



High-Impact Cancer Research Program

*State-of-the-art knowledge for
high-impact cancer research, from
discovery biology to breakthroughs
in therapy and prevention*



HARVARD
MEDICAL SCHOOL

Postgraduate
Medical Education

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Dear Colleagues:

Challenging problems. New strategies for success. Cross-disciplinary and worldwide collaborations. Results that provide profound advances. The opportunities to produce and enable high-impact cancer research are unprecedented. Recent advances continue to expand and reshape our views of the essential features of cancer. We are learning important new aspects of how cancers develop, how to find and diagnose cancers earlier, how to design and unleash powerful new anti-cancer therapies, and how to evaluate cancer risk and even prevent tumors from arising. These advances are delivering useful, productive changes that lead to better cancer outcomes.

We created High-Impact Cancer Research to share this changing science with a diverse group of highly motivated individuals. You will learn new fundamentals on a wide spectrum of cancer science and the skills necessary to envision, design, and lead cutting-edge cancer research projects that can contribute to these changes.

The program provides you the opportunity to:

- Explore the most current understanding of the molecular and cellular basis of cancer development, detection, diagnosis, treatment, and prevention
- Learn innovative science from the innovators themselves
- Hear about new cancer treatments from the individuals who developed the therapies and are testing them in on-going clinical trials.
- Hone the skills necessary to identify and answer key questions needed to make your own future contributions
- Customize your learning experience for your specific interests
- Build an international network of colleagues and friends

This Harvard Medical School program is open to both new and seasoned researchers. The customized facets of this program enable you to tailor your learning experience to your specific research interests and career goals.

We built this program to help participants make high-impact contributions that lead to better cancer outcomes. We deeply enjoy teaching this course and following the successes of past participants. We hope that you will choose to join our next iteration.

With our very best wishes,



George Demetri, MD



Ed Harlow, PhD



Peter Howley, MD

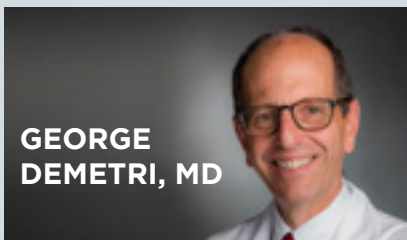
Program Overview

With so many new and promising strategies and recent developments, the opportunities to produce and enable high-impact cancer research are unprecedented. Recent advances continue to expand and reshape our views of the essential features of cancer. We are learning important new aspects of how cancers develop, how to find and diagnose cancers earlier, how to design and unleash powerful new anti-cancer therapies, and how to evaluate cancer risk and even prevent tumors from arising. These advances are delivering useful, productive changes that lead to better cancer outcomes.

High-Impact Cancer Research is the acclaimed Harvard Medical School post-graduate certificate program for cancer research. It teaches the principles and skills shaping today's most important cancer research activities.

High-Impact Cancer Research faculty are distinguished leading experts who have achieved breakthroughs in fields from discovery biology to therapeutics and prevention. In this special program, world leaders in cancer research share their insights and teach this changing science. Participants learn the new fundamentals of a wide spectrum of cancer science and the skills necessary to envision, design and lead cutting-edge cancer research projects that can contribute to these changes.

Program Directors



Associate Director for Clinical Sciences
Dana-Farber/Harvard Cancer Center
Professor of Medicine
Harvard Medical School
Director
Ludwig Center at Harvard
Senior Vice President for Experimental
Therapeutics
Dana-Farber Cancer Institute



Ludwig Professor of Cancer Education
and Research
Department of Biological Chemistry
and Molecular Pharmacology
Harvard Medical School
Special Assistant to the Director
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Shattuck Professor of Pathological
Anatomy
Department of Pathology
Professor
Department of Microbiology and
Immunobiology
Harvard Medical School

Program Objectives

This program is designed to help participants make high-impact contributions that lead to better cancer outcomes. Upon completion of the program, participants will be able to:

- Understand the molecular and cellular basis of cancer development, detection, diagnosis, treatment and prevention
- Learn about key advances within the context of clinical presentation of various human tumors and ways it is currently being used to develop the growing set of therapeutic and preventive approaches to fight cancer
- Hear about new cancer treatments from the individuals who developed the therapies and are testing them in ongoing clinical trials
- Hone skills necessary to identify and answer key questions needed to make future contributions and to effectively communicate your ideas and conclusions
- Acquire critical skills to interpret and assess emerging cancer research
- Envision and design cancer research projects
- Develop writing skills for personal career advancement (e.g., grant applications or funding requests; the science section of a business plan designed to highlight a particular commercial opportunity; papers suitable for submission and publication)
- Build an international network of colleagues and work effectively with international peers

PROGRAM START/END DATE

Program Start/End Date: November 4, 2019 | October 31, 2020

Curriculum

This program uses live presentations, on-demand lectures, peer-to-peer projects and individual study to deliver up-to-date views of how and why cancer develops, and how new interventions are designed and developed for both prevention and therapy.

CURRICULUM HIGHLIGHTS

This program allows participants to learn directly from Harvard's leading faculty in discovery biology and clinical tumor development, and from internationally recognized leaders in the cancer research community who have achieved breakthroughs in therapeutics, risk assessment and prevention.

Peer-to-peer learning projects allow participants to learn from one another, while producing publication-quality reports on important aspects of cancer research. This also allows each participant to develop a large network of international colleagues who will be resources throughout their career.

Students can also customize their learning experience and skills development around their interests and career goals through two optional elective tracks (Communications or Leadership and Management) and an education track for deeper immersion into one of four areas:

- Cancer -Omics
- Clinically challenging cancers
- Risk and prevention
- Therapeutic development

Customization extends to skills-development projects and culminates in a personalized capstone project, with guidance from a faculty mentor chosen expressly for each participant based upon their specific research objectives.

Curriculum

MODULE SPECIFICS

THE CANCER PROBLEM

- The worldwide cancer problem
- Introduction to clinical cancer problems
- Neoplasia and the pathology of cancer
- Introduction to cancer epidemiology
- Introduction to cancer therapy
- The 10 most important cancer research papers published in the past year
- Hallmarks of cancer, a central paradigm of cancer biology

CHARACTERISTIC BIOLOGY OF TUMORS AND CANCER CELLS

- Cell proliferation and cell cycle control
- Oncogenes and signal transduction
- Inherited predisposition
- p53 and Li-Fraumeni syndrome
- Epigenetics
- Programmed cell death
- Mitochondria and metabolism
- Tumor microenvironment
- Invasion and metastasis (epithelial-mesenchymal transition (EMT))
- Protein homeostasis and autophagy
- Tumor heterogeneity and clonal evolution
- Non-coding RNAs and cancer
- Mutational signatures
- RNA expression profiles

PREVENTION AND RISK IDENTIFICATION

- Epidemiology and cancer risk identification
- Environmental carcinogenesis
- Diet, obesity and cancer
- Global tobacco epidemic
- Tobacco control strategies
- HPV vaccine and how it works
- Potential impact of the oncovirus vaccine across the globe

STATE-OF-THE-ART APPROACHES TO CANCER STUDY

- Animal models: from mouse to man
- Zebrafish models of cancer
- Cell Lines, NCI 60, CCLE and newly derived lines
- Human tumor models

THERAPY AND DRUG DEVELOPMENT

- Cytotoxics
- Surgical therapy
- Radiation therapy
- Pharmacodynamics
- Pharmacokinetics
- Small molecule discovery and chemical biology

- Clinical trials: IRB and Phases I, II and III
- Government oversight
- Challenges and opportunities in development of molecularly defined basket trials
- From -Omics to target identification
- Drug discovery: nanotechnology, targeting and RNA therapeutics
- Opportunities and challenges in developing first-in-class innovative agents
- Development of biomarkers for precision cancer medicine
- Antibody-based therapeutics in oncology
- Innovation: new therapeutic strategies
- Therapeutic targeting of ubiquitin ligase activity
- Polymeric nanoparticles: tumor microenvironment variability and implications for new nanoparticle design and development
- Role of venture capital in the creation of new oncology therapeutics companies
- Case Studies:
 - The CML story
 - The BCL-2 inhibitor story
- Proteasome inhibitors: discovery and development of Velcade

IMMUNOTHERAPY

- Immunology as a basis to understand immunotherapy
- Immunogenomics: neoantigens to vaccines
- Rational targeting of Hodgkin disease with immuno-oncology approaches
- Clinical trials for immunotherapy
- Mouse models for immunotherapeutics
- Immuno-oncology aspects and function of myeloid cells
- CAR-T cells
- Discovery of novel targets for cancer immunotherapy
- T cell exhaustion
- Next-generation immunotherapy companies

INFECTION FROM CARCINOGENIC ORGANISMS

- Infectious causes of cancer overview
- Viral oncology: RNA viruses and oncogenes
- Viral oncology: DNA viruses and tumor suppressor genes
- EBV: the first human cancer virus
- Hepatocellular cancer: the role of viruses and inflammation

Curriculum

BREAST CANCER

- Cellular and molecular heterogeneity in breast cancer
- Clinical predispositions to breast and ovarian cancer
- Breast cancer screening
- Breast cancer triple negative
- HER2-driven breast cancer
- Hormone-responsive breast cancer
- Breast cancer metastasis and metastatic niches
- Disparities in breast cancer

CERVICAL CANCER

- Cervical cancer: historical perspectives
- Cervical cancer: clinical perspectives
- Cervical cancer screening

LUNG CANCER

- Introduction to lung cancer
- Genomic approaches in lung cancer
- Identifying and overcoming resistance to therapy in cancers
- Lung cancer: resistance to targeted therapies and impact on therapeutic strategies
- Combination therapies in lung cancer
- RAS, lung cancer and the hunt for new therapeutic strategies

CHILDHOOD LEUKEMIA AND YOUNG ADULT SOLID TUMORS

- Childhood leukemia
- Young adult cancers

LEUKEMIA AND LYMPHOMA

- Hematological malignancies
- Hematological disorders
- Transplantation therapies
- Hematological stem cells
- Leukemia-initiating cells
- The leukemic niche
- Targeted therapy: CML and Gleevec
- Myeloid neoplasms (AML, MDS, Pmpns)
- Role of genetics and clonal evolution
- CLL
- B-cell lymphomas (including Hodgkin lymphoma)
- Plasma cell neoplasms

COLON CANCER

- Clinical introduction to colon cancer
- Progression and tumor evolution
- Screening for colon cancer

MELANOMA

- Melanoma
- DNA damage and repair
- BRAF therapy
- Immunotherapy in melanoma

CHOOSE YOUR TRACK

All participants can customize their educational experience to align with their specific research interests and career goals. Participants choose from one of the following four tracks for more in-depth study and skills advancement. Each track is led by two Harvard faculty members—experts in these specific disciplines.

Note: Participants may audit a second track with permission from the program directors.

Cancer -Omics. This track is designed for individuals with interest in the deep characterization of tumors and their microenvironment for those who want to learn more about cutting-edge developments in technology that are now being applied to cancer diagnostics and therapy.

It explores the biology and evolution of tumors and their microenvironment; use of high-throughput technology platforms for genetic, genomic, epigenetic, proteomic and RNA expression analysis; functional screens using RNAi and CRISPR; and protein detection and location using CyTOF and CycIF.

Clinically Challenging Cancers. This track is designed for clinical researchers who would like to concentrate on new strategies for difficult-to-treat cancers or for basic or population researchers who may want to understand complicated clinical problems. This area of focus explores cancers that are difficult to treat, why these difficulties exist and what might be done to combat them.

Risk and Prevention. This track is designed for scientists who are interested in the cutting-edge problems of risk identification and prevention or for those who want to apply their knowledge to tackle these difficult problems. This area of focus explores the identification of cancer risks, the etiology of risks and advances in prevention strategies, including behavior modification and cancer vaccines.

Therapeutic Development. This area of focus explores the identification of unmet clinical needs, the latest advances in biological and small molecule therapeutic development, new types of clinical trials, and bringing personalized medicine to the commercial application.

Curriculum

OPTIONAL ELECTIVES

This program offers two optional skills-advancement electives. Subject to availability, participants may enroll in either elective after acceptance into the program.

- Communications
- Leadership and Management



COMMUNICATIONS

In this optional elective, participants will gain writing experience through a series of special writing exercises that are assigned throughout the course. These include group writing assignments and individual papers.

Some participants may additionally elect to hone their oral presentation skills. These individuals will receive one-on-one tutoring and participate in a 1.5 day workshop with senior leaders of the Harvard cancer research community. It culminates with an oral presentation of each participant's personalized capstone project.

Participants will then engage in a one-day, interactive workshop to gain experience with these practices.

The following subjects will be covered:

- Managing people
- Diversity
- Unconscious bias
- Personality assessment
- Giving feedback
- Negotiation skills
- Mentorship



LEADERSHIP & MANAGEMENT

Starting midway between the first and second workshops, individuals who opt to participate in this elective workshop will begin a special series of lectures and discussion groups that present leadership and management best practices.

OPTIONAL CAPSTONE PROJECT

In the second half of the program, participants will have the option to write a paper—his or her capstone project for the program.

Examples of potential Capstone Projects include:

- A grant proposal to a funding group of relevance to the participant's research interest
- A clinical protocol appropriate for the participant's institution
- The science section of business plan designed to highlight a particular commercial opportunity
- A critical review of an important recent paper or development in the cancer research community
- A subject review suitable for submission and publication

Other types of papers will be considered on a case-by-case basis.



The subject of this paper is chosen by the participant in collaboration with a faculty mentor. Mentors are chosen by the program directors based on the mentor's expertise in the student's general area of interest. Mentors will provide guidance including:

- Counseling and providing assistance in choosing the subject for the project
- Providing feedback on the paper's outline
- Reviewing the first and final drafts of the project and providing guidance to help optimize its value to each participant and/or their institution

Faculty

PROGRAM DIRECTORS

George D. Demetri, MD

Professor of Medicine
Harvard Medical School
Director, Ludwig Center at Harvard
Senior Vice President for
Experimental Therapeutics
Dana-Farber Cancer Institute
Associate Director for Clinical Sciences,
Dana-Farber/Harvard Cancer Center

Ed Harlow, PhD

Ludwig Professor of Cancer
Education and Research
Department of Biological Chemistry
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Harvard Medical School
Special Assistant to the Director
National Cancer Institute, USA

Peter Howley, MD

Shattuck Professor of Pathological
Anatomy, Department of Pathology
Professor, Department of Microbiology
and Immunobiology
Harvard Medical School

SPECIALTY TRACK LEADERS

Priscilla K. Brastianos, MD

Assistant Professor of Medicine
Harvard Medical School
Director of the Central Nervous System Metastasis
Program
Massachusetts General Hospital

Sara J. Buhrlage, PhD

Assistant Professor of Biological Chemistry and
Molecular Pharmacology
Dana-Farber Cancer Institute
Harvard Medical School

Harold J. Burstein, MD, PhD

Associate Professor of Medicine
Harvard Medical School
Dana-Farber Cancer Institute

James A. DeCaprio, MD

Medical Oncologist
Dana-Farber Cancer Institute
Professor of Medicine
Harvard Medical School

Karen M. Emmons, PhD

Professor of Social and Behavioral Science
Harvard T.H. Chan School of Public Health

Timothy R. Rebbeck, PhD

Vincent L. Gregory Professor of Cancer Prevention
Harvard T.H. Chan School of Public Health
Division of Population Sciences
Dana Farber Cancer Institute

Who Are We Looking For?

This Harvard Medical School program is open to both new and seasoned researchers including professionals in fundamental and clinical research, population health leaders of cancer-focused enterprises including scientific, policy and financial top-flight trainees. Prospective students should hold a master's degree in their field of study, a doctoral degree such as PhD, or PsyD and/or a professional degree such as an MD, MBBS, DDM, DMD, PharD, DNP or foreign equivalent degree.

“The program strength is tied to diversity. We have people from all around the world, from different backgrounds, at different levels, to interact with them has been fantastic!”

Dr. Imran Syed, MD
Clinical Research Fellow
Sarcoma Oncology Center, Cancer Center of SoCal

“My hope is that by participating in a course like High-Impact Cancer Research, a practicing physician might be able to be more effective in how they participate in clinical trials.”

Dr. George Demetri
High-Impact Cancer Reserach Co-Director



LEARN MORE ONLINE

Visit hms.harvard.edu/hicr for more information including student testimonials, a list of all-star faculty and interviews with our program directors.

Admissions

APPLICATION DEADLINES

Please check our website for the most up-to-date program deadlines.

Once you are accepted to the program, payment is required either in full or through a payment schedule. A 10 percent deposit by the deposit deadline date secures your place in the program.

Tuition includes facility fees for the three workshops and access to all four lecture modules (summer, fall, winter and spring). Fees do not include supplemental books, supplies, software or workshop travel and accommodation expenses.

ADDITIONAL APPLICATION AND REGISTRATION INFORMATION IS
AVAILABLE ONLINE AT: **[HMS.HARVARD.EDU/HICR](https://hms.harvard.edu/hicr)**



HIGH-IMPACT CANCER RESEARCH PROGRAM

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