

GEORGE MASON UNIVERSITY
College of Science

BIOL 695 and BIOL704: Precision Oncology Studies (1 credit Seminar Class)

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Email: mpierobo@gmu.edu (preferred method); emails will generally be answered within 48 hours (excluding weekends).

Office hours: Friday 1:30-2:30 by appointment (link for office hours will be sent after appointments have been scheduled). For urgent communications, please email at mpierobo@gmu.edu.

Course meeting days and modality: Friday 12:00-1:15 via Zoom

<https://gmu.zoom.us/j/96333312107?pwd=YNEoXdY7IFn55UaRI1bfiOfERpftI7.1&from=addon>

Meeting ID: 963 3331 2107

Passcode: 067969

One tap mobile

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Pre-requisite: At least one Cancer Biology undergraduate course, or BIOL 682 Advanced Eukaryotic Cell Biology, or BIOL 566 Cancer Biology, or similar.

Course Overview: The purpose of this seminar is to provide an opportunity for students to understand how precision medicine has been developed and integrated in oncology practice. This class will use a journal club-based approach where each week we will have a discussion based on seminal peer-reviewed articles that have had a major impact on the field of precision oncology. Alongside we will also have the opportunity to discuss how the development of high throughput technologies like Next-Generation Sequencing has accelerated target identification and development on anti-cancer drugs able to specifically interfere with the activation of oncogenic signaling molecules.

Learning Outcomes:

At the end of the course students will be able to:

- Explain the main principles of precision medicine in cancer;
- Illustrate how discoveries at the bench can become therapeutic solutions;
- Understand how cancer cells become resistant to treatment;
- Describe progression of precision medicine and its current state in cancer;
- Describe new trends and future directions of precision medicine in cancer;
- Critique a scientific manuscript;
- Share and discuss peer-reviewed research with peers and instructor.

Course Material (Reading List)

- Slamon et al. Human breast cancer: correlation of relapse and survival with amplification of the HER-2/neu oncogene.
- Hudziak et al. Increased expression of the putative growth factor receptor p185HER2 causes transformation and tumorigenesis on NIH 3T3 cells.
- Slamon et al. Use of chemotherapy plus a monoclonal antibody against HER2 for metastatic breast cancer that overexpresses HER2.
- Rusch Differential expression of the Epidermal Growth Factor Receptor and its ligands in primary Non-Small Cell Lung Cancers and adjacent benign lung.
- Lynch Activating Mutations in the Epidermal Growth Factor Receptor Underlying Responsiveness of Non–Small-Cell Lung Cancer to Gefitinib.
- Chabon et al. Circulating tumour DNA profiling reveals heterogeneity of EGFR inhibitor resistance mechanisms in lung cancer patients.
- Le et al. Mismatch repair deficiency predicts response of solid tumors to PD-1 blockade
- Flaherty et al. Molecular Landscape and Actionable Alterations in a Genomically Guided Cancer Clinical Trial: National Cancer Institute Molecular Analysis for Therapy Choice (NCI-MATCH).
- Clark et al. Neoadjuvant T-DM1/pertuzumab and paclitaxel/trastuzumab/pertuzumab for HER2+ breast cancer in the adaptively randomized I-SPY2 trial.
- Paraiso et al. Recovery of phospho-ERK activity allows melanoma cells to escape from BRAF inhibitor therapy.
- van 't Veer et al. Gene expression profiling predicts clinical outcome of breast cancer.
- Cardoso et al. 70-Gene Signature as an Aid to Treatment Decisions in Early-Stage Breast Cancer.
- Von Hoff et al. Pilot Study Using Molecular Profiling of Patients' Tumors to Find Potential Targets and Select Treatments for Their Refractory Cancers.
- Anderson et al. Long-Lasting Complete Responses in Patients with Metastatic Melanoma after Adoptive Cell Therapy with Tumor-Infiltrating Lymphocytes and an Attenuated IL2 Regimen.
- Sahin et al. Personalized RNA mutanome vaccines mobilize poly-specific therapeutic immunity against cancer.
- Ott et al. An immunogenic personal neoantigen vaccine for patients with melanoma.

Class material and communications will be manage through Blackboard.

Grading Policy

A+	4.00	Satisfactory/Passing
A	4.00	Satisfactory/Passing
A-	3.67	Satisfactory/Passing
B+	3.33	Satisfactory/Passing
B	3.00	Satisfactory/Passing
B-	2.67	Satisfactory*/Passing
C	2.00	Unsatisfactory/Passing
F	0.00	Unsatisfactory/Failing

* Although a B- is a satisfactory grade for a course, students must maintain a 3.00 average in their degree program and present a 3.00 GPA for the courses listed on the graduation application.

Information about additional grade notations that apply to graduate students including "IN" Incomplete and "IP" In Progress as well as grading for undergraduate students may be found in the Academic Policies section of the catalog under Grading System.

Grading System

Paper presentations: 50 points
Discussion summaries: 20 points
Final Paper: 20 points
In-class active participation: 10 points.

Paper discussions:

In each session, students will lead the discussion of a scientific paper. List of papers and sign-up sheet will be provided during the first week of class. Students will analyze the assigned paper and lead an in-class discussion. Non-presenters will be graded based on their active participation during the discussion.

Discussion summary:

By Tuesday following the discussion, each student is required to submit a 300-word summary explaining the study design, research question, methods, and results of the study. Students should also reserve one paragraph of the summary statement to what they consider the main take home message of the paper and how it has increased their knowledge on precision medicine compared to the paper analyzed the previous week. Students will submit summaries for 10 papers and each submission will get a maximum of 2 points.

Final Paper:

Students will submit a final paper where using the papers discussed throughout the semester they will provide an opinion piece and personal re-elaboration of how precision medicine has been integrated in oncology, how it has change clinical practice and the clinical trial conception and design, its major limitation and future directions, and how laboratory work and practice is at the basis of precision oncology.

In Class Participation:

Students will be evaluated based on class attendance, active engagement in class discussion (e.g. raising informed discussion points; connecting discussion to reading material; asking questions; bringing questions on the discussed papers).

Academic Standards

Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is [outlined in the university's procedures](#). Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility

Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

Accommodations for Students with Disabilities

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <https://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu. Phone: (703) 993-2474.

Student responsibility

Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor *in advance* of any relevant class meeting, assignment, or exam.

FERPA and Use of GMU Email Addresses for Course Communication

The [Family Educational Rights and Privacy Act \(FERPA\)](#) governs the disclosure of [education records for eligible students](#) and is an essential aspect of any course. **Students must use their GMU email account** to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

Student responsibility

Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check.

Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, **all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct** (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see [University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence](#). Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

Student opportunity

If you prefer to speak to someone **confidentially**, please contact one of Mason's confidential employees in Student Support and Advocacy ([SSAC](#)), Counseling and Psychological Services ([CAPS](#)), Student Health Services ([SHS](#)), and/or the [Office of the University Ombudsperson](#).

Course Materials and Student Privacy

All course materials posted to Blackboard or other course sites are private and should not be shared with anyone not enrolled in this class. By federal law, any materials that identify specific students (via their name, voice, or image) must also not be shared with anyone not enrolled in this class.

Ethics

Ethical behavior in all class related activities is required of every student.

Diversity

Learning to work with and value diversity is essential in every class. Students are expected to exhibit an appreciation for multinational, multiracial, and gender diversity in the classroom.

As a diverse community of learners, students must strive to work together in a setting of civility, tolerance, and respect for each other and for the instructor. Rules of classroom behavior (which apply to online as well as onsite courses) include but are not limited to the following:

- Conflicting opinions among members of a class are to be respected and responded to in a professional manner;
- Side conversations or other distracting behaviors including cell phone use or non-class online access are not to be engaged in during lectures, class discussions or presentations;
- Offensive comments, language or gestures will not be tolerated at any time; students not complying with class policies will be asked to cease immediately or leave the class session.

Campus Closure or Emergency Class Cancellation/Adjustment Policy

If the campus closes, or if a class meeting needs to be canceled or adjusted due to weather or other concern, students should check their email or Blackboard for updates on how to continue learning and for information about any changes to events or assignments.

Course Schedule

Week	Topic
Lecture 1 Jan 24 -Online-	Course overview. Introduction to the course objectives and presentations.
Lecture 2 Jan 31 -Online-	Finding a “Magic Bullet” Part 1: Overexpression of Her2 in breast cancer affect patients’ outcomes. (Slamon et al. Human breast cancer: correlation of relapse and survival with amplification of the HER-2/neu oncogene)
Lecture 3 Feb 7 -Online-	Finding a “Magic Bullet” Part 2: Activation of Her2 has oncogenic effects in non-cancerous cells (Hudziak et al. Increased expression of the putative growth factor receptor p185HER2 causes transformation and tumorigenesis on NIH 3T3 cells)
Lecture 4 Feb 14 -Online-	Finding a “Magic Bullet” Part 3: Targeting Her2 in combination with chemotherapy increases survival in patients with overexpressing Her2 (Slamon et al. Use of chemotherapy plus a monoclonal antibody against HER2 for metastatic breast cancer that overexpresses HER2)
Lecture 5 Feb 21 -Online-	Redefining a “Magic Bullet” during the drug development process Part 1 (Rusch Differential expression of the Epidermal Growth Factor Receptor and its ligands in primary Non-Small Cell Lung Cancers and adjacent benign lung)
Lecture 6 Feb 28 -Online-	Redefining a “Magic Bullet” during the drug development process Part 2 (Lynch Activating Mutations in the Epidermal Growth Factor Receptor Underlying Responsiveness of Non–Small-Cell Lung Cancer to Gefitinib)
Lecture 7 March 7 -Online-	Redefining a “Magic Bullet” during the drug development process Part 3 (Chabon et al. Circulating tumour DNA profiling reveals heterogeneity of EGFR inhibitor resistance mechanisms in lung cancer patients)
No Class March 14	Spring Break
Lecture 8 March 21 -Online-	New trial design in the precision oncology era: Basket Trial. (Le et al. Mismatch repair deficiency predicts response of solid tumors to PD-1 blockade or Flaherty et al. Molecular Landscape and Actionable Alterations in a Genomically Guided Cancer Clinical Trial: National Cancer Institute Molecular Analysis for Therapy Choice (NCI-MATCH))
Lecture 9 March 28 -Online-	New trial design in the precision oncology era: Umbrella trial (Clark et al. Neoadjuvant T-DM1/pertuzumab and paclitaxel/trastuzumab/pertuzumab for HER2+ breast cancer in the adaptively randomized I-SPY2 trial)
Lecture 10 April 04 -Online-	Development of resistant to targeted agents through activation of off-target mechanisms (Paraiso et al. Recovery of phospho-ERK activity allows melanoma cells to escape from BRAF inhibitor therapy)
Lecture 11 April 11 -Online-	Beyond genomic in precision medicine Part 1. Gene signatures for outcome prediction in breast cancer (background reading van 't Veer et al. Gene expression profiling predicts clinical outcome of breast cancer; Cardoso et al. 70-Gene Signature as an Aid to Treatment Decisions in Early-Stage Breast Cancer)
Lecture 12 April 18 -Online-	Beyond genomic in precision medicine Part 2; the Bisgrove trial (Von Hoff et al. Pilot Study Using Molecular Profiling of Patients’ Tumors to Find Potential Targets and Select Treatments for Their Refractory Cancers)
Lecture 13 April 25 -Online-	Cellular targeted therapy in cancer to enhance immunosurveillance and tumor-immune interactions (Anderson et al. Long-Lasting Complete Responses in Patients with Metastatic Melanoma after Adoptive Cell Therapy with Tumor-Infiltrating Lymphocytes and an Attenuated IL2 Regimen)
Lecture 14 May 02 -Online-	New personalized vaccines in cancer (Sahin et al. Personalized RNA mutanome vaccines mobilize poly-specific therapeutic immunity against cancer; or Ott et al. An immunogenic personal neoantigen vaccine for patients with melanoma)
Lecture 15 May 9	Final paper due