

Pancreatic Cancer:
A Summary of NCI's FY2010
and FY2011 Portfolio and
Selected Research Advances

June 2012

Table of Contents

Overview	1
The Pancreatic Cancer Burden	2
Pancreatic Cancer Incidence Rates	2
Pancreatic Cancer Mortality Rates.....	4
NCI's Planning for Pancreatic Cancer Research.....	5
Pancreatic Cancer Progress Review Group.....	5
Clinical Trials Planning Meeting on Pancreas Cancer Treatment	6
NCI's Investment in Pancreatic Cancer Research	8
Health of the Field and Overarching Issues.....	8
NCI Funding for Pancreatic Cancer Research	8
Research Projects and Trials Focused on Pancreatic Cancer	9
Research Projects.....	9
Clinical Trials	11
Specialized Programs of Research Excellence	12
Increased Capacity Building in Pancreatic Cancer Research.....	14
Growth in Number of Investigators.....	14
Training and Career Development	14
Growth in Number of Publications.....	16
Tumor Biology.....	17
Research Projects	17
Select Initiatives	17
Research Highlights	18
Risk, Prevention, Screening, and Diagnosis.....	19
Research Projects	19
Clinical Trials.....	19
Select Initiatives	20
Research Highlights	21
Therapy	22
Research Projects	22
Clinical Trials.....	22
Select Initiatives	23
Research Highlights	23
Health Services Research	24
Research Projects	24
Select Initiatives	24
Research Highlights	25
Scientific Toolkit	26
Research Projects	26
Select Initiatives	26
Research Highlights	27
Clinical Trials Planning Meeting on Pancreas Cancer Treatment	28
American Recovery and Reinvestment Act of 2009.....	29
Funding Mechanisms	29
PRG Priority Areas	29
Clinical Trials Planning Meeting Emphasis Areas.....	30
Conclusion	31
Appendix.....	32

List of Figures

Figure 1. Estimated New Cases and Deaths for Pancreatic Cancer by Year, 2004–2012..... 2

Figure 2. Age-Adjusted Incidence of Pancreatic Cancer by Racial/Ethnic Group, 1982–2008..... 3

Figure 3. Age-Adjusted Male-Female Incidence Rate Trends for Pancreatic Cancer, 1982–2008. 3

Figure 4. Age-Adjusted Mortality Rate Trends for Pancreatic Cancer, 1982–2008 4

Figure 5. Male-Female Mortality Rate Trends for Pancreatic Cancer, 1982–2008 4

Figure 6. Trends in NCI Funding for Pancreatic Cancer, FY2000–FY2011..... 8

Figure 7. Dollar Estimates for Extramural Research in Pancreatic Cancer by Scientific Area,
FY2007–FY2011 10

Figure 8. Total Number of NCI-Sponsored Research Projects Relevant to Pancreatic Cancer,
FY2000–FY2011 10

Figure 9. Pancreatic Cancer Research by PRG Category, FY2000–FY2011..... 11

Figure 10. NCI-Sponsored Clinical Trials Related to Pancreatic Cancer by Phase, April 2012... 11

Figure 11. Number of Investigators with at Least One R01 Grant Relevant to Pancreatic Cancer,
FY2000–FY2011 14

Figure 12. Mechanisms of Extramural Training and Career Development Awards, FY2010 and
FY2011 15

Figure 13. Estimated Number of Scientific Articles on Pancreatic Cancer Research
Acknowledging NCI Support, 2000–2011 16

Figure 14. Pancreatic Cancer Projects Related to Tumor Biology: FY2000, FY2010, FY2011, and
ARRA 17

Figure 15. Pancreatic Cancer Projects Related to Risk, Prevention, Screening, and Diagnosis:
FY2000, FY2010, FY2011, and ARRA 19

Figure 16. Pancreatic Cancer Projects Related to Therapy: FY2000, FY2010, FY2011, and
ARRA 22

Figure 17. Pancreatic Cancer Projects Related to Health Services Research: FY2000, FY2010,
FY2011, and ARRA 24

Figure 18. Pancreatic Cancer Projects Related to Scientific Toolkit: FY2000, FY2010, FY2011,
and ARRA 26

Figure 19. Pancreatic Cancer Research by Clinical Trials Planning Meeting Emphasis Area:
FY2007, FY2010, and FY2011 28

Figure 20. Number of Pancreas Cancer Grants Funded by ARRA Funds by Mechanism..... 29

Figure 21. ARRA-Funded Projects by PRG Priority Area..... 30

Figure 22. ARRA-Funded Projects by Clinical Trials Planning Meeting Emphasis Area..... 30

List of Tables

Table 1. Pancreatic Cancer Progress Review Group Priority Areas and Recommendations 5

Table 2. Recommendations from the Clinical Trials Planning Meeting on Pancreas Cancer
Treatment..... 6

Table 3. Planning Meeting Emphasis Areas and PRG Recommendations 7

Table 4. NCI's Pancreatic Cancer Research Funding, FY2000–FY2011 9

Table 5. NCI-Sponsored Clinical Trials Related to Pancreatic Cancer by Focus, April 2012 12

Table 6. Pancreatic Cancer SPOREs 13

Table 7. Gastrointestinal Cancer SPOREs With Projects Relevant to Pancreatic Cancer 13

Table 8. Extramural Training Awards for Pancreatic Cancer Research, FY2010–FY2011..... 14

Table 9. Intramural Training Support for Pancreatic Cancer Research, FY2010–FY2011 16

OVERVIEW

Pancreatic cancer is one of the deadliest cancers, with a five-year survival rate of only six percent. This report summarizes efforts of the National Cancer Institute (NCI) to address the burden of pancreatic cancer, with a focus on research funded in fiscal years 2010 and 2011. NCI has devoted considerable resources to pancreatic cancer research over the past decade. It has sponsored several efforts to plan and prioritize research in this area, including the 2000 Pancreatic Cancer Progress Review Group (PRG), the 2007 Clinical Trials Planning Meeting on Pancreas Cancer Treatment, and the recent establishment of the Pancreatic Cancer Research Action Planning Group. NCI funding for pancreatic cancer research has increased dramatically over this time period, from \$21 million in FY2001 to \$99.5 million in FY2011, a 356 percent increase. The projects supported have focused on a wide range of topics. This report tracks overarching trends in NCI support of pancreatic cancer research and also analyzes the NCI portfolio according to recommendations and priorities set forth by the PRG and at the Clinical Trials Planning Meeting. Additional NCI-sponsored activities and initiatives that support pancreatic cancer research are also described as are recent scientific advances resulting from NCI-funded research.

THE PANCREATIC CANCER BURDEN

Although pancreatic cancer accounts for only 3 percent of all new cancer cases in the United States, it is the fourth leading cause of cancer death among both males and females. In 2012, an estimated 43,920 individuals will be diagnosed with pancreatic cancer, and an estimated 37,390 deaths will occur as a result of this disease (Figure 1).^{1,2}

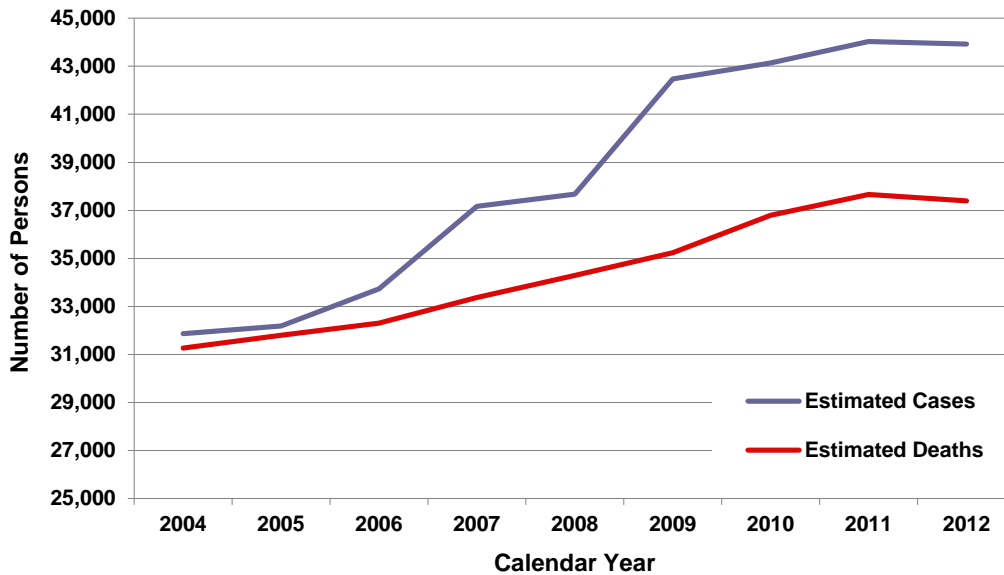


Figure 1. Estimated New Cases and Deaths for Pancreatic Cancer by Year, 2004–2012

Source: American Cancer Society Cancer Facts & Figures

Pancreatic Cancer Incidence Rates

Overall pancreatic cancer incidence rates did not change dramatically between 1982 and 2008 (Figure 2). Over this time period, blacks consistently exhibited higher incidence rates than did whites, Hispanics, Asians/Pacific Islanders, and American Indians/Alaska Natives. It is important to note that incidence rates are only available for Hispanics, Asians/Pacific Islanders, and American Indians/Alaska Natives from 1992 onward. The fluctuation observed in incidence rates for American Indians/Alaska Natives is most likely due to low sample numbers. As shown in Figure 3, pancreatic cancer incidence rates are higher among males for both blacks and whites. The cause(s) of this gender disparity is not yet understood.

¹ American Cancer Society. *Cancer facts & figures 2012*. Atlanta: American Cancer Society; 2012. Available at: <http://www.cancer.org/Research/CancerFactsFigures/CancerFactsFigures/cancer-facts-figures-2012>

² Beginning in 2007, estimated new cancer cases were computed using a new model that includes use of data from a much larger percentage of the U.S. population, allowance for geographical variation in cancer incidence, adjustment for delays in reporting, and inclusion of many sociodemographic, medical facility, lifestyle, and cancer screening behavior variables (see *CA Cancer J Clin.* 2007 Jan-Feb;57(1):30-42). The new method predicted an 8.9 percent higher number of new pancreatic cancer cases compared with the old method that was used for years prior to 2007.

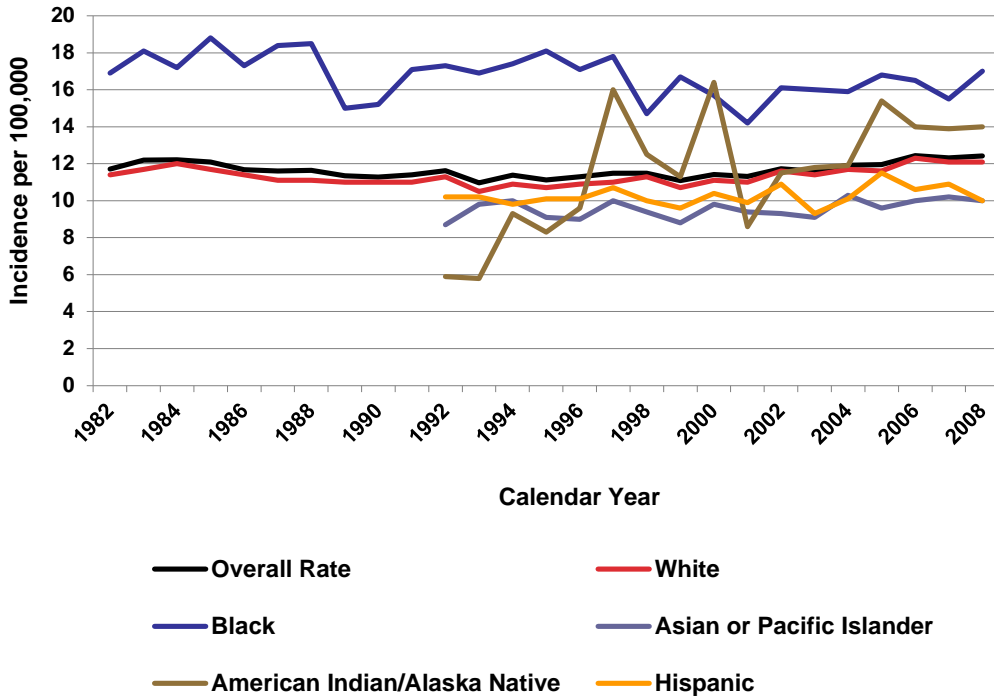


Figure 2. Age-Adjusted Incidence of Pancreatic Cancer by Racial/Ethnic Group, 1982–2008
 Source: NCI's Surveillance, Epidemiology, and End Results (SEER) Program

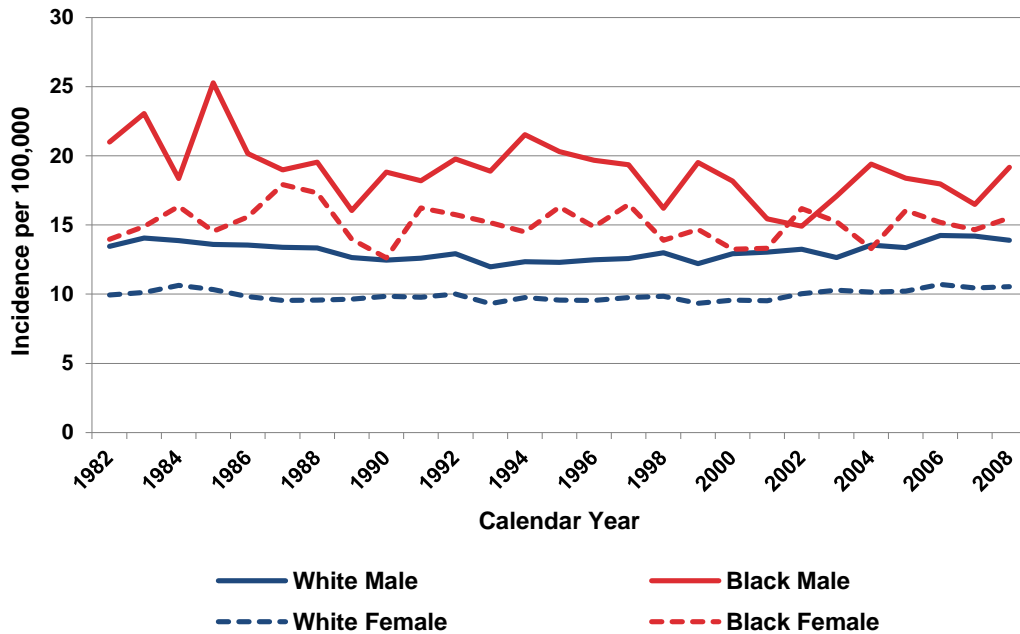


Figure 3. Age-Adjusted Male-Female Incidence Rate Trends for Pancreatic Cancer, 1982–2008
 Source: NCI's SEER Program

Pancreatic Cancer Mortality Rates

Overall mortality rates for pancreatic cancer were relatively stable between 1982 and 2008 (Figure 4). Mortality data are only available for Hispanics, Asians/Pacific Islanders, and American Indians/Alaska Natives from 1992 onward. Pancreatic cancer survival is poor compared with nearly all other types of cancer—only about 6 percent of patients live more than five years after diagnosis. Delayed diagnosis is one factor that may contribute to poor survival. Pancreatic cancer is difficult to detect in its early stages and is seldom diagnosed before it has metastasized. As shown in Figure 5, pancreatic cancer mortality rates are higher for black males than for black females and also higher for white males than for white females.

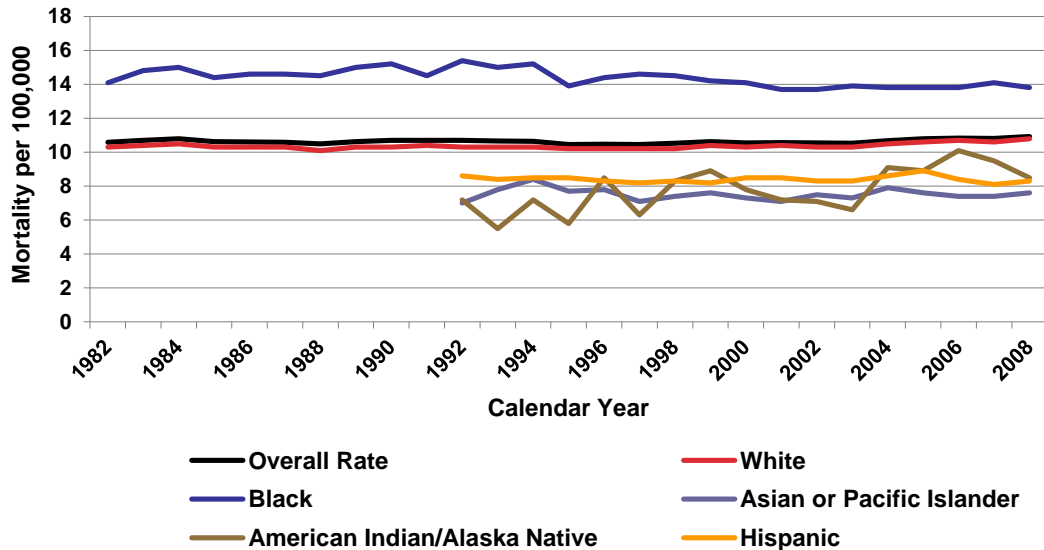


Figure 4. Age-Adjusted Mortality Rate Trends for Pancreatic Cancer, 1982–2008
Source: NCI's SEER Program

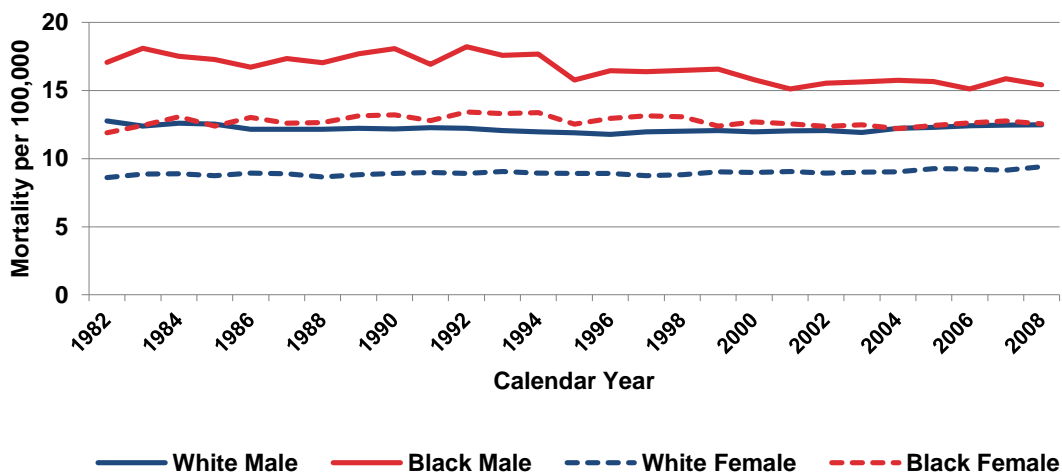


Figure 5. Male-Female Mortality Rate Trends for Pancreatic Cancer, 1982–2008
Source: NCI's SEER Program

NCI'S PLANNING FOR PANCREATIC CANCER RESEARCH

Pancreatic Cancer Progress Review Group

In 2000, the National Cancer Institute convened a multidisciplinary committee of scientists, clinicians, and advocates—the Pancreatic Cancer Progress Review Group—to review the pancreatic cancer research field and make recommendations about the most urgent needs and promising directions for future investment. The PRG report, *Pancreatic Cancer: An Agenda for Action*,³ was issued in 2001. Table 1 lists priority areas and recommendations identified in the report.

Table 1. Pancreatic Cancer Progress Review Group Priority Areas and Recommendations

PRG Priority Area	PRG Recommendations
Health of the Field and Overarching Issues	<ul style="list-style-type: none"> • Develop expanded training and career development efforts. • Create an interdisciplinary coordinating mechanism. • Establish centers of excellence.
Tumor Biology	<ul style="list-style-type: none"> • Understand the normal biology of the pancreas. • Elucidate the development of pancreatic adenocarcinoma. • Study the natural history of stroma and desmoplasia. • Study host-tumor interactions and develop related therapeutic strategies. • Resources: Specimen banks and experimental model systems.
Risk, Prevention, Screening, and Diagnosis	<ul style="list-style-type: none"> • Identify genetic and environmental factors that contribute to disease development. • Develop approaches for prevention in high-risk cohorts. • Develop early detection methods. • Resources: New and expanded registries, specimen banks, large cohort consortia, education for providers and investigators about risk assessment, Web-based imaging library, technology centers for assessing gene and protein expression, and animal models.
Therapy	<ul style="list-style-type: none"> • Facilitate discovery and development of targeted therapeutics. • Discover techniques to assess targeted therapeutics. • Conduct research on the supportive care of patients. • Resources: Investigator access to targeted therapeutic agents for research, molecular target assessment infrastructure, and multidisciplinary clinical trial infrastructure.
Health Services Research	<ul style="list-style-type: none"> • Identify effective forms of provider/patient communication. • Study message effectiveness in patient decision making. • Study requirements and costs of multidisciplinary clinical trials. • Evaluate current practices in diagnosis and care. • Resources: Survivorship registry, Web-based repository, models, and education and communication tools.
Scientific Toolkit	<ul style="list-style-type: none"> • Establish a specimen resource (normal and cancerous samples). • Develop a database of biological profiles of normal and neoplastic cells. • Develop new biological sampling techniques. • Capture knowledge of relevant molecular pathways. • Develop gene-based model systems. • Improve imaging systems.

³ Available at <http://planning.cancer.gov/library/2001pancreatic.pdf>.

In 2007, a portfolio analysis of NCI-funded research entitled *Pancreatic Cancer: Six Years of Research Progress*⁴ was conducted to track progress related to priority areas and recommendations of the PRG. An updated analysis in 2010, *Pancreatic Cancer: A Summary of NCI's Portfolio and Highlights of Recent Progress*,⁵ assessed fiscal year 2009 investments in the PRG priority areas. At this time, NCI also formed the Pancreatic Cancer Research Action Planning Group, which consists of scientists from various divisions, offices and, centers at the Institute who meet regularly to discuss topics in pancreatic cancer research.

Clinical Trials Planning Meeting on Pancreas Cancer Treatment

In 2007, a Clinical Trials Planning Meeting on Pancreas Cancer Treatment was convened by the NCI Gastrointestinal Cancer Steering Committee to discuss the integration of basic and clinical knowledge in design of clinical trials in pancreatic adenocarcinoma. Participants included clinical, translational, and basic science investigators in pancreatic cancer, as well as representatives from the patient advocacy community, the pharmaceutical industry, and government agencies. The major focus of the meeting was to define the direction for clinical trial investigation for treatment of pancreatic cancer over the next three to five years. A Consensus Report of the Meeting was published in November 2009⁶ and recommendations resulting from the meeting are summarized in Table 2.

Table 2. Recommendations from the Clinical Trials Planning Meeting on Pancreas Cancer Treatment

Emphasis Area	Recommendations
New Targets for Drug Development	<ul style="list-style-type: none"> • Enhance research on the identification and validation of relevant targets and molecular pathways. • Establish high-throughput assays.
Utility of Preclinical Models	<ul style="list-style-type: none"> • Support and expand research on preclinical models. • Elucidate the relative strengths of primary tumor xenografts and genetically engineered mouse models. • Make model systems freely available to investigators.
Future Clinical Trials	<ul style="list-style-type: none"> • Perform well-designed Phase II studies to help define strategies likely to succeed in a Phase III setting. • Adopt consistent entry and evaluation criteria for Phase II trials. • Conduct high-priority Phase III trials as intergroup trials and include scientifically appropriate biorepositories. • Conduct trials on rational combinations of targeted agents and develop predictive biomarkers to assist in patient selection. • Explore use of immune therapies, particularly among those with earlier stage disease. • Share trial outcomes, including those of trials with negative results.
Establishment of Biorepositories	<ul style="list-style-type: none"> • Establish infrastructure to facilitate biorepository development. • Include biorepositories as part of all randomized and selected single-arm studies. • Mandate and support access to and sharing of existing biorepositories.
Development of Biomarkers	<ul style="list-style-type: none"> • Test biomarkers in animal models. • Integrate prospective biomarker evaluation into clinical trials.

⁴ Available at <http://planning.cancer.gov/library/2007PancreaticProgRpt.pdf>.

⁵ Available at <http://www.cancer.gov/researchandfunding/reports/pancreatic-research-progress.pdf>.

⁶ Philip PA, Mooney M, Jaffe D, Eckhardt G, et al. [Consensus report of the National Cancer Institute Clinical Trials Planning Meeting on Pancreas Cancer Treatment](#). J Clin Oncol. 2009 Nov 20;27(33):5660–9.

Although the focus of the Clinical Trials Planning Meeting was somewhat different from that of the earlier PRG, many of the topics discussed and recommendations issued by the two groups were similar. PRG recommendations with significant similarity to Planning Meeting emphasis areas are shown in Table 3.

Table 3. Planning Meeting Emphasis Areas and PRG Recommendations

Planning Meeting Emphasis Areas	PRG Priority Areas/Recommendations
New Targets for Drug Development	Therapy <i>Facilitate discovery and development of targeted therapeutics.</i>
Utility of Preclinical Models	Tumor Biology <i>Resource: Develop experimental model systems.</i> Risk, Prevention, Screening, and Diagnosis <i>Resource: Develop animal models.</i> Scientific Toolkit <i>Resource: Develop gene-based model systems.</i>
Future Clinical Trials	Therapy <i>Resource: Develop infrastructure for multidisciplinary clinical trials.</i> Health Services Research <i>Resource: Identify manpower requirements and costs of trials.</i>
Establishment of Biorepositories	Tumor Biology <i>Resource: Create specimen banks.</i> Risk, Prevention, Screening, and Diagnosis <i>Resource: Develop specimen banks.</i> Scientific Toolkit <i>Establish a specimen resource.</i>
Development of Biomarkers	Risk, Prevention, Screening, and Diagnosis <i>Develop early detection methods.</i> Therapy <i>Resource: Develop molecular target assessment infrastructure.</i>

NCI'S INVESTMENT IN PANCREATIC CANCER RESEARCH

This section presents overarching trends in NCI's investment in pancreatic cancer research, describes progress in addressing recommendations in each of the six priority areas identified in the Pancreatic Cancer PRG report,⁷ provides information about recent funding relevant to the recommendations resulting from the Clinical Trials Planning Meeting on Pancreas Cancer Treatment,⁸ and summarizes funding provided for pancreatic cancer research through the American Recovery and Reinvestment Act (ARRA) of 2009. FY2011 projects relevant to the PRG and Clinical Trials Planning Meeting recommendations are listed in the Appendix.

Health of the Field and Overarching Issues

NCI Funding for Pancreatic Cancer Research

NCI has substantially increased its funding for pancreatic cancer research since the PRG recommendations were issued in 2001. Between FY2001 and FY2011, NCI's investment in pancreatic cancer research increased by 356 percent, from \$21.8 million to \$99.5 million. NCI's investment in research relevant to pancreatic cancer between FY2000 and FY2011 is summarized in Figure 6. These values reflect NCI's total intramural and extramural support for pancreatic cancer research.^{9,10} A comparison between NCI's pancreatic cancer investment and its total budget for these years is provided in Table 4. Since 2001 (the year in which the PRG report was published), the cumulative percentage increase in funding for pancreatic cancer research has outpaced that of the overall NCI budget.

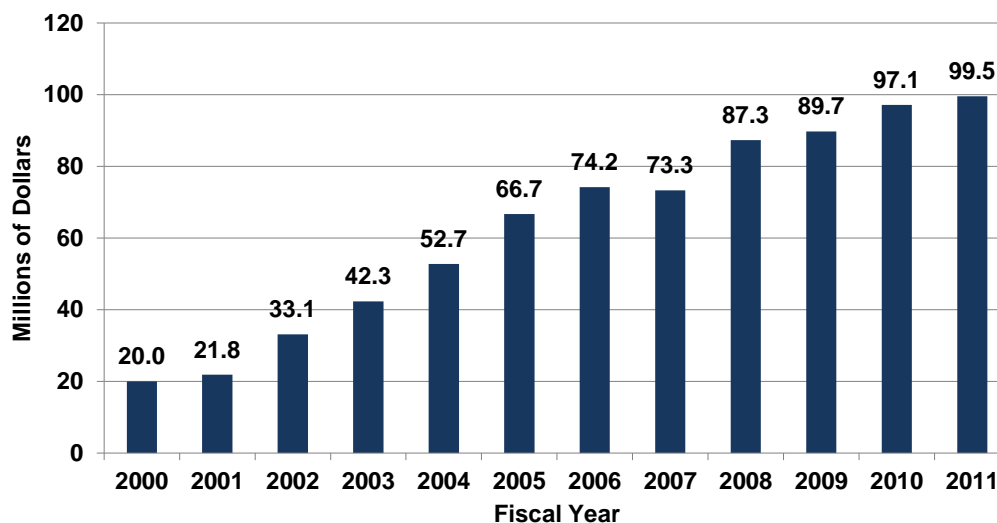


Figure 6. Trends in NCI Funding for Pancreatic Cancer, FY2000–FY2011

⁷ Projects relevant to pancreatic cancer were identified using the NCI Funded Research Portfolio. The abstracts of projects at least 25 percent relevant to pancreatic cancer were reviewed and manually coded to PRG recommendations.

⁸ For the purposes of the current analysis, all projects coded to the PRG recommendations listed in Table 3 were considered relevant to the corresponding Planning Meeting Emphasis Area.

⁹ As reported by the NCI Office of Budget and Finance.

¹⁰ Unless otherwise noted, data for FY2009 and FY2010 do not include projects funded through ARRA.

Table 4. NCI's Pancreatic Cancer Research Funding, FY2000–FY2011

Fiscal Year	Total NCI Pancreatic Cancer Investment (\$M)	Percent Increase in Pancreatic Cancer Investment From Previous Year	Cumulative % Increase in Pancreatic Cancer Investment Since 2001 PRG Report	Total NCI Budget (\$M)	Percent Increase in NCI Budget From Previous Year	Cumulative % Increase in NCI Budget Since 2001 PRG Report
2000	20.0	16.0	N/A	3,311	15.0	N/A
2001	21.8	9.0	N/A	3,754	13.4	N/A
2002	33.1	51.8	51.8	4,177	11.3	11.3
2003	42.3	27.8	94.0	4,592	9.9	22.3
2004	52.7	24.6	141.7	4,724	2.9	25.8
2005	66.7	26.6	206.0	4,795	1.5	27.7
2006	74.2	11.2	240.4	4,747	-1.0	26.5
2007	73.3	-1.2	236.2	4,792	0.9	27.7
2008	87.3	19.1	300.5	4,827	0.7	28.6
2009	89.7	2.7	311.5	4,967	2.9	32.3
2010	97.1	8.2	345.4	5,098	2.6	35.8
2011	99.5	2.5	356.4	5,058	-0.8	34.7

The majority of NCI funding for pancreatic cancer research supports the extramural program. The scientific content of extramural projects funded in FY2007 through FY2010 is shown in Figure 7,¹¹ categorized according to the seven areas of scientific interest represented in the Common Scientific Outline (CSO). For each of these years, the largest portion of extramural spending was in the Treatment category, with a funding level of \$33 million in FY2011. Between FY2007 and FY2011, the largest increase in investment (160%) was in the area of Prevention.

Research Projects and Trials Focused on Pancreatic Cancer

Research Projects

Between FY2000 and FY2011, the number of NCI-sponsored research projects at least 25 percent relevant¹² to pancreatic cancer increased from 85 projects in FY2000 to 283 projects in FY2011 (Figure 8).¹³ This represents a more than threefold increase over the past 11 years.

¹¹ Dollars associated with each funded project are prorated by estimated pancreatic cancer relevance, and this amount is distributed in a weighted fashion among applicable CSO research categories. Pancreatic cancer research projects are included regardless of percent relevance to pancreatic cancer. Training grants and projects not assigned to CSO categories are not included.

¹² NCI grants are indexed for a variety of research categories and organ sites. Each category is assigned a “percent relevance” based on the portion of the grant relevant to the category that is used to prorate the total amount of the grant. Percent relevance values are assigned by professional staff based on review of complete grant applications. A grant may be 100 percent relevant to multiple categories, and the sum of the percent relevance assignments of a grant may exceed 100 percent.

¹³ Extramural projects included in this graph are limited to those with 25 percent or greater relevance to pancreatic cancer, with the exception of training grants, which were identified using the methods described in the Training section. All intramural projects relevant to pancreatic cancer for FY2000–FY2006 are included. FY2007–FY2011 intramural projects included are limited to those with 25 percent or greater relevance to pancreatic cancer. Intramural support for training is not included.

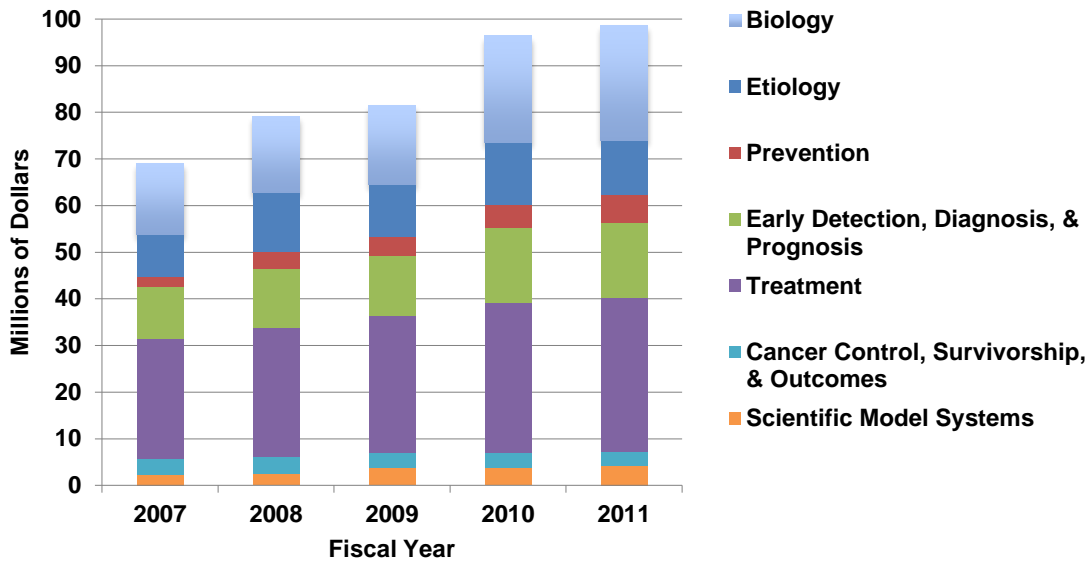


Figure 7. Dollar Estimates for Extramural Research in Pancreatic Cancer by Scientific Area, FY2007–FY2011

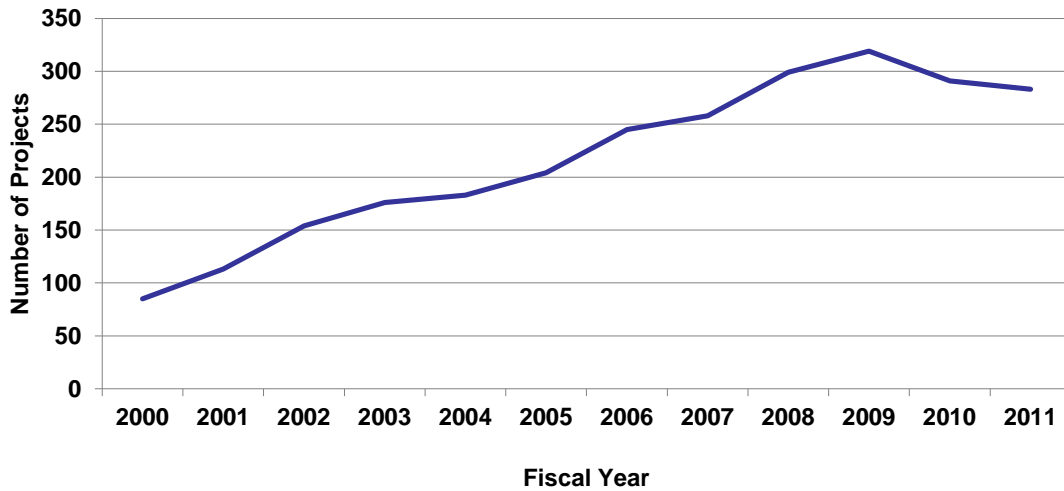


Figure 8. Total Number of NCI-Sponsored Research Projects Relevant to Pancreatic Cancer, FY2000–FY2011

The funded portfolio of pancreatic cancer research projects was classified according to the six main PRG priority areas (Figure 9) and the specific recommendations in each priority area to which they are relevant (Figures 14–18). Many projects address more than one PRG priority area or specific recommendation. Between FY2000 and FY2011, the number of projects coded to each PRG priority area increased by more than twofold. In FY2011, the highest number of projects was coded as being relevant to the category of Tumor Biology. As in FY2000, the category with the lowest number of projects in FY2011 was Health Services Research.

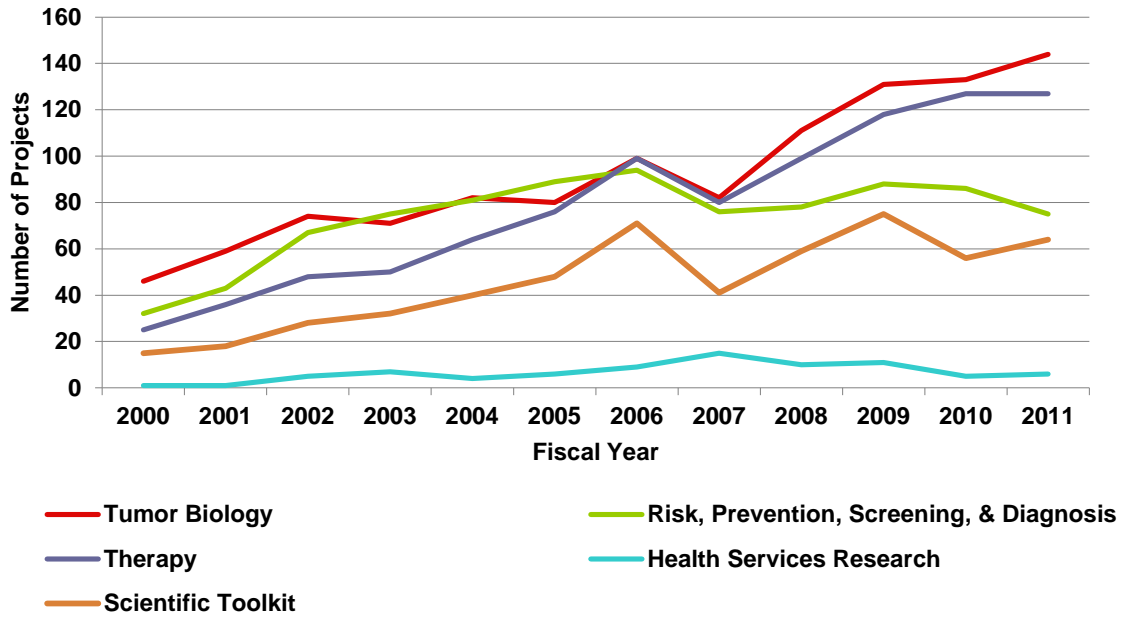


Figure 9. Pancreatic Cancer Research by PRG Category, FY2000–FY2011

Clinical Trials

In April 2012, 59 NCI-sponsored clinical trials relevant to pancreatic cancer were actively accruing patients. As shown in Figure 10, these included 2 Phase 0 trials, 21 Phase I trials, 2 Phase I/II trials, 14 Phase II trials, and 2 Phase III trials.¹⁴ In addition to these, there were 18 trials with no phase specified, several of which focused on identification and validation of biomarkers.

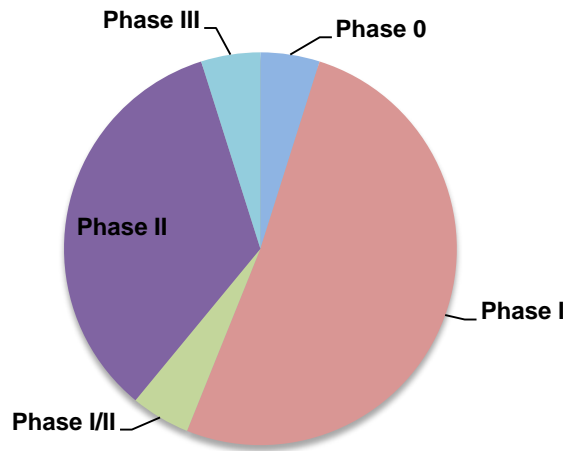


Figure 10. NCI-Sponsored Clinical Trials Related to Pancreatic Cancer by Phase, April 2012

¹⁴ This figure includes only trials actively accruing in April 2012 and does not necessarily account for all pancreatic cancer trials active in FY2012.

The majority of these trials are investigating treatments and/or conducting biomarker/laboratory analysis for pancreatic cancer (Table 5). Other types of trials include education/counseling/training, natural history/epidemiology, supportive care, tissue collection/repository, and prevention. Of the 59 trials, 37 focus on more than one of these areas.

Table 5. NCI-Sponsored Clinical Trials Related to Pancreatic Cancer by Focus, April 2012

Focus of Trial	Number of Trials
Treatment	42
Biomarker/laboratory analysis	39
Educational/counseling/training	1
Natural history/epidemiology	5
Supportive care	3
Tissue collection/repository	6
Prevention	1

Specialized Programs of Research Excellence

Specialized Program of Research Excellence (SPORE) grants support centers that promote a bidirectional flow of research, moving basic research findings from the laboratory to clinical settings while also bringing clinical findings back to the laboratory environment. SPORE investigators from laboratory and clinical settings work collaboratively to design and implement research programs that may have an effect on cancer prevention, detection, diagnosis, and treatment. There are three pancreatic cancer SPOREs (Table 6). In addition, two gastrointestinal SPOREs are conducting projects relevant to pancreatic cancer (Table 7).

Table 6. Pancreatic Cancer SPOREs

Institution	Principal Investigator	Grant Number	Subprojects
Mayo Clinic	Gloria Petersen	P50 CA102701	<ul style="list-style-type: none"> • Regulation of Pancreatic Cancer Cell Proliferation and Survival by GSK-3B • Pancreatic Cancer-Associated Diabetes: Pathogenesis and Biomarkers • Hedgehog and EGF Pathway Interaction: A Novel Approach for Multi-Target Therapy in Pancreatic Cancer • Direct Delivery of Immune-Modulating Therapies to the Pancreatic Tumor Site
University of Alabama at Birmingham	Donald Buchsbaum	P50 CA101955	<ul style="list-style-type: none"> • Biomarker Discovery for Early Detection of Pancreatic Ductal Adenocarcinoma • Combined Modality Targeted Therapy of Pancreatic Cancer With Death Receptor Monoclonal Antibodies • Identifying and Targeting Pathways of Pancreatic Cancer: Progression and Metastasis • Development of Oncolytic Adenovirus Targeting Pancreatic Cancer Stem Cells
University of Nebraska Medical Center	Michael Hollingsworth	P50 CA127297	<ul style="list-style-type: none"> • Immunotherapy of Pancreatic Adenocarcinoma • Inhibitors of N-Cadherin in the Treatment of Pancreatic Cancer • Biomarkers for the Diagnosis of Pancreatic Cancer • Inhibitors or Telomerase in Treatment of Pancreatic Adenocarcinoma

Table 7. Gastrointestinal Cancer SPOREs With Projects Relevant to Pancreatic Cancer

Institution	Principal Investigator	Grant Number	Relevant Subprojects
Dana-Farber/ Harvard Cancer Center	Charles Fuchs	P50 CA127003	<ul style="list-style-type: none"> • Improved Staging of Pancreatic Cancer
Johns Hopkins University	Scott Kern	P50 CA062924	<ul style="list-style-type: none"> • Early Detection of Human Colorectal and Pancreatic Cancer • Antigen-Specific Monitoring and Therapy in Pancreatic Cancer • Markers for Risk in Familial Pancreatic Cancer • Screening Markers for Persons With High Pancreatic Cancer Susceptibility • Pharmacodiagnosics Through Molecular Clues • Fundamentals of Early and Variant Pancreatic Neoplasia

Increased Capacity Building in Pancreatic Cancer Research

Growth in Number of Investigators

Between FY2000 and FY2011, the number of unique investigators with at least one NCI-funded R01 grant in pancreatic cancer rose from 34 to 111, which represents a 226 percent increase (Figure 11).¹⁵

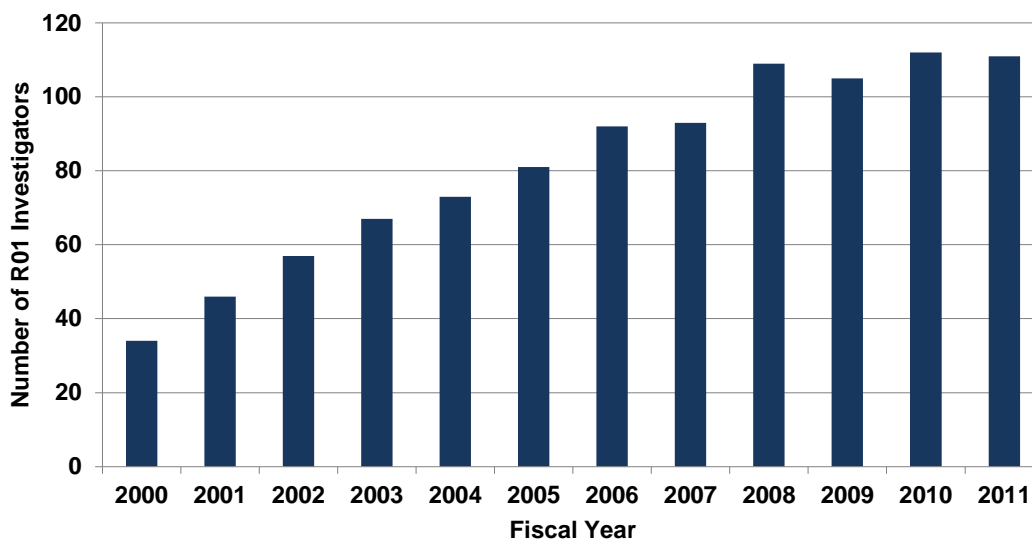


Figure 11. Number of Investigators with at Least One R01 Grant Relevant to Pancreatic Cancer, FY2000–FY2011

Training and Career Development

NCI supports training and career development activities through both its extramural and intramural programs. Extramural training and career development are funded through a combination of individual and institutional awards. As shown in Table 8,¹⁶ NCI funded 30 training and career development awards relevant to pancreatic cancer with a total investment of \$3.23 million in FY2010. In FY2011, 23 awards received \$2.52 million to support training and career development activities in this area.

Table 8. Extramural Training Awards for Pancreatic Cancer Research, FY2010–FY2011

	Number of Extramural Training Awards	Funding Relevant to Pancreatic Cancer (\$M)
FY2010	30	3.23
FY2011	23	2.52

¹⁵ Limited to grants that are at least 25 percent relevant to pancreatic cancer.

¹⁶ Training and career development awards were identified by a combination of database searches for individual awards with potential relevance to pancreas or pancreatic cancer, which were manually reviewed to confirm relevance, and manual review of the portfolios of institutional training and career development awards (K12, R25, T32) for grants containing a pancreatic cancer-relevant component. Award budgets were calculated based on the percent relevance to pancreatic cancer. Trainees supported with funds from their mentors' research grants (e.g., R01s) are not included.

Grant mechanisms used by NCI to support extramural training and career development activities include F31, F32, K01, K05, K07, K08, K12, K22, K23, K24, K99, R25, and T32.¹⁷ Figure 12 illustrates the distribution of awards relevant to pancreatic cancer by mechanism for FY2010 and FY2011. Numbers in parentheses indicate numbers of projects funded through each mechanism. Examples of these awards include:

- **Dissecting Mechanisms of Immune Tolerance in the Pancreatic Tumor's Microenvironment.** This project, which is funded through a K23 award (Mentored Patient-Oriented Research Career Development Award), is investigating the association between inhibition of regulatory T cells and clinical responses in pancreatic cancer patients who are receiving a therapeutic vaccine.¹⁸
- **Understanding the Initiation and Progression of Early Pancreatic Cancer Lesions.** This project, funded through an F32 award (Ruth L. Kirschstein National Research Service Award Postdoctoral Fellowship), involves creation of a genetically engineered mouse model for pancreatic cancer. The mouse will express a fluorescent marker that will make it possible to spatially and temporally track pancreatic cancer precursor cells and early lesions.¹⁹

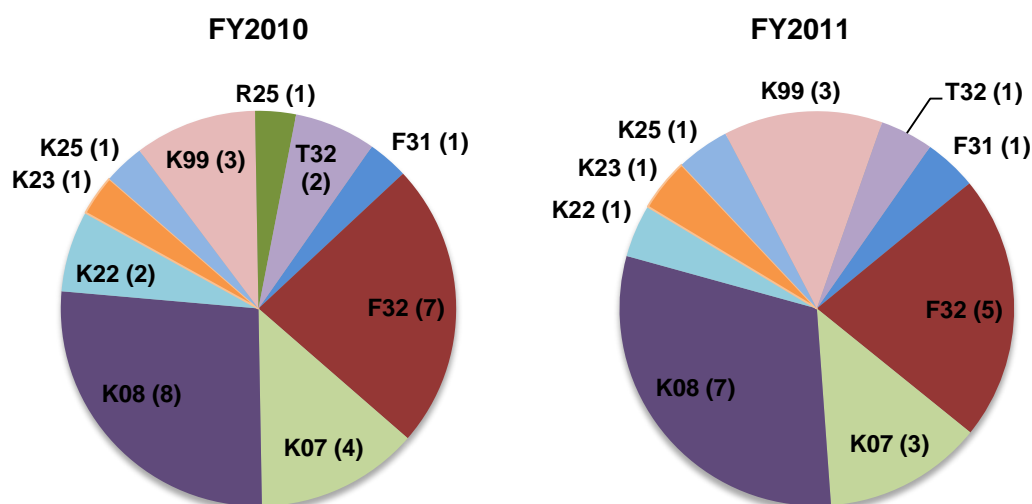


Figure 12. Mechanisms of Extramural Training and Career Development Awards, FY2010 and FY2011

The NCI intramural research program also provides support for trainees. As shown in Table 9,²⁰ in FY2010, \$257,270 in intramural support was provided to 10 trainees conducting research relevant to pancreatic cancer. In FY2011, \$411,229 in support was provided to 16 trainees.

¹⁷ More information about NIH/NCI grant mechanisms can be found at http://grants.nih.gov/grants/funding/funding_program.htm or http://grants.nih.gov/grants/funding/ac_search_results.htm.

¹⁸ Grant number CA148964.

¹⁹ Grant number CA157044.

²⁰ Stipend support for trainees is prorated based on percent relevance of the project to pancreatic cancer.

Table 9. Intramural Training Support for Pancreatic Cancer Research, FY2010–FY2011

NCI Division or Center	Number of Trainees	Stipend/Salary Support
Center for Cancer Research		
FY2010	6	\$193,100
FY2011	9	\$259,780
Division of Cancer Epidemiology and Genetics		
FY2010	4	\$64,170
FY2011	7	\$151,449

Growth in Number of Publications

One indicator of research progress is growth in the number of peer-reviewed publications on a specific topic. The number of pancreatic-cancer-relevant scientific articles acknowledging NCI support increased from 142 to 554 between calendar years 2000 and 2011 (Figure 13), which represents a 290 percent increase. These values should be considered estimates.²¹

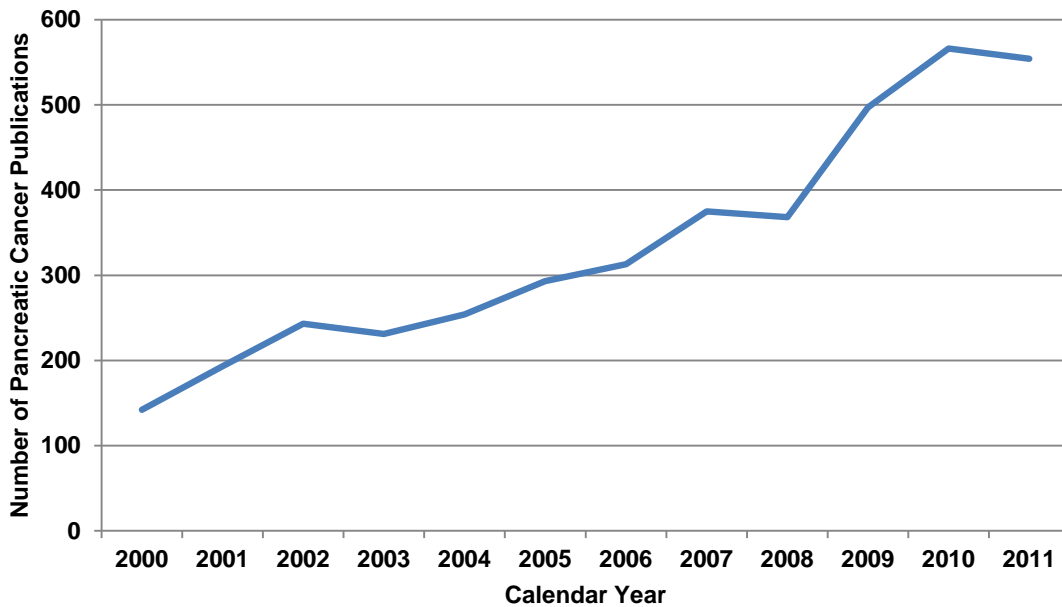


Figure 13. Estimated Number of Scientific Articles on Pancreatic Cancer Research Acknowledging NCI Support, 2000–2011

²¹ These values derive from an April 2012 search of the MEDLINE database (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>) for citations that included terms related to “pancreas” (free-text) and whose authors cited an NCI grant number or author address. The searches were limited to publications in peer-reviewed, English-language journals that contained abstracts. Both intramural and extramural NCI projects are represented. Delays in indexing may artificially lower some counts, particularly for more recent years.

Tumor Biology

Research Projects

Between FY2000 and FY2011, there was an increase in the number of projects relevant to each of the PRG recommendations in the area of tumor biology (Figure 14). Overall, the number of projects related to tumor biology increased by 98 between FY2000 and FY2011, from 46 to 144 (Figure 9).²² In addition, 20 projects related to tumor biology were supported with ARRA funds in FY2009 and FY2010. In FY2000, FY2010, and FY2011, the largest proportions of funded projects involved studying the development of adenocarcinoma. Of note, there were no projects studying pancreatic stroma and reactive tissue in FY2000, but 7 and 16 projects were funded in this area in FY2010 and FY2011, respectively. In addition, a 550 percent increase was observed in the number of projects related to host-tumor interactions and related therapies between FY2000 and FY2011.

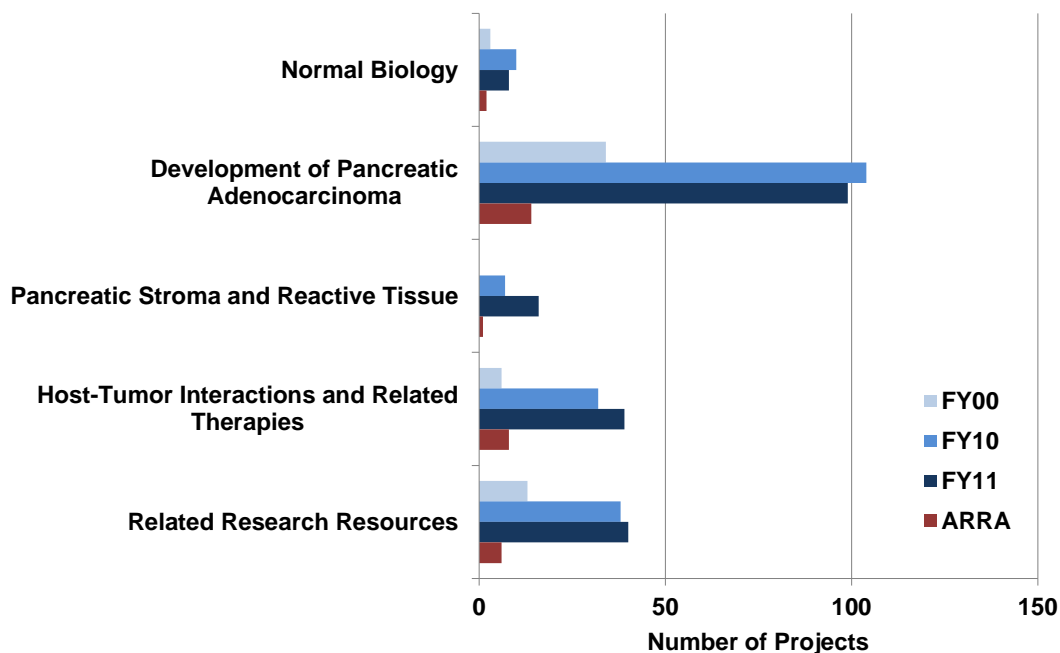


Figure 14. Pancreatic Cancer Projects Related to Tumor Biology: FY2000, FY2010, FY2011, and ARRA

Select Initiatives

NCI solicits research and develops resources through the use of initiatives that encourage work in priority areas, support multidisciplinary research collaborations, and generate research applications in areas that have not been addressed adequately. The following initiatives are among those that fund research relevant to pancreatic cancer tumor biology:

²² The sum of the values presented in the bar graph may exceed the total number of projects relevant to a priority area because many projects are relevant to more than one recommendation within a priority area.

- The **Pilot Studies in Pancreatic Cancer** initiative promotes innovative multidisciplinary pancreatic cancer research.
This PA, which was issued in 2011, and its predecessors supported 44 projects in FY2011 in a variety of areas, including tumor biology.
- The **Tumor Microenvironment Network** initiative promotes research on the tumor microenvironment with a focus on understanding the role of stroma in tumorigenesis and responses to treatment.
Two projects relevant to pancreatic cancer were funded through this Request for Applications (RFA) in FY2011. One of these focuses solely on pancreatic cancer while the other focuses on several gastrointestinal cancers.

Research Highlights

Recent results of NCI-sponsored research on the tumor biology of pancreatic cancer include the following:

- **Distant Metastasis Occurs Late in the Genetic Evolution of Pancreatic Cancer.** Sequencing of the genomes of pancreatic tumors and metastases from seven patients revealed that the metastases were genetically evolved from the original tumor cells. Mathematical modeling of the sequence data suggests that it takes at least ten years after the occurrence of the initiating mutation for the parental, nonmetastatic tumor cell to develop and at least five additional years pass before tumor cells acquire the ability to metastasize. These findings suggest that there is a broad time window of opportunity for early detection of pancreatic cancer.²³
- **Dissecting the Role of the Hedgehog Pathway in Pancreatic Cancer.** Recent research suggests one mechanism by which alterations in the Hedgehog pathway may contribute to pancreatic cancer progression. Loss of Hedgehog signaling in tumor epithelial cells results in lowered levels of the transcription factor GLI1, a regulator of epithelial differentiation. Loss of this protein in experimental model systems resulted in loss of epithelial differentiation, increased cell motility, and contributed to epithelial-to-mesenchymal transition, suggesting that this event may contribute to the highly metastatic behavior of pancreatic tumor cells.²⁴

²³ Yachida S, Jones S, Bozic I, Antal T, et al. [Distant metastasis occurs late during the genetic evolution of pancreatic cancer](#). *Nature*. 2010 Oct 28;467(7319):1114–7.

²⁴ Joost S, Almada LL, Rohmalter V, Holz PS, et al. [GLI1 inhibition promotes epithelial-to-mesenchymal transition in pancreatic cancer cells](#). *Cancer Res*. 2012 Jan 1;72(1):88–99.

Risk, Prevention, Screening, and Diagnosis

Research Projects

Between FY2000 and FY2011, the total number of projects in this priority area increased from 32 to 75 (Figure 9). ARRA funds supported an additional nine projects in this priority area. In FY2000 and FY2010, the largest number of projects in this area investigated genetic and environmental factors that contribute to pancreatic tumor development; however, in FY2011, the largest number of projects focused on methods for early detection (Figure 15).²⁵ The numbers of projects studying methods for early detection and prevention in high-risk cohorts both increased by approximately fourfold between FY2000 and FY2011, while the increase in the number of projects focused on factors that contribute to disease development was more modest (1.2-fold).

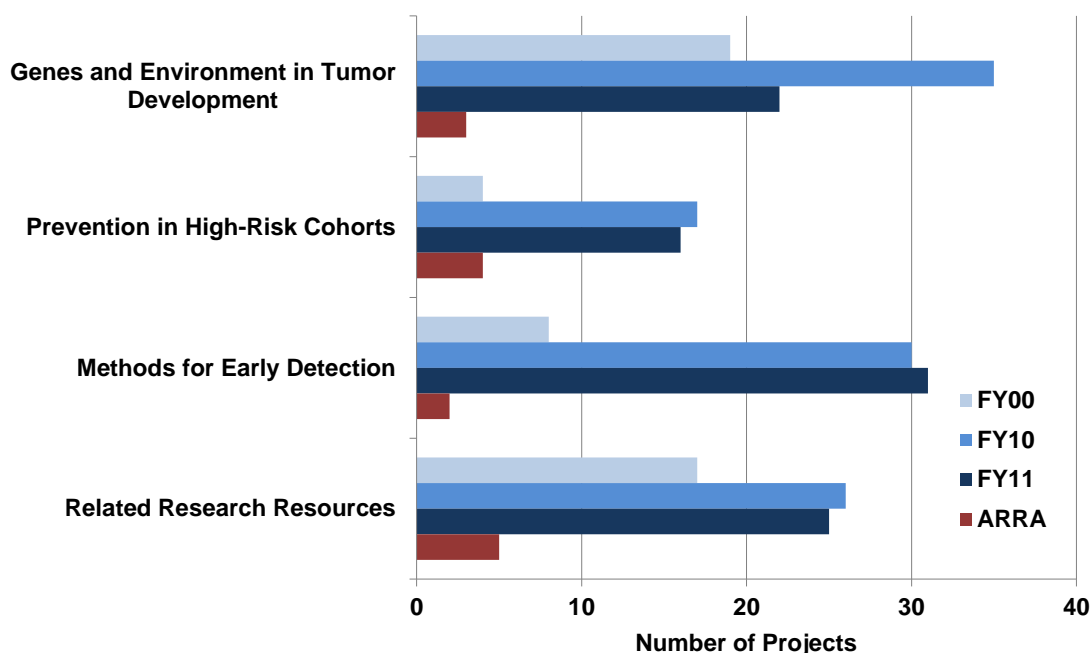


Figure 15. Pancreatic Cancer Projects Related to Risk, Prevention, Screening, and Diagnosis: FY2000, FY2010, FY2011, and ARRA

Clinical Trials

In addition to the grants and contracts summarized above, NCI is conducting clinical trials related to pancreatic cancer risk, prevention, screening, and diagnosis (Table 5). Several of these trials involve tissue collection and/or analysis of biomarkers with potential to detect pancreatic cancer or predict response to therapy.

²⁵ The sum of the values presented in the bar graph may exceed the total number of projects relevant to a priority area because many projects are relevant to more than one recommendation within a priority area.

Select Initiatives

The following initiatives related to risk, prevention, screening, and diagnosis have funded at least one pancreatic cancer study:

- The **Cancer Prevention Research Small Grants Program** is designed to enhance basic and applied cancer prevention research through support of projects related to chemoprevention agents, biomarkers for early cancer detection, cancer-related nutrition science, and/or clinical prevention studies that focus on specific target organs.
This initiative funded one project related to pancreatic cancer in FY2011. This project is developing a unique nanotechnology-based platform to deliver a combination of chemopreventive agents.
- The **Early Detection Research Network (EDRN): Biomarker Development Laboratories** develop, evaluate, and validate biomarkers that may enable earlier cancer detection and risk assessment.
At least three projects supported through this initiative in FY2011 are working to identify biomarkers and develop assays that will facilitate early detection of pancreatic cancer. One project is focused on developing biomarkers that can distinguish pancreatic cysts with high malignant potential from those less likely to progress to cancer. Two other projects are identifying serum biomarkers that may be useful for disease detection, prognosis assessment, or management.
- **Molecular Approaches to Diet and Pancreatic Cancer Prevention** supports research on how food intake and food components influence pancreatic cancer development and prevention.
This initiative supported seven R01 projects in FY2011. One of these projects is evaluating data from five large prospective cohort studies to examine factors related to diet and pancreatic cancer risk. Four other projects are testing the chemopreventive effects of dietary agents in mouse models, and several projects are using model systems to examine the mechanistic basis of potential chemopreventive agents.
- The **Pancreatic Cancer Case-Control Consortium** includes over 50 principal investigators of case-control studies of pancreatic cancer from many countries throughout the world.
This extramural-intramural consortium focuses on joint, pooled analyses of data on risk factors for pancreatic cancer and the effects of the interaction of gene and environmental exposures on risk.
- **PanScan** conducts genome-wide association studies as part of the Cancer Genetic Markers of Susceptibility (CGEMS) project, the goal of which is to identify inherited genetic susceptibility factors.
The PanScan project for the genome-wide scanning of pancreatic cancer has revealed several loci associated with risk of developing pancreatic cancer. Comprehensive investigations of the risk-related loci have begun.
- The **Pancreatic Cancer Cohort Consortium** conducts large-scale investigations within prospective cohort studies that include prediagnostic biospecimen banks.
This intramural-extramural consortium has pooled data and specimens for the PanScan genome-wide discovery project as well as for several major reports characterizing the effects of genetic, environmental, and behavioral risk factors for pancreatic cancer incidence and prognosis.

- The **Pilot Studies in Pancreatic Cancer** initiative promotes innovative multidisciplinary research to better understand the biology, etiology, detection, prevention, and treatment of pancreatic cancer.
This initiative and its predecessors supported 44 projects in FY2011 in a variety of areas, including risk, prevention, screening, and diagnosis.
- The **Tumor Glycome Laboratories of the NIH Alliance of Glycobiologists for Detection of Cancer and Cancer Risk** are searching for glycan-based biomarkers of several cancers.
Of the seven Tumor Glycome Laboratories supported in FY2011, three are investigating potential biomarkers for pancreatic cancer.

Research Highlights

Recent results of NCI-sponsored research related to the risk, prevention, screening, and diagnosis of pancreatic cancer include the following:

- **High Body Mass Index Associated With Pancreatic Cancer Risk.** Analysis of data from seven prospective cohorts—collectively including nearly 1 million individuals, of whom 2,454 were eventually diagnosed with pancreatic cancer—revealed that higher body mass index (BMI) was associated with increased risk of developing pancreatic cancer, independent of other risk factors.²⁶
- **Serum Biomarker Panels for Detection of Pancreatic Cancer.** Several laboratories are using proteomic techniques to identify serum proteins that are elevated in patients with pancreatic cancer. Recent studies have identified multiple proteins—including TIMP1, ICAM1, and OPG—that may be useful when used in combination with CA19-9, a previously identified biomarker.²⁷

²⁶ Jiao L, Berrington de Gonzalez A, Hartge P, Pfeiffer RM, et al. [Body mass index, effect modifiers, and risk of pancreatic cancer: a pooled study of seven prospective cohorts](#). *Cancer Causes Control*. 2010 Aug;21(8):1305–14.

²⁷ Pan S, Chen R, Crispin DA, May D, et al. [Protein alterations associated with pancreatic cancer and chronic pancreatitis found in human plasma using global quantitative proteomics profiling](#). *J Proteome Res*. 2011 May 6;10(5):2359–76; Brand RE, Nolen BM, Zeh HJ, Allen PJ, et al. [Serum biomarker panels for the detection of pancreatic cancer](#). *Clin Cancer Res*. 2011 Feb 15;17(4):805–16.

Therapy

Research Projects

Between FY2000 and FY2011, the number of projects related to therapy increased approximately fivefold, from 25 to 127. In FY2000, FY2010, and FY2011, the majority of projects in this priority area focused on discovery and development of targeted therapeutics (Figure 16). In FY2000, there were no projects at least 25 percent relevant to pancreatic cancer that were studying supportive care; in both FY2010 and FY2011, there was one project in this area. ARRA funds were used to support 21 additional projects related to pancreatic cancer therapy.

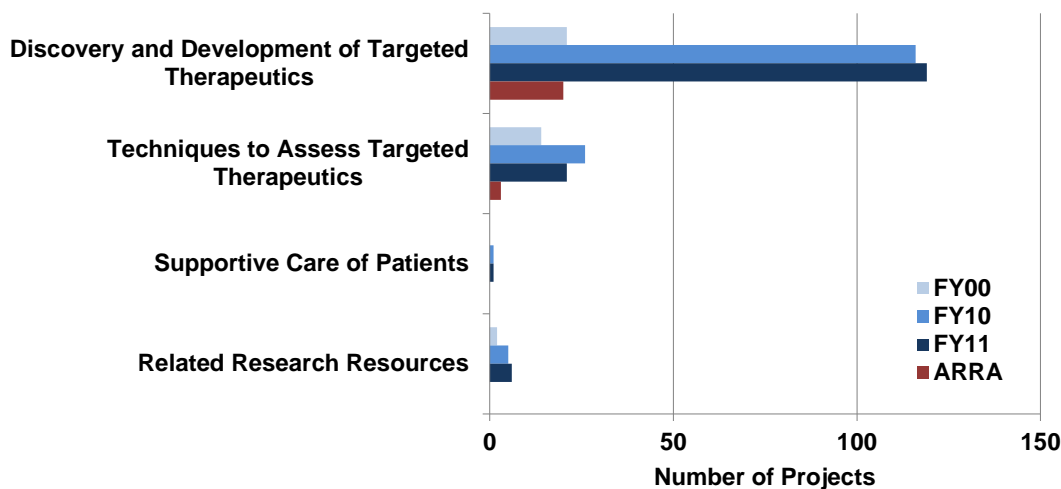


Figure 16. Pancreatic Cancer Projects Related to Therapy: FY2000, FY2010, FY2011, and ARRA

Clinical Trials

NCI sponsors a number of trials related to therapy for pancreatic cancer. Several ongoing trials are evaluating novel agents and novel combinations of agents for the treatment of pancreatic cancer, including one large, randomized Phase III clinical trial. Another Phase III trial is focused on supportive care for patients with pancreatic and other types of cancer.

- Phase III Randomized Study of Adjuvant Gemcitabine Hydrochloride With Versus Without Erlotinib Hydrochloride Followed by the Same Chemotherapy Regimen With Versus Without Chemoradiotherapy With Either Capecitabine or Fluorouracil in Patients With Resected Head of Pancreas Adenocarcinoma.** This trial is designed to compare gemcitabine in combination with the kinase inhibitor erlotinib with gemcitabine alone in pancreatic cancer patients who have undergone surgical resection to determine whether erlotinib can improve outcomes. Erlotinib is currently approved for treatment of inoperable pancreatic cancer, and doctors are hopeful that it also may help patients who have undergone surgery. This trial also is testing these chemotherapeutic regimens in combination with radiotherapy as adjuvant therapy for patients whose disease does not progress following initial treatment.²⁸

²⁸ ClinicalTrials.gov trial number NCT01013649; more in [NCI Cancer Bulletin](#), 2010 Jun 15;7(12).

- **Sulfasalazine in Preventing Acute Diarrhea in Patients With Cancer Who Are Undergoing Pelvic Radiation Therapy.** This trial is investigating whether sulfasalazine, a drug used to treat inflammatory bowel disease, is effective in reducing acute treatment-related diarrhea in patients with one of several different types of cancer who are receiving pelvic radiotherapy.²⁹ Findings from research such as this on supportive care of individuals with cancer often have applications across many cancer sites.

Select Initiatives

The following initiatives related to therapy have funded at least one pancreatic cancer study:

- The **Accelerating Clinical Trials of Novel Oncologic PathWays (ACTNOW)** program supports Phase I–II testing of new agents that target and interrupt molecular pathways involved in cancer.
A randomized Phase II clinical trial supported through ACTNOW is testing an agent that targets the Hedgehog signaling pathway in combination with the chemotherapy drug gemcitabine in patients with metastatic pancreatic cancer.
- **Quick Trials for Novel Cancer Therapies** provides investigators with rapid access to support for pilot, Phase I, and Phase II cancer clinical trials and associated patient monitoring and laboratory studies.
This initiative and its predecessors supported two trials of pancreatic cancer therapies in FY2011.

Research Highlights

Recent results of NCI-sponsored research on therapy for pancreatic cancer include the following:

- **Mouse Model Reveals Mechanism of Pancreatic Cancer Treatment Resistance.** Research using a genetically engineered mouse model revealed that the dense stromal matrix associated with pancreatic ductal adenocarcinoma results in increased tumor fluid pressure, compressed vasculature, and decreased delivery of chemotherapy. Treatment of the mice with a drug called PEGPH20, which breaks down a component of the stromal matrix, resulted in increased delivery of the chemotherapeutic drug gemcitabine and extended survival time.³⁰
- **Activating Macrophages to Attack Pancreatic Tumors.** An antibody capable of activating CD40—a protein that can reverse immune suppression and activate T cell responses—was able to induce tumor regression in some patients who also were being treated with gemcitabine. Follow-up studies in a mouse model of pancreatic cancer unexpectedly revealed that the antibody worked by activating macrophages, which rapidly infiltrated tumors and facilitated depletion of the tumor stroma.³¹

²⁹ ClinicalTrials.gov trial number NCT01198145.

³⁰ Provenzano PP, Cuevas C, Chang AE, Goel VK, et al. [Enzymatic targeting of the stroma ablates physical barriers to treatment of pancreatic ductal adenocarcinoma](#). *Cancer Cell*. 2012 Mar 20;21(3):418–29.

³¹ Beatty GL, Chiorean EG, Fishman MP, Saboury B, et al. [CD40 agonists alter tumor stroma and show efficacy against pancreatic carcinoma in mice and humans](#). *Science*. 2011 Mar 25;331(6024):1612–6.

Health Services Research

Research Projects

Although fewer pancreatic cancer projects are related to health services research than to any of the other PRG priority areas, this priority area exhibited a sixfold increase in number of projects between FY2000 and FY2011 (Figure 9). Research in this area focused on improving diagnosis and care for patients with pancreatic cancer (Figure 17).³² There were no ARRA-funded projects in this area.

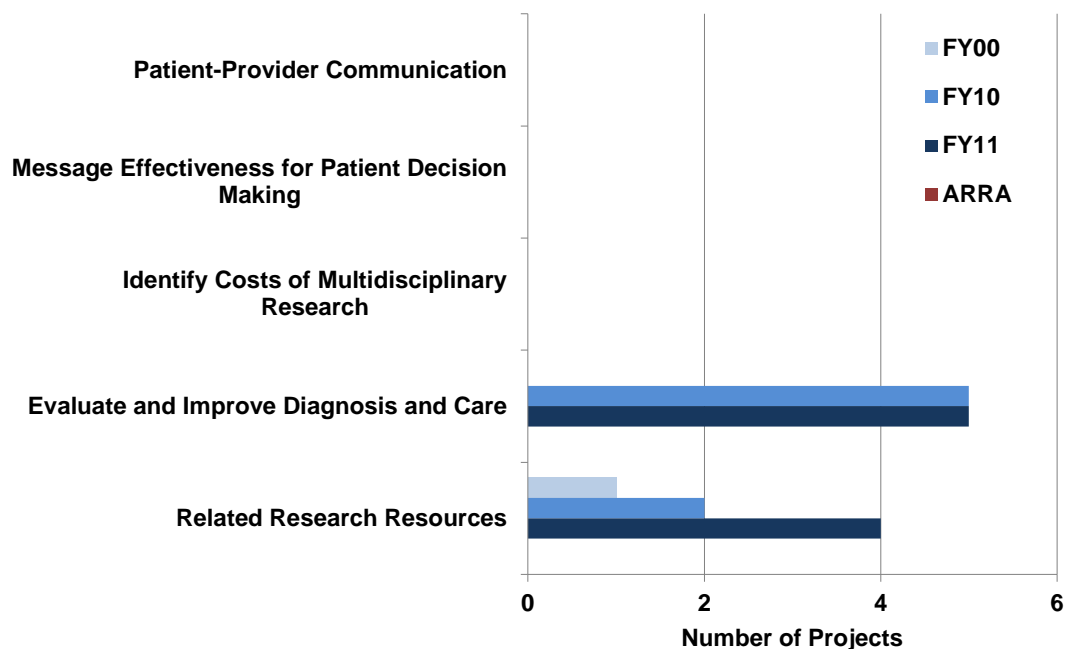


Figure 17. Pancreatic Cancer Projects Related to Health Services Research: FY2000, FY2010, FY2011, and ARRA

Select Initiatives

The following initiatives related to health services research funded at least one pancreatic cancer study:

- The **ELSI Regular Research Program** initiative funds research on the ethical, legal, and social implications of human genome research.
NCI funded one project through this initiative in FY2011. The project is exploring whether family members of participants in cancer biobank research wish to be informed about unanticipated genetic findings.

³² The sum of the values presented in the bar graph may exceed the total number of projects relevant to a priority area because many projects are relevant to more than one recommendation within a priority area.

- The **Cancer Surveillance Using Health-Claims-Based Data System**, which is cosponsored with the Agency for Healthcare Research and Quality, supports research using health claims data for cancer surveillance.
NCI funded two projects related to pancreatic cancer through this initiative in FY2011. One of these projects is developing tools and measures to evaluate the appropriateness of transitions between hospitals and nursing homes for seriously ill and dying cancer patients, and the other is evaluating the effectiveness of standard chemotherapy regimens in elderly Medicare cancer patients, who are currently underrepresented in cancer clinical trials.

Research Highlights

Recent results of NCI-sponsored health services research related to pancreatic cancer include:

- **Pancreatic Intraepithelial Neoplasia in the Surgical Resection Margin Does Not Influence Outcome in Pancreatic Cancer Patients.** A retrospective analysis of patients who underwent surgical resection of pancreatic ductal adenocarcinoma found that the presence of noninvasive pancreatic intra-epithelial neoplasia high grade (PanIN-3) at the resection margin did not affect patient survival. This result has significant implications for surgeons because it appears that no additional resection is needed unless residual invasive cancer is present at the resection margin.³³
- **Development of a Web-Based Cancer Communication and Decision Making System to Connect Patients, Caregivers, and Clinicians.** A module focused on the needs of patients with advanced-stage cancer and their caregivers was created for a Web-based interactive health communication system. The system provides information and also supports users in decision making. Lessons learned through the development and implementation of this system should inform future efforts to enhance communication and shared decision making.³⁴

³³ Matthaehi H, Hong SM, Mayo SC, dal Molin M, et al. [Presence of pancreatic intraepithelial neoplasia in the pancreatic transection margin does not influence outcome in patients with R0 resected pancreatic cancer.](#) Ann Surg Oncol. 2011 Nov;18(12):3493–9.

³⁴ DuBenske LL, Gustafson DH, Shaw BR, Cleary JF. [Web-based cancer communication and decision making systems: connecting patients, caregivers, and clinicians for improved health outcomes.](#) Med Decis Making. 2010 Nov–Dec;30(6):732–44.

Scientific Toolkit

Research Projects

The number of projects related to the pancreatic cancer scientific toolkit increased substantially between FY2000 and FY2011, from 15 to 64 (Figure 9). The largest increase in number of projects was seen in the area of imaging systems, for which there was one project in FY2000 and 23 projects in FY2011 (Figure 18).³⁵ The number of projects related to gene-based model systems also increased substantially over this time period, from 10 to 30. ARRA funds supported ten projects related to the scientific toolkit (Figure 21), with six of these projects focused on gene-based model systems.

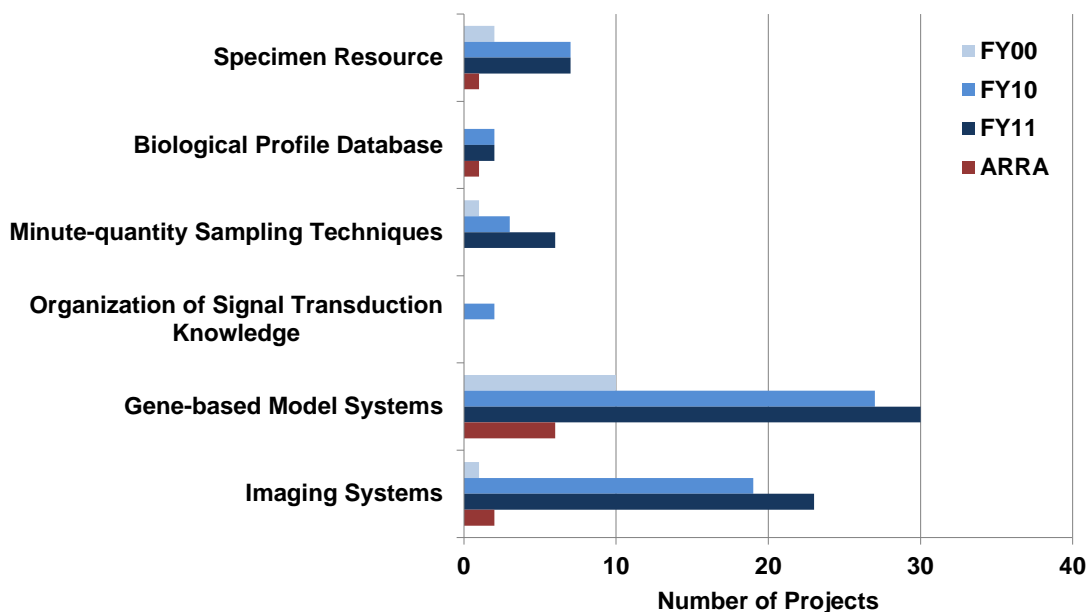


Figure 18. Pancreatic Cancer Projects Related to Scientific Toolkit: FY2000, FY2010, FY2011, and ARRA

Select Initiatives

NCI has established the following initiatives related to the scientific toolkit that have funded at least one pancreatic cancer study:

- The **Mouse Models of Human Cancers Consortium (MMHCC)** initiative supports development of animal models that may provide insight into human cancers. *This initiative funded three projects in FY2011 that were developing and characterizing mouse models to gain insight into the biology of pancreatic cancer.*

³⁵ The sum of the values presented in the bar graph may exceed the total number of projects relevant to a priority area because many projects are relevant to more than one recommendation within a priority area.

- The **Cancer Nanotechnology Platform Partnerships** develop nanotechnology platforms for basic, applied, and translational cancer research using nanoscale devices or nanomaterials. *This initiative supported four projects relevant to pancreatic cancer in FY2011. Two of these were developing theranostic nanoparticles for targeted treatment of pancreatic cancer.*
- The **Academic-Industrial Partnerships for Development and Validation of In Vivo Imaging Systems and Methods for Cancer Investigations** initiative was established to accelerate the translation of *in vivo* spectroscopic and imaging systems and methods for applications in research, clinical trials, and/or clinical practice. *In FY2011, five R01s and one R01 supplement relevant to pancreatic cancer were supported through this initiative. Two of these projects are developing and validating imaging systems for use in mouse models of pancreatic cancer. The other three are developing approaches in humans to assist in the detection and treatment of pancreatic cancer.*

Research Highlights

Recent results of NCI-sponsored research related to development of a scientific toolkit for pancreatic cancer include the following:

- **Mouse Model Points to Genes Involved in Pancreatic Cancer.** Researchers used a genetically engineered mouse model to identify genes that cooperate with oncogenic KRAS to drive pancreatic cancer. They found that loss of the deubiquitinase gene *Usp9x* enhanced tumorigenesis and protected pancreatic cancer cells from dying. Analysis of human tissue revealed that USP9X protein levels are inversely associated with metastatic burden in advanced pancreatic cancer.³⁶
- **Development of a PET Imaging Probe for Pancreatic Cancer.** An antibody fragment that binds to CA19-9, an antigen present on the majority of pancreatic cancer patients, was created and radiolabeled to generate a molecular imaging probe for use with positron emission tomography (PET). Although additional preclinical and clinical characterization of the probe is needed, it has potential to provide a more accurate assessment of disease burden in pancreatic cancer patients.³⁷

³⁶ Pérez-Mancera PA, Rust AG, van der Weyden L, Kristiansen G, et al. The deubiquitinase USP9X suppresses pancreatic ductal adenocarcinoma. *Nature*. Published online 2012 Apr 29.

³⁷ Girgis MD, Kenanova V, Olafsen T, McCabe KE, et al. [Anti-CA19-9 diabody as a PET imaging probe for pancreas cancer](#). *J Surg Res*. 2011 Oct;170(2):169–78.

Clinical Trials Planning Meeting on Pancreas Cancer Treatment

The Clinical Trials Planning Meeting on Pancreas Cancer Treatment was held in late 2007 and the resulting Consensus Report was published in November 2009. Figure 19 shows a summary of NCI-sponsored projects in FY2007, FY2010, and FY2011 that relate to each of the emphasis areas in which recommendations were issued (Table 2). Overall, the largest number of projects was related to new targets for drug development. There were also multiple projects focused on development of preclinical models³⁸ and identification and characterization of biomarkers. Fewer projects were related to biorepository establishment and future clinical trials.

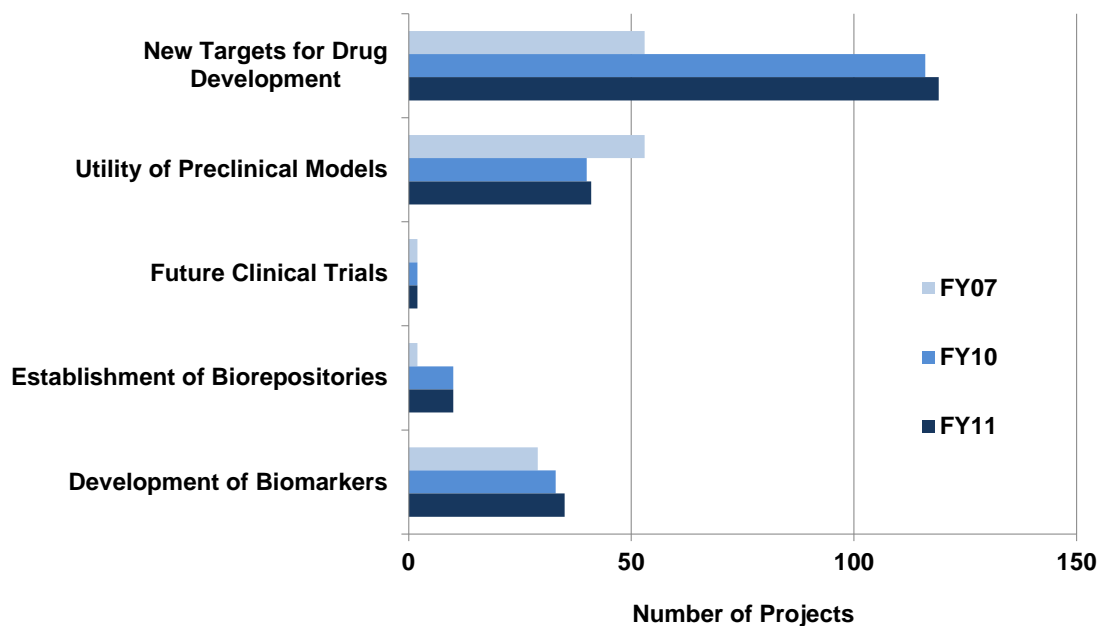


Figure 19. Pancreatic Cancer Research by Clinical Trials Planning Meeting Emphasis Area: FY2007, FY2010, and FY2011

³⁸ Includes cell culture and animal models.

American Recovery and Reinvestment Act of 2009

As part of the American Recovery and Reinvestment Act, NCI received \$1.26 billion to support cancer research and research-related activities in FY2009 and FY2010. Of this, nearly 60 percent was used to supplement existing grants or fund new ones. NCI invested \$14.3 million in extramural research relevant to pancreas cancer. There were 39 projects with at least 25 percent relevance to pancreas cancer supported in FY2009 and FY2010. Of these 39 projects, 15 were supported over two years.

Funding Mechanisms

ARRA funds directed toward pancreatic cancer research were awarded through a variety of mechanisms (Figure 20). The majority of the grants were R01s or R01 supplements. Of note, two Grand Opportunity grants (RC2) and eight Exploratory/Development grants (R21) were supported through ARRA funds.

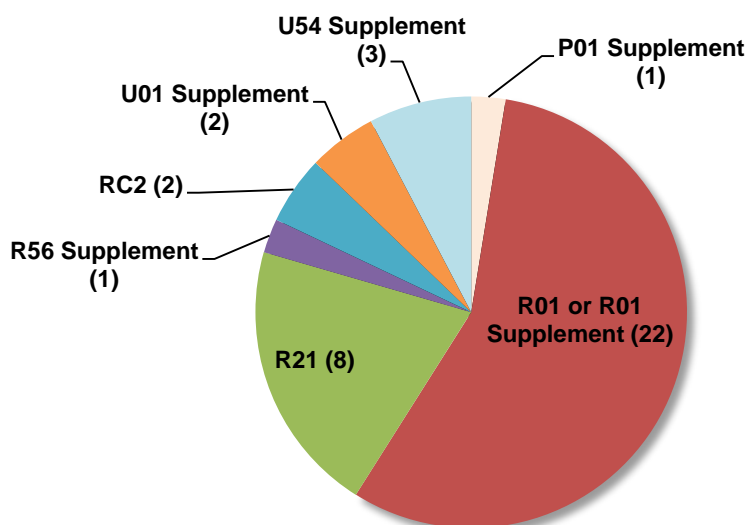


Figure 20. Number of Pancreas Cancer Grants Funded by ARRA Funds by Mechanism

PRG Priority Areas

Pancreatic cancer research funded by ARRA (Figure 21) includes projects in all of the PRG priority areas, with the exception of health services research. The largest number of projects is in the area of therapy. Of the 21 ARRA-funded projects in this area, 20 are focused on facilitating discovery and development of targeted therapeutics. A significant number of projects are related to tumor biology; 14 of these projects are investigating the development of pancreatic adenocarcinoma.

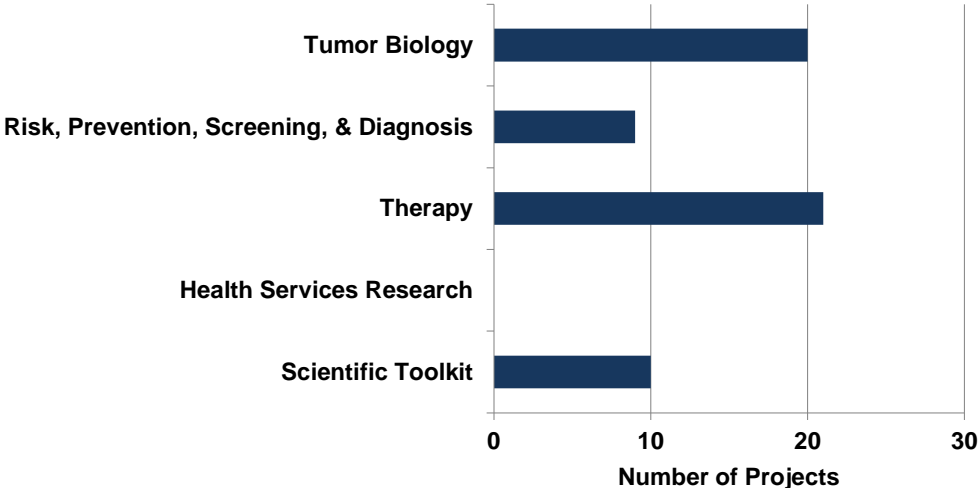


Figure 21. ARRA-Funded Projects by PRG Priority Area

Clinical Trials Planning Meeting Emphasis Areas

ARRA funding was used to support research in four of the five emphasis areas put forth in the Consensus Report of the Clinical Trials Planning Meeting for Pancreas Cancer Treatment (Figure 22). The majority of the projects are related to new targets for drug treatment, and several are focused on preclinical models.

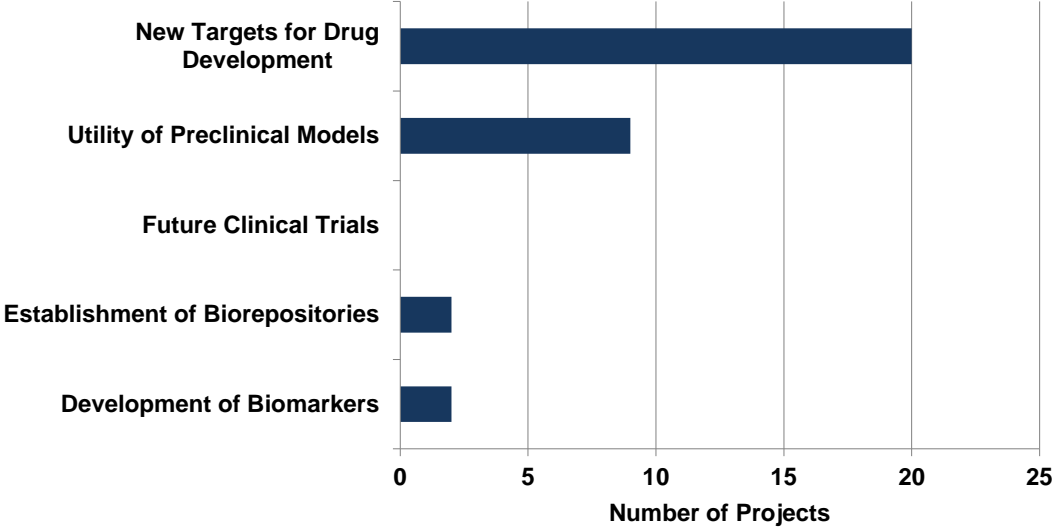


Figure 22. ARRA-Funded Projects by Clinical Trials Planning Meeting Emphasis Area

CONCLUSION

NCI's investment in pancreatic cancer research has increased substantially over the past 11 years. Funding levels more than quadrupled between FY2000 and FY2011, and the numbers of research projects and investigators focused on pancreatic cancer also rose considerably. During this same timeframe, the number of projects related to each of the Pancreatic Cancer PRG recommendations more than doubled, with many of these projects also addressing the recommendations put forth at the 2007 Clinical Trials Planning Meeting on Pancreas Cancer Treatment. In recent years, these projects have yielded important information about many aspects of pancreatic cancer. For example, research in the area of tumor biology has provided insight into the role of the tumor microenvironment in pancreatic cancer progression and response to treatment. Several studies have identified biomarkers with potential to aid in detection, diagnosis, and monitoring of this disease. In addition, researchers are looking for ways to enhance treatment of pancreatic cancer by targeting the immune system as well as components of the tumor microenvironment.

Despite this progress, additional research and effective application of research findings are needed to improve the outcomes of patients diagnosed with pancreatic cancer. In the coming years, NCI will continue to support the work needed to increase understanding of pancreatic cancer and develop better ways to prevent and treat this deadly disease. These efforts will be facilitated by the Pancreatic Cancer Research Action Planning Group and enhanced by collaborations with the advocacy community.

APPENDIX: NCI FY2011 PROJECTS CODED TO PANCREATIC CANCER PROGRESS REVIEW GROUP RECOMMENDATIONS

This appendix lists projects funded by NCI in FY2011 that are relevant to the recommendations set forth by the Pancreatic Cancer Progress Review Group.¹ Projects were identified using the NCI Funded Research Portfolio (NFRP) and all projects listed are at least 25 percent relevant to pancreatic cancer.² Projects relevant to recommendations set forth in the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* are designated with footnotes.³

Projects are sorted by mechanism⁴ and then by project number. Supplements are listed separately from parent grants and are designated with an asterisk after the project number.

Table of Contents

Tumor Biology	33
Risk, Prevention, Screening, and Diagnosis	44
Therapy	50
Health Services Research.....	58
Scientific Toolkit	60

¹ Pancreatic Cancer Progress Review Group. *Pancreatic cancer: an agenda for action*. NIH Publication No. 01-4940. Bethesda (MD): NCI; 2001. Available from: <http://planning.cancer.gov/library/2001pancreatic.pdf>.

² NCI grants are indexed for a variety of research categories and organ sites. Each category is assigned a “percent relevance” based on the portion of the grant relevant to the category that is used to prorate the total amount of the grant. Percent relevance values are assigned by professional staff based on review of complete grant applications. A grant may be 100 percent relevant to multiple categories and the sum of the percent relevance assignments of a grant may exceed 100 percent.

³ [Philip PA, Mooney M, Jaffe D, Eckhardt G, et al. Consensus report of the National Cancer Institute clinical trials planning meeting on pancreas cancer treatment. *J Clin Oncol*. 2009 Nov 20;27\(33\):5660-9.](#)

⁴ More information about NIH/NCI grant mechanisms can be found at http://grants.nih.gov/grants/funding/funding_program.htm or http://grants.nih.gov/grants/funding/ac_search_results.htm.

PRG Priority Area: Tumor Biology

Recommendation 1: Understand the normal biology of the pancreas.

No.	Mech	Project #	Principal Investigator	Project Title
1.	R01	CA112537	Hebrok, Matthias	Embryonic Signaling Pathways in Pancreatic Cancer
2.	R01	CA124586	Konieczny, Stephen	Kras-Induced Cellular Plasticity in Pancreatic Cancer
3.	R01	CA042829	Schuller, Hildegard	GABA-B-R-Mediated Prevention of Pancreatic Cancer
4.	R01	CA130888	Schuller, Hildegard	The GABA-B Receptor Is a Novel Drug Target for Pancreatic Cancer
5.	R01	CA129451	White, Michael	The RaLGTPase Regulatory Network
6.	R01	CA094160	Xie, Jingwu	Molecular Basis of Hedgehog Signaling in Carcinogenesis
7.	R01	CA129956	Xie, Keping	KLF4 Genetic and Epigenetic Changes in Human Pancreatic Cancer
8.	R21	CA137482	Houchen, Courtney	Pancreatic Stem Cells and Cancer

Recommendation 2: Elucidate the development of pancreatic adenocarcinoma.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA067166	Giacca, Amato	Tumor Hypoxia: Molecular Studies and Clinical Exploitation
2.	P01	CA134292	Leach, Steven	Functional Annotation of the Pancreatic Cancer Genome
3.	P20	CA138025	Junn, Ellen	Fresno State-SBCC Partnership: Cancer Research & Training for Central PA (1 of 2)
4.	P20	CA132386	Vuori, Kristiina	Fresno State-SBCC Partnership: Cancer Research & Training for Central CA (2 of 2)
5.	P30	CA036727	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
6.	P30	CA036727*	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
7.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
8.	P50	CA127297	Hollingsworth, Michael	SPORE in Gastrointestinal Cancer
9.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
10.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer
11.	R00	CA149182	Maher, Christopher	Characterization of Cancer Transcriptomes Using Next Generation Sequencing

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology

Recommendation 2: Elucidate the development of pancreatic adenocarcinoma, cont.

No.	Mech	Project #	Principal Investigator	Project Title
12.	R00	CA139050	McNalley, Lacey	KiSS1 Treatment of Pancreatic Adenocarcinoma
13.	R01	CA055360	Bar-Sagi, Dafna	Mechanisms of Signal Transduction by Ras Proteins
14.	R01	CA133557	Bardeesy, Nabeel	TGF-Beta Signaling in Pancreatic Cancer
15.	R01	CA078590	Batra, Surinder	Molecular Studies on MUC4 Mucin Gene
16.	R01	CA133774	Batra, Surinder	Smoking and Pancreatic Cancer
17.	R01	CA154383	Bergers, Gabriele	Multipotential Mesenchymal Stem Cell-Like Cells in Pancreatic Tumorigenesis
18.	R01	CA136786	Blobe, Gerard	Function of TbrIII as a BMP Co-Receptor in Human Cancer
19.	R01	CA132971*	Bouvet, Michael	Color-Coded Imaging of Pancreatic Cancer Microenvironment for Drug Discovery
20.	R01	CA132971	Bouvet, Michael	Color-Coded Imaging of Pancreatic Cancer Microenvironment for Drug Discovery
21.	R01	CA095731	Brunicardi, Francis	PDX-1 Is a Therapeutic Target for Pancreatic Cancer
22.	R01	CA142736	Chauhan, Subhash	Aspects of MUC13 Mucin in Cancer
23.	R01	CA045726	Cheresh, David	Regulation of Metastasis by Alpha V Integrin and Src
24.	R01	CA097159	Chiao, Paul	Mechanisms of RelA Activation in Cancer
25.	R01	CA140410	Chiao, Paul	Function and Regulation Mechanisms of Polo-Like Kinase 3 in Pancreatic Cancer
26.	R01	CA142674	Chiao, Paul	Mechanisms of Overexpressed TrkB in Inducing Pancreatic Cancer Metastasis
27.	R01	CA094184*	Counter, Christopher	Molecular Mechanisms of Neoplastic Transformation in Human Cells
28.	R01	CA094184	Counter, Christopher	Molecular Mechanisms of Neoplastic Transformation in Human Cells
29.	R01	CA123031	Counter, Christopher	Dynamic Requirements of Ras Signaling During Cancer
30.	R01	CA159222	Crawford, Howard	ADAM17 in Pancreatic Cancer and Pancreatitis
31.	R01	CA160924	de Lange, Titia	The Role of Telomere-Related Tetraploidization in Cancer
32.	R01	CA042978	Der, Channing	Biological Activity of Ras Oncogenes
33.	R01	CA122042	Eibl, Guido	The Role of n-3 Polyunsaturated Fatty Acids in Pancreatic Cancer

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology
Recommendation 2: Elucidate the development of pancreatic adenocarcinoma, cont.

No.	Mech	Project #	Principal Investigator	Project Title
34.	R01	CA119075*	Elferink, Lisa	Cellular Response to cMet Endocytosis
35.	R01	CA079827	Engelward, Bevin	Mechanisms of Damage-Induced Homologous Recombination
36.	R01	CA098018	Evan, Gerard	Kinetic Analysis of Myc-Induced Carcinogenesis <i>In Vivo</i>
37.	R01	CA136526	Fernandez-Zapico, Martin	Hedgehog and EGF Interaction: A Novel Therapeutic Approach for Pancreatic Cancer
38.	R01	CA124615	Fischer, Susan	Cyclooxygenase-2-Induced Pancreatic Cancer
39.	R01	CA069122	Freeman, James	Role of TGF-Beta Alterations in Pancreatic Cancer
40.	R01	CA123273	Heaney, Anthony	Refined Fructose Promotes Pancreatic Cancer Growth
41.	R01	CA112537	Hebrok, Matthias	Embryonic Signaling Pathways in Pancreatic Cancer
42.	R01	CA129357	Hingorani, Sunil	Genetic Progression of Pancreatic Mucinous Cystic Neoplasms to Invasive Carcinoma
43.	R01	CA057362	Hollingsworth, Michael	Studies on the Post-Translational Processing of MUC1
44.	R01	CA153821*	Hurley, Laurence	G-Quadruplex-Mediated Transcriptional Regulation of PDGFR- β
45.	R01	CA153821	Hurley, Laurence	G-Quadruplex-Mediated Transcriptional Regulation of PDGFR- β
46.	R01	CA140599	Iacobuzio-Donahue, Christine	TGF-Beta Signaling in Pancreatic Cancer Progression
47.	R01	CA123483	Kern, Scott	Fanconi Defects in Pancreatic Cancer Oncogenesis
48.	R01	CA128920	Kern, Scott	High-Throughput Analysis of Pancreatic Cancer Mutations
49.	R01	CA097022	Klemke, Richard	Survival Mechanisms of Invasive Carcinoma Cells
50.	R01	CA124586	Konieczny, Stephen	Kras-Induced Cellular Plasticity in Pancreatic Cancer
51.	R01	CA155784	Lewis, Brian	Dissecting Hedgehog, TGF-Beta and BMP Signaling During Pancreatic Tumorigenesis
52.	R01	CA138701	Li, Min	Role of Dietary Zinc Transporter ZIP4 in Pancreatic Cancer
53.	R01	CA136754	Lin, Richard	Phosphatidylinositol 3-Kinase and Prevention of Pancreatic Cancer

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology

Recommendation 2: Elucidate the development of pancreatic adenocarcinoma, cont.

No.	Mech	Project #	Principal Investigator	Project Title
54.	R01	CA155620	Lowy, Andrew	RON Receptor in Pancreatic Cancer Biology and Therapy
55.	R01	CA150142	Matsui, William	Cellular Diversity and Clinical Relevance of Stem Cells in Pancreatic Cancer
56.	R01	CA104125	McNiven, Mark	Cytoskeletal Dynamics in Pancreatic Cancer Metastasis
57.	R01	CA129967	Mitchell, Robert	Amplification of Tumor Hypoxic Responses by MIF-Dependent HIF Stabilization
58.	R01	CA150190	Mukhopadhyay, Debabrata	Targeting Pancreatic Cancer Using Peptide Chemistry: From Bench to Bedside
59.	R01	CA140290	Murray, Nicole	Role of PKC Iota in Metaplasia and Initiation of Pancreatic Cancer
60.	R01	CA134767	Nelkin, Barry	Targeting CDK5 in Pancreatic Cancer: Mechanistic and Preclinical Development
61.	R01	CA151588	Pasca di Magliano, Marina	Gli Activity in the Pancreas: Inflammation, Tissue Repair and Cancer
62.	R01	CA116034	Philips, Mark	Regulation of K-Ras by a Farnesyl-Electrostatic Switch
63.	R01	CA105412*	Quigley, James	Transmembrane Proteins Involved in Human Tumor Expansion
64.	R01	CA105412	Quigley, James	Transmembrane Proteins Involved in Human Tumor Expansion
65.	R01	CA124723	Saluja, Ashok	The Inhibition of HSP70 Induces Apoptosis in Pancreatic Cancer Cells
66.	R01	CA042829	Schuller, Hildegard	GABA-B-R-Mediated Prevention of Pancreatic Cancer
67.	R01	CA130888	Schuller, Hildegard	The GABA-B Receptor Is a Novel Drug Target for Pancreatic Cancer
68.	R01	CA131045	Simeone, Diane	ATDC Function in Human Pancreatic Adenocarcinoma
69.	R01	CA140182	Storz, Peter	Protein Kinase D in Oncogenic Oxidative Stress Signaling
70.	R01	CA109525	Su, Gloria	Mouse Model for Human Pancreatic Ductal Adenocarcinoma
71.	R01	CA140550	Tang, Amy	SIAH2-Dependent Proteolysis in Cell Migration, Tumor Growth and Cancer Metastasis
72.	R01	CA071443	White, Michael	Components of Ras-Mediated Growth Control
73.	R01	CA094160	Xie, Jingwu	Molecular Basis of Hedgehog Signaling in Carcinogenesis

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology

Recommendation 2: Elucidate the development of pancreatic adenocarcinoma, cont.

No.	Mech	Project #	Principal Investigator	Project Title
74.	R01	CA129956	Xie, Keping	KLF4 Genetic and Epigenetic Changes in Human Pancreatic Cancer
75.	R01	CA148954	Xie, Keping	Genetic Approaches to Pancreatic Cancer Progression
76.	R01	CA152309	Xie, Keping	Functional Validation of Pancreatic Cancer Progression Biomarker
77.	R03	CA135549	Du, Yuchun	Proteomic and Functional Studies of Mitochondrial Proteins Involved in ROS Metabolism
78.	R03	CA155691	Kunnimalaiyaan, Muthusamy	Role of GSK-3 Isoforms in Pancreatic Cancer
79.	R03	CA158895	Shi, Jiaqi	Translational Control by eIF3f in Pancreatic Cancer
80.	R21	CA155728	Bielenberg, Diane	Targeting Neuropilin 2 with Semaphorin 3F During Pancreatic Carcinoma Progression
81.	R21	CA135164	Friedman, Eileen	A Novel ROS Controlling Kinase
82.	R21	CA137482	Houchen, Courtney	Pancreatic Stem Cells and Cancer
83.	R21	CA155165	Ji, Baoan	Develop and Characterize a Novel Animal Model of Pancreatic Cancer
84.	R21	CA155992	Kumar, Chandan	High-Throughput Transcriptome Sequencing for Systematic Detection of Recurrent Gene Fusions and Transcript Aberrations in Pancreatic Cancer
85.	R21	CA149554	Lampe, Paul	Cx43 Phosphorylation Modulates Kras-Mediated Pancreas Cancer Progression
86.	R21	CA158898	Leach, Steven	High Resolution and Single Cell Analyses of PanIN Initiation and Progression
87.	R21	CA155255	Lowe, Anson	The Role of AGR2 in a Murine Model of Pancreatic Adenocarcinoma
88.	R21	CA143362	Messmer, Bradley	Molecular Evolution of Multifunctional DNA Nanoparticles
89.	R21	CA155175	Wagner, Kay-Uwe	Temporally Controlled Oncogene Expression in a Novel Pancreatic Cancer Model
90.	R21	CA149544	Wang, Huamin	Proteasome-Mediated Degradation of Hematopoietic Progenitor Kinase 1 in Pancreatic Cancer
91.	R37	CA075059	Korc, Murray	Dysregulation of TGF Beta Action in Pancreatic Cancer
92.	U01	CA141576	Castrillon, Diego	LKB1 Tumor Suppressor and Human Cancer

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology

Recommendation 2: Elucidate the development of pancreatic adenocarcinoma, cont.

No.	Mech	Project #	Principal Investigator	Project Title
93.	U01	CA128442	Varki, Ajit	Neu5Gc and Anti-Neu5Gc Antibodies for Detection of Cancer and Cancer Risk
94.	ZIA	BC 011003	Avital, Itzhak	Asymmetric Division and Self-Renewal of Cancer Stem Cells
95.	ZIA	BC 010794	Farrar, William	Characterization of Cancer Stem Cells
96.	ZIA	BC 011162	Hussain, S. Perwez	Molecular Profiling of Pancreatic Cancer
97.	ZIA	BC 011185	Hussain, S. Perwez	Role of Inflammation in the Development and Progression of Pancreatic Cancer
98.	ZIA	BC 011186	Hussain, S. Perwez	Animal Model of Pancreatic Cancer
99.	ZIA	BC 011416	Westlake, Christopher	Investigation of Rabs and Trafficking Regulators Roles in Tumorigenesis

Recommendation 3: Study the natural history of stroma and desmoplasia.

No.	Mech	Project #	Principal Investigator	Project Title
1.	R01	CA161112	Hingorani, Sunil	Overcoming Stromal Barriers to Therapeutics in Pancreas Cancer
2.	R01	CA125162	Joyce, Johanna	Dissecting the Function of Cysteine Cathepsins in the Tumor Microenvironment
3.	R01	CA113669	Maitra, Anirban	Developmental Signaling Pathways in Pancreatic Cancer
4.	R01	CA126888	Munshi, Hidayatullah	Fibrosis-Protease Cross-Talk Regulating Pancreatic Cancer Invasion
5.	R01	CA157980	Olive, Kenneth	Mechanisms of the Stromal Response to Smoothed Inhibition in Pancreatic Cancer
6.	R01	CA151588	Pasca di Magliano, Marina	Gli Activity in the Pancreas: Inflammation, Tissue Repair and Cancer
7.	R01	CA129484	Quigley, James	A Cellular and Molecular Analysis of the Intravasation Step in Tumor Metastasis
8.	R03	CA161136	Goicoechea, Silvia	Invadopodia Assembly in Pancreatic Tumor-Associated Fibroblasts
9.	R21	CA155650	Hwang, Rosa	Conditional Ablation of Stellate Cells to Determine Their Role in Pancreatitis and Pancreatic Cancer
10.	R21	CA152502	Matei, Daniela	Transglutaminase-Modulated Tumor-Stroma Interaction in Pancreatic Cancer
11.	R21	CA155649	Miller, George	The Role of Dendritic Cells in Pancreatic Tumorigenesis

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology

Recommendation 3: Study the natural history of stroma and desmoplasia, cont.

No.	Mech	Project #	Principal Investigator	Project Title
12.	R21	CA152249	Provenzano, Paolo	Dissecting the Roles of Stellate Cells in Pancreas Cancer Progression
13.	R43	CA162766	Slee, Deborah	Preclinical Development of iRGD for Pancreatic Cancer
14.	U01	CA151925	Kalluri, Raghu	Role of Fibroblasts, Myeloid Cells and Matrix in PDAC
15.	U54	CA163120	Batra, Surinder	Pancreatic Tumor Microenvironment Network
16.	U54	CA163111	Wang, Timothy	Myofibroblasts in Gastrointestinal Cancers

Recommendation 4: Study host-tumor interactions and develop related therapeutic strategies.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA067166	Giaccia, Amato	Tumor Hypoxia: Molecular Studies & Clinical Exploitation
2.	P01	CA026731	Tannenbaum, Steven	Endogenous Nitrite Carcinogenesis in Man
3.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
4.	P50	CA127297	Hollingsworth, Michael	SPORE in Gastrointestinal Cancer
5.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer
6.	R01	CA099948	Bergers, Gabriele	Mechanism and Therapeutic Targeting of Evasive Resistance to Antiangiogenic Drugs
7.	R01	CA065910	Cance, William	Focal Adhesion Kinase: Tumor Biology and Therapeutics
8.	R01	CA097159	Chiao, Paul	Mechanisms of RelA Activation in Cancer
9.	R01	CA123031	Counter, Christopher	Dynamic Requirements of Ras Signaling During Cancer
10.	R01	CA159222	Crawford, Howard	ADAM17 in Pancreatic Cancer and Pancreatitis
11.	R01	CA079827	Engelward, Bevin	Mechanisms of Damage-Induced Homologous Recombination
12.	R01	CA098018	Evan, Gerard	Kinetic Analysis of Myc-Induced Carcinogenesis <i>In Vivo</i>
13.	R01	CA136526	Fernandez-Zapico, Martin	Hedgehog and EGF Interaction: A Novel Therapeutic Approach for Pancreatic Cancer
14.	R01	CA124615	Fischer, Susan	Cyclooxygenase-2-Induced Pancreatic Cancer
15.	R01	CA135386	Fischer, Susan	Obesity and Pancreatic Cancer: The Role of IGF-1

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology

Recommendation 4: Study host-tumor interactions and develop related therapeutic strategies, cont.

No.	Mech	Project #	Principal Investigator	Project Title
16.	R01	CA127641	Fisher, Paul	Pancreatic Cancer Management by Novel Gene Therapy & Dietary Agents
17.	R01	CA069122	Freeman, James	Role of TGF Beta Alterations in Pancreatic Cancer
18.	R01	CA157490	Kimmelman, Alec	Investigating the Role of Autophagy in Pancreatic Cancer Radiation Resistance
19.	R01	CA127494	McConkey, David	Proteasome Inhibition and ER Stress
20.	R01	CA129484	Quigley, James	A Cellular and Molecular Analysis of the Intravasation Step in Tumor Metastasis
21.	R01	CA131151	Sarkar, Fazlul	A Novel and Targeted Approach to Inhibit Invasion and Angiogenesis
22.	R01	CA132794	Sarkar, Fazlul	FoxM1: A Molecular Target in Pancreatic Cancer
23.	R01	CA154321	Sarkar, Fazlul	Prevention of Tumor Progression by a Novel Approach
24.	R01	CA025000	Schell, Todd	CD8+ T-Cell-Mediated Immunotherapy of Autochthonous SV40 T-Antigen-Induced Tumors
25.	R01	CA057855	Sherman, Linda	Generating CTL Against Tumor-Associated Peptide Antigens
26.	R01	CA132734	Vile, Richard	Autoimmunity and Anti-Tumor Immunity Outside of the Melanocyte/Melanoma Paradigm
27.	R03	CA149857	Hollingsworth, Michael	A Novel Combination Therapy for the Treatment of Pancreatic Adenocarcinoma
28.	R21	CA156037	Jain, Maneesh	Novel Combination Therapy Against Pancreatic Cancer
29.	R21	CA158976	Nikolovska-Coleska, Zaneta	Novel Mcl-1 Inhibitors for Pancreatic Cancer Therapy
30.	R21	CA159337	Prendergast, George	IDO2 Targeting for Pancreatic Cancer Treatment
31.	R21	CA161182	Spitz, Douglas	Using Ketogenic Diets to Enhance Radio-Chemo-Therapy Response: A Phase I Trial
32.	R21	CA161726	Wang, Xiao-Fan	Preclinical Evaluation of PK2 Antagonists for Pancreatic Cancer
33.	R37	CA050286	Cheresh, David	VEGF and PDGF in Angiogenesis and Tumor Progression
34.	U01	CA141468	Engleman, Edgar G.	Biology and Immunology of Pancreatic Cancer Stem Cells in a Novel Mouse Model

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology

Recommendation 4: Study host-tumor interactions and develop related therapeutic strategies, cont.

No.	Mech	Project #	Principal Investigator	Project Title
35.	U01	CA151925	Kalluri, Raghu	Role of Fibroblasts, Myeloid Cells and Matrix in PDAC
36.	U54	CA163120	Batra, Surinder	Pancreatic Tumor Microenvironment Network
37.	U54	CA132384*	Klonoff, Elizabeth	Comprehensive SDSU/UCSD Cancer Center Partnership 1 of 2
38.	U54	CA132384	Klonoff, Elizabeth	Comprehensive SDSU/UCSD Cancer Center Partnership 1 of 2
39.	ZIA	BC 011185	Hussain, S. Perwez	Role of Inflammation in the Development and Progression of Pancreatic Cancer

Recommendation 5: Create specimen banks of normal and neoplastic human pancreatic tissue.⁵

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA130810*	Brenner, Dean	Translational Research in GI Cancer
2.	P50	CA130810	Brenner, Dean	Translational Research in GI Cancer
3.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
4.	P50	CA127003	Fuchs, Charles	DF/HCC SPORE in Gastrointestinal Cancer
5.	P50	CA127297	Hollingsworth, Michael	SPORE in Gastrointestinal Cancer
6.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
7.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer

Recommendation 6: Develop experimental model systems.⁶

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA134292	Leach, Steven	Functional Annotation of the Pancreatic Cancer Genome
2.	P01	CA026731	Tannenbaum, Steven	Endogenous Nitrite Carcinogenesis in Man
3.	R01	CA078590	Batra, Surdiner	Molecular Studies on MUC4 Mucin Gene
4.	R01	CA133774	Batra, Surdiner	Smoking and Pancreatic Cancer

⁵ Projects coded to Tumor Biology recommendation #5 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Establishment of Biorepositories ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

⁶ Projects coded to Tumor Biology recommendation #6 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Utility of Preclinical Models ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology
Recommendation 6: Develop experimental model systems, cont.

No.	Mech	Project #	Principal Investigator	Project Title
5.	R01	CA154383	Bergers, Gabriele	Multipotential Mesenchymal Stem-Cell-Like Cells in Pancreatic Tumorigenesis
6.	R01	CA132971*	Bouvet, Michael	Color-Coded Imaging of Pancreatic Cancer Microenvironment for Drug Discovery
7.	R01	CA132971	Bouvet, Michael	Color-Coded Imaging of Pancreatic Cancer Microenvironment for Drug Discovery
8.	R01	CA097159	Chiao, Paul	Mechanisms of RelA Activation in Cancer
9.	R01	CA123273	Heaney, Anthony	Refined Fructose Promotes Pancreatic Cancer Growth
10.	R01	CA112537	Hebrok, Matthias	Embryonic Signaling Pathways in Pancreatic Cancer
11.	R01	CA123483	Kern, Scott	Fanconi Defects in Pancreatic Cancer Oncogenesis
12.	R01	CA097022	Klemke, Richard	Survival Mechanisms of Invasive Carcinoma Cells
13.	R01	CA113896*	Lewis, Brian	Molecular Dissection of Pancreatic Ductal Adenocarcinoma
14.	R01	CA113896	Lewis, Brian	Molecular Dissection of Pancreatic Ductal Adenocarcinoma
15.	R01	CA155784	Lewis, Brian	Dissecting Hedgehog, TGF-Beta and BMP Signaling During Pancreatic Tumorigenesis
16.	R01	CA113669	Maitra, Anirban	Developmental Signaling Pathways in Pancreatic Cancer
17.	R01	CA134767	Nelkin, Barry	Targeting CDK5 in Pancreatic Cancer: Mechanistic and Preclinical Development
18.	R01	CA129484	Quigley, James	A Cellular and Molecular Analysis of the Intravasation Step in Tumor Metastasis
19.	R01	CA131151	Sarkar, Fazlul	A Novel and Targeted Approach to Inhibit Invasion and Angiogenesis
20.	R01	CA132794	Sarkar, Fazlul	FoxM1: A Molecular Target in Pancreatic Cancer
21.	R01	CA057855	Sherman, Linda	Generating CTL Against Tumor-Associated Peptide Antigens
22.	R01	CA109525	Su, Gloria	Mouse Model for Human Pancreatic Ductal Adenocarcinoma
23.	R01	CA129451	White, Michael	The RaLGTPase Regulatory Network
24.	R03	CA155691	Kunnimalaiyaan, Muthusamy	Role of GSK-3 Isoforms in Pancreatic Cancer

*Projects marked with an asterisk are supplements.

PRG Priority Area: Tumor Biology
Recommendation 6: Develop experimental model systems, cont.

No.	Mech	Project #	Principal Investigator	Project Title
25.	R21	CA155650	Hwang, Rosa	Conditional Ablation of Stellate Cells to Determine Their Role in Pancreatitis and Pancreatic Cancer
26.	R21	CA155165	Ji, Baoan	Develop and Characterize a Novel Animal Model of Pancreatic Cancer
27.	R21	CA158898	Leach, Steven	High Resolution and Single Cell Analyses of PanIN Initiation and Progression
28.	R21	CA155255	Lowe, Anson	The Role of AGR2 in a Murine Model of Pancreatic Adenocarcinoma
29.	R37	CA075059	Korc, Murray	Dysregulation of TGF Beta Action in Pancreatic Cancer
30.	U01	CA141576	Castrillon, Diego	LKB1 Tumor Suppressor and Human Cancer
31.	U01	CA141468	Engleman, Edgar G.	Biology and Immunology of Pancreatic Cancer Stem Cells in a Novel Mouse Model
32.	U01	CA105492	Holland, Eric	Using Mouse Models to Probe the Relationship of Oncogenesis to Development and Oncogene Dependence
33.	ZIA	BC 011186	Hussain, S. Perwez	Animal Model of Pancreatic Cancer

*Projects marked with an asterisk are supplements.

PRG Priority Area: Risk, Prevention, Screening, and Diagnosis

Recommendation 1: Identify genetic and environmental factors that contribute to disease development.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA117969	Depinho, Ronald	Genetics and Biology of Pancreatic Ductal Adenocarcinoma
2.	P01	CA134292	Leach, Steven	Functional Annotation of the Pancreatic Cancer Genome
3.	P30	CA036727	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
4.	P30	CA036727*	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
5.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
6.	R01	CA133774	Batra, Surinder	Smoking and Pancreatic Cancer
7.	R01	CA121137	Chen, Xinbin	Molecular Oncogenic Properties of Mutant p53
8.	R01	CA123159	Cole, David	Targeting the Casm Oncogene as a Novel Therapy for Pancreatic Cancer
9.	R01	CA079827	Engelward, Bevin	Mechanisms of Damage-Induced Homologous Recombination
10.	R01	CA135386	Fischer, Susan	Obesity and Pancreatic Cancer: The Role of IGF-1
11.	R01	CA124908	Fuchs, Charles	Prospective Cohort Collaborative in Pancreatic Cancer Epidemiology & Pathogenesis
12.	R01	CA125162	Joyce, Johanna	Dissecting the Function of Cysteine Cathepsins in the Tumor Microenvironment
13.	R01	CA154823	Klein, Alison	Validation and Fine-Scale Mapping of Pancreatic Cancer Susceptibility Loci
14.	R01	CA113896*	Lewis, Brian	Molecular Dissection of Pancreatic Ductal Adenocarcinoma
15.	R01	CA113896	Lewis, Brian	Molecular Dissection of Pancreatic Ductal Adenocarcinoma
16.	R01	CA097075	Petersen, Gloria	Pancreatic Cancer Genetic Epidemiology Consortium (PACGENE)
17.	R01	CA114421	Risch, Harvey	Case Control Study of Pancreas Cancer in Shanghai, China
18.	R01	CA042829	Schuller, Hildegard	GABA-B-R-Mediated Prevention of Pancreatic Cancer

*Projects marked with an asterisk are supplements.

PRG Priority Area: Risk, Prevention, Screening, and Diagnosis

Recommendation 1: Identify genetic and environmental factors that contribute to disease development, cont.

No.	Mech	Project #	Principal Investigator	Project Title
19.	R01	CA130888	Schuller, Hildegard	The GABA-B Receptor Is a Novel Drug Target for Pancreatic Cancer
20.	R03	CA139261	He, Ka	Dietary Supplement Use, Physical Activity, Body Mass Index, and Pancreatic Cancer
21.	R21	CA139193	Michaud, Dominique	Serological Markers of Periodontal Disease and Pancreatic Cancer Risk
22.	U01	CA150138	Olson, Sara	Serum IgE and Risk of Pancreatic Cancer

Recommendation 2: Develop approaches for prevention in high-risk cohorts.

No.	Mech	Project #	Principal Investigator	Project Title
1.	R01	CA151727	Dhar, Animesh	Pancreatic Cancer: Crocetin as a Novel Therapeutic Approach
2.	R01	CA122042	Eibl, Guido	The Role of n-3 Polyunsaturated Fatty Acids in Pancreatic Cancer
3.	R01	CA124615	Fischer, Susan	Cyclooxygenase-2-Induced Pancreatic Cancer
4.	R01	CA135386	Fischer, Susan	Obesity and Pancreatic Cancer: The Role of IGF-1
5.	R01	CA127641	Fisher, Paul	Pancreatic Cancer Management by Novel Gene Therapy & Dietary Agents
6.	R01	CA136754	Lin, Richard	Phosphatidylinositol 3-Kinase and Prevention of Pancreatic Cancer
7.	R01	CA129227	Malafa, Mokenge	Intervention of Pancreatic Oncogenic Pathways with Dietary Tocotrienol
8.	R01	CA154172	Rigas, Basil	Phospho-Valproic Acid for Pancreatic Cancer Prevention
9.	R01	CA131151	Sarkar, Fazlul	A Novel and Targeted Approach to Inhibit Invasion and Angiogenesis
10.	R01	CA132794	Sarkar, Fazlul	FoxM1: A Molecular Target in Pancreatic Cancer
11.	R01	CA078814	Sporn, Michael	New Triterpenoids for Chemoprevention and Therapy of Cancer
12.	R01	CA125262	Srivastava, Rakesh	Chemoprevention of Pancreatic Cancer by EGCG
13.	R01	CA129038	Srivastava, Sanjay	Chemoprevention of Pancreatic Cancer by Capsaicin

*Projects marked with an asterisk are supplements.

PRG Priority Area: Risk, Prevention, Screening, and Diagnosis

Recommendation 2: Develop approaches for prevention in high-risk cohorts, cont.

No.	Mech	Project #	Principal Investigator	Project Title
14.	R03	CA139261	He, Ka	Dietary Supplement Use, Physical Activity, Body Mass Index, and Pancreatic Cancer
15.	R03	CA153812	Prabhu, Sunil	Chemoprevention of Pancreatic Cancer Using a Combinatorial Nano-Drug System
16.	R21	CA149785	Halдар, Subrata	Regulation of MicroRNA-16 by Benzyl Isothiocyanate in Pancreatic Cancer

Recommendation 3: Develop early detection methods.⁷

No.	Mech	Project #	Principal Investigator	Project Title
1.	N43	CO110121-000	Fralish, Greg	Phase I SBIR TOPIC 307 Novel Targeted Imaging Reagent for Pancreatic Cancer
2.	N43	CO110069-000	Kroh, Frank	SBIR - Topic 301 - Detection of Cancer - Specific Active Proteases in Urine and Blood
3.	P50	CA130810*	Brenner, Dean	Translational Research in GI Cancer
4.	P50	CA130810	Brenner, Dean	Translational Research in GI Cancer
5.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
6.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
7.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer
8.	R01	CA131944	Batra, Surinder	Molecular Markers for the Diagnosis of Pancreatic Cancer
9.	R01	CA096924	Gold, David	Detection and Diagnosis of Pancreatic Carcinoma
10.	R01	CA137071	Kelly, Kimberly	Development of Molecularly Targeted Imaging Agents for Early Detection of PDAC
11.	R01	CA154455	Lubman, David	Serum Glycoprotein Markers of Cancer Using an Ion Mobility/Mass Spec Approach
12.	R01	CA140211	Misek, David	Distinctive Glycan Fingerprints of Pancreatic Cancer for Plasma Detection
13.	R15	CA152985	Kennedy, Michael	Metabolomics Studies of Human Diseases
14.	R21	CA158267	Allen, Peter	Antibody Bead Array Technology for Diagnosis of Pre-Invasive Pancreatic Cancer
15.	R21	CA161575	Chen, Ru	Pancreatic Juice Biomarker for Pancreatic Cancer

⁷ Projects coded to Risk, Prevention, Screening, and Diagnosis recommendation #3 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Biomarkers ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Priority Area: Risk, Prevention, Screening, and Diagnosis

Recommendation 3: Develop early detection methods, cont.

No.	Mech	Project #	Principal Investigator	Project Title
16.	R21	CA152935	Liu, Yang	Development of Microscopic Spectral Markers for Diagnosis of Pancreatic Lesions
17.	R21	CA149772	Pan, Sheng	Aberrant Glycosylation Signature in Pancreatic Cancer
18.	R21	CA151160	Thompson, E	Fusion Gene Mutations as Biomarkers of Pancreatic Cancer Lymph Node Metastases
19.	R33	CA155586	Porter, Marc	Advanced Development of a Multiplexed SERS-Based Biomarker Detection Platform: A Multiplexed Panel Approach to Early-Stage Cancer Diagnosis
20.	R44	CA157025	Ho, David	Clinical Production and IND-Enabling Studies for PSCA Minibody Imaging in Pancreatic Cancer
21.	R44	CA117218	Iftimia, Nicusor	Image-Guided Intervention System for Pancreatic Cystic Lesions
22.	U01	CA152653	Haab, Brian	Detection of Pre-Invasive Pancreatic Cysts Using Protein and Glycan Biomarkers
23.	U01	CA111294	Hollingsworth, Michael	Early Diagnosis of Pancreatic Cancer
24.	U01	CA128437	Hollingsworth, Michael	Autoantibodies Against Glycopeptide Epitopes as Serum Biomarkers of Cancer
25.	U01	CA111302	Killary, Ann	Biomarkers for the Early Detection of Pancreatic Cancer
26.	U01	CA151455	Lin, Wenbin	Nanoscale Metal-Organic Frameworks for Imaging and Therapy of Pancreatic Cancer
27.	U01	CA128454	Pierce, James	Tumor Glycomics Laboratory for Discovery of Pancreatic Cancer Markers
28.	U01	CA151650	Porter, Marc	Magnetoresistive Sensor Platform for Parallel Cancer Marker Detection
29.	U01	CA128442	Varki, Ajit	Neu5Gc and Anti-Neu5Gc Antibodies for Detection of Cancer and Cancer Risk
30.	U54	CA151668	Gorenstein, David	Texas Center for Cancer Nanomedicine
31.	ZIA	BC 010997	Avital, Itzhak	Purification of a Novel Antibody Against Solid-Organ Cancer Stem Cells

Recommendation 4: Create new registries and expand existing registries.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
2.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer

*Projects marked with an asterisk are supplements.

PRG Priority Area: Risk, Prevention, Screening, and Diagnosis
Recommendation 4: Create new registries and expand existing registries, cont.

No.	Mech	Project #	Principal Investigator	Project Title
3.	R01	CA097075	Petersen, Gloria	Pancreatic Cancer Genetic Epidemiology Consortium (PACGENE)
4.	R01	CA140940	Sherman, Simon	Enhancing the Biomedical Computing Platform for Pancreatic Cancer Research
5.	R21	CA149772	Pan, Sheng	Aberrant Glycosylation Signature in Pancreatic Cancer

Recommendation 5: Develop specimen banks.⁸

No.	Mech	Project #	Principal Investigator	Project Title
1.	P30	CA036727	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
2.	P30	CA036727*	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
3.	P50	CA130810*	Brenner, Dean	Translational Research in GI Cancer
4.	P50	CA130810	Brenner, Dean	Translational Research in GI Cancer
5.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
6.	P50	CA127003	Fuchs, Charles	DF/HCC SPORE in Gastrointestinal Cancer
7.	P50	CA127297	Hollingsworth, Michael	SPORE in Gastrointestinal Cancer
8.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer
9.	U01	CA152653	Haab, Brian	Detection of Pre-Invasive Pancreatic Cysts Using Protein and Glycan Biomarkers

Recommendation 6: Establish consortia to elucidate causal factors.

No.	Mech	Project #	Principal Investigator	Project Title
1.	R43	CA162845	Fralish, Greg	Developing a Plectin-1 Targeted Imaging Agent for the Detection of Pancreatic Cancer

Recommendation 7: Develop education and training resources.

No grants or contracts.

⁸ Projects coded to Risk, Prevention, Screening, and Diagnosis recommendation #5 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Establishment of Biorepositories ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Area: Risk, Prevention, Screening, and Diagnosis

Recommendation 8: Develop a Web-based imaging library.

No.	Mech	Project #	Principal Investigator	Project Title
1.	R01	CA135673	Sevick-Muraca, Eva	Fluorescence-Enhanced Optical Tomography

Recommendation 9: Establish technology centers for gene and protein expression.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA127003	Fuchs, Charles	DF/HCC SPORE in Gastrointestinal Cancer
2.	R01	CA139599	Allbritton, Nancy	Multiplexed Measurement of Kinase Activity in Single Cancer Cells
3.	U01	CA152653	Haab, Brian	Detection of Pre-Invasive Pancreatic Cysts Using Protein and Glycan Biomarkers
4.	U54	CA151668	Gorenstein, David	Texas Center for Cancer Nanomedicine

Recommendation 10: Develop animal models.⁹

No.	Mech	Project #	Principal Investigator	Project Title
1.	R01	CA127641	Fisher, Paul	Pancreatic Cancer Management by Novel Gene Therapy & Dietary Agents
2.	R01	CA129963	Hidalgo, Manuel	Tailoring New Drugs in Pancreatic Cancer
3.	R01	CA125162	Joyce, Johanna	Dissecting the Function of Cysteine Cathepsins in the Tumor Microenvironment
4.	R01	CA131151	Sarkar, Fazlul	A Novel and Targeted Approach to Inhibit Invasion and Angiogenesis
5.	R01	CA132794	Sarkar, Fazlul	FoxM1: A Molecular Target in Pancreatic Cancer
6.	R01	CA125262	Srivastava, Rakesh	Chemoprevention of Pancreatic Cancer by EGCG
7.	R01	CA094084	Yamamoto, Masato	Enhanced CRAd for Pancreatic Cancer
8.	U01	CA105492	Holland, Eric	Using Mouse Models to Probe the Relationship of Oncogenesis to Development and Oncogene Dependence

⁹ Projects coded to Risk, Prevention, Screening, and Diagnosis recommendation #10 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Utility of Preclinical Models ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Priority Area: Therapy

Recommendation 1: Facilitate discovery and development of targeted therapeutics.¹⁰

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA159992	Butts, Kim	Magnetic Resonance Imaging-Guided Cancer Interventions
2.	P01	CA017094	Dorr, Robert	Therapeutic Targeting of Hypoxic and Oxidative Stress
3.	P01	CA067166	Giaccia, Amato	Tumor Hypoxia: Molecular Studies & Clinical Exploitation
4.	P01	CA134292	Leach, Steven	Functional Annotation of the Pancreatic Cancer Genome
5.	P30	CA036727	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
6.	P30	CA036727*	Cowan, Kenneth	UNMC Eppley Cancer Center Support Grant
7.	P50	CA130810*	Brenner, Dean	Translational Research in GI Cancer
8.	P50	CA130810	Brenner, Dean	Translational Research in GI Cancer
9.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
10.	P50	CA127297	Hollingsworth, Michael	SPORE in Gastrointestinal Cancer
11.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
12.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer
13.	R00	CA139050	McNally, Lacey	KiSS1 Treatment of Pancreatic Adenocarcinoma
14.	R01	CA133557	Bardeesy, Nabeel	TGF-Beta Signaling in Pancreatic Cancer
15.	R01	CA099948	Bergers, Gabriele	Mechanism and Therapeutic Targeting of Evasive Resistance to Antiangiogenic Drugs
16.	R01	CA103904	Bortfeld, Thomas	Multi-Criteria IMRT Optimization
17.	R01	CA124714	Brock, Kristy	Dynamic Multi-Organ Anatomical Models for Hypofractionated RT Design and Delivery
18.	R01	CA095731	Brunnicardi, Francis	PDX-1 Is a Therapeutic Target for Pancreatic Cancer
19.	R01	CA065910	Cance, William	Focal Adhesion Kinase: Tumor Biology and Therapeutics
20.	R01	CA045726	Cheresh, David	Regulation of Metastasis by Alpha V Integrin and Src

¹⁰ Projects coded to Therapy recommendation #1 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of New Targets for Drug Development ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Priority Area: Therapy

Recommendation 1: Facilitate discovery and development of targeted therapeutics, cont.

No.	Mech	Project #	Principal Investigator	Project Title
21.	R01	CA123159	Cole, David	Targeting the Casm Oncogene as a Novel Therapy for Pancreatic Cancer
22.	R01	CA151727	Dhar, Animesh	Pancreatic Cancer: Crocetin as a Novel Therapeutic Approach
23.	R01	CA136526	Fernandez-Zapico, Martin	Hedgehog and EGF Interaction: A Novel Therapeutic Approach for Pancreatic Cancer
24.	R01	CA131199	Graves, Edward	Small Animal Image-Guided Radiotherapy
25.	R01	CA161112	Hingorani, Sunil	Overcoming Stromal Barriers to Therapeutics in Pancreas Cancer
26.	R01	CA153821*	Hurley, Laurence	G-Quadruplex-Mediated Transcriptional Regulation of PDGFR- β
27.	R01	CA153821	Hurley, Laurence	G-Quadruplex-Mediated Transcriptional Regulation of PDGFR- β
28.	R01	CA154451	Hwang, Joo	Ultrasound-Enhanced Penetration for Treatment of Pancreatic Cancer
29.	R01	CA067267	Johnson, Candace	Anti-Tumor Mechanisms and Therapeutic Effects of Vitamin D
30.	R01	CA123483	Kern, Scott	Fanconi Defects in Pancreatic Cancer Oncogenesis
31.	R01	CA157490	Kimmelman, Alec	Investigating the Role of Autophagy in Pancreatic Cancer Radiation Resistance
32.	R01	CA037109	Lampidis, Theodore	Anti-Tumor Activity of Sugar Analogs via Blocking Glycolysis vs Glycosylation
33.	R01	CA138701	Li, Min	Role of Dietary Zinc Transporter ZIP4 in Pancreatic Cancer
34.	R01	CA155620	Lowy, Andrew	RON Receptor in Pancreatic Cancer Biology and Therapy
35.	R01	CA113669	Maitra, Anirban	Developmental Signaling Pathways in Pancreatic Cancer
36.	R01	CA129227	Malafa, Mokenge	Intervention of Pancreatic Oncogenic Pathways with Dietary Tocotrienol
37.	R01	CA154846	Mao, Hui	MRI-Capable Receptor-Targeted Drug Delivery for Pancreatic Cancer
38.	R01	CA138723	Maybaum, Jonathan	Mechanism-Based Use of Chk1 Inhibitors in Pancreas Cancer
39.	R01	CA137873*	McAlpine, Shelli	Conformational-Based Design and Development of Antitumor Agents
40.	R01	CA137873	McAlpine, Shelli	Conformational-Based Design and Development of Antitumor Agents

*Projects marked with an asterisk are supplements.

PRG Priority Area: Therapy

Recommendation 1: Facilitate discovery and development of targeted therapeutics, cont.

No.	Mech	Project #	Principal Investigator	Project Title
41.	R01	CA127494	McConkey, David	Proteasome Inhibition and ER Stress
42.	R01	CA104125	McNiven, Mark	Cytoskeletal Dynamics in Pancreatic Cancer Metastasis
43.	R01	CA109389	Mohammad, Ramzi	Specific Targets for Pancreatic Cancer Therapy
44.	R01	CA123547	Morse, David	Targeting Pancreatic Cancer
45.	R01	CA135011	Mukherjee, Priyabrata	Development of a Gold Nanoparticles-Based Targeted Delivery System
46.	R01	CA150190	Mukhopadhyay, Debabrata	Targeting Pancreatic Cancer Using Peptide Chemistry: From Bench to Bedside
47.	R01	CA134767	Nelkin, Barry	Targeting CDK5 in Pancreatic Cancer: Mechanistic and Preclinical Development
48.	R01	CA105412*	Quigley, James	Transmembrane Proteins Involved in Human Tumor Expansion
49.	R01	CA105412	Quigley, James	Transmembrane Proteins Involved in Human Tumor Expansion
50.	R01	CA124998	Safe, Stephen	NUR77 Agonists: New Targets for Pancreatic Cancer Chemotherapy
51.	R01	CA154321	Sarkar, Fazlul	Prevention of Tumor Progression by a Novel Approach
52.	R01	CA025000	Schell, Todd	CD8+ T-Cell-Mediated Immunotherapy of Autochthonous SV40 T-Antigen-Induced Tumors
53.	R01	CA042829	Schuller, Hildegard	GABA-B-R-Mediated Prevention of Pancreatic Cancer
54.	R01	CA130888	Schuller, Hildegard	The GABA-B Receptor Is a Novel Drug Target for Pancreatic Cancer
55.	R01	CA135673	Sevick-Muraca, Eva	Fluorescence-Enhanced Optical Tomography
56.	R01	CA057855	Sherman, Linda	Generating CTL Against Tumor-Associated Peptide Antigens
57.	R01	CA131045	Simeone, Diane	ATDC Function in Human Pancreatic Adenocarcinoma
58.	R01	CA122226	Smith, Charles	Sphingosine Kinase as a Target for Cancer Therapy
59.	R01	CA078814	Sporn, Michael	New Triterpenoids for Chemoprevention and Therapy of Cancer
60.	R01	CA125262	Srivastava, Rakesh	Chemoprevention of Pancreatic Cancer by EGCG

*Projects marked with an asterisk are supplements.

PRG Priority Area: Therapy

Recommendation 1: Facilitate discovery and development of targeted therapeutics, cont.

No.	Mech	Project #	Principal Investigator	Project Title
61.	R01	CA129038	Srivastava, Sanjay	Chemoprevention of Pancreatic Cancer by Capsaicin
62.	R01	CA140182	Storz, Peter	Protein Kinase D in Oncogenic Oxidative Stress Signaling
63.	R01	CA133697	Tamanoi, Fuyuhiko	Nanovalve Platform: Targeted, Controlled Release of Anticancer Drugs
64.	R01	CA140550	Tang, Amy	SIAH2-Dependent Proteolysis in Cell Migration, Tumor Growth and Cancer Metastasis
65.	R01	CA128865	Turkson, James	Therapeutic Application of Novel Stat3 Inhibitors in Breast and Pancreatic Cancer
66.	R01	CA132734	Vile, Richard	Autoimmunity and Anti-Tumor Immunity Outside of the Melanocyte/Melanoma Paradigm
67.	R01	CA138461	Wang, Liewei	Pharmacogenomics and Mechanisms of Cytidine Analogues
68.	R01	CA158300	Wientjes, M.	Synergistic Chemo-siRNA Combination Therapy
69.	R01	CA161613	Wong, John	Integrated 3D X-Ray/Ultrasound-Guided Radiation Therapy of Soft Tissue Targets
70.	R01	CA093455	Wright, Amy	Discovery of Novel Antitumor Agents Effective Against Pancreatic Cancer
71.	R01	CA094084	Yamamoto, Masato	Enhanced CRAd for Pancreatic Cancer
72.	R01	CA140424	Yeh, Jen Jen	Targeting Ras-Ral GEF-Ral Effector Signaling for Pancreatic Cancer Treatment
73.	R01	CA140582	Zhang, Jian-Ting	Therapeutic Targeting of Stratifin Structure and Function
74.	R03	CA152530	Bae, Insoo	Nrf2, a New Therapeutic Target for Human Pancreatic Ductal Adenocarcinoma
75.	R03	CA161832	Govindarajan, Rajgopal	Epigenetic Therapy with 3-Deazaneplanocin A and Gemcitabine for Pancreatic Cancer
76.	R03	CA149857	Hollingsworth, Michael	A Novel Combination Therapy for the Treatment of Pancreatic Adenocarcinoma
77.	R03	CA155778	McNiven, Mark	Novel Therapeutic Inhibition of the Rac Oncogene in Pancreatic Cancer
78.	R21	CA155393	Alexandrow, Mark	MCM Helicase as a Novel Target for Pancreatic Cancer Treatment
79.	R21	CA155728	Bielenberg, Diane	Targeting Neuropilin 2 with Semaphorin 3F During Pancreatic Carcinoma Progression

*Projects marked with an asterisk are supplements.

PRG Priority Area: Therapy

Recommendation 1: Facilitate discovery and development of targeted therapeutics, cont.

No.	Mech	Project #	Principal Investigator	Project Title
80.	R21	CA143755	Cabot, Myles	Assessing Pancreatic Cancer Susceptibility to Ceramide-Mediated Cell Death
81.	R21	CA153240	Counter, Christopher	Small Molecular Weight eNOS Inhibitors for the Treatment of Pancreatic Cancer
82.	R21	CA156088	Dadachova, Ekaterina	Targeted Therapy of Pancreatic Cancer with <i>In Vivo</i> Radionuclide Generator
83.	R21	CA161494	Der, Channing	Genetic Dissection and Inhibitor Targeting of Rac Signaling in Pancreatic Cancer
84.	R21	CA140751	Fletcherick, Robert	Nuclear Receptor LRH-1 in Pancreatic Cancer
85.	R21	CA135164	Friedman, Eileen	A Novel ROS-Controlling Kinase
86.	R21	CA138331	Hakansson, Kristina	Novel Approaches for Structural Determination of Cancer Stem Cell Glycans
87.	R21	CA150945	Hawkins, William	On the Trail to Pancreas Cancer-Selective Tumor Cell Death (Apoptosis)
88.	R21	CA156037	Jain, Maneesh	Novel Combination Therapy Against Pancreatic Cancer
89.	R21	CA135604	Javle, Milind	Phase I Study of the BikDD Nanoparticle for Advanced Cancer of the Pancreas
90.	R21	CA149939	Ko, Andrew	Dual Targeting of MEK and EGFR Signaling Pathways in Advanced Pancreatic Cancer
91.	R21	CA133691	Krishnan, Sunil	Integrated Imaging and Photothermal Ablation of Pancreatic Cancer Resection Margin
92.	R21	CA150100	Ljungman, Mats	Targeting ATDC with PARP Inhibitors in Pancreatic Cancer
93.	R21	CA152502	Matei, Daniela	Transglutaminase-Modulated Tumor-Stroma Interaction in Pancreatic Cancer
94.	R21	CA149869	McFadden, Grant	Virotherapy for Pancreatic Cancer with Wildtype and Armed Myxoma Viruses
95.	R21	CA158976	Nikolovska-Coleska, Zaneta	Novel Mcl-1 Inhibitors for Pancreatic Cancer Therapy
96.	R21	CA159337	Prendergast, George	IDO2 Targeting for Pancreatic Cancer Treatment
97.	R21	CA137418	Raucher, Drazen	Thermally Targeted Cell Cycle Inhibitors for the Treatment of Pancreatic Cancer
98.	R21	CA158474	Resh, Marilyn	Hedgehog Palmitoylation as a Novel Target for Inhibiting Pancreatic Cancer
99.	R21	CA127098	Scheider, Erasmus	Selective Sensitization of Pancreatic Tumor Cells to Chemotherapy

*Projects marked with an asterisk are supplements.

PRG Priority Area: Therapy

Recommendation 1: Facilitate discovery and development of targeted therapeutics, cont.

No.	Mech	Project #	Principal Investigator	Project Title
100.	R21	CA143474	Sun, Duxin	New Molecular Target and Its Inhibitors for Use Against Pancreatic Cancer
101.	R21	CA161726	Wang, Xiao-Fan	Preclinical Evaluation of PK2 Antagonists for Pancreatic Cancer
102.	R43	CA162766	Slee, Deborah	Preclinical Development of iRGD for Pancreatic Cancer
103.	R44	CA132396	Gupta, Ramesh	Preclinical Studies on Polyunsaturated Fatty Acid-Taxoid Conjugate for IND Filing
104.	R44	CA125871	Morgan, Lee	Camptothecin Analogs for Cancer Therapy
105.	R44	CA126023	Zhao, Ming	Targeted Tumoricidal Bacteria
106.	U01	CA141576	Castrillon, Diego	LKB1 Tumor Suppressor and Human Cancer
107.	U01	CA141468	Engleman, Edgar G.	Biology and Immunology of Pancreatic Cancer Stem Cells in a Novel Mouse Model
108.	U01	CA151886	Halas, Nancy	Preclinical Platform for Theranostic Nanoparticles in Pancreatic Cancer
109.	U01	CA151455	Lin, Wenbin	Nanoscale Metal-Organic Frameworks for Imaging and Therapy of Pancreatic Cancer
110.	U01	CA151810	Yang, Lily	Theranostic Nanoparticles for Targeted Treatment of Pancreatic Cancer
111.	U54	CA151668	Gorenstein, David	Texas Center for Cancer Nanomedicine
112.	U54	CA132384*	Klonoff, Elizabeth	Comprehensive SDSU/UCSD Cancer Center Partnership 1 of 2
113.	U54	CA132384	Klonoff, Elizabeth	Comprehensive SDSU/UCSD Cancer Center Partnership 1 of 2
114.	U54	CA132379	Navarro, Ana	Comprehensive SDSU-UCSD Cancer Center Partnership (2 of 2)
115.	ZIA	BC 011342	Avital, Itzhak	Pancreatic Perfusion for Locally Unresectable Pancreatic Cancer
116.	ZIA	BC 010451	Barchi, Joseph	Carbohydrate Antigen-Bearing Nanoparticles for Anti-Adhesives and Tumor Vaccines
117.	ZIA	BC 010649	Kammula, Udai	Immunotherapy Strategies for Gastrointestinal and Hepatocellular Cancer
118.	ZIA	BC 011302	Luo, Ji	Screen for Ras Inhibitors
119.	ZIA	BC 011267	Rudloff, Udo	Preclinical Drug Development in Pancreas Cancer

*Projects marked with an asterisk are supplements.

PRG Area: Therapy

Recommendation 2: Discover techniques to assess targeted therapeutics.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA017094	Dorr, Robert	Therapeutic Targeting of Hypoxic and Oxidative Stress
2.	P50	CA130810*	Brenner, Dean	Translational Research in GI Cancer
3.	P50	CA130810	Brenner, Dean	Translational Research in GI Cancer
4.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
5.	P50	CA127297	Hollingsworth, Michael	SPORE in Gastrointestinal Cancer
6.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
7.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer
8.	R01	CA139599	Allbritton, Nancy	Multiplexed Measurement of Kinase Activity in Single Cancer Cells
9.	R01	CA132971*	Bouvet, Michael	Color-Coded Imaging of Pancreatic Cancer Microenvironment for Drug Discovery
10.	R01	CA132971	Bouvet, Michael	Color-Coded Imaging of Pancreatic Cancer Microenvironment for Drug Discovery
11.	R01	CA095731	Brunicardi, Francis	PDX-1 Is a Therapeutic Target for Pancreatic Cancer
12.	R01	CA124766	D'Souza, Warren	Feedback Control of Respiration-Induced Tumor Motion with a Treatment Couch
13.	R01	CA129963	Hidalgo, Manuel	Tailoring New Drugs in Pancreatic Cancer
14.	R01	CA137071	Kelly, Kimberly	Development of Molecularly Targeted Imaging Agents for Early Detection of PDAC
15.	R01	CA157490	Kimmelman, Alec	Investigating the Role of Autophagy in Pancreatic Cancer Radiation Resistance
16.	R01	CA127494	McConkey, David	Proteasome Inhibition and ER Stress
17.	R01	CA094084	Yamamoto, Masato	Enhanced CRAAd for Pancreatic Cancer
18.	R21	CA137687	Barrett, Michael	High-Definition Clonal Analyses of Archival Pancreatic Adenocarcinoma Samples
19.	R44	CA125871	Morgan, Lee	Camptothecin Analogs for Cancer Therapy
20.	U01	CA151886	Halas, Nancy	Preclinical Platform for Theranostic Nanoparticles in Pancreatic Cancer
21.	ZIA	BC 011267	Rudloff, Udo	Preclinical Drug Development in Pancreas Cancer

*Projects marked with an asterisk are supplements.

PRG Area: Therapy

Recommendation 3: Conduct research on the supportive care of patients.

No.	Mech	Project #	Principal Investigator	Project Title
1.	R01	CA122596	Zimmers, Teresa	Manipulation of STAT3 Signaling for Muscle Preservation in Cancer Cachexia

Recommendation 4: Develop mechanisms to facilitate access to targeted therapies.

No grants or contracts.

Recommendation 5: Develop infrastructure for molecular target assessment.¹¹

No.	Mech	Project #	Principal Investigator	Project Title
1.	R01	CA154846	Mao, Hui	MRI-Capable Receptor-Targeted Drug Delivery for Pancreatic Cancer
2.	R01	CA042829	Schuller, Hildegard	GABA-B-R-Mediated Prevention of Pancreatic Cancer
3.	R01	CA130888	Schuller, Hildegard	The GABA-B Receptor Is a Novel Drug Target for Pancreatic Cancer
4.	U01	CA151810	Yang, Lily	Theranostic Nanoparticles for Targeted Treatment of Pancreatic Cancer

Recommendation 6: Improve infrastructure for clinical trials and promote patient participation.¹²

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
2.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer

¹¹ Projects coded to Therapy recommendation #5 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Biomarkers ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

¹² Projects coded to Therapy recommendation #6 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Future Clinical Trials ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Priority Area: Health Services Research

Recommendation 1: Identify effective forms of provider/patient communication.

No grants or contracts.

Recommendation 2: Study message effectiveness in patient decision making.

No grants or contracts.

Recommendation 3: Study requirements and costs of multidisciplinary clinical trials.

No grants or contracts.

Recommendation 4: Evaluate current practices in diagnosis and care.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA127003	Fuchs, Charles	DF/HCC SPORE in Gastrointestinal Cancer
2.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
3.	R01	CA124766	D'Souza, Warren	Feedback Control of Respiration-Induced Tumor Motion with a Treatment Couch
4.	R01	CA132900	Lamont, Elizabeth	Population-Based Assessment of Cancer Trial Generalizability in the Elderly
5.	R21	CA161781	Teno, Joan	The Revolving Door of Cancer Care For Older Americans

Recommendation 5: Develop a survivorship registry.

No grants or contracts.

Recommendation 6: Create a Web-based repository for information about clinical trial costs.

No grants or contracts.

*Projects marked with an asterisk are supplements.

PRG Area: Health Services Research

Recommendation 7: Develop new models for application in community and academic settings.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
2.	R01	CA132900	Lamont, Elizabeth	Population-Based Assessment of Cancer Trial Generalizability in the Elderly
3.	R21	CA161781	Teno, Joan	The Revolving Door of Cancer Care For Older Americans

Recommendation 8: Create new education, training, and communication tools.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
2.	R01	CA154517	Petersen, Gloria	Disclosing Genomic Incidental Findings in a Cancer Biobank: An ELSI Experiment

*Projects marked with an asterisk are supplements.

PRG Priority Area: Scientific Toolkit

Recommendation 1: Establish a specimen resource.¹³

No.	Mech	Project #	Principal Investigator	Project Title
1.	P50	CA130810*	Brenner, Dean	Translational Research in GI Cancer
2.	P50	CA130810	Brenner, Dean	Translational Research in GI Cancer
3.	P50	CA101955	Buchsbaum, Donald	UAB/UMN SPORE in Pancreatic Cancer
4.	P50	CA127003	Fuchs, Charles	DF/HCC SPORE in Gastrointestinal Cancer
5.	P50	CA127297	Hollingsworth, Michael	SPORE in Gastrointestinal Cancer
6.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
7.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer

Recommendation 2: Develop a database of biological profiles.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA117969	Depinho, Ronald	Genetics and Biology of Pancreatic Ductal Adenocarcinoma
2.	R01	CA140940	Sherman, Simon	Enhancing the Biomedical Computing Platform for Pancreatic Cancer Research

Recommendation 3: Develop new biological sampling techniques.

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA134292	Leach, Steven	Functional Annotation of the Pancreatic Cancer Genome
2.	R21	CA149939	Ko, Andrew	Dual Targeting of MEK and EGFR Signaling Pathways in Advanced Pancreatic Cancer
3.	R21	CA138280	Makrigrigorgos, G.	Technology for Sensitive and Reliable Mutational Profiling in Pancreatic Cancer
4.	R21	CA143362	Messmer, Bradley	Molecular Evolution of Multifunctional DNA Nanoparticles

¹³ Projects coded to Scientific Toolkit recommendation #1 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Establishment of Biorepositories ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Priority Area: Scientific Toolkit
Recommendation 3: Develop new biological sampling techniques, cont.

No.	Mech	Project #	Principal Investigator	Project Title
5.	R33	CA155586	Porter, Marc	Advanced Development of a Multiplexed SERS-Based Biomarker Detection Platform: A Multiplexed Panel Approach to Early-Stage Cancer Detection
6.	U01	CA151650	Porter, Marc	Magneto-resistive Sensor Platform for Parallel Cancer Marker Detection

Recommendation 4: Capture knowledge of relevant molecular pathways.

No grants or contracts.

Recommendation 5: Develop gene-based model systems.¹⁴

No.	Mech	Project #	Principal Investigator	Project Title
1.	P01	CA134292	Leach, Steven	Functional Annotation of the Pancreatic Cancer Genome
2.	P01	CA026731	Tannenbaum, Steven	Endogenous Nitrite Carcinogenesis in Man
3.	P50	CA102701	Petersen, Gloria	Mayo Clinic SPORE in Pancreatic Cancer
4.	R01	CA078590	Batra, Surinder	Molecular Studies on MUC4 Mucin Gene
5.	R01	CA133774	Batra, Surinder	Smoking and Pancreatic Cancer
6.	R01	CA097159	Chiao, Paul	Mechanisms of RelA Activation in Cancer
7.	R01	CA127641	Fisher, Paul	Pancreatic Cancer Management by Novel Gene Therapy & Dietary Agents
8.	R01	CA112537	Hebrok, Matthias	Embryonic Signaling Pathways in Pancreatic Cancer
9.	R01	CA129963	Hidalgo, Manuel	Tailoring New Drugs in Pancreatic Cancer
10.	R01	CA123483	Kern, Scott	Fanconi Defects in Pancreatic Cancer Oncogenesis
11.	R01	CA097022	Klemke, Richard	Survival Mechanisms of Invasive Carcinoma Cells
12.	R01	CA113896*	Lewis, Brian	Molecular Dissection of Pancreatic Ductal Adenocarcinoma
13.	R01	CA113896	Lewis, Brian	Molecular Dissection of Pancreatic Ductal Adenocarcinoma

¹⁴ Projects coded to Scientific Toolkit recommendation #5 are also relevant to the *Clinical Trials Planning Meeting on Pancreas Cancer Treatment Consensus Report* Emphasis Area of Utility of Preclinical Models ([J Clin Oncol. 2009 Nov 20;27\(33\):5660-9](#)).

*Projects marked with an asterisk are supplements.

PRG Priority Area: Scientific Toolkit
Recommendation 5: Develop gene-based model systems, cont.

No.	Mech	Project #	Principal Investigator	Project Title
14.	R01	CA155784	Lewis, Brian	Dissecting Hedgehog, TGF Beta and BMP Signaling During Pancreatic Tumorigenesis
15.	R01	CA113669	Maitra, Anirban	Developmental Signaling Pathways in Pancreatic Cancer
16.	R01	CA109389	Mohammad, Ramzi	Specific Targets for Pancreatic Cancer Therapy
17.	R01	CA134767	Nelkin, Barry	Targeting CDK5 in Pancreatic Cancer: Mechanistic and Preclinical Development
18.	R01	CA129484	Quigley, James	A Cellular and Molecular Analysis of the Intravasation Step in Tumor Metastasis
19.	R01	CA109525	Su, Gloria	Mouse Model for Human Pancreatic Ductal Adenocarcinoma
20.	R03	CA155691	Kunnimalaiyaan, Muthusamy	Role of GSK-3 Isoforms in Pancreatic Cancer
21.	R21	CA155650	Hwang, Rosa	Conditional Ablation of Stellate Cells to Determine Their Role in Pancreatitis and Pancreatic Cancer
22.	R21	CA155165	Ji, Baoan	Develop and Characterize a Novel Animal Model of Pancreatic Cancer
23.	R21	CA158898	Leach, Steven	High Resolution and Single Cell Analyses of PanIN Initiation and Progression
24.	R21	CA155255	Lowe, Anson	The Role of AGR2 in a Murine Model of Pancreatic Adenocarcinoma
25.	R37	CA075059	Korc, Murray	Dysregulation of TGF Beta Action Pancreatic Cancer
26.	U01	CA141576	Castrillon, Diego	LKB1 Tumor Suppressor and Human Cancer
27.	U01	CA141468	Engleman, Edgar G.	Biology and Immunology of Pancreatic Cancer Stem Cells in a Novel Mouse Model
28.	U01	CA105492	Holland, Eric	Using Mouse Models to Probe the Relationship of Oncogenesis to Development and Oncogene Dependence
29.	ZIA	BC 011186	Hussain, S. Perwez	Animal Model of Pancreatic Cancer
30.	ZIA	BC 011411	Van Dyke, Terry	Development of ES/iPSC Approach for Non-Germline GEM Modelling

*Projects marked with an asterisk are supplements.

PRG Priority Area: Scientific Toolkit

Recommendation 6: Improve imaging systems.

No.	Mech	Project #	Principal Investigator	Project Title
1.	N43	CO110121-000	Fralish, Greg	Phase I SBIR TOPIC 307 Novel Targeted Imaging Reagent for Pancreatic Cancer
2.	N43	CO110120-000	Keppler, Jennifer	Phase I SBIR TOPIC 307 Engineered ImmunoPET Tracers for Pancreatic Cancer
3.	P01	CA159992	Butts, Kim	Magnetic Resonance Imaging-Guided Cancer Interventions
4.	P50	CA127003	Fuchs, Charles	DF/HCC SPORE in Gastrointestinal Cancer
5.	P50	CA062924	Kern, Scott	SPORE in Gastrointestinal Cancer
6.	R01	CA139599	Allbritton, Nancy	Multiplexed Measurement of Kinase Activity in Single Cancer Cells
7.	R01	CA142669	Bouvet, Michael	Fluorophore-Conjugated Antibodies for Imaging and Resection of GI Tumors
8.	R01	CA124714	Brock, Kristy	Dynamic Multi-Organ Anatomical Models for Hypofractionated RT Design and Delivery
9.	R01	CA124766	D'Souza, Warren	Feedback Control of Respiration-Induced Tumor Motion with a Treatment Couch
10.	R01	CA137071	Kelly, Kimberly	Development of Molecularly Targeted Imaging Agents for Early Detection of PDAC
11.	R01	CA154846	Mao, Hui	MRI-Capable Receptor-Targeted Drug Delivery for Pancreatic Cancer
12.	R01	CA151374	Martin, Lainie	Evaluation of <i>In Vivo</i> Optical Imaging in Pancreatic and Ovarian Cancer Patients
13.	R01	CA135673	Sevick-Muraca, Eva	Fluorescence-Enhanced Optical Tomography
14.	R01	CA161613	Wong, John	Integrated 3D X-Ray/Ultrasound-Guided Radiation Therapy of Soft Tissue Targets
15.	R15	CA152985	Kennedy, Michael	Metabonomics Studies of Human Diseases
16.	R21	CA133691	Krishnan, Sunil	Integrated Imaging and Photothermal Ablation of Pancreatic Cancer Resection Margin
17.	R43	CA162845	Fralish, Greg	Developing a Plectin-1 Targeted Imaging Agent for the Detection of Pancreatic Cancer
18.	R44	CA157025	Ho, David	Clinical Production and IND-Enabling Studies for PSCA Minibody Imaging in Pancreatic Cancer
19.	R44	CA117218	Iftimia, Nicusor	Image-Guided Intervention System for Pancreatic Cystic Lesions

*Projects marked with an asterisk are supplements.

PRG Priority Area: Scientific Toolkit
Recommendation 6: Improve imaging systems, cont.

No.	Mech	Project #	Principal Investigator	Project Title
20.	U01	CA151886	Halas, Nancy	Preclinical Platform for Theranostic Nanoparticles in Pancreatic Cancer
21.	U01	CA151455	Lin, Wenbin	Nanoscale Metal-Organic Frameworks for Imaging and Therapy of Pancreatic Cancer
22.	U01	CA151810	Yang, Lily	Theranostic Nanoparticles for Targeted Treatment of Pancreatic Cancer
23.	U54	CA151668	Gorenstein, David	Texas Center for Cancer Nanomedicine

*Projects marked with an asterisk are supplements.