Evaluation of the *Activities To Promote Research Collaborations* Program

Final Report

Submitted to:

Kelly Kim, Project Officer
National Cancer Institute
National Institutes of Health
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Contract No. GS10F0114L/Order No. 263-FQ-608878 ■ January 16, 2008

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Consulting Services & Research

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1. Introduction and Background

The Division of Cancer Biology (DCB) of the National Cancer Institute (NCI), National Institutes of Health (NIH), made a decision to conduct a full-scale evaluation of the Activities to Promote Research Collaborations (APRC) awards that supported research consortia, based on the recommendations of a feasibility study of the program in 2004 (Contract No. S10F0114L/Order No. 263-FD-412887, September 30, 2004). The goal of this evaluation was to perform a thorough review of the APRC program that would enable the DCB to determine whether it was accomplishing its stated goals and, if so, how to improve its implementation. This report summarizes evaluation activities conducted and presents findings from evaluation data collected. Following a brief summary of the background of the APRC program, we describe the methods used to conduct the evaluation, including the processes for interviewing APRC researchers, developing procedural research questions, performing publications and literature reviews, and developing data collection instruments. The design of the evaluation includes outcome and process components. Findings of this evaluation are presented in the Results section. The report concludes with a discussion of the findings and issues affecting APRC program successes.

1.1 Background

The DCB developed the APRC program in 1998 to support novel collaborative activities in cancer biology—efforts to bring together new ideas and approaches from disparate scientific disciplines. The program provides funding in the form of administrative supplements to DCB grantees, leading to the establishment of new multidisciplinary consortia of investigators from complementary fields. The program is distinct from and does not replace other grant or funding mechanisms. It funds collaborative activities, also known as capacity building, that bring together ideas and approaches from different disciplines, including those not currently supported by the DCB. The goal of these consortia is to conduct joint research that would not be possible in the absence of the pooled set of skills and expertise from the individual investigators.

The specific goals of the APRC program include (1) generation of innovative concepts and advances in cancer biology, such as new knowledge from collaborative projects; and (2) the increased productivity of program participants and their enhanced capacity to pursue other future collaborations. Two administrative mechanisms are available under the APRC program to facilitate scientific collaboration. The first approach is to establish collaborations through exploratory meetings or workshops that bring together investigators from a broad range of fields. The investigators discuss and develop new insights, paradigms, or technologies that would move a field in a different direction, establish a new field, or address unique research opportunities or controversial topics. The total direct costs for an exploratory meeting/workshop were limited to a maximum of $25,000. This mechanism was not a funding option in the 2007 program announcement but may be a consideration for future funding.

The second administrative approach supports research collaboration and the establishment of new research consortia among investigators in complementary fields in developing or rapidly moving areas of cancer research. The goal is to achieve specific research objectives by pooling investigators' respective expertise and efforts. Typically, APRC consortia are composed of two to five investigators with this focus. The collaborative research project must be within the general scope of the Principal Investigator's (PI's) active DCB-funded grant and cannot be duplicative of any active or previously funded research topic for any of the consortium members. Preference in funding is given to applicants whose proposed researchers have not collaborated (including on publications) in the past 5 years. The laboratory-associated direct cost for collaborative research is limited to a maximum of $40,000 per year per investigator, with a combined total direct consortium cost of $120,000 per year.

The DCB has had an annual budget of approximately $1 million to $1.5 million to support the APRC program.

1.2 Goals of the Evaluation

The DCB supports and funds grants in basic cancer cell biology; tumor biology and metastasis; cancer immunology and hematology; cancer etiology, including chemical and physical carcinogenesis and viral cancer carcinogenesis; mechanisms underlying DNA and chromosome aberrations; and structural biology and technology development. Many of the advances made in these related fields in recent years have resulted from the collaboration of researchers who contributed knowledge from multiple disciplines to develop innovative procedures and technologies that increase NCI's understanding of the etiology, prevention, and treatment of cancer.

One of the goals of the APRC evaluation was to increase the DCB's understanding of the value of interdisciplinary research and inform NCI's future approach to supporting and encouraging scientific collaboration among researchers from multiple disciplines. In addition, it was intended that the evaluation findings would support NCI's commitment, as stated in its Fiscal Year (FY) 2005 Plan, to "increase funding for…research grants and provide incentives for transdisciplinary and collaborative research" (The Nation's Investment in Cancer Research, p. ix). The ultimate goal of this evaluation was to position the DCB and NCI to maximize their available resources to encourage and support collaborative research in a manner that will move the field of cancer research forward, address unique research opportunities or controversial topics, and provide answers to serious concerns about the health of our Nation. This evaluation effort is consistent with the recommendations of the Institute of Medicine (IOM). IOM noted that despite decades of discussion about the importance of interdisciplinary research, little data are available to document the success of such efforts (IOM, 2000).

Finally, it is hoped that the results of the evaluation will support NCI's established framework for accountability, consistent with the President's Management Agenda and the congressionally mandated Government Performance and Results Act (GPRA).

1.3 Timeliness of the Evaluation

Congress enacted the GPRA of 1993 to focus on improving program performance and providing greater accountability for results in the Federal Government. The APRC evaluation plan was designed to satisfy this mandate and yield feedback for results-oriented management of the program. Results of the APRC evaluation will help NCI and the DCB to make important decisions about the future funding of APRC supplements and to better manage the program. The evaluation results will be available before important funding decisions have to be made in the spring cycle of funding for FY 2009. Results of the evaluation also will position the DCB to be a major contributor to other NCI divisions and NIH Institutes that are facing the challenge of how to conduct responsible evaluation of similar initiatives to support collaborative research.

2. Methods—Evaluation Design

In this section, CSR, Incorporated (CSR) presents the evaluation goals, the conceptual framework that guided the evaluation, the telephone interview process, the data collection tools developed and implemented, and the data analysis methods used.

2.1 Evaluation Design

Guided by the IOM recommendations, the evaluation design included a series of research questions focused on measuring process, capacity building, and innovative outcomes, each with a string of quantitative and qualitative measures.

2.1.1 *Study Questions*

NCI and CSR identified specific research questions and measures to guide the development and implementation of process and outcome evaluation components.

2.1.1.1 *Process Evaluation Components*

The process evaluation focused on three research topics: (1) APRC collaborators' ability to form consortiums and establish research partnerships, (2) methods used to promote APRC collaborations by working together to achieve research objectives, and (3) potential changes that may need to be made in the APRC funding mechanism to strengthen research collaboration efforts. The questions were as follows:

- Question l: How did the APRC collaborators come together to form the consortium?
  - Description of early experiences with the proposal process; and
  - Methods used to plan and establish collaboration with investigators from other disciplines.
- Question 2: How did the APRC collaborators work together to achieve their research objectives?
  - Methods used to communicate with APRC collaborators;
  - Methods used to incorporate knowledge/ facts/understanding from one discipline to another;
  - Types of professional relationships developed; and
  - Skill development activities in which co-investigators engaged during the course of the APRC award.
- Question 3: What changes should be made in the APRC consortium to strengthen its use as a mechanism for promoting research collaborations?
  - Administrative issues;
  - Communication issues; and
  - Funding issues/review of applications.

2.1.1.2 *Outcome Evaluation Components*

The outcome evaluation focused on two research questions in the areas of capacity building and research innovations, each again with a series of measures:

Capacity Building

- Question l: Does the APRC support and encourage new scientific collaboration for NCI grantees?
  - Joint research is carried out by researchers from disparate scientific disciplines;
  - Research is not duplicative of any active or previously funded research topic for any of the consortium members;
  - APRC co-investigators participate in interdisciplinary research that they would not have pursued in the absence of the APRC award;
  - APRC increases the productivity of the participants;
  - APRC collaboration adds value to the underlying funded research of the PI's DCB-funded parent grant;
  - APRC co-investigators secure funding for future research that is built on knowledge/

products developed under the APRC project; and
  - APRC investigators continue to communicate and share information, following completion of the APRC award that leads to related interdisciplinary research.

Research Innovations

- Question 2: Does the APRC collaboration result in novel and promising concepts and innovative advances in cancer research?
  - Investigators develop a new technology that contributes to an understanding of cancer biology;
  - New knowledge is generated from collaborative projects as opposed to individual investigator-driven projects;
  - Application for a patent is filed for a product developed under the APRC award;
  - Publications are coauthored by the APRC co-investigators that would not have been prepared in the absence of the APRC;
  - APRC co-investigators develop hypotheses/new research topics that are pursued by research efforts that follow the APRC project;
  - APRC co-investigators enter into the field-testing of a diagnostic instrument or other methodology developed under the APRC award;
  - APRC co-investigators develop conference papers/poster sessions to report on work performed under the APRC award; and
  - APRC co-investigators earn awards/other professional recognition for work performed under the APRC award.

Two sources of information were used to answer these research questions: (1) data from a telephone survey interview and (2) secondary data regarding publications and grants of funded and unfunded researchers who applied for APRC grants.

2.1.2 *Target Population*

In consultation with the DCB, CSR focused the full-scale evaluation on APRC-funded researchers who were funded in FYs 1998–2004. Because each APRC-funded project has up to 2 years to complete its collaborative research effort, CSR effectively limited the eligible sample to those researchers who had completed their work no later than the end of FY 2006. This decision was made on theoretical grounds that the occurrence of certain outcomes (e.g., APRC-related publications, presentations, and new grant applications) required at least 1 year, post-APRC completion, to become readily observable.

In addition, the DCB proposed that secondary data analysis be conducted for a study comparing funded and unfunded investigators. The data obtained from these secondary data sources were primarily used to determine whether APRC-funded applicants, compared with unfunded applicants, were more successful in developing APRC-related research ideas into publications and new grant applications. Using PubMed, a National Library of Medicine (NLM) portal, we conducted publication searches to identify and retrieve/download the articles the investigators published. These articles were carefully reviewed and analyzed for scientific content (i.e., subject matter relevance) and collaborative authorship. We obtained new grant applications in comprehensive searches of the Program Management Application (PMA) and Information for Management, Planning, Analysis, and Coordination (IMPAC II) systems described under 2.2.1 Data Sources.

The DCB recommended limiting the evaluation focus on grantees awarded funding for collaborative research, as opposed to those awarded funding for a workshop or meeting. This decision was driven by several factors, including (1) the majority of APRC dollars go toward funding collaborative research, (2) the sample size of workshop awardees is limited, and (3) evaluation of workshops requires the development of a new survey instrument. This decision strengthened the DCB's focus on developing lessons that would best inform its future management and fiscal funding decisions.

2.1.3 *Study Components*

For the present evaluation, CSR used and further refined the evaluation design and data collection tools that were pretested in the feasibility study.

Similar to the feasibility study, CSR collected process and outcome indicators through semi-structured telephone interviews with APRC-funded researchers. Interviews were limited to funded investigators because the results of the feasibility study indicated that unfunded investigators frequently did not recall details of their grant application. CSR also collected additional descriptive and outcome information (i.e., investigator characteristics and grant histories) from reviews of secondary data sources, such as NCI's PMA and e-Grants systems, for both funded and unfunded APRC applicants.

Table 2-1. Study Components

Data Source	Information Obtained	Descriptors
Category: Grant		
DCB Network		
	APRC descriptors	• APRC supplement information
	APRC abstracts	• APRC abstract • Relation to parent grant
e-Grants		
	APRC abstracts	• APRC abstract • Relation to parent grant
	Grant abstracts	• Grants abstract • Related to APRC
PMA		
	Grant abstracts	• Grants abstract • Related to APRC
	Grant history	• Application information • Pre/post APRC indicator • APRC investigators
	PI descriptors	• Contact information • Investigator information
Category: Publications		
PubMed		
	Publication abstracts	• Related to APRC • Pre/post APRC
	Author information	• APRC affiliation • Funded/unfunded APRC
Category: Interview		
Interview		
	Multidisciplinary aspects	• Interview information

2.1.4 *Telephone Surveys*

CSR, using DCB records, developed a list of 410 funded APRC investigators (PIs, co-PIs, and junior-level investigators) from the FY 1998–2004 award cycles. Of those identified, contact information was available for and invitations sent to 311 investigators to participate in a telephone interview. Individuals not responsive to the e-mails were sent two additional reminder e-mails. Investigators who did not respond received a telephone call from CSR. The result was that 140 individuals agreed to participate in the interview. Of these, telephone surveys were conducted with 121 APRC applicants, from 73 collaborative units, who were funded from 1998 to 2004. This met the DCB's target goal of 100 completed interviews. Details of the survey development and key variables derived from the interviews are presented in this section.

CSR designed separate semi-structured interview protocols to guide the interviews with the APRC-funded and unfunded researchers. In this, we were guided by a preliminary set of questions that NCI developed, crafting an instrument that included both a mix of quantifiable response data—both "yes/no" questions and Likert scale questions—and open-ended questions gathering data regarding qualitative information on each researcher's experience with the APRC program.

CSR pretested the interview protocols with eight APRC-funded researchers and eight applicants who did not receive the award in the feasibility study. Based on the results of the feasibility study and input from the advisory board, we added questions about the following to the questionnaire: self-described area of expertise; prior membership in an organized transdisciplinary research consortium or collaborative effort; problems in forming the APRC consortium; interactions with co-investigators; perception of teamwork; training opportunities for students and fellows; and probes for recommended changes in specific areas, such as administration,

funding, and communication. It was also decided not to interview the unfunded applicants in the full-scale evaluation.

CSR developed a list of possible APRC-funded researchers from the FY 1998–2004 award cycles for interviews. We contacted the prospective respondents via a standard e-mail message (see Appendix A) to ascertain their willingness to communicate. We explained the purpose of the evaluation and told them CSR would follow up to conduct the interview. A CSR staff member then phoned those who responded affirmatively to schedule the interview. We also made follow-up phone calls to invite the participation of those who did not respond to the e-mail.

The necessary documentation was submitted to the Office of Management and Budget (OMB) in accordance with the OMB clearance requirements under the Paperwork Reduction Act (PRA) of 1995, P.L. 104-13, which outlines the process for gaining OMB clearance for systematic collection of information by Federal agencies. In October 2006, we were granted OMB clearance for use of a standardized interview guide. CSR administered the OMB-approved guide during telephone interviews with funded APRC senior- and junior-level investigators.

2.1.5 *Key Variables for APRC-Funded Researchers*

The categories of variables collected through the interview guide for APRC awardees include basic descriptors of each PI, variables describing the PI's early experiences with the APRC application process and actual experience while working on the APRC supplement, variables that measure accomplishments resulting from APRC participation, and variables describing the PI's overall assessment of the APRC experience (see Appendix E). More detail on these, and justification for inclusion, is provided below.

- *Principal Investigator Descriptors.* CSR designed an Interview Guide Face Sheet to record data that could be extracted from the DCB's "L Drive," which provides contact information and other basic descriptors of each APRC applicant. The variables include the name of the PI interviewed and his or her e-mail and phone number; the type of application; the named collaborators; the parent grant; the DCB Project Officer; the originating DCB branch; the interviewer; and the date, beginning time, and ending time of the actual interview.
- *Early Experiences with the APRC Program*. CSR collected background information on the PI's experience with the application process to describe key inputs and the context of the APRC involvement. These data are required to explain the early process of the APRC experience and to account for variations in measures of outcomes. Questions were asked to determine the PI's source of information about the APRC funding, involvement with the DCB during the application period, and early experiences in recruiting potential collaborators to participate in the APRC project.
- *Variables Describing APRC Experience*. CSR posed questions to determine the type of support that PIs received from their colleagues and institution, problems encountered during the APRC project, the range of disciplines involved in the collaboration, types of interactions with collaborators during the APRC project, and history of working with APRC collaborators.
- *Measures of Accomplishments*. PIs were asked to report on a variety of accomplishments that would have resulted from their participation in the APRC, reasons for success/lack of success, and plans for continued collaboration beyond the life of the APRC funding.
- *Assessment of the APRC Experience*. CSR developed a series of scales to measure outcomes of the APRC program. These scales ranged from obtaining additional funding; to the development of new products, technologies, and publications; and to the forging of new collaborative research endeavors. Questions also were posed to assess the extent to which the APRC funding accounted for successful outcomes, other benefits that might have resulted from participating in the APRC research, and recommendations for improving the APRC program in the future.

2.2 Review of Secondary Data

CSR collected and analyzed secondary data from two sources: (1) existing NCI and NIH databases on grant applicants and recipients and (2) PubMed. In the feasibility study, CSR explored the IMPAC II/PMA database to determine what elements would be relevant to evaluating the APRC program, as well as the most efficient process of retrieving these data. This document provides additional details regarding the rationale for data selection. The second source, PubMed, was used to obtain publication outcome data for all investigators.

The data obtained from secondary data sources were used to determine whether APRC-funded applicants, compared with unfunded applicants, were more successful in developing APRC-related research ideas into publications and new grant applications. Descriptive (univariable) statistics were calculated and further multivariable analyses controlled for a host of other variables, including number of years of grant-seeking (grant-years calculated as time from first NIH grant application to time of APRC grant application), number of co-PIs/other collaborators in consortium, publication history, and grant-seeking and grant award history.

2.2.1 *Data Sources*

The DCB network files were the primary data source used to identify APRC applications, funded and unfunded, from FYs 1998 to 2004. The applications were identified from programmatic spreadsheets on the DCB network. In addition to the DCB network, we used two other data sources: (1) the PMA, a customized database linked to the IMPAC II server; and (2) e-Grants, a Web-based, electronic imaging system for storage and retrieval of all documents in the official NCI grant files. The latter is maintained by NCI's Grants Administration Branch. The DCB network, PMA, and e-Grants served as the primary data sources for the grants study variables. CSR imported all data extracted from these sources into a Microsoft Access (Access) database developed for the project.

PubMed served as the sole source for identifying APRC investigators' publications. Publications relevant to the study were imported into EndNote, a reference management application, and prepped into an analytical dataset using Access. CSR also developed an Access database in order to schedule, track, and manage information from the interviews.

2.2.2 *Sample Selection*

As the DCB decided before the start of the evaluation, secondary data analysis would be conducted on a minimum of 200 senior investigators (PIs and co-PIs; 100 APRC-funded and 100 unfunded). To achieve this sample size, CSR randomly selected a sample of 79 collaborative units from the complete list of APRC applications for years 2001 through 2004. We did not conduct secondary data analysis on years prior to 2001 because APRC application information was unavailable for unfunded applicants. In addition, after discussion with DCB staff, we did not include 2004 data in the secondary data collection sample because it was believed that doing so would result in too little elapsed time to observe the occurrence of APRC-related publication and new grant applications. The number of units and collaborators included in the secondary analysis by APRC funding year are presented in Table 2-2.

2.2.3 *Key Variables*

For both funded and unfunded APRC applicants, the following key outcomes were evaluated:

Table 2-2. Number of Consortia Units and Collaborators in the Secondary Analysis by APRC Funding Year

	Funded Researchers		Unfunded Researchers		Total	
Year	# Units	# Collaborators	# Units	# Collaborators	# Units	# Collaborators
2001	9	25	9	29	18	54
2002	16	43	9	24	25	67
2003	15	41	21	56	36	97
Total	**40**	**109**	**39**	**109**	**79**	**218**

- Number and type of pre- and post-APRC grant applications in which APRC collaborators are involved;
- Number and type of post-APRC grant applications in which APRC work is built;
- Number of pre- and post-APRC publications in which APRC collaborators are coauthors;
- Number of post-APRC publications in which APRC work is built.

To obtain these data, the two items used in the grant applications were the applicant's abstract and the discussion of the investigator team in each of the reviewer critiques. CSR staff reviewed each application for mention of collaborative partners in the critique sections of the write-up. In the case of the grant applications, the items of interest were the applicant's abstract and the key personnel, and the expanded budget/budget justification sections of the proposal. In reviewing the applications, we noted whether any member of the APRC team was proposed as personnel on the application.

2.2.4 *Data Extraction Protocol*

Separate usernames and passwords were provided to each CSR staff member to access the DCB network, including e-Grants and the PMA. We used PMA to search for other grant applications that were submitted to the NIH by our sample of investigators.

2.2.4.1 *Data Extraction from PMA*

As discussed in 2.2.1, PMA was one of the primary data sources for the study. Initially, the CSR database manager identified the individuals relevant to the study. Using PMA, an identifier (IMPAC II_ID) for each individual was recorded in a study database. IMPAC II_ID is a numeric identifier used by IMPAC II to assign a unique number to each individual in the system. Using the IMPAC II_ID variable, CSR extracted grant history, person's expertise, and person's degree information, which were imported and managed into a study database.

CSR searched the PMA for new and competing renewal applications, including amended applications and applications for supplements submitted at least 1 year after the initiation of the APRC award, using the Name Query Form.

The above information was transferred to a project database. CSR also downloaded the original grant application to the local hard disk. Usually these documents were downloadable from a link/button within PMA. In some instances, however, where such a link was not present, CSR was able to enter e-Grants to access and download them. Care was taken to avoid double counting in cases of multiple iterations of the same application. The structure of the system guards against this because when an application is withdrawn in favor of an amended application, the document for the amended application automatically replaces that of the previous application in the system.

2.2.4.2 *Data Extraction from e-Grants*

Because the APRC awards were made as administrative supplements rather than grant awards, information about the APRC applications was not available in the IMPAC II/PMA system. This information was available in the NCI e-Grants system. On the e-Grants search screen, CSR performed a search on the investigator's name, which resulted in a list of all grants ever held by that investigator. The description of the proposed research was found in the e-Grants documents under a subheading called "award files." The pertinent pages were saved in a study folder as an electronic document.

In the case of APRC applications from years 2002 and later, information was available in a DCB public folder through Microsoft Outlook. This folder contained reviews of the APRC applications by the DCB Program Directors and also included a summary of the application by the lead Program Director. Information collected from Outlook was extracted and organized into a study folder that was made available to the CSR project manager.

Retrieving unfunded APRC applications with dates prior to 2002 presented a unique challenge. Because these applications were not funded, they were not available in Outlook. DCB started to maintain records of such unfunded applications from 2002 onwards. CSR sent e-mails to the PIs of such applications soliciting hard copies. A total of 13 hard copies were received through e-mail and telephone solicitations. In cases in which CSR was

unable to receive any copies, the APRC unit was dropped from the study sample.

2.2.4.3 *Data Extraction from PubMed*

A librarian with extensive experience searching PubMed performed searches for each PI and collaborating investigator for each of the units, funded and unfunded. The search was limited by date, restricted to all articles published 5 years prior to the date of the APRC application and up to the present date. These searches were performed using the first initial and last name. This is a broad way to search; however, it is the only way to capture, in PubMed, all relevant citations because not all records include first names. Many false hits are obtained in this search because all first names starting with that letter are retrieved. Limiting the search by affiliation would exclude those records where the subject (PI or co-PI) was not the first author. Because of the number of false hits received in this type of search, all retrieved records were verified, using the PubMed link to the article's source to verify the author's first name, where possible. Checking each record for affiliation and co-authors, who frequently write with the investigator, was another method used to verify true hits. If an investigator's name was very common and the amount of records retrieved formidable, CSR ran a search on the Internet to locate any available bibliography to compare its citations with citations from PubMed. The information captured in PubMed for each investigator included the full citation, the abstract when available, and the grant number(s). All of this information was subsequently imported into EndNote.

2.2.4.4 *Document Review*

In order to collect qualitative data from reviews of program documents for post-APRC–related publications and submission of new applications to a NIH Institute, CSR compared the publication and grant histories of investigators who received APRC awards with unsuccessful APRC applicants. Content analysis was performed for research publications as well as for new applications by reviewing the face page, abstract, key personnel, and specific aims of the APRC application to gain an understanding of the research proposed. The results of this review were useful in determining if the publications were a direct result of the APRC-supported collaborative research and if new post-APRC applications dealt with research questions proposed in the APRC application. This review also provided the opportunity to record the number of investigators affiliated with the publication or application and to determine if any of them were part of the APRC unit.

2.2.4.5 *Data Security*

To protect confidentiality, after the data were abstracted, CSR moved the files stored on the local hard drive to a secure network location and deleted the folder on the desktop. In addition, all paper copies of applications and other confidential documents were stored in a locked file drawer.

2.2.4.6 *Quality Control*

Quality control of the interview information was implemented in three ways.

- First, CSR trained all interviewers in how to conduct the phone interviews, which ensured that all questions were asked in the same way.
- Second, another CSR staff person independently reviewed 10 percent of the keyed interview data as part of a data quality check.
- Finally, investigators who had multiple APRC applications were interviewed only once regarding their most current application. By doing so, no additional burden was placed on the respondent and the reliability of the respondent's recall was improved.

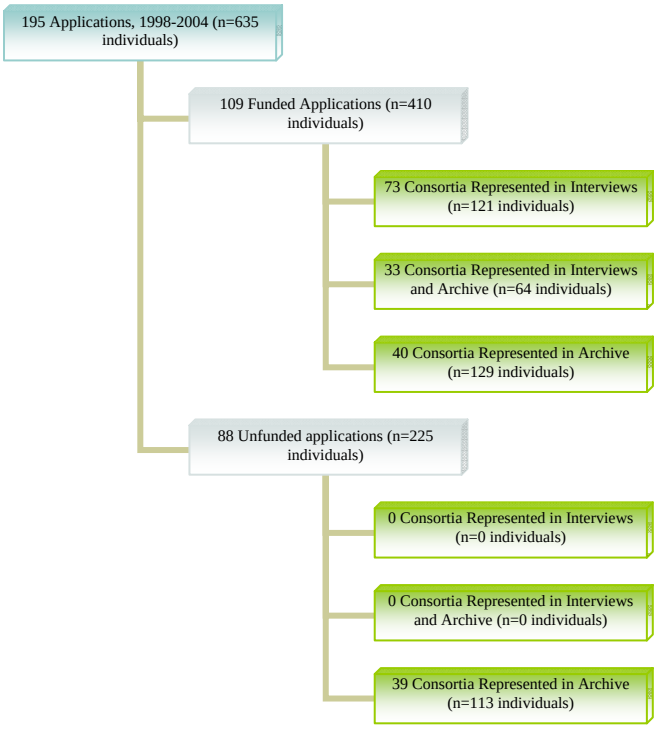
For the publications, the librarian reviewed all records to make sure the first name, affiliation, coauthors, or subject material matched that of the investigator who was the subject of the search. Often, bibliographies were retrieved from the Internet, either from the author's affiliation Web site or from his or her CV, and these were compared with the PubMed results.

3. Results

3.1 Evaluation Sample

Figure 1 illustrates the pool of researchers for the years 1998–2004 who were used for the evaluation. A total of 635 investigators were identified, 410 of whom were funded and 225 of whom were unfunded; 29 were counted more than once because they were part of more than one consortia or application. The number of unique researchers was 356 funded and 212 unfunded.

Figure 1. Summary of APRC Applications Included Evaluation, Application Years 1998–2004



3.2 Telephone Interview

The following sections summarize the results of the telephone interviews.

3.2.1 *Characteristics of Interviewees and Their APRC Applications*

A total of 311 individuals were approached to participate in the telephone interview; 140 (45%) agreed to participate, 33 (1%) declined, 97 (31%) did not respond, and 41 (13%) could not be contacted because of incorrect or out-of-date contact information.

Of those 121 who were interviewed, 109 were PIs/co-PIs and 12 were other staff on the project. These 121 individuals represented 73 different consortia units.

The mean and median number of individuals interviewed from a consortia unit was 1 (range 1–4).

Table 3-1 illustrates the funding amounts and funding years for the APRC applications of the interviewees.

Table 3-1. Funding Amount and Application Year of Applications Representing Those Interviewed

Characteristic	n	%
Amount of APRC funding		
0–40,000	16	13
40,000–80,000	23	19
80,000–120,000	40	33
120,000+	42	35
Year of APRC funding		
1998	7	6
1999	13	11
2000	24	20
2001	19	16
2002	24	20
2003	29	24
2004	5	4

Of the 121 researchers who participated in a telephone interview, 110 (90%) self-identified that biology was their primary field of expertise. Table 3-2 presents the biology subfields identified. Few individuals identified chemistry (n=9), physics (n=1), or computer sciences (n=1) as their primary expertise field. No respondents identified engineering as their expert field. Two indicated that epidemiology was their primary field of expertise. Because 90 percent identified biology as their primary field, it was not possible to characterize the transdisciplinary nature of the consortia groups

based on the six categories prespecified in the original study design: biology, chemistry, physics, computer sciences, engineering, and other.

Table 3-2. Subfields of Those Who Self-Identified Biology as Primary Expertise Field*

	n	%
Cancer biology	36	33
Molecular biology/microbiology	21	19
Cell biology	12	11
Biochemistry	7	5
Virology	6	5
Genetics	3	3
Other	15	14
Multiple subspecialities	8	8
None specified	2	2
Total	**110**	**100**

*Interview Guide, Question 1.

3.2.2 *Process Evaluation*

The following section focuses on findings for the analysis of data related to process evaluation questions.

3.2.2.1 *Question 1: How did the APRC collaborators come together to form the consortium?*

Interviewees were asked questions to ascertain their experiences with the proposal process and to describe the methods used to plan and establish collaborations with other investigators.

Fifteen interviewees (12%) read about APRC in an NIH guide and 26 (21%) heard about it from a DCB staff member. Most (n=76, 63%) cited "other" as their source of introduction to the program. Elaboration on "other" included collaborator/PI/ colleague (n=53, 70%), NIH or NCI e-mail or publicity (n=10, 13%), don't know or don't remember (n=7, 9%), other (n=4, 5%), and meeting/conference/workshop (n=2, 3%). Sixty-six interviewees (55%) had someone in their unit contact the Program Director or other DCB staff member to discuss the application prior to the award. Of those 66 individuals, 44 (67%) personally spoke with a DCB staff member and 46 (70%) found the advice received helpful. Table 3-3 summarizes the kinds of advice received from a DCB staff member that were considered helpful. DCB staff were most helpful in providing information about the award and in determining appropriateness and eligibility for the award.

Table 3-3. Ways in Which DCB Staff Members Were Helpful for Those Who Personally Spoke with One Before APRC Application*

	n	%
Helpful in providing information about award	18	39
Helpful in determining appropriateness and eligibility	12	26
Offered general advice, assistance, or encouragement	4	9
Helpful in more than one of these ways	2	4
Don't know or don't remember	3	7
No elaboration or nonspecific	5	11
No response/missing	2	4
Total	**46**	**100**

*Interview Guide, Question 3.

Most interviewees had not been a member of an organized transdisciplinary research consortium or collaborative team before participating in the APRC program (Table 3-4). Of the 47 who indicated they had, 42 reported participating in a prior transdisciplinary research consortia/collaborative effort and 40 in some other transdisciplinary research projects. Thirty-eight of these transdisciplinary consortia/collaborative efforts and 37 transdisciplinary research program projects were active in the past 5 years.

Table 3-4. Prior Participation in Transdisciplinary Research by APRC Researchers*

Had you been a member of an organized transdisciplinary research consortium or collaborative prior to APRC?	n	%
Yes	47	39
No	71	59
Don't know	0	0
No response/missing	3	2
Total	**121**	**100**

*Interview Guide, Question 4.

Interviewees were asked whether they had received institutional and professional support and

encouragement in applying for the award and working with their co-investigators (Table 3-5). The number of those who said their colleagues or supervisors did encourage them in applying for the award (n=53, 44%) was equal to the number who said they did not. The majority (n=73, 60%) did not receive tangible incentives, such as funding initiatives, as encouragement. Most interviewees (n=63, 52%) indicated that they would have worked with their investigators even if they had not been involved in the APRC program, and 76 (63%) said it was not the first time they had worked with investigators in other fields. Many of those who stated they would have worked with other investigators in the absence of the APRC reported having had prior discussions with them. At the same time, they noted that having the APRC made the collaboration easier (n=18, 29%). Other reasons they still would have collaborated included no elaboration on why but the project would have been different (n=11, 17%), already worked together or had an ongoing collaboration (n=9, 14%), researched similar topics or had shared interests (n=5, 8%), worked in the same department or research group (n=5, 8%), co-investigator had unique resources (n=4, 6%), and other funds were available (n=1, 2%).

3.2.2.2 *Question 2: How did the APRC collaborators work together to achieve their research objectives?*

A majority (n=95, 79%) of the interviewees said they did not have problems forming or participating in the consortium. Problems that were described are summarized as institutional or logistical barriers (n=8, 7%), inadequate funding or delays in receiving funding (n=6, 5%), collaboration requirements too restrictive or unclear (n=2, 2%), award length too short (n=1, 1%), personal conflicts (n=1, 1%), and scientific conflicts (n=1, 1%).

Telephone and e-mail were the more common forms of interaction among investigators. Through the duration of the APRC project (which averaged 2 years), the average number of interactions by telephone was 102 (range 0–960); by e-mail, 109 (range 0–1,080); and face-to-face meetings, 74 (0–1,080). The most frequently cited purpose of these interactions (n=101, 83%) was "talking about research results," followed by "discussing methods and approaches" (n=95, 79%) and "developing a consensus about goals" (n=73, 60%).

3.2.2.3 *Question 3: What changes should be made in the APRC consortium to strengthen its use as a mechanism for promoting research collaborations?*

CSR solicited interviewees' recommendations for improving the APRC program in four areas: (1) administration changes, (2) funding requirements, (3) ways to communicate effectively with other collaborators and DCB staff, and (4) other improvements. When asked about changes in administration, the majority (67%) offered no recommendations (Table 3-6). The same held true when asking about funding requirements (46%), followed by 21 percent of interviewees recommending an increase in the funding available.

.Table 3-5. Support Received in Applying for APRC Award*

Questions	Yes n (%)	No n (%)	Don't Know n (%)	No Response n (%)
Did you receive encouragement in applying for this award from your colleagues or supervisors?	53 (44)	53 (44)	10 (8)	5 (4)
Was there any other type of encouragement from your institution such as funding initiatives or other incentives to encourage or pursue transdisciplinary collaborations?	30 (25)	73 (60)	9 (7)	9 (7)
Was the APRC program the first time you collaborated with anyone from the fields/disciplines of your co-PIs?	76 (63)	37 (31)	1 (1)	7 (6)
Would you have worked with these co-PIs if you had not been involved in the APRC program?	63 (52)	49 (40)	4 (3)	5 (4)

*Interview Guide, Questions 5, 6, 8, and 9.

None of the interviewees recommended any other improvements. Most interviewees (73%) felt their work could not have been accomplished without APRC funding.

Table 3-6. APRC Researchers' Recommendations to Improve the APRC Program*

	n	%
Changes in administration		
No recommendation	81	67
More communication and publicity about award	7	6
More stringent guidelines/criteria	4	3
Less stringent guidelines/criteria	3	2
More opportunities for younger investigators	2	2
More DCB involvement	2	2
Other	3	2
More money	1	1
Less DCB involvement	1	1
No response/missing	17	14
Requirements for funding		
No recommendation	56	46
Increase amount of funding available	26	21
Allow funding for established collaborations/relax collaboration requirements	6	5
Change restrictions on prior funding for eligibility	6	5
More flexibility in years that can be funded	5	4
Other	4	3
Change distribution of funds	2	2
Allow more than one application at a time	1	1
Should be a separate award and not a supplement	1	1
No response/missing	14	12
How to communicate effectively with other collaborators and DCB staff		
No recommendation	88	73
Direct contact with DCB, more involvement from/with DCB	4	3
Clarify or change requirements of PI communication	3	2
Change meeting frequency, timeline, or attendees	3	2
Other	2	2
No response/missing	21	17
Other improvement		
No recommendation	66	55
Keep the funding mechanism, expand the program	11	9
Other	6	5
Change time allowed for research funds	5	4
Change prior funding requirement or collaboration requirements	4	3
Change application logistics	2	2
Increase funding	1	1
More communication and publicity about award	1	1
No response/missing	25	21

*Interview Guide, Question 17.

3.2.3 *Outcome Evaluation*

3.2.3.1 *Question 1: Does the APRC support and encourage scientific collaboration for NCI grantees (the capacity-building goal)?*

Interviewees were asked to rate their experiences for several items regarding scientific collaboration, using a Likert scale. Mostly, they agreed or strongly agreed with many of the assessments (Table 3-7). On average, they felt neutral about the availability of other funding to support their research.

Interviewees were asked about several capacity-building outcomes. Their responses are summarized in Table 3-8. More than half of the APRC participants interviewed reported an opportunity to join/become active in different professional areas, develop a new research proposal, develop trust and collegiality with APRC co-investigators, and provide training opportunities for students or postdocs. Gaining access to new technical information/data sets and receiving recognition or awards for work performed were not as common. Of the 63 interviewees with new developments, 27 (43%) developed a new technology, 3 (5%) developed a diagnostic tool, 21 (2%) developed a new methodology, and 1 (2%) developed more than one of these items; 11 interviewees did not elaborate.

Table 3-7. APRC Researchers' Assessment of Experiences with the APRC Program*

Assessment	Strongly disagree n (%)	Disagree n (%)	Neutral N (%)	Agree n (%)	Strongly agree n (%)	DK/NA or No Response	Mean Value[1]
Scientists from different disciplines were able to bring their expertise to bear on common problems in productive new ways.	1 (1)	2 (2)	11 (9)	36 (30)	66 (55)	5 (4)	4.4
The research conducted under APRC helped launch important follow-up research.	3 (2)	10 (8)	6 (5)	24 (20)	74 (61)	4 (3)	4.3
The APRC project was based on teamwork, where researchers integrated scientific findings as a team.	1 (1)	5 (4)	12 (10)	43 (36)	56 (46)	4 (3)	4.3
The APRC collaboration strengthened the capabilities of each of the collaborators in his or her other research productivity.	2 (2)	2 (2)	18 (15)	42 (35)	50 (41)	7 (6)	4.2
The research conducted under APRC helped to develop new insights and paradigms.	2 (2)	7 (6)	11 (9)	40 (33)	56 (46)	5 (4)	4.2
Under the APRC program, new collaborative ties were forged that would not have been formed otherwise.	3 (2)	7 (6)	10 (8)	51 (42)	45 (37)	5 (4)	4.1
The APRC consortium was a cohesive unit.	2 (2)	8 (7)	16 (13)	39 (32)	48 (40)	8 (7)	4.1
The APRC award provided an introduction to new professional contacts.	2 (2)	12 (10)	17 (14)	38 (31)	48 (40)	4 (3)	4.0
The APRC award provided opportunities to receive training in new research techniques and the use of new instrumentation or new technologies	7 (6)	12 (10)	22 (18)	30 (25)	46 (38)	4 (3)	3.8
The APRC experience encouraged more time spent collaborating with researchers in other disciplines to integrate ideas into work.	4 (3)	11 (9)	16 (13)	55 (45)	31 (26)	4 (3)	3.8
Before participation in APRC, journals or publications outside of primary field were read.	2 (2)	23 (19)	27 (22)	36 (30)	29 (24)	4 (3)	3.6
Outside the APRC program, no funding source was available for this research.	9 (7)	29 (24)	17 (14)	32 (26)	27 (22)	7 (6)	3.3

*Interview Guide, Question 15.
[1]Mean was calculated for values "strongly agree"=1 to "strongly disagree"=5.

Table 3-8. Capacity-Building Outcomes from APRC Award*

	Yes n (%)	No n (%)	Don't know n (%)	No response n (%)
Develop a new technology, diagnostic tool, or methodology	63 (52)	51 (42)	3 (2)	4 (3)
Join/become active in different professional areas	66 (55)	50 (41)	1 (1)	4 (3)
Develop a new research hypothesis that will be pursued	76 (63)	37 (31)	4 (3)	4 (3)
Develop a research proposal to continue APRC research	67 (55)	47 (39)	1 (1)	6 (5)
Access to new technical information/data sets	81 (67)	34 (28)	0 (0)	6 (5)
Develop trust and collegiality with other APRC investigators in unit	101 (83)	9 (7)	5 (4)	6 (5)
Provide training opportunities for students or postdocs	97 (80)	16 (13)	2 (2)	6 (5)

*Interview Guide, Question 10, a, b, f, g, i, k, and l.

elaborate. Of the 67 individuals who developed a research proposal to continue APRC research, 29 (43%) were funded, 9 (13%) were submitted but not yet reviewed, 3 (4%) were not funded, and 18 (27%) were planned or in progress but not yet submitted. Information regarding status was not provided for eight (12%) research proposals. Of the 81 interviewees who responded that they gained access to technical information/data, access to general information was most common (n=29, 36%), followed by access to methodology (n=13, 16%), access to new technology (n=12, 15%), access to more than one new tool (n=10, 12%), and access to data (n=4, 5%). Thirteen (16%) interviewees did not elaborate.

Ninety interviewees reported that the training opportunities for students and postdocs were beneficial (Table 3-9).

Table 3-9. Benefits Gained to Postdoctoral Fellows and Students, as Described in the Investigator and Staff Interviews*

Benefit	N	%
Learned new skills or gained new knowledge	32	36
Advanced career (no specific elaboration)	23	26
Provided funding	14	15
Resulted in publications	5	6
Developed new research	2	2
Beneficial in one or more of the above ways	14	15
TOTAL	**90**	**100**

*Interview Guide, Question 10, l.

Eighty-seven (76%) interviewees stated they have continued to collaborate with APRC investigators after completion of the APRC-funded project, and 28 (24%) said they have not continued to collaborate. Table 3-10 describes the reasons for which investigators are or are not continuing to collaborate.

Table 3-10. Reason for Continuing to Collaborate (or Not) with APRC Co-Investigators After Completing APRC Project*

	N	%
Reasons for continuing collaboration	87	100
Finish papers/publications	5	6
Other existing research	14	16
New research	36	41
Informal collaborations	15	17
More than one of the above	2	2
Other	3	3
Nonspecific	8	9
No response/missing	4	5
Reason for not continuing collaboration	28	100
Lack of funding	3	11
Lack of interest	1	4
Logistical problems	4	14
Incompatible existing or new projects	3	11
Collaboration did not work well	2	7
More than one of the above	2	7
Other	2	7
Nonspecific	3	11
No response/missing	8	29

*Interview Guide, Question 13.

3.2.3.2 *Question 2: Does the APRC collaboration result in novel and promising concepts and advances in cancer research (the innovative goal)?*

Interviewees were asked about several innovative outcomes. Their responses are summarized in Table 3-11. More than half of the APRC participants interviewed said they did the following: developed a new technology, diagnostic tool, or methodology; had the opportunity to join/become active in different professional areas; developed publications with other APRC investigators; submitted conference abstracts or presented research; developed a new research hypothesis; developed a new research proposal; developed trust and collegiality with APRC co-investigators; and provided training opportunities for students or postdocs. Filing for a patent was an uncommon outcome. Of the 63 individuals with new developments, 27 (43%) developed a new technology, 3 (5%) a diagnostic tool, 1 (2%) a new methodology, and 1 (2%) more than one of these items.

The majority (n=83, 69%) of interviewees reported no impediments to generating concrete outputs. For the 30 who did report impediments (the remaining 9 individuals did not respond or responded "don't know"), the impediments included inadequate funding (n=8, 27%), technical issues (n=5, 17%), resources limited or difficult to obtain (n=3, 10%), award length too short (n=3, 10%), institutional or legal barriers (n=3, 10%), competing commitments (n=2, 7%), and difficulties with collaborators (n=1, 3%). Six individuals did not elaborate.

3.2.4 *Benefits of Participating in APRC*

Seventy-five (62%) interviewees said their APRC project had been as successful as they had hoped, 37 (31%) said it had not been as successful, 4 (3%) did not know, and 5 (4%) did not respond. Table 3-12 presents the reasons the interviewees felt they had less successful projects.

Table 3-11. Innovative Outcomes from the APRC Award*

	Yes n (%)	No n (%)	Don't know n (%)	No response n (%)
Develop a new technology, diagnostic tool, or methodology	63 (52)	51 (42)	3 (2)	4 (3)
File for a patent of product developed under APRC	10 (8)	104 (86)	3 (2)	4 (3)
Develop publications with APRC members providing input	76 (63)	40 (33)	0 (0)	5 (4)
Develop publications with APRC members as coauthors	67 (55)	21(17)	0 (0)	33 (27)
If none published, publications are in progress	24 (20)	23 (19)	2 (2)	72 (60)
Submit conference abstract or present based on APRC research	74 (61)	38(31)	4 (3)	5 (4)
Recognition for work performed or other awards	26 (21)	89 (74)	1 (1)	5 (4)

*Interview Guide, Question 10, a, c, d, e, and j.

Table 3-12. APRC Researchers' Views on Why the APRC Project Was Less Successful Than They Had Hoped*

	n	%
Technical problems	11	30
Difficulty in collaborating	4	11
Not enough funding/money	4	11
Administrative problems	2	5
More than one of the above	2	5
Other or nonspecific	10	27
No response/missing	4	11
Total	**37**	**100**

*Interview Guide, Question 11.

Each interviewee was asked to list three major benefits of working with the APRC program. These answers respond to both process and outcome measures. The majority of participants indicated that working collaboratively (84%) and learning about new areas of research or technologies were major benefits (78%) (Table 3-13). Thirteen (11%) individuals reported no specific benefits of participating in the program.

Table 3-13. Major Benefits of Participating in APRC Program*

Benefits	n	%
Work collaboratively	102	84
Explore or learn about new areas of research or new technologies	94	78
Generate outputs (e.g. publications), provide foundation for future work (new research, new ideas, new technology)	40	33
General financial support	24	20
Career development	22	18
Evaluate hypotheses from other research, pursue high-risk research	18	15
None	13	11
Complete work, increased time efficiency/effectiveness for project completion	11	9
Other	10	8
No response/missing	4	3

*Interview Guide, Question 16.

3.3 Archival Results

3.3.1 *Pre- and Post-APRC Grant Applications and Publications*

Secondary data (grant information, grant history, and publications) were collected for 40 funded units (109 investigators) and 39 unfunded units (109 investigators) from APRC application years 2001–2003 (Table 3-14). The majority (78%) of the funded APRC applications were for amounts greater than $80,000.

Table 3-14. Funding Amount and Application Year and Grant Success History for Units Archived for Secondary Data Analysis

Characteristic	Funded (n=40) n (%)*	Unfunded (n=39) n (%)*
Amount of APRC funding		
0–40,000	4 (10)	N/A
40,000–80,000	5 (13)	
80,000–120,000	18 (45)	
120,000+	13 (33)	
Year of APRC funding/application		
2001	9 (23)	9 (23)
2002	16 (40)	9 (23)
2003	15 (38)	21 (54)

*Units or mean (range).

Table 3-15 describes the characteristics of pre- and post-APRC grant applications submitted by investigator APRC funding status for the 218 investigators (109 funded and 109 unfunded) in the archival sample from 2001–2003. Information was collected for a total of 9,908 grant applications. Of these, Type 1 (new) and Type 2 (competing continuation) represented approximately half of all applications. In order to evaluate competitiveness of grant applications, analyses and tabulations for grant application history were limited to these application types.

Table 3-15. Characteristics of Pre and Post-APRC Grant Applications by Investigator APRC Funding Status

	Pre-APRC Grant Application				Post-APRC Grant Application			
	Funded APRC estigators 109)		Unfunded APRC Investigators (n=109)		Funded APRC Investigators (n=109)		Unfunded APRC Investigators (n=109)	
	n	%	n	%	n	%	n	%
Grant Applications	**2,796**		**2,987**		**1,774**		**1,541**	
Type 3, 4, and 5	1,394	49.9	1,381	46.2	827	46.6	737	47.8
Type 6, 7, 8, and 9	76	2.7	82	2.7	19	1.1	27	1.8
Type 1 and 2	1,326	47.4	1,524	51.0	928	52.3	777	50.4
With Award Status Info	1,319	99.5	1,524	100.0	925	99.7	774	99.6
Funded	539	40.9	547	35.9	377	40.8	218	28.2
Percentile	12.2 (0.0 - 52.6)		12.7 (0.0 - 53.3)		17.1 (0.0 - 68.0)		14.4 (0.0 - 61.4)	
Mechanism								
R01	334	62.0	347	63.4	149	39.5	110	50.5
Other R	71	13.2	71	13.0	52	13.8	39	17.9
P01	27	5.0	35	6.4	66	17.5	17	7.8
Other P	39	7.2	18	3.3	35	9.3	25	11.5
K	13	2.4	15	2.7	1	0.3	1	0.5
T or F	36	6.7	39	7.1	10	2.7	5	2.3
Other	19	3.5	22	4.0	64	17.0	21	9.6
Institute								
BHP/HRSA	0	0.0	0	0.0	0	0.0	0	0.0
FIC	3	0.6	1	0.2	1	0.3	3	1.4
NBIBIB	2	0.4	0	0.0	12	3.2	3	1.4
NCI	265	49.2	333	60.9	186	49.3	103	47.2
NCMHD	0	0.0	0	0.0	0	0.0	0	0.0
NCRR	19	3.5	11	2.0	44	11.7	25	11.5
NEI	3	0.6	0	0.0	2	0.5	1	0.5
NHGRI	7	1.3	0	0.0	1	0.3	0	0.0
NHLBI	27	5.0	22	4.0	10	2.7	11	5.0
NIA	6	1.1	9	1.6	1	0.3	7	3.2
NIAAA	0	0.0	5	0.9	2	0.5	2	0.9
NIADDK	5	0.9	7	1.3	0	0.0	0	0.0
NIAID	41	7.6	54	9.9	22	5.8	28	12.8
NIAMS	11	2.0	5	0.9	13	3.4	1	0.5
NICHD	12	2.2	22	4.0	3	0.8	3	1.4
NIDA	0	0.0	0	0.0	0	0.0	0	0.0
NIDCR	2	0.4	10	1.8	12	3.2	3	1.4
NIDDK	24	4.5	10	1.8	14	3.7	3	1.4
NIEHS	13	2.4	7	1.3	5	1.3	6	2.8
NIGMS	74	13.7	29	5.3	30	8.0	8	3.7
NIMH	0	0.0	1	0.2	1	0.3	0	0.0
NINDS	24	4.5	15	2.7	17	4.5	7	3.2
NIOSH	1	0.2	0	0.0	0	0.0	0	0.0
NLM	0	0.0	0	0.0	0	0.0	1	0.5
Missing	0	0.0	6	1.1	1	0.3	3	1.4

Funded and unfunded investigators had similar proportions of competitive application types before the APRC (47.4% and 51.0%, respectively) and after the APRC (52.3% and 50.4%, respectively).

APRC-funded investigators, compared to unfunded APRC investigators had higher proportions of successfully funded pre and post-APRC grant applications (40.9% versus 35.9%; 40.8% versus 28.2%, respectively). The mean percentile ranking of pre-APRC grant applications was similar among funded and unfunded APRC investigators (means = 12.2 versus 12.7). However, the mean percentile ranking of post-APRC grant applications was somewhat higher among funded compared to unfunded APRC investigators (means = 17.1 versus 14.4).

For both APRC-funded and APRC-unfunded investigators, the majority of the successful pre and post-APRC grant applications were R01 applications and were funded by NCI. Unfunded APRC investigators had a larger proportion of their successful grant applications come from NCI as compared to funded APRC investigators.

Funded APRC investigators, compared to unfunded APRC investigators, had higher means numbers of post-APRC grant applications and successful post-APRC grant applications per person (see Table 3-16). However, funded APRC investigators had somewhat lower mean numbers of pre-APRC grant applications per person. There were few post-APRC grant applications with topics pertinent to APRC-proposed research. The mean number of post-APRC grant applications that were related to the APRC supplement were similar (0.13 versus 0.09 for funded and unfunded APRC investigators, respectively).

Table 3-16. Key Descriptive Statistics of Grant Applications,[1] Publications, and Investigator Characteristics by Investigator APRC Funding Status

	Funded Investigators (n=109)					Unfunded Investigators (n=109)				
	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Grant Applications										
Pre-APRC	1,326	12.17	13.69	0	82	1,524	13.98	13.94	0	96
Post-APRC	928	8.51	7.30	0	48	777	7.13	5.35	0	29
Successful	377	3.46	3.68	0	21	218	2.00	2.09	0	11
Related (to APRC supplemental)	14	0.13	0.36	0	2	10	0.09	0.29	0	1
Publications										
Pre- APRC	2,662	24.42	27.47	0	215	1,983	18.19	14.31	0	69
Collaborations	157	1.44	3.99	0	22	113	1.04	2.22	0	11
Related (to APRC supplemental)	4	0.04	0.19	0	1	1	0.01	0.10	0	1
Post- APRC	2,297	21.07	21.38	0	145	1,781	16.34	16.21	0	90
Collaborations	201	1.84	4.10	0	27	125	1.15	2.01	0	12
Related (to APRC supplemental)	111	1.02	1.09	0	5	26	0.24	0.53	0	2
Investigator Characteristics										
Number of co-investigators in unit		3.02	1.07	2	6		3.13	1.06	2	5
Investigator experience[2]		11.90	9.20	0	33		13.68	9.28	0	33

[1] Types 1 and 2 only.

[2] Number of years since the investigator's earliest grant application.

A total of 8,723 publications were reviewed for the 218 investigators in the archival sample (pre-APRC publications = 4,645 and post-APRC publications = 4,078). Funded APRC investigators, and compared to unfunded investigators, had somewhat higher mean numbers of all types of pre and post-APRC publications per person including: the total number of publications, publications with APRC collaborators, and publications related to the ARPC supplement. However, very few (< 5%) pre and post-APRC publications had topics that were pertinent to the APRC-proposed research. Thus, comparisons made between funded and unfunded APRC investigators should be interpreted with caution.

Table 3-17 presents the estimated differences in key post-APRC outcomes in relation to APRC funding status, with and without adjustment for other factors that might be associated with these outcomes: number of pre-APRC publications, number of pre-APRC grant applications, number of investigator grant-years, number of investigators in APRC unit, and year of APRC application. These estimated differences are derived from generalized estimating equation (GEE) models which take into account within-unit correlations. Without adjustment for other factors, being an APRC award recipient was significantly associated with more successful post-APRC grant applications (p<.0005), post-APRC–related publications (p<.0001), and post-APRC publications (p=.065). There was no significant association with post-APRC publications in which APRC collaborators were coauthors (collaborative publications). With adjustment for other factors, being an APRC award recipient was associated with one more successful post-APRC grant applications (p=.004) and almost one more post-APRC–related publication (p<.0001) compared with unfunded APRC applicants. Also after adjustment for other factors, the difference in the number of post-APRC publications between funded and unfunded APRC investigators was no longer marginally significant (p=.6067).

Table 3-17. Estimated Effects[1] of Investigator APRC Funding Status in Relation to Post-APRC Outcomes

	Unadjusted (n=218)			Adjusted[2] (n=218)		
	Estimate	SE	p-value	Estimate	SE	p-value
Grant applications	1.39	0.89	0.116	0.63	0.73	0.3868
Grant applications (successful)	1.46	0.42	<0.0005	1.01	0.35	0.004
Publications	4.74	2.57	0.065	-0.74	1.43	0.6067
Publications (collaborations)	0.78	0.58	0.1782	0.69	0.54	0.2009
Publications (related)	0.80	0.15	<.0001	0.74	0.15	<.0001

[1] Effects estimated using generalized estimating equation to account for the within-APRC unit correlation.
[2] Adjusted for number of pre-APRC publications, number of pre-APRC grant applications, number of investigator grant-years, number of investigators in APRC unit, and year of APRC application.

3.3.2 *Transdisciplinary Nature of Consortia*

Characterizing the transdisciplinary nature of consortia was a major interest of the evaluation. However, in the interview, most individuals indicated their expertise to be biology, and there was little variation. Thus, because 90 percent of the respondents identified biology as their primary field, it was not possible to characterize the transdisciplinary nature of the consortia groups based on the six prespecified categories in the interview (biology, chemistry, physics, computer sciences, engineering, and other). CSR utilized IMPAC II data to evaluate the transdisciplinary nature of the consortia. However, these data also were limited because of the large number of missing values in the IMPAC II system.

The IMPAC II system contained data or field of expertise for 178 of those who applied for APRC funds. A total of 990 expertise items were reported; some investigators reported more than one field of expertise. These specific items were more broadly classified into seven categories (Table 3-18;

Appendix G). For those who reported more than one specific item, we assessed whether the specific items were related to the same broad category, such as "microbiology" and "virology" both being "biology," or whether these specific items crossed over various categories, such as "microbiology" and "epidemiology" being "biology" and "public health." Respondents who reported only one field of expertise were assigned expertise in that broad category. When an individual's specific expertise crossed categories, he or she was assigned the most frequent or "multiple" categories. Similar to the interview data, the majority of individuals were classified as having biology as their expertise in the IMPAC II data. Twenty-three respondents reported equal frequency of a combination of expertise, with the most common combinations being biology-chemistry, biology-clinical, and chemistry-clinical. Because of missing data for expertise in IMPAC II, most of the consortia had only one or two individuals represented, and no consortia had more than four. Thus, we did not have sufficient numbers to characterize and make comparisons of the transdisciplinary nature of the consortia between funded and unfunded groups.

Table 3-18. Broadly Classified Disciplines Represented in the APRC Research Consortia Based on Self-Reported Expertise Data Available from IMPAC II, by APRC-Funded Status

Expertise	n	%
Biology	115	65
Chemistry	14	8
Physics, Computational Sciences, and Engineering	4	4
Clinical	10	6
Public Health	2	1
Other	10	6
Multiple	23	13

4. Conclusions

The APRC program has been in existence for almost 10 years. Data extracted from DCB resource files and findings from telephone interviews of funded APRC research investigators provide a wealth of information to support substantive conclusions. These conclusions underscore the results of the APRC evaluation, which will help NCI and the DCB to (1) formulate sound decisions regarding future funding of APRC supplements and (2) better manage the program.

We have summarized the major APRC outcomes by data source, starting with interview conclusions and then archival conclusions. These conclusions address the two primary goals of the APRC program in determining whether (1) the program was successful in conducting joint research that would not be possible without the collective skills and expertise of multidisciplinary consortia investigators and (2) the collaborations resulted in novel and promising concepts and innovative advances in cancer research.

4.1 Interview Conclusions

Interviewee reports support the following conclusions in regard to conducting research with multidisciplinary investigators:

- Most investigators had not been a member of an organized transdisciplinary research consortium or collaborative team prior to participating in the APRC program.
- Working collaboratively and learning about new areas of research or technologies were major benefits of the program.
- Investigators who spoke with DCB Program Directors or other DCB staff members about APRC award information, guidance in determining appropriateness of the proposed research, and staff eligibility found their advice helpful.
- The majority of investigators had no recommendations for making changes or improving the administration of the APRC program, its funding, or communications with other collaborators and DCB staff. Most impressive, the majority of the investigators thought that they could not have accomplished their work without APRC funding.
- Investigators assessed their experiences with the APRC program as follows:
  - Scientists from different disciplines were able to bring their expertise to bear on common problems in productive ways;
  - The research conducted helped launch important follow-up information;
  - The project was based on teamwork, where researchers integrated scientific findings as a team; and
  - Research conducted under the APRC helped to develop new insights and paradigms.

Interviewee reports also support the following conclusions concerning advances in cancer research:

- Capacity-building outcomes and responses resulted in more than half of the APRC participants indicating that they had the opportunity to join/become active in different professional areas, develop a new research proposal, develop trust and collegiality with APRC co-investigators, and provide training opportunities for students or postdocs. Gaining access to new technical information/datasets and receiving recognition or awards for work performed were not as common.
- Training opportunities for students and postdocs were beneficial because they were able to advance their knowledge by learning new skills or gaining new knowledge, enhance their publication history, and contribute to the development of new research areas.
- A significant number of researchers stated they have continued to collaborate with APRC investigators after completion of the APRC-funded project. They indicated that working collaboratively and learning about new areas of research or technologies were major benefits.

- More than half of the APRC participants indicated that they did the following:
  - Developed a new technology, diagnostic tool, or methodology;
  - Had the opportunity to join/become active in different professional areas;
  - Developed publications with other APRC investigators;
  - Submitted conference abstracts or presented research;
  - Developed a new research hypothesis;
  - Developed a new research proposal;
  - Developed trust and collegiality with APRC co-investigators; and
  - Provided training opportunities for students or postdocs.
- The majority of interviewees said there were no impediments to generating concrete outputs.

4.2 Secondary Data Analysis Conclusions (Grant Information, Grant History, and Publications)

- Because the majority of individuals identified biology as their primary field, it was not possible to characterize the transdisciplinary nature of the consortia groups based on the six prespecified categories in the interview: biology, chemistry, physics, computer sciences, engineering, and other. CSR used IMPAC II data to evaluate the transdisciplinary nature of the consortia. However, these data also were limited due to the large number of missing values in the IMPAC II system.
- Approximately half of the 9,908 grant applications reviewed were new or competing continuations. Unfunded investigators had slightly higher mean pre-APRC grant applications than funded investigators; however, unfunded investigators had somewhat lower post-APRC grant applications and successful post-APRC grant applications. Few grants submitted were related to the proposed (unfunded) or actual (funded) APRC research.
- Funded APRC investigators had somewhat higher proportions of successfully funded pre and post-APRC grant applications. For both APRC-funded and APRC-unfunded investigators, the majority of the pre-APRC grant applications were R01 applications; there was no substantial difference in the distribution of grant application mechanisms in relation to APRC-funded status. The majority of successful pre and post-APRC applications were funded by NCI. Moreover, unfunded APRC investigators had a larger proportion of their successful grant applications come from NCI as compared to funded APRC investigators.
- Without adjustment for other factors, being an APRC award recipient was significantly associated with more successful post-APRC grant applications, post-APRC–related publications, and post-APRC publications. There was no significant association with post-APRC publications in which APRC collaborators were coauthors (collaborative publications).
- With adjustment for other factors, being an APRC award recipient was associated with one more successful post-APRC grant applications and almost one more post-APRC–related publication compared with unfunded APRC applicants. Also after adjustment for other factors, the difference in the number of post-APRC publications between funded and unfunded APRC investigators was no longer marginally significant.
- In general, it is too early to know if the APRC program is a complete success. Although it was initiated in 1998, CSR had to narrow down the secondary data collection efforts to 3 years, 2001–2003. Complete documentation was not available for 1998–2000. As a result, it was difficult to evaluate APRC-specific successes or failures, such as APRC-related publications over the 10 year period when the APRC was in existence.

5. Recommendations

Data from this evaluation reveal progress in intellectual stimulation, scientific collaboration, and changes in scientific direction. However, additional work could be completed to further characterize the APRC program. In light of the findings from the evaluation and the conclusions above, CSR has the following recommendations for the DCB:

- If the APRC program mechanism is continued, perform another secondary data analysis after more time has elapsed to evaluate APRC-related outcomes.
- Consider performing closeout interviews regarding the success of the project prior to the termination of research project funding or shortly thereafter. This would ensure better recall by investigators and staff regarding how well the research goals and objectives were met and the degree of involvement and support that NCI provided in the research process.
- Establish a procedure for alerting current and potential investigators of current APRC grant program announcements, including research objectives, goals, and potential funding. These could include flyers, circulars for distribution in booths at scientific forums, and periodic e-mail notices of new grant program initiatives from Program Directors.
- Develop and include more specific criteria related to the different expertise fields of the proposed collaborating team members. It should also be required that the transdisciplinary contribution of each consortium member be provided in the grant application. The transdisiciplinary nature and diversity of the consortium should be a stronger element of consideration by the NCI review committee when evaluating the strength of the grant application.
- Develop criteria for determining if a particular collaboration is of significant importance to the collaborating partner in terms of complementary skills and expectations.
- Increase programmatic management oversight of ongoing research collaborations; specifically to address grant-related issues or problems. This will help ensure that transdisciplinary investigations between diverse scientific collaborations are successful.
- Consider initiating periodic (once-a-year) mandatory online training for Program Directors because of inconsistencies and data gaps in the internal electronic grant systems. These trainings would include data entry requirements for databases containing funded grants with a focus on fixed-field data entry requirements.
- Hold a consensus conference by inviting outstanding researchers representing diverse disciplines and advisory council members to address future research directions, including new concepts, ideas, and research gaps requiring attention. Such a conference would be useful for the DCB in determining programmatic needs regarding continuance of the APRC program mechanism as well as in identifying important new research areas.
- Create forums for bringing together research professionals in diverse scientific areas to discuss DCB transdisciplinary gaps. Despite progress in transdisciplinary research in recent years, conceptual and intellectual barriers continue to exist, thus creating problems in scientific advancements.
- Acknowledge and recognize outstanding scientists, engineers, medical researchers, and others with awards for their promising achievements and cutting-edge research. This could be done by way of recognition in public forums and developing specific award announcements (similar to Pioneer Awards) to which individual researchers or members of a collaborative unit could apply.

References

CSR, Incorporated. 2004, September 30. Feasibility Study to Evaluate the *Activities to Promote Research Collaborations* Program. Final Report. Submitted to Kelly Kim, Project Officer, National Cancer Institute. Contract No. GS10F0114L/Order No. 263-FD-412887.

Dodgson, M. 1991. The management of technological collaboration. *Engineering Management Journal* 1(4):187–192.

Institute of Medicine (IOM). Committee on Building Bridges in the Brain, Behavioral, and Clinical Sciences, Division of Neuroscience and Behavioral Health. Pellmar, T.C., and Eisenberg, L., Eds. 2000. *Bridging Disciplines in the Brain, Behavioral, and Clinical Sciences*. Washington, DC: National Academy Press. Available at: http://books.nap.edu/html/bridging_disciplines/.

National Institutes of Health (NIH). 2006, December 14 (release date). *FY07 Activities to Promote Research Collaborations (APRC) Program*. NIH Guide. Available at: http://dcb.nci.nih.gov/newsdetail.cfm?ID=26.

Evaluation of the *Activities To Promote Research Collaborations* Program

Appendix A: Standard NCI Letter to Prospective Respondents (Senior Investigators)

CSR Incorporated
Consulting Services & Research

Appendix A: Standard NCI Letter to Prospective Respondents (Senior Investigators)

Dear Dr. _____:

NCI's Division of Cancer Biology (DCB) has contracted with CSR, Incorporated to evaluate the impact and contributions of the Activities to Promote Research Collaborations (APRC) Program in advancing the goals of the DCB. This evaluation will focus on APRC applicants/consortia that were awarded APRC funding from the inception of the program in 1998 through fiscal year 2004.

As an APRC-funded Principal Investigator, research collaborator, or consortia member, you are being requested to participate in a telephone survey that will ask for your candid response to questions about your experience and overall assessment of the APRC program. It will take approximately 30 minutes of your time to complete the telephone interview. Your response would be voluntary, and the information you provide will be non-identifiable and kept confidential, except as otherwise required by law.

On behalf of DCB, you are being requested to please confirm your availability to participate in this study by completing and e-mailing or faxing the attached form back to me. Upon hearing from you, a CSR, Incorporated staff member will contact you to schedule a phone interview at your earliest convenience and preferably during the time that you indicate below between January 22 and March 16, 2007. At the time when CSR confirms the date and time of your interview, you will be asked about the names and/or contact information of other key personnel on your APRC research project in order to help us update our records.

Please complete and return the information in the form below by e-mail or fax within 7 working days of receipt of this invitation.

I look forward to hearing from you. Your participation is critical to properly evaluate the successes and failures of the APRC Program.

Sincerely,

Helen K. Cesari *(on behalf of DCB/NCI/NIH)*
Project Director
CSR, Incorporated
2107 Wilson Blvd., Suite 1000
Arlington, VA 22201
Ph: (703) 312-5220
Fax: (703) 312-5230
E-mail: hcesari@csrincorporated.com
Attachment (See Appendix D)

Evaluation of the *Activities To Promote Research Collaborations* Program

Appendix B: Standard NCI Letter to Prospective Respondents (Junior Investigators)

CSR Incorporated
Consulting Services & Research

Appendix B: Standard NCI Letter to Prospective Respondents (Junior Investigators)

Dear _____ :

NCI's Division of Cancer Biology (DCB) has contracted with CSR, Incorporated to evaluate the impact and contributions of the Activities to Promote Research Collaborations (APRC) Program in advancing the goals of the DCB. This evaluation will focus on funded and unfunded APRC applicants/consortia from the inception of the program in 1998 through fiscal year 2004.

Our records indicate that you are listed as one of the key personnel (e.g., graduate student, post-doctoral fellow, laboratory technician, etc.) for the following funded APRC grant application: Fiscal Year _____ , Grant # _____(*provide grant number)*, entitled "_____" (*provide title of grant application).* The Principal Investigator on this grant was: _____ *(provide full name of the PI).* The title of the Parent Grant under which this APRC supplement was awarded is : "_____" *(provide title of parent grant).*

As one of the key personnel on the above referenced grant, you are being requested to participate in a telephone survey that will ask for your candid response to questions about your experience and overall assessment of the APRC program. It will take approximately 30 minutes of your time to complete the telephone interview. Your response would be voluntary, and the information you provide will be non-identifiable and kept confidential, except as otherwise required by law.

On behalf of DCB, you are being requested to please confirm your availability to participate in this study by completing and e-mailing or faxing the attached form back to me. Upon hearing from you, a CSR, Incorporated staff member will contact you to schedule a phone interview at your earliest convenience and preferably during the time that you indicate below between _____ *(project interview timeline)* and _____ *(project interview timeline*). At the time when CSR confirms the date and time of your interview, you will be asked about the names and/or contact information of other key personnel on your APRC research project in order to help us update our records.

Please complete and return the information in the form below by e-mail or fax within 7 working days of receipt of this invitation.

I look forward to hearing from you. Your participation is critical to properly evaluate the successes and failures of the APRC Program.

Sincerely,

Helen K. Cesari (*on behalf of DCB/NCI)*
Project Director
CSR, Incorporated
2107 Wilson Blvd., Suite 1000
Arlington, VA 22201
Ph: (703) 741-7130
Fax: (703) 312-5230
Attachment (see Appendix D)

Evaluation of the *Activities To Promote Research Collaborations* Program

Appendix C: Standard Reminder Transmittal to Funded and Unfunded APRC Grantees

CSR Incorporated
Consulting Services & Research

Appendix C: Standard Reminder Transmittal to Funded and Unfunded APRC Grantees

Dear _____:

This is a follow-up to an e-mail request that was recently sent to you on behalf of the National Cancer Institute's (NCI) Division of Cancer Biology (DCB). To date, you have not responded to the NCI/DCB invitation to participate in a telephone survey to evaluate the impact and contributions of the Activities to Promote Research Collaborations (APRC) Program in advancing the goals of the DCB. The telephone interview will take approximately 30 minutes of your time. Your response would be voluntary, and the information you provide will be non-identifiable and kept confidential, except as otherwise required by law.

Since we have not heard from you, I am asking that you complete and return the attached requested information indicating your willingness/unwillingness to participate in the telephone interview. If you are available, please complete and submit the form providing the dates/times, etc., that you wish to be scheduled for the survey.

Thank you for your attention to this request. I look forward to hearing from you. Your participation is critical to properly evaluate the successes and failures of the APRC Program.

Sincerely,

Helen K. Cesari *(on behalf of DCB/NCI/NIH)*
Project Director
CSR, Incorporated
2107 Wilson Blvd., Suite 1000
Arlington, VA 22201
Ph: (703) 312-5220
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Attachment (see Appendix D)

Evaluation of the *Activities To Promote Research Collaborations* Program

Appendix D: APRC Survey Participation Agreement Form (Standard for Senior/Junior Investigators)

CSR Incorporated
Consulting Services & Research

Appendix D: APRC Survey Participation Agreement Form (Standard for Senior/Junior Investigators)

APRC Survey Participation Agreement Form

Please fill in the following information:

1) I am willing to participate in the survey: _____yes _____no

2) Three dates (and times) I would be available (between _____ and _____) for the 30-minute interview are:

Time Zone: *(check one)* __Eastern __Central __Mountain __Pacific
Date _____ Time _____
Date _____ Time _____
Date _____ Time _____

3) Phone Number where I can be reached for the interview: _____.

4) Complete Mailing/Contact Information:

Name:
_____
Organization/University Name:
_____
Address:
_____

City: _____ State: _____ Zip Code: _____

Evaluation of the *Activities To Promote Research Collaborations* Program

Appendix E: APRC Interview Guide

CSR Incorporated
Consulting Services & Research

Appendix E: APRC Interview Guide

Name:_____ **Interview Date:**_____ **Taped Interview**

Start Time:_____ **Stop Time:**_____ **transcribe only nuggets**

Tape: Side A _____ **Side B** _____

Activities to Promote Research Collaborations (APRC) Interview Guide

Introductory Statement:

Hello, this is __(name)_____. I am with CSR, Incorporated, the contractor performing the interview for the Division of Cancer Biology, NCI/NIH APRC Project. A staff person had scheduled this time with you for us to talk. Is now a good time for you?

I will be asking you about your experiences and opinions regarding the APRC project. The information is being collected under the statutory authorities for the National Cancer Institute (NCI) found in 42 USC 285a *(unnecessary to read the underscored citation).* Your response is voluntary. The information you provide will be non-identifiable and kept confidential, except as otherwise required by law, and there will be no consequences of not providing the information.

May I tape this conversation? ☐ **Yes** ☐ **No**

According to our records, you are listed as a (PI or Co-PI) for an APRC grant that was funded in (year of funding) (*See information sheet for the grantee's role and year of funding).* The title of the funded APRC grant is: _____ (*see information sheet*) and the title of the Parent grant is: _____.

I would like to start by asking you a few questions about your early experiences with the APRC Program.

1. **What is your primary field of expertise or specialty?** *(Check the appropriate box. If Other, note the specialty provided. Probe for specialty within each area.)*

   a. ☐ Biology *(Specialty:)*_____
   b. ☐ Chemistry *(Specialty:)*_____
   c. ☐ Physics *(Specialty:)*_____
   d. ☐ Engineering *(Specialty:)*_____
   e. ☐ Computer Sciences (including bioinformatics) *(Specialty:)*_____
   f. ☐ Other (including social science, epidemiology, etc.) *(Specialty:)*_____

2. **How did you become aware of the APRC program?** *(Check 1 box only.)*

   a. ☐ Read about it in an NIH Guide Notice.
   b. ☐ Heard about it from a Division of Cancer Biology (DCB) staff member.
   c. ☐ Other *Please specify:* _____.

3. **Did anyone in your unit contact the Program Director or another DCB staff member to discuss the APRC application prior to applying for the award?** ☐ **Yes** ☐ **No** ☐ **DK**

   If Yes:

   a. Did you personally speak with a Program Director or a DCB staff member? ☐ **Yes** ☐ **No** ☐ **DK**
   b. Did you find their advice helpful? ☐ **Yes** ☐ **No** ☐ **DK**
   c. Why or why not?_____

If No, go to Q4.

4. **Before submitting your application for an APRC award, had you ever been a member of an organized transdisciplinary research consortium or collaborative effort through a Federal Program Grant or another collaborative mechanism?** ☐ **Yes** ☐ **No** ☐ **DK**
(*A consortium or collaborative effort is defined as a research group/team which is typically comprised of a PI, Co-PIs, and other investigators or key personnel [graduate students, post-doctoral fellows, technicians, etc.]).*

If Yes, then ask the following. If NO, go to Question 5:

a. How many?
   1) _____ # of Program Project Grants
   2) _____ # of other consortia/collaborative efforts
   _____ TOTAL of 1 and 2

b. How many of these transdisciplinary collaborative efforts were on grants that were **Active** in the past 5 years?
   1) _____ # of Program Project Grants
   2) _____ # of other consortia/collaborative efforts
   _____ TOTAL of active grants in the last 5 yrs

Now, I would like to ask you a few questions about your experience during the time that you worked on the APRC program.

5. **a.** **Did you receive encouragement in applying for this award from your colleagues or supervisors?** ☐ **Yes** ☐ **No** ☐ **DK**

If Yes, please describe: _____

b. **Was there any other type of encouragement from your institution such as funding initiatives or other incentives to encourage or pursue transdisciplinary collaborations (e.g., specific resources)?** ☐ **Yes** ☐ **No** ☐ **DK**

If Yes, please describe: _____

6. **Please describe any problems you had in forming or participating in the APRC consortium.** (*Probe for problems encountered during pre-application and during the period of collaboration and any unanticipated complexities—administrative or scientific—that were particularly difficult.)*

Is there anything else that you would like to add? _____

7. I would like to ask you about the frequency and types of interactions that you had with your co-PIs on the APRC.

a. How long was the APRC Project?: _____ (months)? _____ (years)?

b. How many years are you into the APRC research grant? (*Probe for 1st, 2nd, etc.).* _____

c. With what frequency did you have the following interactions?

How many times per:

1) ☐ Telephone _____ /month? _____ /year? _____ /APRC duration _____Total
2) ☐ E-mail _____ /month? _____ /year? _____ /APRC duration _____Total
3) ☐ Face-to-face meetings _____ /month? _____ /year? _____ /APRC duration _____Total
(includes video teleconferencing)

d What was the purpose of those interactions? Did they help you to:

1) ☐ Develop a consensus about goals
2) ☐ Talk about research results
3) ☐ Discuss methods and approaches
4) ☐ Other (*Please describe.):* _____

8. Would you have worked with these co-PIs if you had not been involved in the APRC program? ☐ **Yes** ☐ **No** ☐ **DK**

If Yes, please explain why: _____

_____

_____

9. Was the APRC program the first time you have collaborated with anyone from the fields/disciplines of your co-PIs? ☐ **Yes** ☐ **No** ☐ **DK**

If No, please elaborate: _____

_____

_____

Now, I would like to ask you a few questions about what you gained from participating in the APRC Program.

10. Did your collaboration on the APRC result in any of the following? (*Check all that apply; read Q, as necessary, for each.*)

	Y	N	DK	
a.	☐	☐	☐	Did you develop a new technology, diagnostic tool, or methodology? *Please describe:* _____
b.	☐	☐	☐	Did you have an opportunity to join/become active in different professional areas/disciplines not familiar to you before? *Please describe:* _____
c.	☐	☐	☐	Did you file for a patent of a product developed under APRC?
d.	☐	☐	☐	Did you develop any publications in which other APRC members provided valuable input?
	☐	☐	☐	**If YES**, did any of the Co-PIs or key personnel co-author a paper with you? *Please specify:* _____
	☐	☐	☐	**If No,** are there any publications under development with co-PIs or other key personnel. **If Yes**, how many? _____
e.	☐	☐	☐	Did you develop and submit a conference abstract or prepare a conference paper or poster session materials on which other APRC members provided valuable input? *Please specify:* _____
f.	☐	☐	☐	Did you develop a new research hypotheses that are/will soon be pursued by another research effort? *Pease describe:* _____
g.	☐	☐	☐	Did you develop a research proposal to continue APRC research? *Please describe type of research and the status of application:* _____
h.	☐	☐	☐	Did your collaboration on the APRC result in you collaborating with <u>NON-APRC</u> researchers on other projects? **If YES**, how many? _____ ***Probe for:*** Institution Grant Mechanism # of Collaborators # of Transdisciplinary Fields

Did your collaboration on the APRC result in any of the following? (*Check all that apply; read Q, as necessary, for each.*)

	Y	N	DK	
i.	☐	☐	☐	Did you have the ability to access new technical information/data sets and informational/ methodological tools?

Please describe: _____

_____

_____

j.	☐	☐	☐	Did you get recognition for work performed (cash, certificates, or public acknowledgment) or receive any other awards?

Please specify: _____

_____

_____

k.	☐	☐	☐	Did you develop trust and collegiality with other APRC investigators within your APRC unit?

Probe to find out if there were any trust or collegiality issues: _____

_____

_____

l.	☐	☐	☐	Were there training opportunities for students or postdocs or fellows? (**If No, go to Question 10.m.**).
	☐	☐	☐	Were they beneficial for their career development?

If Yes, in what ways? *(If the interviewee is a student or fellow, ask him or her directly.):* _____

_____

_____

_____

m.	☐	☐	☐	Other (*Please describe any other major outcomes of your work):* _____

_____

_____

_____

11. Was your APRC project as successful as you had hoped it would be? ☐ **Yes** ☐ **No** ☐ **DK**

If No, please describe why not. *(Probe for causes of conflict or frustration, trust issues, leadership issues, openness to criticism, and whether they were resolved.)*

_____

_____

_____

12. Do you think there were impediments to generating concrete outputs, such as publications, new grant applications, etc., from the APRC project? ☐ **Yes** ☐ **No** ☐ **DK**

If Yes, please describe the impediments: _____

_____

_____

13. Besides what we have just discussed, have you continued to collaborate with your APRC partners in other ways since completing the research? ☐ **Yes** ☐ **No** ☐ **DK** ☐ **NA**

If Yes, please describe: _____

_____

_____

If you have not continued to collaborate, please explain why not: _____

_____

_____

Now, I would like to ask you a few questions about your overall assessment of the APRC experience.

14. Do you think you could have accomplished this work without APRC funding? ☐ **Yes** ☐ **No** ☐ **DK**

Please explain: _____

_____

_____

15. On a scale of 1 to 5 (*that is, 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, or 5=strongly agree)*, please tell me how strongly you agree or disagree with the following statements:

a. Outside of the APRC program, no funding source was available for this research.

1	2	3	4	5	6
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	DK/NA

b. The research you conducted under APRC helped to launch important follow-up research.

1	2	3	4	5	6
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	DK/NA

c. The APRC award provided an introduction to new professional contacts.

1	2	3	4	5	6
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	DK/NA

d. Scientists from different disciplines were able to bring their expertise to bear on common problems in productive new ways under the APRC program.

1	2	3	4	5	6
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	DK/NA

***Probe for information, if response is 1*:** _____

_____

e. Under the APRC program, you were able to forge new collaborative ties that would not have been formed otherwise.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

f. The APRC collaboration strengthened the capabilities of each of the collaborators in their other research productivity.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

g. The research you conducted under APRC helped to develop new insights and paradigms.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

h. The APRC award provided you with the opportunity to receive training in new research techniques, the use of new instrumentation, or new technology.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

i. Before your participation in APRC, you frequently read journals or publications outside your primary field.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

j. The APRC experience has encouraged you to spend more time collaborating with researchers outside your own discipline for the purpose of integrating their ideas into your own work.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

k. The APRC consortium was a cohesive unit.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

l. The APRC project was based on teamwork, where scientific findings were integrated as a team.

1 2 3 4 5 6

Strongly Disagree Disagree Neutral Agree Strongly Agree DK/NA

16. What do you consider the three major benefits of your experience in working on the APRC program?

a. _____

_____

_____

b. _____

_____

_____

c. _____

_____

_____

17. What recommendations would you make to improve the APRC program in the future? *(Probe for:)*

a. Changes in administration of the program_____

b. Requirements for funding

c. How to communicate effectively with other collaborations and with DCB staff

d. Other improvement

18. Can you provide the names and contact information of key personnel,(non Co-PIs) such as post-docs, graduate students, or technicians) who are not listed on the grant? *Request e-mail address or phone number for each.*

Name	**Contact Information**

Thank you for taking the time to respond to this survey.

Evaluation of the *Activities To Promote Research Collaborations* Program

Appendix F: Thank-You Letter to Interview Participants

CSR Incorporated
Consulting Services & Research

Appendix F: Thank-You Letter to Interview Participants

Dear Dr. _____:

Thank you for participating in the National Cancer Institute (NCI) evaluation survey of the Activities to Promote Research Collaborations (APRC) Program. We know that your time is valuable, and we truly appreciate your willingness to offer your experience and overall assessment of the program.

Your contributions will assist CSR, Incorporated in properly evaluating the impact and effectiveness of the APRC program in advancing the goals of the Division of Cancer Biology.

Once again, we would like to thank you for taking the time to give your valued opinions and wish you success in your future research endeavors.

Sincerely,

Helen K. Cesari
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Fax: (703) 312-5230
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Evaluation of the *Activities To Promote Research Collaborations* Program

Appendix G: Self-Described Expertise in IMPAC (Based on Seven-Category Classification)

CSR Incorporated
Consulting Services & Research

Appendix G: Self-Described Expertise in IMPAC (Based on Seven-Category Classification)

Stated Expertise	Number of Observations	Assigned Expertise Category
Aging and nutrition	1	Clinical
Aging, cellular	3	Biology
Aids	1	Clinical
Allied health sciences education and training	1	Public Health
Analytical chemistry	2	Chemistry
Anatomy, other	1	Biology
Animal	2	Biology
Animal genetics	5	Biology
Animal models of human disease	10	Biology
Anti-cancer agents	9	Chemistry
Antigens	2	Biology
Artificial organs	1	Clinical
Autoimmunity	3	Biology
Bacterial/viral/mycotic disease immunology	1	Biology
Bacteriology	4	Biology
Behavioral medicine	1	Clinical
Biochem/endoc	3	Chemistry
Biochemical	1	Chemistry
Biochemical endocrinology	1	Chemistry
Biochemical genetics	8	Chemistry
Biochemical pharmacology	3	Chemistry
Biochemical/molecular	2	Chemistry
Biochemistry, other	11	Chemistry
Biochemistry-unspec	3	Chemistry
Bioengineering, other	3	Engineering
Biohemical pharmacology/toxiology	2	Chemistry
Biology, other	8	Biology
Biomaterials/materials science	2	Physics
Biophysical chemistry	1	Physics
Biophysics, other	2	Physics
Bladder cancer	1	Clinical
Blood banking/leucocyte preservation/blood substitutes	1	Clinical
Blood/blood forming	1	Biology
Brain/nervous system cancer	3	Clinical
Breast cancer	16	Clinical
Cancer immunology	10	Biology
Cancer prevention	5	Public Health
Cancer, other	20	Clinical
Carbohydrate biochemistry	2	Chemistry
Carbohydrate chemistry	1	Chemistry

Stated Expertise	Number of Observations	Assigned Expertise Category
Carcinogenesis, chemical	6	Chemistry
Carcinogenesis, environmental	1	Biology
Carcinogenesis, mechanisms	17	BIology
Carcinogenesis, radiation-induced	3	Biology
Cardiovascular disease epidemiology	1	Public Health
Cardiovascular diseases	1	Clinical
Cardiovascular pharmacology	1	Chemistry
Cardiovascular physiology	1	Biology
Cell	1	Biology
Cell biology nec-other	1	Biology
Cell biology nec-unspec	3	Biology
Cell biology, other	10	Biology
Cell culture	13	Biology
Cell cycle regulation	10	Biology
Cell division	1	Biology
Cell physiology	2	Biology
Cell radiation	1	Biology
Cellular immunology	10	Biology
Chemical kinetics/dynamics	1	Chemistry
Chemical pharmacology	1	Chemistry
Chemistry, other	4	Chemistry
Chemotherapeutic agents: neoplastic disease	2	Clinical
Chemotherapy, cancer	4	Clinical
Child and family social services	1	Other
Chromatography/separation science	1	Chemistry
Chromosome structure/organization	2	Biology
Clinical dental sciences, other	1	Clinical
Clinical chemistry	1	Chemistry
Clinical medical sciences, other	2	Clinical
Clinical pharmacology	1	Clinical
Clinical, therapeutics	2	Clinical
Colorectal cancer	2	Clinical
Comparative pathology	1	Biology
Computational chemistry	1	Computational Sciences
Contractile physiology	1	Biology
Contractile systems	3	Biology
Crystallography	1	Chemistry
Cyclic nucleotide biochemistry	3	Chemistry
Cyclic nucleotide pharmacology	2	Biology
Cytogenetics	1	Biology
Cytokines	8	Biology
Cytopathology	1	Biology
Cytoskeletal systems	9	Biology
Dermatology	1	Clinical
Developemental cell biology/differentitation	15	Biology
Developmental	2	Biology

Stated Expertise	Number of Observations	Assigned Expertise Category
Developmental genetics	1	Biology
Developmental neurobiology	2	Biology
Diagnosis/early detection of cancer	3	Clinical
Diagnostic radiology	2	Clinical
DNA replication damage and repair	9	Biology
Drug deliver'drug delivery systems	2	Chemistry
Drug enzymology	1	Chemistry
Drug metabolism	2	Chemistry
Electron microscopy	1	Chemistry
Embryology/fetal grwoth and development	1	Biology
Endocrine	2	Biology
Endocrine physiology	1	Biology
Endocrinology	2	Biology
Endocrinology nec	1	Biology
Environmental toxiciology	2	Biology
Enzyme/metabolism	3	Chemistry
Enzymology	4	Chemistry
Epidemiological methods	2	Public Health
Epidemiology	1	Public Health
Epidemiology, other	1	Public Health
Experimental nutrition	1	Clinical
Experimental pathology - tumors	4	Clinical
Fine structure	2	Chemistry
Food additives	1	Public Health
Food microbiology	1	Public Health
Gastrointestinal cancer	5	Clinical
Gene regulation/expression	34	Biology
Gene structure/organization/mapping	9	Biology
Genetics, other	6	Biology
Genetics-other	2	Biology
Gerontology/geriatrics	1	Clinical
Growth factors	12	Biology
Growth/development nec	1	Biology
Gynecologic cancer	2	Clinical
Head and neck cancer	2	Biology
Health and behavior	1	Public Health
Health services deliver, other	1	Public Health
Health services evaluation	1	Public Health
Hematology	1	Biology
Hematology, other	3	Biology
Hematology/immunology	1	Biology
Histopathology	2	Biology
HIV	4	Clinical
Hormone/vitamin	2	Clinical
Host-parasite relationships	1	Clinical
Host-tumor interaction/metastasis	7	Biology

Stated Expertise	Number of Observations	Assigned Expertise Category
Human genetics	6	Biology
Human/clinical	1	Clinical
Hypersensitivity	1	Biology
Immune mediators	2	Biology
Immunobiology	4	Biology
Immunoblobulins/antibodies	6	Biology
Immunochemistry	4	Chemistry
Immunogenetics	2	Biology
Immunology	8	Biology
Immunology, other	8	Biology
Immunopathology	7	Biology
Immunoregulation	6	Biology
Immunotherapy	5	Clinical
Immunotherapy, cancer	5	Clinical
Infectious disease epidemiology	2	Public Health
Infectious diseases	5	Clinical
Internal medicine	1	Clinical
Lactation/infant nutrition	1	Public Health
Leukemias	8	Clinical
Lipid biochemistry	1	Chemistry
Lipid nutrition	1	Chemistry
Long-term care for elderly	1	Clinical
Lung cancer	2	Clinical
Lymphocyte biology	6	Biology
Lymphomas	5	Clinical
Medicinal chemistry	1	Chemistry
Medicinal/pharmaceutical	1	Clinical
Melanoma	5	Clinical
Membrane biochemistry	2	Chemistry
Membranes, structure/function	4	Biology
Metabolic/nutritional physiology	1	Clinical
Metabolism: amino acids/peptides/proteins	2	Chemistry
Metabolism: lipids/lipoproteins/membrane constituents	2	Chemistry
Microbial genetics	5	Biology
Microbiology, medical	1	Biology
Microbiology, other	1	Biology
Microbiology-unspec	1	Biology
Minerals	1	Clinical
Mitochondria/chloroplasts	1	Biology
Molecular biology	3	Biology
Molecular biology, other	20	Biology
Molecular genetics	19	Biology
Molecular neurobiology	7	Biology
Molecular virology	14	Biology
Molecular/receptor pharmacology	2	Biology

Stated Expertise	Number of Observations	Assigned Expertise Category
Morphogenesis	1	Biology
Motility, cellular	9	Biology
Mutagenesis	2	Biology
Natural products chemistry	1	Chemistry
Network analysis	1	Computational Sciences
Neural growth/development/degeneration	3	Biology
Neural protheses	1	Clinical
Neuro/muscular	1	Biology
Neuroimmunology	1	Biology
Neurological models	1	Computational Sciences
Neuropharmacology	1	Biology
Neurophysiology	1	Biology
Neurophysiology/electrophy	1	Biology
Neurosciences, other	4	Clinical
Neurovirology	1	Biology
Nuclei, structure/function	4	Chemistry
Nucleic acid	1	Biology
Nucleic acid biochemistry	5	Chemistry
Nutrition-unspec	2	Clinical
Nutritional biochemistry	3	Chemistry
Oncogenes	32	Biology
Oncology	4	Clinical
Oncology, other	4	Clinical
Optics/optical instrumentation	1	Other
Oral pathology	2	Clinical
Organic chemistry	2	Chemistry
Organic synthesis	2	Chemistry
Other	1	Other
Other areas	16	Other
Oto/rhino/laryngology	1	Clinical
Pancreatic cancer	3	Clinical
Pathology	1	Biology
Pathology, other	9	Biology
Pediatric oncology	1	Clinical
Pediatrics	1	Clinical
Perinatal epidemiology	1	Public Health
Periodontics	1	Clinical
Pharmaceutics	1	Chemistry
Pharmaco-endocrinology	1	Chemistry
Pharmacology, other	2	Chemistry
Pharmacology-unspec	1	Chemistry
Pharmacy	1	Clinical
Pharmacy-other	1	Clinical
Physiological/clin.	1	Clinical
Physiology, cell	3	Biology
Prevention and treatment evaluation	1	Public Health

Stated Expertise	Number of Observations	Assigned Expertise Category
Prostate cancer, organ-site specific	4	Clinical
Protein/amino acid	1	Chemistry
Protein/amino acid biochemistry	5	Chemistry
Psychometrics	1	Computational Sciences
Public health	1	Public Health
Pulmonary diseases	1	Clinical
Pulmonary pharmacology/toxicology	1	Clinical
Quantitative genetics	1	Computational Sciences
Radiation biology	1	Biology
Receptors	13	Biology
Reproductive	1	Biology
Reproductive biology	1	Biology
Reproductive endocrinology	4	Biology
Reproductive physiology	1	Biology
Retroviruses (not HIV)	4	Biology
Rheumatology	2	Clinical
RNA synthesis	5	Biology
Second messengers//signal transduction	21	Biology
Sensory physiology	1	Biology
Somatic cell genetics	4	Biology
Spectroscopy	1	Chemistry
Spectroscopy: ESR/NMR	1	Chemistry
Spectroscopy: fluorescence	2	Ch2
Substance abuse pharmacology/toxicology	1	Clinical
Surgery, cardiovascular/vascular	1	Clinical
Surgery, genitourinary	1	Clinical
Surgery, oncological	1	Clinical
Surgical oncology	3	Clinical
Systematic biology/evolution	1	Biology
T, b cells	9	Biology
Thrombosis/hemostasis/platelet function	2	Biology
Time series analysis	1	Computational Sciences
Tissue culture	2	Biology
Toxicol/pharmacodynamics	1	Chemistry
Toxicology/forensic medicine	1	Clinical
Trace element biochemistry	1	Chemistry
Trace element nutrition	1	Clinical
Transplantation immunology	2	Biology
Transport, cellular	3	Biology
Trauma/burns/wounds	1	Clinical
Tumor biology	25	Biology
Tumor immunology	8	Biology
Tumor markers	6	Biology
U.V. radiation biology	3	Biology
Unknown consultant code	6	Other
Unspecified	1	Other

Stated Expertise	Number of Observations	Assigned Expertise Category
Urology	1	Clinical
Viral	8	Biology
Viral genetics	6	Biology
Virology	3	Biology
Virology: DNA viruses	9	Biology
Virology: RNA viruses	5	Biology
Vitamins	1	Clinical
White blood cells/stem cells/leukopoiesis	6	Biology