



PERSONNEL AND
READINESS

UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

FEB - 8 2023

The Honorable Jon Tester
Chairman
Subcommittee on Defense
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The Department's response to House Report 116-453, pages 332-333, accompanying H.R. 7617, the Department of Defense Appropriations Bill, 2021, "Peer-Reviewed Cancer Research Programs," is enclosed.

The report covers fiscal year (FY) 2021 congressional appropriations for the Peer-Reviewed Cancer Research Program (PRCRP) (\$115 million), provides an overview of FY 2009-FY 2020 PRCRP research outcomes, and summarizes the projects selected for FY 2021 funding, including topic areas and relevance to military health. The FY 2021 PRCRP Programmatic Panel selected 71 applications for funding, representing 86 separate awards, (17.5 percent of compliant applications received) based on scientific peer-review ratings, a balanced portfolio, programmatic intent, and relevance to military health. Through analyses of military health needs, topic area research, patient outcome gaps, and Federal and non-Federal funding landscapes, the FY 2021 PRCRP funded innovative and impactful research to support Service members and their families.

Thank you for your continued strong support for the health and well-being of our Service members, veterans, and their families. I am sending similar letters to the other congressional defense committees.

Sincerely,

A handwritten signature in black ink, appearing to read "Gilbert R. Cisneros, Jr.", written in a cursive style.

Gilbert R. Cisneros, Jr.

Enclosure:
As stated

cc:
The Honorable Susan Collins
Ranking Member



PERSONNEL AND
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UNDER SECRETARY OF DEFENSE

4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

FEB - 8 2023

The Honorable Ken Calvert
Chairman
Subcommittee on Defense
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

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cc:
The Honorable Betty McCollum
Ranking Member



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FEB - 8 2023

The Honorable Jack Reed
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

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cc:
The Honorable Roger F. Wicker
Ranking Member



PERSONNEL AND
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UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

FEB - 8 2023

The Honorable Mike D. Rogers
Chairman
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

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Enclosure:
As stated

cc:
The Honorable Adam Smith
Ranking Member

Report to the Congressional Defense Committees



In Response to: House Report 116–453, Pages 332-333, Accompanying H.R. 7617, the Department of Defense Appropriations Bill, 2021, “ Peer-Reviewed Cancer Research Program”

January 2023

The estimated cost of this report for the Department of Defense (DoD) is approximately \$6,300.00 for Fiscal Years 2022–2023. This includes \$3,200.00 in expenses and \$3,100.00 in DoD labor.

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BACKGROUND AND PURPOSE

This report is in response to House Report 116–453, pages 332-333, accompanying H.R. 7617, the Department of Defense Appropriations Bill, 2021, which requests that the Assistant Secretary of Defense for Health Affairs provide a report to the congressional defense committees on the status of the Peer Reviewed Cancer Research Program (PRCRP). For each research area, the report includes the funding amount awarded, progress of the research, and relevance of the research to Service members and their families.

The Defense Health Agency manages the Defense Health Program (DHP) Research, Development, Test and Evaluation (RDT&E) appropriations. The U.S. Army Medical Research and Development Command (USAMRDC) provides execution management for the DHP RDT&E PRCRP Congressional Special Interest funds.

FISCAL YEAR 2021 PRCRP INTRODUCTION AND STATUS

Congressional language specifies the appropriated dollar amount for Fiscal Year (FY) 2021 PRCRP and indicates the different Topic Areas (Table 1).

Table 1. FY 2021 PRCRP Topic Areas

• Bladder Cancer	• Germ Cell Cancers*	• Neuroblastoma
• Blood Cancers	• Head and Neck Cancers	• Pediatric, Adolescent, and Young Adult Cancers [‡]
• Brain Cancer	• Link between Scleroderma and Cancer*	• Pediatric Brain Tumors
• Cancers Associated with the Use of Beryllium*	• Liver Cancer	• Sarcoma*
• Colorectal Cancer	• Lymphoma [‡]	• Stomach Cancer
• Endometrial Cancer*	• Mesothelioma	• Thyroid Cancer*
• Esophageal Cancer	• Metastatic Cancers	

*New for FY 2021

‡Returning for FY 2021

[‡]Research focused on children (ages 0–14 years), adolescents (ages 15–24 years), and/or young adults (ages 25–39 years)

VISION SETTING

In response to the congressional language, the PRCRP holds an annual investment strategy meeting (Vision Setting) to review the research landscape, including Federal and non-Federal research funding of the specified topic areas for that fiscal year, the knowledge and product gaps in cancer research and care, and the relevance of cancer research to military health.

Coordination with other Federal and non-Federal agencies enables the identification of research areas for investment to optimize the impact of cancer research and care efforts.

During the FY 2021 PRCRP Vision Setting, the programmatic panel members (i.e., clinicians, scientists, veterans, active duty military oncologists, and patients) identified a list of FY 2021 PRCRP Overarching Challenges in the current spectrum of cancer research to inform development of a strategy to close research gaps. The Overarching Challenges represent a new way for the PRCRP to link different gaps in cancer research and patient care across the different topic areas.

FY 2021 PRCRP Overarching Challenges:

- Develop strategies and biomarkers to predict cancer risk, treatment resistance, recurrence, and advanced disease to mitigate risk in target populations.
- Improve prevention strategies, diagnosis, treatment, and outcomes for patients in underserved or under recognized populations.
- Transform cancer treatment through the identification of novel biomarkers and new targets, especially for advanced disease (metastatic and/or recurrence); improve immunotherapy; and eliminate the risks of therapy-associated toxicity.
- Identify and understand the unique and novel features driving cancer presentation to improve outcomes across the spectrum of ages (e.g., children, adolescents, young adults, older adults).
- Identify and understand the mechanisms behind cancer epigenetics, biological development, etiology, and genetic basis.
- Develop strategies to improve ease of care/accessibility and address survivorship issues including quality of life, long-term treatment effects, psychological impact of recurrence, neurocognitive deficits, and overall mental health.
- Develop and improve minimally invasive methods to detect cancer initiation, recurrence, and progression.
- Develop open access platform(s) or methods to coordinate and integrate multiple databases, biorepositories, and data-sharing interfaces.

Each applicant must respond to at least one of the FY 2021 PRCRP Overarching Challenges. This positions the PRCRP to invest in research gaps identified during the Vision Setting. During Vision Setting, the FY 2021 PRCRP Programmatic Panel recommended the best award mechanisms to achieve the vision of the PRCRP and most effectively address the FY 2021 PRCRP Overarching Challenges. Table 2 presents the types of award mechanisms offered in FY 2021 by the PRCRP.

Table 2. FY 2021 PRCRP Funding Opportunities

FY 2021 Award Mechanism	Intent	Research Costs per Award
Idea Award	Studies focused on innovation	\$500,000
Career Development Award – Fellow Option	Advance cancer research by developing early-career investigators	\$400,000
Impact Award	Studies focused on near-term clinical impact	\$1,25,000
Translational Team Science Award	Correlative studies focused on informing the clinic	\$2,500,000
Behavioral Health Science Award	Studies intended to improve survivorship and patient outcomes	\$1,000,000

Congressional language requested that PRCRP-funded research be relevant to Service members and their families. The PRCRP devised a FY 2021 investment strategy to address military health concerns that prioritizes protection against force vulnerabilities. The FY 2021 PRCRP addressed these core capabilities by *requiring* that all applications address at least one of the FY 2021 PRCRP relevant military health focus Areas, presented in Table 3.

Table 3. FY 2021 Relevance to Military Health Focus Areas

Environmental Exposures	<ul style="list-style-type: none"> • Environmental/exposure risk factors associated with cancer
Mission Readiness	<ul style="list-style-type: none"> • Gaps in cancer prevention, early detection/diagnosis, prognosis, and/or treatment that may affect the general population, but have a particularly profound impact on the health and well-being of military Service members, veterans, and their beneficiaries • Gaps in quality of life and/or survivorship that may affect the general population, but have a particularly profound impact on the health and well-being of military Service members, veterans, and their beneficiaries

APPLICATION REVIEW PROCESS

Following receipt of applications, the PRCRP uses the Congressionally Directed Medical Research Programs (CDMRP) two-tier review process to evaluate and recommend final awards for funding. To ensure that each program’s research portfolio reflects not only the most meritorious science, but also the most programmatically relevant research, the CDMRP developed this two-tier model based upon recommendations from a 1993 report issued by the National Academy of Medicine (formerly the Institute of Medicine).

The first tier of review entails a scientific peer review of the applications received for funding. An external panel, recruited specifically for each peer review session, conducts these reviews. The panel incorporates the expertise of scientists, clinicians, military members, and consumers (lay persons with experience in cancer either as patients or caregivers). The peer review process evaluates the applications based on established scientific and technical criteria as delineated in each program announcement/funding opportunity.

The second tier of review, the programmatic review, involves a programmatic panel. The PRCRP Programmatic Panel includes scientists, clinicians, military members, and consumers who are lay persons with experience in cancer, either as patients or caregivers (<https://cdmrp.health.mil/prcrp/panels/panels>). The panel assesses the applications based on their scientific peer-reviewed ratings, portfolio composition, programmatic intent, and relevance to congressional language. Following, the experts recommend applications for funding that are scientifically sound and best meet the program’s interests and goals to the Commanding General, USAMRDC.

During October–November 2021, CDMRP convened the FY 2021 PRCRP peer review panels. The panels used peer review criteria to evaluate applications that included technical merit and impact on patient outcomes. During December 2021–February 2022, CDMRP convened the FY 2021 PRCRP Programmatic Panel for programmatic review. These experts assessed the applications based on their respective scientific peer-reviewed ratings and relevance to military health, and compared each peer-reviewed application with the portfolio composition and intent of the published program announcement to ensure a balanced portfolio and alignment with programmatic intent. The FY 2021 PRCRP programmatic review considered each FY 2021 PRCRP Topic Area, Overarching Challenges, impact, and award mechanism-specific criteria to ensure a balanced portfolio. Following, the experts recommended applications that were scientifically sound and best met the program’s interests and goals.

In FY 2021, the PRCRP funded 71 applications (representing 86 separate awards) of the 491 full applications received, for a 17.5 percent funding rate totaling \$102,708,258. The remaining \$12,291,742 of the FY 2021 PRCRP appropriation is directed toward administrative and management costs in support of these PRCRP projects and Department of Defense (DoD) withholds, including USAMRDC withholds, Small Business Innovation Research (SBIR)/Small Business Technology Transfer Programs (STTR) allocations, and CDMRP management costs (Table 4).

Table 4. FY 2021 PRCRP Budget

Budget Allocations*	Amount
FY 2021 PRCRP Congressional Appropriation	\$115,000,000
Less: USAMRDC Withholds	(\$2,223,280)
Less: SBIR/STTR Withholds	(\$3,836,000)
Less: CDMRP Management Costs	(\$6,232,462)
Amount Available for FY 2021 Research	\$102,708,258

Table 5 presents total research recommended for FY 2021 funding, by Topic Area.

Table 5. FY 2021 Total Research Dollars Invested per Topic Area

Topic Area	Number of Awards	Total Award Amount
Bladder Cancer	7	\$7,258,388
Blood Cancer	5	\$4,291,473
Brain Cancer	3	\$4,808,824
Cancers related to the Use of Beryllium*	0	0
Colorectal Cancer	6	\$6,826,690
Endometrial Cancer	4	\$6,512,628
Esophageal Cancer	4	\$4,787,519
Germ Cell Cancers	4	\$3,519,971
Head and Neck Cancers	6	\$5,165,333
Link between Scleroderma and Cancer*	0	0
Liver Cancer	5	\$5,603,897
Lymphoma	6	\$7,013,174
Mesothelioma	4	\$3,598,393
Metastatic Cancers	1	\$1,434,497
Neuroblastoma	5	\$6,448,390
Pediatric, Adolescent, and Young Adult Cancers	10	\$14,034,178
Pediatric Brain Tumors	3	\$3,428,937
Sarcoma	6	\$6,996,169
Stomach Cancer	4	\$5,179,030
Thyroid Cancer	3	\$5,800,767

*No awards were made for these topic areas. Applications received were either not meritorious as determined during the two-tier review or not compliant with congressional language.

The PRCRP awarded all FY 2021 research funds by September 30, 2022. The Department expects outcomes by the end of each period of performance, which spans 2 to 4 years from the start date of an award.

FY 2021 PRCRP TOPIC AREAS: RELEVANCE TO MILITARY HEALTH

Cancer research profoundly impacts the reduction of cancer burden on military families and improves force readiness. Tables 6a and 6b show potential cancer risks and effects on military health. Successful studies may lead to innovative approaches for the prevention of cancer development, improved diagnostic/detection methods, new prognostic information, potentially novel treatments, and better ways to cope with quality of life issues.

ENVIRONMENTAL EXPOSURES




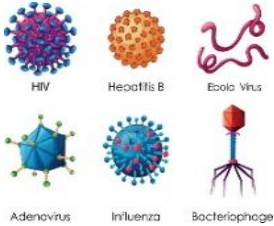
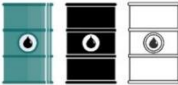


The Department of Veterans Affairs (VA) has acknowledged certain exposures increase cancer risk among Service members and their families.^{1,2} Service members operate in environments that may increase the incidence of multiple cancers immediately or years, if not decades, later. Exposures linked to increased cancer risk include, but are not limited to, chemical weapons, including storage; ionizing radiation; herbicides; electromagnetic fields; jet fuel; organic materials; biological agents; environmental hazards; herbicides; pesticides; air pollutants; burn pits; chemical and biological warfare weapons; and other occupational hazards. Tables 6a and 6b detail the potential carcinogenic agents implicated in cancer and military health. Specific risk levels of exposures may vary depending on the deployment environment. For example, use of exposed asbestos as building material declined in the United States; however, many countries where Service members deploy still use asbestos as key material for housing and building manufacturing.³ Cancers that develop due to asbestos exposure include mesothelioma, cancer of the larynx, pharynx (throat), stomach, colon, and rectum.⁴ A study by the Centers for Disease Control and Prevention reported a rise in mesothelioma deaths by 5 percent from 1999 to 2015.⁵ Asbestos and other elongated mineral particles remain a relevant exposure to military members.

The VA currently recognizes seven categories of associated cancers with Agent Orange exposure. Although the Vietnam War ended in 1975, C-123 airplanes responsible for spraying the pesticide known as Agent Orange stayed in commission until 1982.⁶ The National Academy of Medicine determined that Service members who were not involved in the Vietnam conflict may have been exposed to Agent Orange residue. Reservists who served on these planes are eligible for the Agent Orange Registry and benefits.⁷

The VA recently recognized airborne hazards as a risk factor for many rare respiratory tract cancers. Due to the rarity of some of these cancers, such as cancers of the head and neck, data may not directly demonstrate a causation of military service with cancer incidence. Nonetheless, the VA took action to acknowledge the cancer risk potential for these cancers.⁸

Infectious agents such as *Helicobacter pylori* (stomach cancer), human papillomavirus virus (associated with head and neck cancers, and cancers of the genital tract), and hepatitis (liver cancer) present another area of cancer risk.⁹⁻¹¹


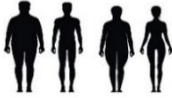

Table 6a. Exposure-Related Cancer Risks*

Environmental or Occupational Exposure-Related Cancer Risks	
Risk	Related Cancer
<p>Agent Orange and other herbicides</p> 	<p>Soft tissue sarcoma, Hodgkin’s lymphoma, non-Hodgkin’s lymphoma, chronic lymphocytic leukemia, multiple myeloma, respiratory, thyroid, bladder cancer</p>
<p>Asbestos</p> 	<p>Mesothelioma, bladder cancer</p>
<p>Radiation</p> 	<p>Leukemias (except chronic lymphocytic leukemia), thyroid, bone, liver, esophageal, stomach, colorectal, bladder, salivary gland, multiple myeloma, brain, lymphoma (except Hodgkin’s lymphoma), endometrial/uterine cancers</p>
<p>Infectious Agents</p> 	<p>Epstein-Barr virus: Lymphoma, oral cavity Hepatitis B and hepatitis C viruses: Liver cancer Human immunodeficiency virus: Kaposi sarcoma, lymphoma, cervical, anal, throat, liver cancer Human papilloma virus: Cervical, head and neck, vulvar, vaginal, penal, anal cancers Human T-cell lymphotropic virus type 1: Adult T-cell lymphoma Helicobacter pylori: Gastric cancer</p>
<p>Industrial Solvents</p> 	<p>Liver, bladder, gastric, blood (leukemia, lymphoma), nasopharyngeal, bone, brain, adrenal cancer</p>
<p>Contaminated Water: Camp Lejeune (1953–1987)</p> 	<p>Leukemia, bladder, esophageal, multiple myeloma, non-Hodgkin’s lymphoma</p>
<p>Chemical Weapons</p> 	<p>Nasopharyngeal, laryngeal, squamous cell carcinoma, acute myeloid leukemia</p>

*See “References for Tables 6a and 6b” section

Service members, their families, veterans, and the American public are also at risk for developing various cancers due to lifestyle choices (Table 6b). The PRCRP remains committed to decreasing the burden of cancer on these populations by funding innovative and high-impact research.

Table 6b. FY 2021 Cancer Risk Factors and Lifestyle*

Additional Cancer Risks	
Risk	Related Cancer
Alcohol 	Oral, esophageal, liver, head and neck, colorectal cancer
Obesity 	Endometrial, esophageal, gastric, liver, colorectal, thyroid cancer
Tobacco 	Oral cavity, esophageal, bladder, stomach, colorectal, cervical, head and neck, adrenal cancers

*See “References for Tables 6a and 6b” section.

MISSION READINESS

A Service member’s cancer diagnosis affects not only the individual Service member, but also the Service member’s entire unit and mission. Each Service member plays a crucial role in mission readiness that may be affected by a cancer diagnosis of the Service member or family member (Tables 6a and 6b). Research that improves survival, while minimizing side effects, will have a major impact on mission readiness by enabling an active duty Service member to return to full duty. Additionally, mission readiness includes ensuring that family members receive world-class healthcare. Service members become affected when a member of their family or support system receives a cancer diagnosis. Time off to assist in the care, recovery, and well-being of family members will affect overall unit force readiness and vulnerabilities.

Cancer not only directly affects the military’s capabilities, but also indirectly places a burden on the Military Health System (MHS). Data provided by the Armed Forces Health Surveillance Branch (AFHSB), based on electronic records within Defense Medical Surveillance System (DMSS), demonstrated the impact of cancer care on the MHS. Table 7 presents MHS medical encounters for select cancer types (2010–2019) within the PRCRP’s topic areas.

Table 7. MHS Medical Encounters for Select Cancers (2010–2019)*

Cancer Type	Patient Category	Number of Patients	Number of Outpatient Encounters	Number of Hospital Bed Days
Bladder Cancer	Active Service members	427	3,107	269
	Other DoD Beneficiaries	66,887	940,960	88,263
Leukemia	Active Service members	1,059	48,162	17,793
	Other DoD Beneficiaries	46,407	1,110,000	194,538
Osteosarcoma	Active Service members	717	10,457	3,064
	Other DoD Beneficiaries	15,020	90,505	24,590
Stomach Cancer	Active Service members	236	3,417	1,737
	Other DoD Beneficiaries	16,546	198,188	64,973
Totals		147,299	2,404,796	395,227

*Data provided by the AFHSB based on electronic records within DMSS. Does not include care received outside the MHS. Includes all MHS inpatient and outpatient encounters where the first (primary) diagnosis was for leukemia. Active Component Service members (ACSM) does not include Activated Reserve and Activated National Guard. This does not include care received while deployed or any care received outside of the MHS that was not processed through TRICARE (i.e., care covered by other insurance sources or care paid for entirely out of pocket). Other DoD beneficiaries include: National Guard/Reserve members; family members of ACSM and National Guard/Reserve members; former Service members; and family members of former Service members.

A report commissioned by The Leukemia & Lymphoma Society found that treatment cost for blood cancers during the first year following diagnosis is \$156,000 per patient.¹² Costs for 3 years of follow-on care vary, depending on blood cancer type (e.g., \$200,000 for chronic leukemia to over \$800,000 for acute leukemia). Other cancers, such as bladder cancer, have mean lifetime costs that can exceed \$200,000.^{13,14} Studies show the costs of national cancer care in 2020 were \$208 billion.¹⁵ The MHS and VA burden includes costs for active duty Service members, their families, veterans, and other military beneficiaries.

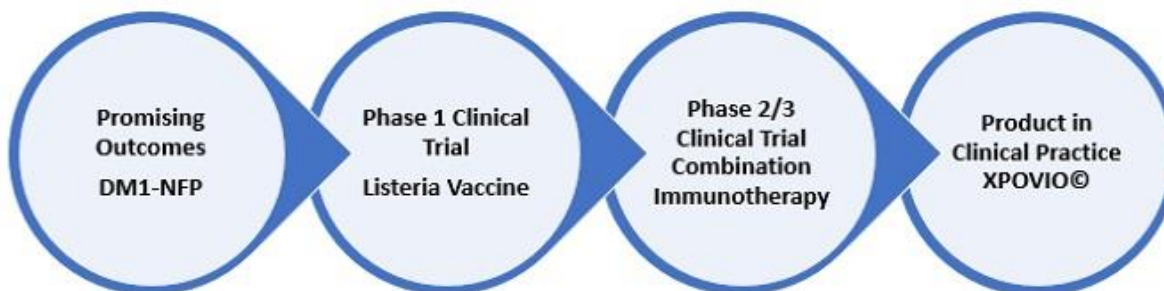
PRCRP CONTRIBUTIONS TO THE CLINICAL RESEARCH PIPELINE

The PRCRP has funded several clinical pipeline projects with potential to have a profound impact on the health of active duty Service members and their families, veterans, and the American public. Table 8 describes selected awards.

Table 8. Select PRCRP Clinical Pipeline Projects

PRCRP Portfolios	Organization	Summary
<p>Neuro-Oncology: Adult Brain Cancer, Pediatric Brain Cancer, and Neuroblastoma</p>	<p>University of Alabama at Birmingham</p>	<p>This project focuses on malignant glioma, a type of brain cancer, including investigation of the anti-glioma responses of IL-12-oncolytic herpes simplex viral therapy. Findings showed PD-1+ CD4+ T cells may be therapeutic biomarkers for predicting which patients with brain tumors will likely benefit from IL12-oHSV immunotherapy.</p>
	<p>University of North Carolina (UNC)</p>	<p>Utilizing a promising Chimeric Antigen Receptor T cell therapy (CAR-T) approach, the team at UNC plans to attack solid pediatric tumors. Though CAR-T continues to remain an elusive therapy for solid tumors, this approach being tested may improve the antitumor activity of CAR-T cells through enhanced survival and efficacy at the tumor site. A Phase 1 trial currently underway tests this new method on children with relapsed/refractory neuroblastoma.</p>
<p>Gastrointestinal Oncology: Colorectal Cancer and Liver Cancer</p>	<p>Thomas Jefferson University/Institute for Cancer Research/ Seattle Institute for Biomedical and Clinical Research</p>	<p>This study focuses on the receptor GUCY2C and its potential to inhibit the development or spread of colorectal cancer (CRC). The prevention strategy trial includes using oral linaclotide, a drug used to treat irritable bowel syndrome, in patients with established adenomas or carcinomas to inhibit CRC.</p>
	<p>Brigham and Women’s Hospital</p>	<p>Using messenger ribonucleic acid (mRNA) nanoparticles to reprogram the tumor microenvironment of liver cancer, this team restored the function of the tumor suppressor, p53, in preclinical laboratory work. This work demonstrated that in combination with immune checkpoint blockade, the p53 mRNA nanoparticle technology led to significantly increased antitumor immune responses in liver cancer models.</p>
<p>Urology Oncology: Bladder Cancer</p>	<p>Cedars-Sinai Medical Center</p>	<p>This team investigated improving outcomes for patients with advanced bladder cancer. Inflammatory mediators released by chemotherapy often cause immunogenic cell death (ICD) or the ability to invoke an immune response to cause cell death. Gemcitabine, a bladder cancer treatment, initiates the inflammatory response, but not ICD, due to inhibition by prostaglandin E2 (PGE2). Using the PGE2 inhibitor celecoxib in combination with gemcitabine, this team overcame the inhibition and sensitized bladder cancer cells to ICD.</p>

SELECTED MAJOR RESEARCH OUTCOMES AND PRODUCTS



Outcome with Promise: The diagnosis of a child with Diffuse Intrinsic Pontine Glioma (DIPG), also known as Diffuse Midline Glioma, is devastating due to its inoperability. DIPG has a one percent survival rate. Research conducted at Weill Cornell Medicine resulted in development of a peptide nanofiber precursor (NFP) system comprised of individual peptide conjugates that self-assemble into a highly stable single-layer structure shown to improve tissue penetration, a much-needed asset for the treatment of DIPG. This project evaluated the ability of NFPs to carry emtansine (DM1), which received approval as a drug for breast cancer treatment and demonstrated effectiveness against other brain cancers, such as glioblastoma multiforme, to treat orthotopically implanted human-derived DIPG tumors in mice. **DM1-NFP** exhibited selective toxicity toward glioma cells, and a single treatment increased survival times in mice. The results of this study are a critical first step in identifying effective treatment methods for DIPG.

Product in Phase 1 Clinical Trial: In the fight against CRC, the team at Thomas Jefferson University used **Listeria-based cancer vaccine** to optimize the immune response in a CRC model. Results demonstrated protection against metastatic spread of CRC to the lungs and led to a Phase 1 clinical trial for CRC patients with minimal residual disease. This Listeria-based vaccine may be the first step in protecting against disease recurrence in CRC but could also lead to more positive outcomes for other cancers, as well.

Product in Phase 2 and 3 Clinical Trial: Novel combinations of immunotherapies are at the leading edge of new cancer treatment regimens. The study conducted at UNC focused on a key mediator of immunotherapy and resulted in ongoing Phase 2 and Phase 3 clinical trials for the combination of **denosumab and other immunotherapeutic agents** for patients with rare and metastatic melanoma.

Product in Clinical Practice: The PRCRP contributed to a groundbreaking achievement for cancer research and military health. The Ohio State University conducted seminal work on the overexpression of a protein called exportin (XPO1), which led to clinical trials to test selinexor as a new treatment for blood cancers. In 2020, the findings led to approval by the Food and Drug Administration of **XPOVIO®** (selinexor), in combination with ibrutinib, as an oral treatment of multiple myeloma and relapsed or refractory diffuse large B-cell lymphoma. Analogues of selinexor are currently under study to improve responses and extend to other blood cancers.

Other accomplishments may be reviewed at the PRCRP webpage for research highlights (<https://cdmrp.health.mil/prcrp/highlights>). Table 9 provides a summary of research outcomes funded by the PRCRP from FY 2009 through FY 2019.

Table 9. Summary of FY 2009–FY 2020 PRCRP Research Outcomes

Reported Research Outcome Type	Number of Outcomes
Follow-On Funding Obtained	256
Patents (including provisional)	104
Presentations	1,547
Publications	1,377
Total Reported Outcomes	3,284

SUMMARY

The PRCRP’s vision is to advance mission readiness of U.S. military members affected by cancer and improve quality of life by decreasing the burden of cancer among Service members, their families, veterans, and the American public. Through analyses of military health needs, gaps in topic area research and patient outcomes, and Federal and non-Federal funding landscapes, the FY 2021 PRCRP responded to congressional language by funding innovative and impactful science to support Service members and their families. In FY 2021, the PRCRP funded 71 applications (representing 86 separate awards) of the 491 full applications received, for a 17.5 percent funding rate totaling \$102,708,258. The FY 2021 PRCRP investment in these awards represents its commitment to advancing the health and well-being of Service members, their families, veterans, and the American public.

REFERENCES

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APPENDIX A: FY 2009–FY 2020 PRCRP APPROPRIATIONS AND TOPIC

Fiscal Year	Appropriation/ (Awards)*	Topic Areas*
2009	\$16M (38)	\$4M, Melanoma and other skin cancers as related to deployments of Service members to areas of high exposure; \$2M, Pediatric brain tumors within the field of childhood cancer research; \$8M, Genetic cancer and its relation to exposure to the various environments that are unique to a military lifestyle; and \$2M, Noninvasive cancer ablation treatment, including selective targeting with nanoparticles
2010	\$15M (30)	Melanoma and other skin cancers; Pediatric brain tumors within the field of childhood cancer research; Genetic cancer research and genomic medicine; Kidney cancer; Blood cancer; Colorectal cancer; <i>Listeria</i> vaccine for cancer; and Radiation protection utilizing nanotechnology
2011	\$16M (44)	Melanoma and other skin cancers; Pediatric cancer research; Genetic cancer research; Kidney cancer; Blood cancer; Colorectal cancer; Pancreatic cancer; Mesothelioma; <i>Listeria</i> vaccine for cancer; and Radiation protection utilizing nanotechnology
2012	\$12.8M (27)	Melanoma and other skin cancers; Pediatric brain tumors; Genetic cancer; Pancreatic cancer; Kidney cancer; Blood cancer; Colorectal cancer; Mesothelioma; and <i>Listeria</i> vaccine for cancer
2013	\$15M (27)	Melanoma and other skin cancers; Pediatric brain tumors; Genetic cancer; Pancreatic cancer; Kidney cancer; Blood cancer; Colorectal cancer; Mesothelioma; and Neuroblastoma
2014	\$25M (47)	Blood cancer; Colorectal cancer; Genetic cancer research; Kidney cancer; <i>Listeria</i> vaccine for cancer; Melanoma and other skin cancers; Mesothelioma; Myeloproliferative disorders; Neuroblastoma; Pancreatic cancer; Pediatric brain tumors; and Cancers related to radiation exposure
2015	\$50M (110)	Colorectal cancer; Genetic cancer research; Kidney cancer; <i>Listeria</i> vaccine for cancer; Liver cancer; Melanoma and other skin cancers; Mesothelioma; Myeloproliferative disorders; Neuroblastoma; Pancreatic cancer; and Stomach cancer
2016	\$50M (89)	Bladder cancer; Colorectal cancer; Immunotherapy; Kidney cancer; <i>Listeria</i> vaccine for cancer; Liver cancer; Lymphoma; Melanoma and other skin cancers; Mesothelioma; Myeloproliferative disorders; Neuroblastoma; Pancreatic cancer; Pediatric brain tumor; and Stomach cancer
2017	\$60M (92)	Bladder cancer; Brain cancer; Cancer in children, adolescents, and young adults; Colorectal cancer; Immunotherapy; <i>Listeria</i> -based regimens for cancer; Liver cancer; Lymphoma; Melanoma and other skin cancers; Mesothelioma; Neuroblastoma; Pancreatic cancer; Pediatric brain tumor; and Stomach cancer
2018	\$80M (114)	Adrenal cancer; Bladder cancer; Blood cancers; Brain cancer; Cancer in children, adolescents, and young adults; Colorectal cancer; Immunotherapy; <i>Listeria</i> -based regimens for cancer; Liver cancer; Lymphoma; Melanoma and other skin cancers; Mesothelioma; Myeloma; Neuroblastoma; Pancreatic cancer; Pediatric brain tumor; and Stomach cancer
2019	\$90M (103)	Bladder cancer; Blood cancers; Brain cancer; Cancer in children, adolescents, and young adults; Colorectal cancer; Immunotherapy; <i>Listeria</i> -based vaccines for

Fiscal Year	Appropriation/ (Awards)‡	Topic Areas*
		cancer; Liver cancer; Lymphoma; Mesothelioma; Neuroblastoma; Pancreatic cancer; Pediatric brain tumor; Rare cancers; and Stomach cancer
2020	\$110.0M (98)	Bladder cancer; Blood cancers; Brain cancer; Colorectal cancer; Esophageal cancer; Head and neck cancer; Immunotherapy; Liver cancer; Mesothelioma; Metastatic cancers; Neuroblastoma; Pediatric, adolescent, and young adult cancers; Pediatric brain tumor; and Stomach cancer

*Congressional language designates topic areas (as published in the Public Law, Congressional Record, and post-Presidential signature communications for clarification on language).

‡Number of awards represents all open, pending closeout, and closed awards, and does not include withdrawals.