* (2015).
- 5. Skin Regeneration**
 - Mahjour, Seyed Babak, et al. "Rapid creation of skin substitutes from human skin cells and biomimetic nanofibers for acute full-thickness wound repair." *Burns* 41.8 (2015): 1764-1774.
 - Wang, Xiaojie, et al. "Principles and mechanisms of regeneration in the mouse model for wound-induced hair follicle neogenesis." *Regeneration* (2015).
- 6. Skeletal muscle regeneration**
 - Long, Chengzu, et al. "Postnatal genome editing partially restores dystrophin expression in a mouse model of muscular dystrophy." *Science* (2015): aad5725.
 - McClung, Joseph M., et al. "Muscle cell derived angiopoietin-1 contributes to both myogenesis and angiogenesis in the ischemic environment." *Frontiers in Physiology* 6 (2015): 161.
- 7. Pancreas regeneration**
 - Li, Mingyu, Patrick Page-McCaw, and Wenbiao Chen. "FGF1 Mediates Overnutrition-Induced Compensatory β -Cell Differentiation." *Diabetes* 65.1 (2016): 96-109.
 - Grabliauskaite, Kamile, et al. "Inactivation of TGF β receptor II signalling in pancreatic epithelial cells promotes acinar cell proliferation, acinar-to-ductal metaplasia and fibrosis during pancreatitis." *The Journal of pathology* (2015).
- 8. Cartilage regeneration**
 - Almeida, Henrique V., et al. "Coupling Freshly Isolated CD44+ Infrapatellar Fat Pad-Derived Stromal Cells with a TGF- β 3 Eluting Cartilage ECM-Derived Scaffold as a Single-Stage Strategy for Promoting Chondrogenesis." *Advanced healthcare materials* 4.7 (2015): 1043-1053.
 - Guo, Liyun, et al. "Preparation and Characterization of a Novel Decellularized Fibrocartilage "Book" Scaffold for Use in Tissue Engineering." *PloS one* 10.12 (2015).
- 9. Corneal Regeneration**
 - Rama, Paolo, et al. "Limbal stem-cell therapy and long-term corneal regeneration." *New England Journal of Medicine* 363.2 (2010): 147-155.
 - Rama, Paolo, Stanislav Matuska, and Graziella Pellegrini. "Limbal Stem-Cell Expansion and Transplantation." *Corneal Transplantation*. Springer International Publishing, 2016. 193-202.
- 10. Intestinal regeneration**
 - Shaffiey, Shahab A., et al. "Intestinal stem cell growth and differentiation on a tubular scaffold with evaluation in small and large animals." *Regenerative medicine* 11.1 (2016): 45-61.
 - Totonelli, Giorgia, et al. "A rat decellularized small bowel scaffold that preserves villus-crypt architecture for intestinal regeneration." *Biomaterials* 33.12 (2012): 3401-3410.
- 11. Spinal Cord Regeneration**
 - Chen, Lizhen, et al. "Axon injury triggers EFA-6 mediated destabilization of axonal microtubules via TACC and doublecortin like kinase." *Elife* 4 (2015): e08695.
 - Hui, Subhra Prakash, Tapas Chandra Nag, and Sukla Ghosh. "Characterization of Proliferating Neural Progenitors after Spinal Cord Injury in Adult Zebrafish." *PloS one* 10.12 (2015).
- 12. Bone regeneration**
 - Cunniffe, Gráinne M., et al. "Porous decellularized tissue engineered hypertrophic cartilage as a scaffold for large bone defect healing." *Acta biomaterialia* 23 (2015): 82-90.
 - Tang, Wei, et al. "Bioinspired trimodal macro/micro/nano-porous scaffolds loading rhBMP-2 for complete regeneration of critical size bone defect." *Acta biomaterialia* (2015).
- 13. Prostate Regeneration**
 - Ikehara, Akashi, et al. "Bone marrow-derived macrophages are associated with androgen modulated prostate regeneration." *The Prostate* 72.1 (2012): 1-11.



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- Li, Ting, et al. "ALDH1A1 is a marker for malignant prostate stem cells and predictor of prostate cancer patients' outcome." *Laboratory investigation* 90.2 (2010): 234-244.

14. Hematopoiesis

- Krock, Bryan L., et al. "The aryl hydrocarbon receptor nuclear translocator is an essential regulator of murine hematopoietic stem cell viability." *Blood* 125.21 (2015): 3263-3272.
- Roychoudhury, Jayeeta, et al. "MEIS1 regulates an HLF–oxidative stress axis in MLL-fusion gene leukemia." *Blood* 125.16 (2015): 2544-2552.

15. Skin Regeneration

- El Sadik, Abir O., Tarek A. El Ghamrawy, and Tarek I. Abd El-Galil. "The Effect of Mesenchymal Stem Cells and Chitosan Gel on Full Thickness Skin Wound Healing in Albino Rats: Histological, Immunohistochemical and Fluorescent Study." *PloS one* 10.9 (2015): e0137544.
- Seavey, Jonathan G., et al. "Use of a bioartificial dermal regeneration template for skin restoration in combat casualty injuries." *Regenerative medicine* 11.1 (2016): 81-90.

16. Thyroid Regeneration

- Kurmann, Anita A., et al. "Regeneration of Thyroid Function by Transplantation of Differentiated Pluripotent Stem Cells." *Cell stem cell* 17.5 (2015): 527-542.
- Zane, M., et al. "Normal vs cancer thyroid stem cells: the road to transformation." *Oncogene* (2015).

17. Other Interesting Topics (Pick 2 papers)

- Alvarez Palomo, Ana Belén, et al. "Plant hormones increase efficiency of reprogramming mouse somatic cells to induced pluripotent stem cells and reduce tumorigenicity." *Stem cells and development* 23.6 (2013): 586-593.
- Bray, Natasha. "Neural repair: Redirecting regeneration." *Nature Reviews Neuroscience* 17.1 (2016): 2-3.
- Jażwińska, Anna, and Pauline Sallin. "Regeneration versus scarring in vertebrate appendages and heart." *The Journal of pathology* 238.2 (2016): 233-246.
- Wolf, Joshua H., et al. "Serum lipid expression correlates with function and regeneration following living donor liver transplantation." *Liver Transplantation* 22.1 (2016): 103-110.
- Picke, A-K., et al. "Bone defect regeneration and cortical bone parameters of type 2 diabetic rats are improved by insulin therapy." *Bone* 82 (2016): 108-115.
- Uno, Narumi, Yasuhiro Kazuki, and Mitsuo Oshimura. "Potential Usage of Human Artificial Chromosome for Regenerative Medicine." *Gene Therapy and Cell Therapy Through the Liver*. Springer Japan, 2016. 75-83.
- Kumar, Hridyesh, and Pradip Kumar Dutta. "Functionalized Chitosan: A Quantum Dot-Based Approach for Regenerative Medicine." *Chitin and Chitosan for Regenerative Medicine*. Springer India, 2016. 297-349.
- Childers, Martin K., and Zejing Wang. "Regenerative Medicine Approaches to Degenerative Muscle Diseases." *Regenerative Medicine for Degenerative Muscle Diseases*. Springer New York, 2016. 1-20.
- Góra, Aleksander, et al. "Tubular Tissues and Organs of Human Body—Challenges in Regenerative Medicine." *Journal of Nanoscience and Nanotechnology* 16.1 (2016): 19-39.
- Iezzi, R. "Regenerative ophthalmology: Technologic and pharmacologic approaches to restoring sight via retinal prosthesis." *Clinical Pharmacology & Therapeutics* 99.1 (2016): 33-35.
- Jobaliya, Chintan D., et al. "Targeted Application of Human Genetic Variation Can Improve Red Blood Cell Production from Stem Cells." *Cell Stem Cell* 18 (2016): 1-6.

18. Endometrial regeneration

- Gil-Sanchis, Claudia, et al. "Contribution of different bone marrow-derived cell types in endometrial regeneration using an irradiated murine model." *Fertility and sterility* 103.6 (2015): 1596-1605.
- Nagori, Chaitanya B., Sonal Y. Panchal, and Himanshu Patel. "Endometrial regeneration using autologous adult stem cells followed by conception by in vitro fertilization in a patient of severe Asherman's syndrome." *Journal of human reproductive sciences* 4.1 (2011): 43.