



ENRICH

EUROPEAN NETWORK OF
RESEARCH AND INNOVATION
CENTRES AND HUBS, USA

US Research Handbook on Cancer



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Executive Summary

This research handbook is a product of ENRICH in the USA, which is a European Network of Research and Innovation Centers and Hubs. Promoted by the European Commission through Horizon 2020, ENRICH in the USA acts as a central contact point for European research and innovation actors seeking to grow and reinforce collaboration across the Atlantic. The mission of the Network is to provide standardized as well as various tailor-made, research & innovation internationalization support services to European researchers and innovators, to accelerate access to the US market, and maximize chances of success.

The research handbook on US R&D related to cancer provides an assessment of the United States (US) research community landscape and aims to support research and innovation cooperation between the European Union (EU) and the US. Cancer is a leading research area in the US and in the EU, mostly due to cancer being the current second leading cause of death in both regions.

The Research handbook identifies the US key university research groups, research centers and industry clusters, as well as some of the main research networks, professional associations and conferences/events focused on cancer research. Furthermore, the Research handbook identifies potential approaches to develop collaborative projects with the US cancer research community and assesses the opportunity for EU researchers to participate in US funding programs related to cancer R&D. Therefore, this research handbook aims to be an effective source to gain knowledge on the US cancer research community and possible first contacts for initial approaches to establishing collaborative activities.



Figure 1 - Initial Approaches to Establishing Collaborative R&D Activities

The EU and the US are key partners in R&D and innovation^{1,2}. As an example, nearly one tenth of European scientific publications having participation from US authors³. R&D and innovation are key components of the EU and US smart growth strategies. Therefore, the EU and the US have achieved many significant scientific innovations due to the quality of the research developed by their universities, research centers and industry clusters in strategic research areas, such as cancer⁴.

In order to identify the US key research players in the field of cancer, the project team conducted extensive desk research based on a literature review and document analysis. This research handbook is primarily focused on four Thematic Research Areas: Cancer Prevention, Cancer Diagnosis, Cancer Prognosis, and Cancer Treatment^{5,6,7,8}.

There is a high degree of spatial concentration of cancer R&A activities in the northeast region of the US, particularly in the states of Maryland, Massachusetts, Michigan, New York and Pennsylvania. However, there is also a high concentration of players in San Francisco, California, since it is home to at least one globally recognized university cancer research group, two country leading cancer research centers and an important industry cluster focused on cancer research.

Through desk research, this research handbook reveals the US research community encompasses a complex set of different actors that work in concert towards the development of cancer R&D activities. These key actors are primarily university research groups, research centers, and industry clusters.

University research groups

The US is home to some of the main university research groups in the field of cancer. Since cancer is a multidisciplinary topic that comprises knowledge from different research areas, this research handbook identifies 19 university research groups based on the four Thematic Research Areas related to cancer.

The 19 university research groups identified in this research handbook are categorized by university. Thus, this research handbook also highlights six leading universities in the field of Cancer, such as Johns Hopkins University and Harvard University, which have more than one research group focused on cancer R&D. Moreover, these research groups are composed of researchers from the four Thematic Research Areas related to cancer, as well as from health or biology fields related to cancer (e.g., Department of Microbiology and Immunobiology, Harvard Medical School).

¹<https://www.degruyter.com/downloadpdf/j/ergo.2013.8.issue-1/ergo-2013-0002/ergo-2013-0002.pdf>

²<http://ec.europa.eu/research/iscp/index.cfm?amp;pg=usa>

³<https://www.degruyter.com/downloadpdf/j/ergo.2013.8.issue-1/ergo-2013-0002/ergo-2013-0002.pdf>

⁴<http://www.eusscienceandtechnology.eu/assets/content/BILATUSA4.0%20-USFunding%20Opportunities%20for%20EU%20Researchers.pdf>

⁵<https://deainfo.nci.nih.gov/advisory/pcp/annualreports/pcp10-11rpt/FullReport.pdf>

⁶http://clincancerres.aacrjournals.org/content/22/2_Supplement/IA18.short

⁷<http://www.ludwigcancerresearch.org/our-science/making-discoveries/research-areas>

⁸<https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant/types-of-cancer-research.html>



Research centers

In the US, the establishment of research centers has mutually benefited research institutions and industrial partners through the development of multidisciplinary research that creates a powerful node for innovation in the field of cancer.

The Research handbook highlights three different types of research centers: cancer centers that are established by a university, several companies and other organizations; cancer centers that are affiliated with universities; and freestanding cancer centers. Based on these three types, 11 research centers that bring together university researchers and healthcare professionals are highlighted by the Research handbook.

Industry clusters

As detailed within this research handbook, the healthcare industry is highly focused on fostering cancer research since there is a significant need for an improvement of the cancer care delivery globally, including in the US. The assessment of the US research community reveals that industry clusters play a key role in cancer R&D activities. Industry clusters act as a bridge between the research community and the specific needs of the healthcare delivery systems.

Based on the US Cluster Mapping Project⁹, a national economic development initiative led by Harvard Business School and with the support of the US Department of Commerce, Economic Development Administration, the Research handbook identifies five industry clusters that stand out for their cancer R&D activities: San Francisco Bay cluster, Boston/Massachusetts cluster, New York cluster, Philadelphia cluster and Virginia cluster. Among these five industry clusters, the San Francisco Bay cluster and the Boston/Massachusetts cluster can be highlighted due to their exceptional cancer R&D activities.

Research networks, professional associations and networking events

The Research handbook reveals that research networks and professional associations play a crucial role in fostering interaction between researchers, community practitioners and pharmaceutical sector members. Since cancer consists of numerous diseases and each cancer disease is multi-factorial, cancer research activities require an interdisciplinary team. As a result, research networks, professional associations and networking events are crucial to accelerate research in this particular field because they provide an important opportunity for researchers, community practitioners and pharmaceutical sector members to share knowledge and information for progressing cancer research more efficiently and in a timely manner.

The Research handbook identifies seven research networks and professional associations as well as 15 of the main conferences and other networking events focused on cancer research, based on an extensive literature review.

⁹<http://www.clustermapping.us/>

US R&D initiatives and programs

In the US, public funding for cancer research has been leading to significant advances in cancer prevention, detection, diagnosis, treatment, and patient quality of life. This is primarily because the US government has been significantly incentivizing the cancer over the past years. In this context, most funding for cancer research is provided by federal agencies, which then allocate a certain budget to research organizations which are distributed nation-wide.

Since cancer has a major societal burden, private funds and initiatives also have a very important role in fostering cancer research through the award of grants. Although private funding has been increasing for research in this field and consequently start playing a growing role in its progress in the US, public funding will be always crucial to support high-risk and pioneering cancer research.

Overall, both public and private organizations funding cancer research in the US are highly committed to support international cooperation, as they clearly state that the funds they provide are eligible to foreign organizations. National Cancer Institute, which is believed to be the public agency that provides more funds to cancer research activities in the US is open to provide resources to foreign governments. In parallel, the American Cancer Society, the largest private not-for-profit source of funds for cancer research, awards international fellowships with the aim of fostering a bi-directional flow of knowledge and experience between the US and other countries.

ENRICH in the USA Summary

ENRICH is the European Network of Research and Innovation Centers and Hubs. Started in April 2017, ENRICH in the USA is a H2020 funded initiative whose mission is to establish a Network of European Research and Innovation Centers and Hubs throughout the United States of America. ENRICH in the USA acts as a central contact point for European research and innovation actors seeking to grow, reinforce collaboration, as well as find commercialization paths across the Atlantic.

To do so, ENRICH in the USA is leveraging a network of vetted European and US Partners (entities - including “Ambassadors”) and Experts (persons - including “Mentors”) as defined below.

The Ambassadors are stakeholders (entities) already supporting R&I actors, and willing to join forces on outreach, funding, programs, and curriculums; this group includes Angel Networks, Venture Capital Firms, Corporate Investors, Corporate Open Innovation Teams, University Incubators, Equity-based accelerators, Clusters, Region, State and Country Government agencies and more. They can also support ENRICH in the USA via sponsorship (cash or in-kind).

Vetted by approved Ambassadors and ENRICH in the USA team, Experts are individuals who are usually employees of Ambassadors with skills and industry experience. It includes Consultants/Service Providers (i.e., accountants, lawyers, etc.), Angel investors, as well as Mentors. Mentors are volunteering their time to support EU innovators (i.e., review pitch, collaterals, participate in meetings, etc.).

The ENRICH in the USA Network includes the following entities:

- **Three physical ENRICH in the USA Centers:**
 - San Francisco Centre (managed by Temple University SBDC)
 - Boston Centre (managed by Temple University SBDC)
 - Washington, DC Centre (managed by NCURA)
- **Five Landing Hubs across the US and plans to expand the ENRICH in the USA Network beyond these first Hubs, over four years:**
 - In PA: Temple University
 - In VA: George Mason University
 - In CA: California Polytechnic University or Cal Poly
 - In CA: UC Berkeley
 - In IN: Purdue University
- **Planned for 2022:**
 - In MA: University of Massachusetts or U Mass
 - In MI: University of Michigan
 - In TX: UT Austin
 - In MO: University of Missouri or Mizzou
 - In ID: Boise State University

The ENRICH in the USA Network is built on local US experience and strong existing ties between the EU and the US, while providing new researcher- and entrepreneur-serving capabilities which address the resource gaps necessary to enable access for all EU Member States and Associated Countries, as well as every state in the US.

A variety of services have been proposed for researchers and entrepreneurs engaged by the Network during the pilot phase, then the Centers’ pilot activities have been evaluated to inevitably retain the



initiative's most successful components to ensure a sustainable plan for ENRICH in the USA in the future.

Piloted services targeted various, commercially viable technology maturity levels, both research-oriented and market-oriented and included research connection symposia, business matchmaking opportunities, working visits, immersion weeks, innovation tours to US organizations to explore technology/product partnerships and/or business development middle/long term opportunities, pitching to potential investors, entrepreneurial bootcamps, workspace access, mentorship/advisory, hands-on (pre-acceleration) enrichment programs, and more.

ENRICH in the USA Consortium:

Coordinator: GAC Group (GAC), France

Partners:

- > German Aerospace Centre (DLR), Germany
- > Temple University SBDC (Temple), USA
- > European Business and Innovation Centre Network (EBN), Brussels - Partner in Phase 1 (2017-2020)
- > International Business Innovation Association (InBIA), USA - Partner in Phase 1 (2017-2020)
- > European American Enterprise Council (EAEC), USA - Partner in Phase 1 (2017-2020)
- > INTRASOFT International (INTRA), Luxembourg - Partner in Phase 1 (2017-2020)
- > Sociedade Portuguesa de Inovação (SPI), Portugal
- > Regional Centre for Information and Scientific Development (RCISD), Hungary
- > National Council of University Research Administrators (NCURA), USA

Services:

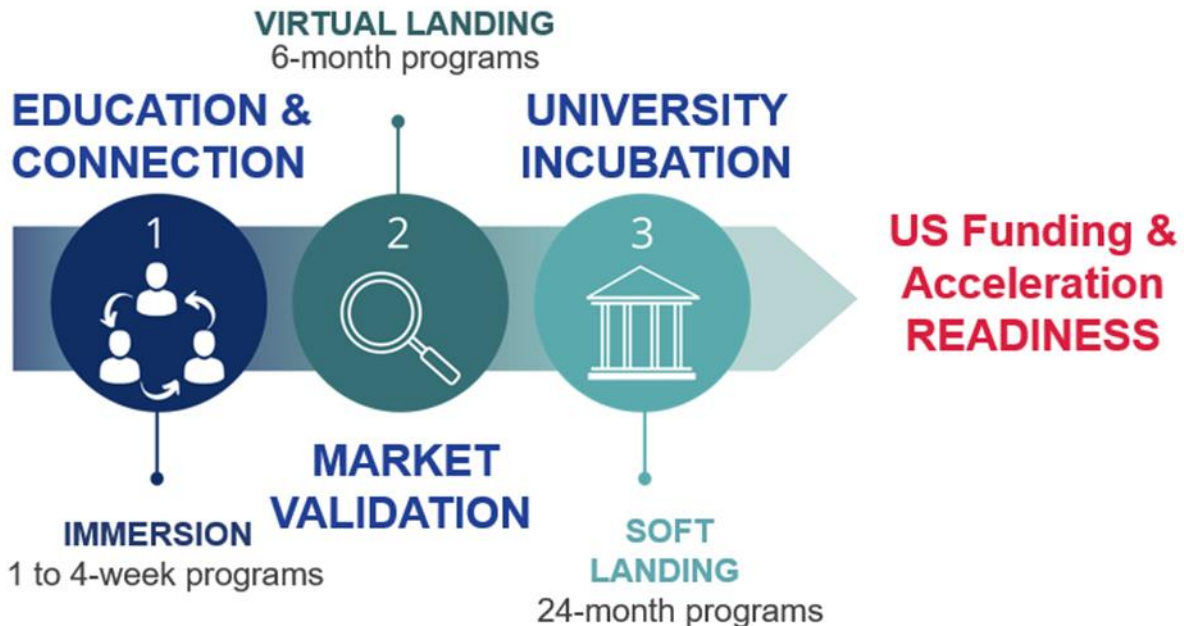


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List of Abbreviations

Table 1 - List of Abbreviations

Abbreviation	Explanation
AACR	American Association for Cancer Research
ACS	American Cancer Society
ASCO	American Society of Clinical Oncology
BCRF	Breast Cancer Research Foundation
BCRP	Breast Cancer Research Program
CCBGM	Center for Computational Biotechnology and Genomic Medicine
CDC	Centers for Disease Control and Prevention
CDMRP	Congressionally Directed Medical Research Program
CGH	Center for Global Health
CRN	Cancer Research Network
DCPC	Centers for Disease Control and Prevention's Division of Cancer Prevention and Control
DF/HCC	Dana-Farber/Harvard Cancer Center
DoD	Department of Defense
ECBC	Edgewood Chemical Biological Center
EDA	Economic Development Agency
ESCA	European Secretariat for Cluster Analysis
EU	European Union
FDA	Food and Drug Administration
FFRDC	Federally Funded R&D Centers
FNLCR	Frederick National Laboratory for Cancer Research
FOA	Funding Opportunity Announcement
FY	Fiscal Year
GDP	Gross Domestic Product

HCI	Huntsman Cancer Institute
HCRN	Hoosier Cancer Research Network
HHS	Department of Health and Human Services
IBM	International Business Machines
ICGC	International Cancer Genome Consortium
IUCRC	Industry–University Cooperative Research Centers
KCRP	Kidney Cancer Research Program
MIT	Massachusetts Institute of Technology
NCCN	National Comprehensive Cancer Network
NCI	National Cancer Institute
NIH	National Institutes of Health
NIBIB	National Institute of Biomedical Imaging and Bioengineering
NSF	National Science Foundation
OGS	Office of Grants Services
OISE	Office of International Science and Engineering
OSUCCC – James	Ohio State University Comprehensive Cancer Center – Arthur G. James Cancer Hospital and Richard J. Solove Research Institute
PCF	Prostate Cancer Foundation
PCRP	Prostate Cancer Research Program
PQ	Provocative Questions
RDI	Research Development and Innovation
R&D	Research and Development
SABCS	San Antonio Breast Cancer Symposium
SCH	Smart and Connected Health
SITC	Society for Immunotherapy of Cancer
UCLA	University of California, Los Angeles
UCSF	University of California, San Francisco
UIUC	University of Illinois at Urbana-Champaign

US	United States
USAMRIID	US Army Medical Research Institute of Infectious Diseases
USP	US Pharmacopeial Convention
UW	University of Washington



1 Introduction

Context

This research handbook, which has been developed in the context of the ENRICH in the USA network¹⁰, aims to provide relevant information on the United States (US) landscape concerning the cancer research community. To do so, it provides information on the research community, including key research universities, centers, networks, relevant conferences and events, as well as important industry clusters and initiatives involving the public and private sectors.

The research handbook can be an effective source or tool to gain knowledge on the US cancer research community and:

- To identify potential approaches to developing collaborative projects with US researchers, research groups and research organizations. The researchers, research groups and organizations can be contacted directly to develop a rapport and potential interest in collaborating.
- To identify relevant networks and conferences that can be used as a conduit to meeting potential collaborators.
- To identify and assess the opportunity to participate in US funding programs related to cancer research and development (R&D) in order to propose potential project opportunities to US research counterparts.

Therefore, it is the hope of the research handbook authors that the information is useful in assisting European Union (EU) researchers in their efforts to develop stronger ties to the US cancer research community.



Figure 2 - Initial Approaches to Establishing Collaborative R&D Activities

¹⁰<https://near-us.eu/project-overview>

Health sector: Cancer Research

Advances in cancer prevention, early detection, diagnosis, prognosis and treatment are mainly the result of research conducted by scientists in a wide range of disciplines. Thus, cancer research requires interdisciplinary partnerships and collaborations comprising researchers, clinicians and patients in order to translate discoveries into advances¹¹. Regarding cancer, research progress is cyclical and ongoing, leading to longer lives and improved quality of life for the patients diagnosed with the disease globally^{12,13}.

Cancer research can be divided into four broad categories.

- Basic research is the research handbook of animals, cells, molecules, or genes to obtain new knowledge about cellular and molecular changes that occur naturally or during the development of a disease.
- Translational research is an approach that aims to accelerate the application of discoveries in the laboratory to clinical practice.
- Clinical research is the research handbook concerning the application of improved or new treatments and procedures in patients.
- Population research is the research handbook of cancer incidence, risk factors and patterns underlying cancer causes¹⁴.

Importance of Cancer research to the EU

In the EU, cancer accounts on average for about one quarter of all deaths and is the number one cause of death for people aged 45-64, surpassing cardiovascular diseases¹⁵. The most frequent forms of cancer in the EU Member States are breast, prostate, lung and colorectal cancers. Currently, cancer is a key public health concern and the fight against it is a key priority¹⁶. Therefore, the EC is highly committed to reduce cancer incidence by 2020. In particular, as laid down by the European Commission in 2021, Europe's Beating Cancer Plan is a key pillar of a stronger European Health Union and a more secure, better prepared and more resilient EU. It outlines substantive actions to mitigate the impact of the COVID-19 pandemic on cancer care and support structural improvements for a more sustainable cancer pathway. In addition, the new, ambitious EU4Health program and other EU instruments will provide substantial financial support with €4 billion to Member States in their efforts to make their health systems more robust and more able to address cancer. Moreover, since 2014, the EC implemented the Expert Group on Cancer Control which is responsible for the development of policies and actions concerning the disease control, as well as in charge of providing information and advice to the EC on how to implement and monitor the actions proposed by the Group¹⁷.

Importance of Cancer research to the US

¹¹<https://www.aacrfoundation.org/Pages/what-is-cancer-research.aspx>

¹²<https://www.asco.org/research-progress/reports-studies/clinical-cancer-advances>

¹³<http://blogs.bath.ac.uk/crab/2016/02/15/recent-developments-in-cancer-research-an-overview/>

¹⁴<https://www.aacrfoundation.org/Pages/what-is-cancer-research.aspx>

¹⁵<https://ec.europa.eu/research/health/index.cfm?pg=area&areaname=cancer>

¹⁶https://ec.europa.eu/health/major_chronic_diseases/diseases/cancer_en

¹⁷<http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3203>



The National Cancer Act of 1971 and the establishments of the National Cancer Program and the Cancer Moonshot¹⁸ initiative have been the key initiatives for promoting cancer research in the country¹⁹. The National Cancer Program, coordinated by the NCI, conducts and supports research, training and health information dissemination related to cancer in order to advance research and clinical practices²⁰.

Thereby, from November 2015 to October 2016, the US Food and Drug Administration (FDA) approved 20 therapies for over 12 different types of cancer²¹, reflecting the significant performance of the country in terms of innovative cancer treatments. According to the latest data, in 2018, total US medical and health R&D spending was \$194.2 billion, from which Industry invested \$129.5 billion or 66.7% and Federal agencies invested a total of \$43 billion or 22.2%²². This represents a total growth in investment of 36% compared to 2013. In this context, the EU emphasized that bilateral cooperation with the US is particularly important in both fields when concerning disease prevention²³. It is estimated that in the US, 1.8 million people were diagnosed with cancer in 2020 and the annual cancer incidence is expected to reach 2.2 million in 2030^{24,25}.

Cancer research cooperation between the EU and the US

The EU and the US are key partners in R&D. In 1998, the EU and the US signed the Agreement for Scientific and Technological Cooperation, which governs the R&D and innovation cooperation between the EU and the US. This agreement has been renewed four times for a period of five years each time and is now valid until October 2023^{26,27}. This has important implications for future cooperation under Horizon Europe, considering that within health research, the US is the EU's main partner in terms of participation in the past Framework Programs (FP7 and Horizon 2020) projects. The EU and the US have agreed on a reciprocal opening in the field of health research, which represented the most significant example of reciprocity in research between the EU and the US. As a result, the US participants were eligible for funding when participating in projects under the Horizon 2020 Health Societal Challenge and the EU researchers are eligible for funding when participating in US National Institutes of Health (NIH) projects^{28,29}. It should also be highlighted that Europe's Beating Cancer Plan foresees stronger international cooperation, notably through collaborative research within the framework of Horizon Europe³⁰.

The majority of the EU Framework Programs cooperation with the US is conducted through the NHS - NIH, the National Science Foundation (NSF), Department of Defense (DoD) and the Bill and Melinda

¹⁸ <https://www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative>

¹⁹ <https://www.asco.org/research-progress/reports-studies/clinical-cancer-advances/executive-summary>

²⁰ <https://www.nih.gov/about-nih/what-we-do/nih-almanac/national-cancer-institute-nci>

²¹ <https://www.asco.org/research-progress/reports-studies/clinical-cancer-advances/executive-summary>

²² https://www.researchamerica.org/sites/default/files/RA-2017_InvestmentReport.pdf

²³ https://www.researchamerica.org/sites/default/files/Publications/InvestmentReport2019_FnI.pdf

²⁴ <https://www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/cancer-facts-figures-2018.html>

²⁵ <https://www.asco.org/research-progress/reports-studies/clinical-cancer-advances/executive-summary>

²⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Ari0009>

²⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Ari0009>

²⁸ http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020_localsupp_usa_en.pdf

²⁹ http://ec.europa.eu/research/iscp/pdf/policy/us%20clean_roadmap_2017.pdf

³⁰ https://ec.europa.eu/health/sites/default/files/non_communicable_diseases/docs/eu_cancer-plan_en.pdf



Gates Foundation. In the field of cancer research, the EU and the US also cooperate in important multi-lateral initiatives (e.g., International Cancer Genome Consortium), reflecting that cancer research is considered the highest priority area for the EU-US cooperation^{31,32}.

The EU and the US have also, throughout the years, established cooperation within a framework of different multi-lateral initiatives that are related to health. Some examples that can be highlighted include participation and collaboration within the International Rare Disease Research Consortium, the International Initiative for Traumatic Brain Injury, the Global Research Collaboration for Infectious Diseases Preparedness, the Global Alliance of Chronic Diseases and the Global Tuberculosis Vaccine Partnership³³.

Moreover, according to the most recent information available, the EU-US output in health research represented 32% of the EU-US overall co-publications and accounted for 14% of the US publications in this research area. In terms of health research areas, Medicine has the highest number of EU-US co-publications, followed by: Biochemistry, Genetics and Molecular Biology; and Immunology and Microbiology³⁴. Overall, the cooperation between the EU and the US in the field of Cancer research is considered to be highly important and part of the Healthcare strategy for both regions. The EU and the US are global leaders in terms of cancer R&D activities and, therefore, their cooperation is crucial for the development of cancer research breakthroughs.

Thematic Research Areas related to Cancer research

Cancer research requires a multidisciplinary approach, since it varies across its type, stage, and cause³⁵. Therefore, cancer research must have the contribution of a multidisciplinary team of professionals: researchers, clinicians and health professionals from different research fields. According to several references, the main thematic research areas related to cancer research are the following^{36,37, 38, 39}:

- **Cancer Prevention:** research aiming at defining how cancer develops and identifying the cancer risk factors, paving the way for progressing cancer prevention^{40,41}.
- **Cancer Diagnosis:** research for developing tests and technologies that can result in improved or new diagnostic tools (e.g., clinical laboratory tests, imaging tools and genomic analysis), for facilitating the diagnosis of patients at all stages of cancer⁴².

³¹http://ec.europa.eu/research/iscp/pdf/policy/roadmaps_usa-2016.pdf

³²<http://icgc.org/>

³³

https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/documents/us_roadmap_2018.pdf

³⁴http://www.eusscienceandtechnology.eu/assets/content/Deliverables/BILAT_USA_4.0_Deliverable_2.1_Report_on_Status_of_UO_and_EU-US_STI_Cooperation_patterns_v1_forweb.pdf

³⁵<http://ascopubs.org/doi/full/10.1200/jop.2014.003350>

³⁶<https://deainfo.nci.nih.gov/advisory/pcp/annualreports/pcp10-11rpt/FullReport.pdf>

³⁷http://clincancerres.aacrjournals.org/content/22/2_Supplement/IA18.short

³⁸<http://www.ludwigcancerresearch.org/our-science/making-discoveries/research-areas>

³⁹<https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant/types-of-cancer-research.html>

⁴⁰<https://www.cancer.gov/research/areas/prevention>

⁴¹http://cancerpreventionresearch.aacrjournals.org/site/misc/journal_ifora.xhtml

⁴²<https://www.cancer.gov/research/areas/diagnosis#3>



- **Cancer Treatment:** research to improve the existing cancer treatments and to develop new cancer treatment, which are more effective and less toxic treatments than the existing ones⁴³.
- **Cancer Prognosis:** research for improving the accuracy of the forecast concerning the most likely outcome of a cancer patient⁴⁴.

⁴³<https://www.cancer.gov/research/areas/treatment>

⁴⁴<https://www.cancer.gov/about-cancer/diagnosis-staging/prognosis>



2 US research community landscape

The US is the world-leading country in both terms of public and private R&D investment^{45,46}. In 2019, the country's Gross domestic spending on R&D was estimated to \$656 billion (nearly €541 billion), which represents about 3.1% of its Gross Domestic Product (GDP), and more importantly, accounted for over a third of the global R&D investment⁴⁷. The R&D programs are mainly supported by industry (\$463 billion, nearly €382 billion), the Federal Government (\$138 billion, nearly €114 billion), Academia (\$22 billion, nearly €18 billion), and non-profits organizations (\$27 billion, nearly €23 billion)⁴⁸.

The federal R&D investment on cancer research is mainly carried out by the NCI through intramural and extramural programs⁴⁹. The Fiscal Year (FY) 2021 budget allocated \$6.6 billion (nearly €5.5 billion) to NCI, a \$119 million (nearly €98 million) increase over the regular and Cancer Moonshot appropriations allocated in FY 2020⁵⁰, demonstrating the increasing importance of cancer R&D for the US.

Further, it should be highlighted that according to latest estimates from the Business Research and Development Survey (BRDS), businesses performed \$114.5 billion (nearly €95 billion) of research and development with health or medical applications in the United States in 2018. R&D with these health-related purposes represented 26% of the total R&D performed by businesses in the United States in 2018, a much higher share than the other application areas tracked by BRDS⁵¹.

The US research landscape is comprised of world leading universities, research centers, research networks and industry clusters that are primarily funded by an extensive network of federal and state funding initiatives and industry endowments⁵². The US research community encompasses a complex set of different actors that receive support through a large number of agencies, such as the Department of Health and Human Services (HHS), the Department of Defense (DoD) and NSF. The key actors in the US research landscape are university research groups, research centers and industry clusters, which play different but complementary roles in the R&D field⁵³.

In regard to the geographic distribution of the key players of the US cancer research community, there are several aspects that should be highlighted. First, as it can be seen from the map below, there is a high concentration of cancer R&D activities in the northeast region of the US, particularly in the states of Maryland, Massachusetts, Michigan, New York and Pennsylvania. Secondly, it is important to note San Francisco city, located in the state of California, is simultaneously home to a globally recognized

⁴⁵<https://www.aip.org/fyi/2016/us-rd-spending-all-time-high-federal-share-reaches-record-low>

⁴⁶https://www.iriweb.org/sites/default/files/2016GlobalR%26DFundingForecast_2.pdf

⁴⁷http://digital.rdmag.com/researchanddevelopment/2018_global_r_d_funding_forecast?pg=4#pg4

⁴⁸<https://nces.nsf.gov/pubs/nsf21324>

⁴⁹<https://www.quora.com/How-much-money-is-spent-on-Cancer-research-per-year>

⁵⁰[https://www.cancer.gov/about-nci/budget#:~:text=NCI%20Budget%20Process-Current%20Fiscal%20Year%20\(FY%202021\)%20Budget,appropriations%20allocated%20in%20FY%202020.](https://www.cancer.gov/about-nci/budget#:~:text=NCI%20Budget%20Process-Current%20Fiscal%20Year%20(FY%202021)%20Budget,appropriations%20allocated%20in%20FY%202020.)

⁵¹<https://nces.nsf.gov/pubs/nsf21316>

⁵²<http://www.rcuk.ac.uk/international/offices/us/research-landscape-in-the-usa/>

⁵³<https://itif.org/publications/2014/06/30/understanding-us-national-innovation-system>



university cancer research group, two country leading cancer research centers and an important industry cluster focused on cancer research. Finally, it is interesting to observe that most industry-university research centers conducting cancer R&D activities are not concentrated in a particular region of the country but distributed nationwide.

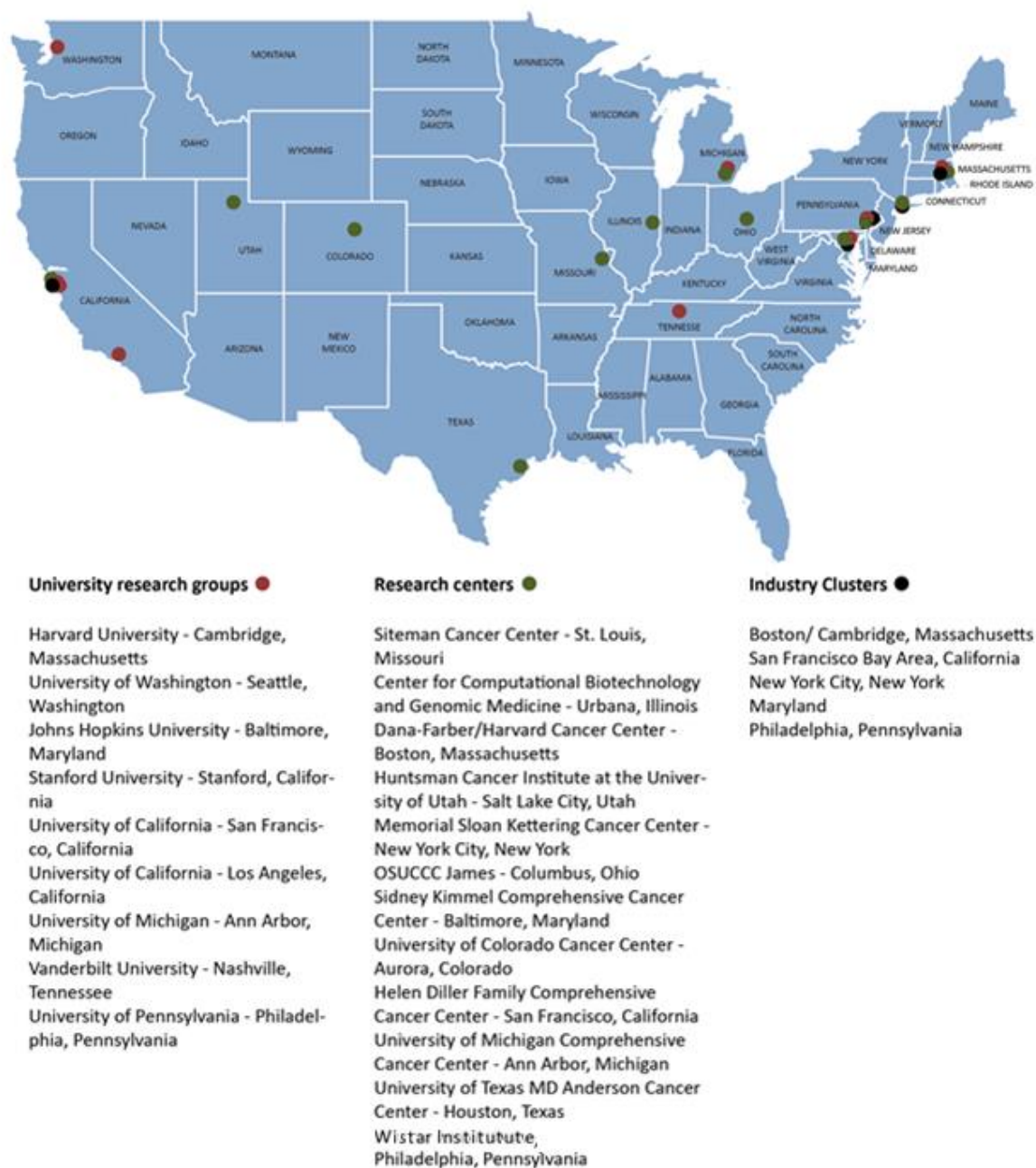


Figure 3 - US Geographic Distribution of University Research Groups, Industry-University Research Centers and Industry Clusters Focused on Cancer R&D Activities

2.1. University research groups

University research groups are comprised of researchers who share common and complimentary research interests in leading areas and have similar needs concerning research infrastructure^{54,55}. With respect to this research handbook, a university research group is either a research center or institute housed at a university campus, or a division, department or laboratory of a university. The research groups identified in this section have been selected based on extensive literature review. They are focused on at least one of the four main thematic research areas: Cancer Prevention, Cancer Diagnosis, Cancer Prognosis or Cancer Treatment.

As previously mentioned, cancer research is a multidisciplinary field that requires knowledge from several different disciplines. Therefore, universities can have more than one research group focused on cancer research. In fact, the majority of the universities identified in this research handbook are also home to world-recognized Cancer Research Centers, which encompass researchers from different university departments and/or divisions. For instance, some of the world leading universities in cancer research that are based in the US, such as Harvard University and Johns Hopkins University, have more than one research group that conducts cancer research.

In this research handbook, two types of research groups have been identified: groups, such as Department of Microbiology, Immunology and Molecular Genetics at the University of California - Los Angeles, which are not exclusively dedicated to cancer research; and groups exclusively dedicated to cancer research activities, such as the Division of Oncology of the University of Washington and Division of Oncology of the Stanford University School of Medicine⁵⁶.

Most of the identified research groups are focused on the R&D of new or improved cancer treatments, which reveals the current importance that is given by the US research community to this field. Among those activities, it should be highlighted the research activities for the improvement of chemo-, radio-, and hormone-therapies as well as research activities for the development of precision medicine-based anti-cancer therapies, such as immunotherapies and stem cells transplants⁵⁷.

⁵⁴ <http://www.sussex.ac.uk/research/about/groups/>

⁵⁵ <https://www.wits.ac.za/health/research/research-entities/definition-of-an-entity/>

⁵⁶ The contacts were collected from publicly available sources in July 2021.

⁵⁷ <https://www.cancer.gov/about-cancer/treatment/types>



Table 2 - Sample of University Research Groups

Harvard University

Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
Department of Biological Chemistry and Molecular Pharmacology, Harvard Medical School	Dr. Stephen Blacklow	Stephen_blacklow@hms.harvard.edu	Cancer prevention, diagnosis, prognosis and treatment	http://bcmp.hms.harvard.edu/
Department of Cell Biology, Harvard Medical School	Dr. Wade Harper	wade_harper@hms.harvard.edu	Cancer prevention, diagnosis, prognosis and treatment	http://cellbio.med.harvard.edu/
Department of Biomedical Informatics, Harvard Medical School	Dr. Isaac S. Kohane	isaac_kohane@hms.harvard.edu	Cancer prevention, diagnosis and prognosis	https://dbmi.hms.harvard.edu/



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004518.



Johns Hopkins University

Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
Division of Cancer Imaging Research, Johns Hopkins Medicine	Dr. Michael Anthony Jacobs	manthonyjacobs@mri.jhu.edu	Cancer Diagnosis	www.hopkinsmedicine.org/radiology/research/divisions/cancer-imaging-research/index.html
Department of Radiology, Johns Hopkins Medicine	Elliot K Fishman	efishman@jhmi.edu	Cancer diagnosis	https://www.hopkinsmedicine.org/radiology/
McKusick-Nathans Institute of Genetic Medicine, Johns Hopkins Medicine	Professor David Lee Valle	dvalle@jhmi.edu	Cancer prevention, diagnosis, prognosis and treatment	www.hopkinsmedicine.org/institute-genetic-medicine/index.html
Institute for Computational Medicine (ICM), Department of Biomedical Engineering	Dr. Raimond Winslow	rwinslow@jhu.edu	Cancer prevention, diagnosis and prognosis	https://icm.jhu.edu/



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004518.



Stanford University

Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
Division of Oncology, School of Medicine	Professor James Ford	jmf@stanford.edu	Cancer prevention, diagnosis, prognosis and treatment	https://oncology.stanford.edu/

University of California, Los Angeles (UCLA)

Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
Department of Microbiology, Immunology and Molecular Genetics	Professor Jerome A. Zack (Chair)	jzack@ucla.edu	Cancer prevention, diagnosis, prognosis and treatment	www.mimg.ucla.edu/about/
Department of Radiation Oncology, UCLA Health	Professor Michael Steinberg (Chair)	msteinberg@mednet.ucla.edu	Cancer Treatment	http://radonc.ucla.edu/

University of California, San Francisco (UCSF)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004518.



Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
UCSF Hematology and Oncology Division, Department of Medicine	Professor Emeritus Donald Abrams	donald.abrams@ucsf.edu	Cancer prevention, diagnosis, prognosis and treatment	https://hemonc.ucsf.edu/

University of Michigan

Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
Division of Hematology and Oncology, Department of Internal Medicine, Michigan Medicine	Professor Shannon Ann Carty	scarty@umich.edu	Cancer prevention, diagnosis, prognosis and treatment	https://medicine.umich.edu/dept/intmed/divisions/hematology-oncology
Division of Allergy and Clinical Immunology, Department of Internal Medicine, Michigan Medicine	Professor James L. Baldwin	jbaldwin@umich.edu	Cancer prevention, diagnosis, prognosis and treatment	https://medicine.umich.edu/dept/intmed/divisions/allergy-clinical-immunology

University of Pennsylvania



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004518.



Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
Division of Hematology and Oncology, Pen Medicine	Dr. John H. Glick	glickjh@mail.med.upenn.edu	Cancer prevention, diagnosis, prognosis and treatment	www.pennmedicine.org/departments-and-centers/department-of-medicine/divisions/hematology-and-oncology

University of Washington (UW)

Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
UW Division of Oncology	Dr. Nancy E. Davidson	ndavidson@fredhutch.org	Cancer prevention, diagnosis, prognosis and treatment	https://depts.washington.edu/oncology/
Allergy and Immunology, John T. Milliken Department of Medicine, UW School of Medicine in St. Louis	Professor and Chair Joan M. Goverman	goverman@uw.edu	Cancer prevention, diagnosis, prognosis and treatment	https://oncology.wustl.edu/
Oncology Divisions, John T. Milliken Department of Medicine, UW School of Medicine in St. Louis	Dr. Ramaswamy Govindan	rgovindan@wustl.edu	Cancer prevention, diagnosis, prognosis and treatment	https://oncology.wustl.edu/index.html





Vanderbilt University

Research group	Research coordinator (RC) name	RC email address	Relevant research areas	Internet link
Division of Hematology and Oncology, Department of Medicine, Vanderbilt University Medical Center	Dr. W. Kimryn Rathmell	kimryn.rathmell@vanderbilt.edu	Cancer prevention, diagnosis, prognosis and treatment	https://medicine.vumc.org/hematology-and-oncology
Department of Radiation Oncology, Vanderbilt University Medical School	Professor Lisa Kachnic	lisa.a.kachnic@vanderbilt.edu	Cancer Treatment	www.vumc.org/radiation-oncology/



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004518.

2.2. Research centers

Cancer Research Centers are crucial to translate scientific knowledge into new discoveries that can lead to the improvement of existing treatment or the development of new treatments for cancer patients. Cancer research requires an interdisciplinary approach that includes the contribution of researchers and physicians from different academic programs and medical departments. In the US, the establishment of Cancer Research Centers has been accelerated by the NCI Cancer Centers Program, which provides grants to foster cutting-edge cancer research programs. Currently, there are 71 NCI-Designated Cancer Centers, located in 36 states and the District of Columbia⁵⁸ (Figure 4). Through the NCI-Designated Cancer Centers program, NCI recognizes centers around the country that meet high standards for transdisciplinary and state of the art research focused on developing new and improved approaches to preventing, diagnosing, and treating cancer. It should be highlighted that some of the centers also provide public education and outreach programs on cancer prevention and screening, with special attention to the needs of underserved populations⁵⁹.

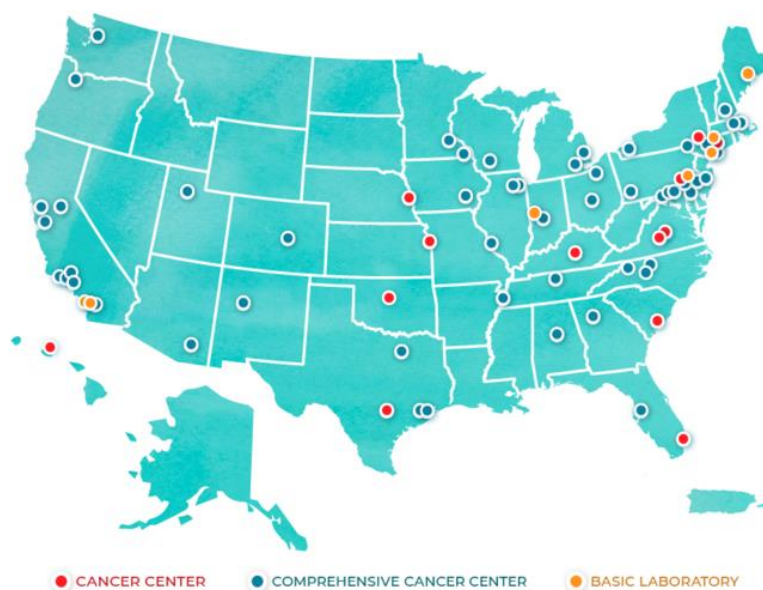


Figure 4: Location of NCI-Designated Research Centers (2021)⁶⁰

In addition, NSF is also highly committed to advance cancer research through the establishment of Industry–University Cooperative Research Centers (IUCRC)⁶¹. The program aims to generate breakthrough research by enabling close and sustained engagement between industry innovators, world-class academic teams and government agencies. To this end, the program support partnering

⁵⁸ <https://www.cancer.gov/research/nci-role/cancer-centers>

⁵⁹ A complete list of 71 NCI-Designated Cancer Centers can be found [here](#).

⁶⁰ <https://www.cancer.gov/research/infrastructure/cancer-centers/find>

⁶¹ <https://www.nsf.gov/eng/iip/iucrc/home.jsp>

with universities to drive innovations in various focus areas, including biotechnology, information, communication and computing, health and safety, etc⁶².

In this context, there are three main types of cancer research centers considered by this research handbook:

- Cancer Centers that are established by a university and several companies and other organizations (e.g., NSF sponsored Industry–University Cooperative Research Centers).
- Cancer Centers that are affiliated with universities (e.g., University of Michigan Comprehensive Cancer Center).
- Freestanding Cancer Centers (e.g., Memorial Sloan Kettering Cancer Center).

The Cancer Research Centers highlighted in this section were identified based on the abovementioned criteria and represent examples of centers that are globally recognized by their cancer research activities. The selection of the Centers was done by desk research, which included an extensive literature review and a review of known federal entities that support the establishment of these research centers.

Advanced Mammalian Biomanufacturing Innovation Center

Research Areas: Cancer Treatment

Coordinators: Dr. Sarah W. Harcum,

<https://www.clemson.edu/cecas/departments/bioe/people/faculty-staff/directory/harcum.html> and

Dr. William Bentley , <https://bentley.umd.edu/>

NSF Industry–University Cooperative Research Center

The Advanced Mammalian Biomanufacturing Innovation Center (AMBIC) brings together leading academic and industrial biotechnologists focused on mammalian cell culture manufacturing at a precompetitive research level. AMBIC's mission is to develop enabling technologies, knowledge, design tools, and methods that apply and integrate high-throughput and genome-based technologies to fast-track advanced biomanufacturing processes. Much biomanufacturing involves the use of cells to make medicines, including cancer medicines and vaccines.

Alvin J. Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine

Research Areas: Cancer Prevention, Diagnosis and Treatment

Coordinator: Dr. Timothy Eberlein, <https://wuphysicians.wustl.edu/for-patients/find-a-physician/timothy-j-eberlein>

NCI-Designated Cancer Center: Comprehensive Cancer Center

The Alvin J. Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine is a research center focused on cancer treatment, research, prevention, education and community outreach. The Center has a broad list of research programs that include hematopoietic

⁶² <https://iucrc.nsf.gov/>

development and malignancy, oncologic imaging, prevention and control, tumor immunology and cell-to-cell communications in cancer. Scientists and physicians affiliated with the center hold more than \$145 million (nearly €118 million) annually in basic and clinical oncology research grants.

<https://siteman.wustl.edu/>

Center for Computing and Genomics (CCBGM)

Research Areas: Cancer Treatment

Coordinator: Dr. Ravishankar Iyer, www.iucrc.org/center/center-computational-biotechnology-and-genomic-medicine⁶³

NSF Industry–University Cooperative Research Center

CCBGM is an NSF IUCRC that aims to use the power of computational predictive genomics to advance societal issues, such as enabling patient-specific cancer treatment. The CCBGM brings together two universities – the University of Illinois (at Urbana-Champaign) and the University of Chicago – and Mayo Clinic, a non-profit medical research group. The Center aims at leveraging the expertise of their researchers in high-performance computing and cancer genomics to foster multidisciplinary research with a focus on clinical knowledge.

<http://www.iucrc.org/center/center-computational-biotechnology-and-genomic-medicine>

Dana-Farber/Harvard Cancer Center (DF/HCC)

Research Areas: Cancer Prevention, Diagnosis and Treatment

Coordinator: Dr. Laurie H. Glimcher, www.dfcc.harvard.edu/insider/member-detail/member/laurie-h-glimcher-md/

NCI-Designated Cancer Center: Comprehensive Cancer Center

The DF/HCC is formed by five Boston academic medical institutions (Beth Israel Deaconess Medical Center, Boston Children’s Hospital, Brigham and Women’s Hospital, Dana-Farber Cancer Institute, and Massachusetts General Hospital) and two Harvard Schools (the Harvard Medical School and the Harvard T.H. Chan School of Public Health). The Center is specialized on clinical, translational, basic, and population-based research programs. DF/HCC includes 17 transdisciplinary research programs, such as cancer cell biology, cancer data sciences, cancer epidemiology, cancer genetics and cancer immunology. In addition, the Center has working groups focused on areas such as angiogenesis, cancer invasion, metastasis, imaging, nursing, palliative care, survivorship, and viral oncology.

www.dfcc.harvard.edu/

⁶³There is no specific link to a page with Ravishankar Iyer profile, but you can contact him for more information at rkiyer@illinois.edu or (217) 333-7774.

Huntsman Cancer Institute at the University of Utah (HCI)

Research Areas: Cancer Prevention, Diagnosis and Treatment

Coordinator: Dr. Mary Beckerle,

<http://medicine.utah.edu/faculty/mddetail.php?facultyID=u0028589>

NCI-Designated Cancer Center: Comprehensive Cancer Center

HCI at the University of Utah is a cancer research and treatment center focused on the research handbook of cancer genetics. HCI conducts basic, translational, and clinical research and follows a “lab bench to patient bedside” research model. The Center research programs include control of cell growth and differentiation, cell regulation, experimental therapeutics and cancer population science. The HCI's mission is to understand cancer from its beginnings, to use that knowledge in the creation and improvement of cancer treatments, and to provide education about cancer risk, prevention and care.

<http://huntsmancancer.org/index.php>

Memorial Sloan Kettering Cancer Center

Research Areas: Cancer Prevention, Diagnosis, Prognosis and Treatment

Coordinator: Dr. Ned Groves, www.mskcc.org/profile/ned-groves

NCI-Designated Cancer Center: Comprehensive Cancer Center

The Memorial Sloan Kettering Cancer Center is the oldest private cancer center in the US. The Center is specialized on patient care, innovative research and educational programs. It comprises a multidisciplinary team from different academic programs and medical departments. The Center research programs are focused in several areas, such as: cancer genetics and genomics; cancer immunotherapy and vaccines; cancer metabolism; cell signaling and regulation; cell-based therapy; and computational oncology. The Center has also established innovative collaborations with Hackensack Meridian Health and International Business Machines (IBM) with the aim to improve the quality of cancer care delivery.

www.mskcc.org/

Ohio State University Comprehensive Cancer Center – Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC – James)

Research Areas: Cancer Prevention and Treatment

Coordinator: Dr. Raphael E. Pollock, <https://cancer.osu.edu/research-and-education/find-a-researcher/search-researcher-directory/raphael-e-pollock>

NCI-Designated Cancer Center: Comprehensive Cancer Center

The OSUCCC – James is a transdisciplinary cancer research center focused on cancer treatment and patient care. The research programs of the Center include cancer control, leukemia research, molecular biology and cancer genetics, molecular carcinogenesis and chemoprevention, and translational therapeutics. Specialized technology needed for particular studies are available through the 20 Shared Resources and Cores at the OSUCCC – James. The Center encourages inter-program collaborations as well as collaborations with other researchers. Currently, the Center is the only NCI–



designated comprehensive cancer center aligned with a nationally ranked academic medical center and a freestanding cancer hospital.

<https://cancer.osu.edu/>

Sidney Kimmel Comprehensive Cancer Center

Research Areas: Cancer Prevention and Treatment

Coordinator: Dr. William Nelson,

https://www.hopkinsmedicine.org/kimmel_cancer_center/our_experts.html

NCI-Designated Cancer Center: Comprehensive Cancer Center

The Johns Hopkins Kimmel Cancer Center has leading programs in cancer clinical research, laboratory research, education, community outreach, prevention and control. The mission of the Cancer Center is to go beyond the cutting edge in science and medicine and perform research activities that can be translated into discoveries and innovative cancer therapies. The Johns Hopkins Kimmel Cancer Center has research programs in several research topics, including cancer biology; cancer chemistry and structural biology; cancer immunology; cancer molecular and functional imaging; cancer prevention and control; and hematologic malignancies and bone marrow transplant.

https://www.hopkinsmedicine.org/kimmel_cancer_center/

The Wistar Institute Cancer Center

Research Areas: Cancer Prevention, Diagnosis and Treatment

Coordinator: Dr. Dario C. Altieri,

<https://wistar.org/our-scientists/dario-c-altieri>

NCI-Designated Cancer Center: Basic Laboratory Cancer Center

The Wistar Institute Cancer Center merges basic, translational, and patient-oriented cancer research in a single scientific continuum with a focus on cancer prevention, diagnosis, and therapy. The institute's scientists pursue research to understand the causes, treatment, and prevention of cancer. The Wistar Institute is structured into three research programs, taking an interdisciplinary approach to cancer research: the gene expression and regulation program, the molecular and cellular oncogenesis program, and the immunology, microenvironment and metastasis program.

<https://wistar.org/>

University of Colorado Cancer Center

Research Areas: Cancer Prevention, Diagnosis and Treatment

Coordinator: Dr. Richard Schulick,

<https://medschool.cuanschutz.edu/colorado-cancer-center/about-us/cu-cancer-center-leadership>

NCI-Designated Cancer Center: Comprehensive Cancer Center

The University of Colorado Cancer Center is a consortium composed of three state universities (the University of Colorado-Boulder, University of Colorado Anschutz Medical Campus and Colorado State University) and three institutions (University of Colorado Health - a network comprised of University



of Colorado Hospital, Poudre Valley Hospital, Medical Center of the Rockies and Memorial Hospital; Children's Hospital Colorado; and Denver VA Medical Center). The Center is focused on translational prevention, diagnosis, treatment, survivorship and outreach programs. The Center research programs are focused on: cancer cell biology; cancer prevention and control; developmental therapeutics; hematologic malignancies; and molecular oncology.

<http://www.ucdenver.edu/academics/colleges/medicalschool/centers/cancercenter/Pages/CancerCenter.aspx>

University of California, San Francisco (UCSF) Helen Diller Family Comprehensive Cancer Center

Research Areas: Cancer Prevention, Diagnosis, Prognosis and Treatment

Coordinator: Dr. Alan Ashworth, http://cancer.ucsf.edu/people/profiles/ashworth_alan

NCI-Designated Cancer Center: Comprehensive Cancer Center

The UCSF Helen Diller Family Comprehensive Cancer Center is a multidisciplinary research and clinical care center that aims to improve the outcome of cancer patients. The Center is specialized in basic science, clinical research, epidemiology/cancer control and patient care. The UCSF multidisciplinary team is comprised of laboratory scientists; clinical investigators; providers of patient care; epidemiologists; socio-behavioral scientists specialized on cancer control; cancer genetics; cancer immunology; experimental therapeutics; hematopoietic malignancies; neurologic oncology; and tobacco control.

<http://cancer.ucsf.edu/>

University of Michigan Comprehensive Cancer Center

Research Areas: Cancer Prevention, Diagnosis, Prognosis and Treatment

Coordinator: Dr. Eric R. Fearon, <http://www.med.umich.edu/intmed/mmg/faculty/bios/fearon.htm>

NCI-Designated Cancer Center: Comprehensive Cancer Center

The University of Michigan Comprehensive Cancer Center is a multidisciplinary center that combines traditional disciplines with disciplines that are not typically associated with cancer research, such as engineering and mathematics. The Center encompasses members from 42 departments across 8 schools of the University of Michigan. The Center research portfolio is focused on: cancer epidemiology and prevention; cancer hematopoiesis and immunology; cancer genetics; and cancer biology and developmental therapeutics.

<https://www.mccancer.org/>

University of Texas MD Anderson Cancer Center

Research Areas: Cancer Prevention and Treatment

Coordinator: Dr. Peter WT Pisters, www.mdanderson.org/about-md-anderson/facts-history/president-peter-pisters.html

NCI-Designated Cancer Center: Comprehensive Cancer Center



The University of Texas MD Anderson Cancer Center is focused on cancer patient care, research, education and prevention. The Center research programs include a variety of areas ranging from bone disease research to intervention programs for improving the quality of life of brain cancer patients. In FY16, MD Anderson spent over \$787 million (nearly €709 million) in research. In addition, the Moon Shots Program has received about \$428 million (nearly €385 million) from private philanthropic commitments.

www.mdanderson.org/



2.3. Industry clusters

For the purpose of this research handbook, industry clusters are defined as geographic concentrations of businesses of closely related industries. In the US, the industry clusters have been a catalyst for economic growth for over a century, mostly due to the ability of some leading universities in the country to work cooperatively with industry. The US is embracing the system of a label or guarantee of quality from national programs such as the European Secretariat for Cluster Analysis (ESCA) certification based on a bronze, silver, or gold label⁶⁴.

Despite their importance, the cluster organizations in the US are not as institutionalized as in the EU. Nevertheless, there are numerous clusters that are represented by a formal cluster organization and tend to be supported by local Economic Development Agencies (EDA's), whereas some others are part of public and/or private organizations (e. g. Federal Agencies, Industry Associations, etc.) that aim to promote competitiveness and innovation in a particular sector.

The US Cluster Mapping Project, a national economic development initiative led by Harvard Business School and with the support of the US Department of Commerce, Economic Development Administration, aggregates all the country clusters providing valuable insights on business environment, demographics and performance of the clusters⁶⁵. The platform can be considered as a formal US cluster connector and has been used to identify the most relevant industry clusters for the Healthcare and Life Sciences sectors. These two sectors have been selected to identify the industry clusters focused on cancer research, as they are the only sectors which encompass the communities who conduct cancer research activities.

ENRICH in the USA, as a Network of European Research and Innovation Centers and Hubs throughout the US, offers an opportunity for European SMEs and researchers to access US HealthTech innovation hubs by facilitating access to university-centric ecosystems. This service is realized through **J-1 Soft Landing Programs** at incubators/innovation centers of universities, which offers core services such as hosting, education, supervision and coaching of EuropeanTech Entrepreneurs and Intrapreneurs, as well as access to the ENRICH Community Platform to attend advisory sessions, one-one meetings, and apply to local and international events. The first list of universities that are considering the program (with variations) starting in 2021 can be found below:

- UC Berkeley, CA
- Cal Poly University, San Luis Obispo, CA
- Temple University, Philadelphia, PA
- George Mason University, Fairfax, VA
- Purdue University, West Lafayette, IN
- Georgia Tech University, Atlanta, GA
- University of Missouri (Mizzou), Columbia, MO
- University of Massachusetts (UMass), Boston, MA

⁶⁴ESCA, Jan 2017. <http://cluster-analysis.org/benchmarked-clusters/?country=6a7389f0dba345fab09a30cd321b3d23>

⁶⁵<http://www.clustermapping.us/>



- University of Boise, Idaho

The sections to follow present the clusters focused on cancer research in the US and the corresponding Soft-Landing hubs of the ENRICH in the USA as initial contact points of approach for considered collaboration activities.

Boston/ Cambridge cluster

Boston is widely recognized as a leading Healthcare and Life Sciences cluster. Boston is home to a large network of hospitals, research centers, universities and Healthcare companies. Currently, the Boston area accounts for 25 hospitals, 20 community health centers and over 120 Health IT and Digital Health companies. Moreover, Boston has more than 46,000 scientists and researchers and over 21,000 students at institutions and hospitals, which reveals Boston's leading position in healthcare research⁶⁶.

Cancer research is a growing research area that is playing an increasing importance within the Healthcare and Life Sciences sectors. Thus, Boston/ Cambridge is currently home to some of the key hospitals and research centers in the cancer field, such as the Massachusetts General Hospital Center for Cancer Research, the Dana-Farber Cancer Institute, the Koch Institute for Integrative Cancer Research at Massachusetts Institute of Technology (MIT) and the Cancer Research Center at the Boston University Medical Campus.

Furthermore, the headquarters of some of the US leading cancer biopharmaceutical companies are also located in the Boston/ Cambridge area. The presence of those companies, such as Ariad Pharmaceuticals, Epizyme, Infinity Pharmaceuticals, Agios Pharmaceuticals and Merrimack Pharmaceuticals, highly contributes to the development of Cancer R&D activities in the Boston/ Cambridge area⁶⁷.

ENRICH in the USA Soft Landing Hubs: Initial Contact point for Massachusetts

Through the **ENRICH J-1 Soft Landing Programs**, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the **HealthTech** domain.

The University of Massachusetts (UMass) is the only public research system in Massachusetts. The university system includes five campuses (Amherst, Boston, Dartmouth, Lowell, and a medical school in Worcester), and a satellite campus. UMass is planned to be the home of **ENRICH in the USA HealthTech and Smart "everything" Landing Hub**. With more than 20 partners from academia, industry, and government, the Hub will cover all sectors with a strong focus on cutting edge technologies with applications health. It should be highlighted that the Hub's partnership with UMass is a great opportunity for SMEs and researchers working on health technologies as UMass one of the major facilitators of innovation in the US Cancer R&D. In particular, UMass is home to several initiatives, including the **Center for Personalized Cancer Therapy (CPCT)**. **Located in the Integrated Sciences Complex, the CPCT is a collaborative venture between the UMass and the Dana Farber/Harvard Cancer Center**. The CPCT research team, which includes faculty, postdoctoral fellows,

⁶⁶<https://www.boston.gov/departments/economic-development/healthcare-and-life-sciences>

⁶⁷<https://www.bizjournals.com/boston/blog/bioflash/2013/09/list-12-of-the-largest.html>

graduate students, and undergraduate students, helps investigators and clinicians analyze samples, identify genetic variants contributing to disease risk, and reveal complex mechanisms involved in human disease.

San Francisco Bay Area cluster

The San Francisco Bay Area is widely recognized as an epicenter of innovation. The Bay Area has significant access to venture capital and federal funds. In 2016, the Bay Area received venture capital investment valuing \$839 million (nearly €755 million)⁶⁸. Furthermore, in the same year, it also received 22% of the US investment for research development and innovation (RDI), as well as 8% of the total NIH funding (\$1.5 billion, nearly €1.4 billion)⁶⁹.

The San Francisco Bay Area is also known to be one of the world leading Healthcare and Biotech clusters. The Bay Area is home to globally recognized hospitals and several world leading universities and Cancer Research Centers, such as Stanford University, UCSF and the Helen Diller Family Comprehensive Cancer Center^{70,71}.

In this area, there is also a high concentration of important Biopharma companies, namely CellSight Technologies, FLX Bio, Freenome, MandalMed and MiNDERA, which are focused on the development of improved or new cancer diagnosis tools and/or anti-cancer treatments⁷². Overall, the San Francisco Bay Area offers a highly innovative environment that allows the cooperation between industry and academia stakeholders to foster cancer R&D.

ENRICH in the USA Soft Landing Hubs: Initial Contact points for California

Through the **ENRICH J-1 Soft Landing Programs**, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the **HealthTech** domain.

The **ENRICH in the USA Soft Landing Programs** in the Bay Area is the Citris Foundry at Berkeley University. CalPoly University, located in the South of the Bay Area is also a vetted ENRICH Soft Landing location focusing on AgTech and CleanTech industries

The University of California (UC), Berkeley is one of the world's preeminent public universities, boasting a distinguished faculty (with 22 Nobel laureates to date), stellar research libraries, and more than 350 academic programs. At the heart of Berkeley's excellence are its 1,582 full-time faculty members, dispersed among 130 academic units and 80 interdisciplinary research units, including work in the domain of cancer research. Aside from offering several programs and booth camps focused on the research and innovation in the field of cancer research, UC Berkeley is soft landing site for the **ENRICH in the USA ICT, IoT and "Smart everything" Landing Hub**.

⁶⁸<https://www.tfhc.nl/agenda/digital-health-mission-silicon-valleybay-area/>

⁶⁹<https://www.tfhc.nl/agenda/digital-health-mission-silicon-valleybay-area/>

⁷⁰<https://www.genengnews.com/the-lists/top-10-us-biopharma-clusters/77900917>

⁷¹https://www.google.pt/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKEWjXyMnjmK_YAhXCORQKHm8DBUOFgg5MAI&url=https%3A%2F%2Fwww.industrystudiesconference.org%2Fconference%2Fpapers%2Fdownload%2F70&usq=AOvVaw1e8DBJofJ_WkUYh3nQTdcs

⁷²<https://biopharmguy.com/links/company-by-name-northern-california.php>

The focus of the Hub is ICT, IoT and "Smart everything" in B2B2C applications. Hub as its own Centre and represents a great location for European SMEs and researchers operating in HealthTech and Tech for Good domains. At present, the hub has over twenty partners, including accelerators, agencies, universities and other relevant stakeholders.

UC Berkeley also hosts **the UC Berkeley Cancer Research Lab (CLR)**. **Founded in 1951, CLR aims to support fundamental cancer research on the UC Berkeley campus. The objective is to provide world-class scientists at Berkeley with resources and facilities that will help them in their ambitious quest to develop novel therapeutic approaches to cancer. In this sense, CRL provides Berkeley researchers access to cutting edge technology that makes their breakthrough research possible. We support this technology in three separate Core Facilities: Flow Cytometry Facility, Molecular Imaging Center, Gene Targeting Facility.**

New York cluster

New York is widely recognized for its Life Sciences cluster, which brings together over 120 Life Sciences companies, world-renowned universities and research centers, a large research talent pool and important physical resources. Currently, the city has the US largest concentration of academic institutions, with nine globally acclaimed academic medical centers, including: Columbia University, Weill Cornell Medical College, New York University, Albert Einstein College of Medicine, and the Rockefeller University⁷³.

Besides its human and physical resources, New York receives a large amount of funds for R&D. In 2016, it received \$2.206 billion (nearly €1.985 billion) from the NIH for Health-related R&D activities. In the same year, 70 New York businesses were awarded by the NIH with \$51 million (nearly €46 million) for the R&D of technologies with potential commercial applications⁷⁴.

Regarding cancer research, New York is home to several world-wide recognized research centers, including the Memorial Sloan Kettering Cancer Center, the Herbert Irving Comprehensive Cancer Center, Tisch Cancer Institute at Mount Sinai and the New York Presbyterian Hospital Cancer Center. The city is also the location of globally acclaimed Biopharmaceutical companies focused on cancer diagnosis and treatment R&D, such as Bantam Pharmaceutical, Chimeron Bio, Cynvec, DanDrit Biotechnology and RGenix. The existence of the abovementioned research centers and companies in New York promote the linkage between academia and industry in terms of cancer R&D⁷⁵.

ENRICH in the USA Soft Landing Hubs: Initial Contact point for New York

Through the **ENRICH J-1 Soft Landing Programs**, interested participants can access Incubators/Innovation centers and partners dedicated to R&I in the **HealthTech** domain.

New York is the location of the **ENRICH in the USA Advanced Manufacturing Landing Hub**. Hosted by the Council of the Great Lakes Region, which has offices in Cleveland, Ohio and Toronto, Ontario, Canada and a binational presence at the TRcC Incubator in Niagara Falls, New York, the Advanced Manufacturing Hub provides European stakeholders unprecedented connectivity to two national economies, and more

⁷³<https://www.nycedc.com/industry/life-sciences>

⁷⁴<http://www.faseb.org/viewer.aspx?id=289&name=Value-of-NIH-Funding-in-New-York.pdf>

⁷⁵<https://biopharmguy.com/links/state-ny-all-geo.php>

importantly, easy access to a number of world-class manufacturing clusters and institutes from various sectors including healthcare.

ENRICH in the USA is also in discussion with NYC university incubators to address other specific industry sectors, including HealthTech.

Visiting European stakeholders in medical technology can enjoy connecting with centers of excellence and networking their products and services to manufacturing giants, including, but not limited to, **IBM, 3M, Dow Chemical, and Procter and Gamble.**

New York is also home to the **Columbia University's Herbert Irving Comprehensive Cancer Center (HICCC).** The HICCC is dedicated to discovering, designing, and delivering innovative cancer care and research for all those affected by cancer. In 2020, the HICCC was competitively renewed again as a designated Comprehensive Cancer Center by the NCI, the largest funder of cancer research in the world.

Maryland cluster

Maryland is acknowledged internationally for its healthcare expertise and innovative culture. Currently, Maryland is home to over 500 Biotechnology firms, 2,360 life sciences companies and some of the US leading universities, such as the Johns Hopkins University and the University of Maryland⁷⁶. In 2016, the Johns Hopkins University was the US top academic beneficiary of NIH and FDA research grant funding, accounting for around 64.5% of the state's NIH funding (556 awards totaling \$271 million, nearly €244 million)⁷⁷.

Furthermore, Maryland is home to several federal agencies responsible for setting health standards, approving products for sale to the US market, and conducting and/or funding research, such as the FDA, the NIH, the Frederick National Lab for Cancer Research, US Army Medical Research Institute of Infectious Diseases (USAMRIID), Edgewood Chemical Biological Center (ECBC), Walter Reed and the US Pharmacopeial Convention (USP)⁷⁸. Important biopharma companies focused on cancer diagnosis and treatment, namely Gliknik, Medigen, OncoBindi and Shuttle Pharmaceuticals, are also headquartered in Maryland⁷⁹. Overall, Maryland offers a highly innovative environment that promotes the development of cancer R&D activities.

ENRICH in the USA Soft Landing Hubs: Initial Contact points for Maryland

Through the **ENRICH J-1 Soft Landing Programs**, interested participants can access Incubators/Innovation Centers dedicated to R&I in the **HealthTech** domain.

Locations for the **ENRICH in the USA Soft Landing Programs** in the closest proximity of the Maryland area is the **ENRICH in the USA Federal Centre, Washington D.C** and **George Mason University, VA.**

ENRICH in the USA Federal Centre in D.C. is located at the **National Council of University Research Administrators** premises. The Centre is home to **ENRICH in the USA Government Landing Hub**, which connects companies and researchers with the US Government agencies and contractors. With its own center, the Hub provides a great location for B2G and Research Development activities related HealthTech. The Hub brings together more than 20 partners, which include government agencies, accelerators, incubators, universities,

⁷⁶<https://open.maryland.gov/open4business/biohealth-technology/>

⁷⁷<https://www.genengnews.com/the-lists/top-10-us-biopharma-clusters/77900917>

⁷⁸<https://open.maryland.gov/open4business/biohealth-technology/>

⁷⁹<https://biopharmguy.com/links/state-md-all-geo.php>



schools, and co-working spaces in the D.C. area. The US Government agencies that are partners and can be of interest for SMEs and researchers from the medical domain include NIH, DoD, DoE, USDA, NSF and DoC.

George Mason University is a public, coeducational institution of higher learning in Fairfax, Virginia, U.S. It consists of 12 colleges and schools offering a variety of undergraduate and graduate degrees. Several of its graduate programs have been recognized nationally for excellence and distinction, including the **George Mason University Center for Applied Proteomics and Molecular Medicine**. The University is also the location of the **ENRICH in the USA Smart City / Infrastructure Landing Hub**, which includes **Virginia Tech University and Smart City Works** as partners.

Greater Philadelphia cluster

The Philadelphia area is the 5th largest R&D hub in the US, with \$10.5 billion (nearly €9.5 billion) in annual expenditures in R&D. Moreover, in 2015, this cluster received \$271.4 million (nearly €244.2 million) in venture capital and \$102.9 million (nearly €92.6 million) in NIH funding⁸⁰.

The Greater Philadelphia Biotechnology cluster is a large and innovative cluster that comprises activities on healthcare treatment and diagnostics, medical devices and healthcare IT. Considering cancer research, the Philadelphia area is home to world-renowned research centers, such as the Abramson Cancer Center at Penn Medicine, the Penn Pancreatic Cancer Research Center and the Center for Childhood Cancer Research. Even though the University City Science Center located in Philadelphia is not focused in Cancer R&D, it represents the oldest US research campus and an important catalyst of new ideas and technologies related to cancer research⁸¹.

Additionally, the headquarters of some of the most recognized US Biopharmaceutical companies dedicated to cancer R&D are in Philadelphia. These companies, which include Adaptimmune Therapeutics and Immunome, are particularly focused on cancer treatment R&D activities⁸².

ENRICH in the USA Soft Landing Hubs: Initial Contact points for Pennsylvania

Through the **ENRICH J-1 Soft-Landing Programs**, interested participants can access Incubators/Innovation Centers dedicated to R&I in the **HealthTech** domain.

Locations for the **ENRICH in the USA Soft Landing Programs** in Philadelphia area is the **ENRICH in the USA Philadelphia Biotechnology Landing Hub**.

Located in Philadelphia, Pennsylvania and hosted by **Temple University SBDC** and the **University City Science Center**, **ENRICH in the USA Philadelphia Biotechnology Landing Hub** enables innovative bio-related European companies to leverage the Center's close relationship with over 30 universities, private sector firms and government institutions. Located in the heart of the City Square, companies will be immersed in an ecosystem of innovation and success that has turned concepts into multi-national conglomerates for the last 55+ years. In addition to being the long-time home of biomedical giants such as GlaxoSmithKline, Merck, Baxter Healthcare, and Johnson & Johnson, to name a few, the area holds promise for small innovators to grow exponentially.

⁸⁰<http://www.liftstream.com/philadelphia-biotech-.html>

⁸¹<https://www.sciencecenter.org/about-us>

⁸²<https://biopharmguy.com/links/state-pa-all-geo.php>

Located in Philadelphia are also **the ENRICH in the USA** partner institutions, **the Wistar Institute Cancer Center** and **Fels Cancer Institute for Personalized Medicine at Temple University**. **The Wistar Institute Cancer Center** is an NCI-Designated Cancer Centre, which aims to merge basic, translational, and patient-oriented cancer research in a single scientific continuum with a focus on cancer prevention, diagnosis, and therapy. The institute's scientists pursue research to understand the causes, treatment, and prevention of cancer.

Fels Cancer Institute for Personalized Medicine is part of Temple University's Lewis Katz School of Medicine and oriented towards research and training in cancer-related basic biological and biochemical sciences, with progressive extension into the areas of molecular, developmental and chemical biology to advance knowledge of the etiology and pathogenesis of cancer. A major goal of the institute is to utilize the advances made in basic science programs to develop novel targeted therapies for the treatment of cancer.

3 Recognized research networks/ professional associations and events

The US NIH considers that research networks and other organizational associations that comprise researchers and community practitioners are crucial to accelerate the translation of cancer research into practice⁸³. In the US, cancer research networks are highly supported by the US Government due to the Government's ability to promote the linkage between researchers and healthcare professionals⁸⁴.

In the field of cancer research, advances are rapid and cancer care delivery is continuously being reshaped due to the discovery and consequent entrance of new treatments in the healthcare market. Therefore, cancer research networks often act as a bridge between research and clinical practice through interdisciplinary collaborations, supportive funding and cooperation projects. Cancer research networks are often comprised of academics, community practitioners and pharmaceutical sector members.

Medical professional associations are also crucial for improving the quality of patient care delivery as well as for enabling physicians to partner with researchers and patients in order to develop innovative cancer treatments. Cancer patient journey, which includes the cancer diagnosis, prognosis and treatment, is a highly complex process that requires the involvement of medical professionals from diverse fields^{85,86}. Therefore, medical professional associations play a highly important role in linking health professionals from different oncology and oncology-related fields, as well as guaranteeing that their medical professionalism is put in practice during their research activities and clinical practice.

Moreover, the organization of conferences and events is one of the main activities of cancer research networks and professional associations. A review of the US conferences and events that are focused on cancer research was conducted to identify the most relevant research networks and professional associations in this area.

Through gaining knowledge of the relevant cancer research networks, professional associations and future conferences, one can identify the most effective approach to establishing relevant contacts in the US research community in order to pursue research collaborative opportunities.

⁸³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3037724/>

⁸⁴ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3037724/>

⁸⁵ <https://www.cancer.net/navigating-cancer-care/cancer-basics/cancer-care-team/oncology-team>

⁸⁶ <https://www.cancer.org/treatment/finding-and-paying-for-treatment/choosing-your-treatment-team/health-professionals-associated-with-cancer-care.html>



3.1. Research networks and professional associations

American Association for Cancer Research (AACR)

AACR is a scientific organization focused on preventing and curing cancer through research, education, communication, and collaboration. AACR's membership comprises a wide network of 37,000 investigators, health care professionals, cancer survivors, advocates and students from all over the world that aim to accelerate the prevention and cure of cancer diseases. In this context, AACR promotes interactions and collaborations through the organization of meetings, conferences, and educational workshops, such as the AACR Annual Meeting, which brings together more than 18,000 researchers from over 60 countries year. This association is also responsible for the edition of the Cancer Research journal, which is globally the most highly cited peer-reviewed journal in the field (cancer research).

www.aacr.org/Pages/Home.aspx

American Cancer Society (ACS)

The ACS is a nationwide, community-based and voluntary health organization that aims to accelerate the progress and eliminate cancer through research, education, advocacy, and service. The Society is structured into regional and local offices throughout the US, supporting 6 geographic regions with regional offices, and more than 300 local offices in those regions. Moreover, the ACS's main activities include providing grants to researchers in order to improve treatments, uncover factors that may cause cancer, and provide better quality of life to cancer patients.

www.cancer.org/

American Society of Clinical Oncology (ASCO)

ASCO is a professional association focused on cancer research, education and promotion of quality patient care. This association currently has over 40,000 oncology professional members from all oncology subspecialties representing more than 150 countries.

In order to achieve its mission, ASCO organizes several national and international oncology events, symposia and conferences, such as the ASCO Annual Meeting, the ASCO Oncology Practice Conference and the Cancer Survivorship Symposium. The ASCO events are considered to be some of the most relevant events in the cancer research field, which is mostly due to the presence of renowned researchers and clinicians who come from all over the world to discuss the most recent research discoveries and challenges in the cancer research field.

Besides the events, ASCO also develops and publishes clinical practice guidelines for the diagnosis and treatment of cancer diseases in the US. These guidelines are followed by the national health systems of other countries, including some EU Member States.

www.asco.org/



Cancer Research Network (CRN)

The CRN is an NCI-funded initiative that brings together a consortium of research groups affiliated with non-profit integrated health care delivery systems. The CRN aims to promote collaborative research in four broad areas: prevention and screening; epidemiology of prognosis and outcomes; health care quality and cost; and communications and dissemination. Thus, the CRN welcomes projects that aim to improve knowledge about cancer etiology, prevention, early detection, treatment, and prognosis. The CRN investigators often collaborate with investigators at the NCI, NCI-designated cancer centers, academic institutions and other research consortia and research networks.

<https://crn.cancer.gov/>

Hoosier Cancer Research Network (HCRN)

HCRN is an independent not-for-profit contract research organization that aims to advance cancer research, education, and patient advocacy. The HCRN's mission is accomplished through the promotion of relationships between academic, community, pharmaceutical, and biotech partners. Currently, the HCRN conducts cancer research in collaboration with over 300 academic and community clinical research sites across the US and internationally. Furthermore, the Network organizes several events focused on cancer research.

<https://hoosiercancer.org/>

National Comprehensive Cancer Network (NCCN)

The NCCN is an alliance of cancer centers focused on patient care, research, and education. The NCCN aims to improve the quality and efficiency of cancer patient care and advance cancer research. Currently, the NCCN is comprised of 27 cancer centers specialized in diagnosis and treatment of patients with different types of cancer, mainly complex, aggressive, or rare cancer diseases. Furthermore, the NCCN organizes periodical conferences and congresses focused on improving cancer care delivery, such as the NCCN 23rd Annual Conference: Improving the Quality, Effectiveness, and Efficiency of Cancer Care.

www.nccn.org/

Society for Immunotherapy of Cancer (SITC)

SITC is a member-driven non-profit organization with the objective of improving cancer patient outcomes by advancing cancer immunotherapy research and its clinical application. The Society includes as members basic and translational scientists, practitioners, nurses, industry professionals, government leaders and students related to 17 different oncology specialties. Currently, SITC has around 1,700 members conducting research and treatment on a dozen types of cancer. The Society promotes collaborations among national and international organizations, agencies and associations. Furthermore, SITC organizes the SITC Annual Conference, which brings together stakeholders from the



cancer immunotherapy field with the aim to advance cancer immunotherapy research and discover breakthroughs in this field.

<http://www.sitcancer.org/home>



3.2. Conferences and other networking events

Conferences and other networking events provide an important platform where cancer researchers and professionals can present and discuss high-quality research advances. Cancer conferences are also an excellent opportunity to foster R&D collaboration between researchers, professionals and industry members, share knowledge and discuss next-generation diagnostics and treatments.

Due to the importance of cancer research, there are numerous conferences and other networking events focused on this field in the US. Some of the leading cancer research conferences and other networking events were identified by desk research, which included an extensive literature review and a review of the conferences sponsored by recognized cancer research networks and cancer professional associations.

The conferences and other networking events identified in this research handbook emphasize the areas of cancer prevention and cancer treatment. In addition, the conferences that focus on cancer research are evenly spread throughout the year and concentrate in the state of California.





Table 3 - Conferences and Other Networking Events Focused on Cancer Research

Date	Conference/event title	Interval	Location	Research areas	Internet link
20-22 January, 2022	Gastrointestinal Cancers Symposium	Annual	San Francisco, California	Cancer prevention and treatment	https://meetings.asco.org/gi/attend
25-27 January, 2022	The Precision Medicine World Conference Silicon Valley	Annual	Mountain View, California	Cancer prevention, prognosis, diagnosis and treatment	https://past.pmwintl.com/
March TBD, 2022	NCCN Annual Conference: Improving the Quality, Effectiveness, and Efficiency of Cancer Care	Annual	Orlando, Florida	Cancer treatment	https://www.nccn.org/professionals/meetings/annual_conference.aspx
8-13 April, 2021	AACR Annual Meeting	Annual	Chicago, Illinois	Cancer prevention, prognosis, diagnosis and treatment	https://www.aacr.org/meeting/
21-23 April 2022	IPMC 2022	Annual	Las Vegas, Nevada	Precision medicine	https://magnusconferences.com/precision-medicine/
June 3, 2022	ASCO Annual Meeting	Annual	Chicago, Illinois	Cancer prevention, prognosis, diagnosis and treatment	https://am.asco.org/
11-12 June, 2021	APPOS — 3rd Annual APP Oncology Summit - Cincinnati	Annual	Cincinnati, Ohio	Cancer treatment	https://apponcologysummit.medmanager.com/store/app-oncology-summit-cincinnati/agenda



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Date	Conference/event title	Interval	Location	Research areas	Internet link
22-23 October, 2021	34 th Annual Conference on Preventive Oncology	Annual	Worldwide	Cancer prevention	https://preventiveoncology.conferenceseries.com/
21-24 October, 2021	53rd Congress of the International Society of Paediatric Oncology 2021	Annual	Honolulu, Hawaii	Conference program to be determine	https://siop-congress.org/
25-27 October, 2021	6 th International Conference on Cancer Biology and Drug Delivery	Annual	Baltimore, Maryland	Cancer prevention and treatment	https://cancerbiology.conferenceseries.com/
14-19 November 2021	Gordon Research Conference	Annual	Ventura, California	Cancer treatment	http://www.grc.org/physical-science-of-cancer-conference/2021/
10-14 November, 2021	SITC 2021	Annual	Washington, District of Columbia	Cancer treatment	www.sitcancer.org/education/annualmeeting
7-10 December, 2021	41st Annual San Antonio Breast Cancer Symposium (SABCS)	Annual	San Antonio, Texas	Cancer prevention, diagnosis and treatment	https://www.sabcs.org/
TBD, 2022	International Conference on Tumor & Cancer Immunology and Immunotherapy	Annual	San Diego, California	Cancer treatment	https://cancerimmunology.conferenceseries.com/



4 US R&D initiatives and programs

The US R&D funding system is highly decentralized and comprises several actors, such as agencies of federal and state governments, universities, the private sector and non-profit organizations⁸⁷. R&D is a driver of innovation and economic growth and, therefore, has particular importance for the aforementioned actors. In the US, the research developed by universities and research centers is highly supported by funds that prioritize research areas, which can lead to technological breakthroughs⁸⁸.

In recent years, public funding for cancer research has led to significant advances in cancer prevention, detection, diagnosis, treatment, and quality of life for patients. As a result, the US government has recognized the importance of funding cancer research and has provided funds to federal agencies (e.g., NIH, the CDC, the US DoD and NSF) for initiatives and programs that promote cancer research. Since cancer has a major societal burden, private funds and initiatives also have a very important role in fostering cancer research through the award of grants.

A review of both US public and private funding initiatives was conducted to identify the most relevant R&D initiatives and programs focused on cancer research. The following subsections provide descriptions of the initiatives and programs; while Annex 1 provides a summary table of the initiatives and programs.

4.1. Public initiatives/programs

In the US, public funding is especially crucial to support high-risk and pioneering research, since the private sector typically does not fund this type of research⁸⁹. In the US, cancer R&D is supported through a number of other federal agencies and institutes. The NIH is the main federal agency for promoting cancer research; however, the Centers for Disease Control and Prevention (CDC), the Department of Defense and NSF also provide important grants focused on cancer research⁹⁰.

In the case of the US public funding, there is no need for analyzing the existing initiatives and programs at federal and state levels separately. This is simply because most of the funding is provided by federal agencies, such as the National Institutes of Health⁹¹. These agencies allocate a certain budget to different research organizations, which are distributed across the country.

⁸⁷ <http://www.eusscienceandtechnology.eu/assets/content/documents/InnovationSystemInnovationPolicyUS.pdf>

⁸⁸ <http://www.itif.org/files/2011-university-research-funding.pdf>

⁸⁹ <https://www.asco.org/advocacy/advocacy-agenda-initiatives/federally-funded-cancer-research>

⁹⁰ https://www.aacr.org/professionals/policy-and-advocacy/advocacy-tools/federal-agencies_9db83d/

⁹¹ <https://www.cancer.gov/about-ncj>



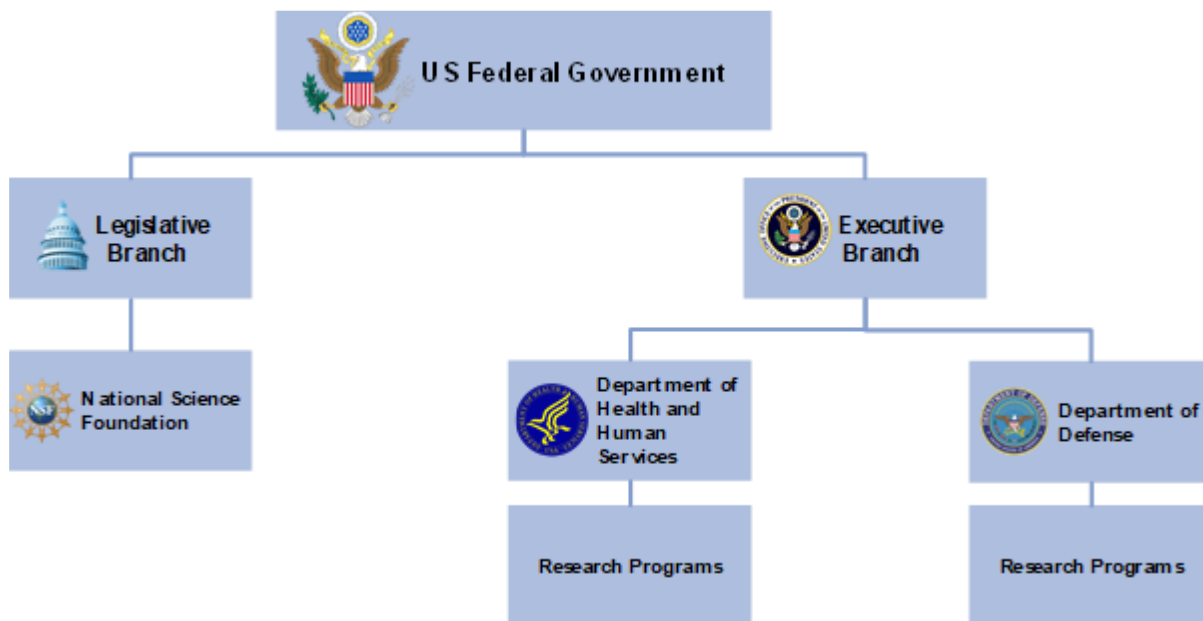


Figure 5 - US Government Organizational Chart

4.1.1. Department of Health and Human Services (HHS)

The US HHS is comprised of several agencies that provide funding for initiatives and programs to promote cancer research. Among those, there are two that particularly stand out: National Institutes of Health and Centers for Disease Control and Prevention.

National Institutes of Health (NIH)

The NIH, which is part of the US HHS, is the largest public funder of biomedical research in the world, investing more than \$42 billion (nearly €35 billion) a year in R&D activities⁹².

NIH Grants and Funding	
International Collaboration	<p>In general, foreign institutions and international organizations, including public and private non-profit or for-profit organizations, are eligible to apply for NIH research project grants. Foreign institutions and international organizations are not eligible to apply for Kirschstein-NRSA institutional research training grants, program project grants, center grants, resource grants, SBIR/STTR grants, or construction grants.</p> <p>European researchers could review the Eligibility section of the Funding Opportunity Announcement (FOA) to determine whether their non-US entity is eligible to apply to that particular FOA⁹³.</p>

⁹² https://grants.nih.gov/grants/about_grants.htm

⁹³ <https://grants.nih.gov/grants/who-is-eligible.htm>

National Cancer Institute (NCI): In the US, most cancer research is publicly funded through the NCI. The NCI is one of the 27 institutes and centers that comprise the US National Institutes of Health, which is a component of the US Department of Health and Human Services⁹⁴. The NCI is focused on supporting research, training and information dissemination activities through the provision of grants⁹⁵. Furthermore, the NCI leads the National Cancer Program and is the largest funder of cancer research in the world⁹⁶. Each year the NCI issues grants to support cancer research and clinical trials⁹⁷. Currently, the NCI provides three different types of funding opportunities: Requests For Applications (RFA)⁹⁸ that provide funding for several areas of cancer research⁹⁹; NCI and Trans-NIH Initiatives that offer funding for specific areas of cancer research¹⁰⁰; and Requests for Proposals for Contracts that provide opportunities for contract funding¹⁰¹. In addition, the NCI supports advances on cancer research through 12 different programs: Cancer Biology Research, Cancer Genomics Research, Research on Causes of Cancer, Cancer Diagnosis Research, Cancer Prevention Research, Cancer Screening and Early Detection Research, Cancer Treatment Research, Public Health Research and Cancer, Cancer Health Disparities Research, Childhood Cancers Research, Global Burden of Cancer, and Clinical Trials¹⁰².

NCI aims to partner with Foreign Governments in order to establish ongoing collaborations with foreign scientists and foster exchanges of clinicians and scientists focused on cancer research¹⁰³. In this context, the NCI Center for Global Health (CGH) was created in 2011 to promote international cancer research and cancer control¹⁰⁴. The CGH facilitates global collaboration with the NCI by leveraging research resources with US government agencies, foreign governments, non-government organizations, and pharmaceutical and biotechnology companies¹⁰⁵.

First Approach	
Information about Funding Opportunities	European researchers interested in CGH and NCI grants could contact Dr. Satish Gopal
Contact	Dr. Satish Gopal
Email	satish.gopal@nih.gov
Phone Number	(240)-276-5810
Internet link	www.cancer.gov/grants-training/grants-funding/contacts

⁹⁴ www.cancer.gov/grants-training

⁹⁵ <https://www.cancer.gov/about-nci>

⁹⁶ <https://www.cancer.gov/about-nci/overview>

⁹⁷ <https://www.cancer.gov/grants-training/grants-funding/funding-strategy>

⁹⁸ A type of solicitation notice in which an organization announces that grant funding is available, and allows researchers and other organizations to present bids on how the funding could be used.

⁹⁹ <https://deais.nci.nih.gov/foastatus/>

¹⁰⁰ <https://deais.nci.nih.gov/foastatus/?mech=R01,R21>

¹⁰¹ https://ncioa.cancer.gov/oa-internet/appl/rfp/published_rfps.jsp

¹⁰² <https://www.cancer.gov/research/areas/>

¹⁰³ <https://www.cancer.gov/about-nci/organization/cgh>

¹⁰⁴ <https://www.cancer.gov/about-nci/organization/cgh/research-training>

¹⁰⁵ <https://www.cancer.gov/grants-training/grants-funding/contacts>



Cancer Moonshot Initiative: The Cancer Moonshot is a NCI Key Initiative that aims to accelerate cancer research and improve its prevention and early stage detection¹⁰⁶. The NCI accepts applications for research grants that support the Cancer Moonshot Blue Ribbon Panel recommendations, which aim to accelerate progress in cancer research and lead to improved cancer prevention, detection, and treatment¹⁰⁷.

First Approach	
Information about Funding Opportunities	European researchers interested in participating in this initiative could look for administrative information and application requirements through the FOAs. For further information European researchers could contact the Scientific/Research Contacts identified in the FOAs.
Internet link	www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative/funding

RAS Initiative: The RAS Initiative was established by the NCI in 2013 with the aim to explore new approaches for attacking the proteins encoded by mutant forms of RAS genes and to ultimately develop innovative and effective treatments for RAS-related cancers¹⁰⁸. The RAS Initiative is also focused on promoting connections among researchers in order to foster the development of new ideas and technologies that could contribute to innovative treatments for RAR-related cancer diseases. Thus, the initiative activities are conducted at the Frederick National Laboratory for Cancer Research (FNLCR) Hub¹⁰⁹. In addition, the RAS Initiative promotes cooperation among researchers from all sectors to work together to attack mutant RAS-driven cancers¹¹⁰.

First Approach	
Contact	European researchers interested in participating in this initiative could contact the Partnership Development Office, Leidos Biomedical Research, Inc./ FNLCR, Vladimir Popov.
Email	vladimir.popov@nih.gov
Phone Number	(301) 360-3401
Internet link	www.cancer.gov/grants-training/grants-funding/funding-opportunities#special-initiatives

¹⁰⁶<https://www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative>

¹⁰⁷<https://www.cancer.gov/grants-training/grants-funding/funding-opportunities>

¹⁰⁸<https://www.cancer.gov/research/key-initiatives/ras>

¹⁰⁹<https://www.cancer.gov/research/key-initiatives/ras/spokes-funding>

¹¹⁰www.cancer.gov/grants-training/grants-funding/funding-opportunities#special-initiatives

Provocative Questions (PQ) Program: The PQ Program aims to foster research projects designed to use innovative research strategies to solve specific problems in cancer research identified by the NCI and currently ignored, paradoxical or difficult to address¹¹¹. The PQ Program includes six RAFs of identical scientific scope. Each of the 6 RAFs has specific basic requirements and a total amount of set-aside funds for 2018¹¹².

First Approach	
Contact	European researchers interested in the PQ initiative could contact the Contact Point, Sean Hanlon. Comprehensive information on all the submission requirements, including page limits, special sections, and responsiveness criteria, as well as set-aside funds, and the anticipated number of awards are also available in the FOA documents ¹¹³ .
Email	sean.hanlon@nih.gov
Internet link	https://provocativequestions.nci.nih.gov/contact-us

Centers for Disease Control and Prevention

Centers for Disease Control and Prevention’s Division of Cancer Prevention and Control (DCPC): The DCPC is a national initiative that aims to conduct and support research intended to help the cancer community to better understand the reasons that increase cancer risk and identify opportunities to prevent cancer¹¹⁴. In the context of this initiative, the CDC provides grants and cooperative agreements to support research and non-research public health programs that are aligned with the CDC’s public health mission both domestically and globally. In 2020, the Office of Grants Services (OGS) supported 5,008 grant awards to 1,861 recipients¹¹⁵.

First Approach	
Information about Funding Opportunities	CDC’s awards and administers grants and cooperative agreements to state and local governments, foreign ministries and associations, domestic non-profits/educational institutions, and domestic for-profit groups.
International Collaboration	The eligibility criteria for CDC’s funding opportunities can be found in the FOAs listed on www.grants.gov . Each FOA outlines who is eligible to apply, special eligibility requirements, and the justification for eligibility ¹¹⁶ .
Email	https://wwwn.cdc.gov/DCS/ContactUs/Form (Contact Form)
Internet link	www.cdc.gov/grants/aboutcdcgrants/index.html

¹¹¹<https://provocativequestions.nci.nih.gov/about-pqs/mission>

¹¹²<https://provocativequestions.nci.nih.gov/pq-funding-opportunity-information/funding-overview>

¹¹³<https://provocativequestions.nci.nih.gov/pq-funding-opportunity-information/funding-overview>

¹¹⁴<https://www.cdc.gov/cancer/dcpc/about/>

¹¹⁵<https://www.cdc.gov/grants/index.html>

¹¹⁶<https://www.cdc.gov/funding/DetermineYourFundingEligibility.html>

4.1.2. Department of Defense (DoD)

The US Army, on behalf of the DoD, administers several federally funded programs focused on cancer research. These programs include awards that are attributed to extramural investigators, who are selected through a two-stage external peer review process that includes scientists, clinicians, and consumer advocates¹¹⁷.

DoD Grants and Funding	
International Collaboration	The DoD foreign eligibility criteria depend on the level of sensitivity of the researchers and the specific policy of each agency. The authorizing legislation and agency policies will determine whether a foreign individual or organization may apply for a specific grant ¹¹⁸ .

Congressionally Directed Medical Research Program (CDMRP)

Prostate Cancer Research Program (PCRP): The PCRP aims to promote research in different areas that include: biomarker development; genetics; imaging, resistance mechanisms; survivorship and palliative care; therapy; tumor and microenvironment biology. Each year, the PCRP issues new grant opportunities to national and international organizations to advance prostate cancer prevention, diagnosis and treatment as well as to develop strategies to improve the quality of life of patients with prostate cancer^{119,120,121}.

First Approach	
Information about Funding Opportunities	European researchers interested in the PCRP could contact the point of contact identified in the FOA's.
Emails	cdmrpwebmaster@cdmrp.org ; help@ebrap.org
Internet link	http://cdmrp.army.mil/funding/pcrp

Breast Cancer Research Program (BCRP): The BCRP aims to challenge the research community to conduct research focused on developing innovative treatments for breast cancer diseases. Therefore, this initiative is focused on research activities for improving breast cancer prevention, diagnosis, prognosis and treatment¹²². Each year, the BCRP issues new grant opportunities to national and international organizations in order to support breast cancer research^{123,124}.

¹¹⁷ <https://www.nap.edu/read/11089/chapter/3>

¹¹⁸ <https://www.grants.gov/web/grants/learn-grants/grant-eligibility.html>

¹¹⁹ <http://cdmrp.army.mil/funding/pcrp>

¹²⁰ <http://cdmrp.army.mil/funding/pa/FY17-PCRP-GAI.pdf>

¹²¹ <http://cdmrp.army.mil/pcrp/>

¹²² <http://cdmrp.army.mil/bcrp/default>

¹²³ <http://cdmrp.army.mil/funding/pa/FY17-BCRP-GAI2.pdf>

¹²⁴ <http://cdmrp.army.mil/funding/bcrp>



First Approach	
Information about Funding Opportunities	European researchers interested in the BCRP could contact the point of contact identified in the FOA's.
Emails	cdmrpwebmaster@cdmrp.org ; help@ebrap.org
Internet link	http://cdmrp.army.mil/funding/bcrp

Kidney Cancer Research Program (KCRP): The KCRP was established in 2017 with the aim to address issues regarding prevention, detection, treatment, and the long-term effects of treatment for kidney cancer for service members, veterans, and the American population in general. Only in 2017, the US Congress directed \$10 million (nearly €9 million) for the DoD to fund kidney cancer research. Each year, the KCRP issues new grant opportunities to national and international organizations in order to support kidney cancer research^{125,126}.

First Approach	
Information about Funding Opportunities	European researchers interested in the KCRP could contact the point of contact identified in the FOA's.
Emails	cdmrpwebmaster@cdmrp.org ; help@ebrap.org
Internet link	http://cdmrp.army.mil/funding/kcrp

4.1.3. National Science Foundation (NSF)

The NSF provides support through grants and cooperative agreements to universities, businesses, informal science organizations and other research organizations focused on areas that are most likely to result in considerable technological progress¹²⁷. The NSF funds initiatives that aim to advance research that contributes to the scientific community's better understanding of cancer and its treatment, such as the Smart and Connected Health (SCH) Program and the Genetic Mechanisms Program¹²⁸.

The NSF supports cooperative research between universities and industry, as well as US researchers' participation in international scientific and engineering research activities. Collaboration between US researchers and European researchers can be funded in almost all new proposals to NSF or in supplements to existing NSF awards. Thus, European researchers interested in collaborating with US

¹²⁵<http://cdmrp.army.mil/funding/kcrp>

¹²⁶<http://cdmrp.army.mil/funding/pa/FY17-KCRP-CDA.pdf>

¹²⁷<https://www.nsf.gov/about/how.jsp>

¹²⁸https://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=137974



researchers could ask their US counterparts to contact the NSF disciplinary program officer or use the Office of International Science and Engineering (OISE) Regional and Country Contacts to inquire about funding possibilities¹²⁹.

First Approach	
European Union OISE Regional Contact	eeinfo@nsf.gov
International Collaboration	OISE fosters institutional partnerships throughout the global science and engineering research and education community, and it supports international collaborations in NSF's priority research areas. OISE encourages funding applicants to include an international component in proposals submitted to the appropriate research directorate ¹³⁰ .
Internet links	www.nsf.gov/od/oise/country-list.jsp ; www.nsf.gov/od/oise/europe/

¹²⁹<https://www.nsf.gov/od/oise/europe/>

¹³⁰<https://www.nsf.gov/od/oise/about.jsp>



4.2. Private initiatives/programs

Even though share of funding for promoting cancer R&D from private organizations has been growing in the US, it is not always the case for certain regions of the country. According to a research handbook conducted by KPMG, for every \$1.00 provided by NIH in the state of Massachusetts, its life sciences industry attracted \$1.32 of venture capital; whereas for every \$1.00 of NIH funds provided to New York State, its life sciences industry only secured \$0.06 of venture capital¹³¹.

In regard to private funding, there are some non-federal organizations that particularly stand out due to the large amount of funds they provide in support of cancer R&D initiatives and programs, namely: American Society of Cancer, Breast Cancer Research Foundation and Prostate Cancer Foundation. Annex 1 includes some funding details of other US private organizations - Cancer Research Institute, Conquer Cancer Foundation, American Brain Tumor Association and The Leukemia and Lymphoma Society - which also provide funds for cancer R&D and therefore play an important role in the US cancer research progress.

4.2.1. American Cancer Society (ACS)

Currently, the ACS is the largest private, not-for-profit source of funds for cancer research. The Society funds are highly focused on peer-reviewed proposals in areas that are considered crucial to prevent and cure cancer. The ACS aims to promote the next generation cancer research and develop a strong foundation of preliminary evidence to make scientific breakthroughs¹³².

The ACS provides Research Grants for Independent Investigators, Mentored Research Grants, Health Professional Training Grants and Professor Grants and International Fellowships in seven main cancer fields: biology, etiology, prevention, early detection, diagnosis and prognosis, treatment, cancer control, survivorship and outcomes research, and scientific model systems^{133, 134}. The ACS International Fellowships are awarded with the aim of fostering a bi-directional flow of knowledge and experience between the US and other countries¹³⁵.

First Approach

¹³¹<https://pfnyc.org/wp-content/uploads/2020/02/New-Yorks-Next-Big-Industry-Commercial-Life-Sciences-Partnership-Fund-for-New-York-City.pdf>

¹³²www.cancer.org/research/we-fund-cancer-research.html

¹³³<https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant/grant-types.html>

¹³⁴<https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant/types-of-cancer-research.html>

¹³⁵<https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant/grant-types.html>



Information about Funding Opportunities	European researchers interested in the ACS's grants and fellowships could contact the ACS through the following email: grants@cancer.org
International Collaboration	Research Scholar Grants Eligibility: Independent investigators in the first 6 years of an independent research career or faculty appointment are eligible to apply. Eligibility is extended for 8 years for clinician scientists who remain active in clinical care ¹³⁶ . Applicants who are uncertain about their eligibility status may request a review to the following email: grants@cancer.org ¹³⁷ .
Internet link	www.cancer.org/research/we-fund-cancer-research/apply-research-grant.html

4.2.2. Breast Cancer Research Foundation (BCRF)

The BCRF is a nonprofit organization that aims to foster research for promoting breast cancer prevention and treatment. Thus, the Foundation primarily supports cancer research related to tumor biology, genetics, prevention, treatment, metastasis and survivorship¹³⁸.

Only in 2018, BCRF awarded \$63 million in grants to support the work of nearly 300 scientists at leading medical and academic institutions across 14 countries, making BCRF the largest private funder of breast cancer research worldwide¹³⁹. The BCRF encourages innovative collaborations focused on activities to research breast cancer prevention and treatment. Grants are awarded on an annual basis, but grantees can be invited for renewal depending on the research progress and relevance of the topic¹⁴⁰.

First Approach	
International Collaboration	The BCRF provides grants for US and International researchers. AACR membership is required ¹⁴¹ .
Contact Person	European researchers interested in international collaborations could contact the Scientific Director, Dr. Larry Norton ¹⁴²
Email	nortonl@mskcc.org ; bcrf@bcrf.org
Phone Number	(646) 888-5319
Internet link	www.bcrf.org/grant-guidelines

¹³⁶ <https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant/grant-types/research-scholar-grants.html>

¹³⁷ <https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant/grant-types.html>

¹³⁸ www.bcrf.org/grant-guidelines

¹³⁹ <https://www.bcrf.org/about>

¹⁴⁰ <https://www.bcrf.org/grant-guidelines>

¹⁴¹ <http://www.aacr.org/Funding/Pages/Funding-Detail.aspx?ItemID=71#.WoxL-6jFIu>

¹⁴² <https://www.bcrf.org/researchers/larry-norton>

4.2.3. Prostate Cancer Foundation (PCF)

The PCF is a philanthropic organization focused on advancing research on prostate cancer diagnosis and treatment. The PCF is highly focused on funding innovative prostate cancer projects that could lead to new advancements and improve patient care and treatment¹⁴³. PCF grant funding has led directly to many advances in important fields, such as cancer genetics, biomarkers, targeted therapies, nutrition, prevention and metastases treatment¹⁴⁴.

In this context, the PCF created the PCF Human Capital Initiative, which includes awards that aim to identify and support next generation cancer research: Young Investigator Awards, PCF Creativity Awards, PCF Challenge Awards and Recognition Awards¹⁴⁵.

First Approach	
International Collaboration	European researchers could analyze the details on eligibility requirements for each RFA.
Contact Person	European researchers interested in PCF's awards could contact the PCF through the following email: applications@pcf.org
Internet link	www.pcf.org/c/open-rfas/

¹⁴³<https://www.pcf.org/about-us/>

¹⁴⁴<https://www.pcf.org/c/research-accomplishments/>

¹⁴⁵<https://www.pcf.org/c/funding-strategy/>

5 Observations

It can be concluded that the US is one of the global leaders concerning cancer research. The US cancer research landscape encompasses world leading universities, and globally acclaimed research centers and industry clusters. These research actors are mostly located in the northeast region of the US, particularly in the states of Maryland, Massachusetts, Michigan, New York and Pennsylvania. However, there is also a high concentration of actors in San Francisco, California, since it is simultaneously home to at least a globally recognized university cancer research group, two country leading cancer research centers and an important industry cluster focused on cancer research.

In regards to the cancer research players, it is important to highlight that cancer research requires an interdisciplinary team because, in fact, cancer consists of numerous diseases that have different causes, risk factors, prognosis and treatments. In addition, a cancer disease is a multi-factorial disease, so several medical specialties are required for cancer research activities. This is the reason why research networks, professional associations and networking events are so crucial for cancer research. They provide an opportunity for the different cancer-related professionals and researchers to share knowledge and information for progressing cancer research more efficiently and in a timely manner.

Public funding for cancer research has been leading to significant advances in cancer prevention, detection, diagnosis, treatment, and quality of life for patients. This is primarily due to the US government recognizing the importance of cancer research and allocating funds for cancer research. In the case of the US public funding concerning cancer research, most of the funding is provided by federal agencies that then allocate a certain budget to several research organizations which are distributed nation-wide.

Since cancer has a major societal burden, private funds and initiatives also have a very important role in fostering cancer research through the award of grants. Private funding has been increasing for research and consequently is playing a growing role. Nevertheless, public funding remains crucial to support high-risk and pioneering cancer research.

Overall, both public and private organizations funding cancer research in the US are highly committed in supporting international cooperation, as they clearly state that the funds they provide are eligible to foreign organizations. NCI, which is believed to be the public agency that provides more funds to cancer research activities in the US, is opened to providing resources to foreign governments. In parallel, the ACS, the largest private not-for-profit source of funds for cancer research, awards international fellowships with the aim of fostering a bi-directional flow of knowledge and experience between the US and other countries.



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Euussciencetechnology.eu. Available at: <https://www.euussciencetechnology.eu/assets/content/BILATUSA4.0%20-USFunding%20Opportunities%20for%20EU%20Researchers.pdf> (Accessed: June 30, 2021).

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Annex 1: Examples of US Federal and Private Funding Initiatives and Programs

Table A1 - Examples of US Federal and State Funding Initiatives and Programs

Agencies	Programs/ Initiatives	Relevant Research Areas	Contact Info	Internet link
Federal Initiatives and Programs				
HHS	NCI grants	Cancer prevention, diagnosis, prognosis and treatment	Dr. Satish Gopal: satish.gopal@nih.gov ; (240)-276-5810	www.cancer.gov/grants-training
	Cancer Moonshot Initiative	Cancer prevention, diagnosis and treatment	Contact the point of contact identified in the funding opportunities www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative/funding	www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative
	RAS Initiative	Cancer treatment	Vladimir Popov.: Vladimir.Popov@nih.gov. (301) 360-3401	www.cancer.gov/research/key-initiatives/ras



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Agencies	Programs/ Initiatives	Relevant Research Areas	Contact Info	Internet link
	PQ Program	Cancer prevention, diagnosis, prognosis and treatment	Sean Hanlon: sean.hanlon@nih.gov	https://provocativequestions.nci.nih.gov/pq-funding-opportunity-information/funding-overview
	DCPC grants	Cancer Prevention	Contact the point of contact identified in the funding opportunities: www.cdc.gov/grants/aboutcdcgrants/index.html	www.cdc.gov/grants/aboutcdcgrants/index.html
DOD	PCRP	Cancer prevention, diagnosis and treatment	cdmrpwebmaster@cdmrp.org Help@ebrap.org	http://cdmrp.army.mil/funding/pcrp
	BCRP	Cancer prevention, diagnosis, prognosis and treatment	cdmrpwebmaster@cdmrp.org Help@ebrap.org	http://cdmrp.army.mil/funding/bcrp
	KCRP	Cancer prevention and treatment	cdmrpwebmaster@cdmrp.org Help@ebrap.org	http://cdmrp.army.mil/funding/kcrp
NSF	NSF awards	Cancer prevention, diagnosis, prognosis and treatment	eeinfo@nsf.gov	www.nsf.gov/od/oise/country-list.jsp ; www.nsf.gov/od/oise/europe/



Agencies	Programs/ Initiatives	Relevant Research Areas	Contact Info	Internet link
<u>Private Initiatives and Programs</u>				
ACS	ACS grants and fellowships	Cancer prevention, diagnosis, prognosis and treatment	grants@cancer.org	www.cancer.org/research/we-fund-cancer-research.html
BCRF	BCRF grants	Cancer prevention and treatment	Larry Norton: nortonl@mskcc.org ; (646) 888-5319	www.bcrf.org/grant-guidelines
PCF	PCF grants	Cancer diagnosis and treatment	applications@pcf.org	www.pcf.org/c/funding-strategy/
Leidos	OnPAR	Cancer prevention, diagnosis, prognosis and treatment	OnPAR@leidos.com	https://onpar.leidosweb.com/about-onpar/
AACR	Stand Up to Cancer (SU2C) Basic Cancer Research Fellowships Travel Grants for early-career scientists to attend AACR Annual Meetings Scientific Achievement Awards and Lectureships	Cancer prevention, diagnosis, prognosis and treatment	foundation@aacr.org ; (215) 440-9300	https://aacrfoundation.org/Research/Pages/research-we-fund.aspx



Agencies	Programs/ Initiatives	Relevant Research Areas	Contact Info	Internet link
Cancer Research Institute	CRI Irvington Postdoctoral Fellowship Program Clinic and Laboratory Integration Program Grants	Cancer prevention and treatment	(800) 992-2623	https://www.cancerresearch.org/scientists/fellows-hips-grants
Conquer Cancer Foundation	International Development and Education Awards International Innovation Grants Long Term International Fellowship Advanced Clinical Research Award	Cancer prevention and treatment	grants@conquer.org ; (571) 483-1700	https://www.conquercancerfoundation.org/grants-awards/funding-opportunities
American Brain Tumor Association	ABTA Research Collaboration Grant Program ABTA Basic Research Fellowship Program ABTA Discovery Grant Program Medical Student Summer Fellowship Program	Cancer prevention, diagnosis, prognosis and treatment	info@abta.org ; (773) 577-8750	http://www.abta.org/brain-tumor-research/research-grants/
The Leukemia and Lymphoma Society	Translational Research Program Career Development Program Specialized Center for Research grants	Cancer treatment	http://forms.lls.org/FormRenderer/Form?UID=LLS-26-756&url=http://www.lls.org/aboutlls/contactus/contactus_form/&pageTrackerID=UA ; (800) 955-4572	http://www.lls.org/academic-grants http://www.lls.org/grant-finder





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