

**Units:** 4  
**Term:** Spring  
**Date/Time:** 10:00-11:50 AM Mon, Wed

**Location:** NRT 4508

**Instructor:** Bodour Salhia, Ph.D.

**Office:** NRT 4504  
**Hours:** Wednesday 4PM

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## Course Description

This is the second of two courses with the objective to train and provide individuals with strong backgrounds and interests in biological or medical sciences the theoretical and applied knowledge of modern day biotechnology. It will introduce students to tools and applications that will be instrumental throughout the Translational Biomedical Informatics and Translational Biotechnology Masters programs. This course targets individuals who have some previous training in biomedical sciences, and aims to provide them with the foundations, basic principles, and core concepts in biotechnology and its applications to basic science, health and disease.

## Learning Objectives

Upon successful completion students will have an understanding of foundational molecular genetic technologies and the evolution to next-generation technologies. Students will be able to describe technologies in genomics, transcriptomics, proteomics and epigenomics technologies and will learn how their application use biological systems for scientific and medical purposes. Students will learn how biotechnology leads to commercialization and gain an understanding of governmental regulations and ethics surrounding hot topic issues such as cloning, stem cells and genome sequencing.

## Prerequisite(s):

**TRGN 524.** Applications of Genomic Technology in Biomedical Research I

## Course Notes

This course requires attendance and students are expected to review pre-prepared lectures online and participate in group activities and homework on centralized servers. There will be in person testing at the Keck School of Medicine requiring attendance unless alternative arrangements are made.

## Required Readings and Supplementary Materials

Required readings will be provided. Material will be pulled from biomedical journals such as *Nature*, and other top tier journals and books. Below is a list of required reading:

- Translational research in oncology—10 years of progress and future prospects  
James H. Doroshow and Shivaani Kummar. *NATURE REVIEWS | CLINICAL ONCOLOGY VOLUME 11 | NOVEMBER 2014 | 649*
- Development of the Biological Experimental Design Concept Inventory (BEDCI)  
Thomas Deane, Kathy Nomme, Erica Jeffery, Carol Pollock, and Gülnur Birol  
*CBE—Life Sciences Education Vol. 13, 540–551, Fall 2014*
- Translation research: from accurate diagnosis to appropriate treatment.  
Craig P Webb and Harvey. *Journal of Translational Medicine. 2004*2:35
- Cell Culture, Technology: Enhancing the Culture of Diagnosing Human Diseases.  
Hudu SA, Alshrari AS, Syahida A, Sekawi Z. *J Clin Diagn Res. 2016 Mar*;10(3):
- Stem cell technology. Paulo A Fontes, Angus W Thomsom. *BMJ VOLUME 319 13 NOVEMBER 1999.*
- The future of cancer treatment: immunomodulation, CARs and combination immunotherapy. Danny N. Khalil, Eric L. Smith\*, Renier J. Brentjens and Jedd D. Wolchok. *NATURE REVIEWS | CLINICAL ONCOLOGY VOLUME 13 | MAY 2016 | 273*
- Web document:  
[http://cdrwww.who.int/immunization/documents/Elsevier\\_Vaccine\\_immunology.pdf](http://cdrwww.who.int/immunization/documents/Elsevier_Vaccine_immunology.pdf)
- Vaccines for established cancer: overcoming the challenges posed by immune evasion. Sjoerd H. van der Burg, Ramon Arens, Ferry Ossendorp, Thorbald van Hall and Cornelis. J. M. Melief *Nature Reviews Cancer 16, 219–233 (2016)*

## Description and Assessment of Assignments

This course forms the framework with other concurrent courses, and early participation will be essential. The work load for this course will complement other concurrent courses, and the work-load expectations will be front-loaded to insure the foundations are provided within the first half of the course.

## Grading Breakdown

40% Multiple choice tests  
20% mid-term exam  
15% class participation and discussions  
25% final exam

**Course Schedule: A Weekly Breakdown. Schedule subject to change at discretion of instructor.**

Week	Topic, Assignments, Deliverables
1	<p><b>Topic.</b> Translational Research. Learn about how translational research applies findings from basic science to enhance human health and well-being. In a medical research context, it aims to "translate" findings in fundamental research into medical practice and meaningful health outcomes.</p> <p><b>Assignment:</b> Read the assigned scientific article and be prepared to discuss it. Translational research in oncology—10 years of progress and future prospects James H. Doroshow and Shivaani Kummar. NATURE REVIEWS   CLINICAL ONCOLOGY VOLUME 11   NOVEMBER 2014   649</p>
2	<p><b>Topic.</b> Experimental Design. Examine how to design experiments, carry them out, and analyze the data they yield.</p> <p><b>Assignment.</b> Development of the Biological Experimental Design Concept Inventory (BEDCI) Thomas Deane, Kathy Nomme, Erica Jeffery, Carol Pollock, and Gülnur Birol CBE—Life Sciences Education Vol. 13, 540–551, Fall 2014</p>
3	<p><b>Topic.</b> Cell Culture Technologies. Develop an understanding of techniques for tissue culture, cell culture and organ transplantation.</p> <p><b>Assignment:</b> Cell Culture, Technology: Enhancing the Culture of Diagnosing Human Diseases. Hudu SA, Alshrari AS, Syahida A, Sekawi Z. J Clin Diagn Res. 2016 Mar;10(3):</p> <p><b>Grading:</b> Term Test 1 (Topics 1 and 2).</p>
4	<p><b>Topic.</b> Stem Cell Technologies. Stem cells are defined as totipotent progenitor cells capable of self-renewal and multilineage differentiation. Learn how this rapidly developing field combines the efforts of cell biologists, geneticists, and clinicians to hope of effective treatment for a variety of malignant and non-malignant diseases.</p> <p><b>Assignment.</b> Stem cell technology. Paulo A Fontes, Angus W Thomsom. BMJ VOLUME 319 13 NOVEMBER 1999.</p>
5	<p><b>Topic.</b> Stem Cell Technologies. Stem cells are defined as totipotent progenitor cells capable of self-renewal and multilineage differentiation. Learn how this rapidly developing field combines the efforts of cell biologists, geneticists, and clinicians to hope of effective treatment for a variety of malignant and non-malignant diseases.</p> <p><b>Assignment:</b> Readings will focus on latest discoveries. Under the guidance of the instructor, students will choose a primary research article published the week of class as reading assignment.</p> <p><b>Grading:</b> Term Test 2 (Topics 3 and 4).</p>
6	<p><b>Topic.</b> Stem Cell Technologies Part II. In this part we go into further details using examples of CRISPR and its application in biomedical research. for a variety of malignant and non-malignant diseases.</p> <p><b>Assignment.</b> Class notes and additional current papers identified at time of course.</p>

7	<p><b>Topic.</b> Stem Cell Technologies Part III. In this section we focus on challenges going forward that must be overcome and discuss some of the ethical debates about their use in precision medicine.</p> <p><b>Assignment.</b> Class notes and additional current papers identified at time of course</p> <p><b>Grading:</b> Cumulative Midterm Exam</p>
8	<p><b>Topic.</b> Antibodies and Vaccines. Learn how antibodies are mass produced for research and how to apply the principles of antibodies to develop targeted therapies. Learn how vaccines help develop immunity by imitating an infection and how newer types of vaccines help fight cancer.</p> <p><b>Assignment.</b> Web document:  <a href="http://cdrwww.who.int/immunization/documents/Elsevier_Vaccine_immunology.pdf">http://cdrwww.who.int/immunization/documents/Elsevier_Vaccine_immunology.pdf</a></p>
9	<p><b>Topic.</b> Immunotherapies. Learn how agents are used to modulate the immune system to induce or potentiate its anti-tumor activity. Learn about the development of new agents such as immune checkpoint inhibitors and how they have achieved unprecedented efficacy in a wide variety of tumors, dramatically changing the landscape of cancer treatment in recent years.</p> <p><b>Assignment.</b> Vaccines for established cancer: overcoming the challenges posed by immune evasion. Sjoerd H. van der Burg, Ramon Arens, Ferry Ossendorp, Thorbald van Hall and Cornelis J. M. Melief Nature Reviews Cancer 16, 219–233 (2016)</p>
10	<p><b>Topic.</b> Immunotherapies. Learn how agents are used to modulate the immune system to induce or potentiate its anti-tumor activity. Learn about the development of new agents such as immune checkpoint inhibitors and how they have achieved unprecedented efficacy in a wide variety of tumors, dramatically changing the landscape of cancer treatment in recent years.</p> <p><b>Assignment.</b> The future of cancer treatment: immunomodulation, CARs and combination immunotherapy. Danny N. Khalil, Eric L. Smith*, Renier J. Brentjens and Jedd D. Wolchok. NATURE REVIEWS   CLINICAL ONCOLOGY VOLUME 13   MAY 2016   273</p>
11	<p><b>Topic.</b> Diagnostics. Learn about a broad portfolio of solutions that provide more effective ways to assist in the diagnosis, monitoring and management of disease.</p> <p><b>Assignment:</b> Translation research: from accurate diagnosis to appropriate treatment. Craig P Webb and Harvey. Journal of Translational Medicine. 20042:35</p> <p><b>Grading:</b> Term Test 3 (Topics 8-10)</p>
12	<p><b>Topic.</b> Clinical Trials. Understand the phases of clinical trials and the basic principles of clinical trial design.</p> <p><b>Assignment:</b> unpolished materials to be distributed in class.</p>
13	<p><b>Topic.</b> Government Regulations. Learn about how federal government agencies regulate risk-based system to ensure that new biotechnology products are safe for the environment, human and animal health</p> <p><b>Assignment:</b> unpolished materials to be distributed in class.</p> <p><b>Grading:</b> Term Test 4 (Topics 11 and 12)</p>
14	<p>Biotechnology Careers. Learn about different types of biotechnology jobs.</p> <p><b>Assignment:</b> unpolished materials to be distributed in class.</p>
15	Final Exam

## Statement on Academic Conduct and Support Systems

### Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://adminopsnet.usc.edu/department/departement-public-safety>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

### Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.