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I. BACKGROUND

The purpose of this document is to describe the Interdisciplinary Program in Tumor Biology for master’s students at Georgetown University Medical Center (GUMC). Over the last two decades, there has been a revolution in the study of the molecular biology, biochemistry and cell biology of malignant transformation, cancer prevention, and cancer therapy. The purpose of the GUMC Interdisciplinary Program in Tumor Biology is to provide master’s students with an excellent interdisciplinary environment to train them for cancer research and educational careers. Our program brings together approximately 55 faculty members from GUMC Basic Science and Clinical Departments, and from the Lombardi Comprehensive Cancer Center (LCCC). The LCCC is one of only approximately 40 National Institutes of Health-designated Comprehensive Centers, combining excellence in basic and clinical cancer research, as well as research in cancer prevention and control.

The successful development of cancer investigators depends upon their education in cellular and molecular biology, pharmacology and therapeutics, pathology, virology, infectious diseases, immunology, physiology, epidemiology and behavioral biology of the multitude of neoplastic diseases. Although these multiple disciplines each have their own unique historical basis and methodologies, they all provide important contributions in the fight against cancer. Like other top academic medical centers, GUMC has created a unified master’s program to promote quality education in cancer biology, prevention, and therapy.

II. THE TUMOR BIOLOGY MASTER’S PROGRAM

A. Program Contacts

Leena A. Hilakivi-Clarke, Ph.D.: Director of the Masters of Science in Tumor Biology Program and Professor of Oncology. Dr. Hilakivi-Clarke directs the M.S. program and advises students on course work and laboratory research projects, as well as helps to manage the education program. 
Contact Information: clarkel@georgetown.edu; (202) 687-7237; W407, New Research Building

Ayesha N. Shajahan, Ph.D.: Co-Director of the Masters of Science in Tumor Biology Program and Professor of Oncology. Dr. Shajahan co-directs the M.S. program (Cancer Systems Biology Track) and advises students on course work and laboratory research projects, as well as helps to manage the education program. 
Contact Information: ans33@georgetown.edu; (202) 687-7451; W405B, New Research Building
Karen Bivins-Shepherd: Coordinator for the Master of Science in Tumor Biology and Postdoctoral Program. Karen provides day-to-day administrative support to the Master’s and postdoctoral training programs. She is also responsible for coordinating Lombardi seminar series and Grand rounds.

Contact Information: bivinsk@georgetown.edu; (202) 687-2043; W309A, New Research Building

Anna T. Riegel, Ph.D.: Program Director of the Tumor Biology Training Program, Principal Investigator of Tumor Biology Training Grants, Associate Director for Education - Lombardi Comprehensive Cancer Center, and Professor of the Department of Oncology. Dr. Riegel counsels Ph.D. students on course work and laboratory rotations, directs curriculum review and development, and organizes student comprehensive examinations. She also chairs the Oversight Committee of the program, and represents the program on the Medical Center’s Graduate Advisory Committee.

Contact Information: ariege01@georgetown.edu; (202) 687-1479; E307, New Research Building

Elizabeth Song, M.Ed.: Education Coordinator for Tumor Biology Training Program. Elizabeth supports the academic, instructional, student life, admissions, and administrative aspects of the Tumor Biology Training Program. She is the administrator for the whole training program (M.S., Ph.D., Postdoctoral), but particularly the Ph.D. program. She manages the T32 training grant as well as assists Dr. Riegel with student recruitment, curriculum review and development, grant submissions, and other Tumor Biology programs.

Contact Information: ejs228@georgetown.edu; (202) 687-4689; W313, New Research Building

Cara Richards: Director, Biomedical Graduate Education (BGE). Cara directs the Biomedical Graduate Education, which Tumor Biology M.S. and Ph.D. programs fall under. Her office oversees all of the procedures and requirements for application and admission to the Biomedical Graduate Programs, as well as academic guidance and policy advice to all BGE programs.

Contact Information: clr32@georgetown.edu; (202) 687-1379; SE109, Med-Dent Building

James Epling: Academic Coordinator for Biomedical Graduate Education (BGE). Biomedical Graduate Education (BGE) oversees all GUMC M.S. and Ph.D. programs. James is responsible for monitoring the academic progress of all biomedical students, as well as monitoring and processing merit-based aid.

Contact Information: jae58@georgetown.edu; (202) 687-8674; NE317, Med-Dent Building

B. Program Operation

1) Oversight Committees for the Tumor Biology Training Program (M.S. & Ph.D.)
The Oversight Committee is responsible for daily management of the program and is the final decision making body of the program. The committee meets monthly for program review and decision making. The committee develops publicity for the program within and outside the University, and is a forum for the development of workshops in selected areas or new courses as perceived need arises. The Director of Graduate Studies of the Tumor Biology Training Program,
Dr. Anna T. Reigel, chairs the committee. Membership currently includes the Program Director, Director of Graduate Studies, Education Coordinators, and additional faculty chosen to represent the appropriate basic science areas. Student representatives sit on the committee to serve as a liaison between the Oversight Committee and the student body.

a. Education Oversight Committee Faculty Members

Anna Riegel, Ph.D. Chair
Maria Laura Avantaggiati, M.D., Ph.D.
Stephen Byers, Ph.D.
Fung-Lung Chung, Ph.D.
Robert Clarke, Ph.D., D.S.C.
Elliott Crooke, Ph.D.
Priscilla Furth, M.D.
Leena Hilakivi-Clarke, Ph.D.
Michael Johnson, Ph.D.
V. Craig Jordan, Ph.D.
Mary Beth Martin, Ph.D.
Eliot Rosen, M.D., Ph.D.
Jeff Toretsky, M.D.

b. Ph.D. Oversight Committee Student Representative

Rishi Surana, MD/PhD candidate, rs382@georgetown.edu
Tabari Baker, PhD candidate, tmb45@georgetown.edu

2) Grievance Subcommittee: If needed, this subcommittee will be composed of 3 faculty members chosen at large, plus the Program Director, ex officio. The committee will review student appeals or petitions, investigate the substance of such appeals and recommend a course of action to the Executive Committee.

3) Program Director and Director of Graduate Studies: The Program Director and Director of Graduate Studies will be responsible for the interfacing of this program with those of the participating departments, for organizing all program activities, and for conducting assessment of program quality on an annual basis.

4) Cancer Biology Student Organization (CBSO). The CBSO is a student-run organization that focuses on promoting a collegial atmosphere among students through social gatherings and serves as a forum for students to discuss ideas or concerns regarding the Tumor Biology Training Program. The CBSO also serves to aide in transitioning incoming students into the program. For more information, contact gucbso@gmail.com.
C. Program Training

The Interdisciplinary Program in Tumor Biology provides a comprehensive background suitable for the career development of graduate students interested in basic as well as clinical approaches to cancer research. State-of-the-art tumor research training in areas such as molecular, cellular, and developmental biology is available in the laboratories of participating faculty, all of whom are members of the Lombardi Cancer Center. Formal courses, seminars and ongoing collaborative research projects contribute to a distinctly interdisciplinary educational experience. The primary consideration for acceptance of students into the program is the candidate’s potential for highest quality research and academic scholarship, evaluated by both formal criteria and a personal interview.

Areas of special interest in training and research are the following:

- Cell Cycle and Apoptosis Controls
- Cancer Genetics
- Hormones and Cancer
- Malignant Transformation
- Angiogenesis and Metastasis
- Growth Factors
- Oncogenes and Suppressor Genes
- Chemotherapeutic Drugs and Resistance
- Clinical Oncology, Radiation Oncology, and Pathology
- Molecular Epidemiology
- Tumor Virology and Immunology
- Cancer Prevention and Control

The Masters of Science in Tumor Biology is a 30 credit program requiring a minimum of 24 credits of non-research coursework plus 6 credits of "Cancer Research Techniques" (Laboratory Research). Laboratory Research requires 10 hours per week of laboratory effort. Each student is expected to write a 10-15 page summary of accomplishments at the end of the Laboratory Research. The M.S. Program is only a one year (two full time semesters) program. The program provides laboratory research experience as well as a sound background in the biomedical sciences and specific course work in tumor biology.
D. Program Faculty

Faculty members for the program are carefully chosen from the Georgetown University faculty who are actively engaged in funded tumor research and tumor education.

Lucille Adams-Campbell, Ph.D.
Christopher Albanese, Ph.D.
Maria Laura Avantaggiati, M.D.
Milton Brown, Ph.D.
Stephen Byers, Ph.D.
Fung-Lung Chung, Ph.D.
Robert Clarke, Ph.D., D.Sc.*
Elliott Crooke, Ph.D.
Albert Fornace Jr., M.D.*
Priscilla A. Furth, M.D.
Robert Glazer, Ph.D.
Radoslav Goldman, Ph.D.
Habtom Ressom, Ph.D. *
Leena Hilakivi-Clarke, Ph.D.*
Carolyn K. Hurley, Ph.D.
Michael D. Johnson, Ph.D.
V. Craig Jordan, Ph.D., D.Sc., O.B.E.
Usha Kasid, Ph.D.
Christopher Loffredo, Ph.D.
Mary Beth Martin, Ph.D.
Vicente Notario, Ph.D.
Anna Riegel, Ph.D.
Rebecca Riggins, Ph.D.
Eliot M. Rosen, M.D., Ph.D.
Rabinda Roy, Ph.D.
Richard Schlegel, M.D., Ph.D.
Jeffrey A. Toretsky, M.D.

* Research interest includes Cancer Systems Biology

Note that M.S. Students are not restricted to selecting one of the above faculty members as a research mentor and should consult with Dr. Leena Hilakivi-Clarke or Dr. Ayesha Shajahan about their choice. Students on the Cancer Systems Biology Track are recommended to obtain research mentors who have ongoing research related to Cancer Systems Biology.
E. Tumor Biology Curriculum for M.S. Students (30 Credits)

There are two tracks to choose from – Standard Track or Cancer Systems Biology Track

Standard Track (30 Credits)

Fall Semester
- BIST 501 - Introductory Biostatistics (3)
- TBIO 508 - Cellular & Molecular Aspects of the Transformed Cell (4)
- TBIO 510 - Biochemistry for Cancer Research (2)
- TBIO 705 - Cancer Research Techniques (3)
- Electives (3)

Spring Semester
- BCHB 526 - Core Methods in Biotechnology (3)
- PHAR 534 - Ethical Issues in Scientific Research (2)
- TBIO 520 - Cancer Prevention, Control, & Epidemiology (3)
- TBIO 535 - Cancer Pharmacology I (2)
- TBIO 706 - Cancer Research Techniques (3)
- Electives (2)

Cancer Systems Biology Track (30 Credits)

Fall Semester
- BIST 501 - Introductory Biostatistics (3)
- TBIO 508 - Cellular & Molecular Aspects of the Transformed Cell (4)
- TBIO 510 – Biochemistry for Cancer Research (2)
- TBIO 540 - Biomedical informatics (3)
- TBIO 705 - Cancer Research Techniques (3)

Spring Semester
- BCHB 526 - Core Methods in Biotechnology (3)
- TBIO 530 - Systems Biology and Bioinformatics (3)
- TBIO 562 - Translational Bioinformatics (3)
- TBIO 565 - Informatics Grand-rounds/Evidence based practice (3)
- TBIO 706 - Cancer Research Techniques (3)

Note: Courses in bold are required only for the Systems Biology track
Electives for Standard Track

Fall Semester
  TBIO 513 - Breast Cancer Conference (1)  
  TBIO 522 - Epigenetics I (3)  
  TBIO 525 - Cancer Genetics (3)  
  TBIO 546 - Resources for Cancer Research (0)  
  TBIO 540 - Biomedical Informatics (3)  
  TBIO 543 - Clinical Survey of Cancer (2)  
  TBIO 560 - Animal Models (2)  
  TBIO 581 - Topics in Molecular Epidemiology (1)  
  TBIO 584 – Intro to Tumor Biology (1)  
  TBIO 591 - Signal Transduction Journal Club (1)

Spring Semester
  TBIO 513 - Breast Cancer Conference (1)  
  TBIO 530 - Systems Biology and Bioinformatics (3)  
  TBIO 536 - Cancer Pharmacology II (2 required credits + 2 electives credits = 4 credits total)  
  TBIO 558 - Contemporary Issues in Genetics and Society (3)  
  TBIO 560 - Animal Models (2)  
  TBIO 562 - Translational Bioinformatics (3)  
  TBIO 565 - Informatics Grand-rounds/Evidence based practice (3)  
  TBIO 572 - Pathological Basis of Cancer (2)  
  TBIO 585 - Transcriptomics: Microarray Analysis (1)  
  TBIO 586 - Proteomics: Mass Spectrometry Data Analysis (1)  
  TBIO 587 - Systems Biology: Pathway & Network Data Analysis (1)  
  TBIO 591 - Signal Transduction Journal Club (1)

Electives outside of the Tumor Biology Training Program (TBIO) and what is listed above must be approved by the Director of MS TBIO Program, Dr. Leena Hilakivi-Clarke, (clarkel@georgetown.edu) to be counted towards your degree as an elective.

F. Descriptions of Required Courses

Standard Track (30 Credits)

Standard Track: Fall Semester Required Courses

BIST 501 - Introductory Biostatistics (3 credits)
This course is designed for introductory biostatistical theory and application for students pursuing a master's degree in fields outside of the Department of Biostatistics, Bioinformatics, and Biomathematics. Students first learn the four pillars of exploring and displaying data appropriately, exploring relationships between two variables, issues of gathering sample data, and understanding randomness and probability. On these pillars, students then can develop the
platform for statistical inference including proportions and means, multiple regression, and ANOVA.

**TBIO 508 - Cellular & Molecular Aspects of the Transformed Cell (4 credits)**
Designed to provide students with an integrative overview of mechanisms of growth control and malignant transformation by physical, chemical, and viral mechanisms. Introduction to growth factors, oncogenes, and suppressor genes. Includes an introduction to means of reverting or blocking malignant behavior with a particular emphasis on biochemical and molecular mechanisms.

**TBIO 510 - Biochemistry for Cancer Research (2 credits)**
In this course, students will be introduced to basic biochemical pathways involved in normal human tissue and in carcinogenesis. Furthermore, students will be encouraged to think about how molecular interventions of biochemical pathways could be applied to solve current problems in cancer research.

**TBIO 705 - Cancer Research Techniques (3 credits)**
Laboratory Research Project required for MS Students. Part 1 of 2.

**Standard Track: Spring Semester Required Courses**

**BCHB 526 - Core Methods in Biotechnology (3 credits)**
Introduction to core concepts of biotechnology. Detailed description of methods used for analysis, purification, quantitation of nucleic acids and proteins. Topics include applications of PCR, blotting techniques, basics of cloning and cell culture and applications of biotechnology to product development.

**PHAR 534 - Ethical Issues in Scientific Research (2 credits)**
Discussions of ethical questions and dilemmas facing scientists today.

**TBIO 520 - Cancer Prevention, Control, & Epidemiology (3 credits)**
Cancer epidemiology, prevention and control relies on the conduct of basic science research and applied research in the behavioral, social, and population sciences to create or enhance interventions that, independently or in combination with biomedical approaches, reduce cancer risk, incidence, morbidity and mortality, and improve quality of life. The objectives of this course are to equip students with the understanding of cancer problems from cell to society and to provide them with the evidence of the need of cross-disciplinary collaboration between biomedical and behavioral sciences. The overall goal of the course is to stimulate students to apply broad perspectives to their areas of research interest that ultimately leads to a successful research career in cancer prevention and control.
TBIO 535 - Cancer Pharmacology I (2 credits)
An overview of fundamentals of pharmacology as applied to cancer therapy. Mechanisms of action and resistance to chemotherapeutic, antihormonal, biological response modifiers, and new experimental drugs will be emphasized. TBIO 535 is the first half of the full semester course (TBIO 536; 4 credits).

TBIO 706 - Cancer Research Techniques (3 credits)
Laboratory Research Project required for MS Students. Part 2 of 2.

Cancer Systems Biology Track (30 Credits)

Cancer Systems Biology Track: Fall Semester Required Courses

BIST 501 - Introductory Biostatistics (3 credits)
This course is designed for introductory biostatistical theory and application for students pursuing a master's degree in fields outside of the Department of Biostatistics, Bioinformatics, and Biomathematics. Students first learn the four pillars of exploring and displaying data appropriately, exploring relationships between two variables, issues of gathering sample data, and understanding randomness and probability. On these pillars, students then can develop the platform for statistical inference including proportions and means, multiple regression, and ANOVA.

TBIO 508 - Cellular & Molecular Aspects of the Transformed Cell (4 credits)
Designed to provide students with an integrative overview of mechanisms of growth control and malignant transformation by physical, chemical, and viral mechanisms. Introduction to growth factors, oncogenes, and suppressor genes. Includes an introduction to means of reverting or blocking malignant behavior with a particular emphasis on biochemical and molecular mechanisms.

TBIO 510 – Biochemistry for Cancer Research (2 credits)
In this course, students will be introduced to basic biochemical pathways involved in normal human tissue and in carcinogenesis. Furthermore, students will be encouraged to think about how molecular interventions of biochemical pathways could be applied to solve current problems in cancer research.

TBIO 540 - Biomedical informatics (3 credits)
This didactic course will provide an overview of the field of Biomedical Informatics from different perspectives. Particular emphasis is given to understanding the basic building blocks, various information resources and the application areas of Biomedical Informatics. Students will learn to explore the process of developing and applying computational techniques for determining the information needs of health care providers and patients.

TBIO 705 - Cancer Research Techniques (3 credits)
Laboratory Research Project required for MS Students. Part 1 of 2.
**Cancer Systems Biology Track: Spring Semester Required Courses**

**BCHB 526 - Core Methods in Biotechnology (3 credits)**
Introduction to core concepts of biotechnology. Detailed description of methods used for analysis, purification, quantitation of nucleic acids and proteins. Topics include applications of PCR, blotting techniques, basics of cloning and cell culture and applications of biotechnology to product development.

**TBIO 530 - Systems Biology & Bioinformatics (3 credits)**
An introduction to bioinformatics in systems biology, covering microarray data analysis, proteomic/metabolomic informatics, and regulatory network and pathway analysis.

**TBIO 562 - Translational Bioinformatics (3 credits)**
This didactic course is a one semester course that will cover major concepts, methods and tools used in translational bioinformatics. It is designed as a combination of lectures and practical computer based exercises utilizing functionality of web-based GU resources - such as Protein Information Resource (PIR), and Georgetown Database of Cancer (G-DOC)- a unique translational research platform for connecting molecular and clinical data. Additional hands-on experience will be provided to students in the applications of advanced systems biology level analysis of experimental multi-omics data using Pathway Analysis tools from Pathway Studio software suite (Ariadne Genomics). A campus-wide license for Pathway Studio is available to all.

**TBIO 565 - Informatics Grand-rounds/Evidence based practice (3 credits)**
The course description for this course will be posted soon.

**TBIO 706 - Cancer Research Techniques (3 credits)**
Laboratory Research Project required for MS Students. Part 2 of 2.

**G. Descriptions of Recommended Program Electives for Standard Track**

**Standard Track: Fall Semester Electives**

**TBIO 513 - Breast Cancer Conference (1 credit)**
This course promotes an appreciation for the biology of breast cancer as it occurs in individual women, allowing students to better formulate research programs addressing issues of clinical significance.

**TBIO 522 - Epigenetics I (3 credits)**
This is a combined lecture/literature review/problem-based discussion course designed for upper level undergraduates and graduate students in Human Science, Molecular/Cell Biology, Tumor Biology, Pharmacology, and Neuroscience.
**TBIO 525 - Cancer Genetics (3 credits)**
This course introduces the fundamentals of the molecular genetics and molecular cytogenetics of cancer. In addition, it covers diagnostic, clinical, and population-based aspects of this rapidly advancing field.

**TBIO 546 - Resources for Cancer Research (0 credit)**
This course provides an introduction to the Shared Resources of the Lombardi Cancer Center. Emphasis will be on the practical aspects of utilization.

**TBIO 540 - Biomedical Informatics (3 credits)**
This course provides an overview of the field of Biomedical Informatics from different perspectives. Particular emphasis is given to understanding the basic building blocks, various information resources and the application areas of Biomedical Informatics. Students will learn to explore the process of developing and applying computational techniques for determining the information needs of health care providers and patients.

**TBIO 543 - Clinical Survey of Cancer (2 credits)**
This course features a broad site by site survey of human cancer. The perspective is primarily from the points of view of the medical oncologist and pathologist, with an emphasis on providing an integrated view of each principal cancer covering the following: natural history, biology, and treatment.

**TBIO 560 - Animal Models (2 credits)**
Animal models are an invaluable tool for cancer research and the goal of TBIO 560 is to introduce graduate students to the wide variety of models available, to the factors that inform the choice of an appropriate model for the research planned, and to provide basic training in the ethical, legal, and technical aspects of their use.

**TBIO 581 – Topics in Molecular Epidemiology (1 credit)**
This course introduces students to the concept of carcinogenesis process (chemical, viral, and physical) with a focus on the causes, distribution and prevention of cancer in populations. The course emphasizes the roles of DNA damage/repair, individual genetic differences to environmental exposures in cancer risk. Students will learn how the current knowledge is used to develop molecular and genetic biomarkers that could be applied to assess cancer risk and identify potential risk and protective factors.

**TBIO 584 – Intro to Tumor Biology (1 credit)**
The discipline of Tumor Biology (or cancer biology) occupies the intersection between multiple other fields including biochemistry, physiology, cell biology, pharmacology, and pathology, since at its essence it is the study of how processes within the body, whether normal or perturbed in some way, are involved in carcinogenesis, tumor progression, and the response to anti-cancer therapy. The goal of this course is to provide an overview of the field of Tumor Biology through a series of short informal presentations by Tumor Biology Program faculty describing their research.
interests, how their work relates to the field as a whole, and the research projects currently ongoing in their labs. The course usually starts in the middle of October. Each session includes two to three presentations. The sessions are informal and student participation in discussions is expected. Grading is based on attendance and class participation.

**TBIO 591 - Signal Transduction Journal Club (1 credit)**
Recent papers in the broad area of signal transduction as it pertains to areas such as growth factor signaling, angiogenesis, and transcription control mechanisms will be presented. Each registered student presents a paper in at least one session.

**Standard Track: Spring Semester Electives**

**TBIO 513 - Breast Cancer Conference (1 credit)**
This course promotes an appreciation for the biology of breast cancer as it occurs in individual women, allowing students to better formulate research programs addressing issues of clinical significance.

**TBIO 530 - Systems Biology and Bioinformatics (3 credits)**
An introduction to bioinformatics in systems biology, covering microarray data analysis, proteomic informatics, and regulatory network and pathway analysis, and discuss how a systems approach to the analysis of “omics” data can improve our understanding of biology.

**TBIO 536 - Cancer Pharmacology I & II (2 required credits + 2 electives credits = 4 credits total)**
An overview of fundamentals of pharmacology as applied to cancer therapy. Mechanisms of action and resistance to chemotherapeutic, antihormonal, biological response modifiers, and new experimental drugs will be emphasized. TBIO 536 is a full semester course (4 credits).

**TBIO 558 - Contemporary Issues in Genetics and Society (3 credits)**
This course provides a framework for understanding fundamentals of human medical genetics and the concomitant ethical and social issues that arise, as well as the practical implications for health and well-being.

**TBIO 560 - Animal Models (2 credits)**
Animal models are an invaluable tool for cancer research and the goal of TBIO 560 is to introduce graduate students to the wide variety of models available, to the factors that inform the choice of an appropriate model for the research planned, and to provide basic training in the ethical, legal, and technical aspects of their use.

**TBIO 562 - Translational Bioinformatics (3 credits)**
This didactic course is a one semester course that will cover major concepts, methods and tools used in translational bioinformatics. It is designed as a combination of lectures and practical computer based exercises utilizing functionality of web-based GU resources - such as Protein Information Resource (PIR), and Georgetown Database of Cancer (G-DOC)- a unique translational
research platform for connecting molecular and clinical data. Additional hands-on experience will be provided to students in the applications of advanced systems biology level analysis of experimental multi-omics data using Pathway Analysis tools from Pathway Studio software suite (Ariadne Genomics). A campus-wide license for Pathway Studio is available to all.

**TBIO 565 - Informatics Grand-rounds/Evidence based practice (3 credits)**
The course description for this course will be posted soon.

**TBIO 572 - Pathological Basis of Cancer (2 credits)**
A combination of lecture and lab, this course provides a strong background in pathology as related to cancer. The course consists of general introductory pathology lectures, followed by the pathologic basis of specific cancers, including colon, breast, prostate, cervical and endometrial, and hemapoietic.

**TBIO 585 - Transcriptomics: Microarray Analysis (1 credit)**
An introduction to microarray experimental and data analysis. This is a distinct unit of TBIO 530, which will run from January to mid-February.

**TBIO 586 - Proteomics: Mass Spectrometry Data Analysis (1 credit)**
An introduction to mass spectrometry data analysis and proteomic biomarker discovery. This is a distinct unit of TBIO 530, which will run from mid-February to end of March.

**TBIO 587 - Systems Biology: Pathway & Network Data Analysis (1 credit)**
An introduction to the metabolomics, interactomics, regulatory network and pathway analysis, and omics data integrating and mining. This is a distinct unit of TBIO 530, which will run from end of March to end of April.

**TBIO 591 - Signal Transduction Journal Club (1 credit)**
Recent papers in the broad area of signal transduction as it pertains to areas such as growth factor signaling, angiogenesis, and transcription control mechanisms will be presented. Each registered student presents a paper in at least one session.

*Electives outside of the Tumor Biology Training Program (TBIO) and what is listed above must be approved by the Director of MS TBIO Program, Dr. Leena Hilakivi-Clarke, to be counted towards your degree as an elective.*

**H. Apply to Graduate**

The Graduate School of Arts & Sciences awards master's and doctoral degrees at the end of each month, with the exception of June. The university conducts commencement exercises annually in May.
Students must file an Application to Graduate (instructions below) in order to receive their degree. Applications must be submitted via MyAccess by the first business day of the month in which they intend to graduate. Students will then be given until the last day of the month to meet all degree requirements.

**Students who do not meet all requirements by the monthly deadline** will have their Applications carried over to the following month during the current academic term (Fall, Spring, or Summer). If students do not fulfill the degree requirements by the end of the academic term, however, they **MUST** submit another Application for Graduate Degree for the following academic term.

You **MUST** apply for graduation **NO LATER THAN FEBRUARY 1** if you wish (1) to have your diploma available at the May graduation ceremony, and (2) to have your name and graduation information printed in the commencement program. This early deadline is necessitated by the production schedules of both the diplomas and commencement program.

After Feb. 1 you may still apply for monthly graduation by the first day of the respective month, as noted in the table below. If you do so, you will still be able to participate in the May commencement ceremony, but your diploma will not be available at that time and your graduation information will not be in the commencement program.

For specific instructions on How to Apply to Graduate, please visit: [http://grad.georgetown.edu/academics/how-to-graduate/](http://grad.georgetown.edu/academics/how-to-graduate/)

**III. GEORGETOWN UNIVERSITY GRADUATE SCHOOL BULLETIN**

*This is based on the Academic Integrity Policies & Procedures of the Graduate School published on their bulletin dated as of July 2012.*

**A. Definition of Academic Integrity**

The Center for Academic Integrity, of which Georgetown University is a member, defines academic integrity as “a commitment, even in the face of adversity, to five fundamental values: honesty, trust, fairness, respect, and responsibility.”

A PDF copy of a booklet prepared by the Center, *The Fundamental Values of Academic Integrity*, can be downloaded free of charge at this link:

[http://www.academicintegrity.org/icai/assets/FVProject.pdf](http://www.academicintegrity.org/icai/assets/FVProject.pdf)

These values form the bedrock of all scholarship. Students in the Graduate School of Arts and Sciences are expected to be guided by these values and to maintain the highest standards of academic integrity in pursuit of their educational goals.
B. Responsibility for Academic Integrity

All graduate students are responsible for educating themselves about the proper practices for conducting scholarly work and procedures for documentation in their field of study. Documentation procedures are outlined in a number of standard guides, most of which can be found in Lauinger and Dahlgren libraries. However, since methods vary among different disciplines, students should seek guidance from their department or program about proper and improper approaches to scholarly documentation. Specific questions about which references need to be documented and how attribution should be made may be directed to the course professor, the thesis advisor, or the Director of Graduate Studies. Faculties have a special responsibility to mentor graduate students in the standards of academic integrity appropriate to their disciplines. The Graduate School urges faculty to take appropriate opportunities to teach standards of academic integrity and techniques of scholarly documentation, and to report to the Dean suspected cases of academic misconduct.

C. Violations of Academic Integrity: Academic Misconduct

Academic misconduct is any action or failure to act that violates the five principles listed above. Academic misconduct may include, but is not limited to, the following:

- Plagiarism
- Unacknowledged paraphrase
- Cheating
- Fabrication of data
- Fabrication, alteration, or misrepresentation of academic records
- Facilitating academic dishonesty
- Unauthorized collaboration
- Misuse of otherwise valid academic work
- Misuse of academic resources
- Depriving others of equal access to academic resources

**Plagiarism** is the presentation of someone else’s ideas, writings, or statements as one’s own. Plagiarism is a serious breach of academic integrity, and anyone who is found to have committed plagiarism will be subject to disciplinary action.

**Paraphrase** is the act of putting someone else’s ideas into one’s own words. The use of paraphrase can be an acceptable practice under some circumstances if it is used sparingly and if the original text is properly acknowledged. **Unacknowledged paraphrase**, like plagiarism, is a serious breach of academic integrity.

Any improper use of sources, may constitute plagiarism. Every quotation from another source, whether written, spoken, or electronic, must be bound by quotation marks and be properly cited. Mere citation alone is not sufficient when a scholar has used another person’s words. Similarly,
every paraphrase or summary (a more concise restatement of another's ideas) must be properly cited. A bibliographic entry alone is not sufficient to avoid the imputation of plagiarism for unacknowledged paraphrase or summary of another person’s ideas.

**Cheating** is the use or attempted use of unauthorized materials, information, or study aids in inclass examinations, take-home examinations, or other academic exercises.

**Fabrication of data** is the falsification or invention of data, research results, citations, or any other information used in examinations, papers, experiments, or other academic exercises.

**Fabrication, alteration, or misrepresentation of academic records** includes, but is not limited to, the falsification or invention of such records as resumes and CVs, transcripts, letters of recommendation, grade reports, and examination report forms.

**Facilitating academic dishonesty** is the assistance or attempted assistance of another to commit an act of academic dishonesty.

**Unauthorized collaboration** is a form of academic misconduct. Unless the responsible faculty member has explicitly authorized students to work collaboratively on a particular project, all academic work must be the student’s own. Students who participate in joint projects or collaborative exercises are expected to make themselves aware of and to adhere to their instructor’s expectations for individual contributions to the joint effort as well as any purely individual work to be prepared and submitted for assessment.

**Misrepresentation or misuse of otherwise valid academic work** is a form of academic misconduct. For example, a paper submitted to satisfy the requirements for one course may not be submitted to satisfy a requirement for a second course without explicit permission of both instructors.

It is a violation of academic integrity to misuse academic resources, or to attempt to deprive other scholars, whether students or faculty, of equal access to academic resources, whether those resources are tangible (e.g., library or laboratory materials) or intangible (e.g., access to online or other electronic resources).

The Graduate School reserves the right to use all legal means, including submitting student work to electronic search engines, such as Turnitin.com, to investigate allegations that graduate students have engaged in academic misconduct. Students themselves are encouraged to use Turnitin.com to check their own work for improperly documented content.

Academic misconduct in any form is a serious offense against the academic community in general and against Georgetown University in particular. Students who are found to have violated standards of academic integrity will be subject to academic penalties. These penalties may include, but are not limited to, transcript notations, suspension or dismissal from the University, or revocation of degrees already conferred.
D. Procedures for Adjudicating Alleged Violations of Academic Integrity

1. Jurisdiction

Cases of alleged academic misconduct by any student directly matriculated in the Graduate School of Arts and Sciences shall be adjudicated by the Dean of the Graduate School through the procedures outlined below. The Dean of the Graduate School is the only person authorized to impose sanctions on a Graduate School student for violations of academic integrity committed in connection with a Graduate School program.

Academic integrity cases of graduate students in the McDonough School of Business (MSB) will be adjudicated by a separate academic integrity system administered by MSB. Full information is available at: https://intranet.msb.edu/mba/

Students who are matriculated in dual-degree programs, in which a Graduate School program is pursued concurrently with that of another Georgetown University academic unit (e.g., the Law Center or the Medical School), will generally be subject to the academic disciplinary procedures of the Graduate School when the alleged violations of academic integrity occur within the Graduate School sequence of the dual degree program. When the alleged academic misconduct occurs within the other academic unit’s sequence of a dual degree program, the matter will generally be adjudicated by the other unit. However, the Graduate School retains the right to impose sanctions on graduate students who have been found to have violated standards of academic integrity by another academic unit, and to adjudicate any case that the other academic unit chooses not to pursue. Similarly, findings of academic misconduct by the Graduate School under its own procedures will be reported to the other academic unit.

Cases of alleged academic misconduct on the part of Georgetown University Graduate School students who are enrolled in a course at another university, e.g., through the Consortium of Universities of the Washington Metropolitan Area, will be adjudicated at Georgetown and will be subject to the authority of the Dean of the Graduate School at Georgetown.

Cases of alleged academic misconduct by graduate students who are enrolled at Georgetown as visitors from another Consortium university will be adjudicated at Georgetown and will be subject to the authority of the Dean of the Graduate School at Georgetown in so far as their Georgetown transcript is concerned. If the student is found responsible for academic misconduct, in addition to authorizing any transcript notation, the Dean of the Graduate School will provide the evidentiary materials and findings to the University Registrar for transmittal to the Registrar at the student’s home institution per the policies of the Consortium. Under those policies, the home institution may undertake its own investigation and impose its own sanctions.

Students matriculated in graduate programs offered by other Georgetown University schools (e.g., the School of Continuing Studies) do not fall under the jurisdiction of the Dean of the
Graduate School. Cases involving these students shall be adjudicated by the academic unit in which their program is housed.

2. Reporting Allegations of Academic Misconduct

Anyone who has reason to believe that a graduate student has engaged in academic misconduct is urged to report such information in writing, along with any supporting evidence, to the Dean of the Graduate School. Allegations of academic misconduct may be brought to the Dean’s attention at any time in the student’s academic career, even after the student’s graduation, regardless of when the alleged incident occurred.

*If the allegations concern a course for which a grade has not yet been posted, the faculty member shall not submit either a letter grade or an “Incomplete” until the allegations have either been adjudicated or dismissed.* In the interim, the faculty member should write to the University Registrar to explain that no grade has been submitted because of a pending investigation of alleged academic misconduct. The Registrar will post a grade of “NR” (“No Report”) pending final resolution.

3. Standing Committee on Academic Integrity

The Dean will appoint a Standing Committee on Academic Integrity (henceforth, the “Standing Committee”). The Standing Committee will be composed of:

- Fifteen (15) faculty, appointed to staggered 3-year terms.
- Eight (8) Graduate School students, at least two (2) of whom are pursuing the Ph.D. Each student will be appointed to a one-year term with the possibility of reappointment for a second term.
- One Graduate School associate dean, who will serve as the non-voting Investigating Officer.
- One non-voting ex officio member of the University Research Integrity Committee, to be appointed by the Chair of the University Research Committee.

Faculty representatives on the Standing Committee will be drawn from the full range of the Graduate School’s degree programs, both master’s and doctoral, on both the Main Campus and the Medical Center. The Dean shall designate a faculty member of the Standing Committee to serve as Chair.

The Standing Committee will meet at the beginning of each academic year to familiarize the members with standards of academic integrity expected of Graduate School students, the type of violations brought before the Committee, and the range of sanctions that may be imposed on
those found responsible for academic misconduct. Unless circumstances warrant otherwise, the Committee’s subsequent business, including the assignment of adjudication committees, will be conducted without meeting as a group.

4. Transmittal of Allegations and Decision to Investigate

When an allegation of academic misconduct is received by the Dean, the Dean’s Office will notify the student that an allegation has been received and that the Chair of the Standing Committee will assign an Adjudication Committee to review the allegations. The notice will include a copy of the allegations and a list of the members of the Standing Committee. The student will be informed that he or she has three (3) business days to do either or both of the following:

a) Submit a written statement concerning the allegations that he or she wishes the Adjudication Committee to consider when making the initial decision about whether the allegations merit investigation. The student is encouraged to make any such written submission at this stage short, preferably no longer than one page. If the Adjudication Committee determines that investigation and further adjudication of the allegations are warranted, the student will be given the opportunity to submit an additional written response.

b) Indicate his or her objection to having any specific member of the Standing Committee serve on the Adjudication Committee. If the student has concerns about any member of the Standing Committee serving on the Adjudication Committee, the student must notify the Chair in writing of the good faith basis for the objection within the three-day period.

After the student has been notified and had an opportunity respond, the Dean’s office will refer the allegations and any response submitted by the student to the Chair of the Standing Committee for assignment to an Adjudication Committee. In doing so, the Chair will consider any objection to membership submitted by the student, but the final decision regarding the membership of the Adjudication Committee will rest with the Chair.

An Adjudication Committee shall consist of two faculty and one student member of the Standing Committee. A Standing Committee member who is teaching a course or mentoring a thesis in which academic misconduct has been alleged may not serve on the Adjudication Committee handling that case.

Each member of the Adjudication Committee will be given a complete copy of the allegations, supporting materials, and any written response to the allegations materials submitted by the student. As soon as reasonably possible, the newly-appointed Adjudication Committee will caucus to review these materials. As its first responsibility, the Adjudication Committee will determine whether the allegations could reasonably constitute a violation of the Standards of Academic Integrity.
If the members of the Adjudication Committee determine that the allegations do not constitute a violation of the Standards of Academic Integrity, they will return the materials to the Chair, who will return them to the Office of the Dean with a recommendation that the allegations be dismissed. All materials received will be securely destroyed and both the student and the individual alleging academic misconduct will be informed that the case has been closed. No record of the allegations will appear in the student’s records.

If the Adjudication Committee determines that the allegations do warrant further investigation and adjudication, the members will so notify the Chair, who will notify the Dean.

The Office of the Dean will send written notice to the student that an investigation has been initiated. This notice will include the names of the Standing Committee members who have been appointed to the Adjudication Committee. The student will be informed that he or she has five (5) business days to (a) request an opportunity to meet with the Adjudication Committee and (b) to submit a written response to the allegations, not to exceed ten (10) typewritten pages. A copy of this response will be provided to each member of the Adjudication Committee.

At the discretion of the Dean, a representative from the Office of University Counsel may serve as an advisor to the Standing Committee or any Adjudication Committee.

5. Investigation of Allegations by the Adjudication Committee

Having determined that the facts as alleged could constitute a violation of the standards of Academic Integrity, the Adjudication Committee will initiate an investigation. The Committee may supplement the information it initially receives with any information that it deems necessary. Since the purpose of this investigation will be to make determinations of fact, it will be interrogatory rather than accusatorial in both format and approach.

If specialized knowledge is deemed necessary to investigate a case, the Adjudication Committee may ask the Dean to appoint an appropriate expert to assist the Adjudication Committee in its investigation. The expert will serve as a consultant to the Adjudication Committee and will neither deliberate with the Adjudication Committee nor vote. Copies of any materials provided to the Adjudication Committee by such an expert will also be provided to the student.

If the student so requests, the Committee will meet with and question the student. The student may also propose relevant witnesses from which it would like the Committee to hear. If the student wishes to propose witnesses, the student must submit their names in writing to the Adjudication Committee, along with their relationship to the student, if any, and the nature of their testimony. The Committee will decide whether to hear from these witnesses.

Because the meeting between the Committee and the student is fundamentally an academic proceeding, not a legal one, the student is expected to represent himself or herself, and to speak on his/her own behalf. The student may not be represented by counsel, nor may anyone
participate in the meeting who is not a material witness. The student may be accompanied by one person, such as a friend or family member, but that individual may not participate in the proceedings. Should that person also be an attorney, he or she has a professional obligation to so inform the Committee in advance, in which case the Committee reserves the right to have a representative from the Office of University Counsel present.

The Committee may also interview additional witnesses and/or review any additional material that it believes would be helpful or relevant to its decision-making process. The student against whom the allegations are brought shall have the right to be present as an observer to all witness interviews conducted by the Adjudication Committee. Interviews conducted by the Adjudication Committee may be recorded at the discretion of the Graduate School.

6. **Determination of Responsibility for Academic Misconduct**

The Adjudication Committee will determine by simple majority vote whether it believes the student is responsible for academic misconduct and whether it will recommend that sanctions be imposed on the student. The Adjudication Committee will deputize one of its members to report its determination of responsibility and any recommended sanctions in writing to the Dean of the Graduate School.

Upon receipt of the Committee’s report, the Dean of the Graduate School may

- accept the findings and recommendations of the Adjudication Committee; or
- refer the case back to that Adjudication Committee for further investigation or more detailed written explanation of its findings and recommendations; or
- reject the Adjudication Committee’s findings and/or sanctioning recommendations and explain the rationale for accepting a different interpretation of the facts and/or imposing different sanctions.

The Dean of the Graduate School will provide the student against whom the allegations have been made with a written statement of the final decision and, as appropriate, any recommended sanction.

A one-page summary report of the facts of the case and its outcome will be provided to the Standing Committee. These summaries will be maintained in a sanction precedent file by the Graduate School, and will contribute to the body of precedent to guide future adjudication committees in establishing appropriate sanctions for comparable violations of academic integrity.
7. **Sanctions**

The Dean’s letter imposing sanctions for academic misconduct will become part of the student’s permanent file.

If the misconduct involves a course, the following notation will be placed on the student’s transcript under the relevant course: *“Student found responsible for academic misconduct in the above course.”*

Sanctions recommended by the Adjudication Committee may include but are not limited to suspension or dismissal from the University and revocation of degrees already granted.

Sanctions that may be imposed directly by the Dean of the Graduate School include but are not limited to:

a. Suspension, to be noted on the transcript as *“Suspension for Academic Misconduct”*;

b. Dismissal, to be noted on the transcript as *“Dismissal for Academic Misconduct”*;

c. Revocation of previously awarded degrees, to be noted on the transcript as *“[Degree] revoked for Academic Misconduct.”*

Such transcript notations will become part of the student’s permanent record.

The student’s department or program must comply with any sanctions communicated to them by the Dean of the Graduate School. The Dean of the Graduate School is the only person authorized to impose sanctions on a Graduate School student for violations of academic integrity committed in connection with a Graduate School program. *The department or program shall not impose additional penalties.*

Regardless of the sanctions that may be recommended by the Adjudication Committee and/or imposed by the Dean, if a student is found to have violated academic integrity in a graded activity, the faculty member involved may fail the student or reduce the student’s grade, for either an assignment or for the entire course, at his or her discretion. *If, however, the student is found not to have violated academic integrity, the faculty member shall not penalize the student for academic misconduct.*

8. **Appeals**

A student who has been found responsible for academic misconduct shall have the right to appeal those findings as well as any sanctions that may have been imposed.

Appeals of findings or sanctions will be considered only if the student is able to demonstrate either that new evidence has become available since the case was considered by an Adjudication Committee and/or that he or she was harmed by substantial procedural irregularity in the
process. Such requests must be filed within 30 days of the date of the Dean’s letter imposing penalties and must include a description of the grounds for appeal. Dissatisfaction with the decision is not in itself sufficient grounds to warrant granting an appeal.

A student whose sanctions include termination from a degree program should refer to Section III.G.2. Termination for Findings of Academic Misconduct.

The Dean of the Graduate School will determine whether there are sufficient grounds for appeal.

If the Dean determines there are not sufficient grounds for appeal, the student will be so notified in writing. Such a determination shall be final.

If the Dean determines that there are sufficient grounds for an appeal, the case will be sent back to the original Adjudication Committee for further investigation. In extremely rare cases in which personnel changes or allegations of substantial procedural irregularities make it impossible or impractical to reconvene the original Adjudication Committee, a new Adjudication Committee may be convened.

E. Georgetown University Honor System

The Tumor Biology Training Program upholds Georgetown University’s Honor System. All students enrolled in the Tumor Biology Training Program, including the M.S. program, are held to the Georgetown University standards of ethical conduct as defined by the Honor Council. 

http://gervaseprograms.georgetown.edu/honor/system/53516.html

The Honor Pledge

Upon application to any of the academic divisions of Georgetown University subject to the jurisdiction of the Honor System, all students will agree to sign the Honor Pledge. Upon matriculation, the student will state or write the pledge as follows:

In pursuit of the high ideals and rigorous standards of academic life I commit myself to respect and to uphold the Georgetown University honor system:

To be honest in every academic endeavor, and

To conduct myself honorably, as a responsible member of the Georgetown community as we live and work together.

Faculty may at their discretion require students to include a signed version of the pledge with their assignments.
F. **Georgetown University Ethos Statement**

The Tumor Biology Training Program upholds Georgetown University’s Ethos Statement as well as policies and guidelines set forth by the Office of Student Conduct. All students enrolled in the Tumor Biology Training Program, including the M.S. program, are held to the Georgetown University standards of ethical conduct as defined by the Office of Student Conduct.

http://studentconduct.georgetown.edu/

**Ethos Statement**

Choosing to come to Georgetown University means joining a distinctive community. As a Catholic and Jesuit University, Georgetown places special emphasis on the dignity and worth of every person and the love of truth. Membership in this community carries with it high expectations regarding the ways in which each person will act both within and beyond Healy Gates. In particular, students are expected to honor the following commitments in all their actions:

- A commitment to the highest standards of honesty and personal integrity both inside and outside the classroom.
- A commitment to treat others in a respectful manner, regardless of differences such as race, religion, nationality, ethnicity, gender, or sexual orientation.
- A commitment to open discourse and the free exchange of ideas. A commitment to exercise mutual care and responsibility in all relationships.
- A commitment to an active concern for the safety, security, and well-being of each individual and a respect for individual, communal and university property.

**IV. AVAILABLE RESEARCH & TRAINING FACILITIES**

**A. Shared Resources**

A wide variety of facilities, located for the most part in the Lombardi Comprehensive Cancer Center (LCCC), are available to support the training program. Shared resources allow Lombardi and Georgetown scientists to pool their equipment, technicians and knowledge for the benefit of all. This program, which is supported by funding from the National Cancer Institute, is in place to provide cost effective access to state-of-the-art technologies. New shared resources are continually being developed and brought on line.

Each shared resource is handled like a small business and is coordinated by a faculty member who is experienced in that research area. This person has a staff of one or more who facilitates access to that resource. Each "business" provides a specialized service for a reasonable user fee.

A complete list of the Shared Resources at Lombardi is available here:

http://lombardi.georgetown.edu/research/sharedresources/index.html
B. Lombardi Comprehensive Cancer Center

The Lombardi Comprehensive Cancer Center (LCCC) is a highly integrated and interactive matrix cancer facility dedicated to basic and clinical cancer research and cancer prevention and control. It occupies two buildings on the Georgetown University campus and one building several blocks away off campus. Its members hold appointments with basic and clinical departments. The Cancer Center is a National Cancer Center-designated, Cancer Center Support Grant-funded institution, which sees approximately 3,000 new cancer patients per year. Many of the physicians involved in patient care have offices within the Lombardi Comprehensive Cancer Center. At the current time, the Center also has approximately 40,000 net sq. ft. of laboratory space, primarily in New Research Building, (NRB). There is considerable laboratory-clinical interaction.

In addition to this community of excellent scientific investigators, the Lombardi Comprehensive Cancer Center houses and provides substantial support for a variety of shared resources that facilitate cancer investigation. These are listed above. The majority of these facilities are peer reviewed and funded by the Cancer Center’s Support Grant. The Cancer Center also provides conference space and a library containing virtually all relevant scientific Tumor journals. The Cancer Center has a 250 station local area computer network equipped with a variety of word processing, graphics, and data base programs, Internet access to the National Library of Medicine and Knowledgefinder, as well as access to other Georgetown University and NIH programs.

Additional Georgetown University Medical Center resources available to the program include the Medical Center and university libraries (which currently receive 1,500 biomedical journals), university computer center (which has software developed for molecular dynamics calculations), and the specialized clinical and support facilities available through the Lombardi Comprehensive Cancer Center.