UNIVERSITY OF CALIFORNIA

Michael V. Drake, MD
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December 15, 2020

The Honorable Holly J. Mitchell
Chair, Joint Legislative Budget Committee
1020 N Street, Room 553
Sacramento, California 95814

Dear Senator Mitchell:

Pursuant to Section 104145 of the Health and Safety Code, I am pleased to enclose the University of California's report to the Legislature on the California Breast Cancer Research Program, 2015-2020.

If you have any questions regarding this report, Associate Vice President David Alcocer would be pleased to speak with you. David can be reached by telephone at (510) 987-9113, or by e-mail at David.Alcocer@ucop.edu.

Sincerely,

Michael V. Drake, MD
President

Enclosure

cc: Senate Budget and Fiscal Review
The Honorable Richard D. Roth, Chair
Senate Budget and Fiscal Review Subcommittee #1
(Attn: Ms. Anita Lee)
(Attn: Ms. Jean-Marie McKinney)
The Honorable Kevin McCarty, Chair
Assembly Budget Subcommittee #2
(Attn: Mr. Mark Martin)
(Attn: Ms. Carolyn Nealon)
Mr. Hans Hemann, Joint Legislative Budget Committee
Ms. Erika Contreras, Secretary of the Senate
Ms. Amy Leach, Office of the Chief Clerk of the Assembly
Mr. Jeff Bell, Department of Finance
Mr. Chris Ferguson, Department of Finance
Ms. Rebecca Kirk, Department of Finance

Mr. Gabriel Petek, Legislative Analyst Office
Ms. Jennifer Pacella, Legislative Analyst Office
Mr. Jason Constantouros, Legislative Analyst Office
Provost and Executive Vice President Michael Brown
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Vice President Theresa Maldonado
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The California Breast Cancer Research Program Five Year Report: 2015-2020

December 2020

California Breast Cancer Research Program
Report to the State of California Legislature 2020

Report prepared by the University of California, Office of the President pursuant to Article 1 of Chapter 2 of Part 1 of Division 103 of the California Health and Safety Code

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I. Executive Summary

The California Breast Cancer Research Program (CBCRP) is an international leader in funding breast cancer research focused on prevention and innovative areas of investigation. It is estimated that more than 30,000 California women will be newly diagnosed with breast cancer in 2020. In California alone, 4,620 women die of breast cancer every year — that's more than 12 women **every day** who die from the disease. To address this crisis, CBCRP works to prevent and eliminate breast cancer by leading innovation in research, communication, and collaboration in the California scientific and lay communities.

CBCRP is the largest state-funded breast cancer research effort in the nation and is administered by the Research Grants Program Office (RGPO) within the Office of Research and Innovation in the Division of Academic Affairs of the University of California Office of the President (UCOP). Established with passage of the 1993 Breast Cancer Act, CBCRP was created in response to the frustration that California breast cancer activists had with the slow pace of progress against the disease. Together with scientists, clinicians, state legislators, and University of California officials, they wrote legislation that created a program to fund breast cancer research that puts California in the vanguard of the field. The California Breast Cancer Act increased the tax on cigarettes by 2¢ per pack, with 45% of the revenue going to CBCRP. Today, funding comes from diverse sources in addition to the cigarette tax. See Table 1 for details.

Table 1: CBCRP Income, 2015–2020

Fiscal Year	2015–2016	2016–2017	2017–2018	2018-2019	2019–2020	5-Year Summary
Breast Cancer Research Account (007) ALLOCATION	$9,500,000	$5,086,000	$7,159,000	$10,628,000	$10,614,000	$42,987,000
California Breast Cancer Research Fund (0945) ALLOCATION	$421,000	$421,000	$178,000	$178,000	$178,000	$1,376,000
EXTERNAL FUNDING*	$216,000	$216,000	$216,000	$216,000		$864,000
PRIVATE DONATIONS	$30,036	$58,144	$28,094	$16,700	$136,283	$269,257
TOTAL FUNDS	**$10,167,036**	**$5,781,144**	**$7,581,094**	**$11,038,700**	**$10,928,283**	**$45,496,257**

*Funding from NIH grant 1R25CA188482.

This report provides an overview of the investments and progress made by the Program for the period of July 1, 2015 to June 30, 2020 and describes the strategies CBCRP uses to determine high-impact research topics and projects. Table 2 presents a summary of projects funded by priority area.

Table 2: Research Funded from July 1, 2015 to June 30, 2020 by Priority Area

Priority Area	No. of Projects Funded	Funding Dollars	% of Total Funding
Etiology and Prevention	26	$14,365,293	45%
Detection, Prognosis, and Treatment	23	$6,957,808	22%
Community Impact of Breast Cancer	28	$8,033,014	25%
Biology of the Breast Cell	8	$1,634,148	5%
COVID 19 Seed Funding	35	$862,812	3%
Grand Total	**120**	**$31,853,075**	**100%**

In the past five years, CBCRP has deepened its commitment to the prevention of breast cancer. In 2015, CBCRP recommitted to maintaining about half of its research funds through 2022 focused on prevention-oriented, program-initiated research. This program-initiated research approach supports coordinated, directed and collaborative research that addresses CBCRP's strategic needs. It has yielded significant breakthroughs in the field, some of which are documented in this report. Focused research projects have sought to identify environmental contributors to increasing breast cancer risk and have greatly expanded the level of involvement of breast cancer advocates in research.

In 2016, CBCRP funded the development of Paths to Prevention: The California Breast Cancer Primary Prevention Plan to shift blame away from individuals and focus instead on a systemic approach to eliminating barriers to health in the state. This plan is the first ever comprehensive primary prevention plan for breast cancer in the country, and has the potential to make breast cancer a rare disease in California, other states, and eventually the country. This project and other prevention-related research were highlighted in the *International Journal of Environmental Research and Public Health* Special Issue "Advancing Primary Prevention of Breast Cancer, 2020" for which CBCRP staff served as Guest Editors.

In 2018 CBCRP took a new approach for identifying program-initiated research, CBCRP launched the Global Challenge to Prevent Breast Cancer to crowdsource new ideas on breast cancer primary prevention research. Ten finalists were selected out of dozens of submissions from across the globe, and they presented their ideas at the Global Challenge Idea Showcase and Competition in May 2019, where three winners were named. This approach helped extend the innovative approach CBCRP takes to furthering breast cancer prevention research and brought new allies and collaborators into the field.

Since our 2015 report, CBCRP has also worked to streamline operations by leveraging opportunities to create more efficient, transparent, and user-friendly systems to administer grants within the RGPO. There is now more collaboration between the research programs housed in RGPO (Tobacco-Related Disease Research Program, California HIV/AIDS Research Program, and the UC Research Initiatives), which allows shared costs, improved staff coordination, and reduced staffing redundancies. This has improved grant applicants' experiences, limited cost increases, helped identify and promote best practices, and overall better harnessed the potential of the world class research programs housed at UCOP.

What is Covered in this Report
This report has been prepared by the University of California, pursuant to California Health and Safety Code, Section 104145 and the Revenue and Taxation Code Sections 18791-18796 and 30461-30462.1. The following required reporting elements are addressed in this report:

1. **The number and dollar amounts of research grants, including the amount allocated to indirect costs.**

From July 1, 2015, through June 30, 2020, CBCRP provided 120 single- and multiple-year research projects, totaling over $30 million in direct and indirect costs, funded in the form of 149 grants at 51 different institutions across California. Table 3 provides the number and dollar amounts of grants, including direct and indirect costs, for each year from 2015 to 2020.

2. **The institutions and campuses receiving grant awards.**

All funded grants with recipient institutions are listed in Section III.B: Research Progress and Results.

3. **The subject of research projects.**

All of the projects funded by CBCRP address key questions in one or more of the following research areas, which are discussed further in Section III.A: Strategy for Allocating Research Funds:

- Program Initiatives (environmental contributors, health disparities, and primary prevention);
- Community Impact on Breast Cancer (sociocultural behavioral studies and health policy);
- Breast Cancer Cause and Prevention;
- Earlier Detection, Diagnosis, and Treatment of Breast Cancer; and
- Basic Biology of the Breast (normal breast biology and breast cancer pathogenesis).

4. **The relationship between federal and state funding for breast cancer research.**

CBCRP's Breast Cancer Research Council sets the Program's funding priorities every five to seven years, taking into account the following:

- Perspectives from national breast cancer experts;
- Opinions from California advocates and activists, healthcare providers, public health practitioners, community leaders, biotechnology scientists, and academic researchers;
- Current literature on breast cancer and current gaps in knowledge;
- Analyses of portfolios and programmatic goals of other funding agencies; and
- Data on the efficacy of CBCRP grant mechanisms and topic areas in fulfilling program goals.

CBCRP's priority setting process prevents the funding of duplicate breast cancer research projects and instead focuses on filling important knowledge gaps. CBCRP's leadership role in the International Cancer Research Partnership (ICRP) further informs grant processes by providing a means to compare its portfolio to that of cancer research funding agencies throughout the world.

5. **The relationship between each project and the overall strategy of the research program.**

The following ten goals are used to set overall programmatic research priorities and calls for applications:

- **California Specific:** Fund research that utilizes resources particular to California and/or addresses a breast cancer need that is specific, but not necessarily unique, to the burden of breast cancer in California.
- **Capacity-building:** Fund research that helps recruit, retain, and develop high quality California-based investigators who engage in breast cancer research.
- **Collaboration:** Fund research that uses multi-disciplinary approaches and helps foster collaboration among California scientists, clinicians, advocates, community members, patients, survivors, and others.
- **Disparities and Underserved:** Fund research that addresses disparities, inequalities, and/or underserved populations in California.
- **Innovation:** Fund innovative research (e.g., new drugs, new strategies, new paradigms, new technologies, new applications of tested strategies in new populations and contexts).
- **Non-Duplicative:** Fund research that complements, builds on, and/or feeds into, but is not duplicative of, other research programs.
- **Policy:** Fund research and evaluation that will have policy implications for breast cancer in California.
- **Public Health Outcomes:** Fund research that will improve public health outcomes (e.g., preventing breast cancer, identifying environmental links to breast cancer, detection of breast cancer, effective treatments, and quality of life).
- **Responsive:** Fund research that is responsive to the perceived breast cancer research needs, opportunities, and expectations of CBCRP as identified by scientists and the public in California.
- **Translation and Dissemination:** Fund research that is on a critical path for practical application and leads to more effective products, technologies, interventions, or policies and their application and delivery to Californians.

The review of each individual grant application is also designed to ensure that the research projects funded by CBCRP have both high scientific merit and programmatic interest. Each individual application is evaluated by external scientific review committees for specific aspects of scientific merit including impact on breast cancer, innovation, feasibility, and approach. All applications of sufficient scientific merit undergo a programmatic review by our Breast Cancer Research Council for responsiveness to program priorities, including whether it fits the goals of the award type, integrates advocacy issues, and addresses an under-funded research field.

6. **A summary of research findings including discussion of promising new areas.**

Highlights of funded research concluded during this reporting period are included in the body of this report. Listed below is one example:

- **Robert Harrison of Public Health Institute and Peggy Reynolds of UCSF** were funded to identify chemical profiles that California women are exposed to through their occupations. These researchers found that 161 formal occupations are exposed to more than 1,000 breast carcinogens, and women of color in both formal and informal jobs

may be exposed to a disproportionate level of breast carcinogens. Findings from this investigation and a tool to understand chemical exposures in the workplace can be found here: http://cbcrp.org/worker-exposure/.

Fiscal Overview

CBCRP strives to maximize the funds that go directly to researchers and minimize operational expenditures. For funding allocations distributed between July 1, 2015 and June 30, 2020, CBCRP devoted an average of 4% to administration, 10% to program activities, and 86% to grants. Tables 3 and 4 provide specific expenditure details from funds allocated in the past five years.

Table 3: Grants and Initiatives Funded

Fiscal Year	2015–2016	2016–2017	2017–2018	2018–2019	2019–2020	5-Year Summary
CYCLE	22nd cycle	23rd cycle	24th cycle	25th cycle	26th cycle	
CORE GRANTS AWARDED	9 projects	15 projects	14 projects	14 projects	14 projects	66 projects
Direct Cost Total	$2,931,611	$2,597,938	$2,531,790	$2,083,400	$3,303,517	$13,448,256
Indirect Cost Total	$938,754	$800,782	$1,026,863	$669,603	$1,516,834	$4,952,836
Total Grant Costs	$3,870,36	$3,398,720	$3,558,653	$2,753,003	$4,820,351	$18,401,092
PROGRAM INITIATIVES						
California Breast Cancer Prevention Initiatives Awarded/ Contracts	5 projects	6 projects		4 projects	2 projects	17 projects
Direct Cost Total	$4,522,614	$2,731,635		$1,429,044	$400,000	$9,083,293
Indirect Cost Total	$1,128,407	$471,329		$250,966	$92,213	$1,942,915
Total Grant Costs	$5,651,021	$3,202,964		$1,680,010	$492,213	$11,026,208
Preventing Breast Cancer: Community, Population, and Environmental Approaches Initiatives Awarded/contract		2 projects				2 projects
Direct Cost Total		$1,485,658				$1,485,658
Indirect Cost Total		$77,305				$77,305
Total Grant Costs		$1,562,963				$1,562,963
COVID-19 Seed Funding					35 projects	35 projects
Direct Cost Total					$862,812	$862,812
Indirect Cost Total					0	0
Total Grant Costs					$862,621	$862,621
Pending Initiative Grants (RFPs approved for release)					$8,237,200	
TOTAL GRANT FUNDS Disbursed	**$9,521,386**	**$8,164,647**	**$3,558,653**	**$4,433,013**	**$6,175,376**	**$31,853,075**

Table 4: Administrative and Program Expenditures

Fiscal Year	2015–2016	2016–2017	2017–2018	2018–2019	2019–2020	5-Year Summary
CYCLE	22nd cycle	23rd cycle	24th cycle	25the cycle	26th cycle	
Administration	$483,074	$335,677	$316,317	$352,927	$385,410	$1,873,405
% Total Funds	4.90%	6.10%	4.30%	3.30%	3.60%	4.10%
Research Support and Evaluation	$1,139,390	$908,462	$747,643	$956,009	$985,225	$4,736,729
% Total Funds	11.50%	16.50%	10.20%	8.90%	9.10%	10.50%

Summary

This report gives an in-depth description of the many ways that CBCRP has advanced the field of breast cancer research from 2015-2020. With more than 25 years of experience, CBCRP has empowered communities to engage in high impact research that allows for meaningful interventions to protect women. The work is far from over, but this report provides important insight into just how much has been accomplished.

II. CBCRP Origin and Values

A. About the California Breast Cancer Research Program

i) Origins of the CBCRP

The California Breast Cancer Research Program's (CBCRP) mission is to prevent and eliminate breast cancer by leading innovation in research, communication, and collaboration in the California scientific and lay communities. Established by the California Legislature with passage of the 1993 Breast Cancer Act (AB 2055 (B. Friedman) [Chapter 661, Statues of 1993] and AB 478 (B. Friedman) [AB 478, Statues of 1993]), CBCRP was created in response to the frustration that California breast cancer activists had with the slow pace of progress against the disease. Together with scientists, clinicians, state legislators, and University of California officials, they wrote legislation that created a program to fund breast cancer research that puts California in the vanguard of the field. The California Breast Cancer Act was funded by an increase in the cigarette tax by 2¢ per pack, with 45% of the revenue going to CBCRP.

Since then, CBCRP has made California a leader among states for breast cancer research. The Program is the largest, most stable state-funded breast cancer research effort in the nation. Since 1993, CBCRP has awarded over 1,000 grants to 143 scientific institutions and community entities, totaling more than $280 million for research to prevent, treat, and cure breast cancer. From July 1, 2015, through June 30, 2020, CBCRP provided 120 single- and multiple-year research projects, totaling over $30 million in direct and indirect costs, funded in the form of 149 grants at 51 institutions across California.

ii) Maximizing research funding

CBCRP is administered as a public service by the University of California. CBCRP's staff manages the solicitation, review, award, and oversight of grants and dissemination of research results, working at the University of California, Office of the President (UCOP) in Oakland. The program is housed in the Research Grants Program Office, which is in the Office of Research and Innovation in the Division of Academic Affairs. CBCRP maximizes grant funding by sharing grant making and financial management resources and personnel with the Tobacco-Related Disease Research Program, California HIV/AIDS Research Program, and the UC Research Initiatives programs.

Funding for CBCRP comes primarily from a state tax on cigarettes, a declining source of revenue due to decreasing cigarette consumption. Because the legislation establishing CBCRP specifies cigarettes as the tax basis and does not mention other tobacco products, CBCRP is currently the only program funded through a state tobacco tax that does not receive revenues from other tobacco products such as cigars, chewing tobacco, and e-cigarettes. CBCRP funding is supplemented with taxpayer donations contributed through voluntary tax contributions from state income tax forms and by private contributions. Ninety-five percent of CBCRP's revenue goes directly to funding research and education efforts. Administration costs average less than 5% and other activities (programmatic, educational) account for close to 10% of operational expenses over the five-year period. Table 5 provides an overview of income and operational expenditures.

Table 5: Income and Operational (Administrative and Program) Expenditures

Fiscal Year	2015-2016	2016–2017	2017–2018	2018–2019	2019–2020	5-Year Summary
CYCLE	22nd cycle	23rd cycle	24th cycle	25th cycle	26th cycle	
TOTAL INCOME	$10,167,036	$5,781,144	$7,581,094	$11,038,700	$10,928,283	$45,496,257
Administration	$483,074	$335,677	$316,317	$352,927	$385,410	$1,873,405
% Total Funds	4.9%	6.1%	4.3%	3.3%	3.6%	4.1%
Research Support and Evaluation	$1,139,390	$908,462	$747,643	$956,009	$985,225	$4,736,729
% Total Funds	11.5%	16.5%	10.2%	8.9%	9.1%	10.5%

iii) Funding Philosophy and Future Strategies

CBCRP has established a track record during its 27-year history for funding innovative research ideas that have led to successes. These successes include a CBCRP-funded researcher being awarded a Nobel Prize, investing in capacity to build research collaborations between members of California's diverse communities and scientific researchers to conduct research, informing national policy, and serving as a model for other funding programs and agencies.

While CBCRP is not as large as some of the national breast cancer research funders, its impact is significant in California and around the world. CBCRP's commitment to driving innovative research, engaging community advocates in research and forwarding a science-based public policy shift toward preventing breast cancer is unparalleled. CBCRP is proud of its global impact in prioritizing breast cancer prevention research.

B. Collaborating with Breast Cancer Advocates and California Communities

A growing body of evidence shows research benefits from the inclusion of those who have been directly affected by the disease researchers are studying. These people can become advocates for their communities by helping scientists identify the needs of patients, families, and communities by offering a practical perspective on research topics, methods, and results. Working through community organizations — such as community clinics, breast cancer advocates, and women's health organizations — these advocates help to ensure that research is relevant and that research findings are applied as soon as possible.

Since its inception in 1993, CBCRP has encouraged engaging advocates from breast cancer or other relevant community groups in investigator-initiated research projects. Since 2011, CBCRP has *required* that all investigator-initiated funded research involve advocates in the process.

Figure 1. Integration of Breast Cancer Advocates into CBCRP

Advocates in Leadership

Leadership from breast cancer advocates, as illustrated above in Figure 1 by their involvement throughout CBCRP, ensures that the CBCRP funds research important to the people most affected by the disease.

- Advocates comprise one-third of the CBCRP's 16-member Research Council, the group that makes the final selection of research projects funded by CBCRP. An advocate must always serve as either the Council's Chair or Vice-Chair.
- Advocates serve alongside scientists on review panels and rate all research proposals for scientific merit.
- Advocates also serve on advisory groups guiding the CBCRP's program-initiated research and are involved in setting priorities for CBCRP's research funding. .

A potential advocate to a CBCRP-funded research project must meet three criteria:

1. California residency
2. Active involvement in an appropriate organization or community
3. Ability to represent the priorities, concerns, needs, and views of the community (or organization) and not only her/his personal perspective.

CBCRP has created a suite of technical assistance (TA) tools designed to provide support to researchers new to involving advocates. The following technical assistance tools are available to scientists:

- Brief, narrated PowerPoint presentations walk researchers through essential content, available on CBCRP's website.
- Ninety-minute live web- and phone-based presentations by CBCRP staff support scientists in developing letters of intent (LOI) applications walk applicants through CBCRP expectations for advocacy involvement, and provide tips to give their materials the competitive edge.

- Samples of strong advocacy involvement responses, reading lists, example timelines of collaboration, and other content that is likely to be of interest to applicants and investigators are also available to applicants and investigators.
- CBCRP staff is available for consultation throughout the proposal preparation, submission, and post-award implementation process.

Communities Conducting Research

To facilitate advocacy-centered research, CBCRP has a dedicated funding mechanism for community based participatory research. Since 1997, Community Research Collaboration (CRC) awards have funded community organizations — such as breast cancer advocacy organizations, community clinics, and other organizations serving women with breast cancer — to work in teams with well-trained, experienced academic research scientists. Together, these teams decide which breast cancer questions are most important to them, determine how to study these questions, gather and interpret data, and communicate findings to other community members, scientists, and the public.

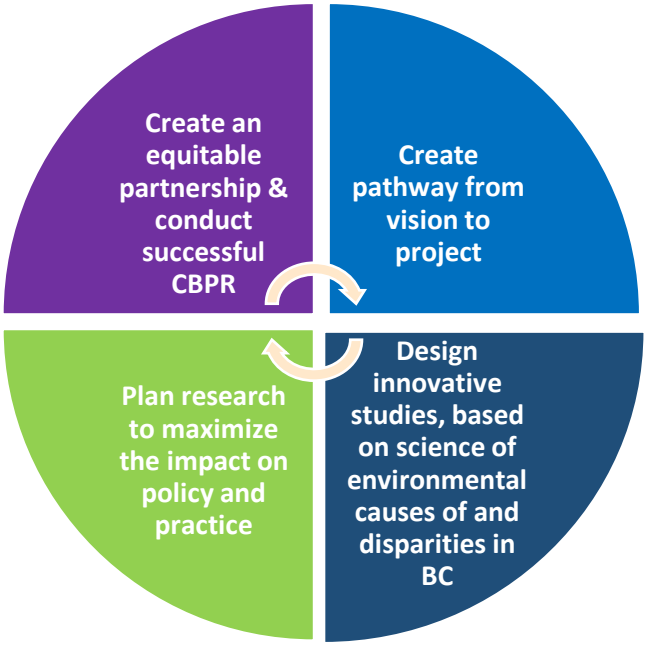
Supporting Advocate Involvement in Research

Recognizing that most community members and advocates do not have research experience when they first connect to CBCRP, we are committed to providing learning and capacity building opportunities to support them. Below are two examples of the programs CBCRP offers:

QuickStart

Since 2010, CBCRP has offered QuickStart, an intensive capacity building program to prepare teams of community members and scientific researchers to partner for community based participatory research (CBPR). Originally called Community Based Research Infrastructure to Better Science (CRIBS), the program was first funded by the National Institute of Environmental Health Sciences (NIEHS) program (Award Number 1RC4ES019826) and co-conducted with Commonweal and Plumbline Consulting. In 2019, a formal evaluation of CRIBS was published in the International Journal of Environmental Research and Public Health. The evaluation determined that the program was effective in all four goals of QuickStart training described in Figure 2. The program has evolved over the years based on participant feedback. In 2018, QuickStart was highlighted in the magazine Research Outreach in an article called "Community collaborations targeting breast cancer."

Figure 2: QuickStart Goals



Between 2015 and 2019, QuickStart was offered once each year. The goals of the program, described in Figure 2, are to provide a foundation for participants to create strong, equitable partnerships between academic researchers and community members and support them as they design a scientifically rigorous research project that addresses community concerns. The program consists of four in-person days of training, weekly assignments, webinars, and four technical assistance calls. Participants are given the option to submit a draft proposal for a mock review. These events were timed so that teams would be able to receive reviewer evaluations, revise their proposal, and submit it for the CRC deadline in spring of each year. At the end of the program successful teams will have built their partnership, deepened their knowledge of the connection between breast cancer, environmental exposures and health disparities, built organizational research capacity, and improved their chances of being funded.

Trainings in 2016, 2017, 2018, and 2019 were supported by a grant from the National Cancer Institute of the National Institutes of Health (Award Number R25CA188482). For 2019, CBCRP combined efforts with the Tobacco-Related Disease Research Program (TRDRP), another research program housed at UCOP. This allowed for an expanded pool of potential participants and also highlighted the connection between breast cancer risk and tobacco use.

Technical Assistance

In addition to the intensive training opportunities, CBCRP also offers free technical assistance support to people interested in engaging in CBPR. One-on-one technical assistance calls provide support as teams prepare their CRC application. Teams also can have a pre-application research plan review, in which research plans are critiqued by active CBPR researchers before the formal application is submitted. CBCRP staff is available by phone for teams to debrief and plan how to respond to the feedback. CBCRP also offers webinars to help prospective teams understand the application process and requirements.

C. Sharing Research with Scientists and the Public

CBCRP is committed to sharing and disseminating research opportunities and findings. Below are highlights of some of the ways CBCRP publicizes the outcomes of its research and collaboration with scientists and community groups across the state.

Research Conferences/Events

CBCRP Symposium

On February 29, 2016, CBCRP hosted a conference that explored research critical for understanding, preventing and curing breast cancer. The conference was designed to encourage participants to break out of "silos" that limit our ability to address the broadest spectrum of breast cancer concerns and engage with each other to generate new, transdisciplinary priorities and collaborations. Over 150 people attended the event, with 35% identifying as advocate community members, 48% as researchers, and the remaining as clinicians and policy makers. Through thought-provoking presentations and small group facilitated conversations, attendees explored ideas that they could take back to the laboratory, clinic, and community organizations and some attendees laid the groundwork to build new partnerships.

Full details of the symposium can be seen here: http://www.cbcrp.org/about/symposium/past-events/2016-details.html.

Conferences

CBCRP offers two types of conference awards: a standard conference award and a community-led award. CBCRP awarded six of these awards between 2015-2020. Highlights include the Cancer Prevention Institute of California's Annual Breast Cancer Conference for newly diagnosed patients, long-term survivors, caregivers, family members, researchers, health care providers, and community service organizations, and Stanford's conference to facilitate collaborations between advocates and clinical and mental health care providers to improve the mental health care for breast cancer patients.

Sharing Research over the Internet and in Social Media

CBCRP is committed to proactive communications with stakeholders, achieved through a variety of online methods:

- **Website:** In 2014, CBCRP redesigned its website to make information clearer and easier to find. Webpages included the following:
  - Links between abstracts of research supported by CBCRP funding to the publications that report results through the National Institutes of Health's PubMed, a public-access database of biomedical journals and open access journal sites;
  - Funding opportunity announcements and technical assistance for applying for grants;
  - Downloadable versions of all CBCRP publications;
  - Opportunities to request specific information from CBCRP and make online donations to CBCRP; and
  - Reports on progress and outcomes of CBCRP's research strategy development.
- **E-newsletter:** CBCRP's email newsletter gives subscribers timely announcements of funding opportunities, early notification of new research resources and breast cancer conferences, and avenues to stay involved, informed, and active in the pursuit of breast cancer cure and prevention. It is distributed to over 1,900 stakeholders each month.

- **Social media:** CBCRP currently has nearly 2,000 followers on our Facebook page. Our Facebook page presents up-to-date information about breast cancer research, along with an online space to exchange ideas, ask questions, and follow links to information about CBCRP-funded research studies. Facebook users can also access invitations to events, announcements of CBCRP-funded research findings, and links to other breast-cancer-related organizations. The Program's Twitter feed also keeps followers current about breast cancer research and opportunities to take part in CBCRP activities.

Serving the Media

CBCRP informs the media about the Program and about CBCRP-funded research projects that are of interest to the general public. When reporters from TV, newspapers, magazines, or other media need information on breast cancer research, CBCRP links them with the appropriate experts. News about CBCRP and research funded by CBCRP also appear in local California newspapers, and on a variety of general news, health news, international news, and blog Web sites.

Publications

In 2020, the International Journal of Environmental Research and Public Health released a special issue devoted entirely to CBCRP's Global Challenge to Prevent Breast Cancer, Advancing Primary Prevention of Breast Cancer. CBCRP staff contributed to this and have also published in several other academic publications.

III. CBCRP Grantmaking

A. Strategy for Allocating Research Funds

CBCRP is committed to ensuring that funding strategies remain up to date with the changing scientific and societal landscape. By combining ongoing strategy assessment with program/funding evaluation, CBCRP is able to ensure that funding investments continue to move the field of breast cancer research forward and provide unique opportunities in areas other funders may not address.

Below is an overview of CBCRP's approach to allocating research funds.

Establishing Funding Criteria

CBCRP routinely reviews its mission and revises programmatic strategies to ensure that funding opportunities address the overall mission. CBCRP completed a programmatic review in 2015 and from that process, CBCRP Research Council reaffirmed the criteria for funding, listed below:

1. **California Specific:** Fund research that utilizes resources particular to California and/or addresses a breast cancer need that is specific but not necessarily unique to the burden of breast cancer in California.
2. **Capacity-building:** Fund research that helps recruit, retain, and develop high quality California-based investigators who engage in research that advances CBCRP initiatives.
3. **Collaboration:** Fund research that uses multi-disciplinary approaches and helps foster collaboration among California scientists, clinicians, advocates, community members, patients, survivors, and others.
4. **Disparities and Underserved:** Fund research that addresses disparities, inequalities, and/or underserved populations in California.
5. **Innovation:** Fund innovative research (e.g., new drugs, new strategies, new paradigms, new technologies, new applications of tested strategies in new populations and contexts).
6. **Non-Duplicative:** Fund research that complements, builds on, and/or feeds into, but is not duplicative of other research programs.
7. **Policy:** Fund research and evaluation that will have policy implications for breast cancer in California.
8. **Public Health Outcomes:** Fund research that will improve public health outcomes (e.g., preventing breast cancer, identifying environmental links to breast cancer, detection of breast cancer, effective treatments, and quality of life) focusing on population interventions.
9. **Responsive:** Fund research that is responsive to the perceived breast cancer research needs, opportunities, and expectations of CBCRP as identified by scientists and the public in California.
10. **Translation and Dissemination:** Fund research that is on a critical path for practical application and leads to more effective products, technologies, interventions, or policies and their application and delivery to Californians.

Offering Multiple Funding Mechanisms

In order to meet a range of research needs, CBCRP funds research through different mechanisms. These mechanisms fall under two umbrellas: program directed research and investigator-initiated research, which are described in the following sections. Both categories have multiple funding mechanisms through which researchers or community advocates can be awarded research funds. As shown in Table 6, over $31 million were distributed in grants through these award types from 2015 to 2020 to fund 120 projects.

Table 6: Research Funded from July 1, 2015 to June 30, 2020 by Award Type

Award Type	No. of Projects Funded	Funding Dollars	% of Total Funding
Program-initiated Research	19	$12,589,171	39.5%
IDEA	28	$6,076,052	19.1%
Translational Research Award	5	$4,705,162	14.8%
CRC Full Research Award	7	$4,712,881	14.8%
CRC Pilot Award	20	$2,760,976	8.7%
Conference Award	6	$146,021	0.5%
COVID 19 Seed Funding	35	$862,812	2.7%
Grand Total	**120**	**$31,853,075**	**100%**

1) Program-directed Research Funding Mechanisms

Since 2004, CBCRP has dedicated funds to identify and drive research forward in areas that are understudied and could contribute significantly to new ways of understanding breast cancer. These program-directed and policy-oriented initiatives are designed to leverage California's unique and diverse population and research resources to support critical studies that significantly move these fields forward and create solutions. There have been three rounds of funding for understudied areas which include the following program-directed initiatives:

- **Special Research Initiative: (SRI)** In 2004, CBCRP launched SRI and devoted 30% of CBCRP research funds to support coordinated, directed, and collaborative research on the identification and elimination of environmental causes of breast cancer and the identification and elimination of disparities and inequities in the burden of breast cancer in California. All grants awarded through SRI were funded before 2015 and are highlighted in the previous version of this report. However, some research projects were completed during the 2015-2020 period. A total of 27 grants totaling $22 million were funded through this initiative. Highlights of the outcomes are included in Section III.B.

- **California Breast Cancer Prevention Initiatives (CBCPI):** In March 2010, CBCRP launched CBCPI and devoted 50% of CBCRP research funds for a second round of program-directed initiatives to support expanding on SRI and deepening the knowledge on causes and possible prevention strategies for the disease. Research funded through CBCPI addressed one of the following research areas:

    - Identification and elimination of environmental causes of breast cancer;
    - Identification and elimination of disparities/inequities in the burden of breast cancer in California;
    - Population-level prevention interventions (including policy research) on known or suspected breast cancer risk factors and protective measures; and
    - Targeted prevention interventions for high-risk individuals, including new methods for identifying or assessing risk.

Grants issued through this initiative are at different stages of completion. Highlights of the outcomes of completed CBCPI-funded research projects are included in Section III.B.1. A total of 22 grants totaling $22 million will have been funded through this initiative.

- **Preventing Breast Cancer: Community, Population, and Environmental Approaches:** In 2015, the CBCRP Council approved setting aside 50% of CBCRP funds for a third round of program-directed initiatives. The planning process is underway and is scheduled to be completed in 2022. CBCRP anticipates that it will begin releasing funding opportunities in 2021 in the following research areas:

    - Identification and elimination of environmental contributors to breast cancer;
    - Identification and elimination of fundamental causes of health disparities with a focus on breast cancer in California; and
    - Development and application of population-level prevention interventions that incorporate approaches to address the needs of the underserved and/or populations experiencing disparities in the burden of breast cancer.

    Highlights of the progress to date are included in Section III.B.1.

For all program-directed funding, researchers can apply for funding through one of the following mechanisms, depending on the specific requirements for each research initiative:

- **Request for Qualifications (RFQs)** to solicit applications to identify the most qualified researcher to conduct studies with specific predetermined research questions and plans through a contract;
- **Program Directed Awards (PDAs)** to fund specific projects identified during the strategy development proposed by the Steering Committee and approved by the CBCRP Council through a cooperative agreement; and
- **Request for Proposals (RFPs)** to support investigator-initiated grants that respond to a specific initiative topic.

Intensive evaluation is conducted on each initiative. Descriptions of the evaluation of SRI and CBCPI are included in Section III.B.1.

In addition to the funds set aside for the initiatives described above, CBCRP allocates $260,000 annually for research that addresses breast cancer related policy issues in California. A Policy Research Advisory Group identifies key policy areas that deserve further investigation. Using an open, competitive, peer-reviewed process, CBCRP established a pool of pre-qualified policy research investigators/teams poised to quickly fill knowledge gaps to inform breast cancer relevant policy. These pre-approved policy teams are then eligible to apply for research funds on the identified topic. Details of the projects undertaken by these teams are described in Section III.B.1.

2) Investigator-Initiated Research Funding Mechanisms

For investigator-initiated research, CBCRP solicits applications from researchers (and in the case of Community Research Collaboration awards (CRC), community-academic teams) based in California for five different types of investigator-initiated research. Below is a description of the types of investigator-initiated funding mechanisms CBCRP used during this reporting period and the rationale for ongoing support. Funding outcomes are detailed in Section III.B.2: Funding Highlights 2015–2020.

- **Community Research Collaborations:** CBCRP allocates $2 million annually to support community-based participatory research (CBPR) that enables community groups and academically-trained scientists to jointly answer important breast cancer questions. Evaluations have found that CRC awards effectively help address underserved populations and address issues that are often missing in research. The CRC Pilot award supports the initial phase of the project, which includes strengthening collaborations, developing feasible methods and tools, and collecting pilot data. Each Pilot award provides 18 months of funding totaling $150,000. The CRC Full award funds projects with a fully developed research plan and supporting preliminary data, carried out by a well-integrated, experienced team of scientists and community members. Full awards cover three years for a total of $600,000.

- **Innovative, Developmental, and Exploratory Awards (IDEAs):** The IDEA grants are used to fund the beginning stages of novel projects (e.g., new drugs, new strategies, new paradigms, new technologies, new applications of tested strategies in new populations and contexts), establish new collaborations, develop new technologies, or adapt technologies from other fields to breast cancer research. Applicants must show how their project is part of a longer-term research process that will lead to practical applications, such as breast cancer diagnosis, treatment, or prevention. Additionally, IDEAs create opportunities for newer researchers by focusing the peer review on the innovation of the idea rather than the track record of the investigator, which gives junior investigators and established researchers an equal playing field. IDEAs are funded at $100,000 to $150,000 for 18 months and require recipients to describe the public health outcomes of their research.

- **Translational Research Awards:** These awards fund research that leads both to more effective products, technologies, interventions, or policies, and to their application and delivery to Californians. This research takes basic science findings and applies them quickly toward treatment, diagnosis, prevention, or another application that can directly affect individuals with breast cancer, either in a medical clinic setting or through a public health measure. Areas of focus include the following:

    - Prevention, detection, diagnosis, or treatment of breast cancer;
    - Improved quality of life for survivors;
    - Reduction in the social burden caused by the disease in California; and
    - Advances in medical practices, health systems changes, health policies, or environmental modifications.

  To ensure that these studies translate to their application and delivery to Californians, CBCRP requires applicants to demonstrate in detail how the project fits along a defined research continuum leading to practical applications.

- **Conferences:** CBCRP conference awards are designed to support events that bring together people with different perspectives who do not usually meet and exchange views with the expectation that the experience will lead to new breast cancer related research projects and new collaborations. In 2018, CBCRP updated its approach to conference funding, now offering the following two types of conference awards:

    - **Standard Conference Award:** Open to all applicants who have the capacity to host an event that satisfies the criteria below; and
    - **Community-Led Conference Award:** Added in 2018, this award supports grassroots organizations that need more time or resources to develop and execute a successful event.

CBCRP funds up to $50,000 per year in conferences/events, with the aim of supporting one community-led conference and one standard conference. Both types of award must address issues related to breast cancer and do one or more of the following:

- Highlight resources particular to California,
- Encourage new collaborations,
- Recruit high quality researchers to the field,
- Examine and create solutions for disparities/inequities,
- Inspire paradigm-shifting research,
- Inform policy,
- Promote translational and/or outcome driven research, or
- Create tools for educating members of the public about breast cancer.

- **Emergency COVID-19 Research Seed Funding:** Statewide funding programs of the UCOP Research Grants Program Office – CBCRP, Tobacco-Related Disease Research Program, California HIV/AIDS Research Program, and the Type 1 Diabetes Research Fund – led a joint effort to distribute up to $4.5 million in grants to research critical aspects of COVID-19. The programs funded $2.1 million in $25,000, six-month seed funding grants prior to July 1 2020 and another $2.4 million in follow-on funding for seed funding recipients who competed through a peer reviewed process. The grants supported by CBCRP funding are listed in Section III.B.2.

3) CBCRP Research Strategy Impact

Evaluating the Funding Mechanisms

CBCRP is committed to evaluating the effectiveness of its various initiatives. We are applying the lessons we learn from these evaluations to our future funding opportunities. CBCRP has completed an initial evaluation of funding translation through the Translational Research Awards and other funding mechanisms. CBCRP is also in the process of evaluating the SRI.

In 2017, CBCRP commissioned an independent evaluation to assess the short- and medium-term outcomes resulting from the Translational Research awards. The evaluation found that all of the funded projects met the expected short-term outcomes identified by the Council. Most of the medium- to longer-term outcomes were achieved by the funded projects. All projects resulted in published papers, almost all (9/11) disseminated their findings to lay audiences, most (8/11) overcame translational barriers, some (6/11) leveraged additional funding totaling almost $9 million, 9/11 have products, technologies, interventions, or policies proceeding toward implementation as a result of their translational grants, and 3 of those projects have implemented them.

Another evaluation in process is a full assessment of the Special Research Initiatives; interim findings are reported later in this chapter under “Special Research Initiatives” and indicate that investigators reported research outcomes in high impact publications and were able to continue their studies with funding from other agencies, more junior researchers involved in the projects stayed in the novel research areas they started with our funding, and the projects filled important knowledge gaps in breast cancer.

An evaluation of the entire CBCRP funding strategy is scheduled to begin in 2021. CBCRP will assess the outcomes of the entire portfolio and devise a strategic plan based on the results.

Selecting Grants that Support Program Goals

Every grant CBCRP funds must be both scientifically meritorious and responsive to program goals. Grants undergo two tiers of review: Scientific merit is determined by a peer review panel consisting of scientists highly knowledgeable about the topics of the applications they consider and advocate reviewers who are in breast cancer advocacy organizations, many of them also living with the disease. The committees use a review process based on established practices at the federal government's National Institutes of Health, but tailored to focus on assessing the qualities of the applications that are important to CBCRP (e.g., impact on breast cancer, translation potential, and community benefit). CBCRP's review process is one of a handful of non-federal peer review systems certified by the National Cancer Institute to meet the National Institutes of Health (NIH) standards of peer review and funding. The CBCRP council evaluates every application for programmatic relevance and scores them according to programmatic criteria (response to priorities, response to award type, dissemination and translation potential, underfunded area, quality of the lay abstract, addressing the needs of the underserved and advocacy involvement). Only applications with strong scientific merit and programmatic scores are funded.

The members of CBCRP's council and review committees for 2015-2020 are listed in Appendices A and D.

B. Research Progress and Results

CBCRP continues to be a leader in expanding the scope and possibility of what breast cancer research can be. Between 2015 and 2020, CBCRP funded challenging research areas by completing its Special Research Initiative projects; launching the California Breast Cancer Prevention Initiatives (CBCPI); and increasing its impact in community based participatory research. CBCRP continues to push the field forward by asking questions about breast cancer prevention and treatment of advanced disease that few other funders support. See Table 7 for details of the funding distribution across CBCRP priority areas.

Table 7: Research Funded from July 1, 2015 to June 30, 2020 by Priority Area

Priority Area	No. of Projects Funded	Funding Dollars	% of Total Funding
Etiology and Prevention	26	$14,365,293	46%
Detection, Prognosis, and Treatment	23	$6,957,808	22%
Community Impact of Breast Cancer	28	$8,033,014	26%
Biology of the Breast Cell	8	$1,634,148	5%
Grand Total	**85**	**$30,990,263**	**100%**

1) Program-Initiated Research

Since 2015, CBCRP has dedicated more than $12 million to funding program-initiated research. Through multi-year efforts planned with the assistance of national experts, these efforts seek to identify gaps in breast cancer research and develop research initiatives to fill these gaps. Between 2015 and 2020, 5 program-initiated research projects developed under the Special Research Initiative were completed and 17 under California Breast Cancer Prevention Initiative (CBCPI) were funded. In 2018, the Preventing Breast Cancer: Community, Population, and Environmental Approaches Initiative (PBCI), a new effort that seeks to drive breast cancer prevention efforts, was launched and is currently under development. Below are highlights of progress made under CBCRP's three program directed initiatives.

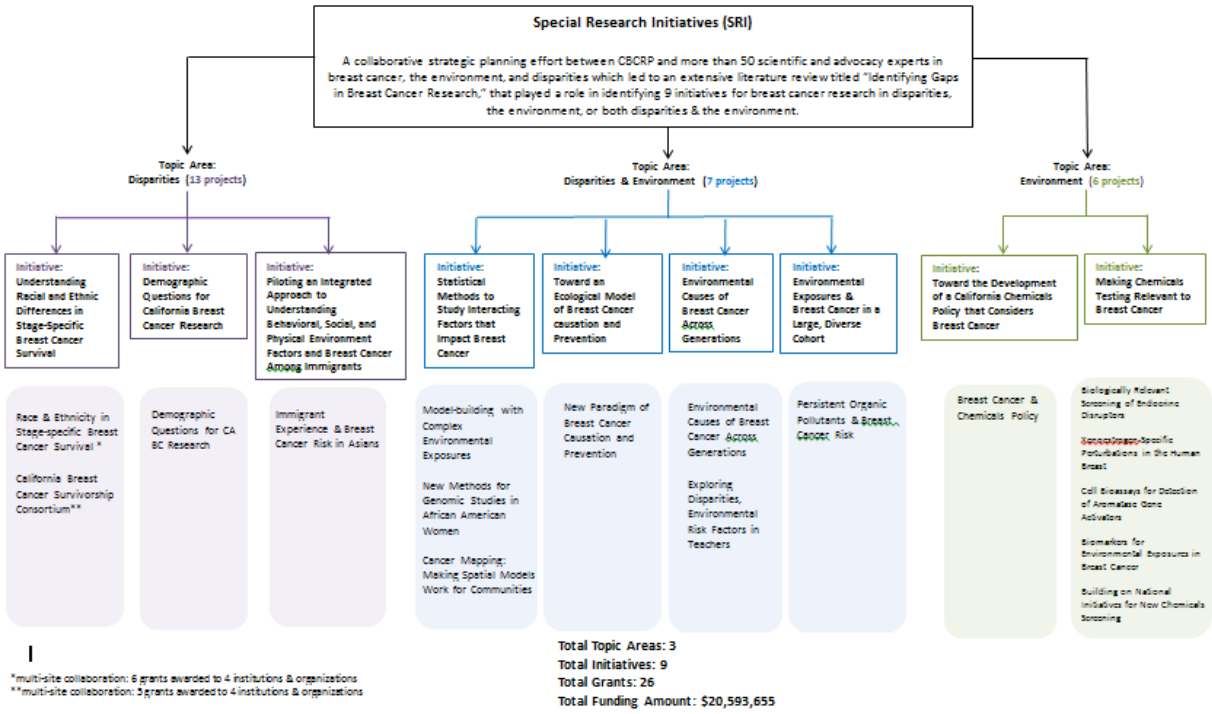
Special Research Initiatives

In 2004, CBCRP launched SRI, which devoted 30% of CBCRP research funds to support coordinated, directed, and collaborative research on the identification and elimination of environmental causes of breast cancer and the identification and elimination of disparities and inequities in the burden of breast cancer in California. Through this initiative, over $20 million were awarded to fund a total of 26 research projects as described in Figure 3.

With nine distinct initiatives, funding of research needs identified in SRIs has had a significant impact in moving the field of breast cancer research forward. SRI-funded projects have met goals and produced products or tools that can be used to better understand the connections between, and create solutions to, breast cancer and the environment and the unequal burden of the disease.

Overall, evaluation of SRI demonstrates that it was a successful effort when considered by multiple criteria. Of all the grants made through SRI, 20% of the funding was for research focused on disparities, 25% on environmental causes of breast cancer, and 55% on the intersection of disparities and breast cancer. As a follow up to these grants, 88% of the investigators received additional funding, 75% from funding sources outside CBCRP.

Figure 3. Special Research Initiatives by Topic Area



SRI brought new people into the areas of breast cancer research addressed in this initiative. SRI was launched around the same time as CBCRP established requirements for advocate involvement in research projects. This led to 16 of the 26 grants involving advocates. Overall, the effort helped new researchers, including graduate students, post docs, and junior faculty enter these areas of breast cancer research (the majority of which continued on with SRI-related research topics). However, because funding from government and other philanthropic sources on these topics is insecure, there was concern that future funding opportunities are not solid enough for new or existing researchers to make SRI topics a priority for the future.

SRI research has resulted in 67 publications with more than 142 total citations. The results of the majority of the research projects from SRI were summarized in the 2010-2015 report to the California Legislature. Highlights of research efforts that have been completed since publication of that report are included below. Tables 9 and 10 on pages 42 and 44 provide funding details of research projects funded through the SRI, CBCPI, and Policy Initiative that were concluded and are in progress respectively, between 2015 and 2020.

Understanding Racial and Ethnic Differences in Stage-Specific Breast Cancer Survival

This project, known as The California Breast Cancer Survivorship Consortium (CBCSC) was funded for $2,728,665. It was established as a collaborative effort between **Beckman Research Institute at City of Hope, Kaiser Research Institute, Cancer Prevention Institute of California and University of Southern California** that leverages data collected by six California-based studies of over 12,000 breast cancer patients. The inclusion of breast cancer cases from four racial/ethnic groups (African Americans, Asian Americans, Latinas, and non-Latina Whites) offered a unique opportunity to study individual, clinical, and contextual factors as potential determinants of the observed survival disparities across racial/ethnic groups. These studies explored the interaction of factors (tumor, individual, social,

environmental, genetic) which account for racial and ethnic differences in stage-specific survival among women diagnosed with breast cancer in California and sought to identify whether these factors lead to higher risks in certain racial and ethnic groups than in other groups.

Overall, researchers found meaningful differences in breast cancer survival based on racial/ethnic differences in some areas and not in others, as described in the following studies:

- **Neighborhood Environment and Breast Cancer Survival**
  Differences were found between the impacts of a person's neighborhood on breast cancer survival based on race. For example, non-Latina white women living in lower socioeconomic status neighborhoods had a higher breast cancer mortality rate, whereas African American women in similar neighborhoods had a lower mortality rate. No neighborhood associations were found for Asian Americans. For Latinas, crowded neighborhoods and multifamily housing increased risk for breast cancer mortality. Findings were published in Cancer, Epidemiology, Biomarkers and Prevention (2015).

- **History of Recreational Physical Activity and Survival After Breast Cancer**
  Women who were physically active before a breast cancer diagnosis had an overall lower risk of mortality and a significantly reduced risk of mortality from cardiovascular disease. No association was observed for breast cancer mortality. These findings were true for all races/ethnicities. Overall, the findings suggest that physical activity is beneficial for all breast cancer survivors but does not impact their breast cancer. Findings were published in American Journal of Epidemiology (2015).

- **Diabetes and Other Comorbidities in Breast Cancer Survival**
  Risk of breast cancer-specific mortality was higher among women with breast cancer and a history of diabetes. Risk patterns were similar across race/ethnicity (non-Latina White, Latina, African American and Asian American), body size, menopausal status, and stage at diagnosis. Findings were published in Cancer, Epidemiology, Biomarkers and Prevention (2015).

- **Obesity and Mortality after Breast Cancer**
  The relationship between weight and breast cancer mortality differs by race. For example, for non-Latina white women, being underweight increased risk of mortality in breast cancer survivors, though only morbid obesity in Latinas was associated with higher risk of mortality. No BMI-mortality associations were apparent in African Americans and Asian Americans. This study was highlighted by the National Cancer Institute Epidemiology and Genomics Research division as having great potential scientific and/or public health impact. Findings were published in American Journal of Epidemiology (2014).

- **Intersection of Race/Ethnicity and Socioeconomic Status in Mortality After Breast Cancer**
  Investigating disease by considering socioeconomic factors is common practice; however, adding a lens of the socioeconomic status of a person's neighborhood offers a new and potentially significant view to better understand breast cancer mortality. Using the consortium data, researchers found that where people live may influence their survival rates. For example, African American women in low socioeconomic neighborhoods, regardless of education level, were found to have significantly higher breast cancer mortality than non-Latina white women with high education and high neighborhood socioeconomic status. No significant differences were observed in Asian American women. Researchers noted that future studies that disaggregate Asian American women into more culturally specific subgroups could uncover differences undetected in the current study. Further research exploring neighborhood socioeconomic status could provide important insights into a range of social determinants of health. Findings were

published in the Journal of Community Health (2015).

- **Validation of Self-Reported Comorbidity Status of Breast Cancer Patients with Medical Records**
  Common comorbidities such as diabetes, hypertension, myocardial infarction, and other heart diseases are increasingly found to influence survival of breast cancer patients. Accurate reporting of these comorbidities can affect treatment decisions. This study explored whether discrepancies between self-reporting and electronic medical records differed by demographic characteristics such as age, race/ethnicity, neighborhood socioeconomic status, and by comorbidity characteristics such as timing and treatment for comorbidity. Researchers found that electronic medical records tended to be more accurate, but that self-reporting could provide good results, and that demographic factors did not seem to play a significant role in the effectiveness of reporting. Findings were published in Cancer Causes Control (2016).

- **The Effect of Patient and Contextual Characteristics on Racial/Ethnic Disparity in Breast Cancer Mortality**
  Few studies have investigated the combined roles of clinical, lifestyle, and contextual factors (i.e., those related to socioeconomic and man-made ("built") physical attributes of an individual's surroundings) in relation to breast cancer-specific mortality. Using consortium data, researchers found that while these factors can influence breast cancer-specific mortality, these variables did not explain disparities in racial or ethnic mortality. Findings were published in Cancer Epidemiology Biomarkers and Prevention (2016).

- **Impact of Neighborhoods and Body Size on Survival After Breast Cancer Diagnosis**
  With data from the Neighborhoods and Breast Cancer Study, researchers examined the associations between body size, social and built environments, and survival following breast cancer diagnosis among 4,347 women in the San Francisco Bay Area. Lower neighborhood socioeconomic status and greater neighborhood crowding were associated with higher waist-to-hip ratio (WHR). After adjusting for tumor treatment, personal characteristics, and neighbor characteristics, the study found that WHR, but not neighborhood characteristics, was positively associated with overall mortality and marginally with breast cancer-specific mortality. Findings suggest that WHR is an important modifiable prognostic factor for breast cancer survivors. Findings were published in Health Place in (2015).

Piloting an Integrated Approach to Understanding Behavioral, Social, and Physical Environment Factors and Breast Cancer among Immigrants

This initiative devoted $722,098 to explore links between immigrant status and breast cancer risk. The award was given to **Scarlett Gomez** at **Cancer Prevention Institute of California** and focused specifically on the increasing incidence rates of breast cancer among Asian Americans in California by exploring breast cancer risk factors like diet and weight gain, and emerging risk factors, including infectious exposures, family and community contexts, and social stressors related to the immigration process, being an immigrant, and discrimination. Researchers found that in Asian and Pacific Islander women, foreign-born women had higher levels of stress compared to US-born. Stress was greater among women experiencing fewer socioeconomic resources, more discrimination, more acculturative stress, and low English proficiency. English proficiency accounted for much of the disparity in stress between foreign-born and US-born API women. They also found preliminary evidence that breast cancer risk among immigrant Asian American women may be higher among their US-born counterparts. They also found that the longer women lived in the U.S., the more likely their body mass index would increase, which may be linked to high stress from language barriers, less neighborhood cohesion, and other

stressors that could inhibit physical activity. This may be a contributing factor in their increased breast cancer risk. Results were published in Journal of Epidemiology & Community Health (2016), Journal of Health Disparities Research & Practice (2018), Journal of Racial and Ethnic Health Disparities (2018), Prevention of Chronic Diseases (2019), and PLoS One (2020).

Making Chemicals Testing Relevant to Breast Cancer

The evaluation of the impacts of exposure to many chemicals on breast cancer risk is limited by the availability of toxicity data. There is a critical need for a toxicity testing strategy for breast cancer that would identify biological mechanisms in breast cancer and development of new tests to screen for activity in these mechanisms. This initiative funded five studies for a total of $4,909,249 to develop new methods and models for identifying and testing chemicals for their potential to contribute to breast cancer. These projects specifically focused on developing a battery of assays for screening chemicals that incorporates the spectrum of mechanisms (tumor promotion, tumor initiation, tumor enabling and developmental disruption) by which chemicals are known or suspected to contribute to breast cancer.

Since 2015, researchers at the **California Pacific Medical Center Research Institute (CMPC)**, led by **Shanaz Dairkee**, sought to develop reliable methods to identify chemicals that may play a role in breast carcinogenesis, with a specific interest in understanding the carcinogenic potential of low dose exposure to estrogenic chemicals used in common consumer products. Major findings of this study include:

- In general chemicals are tested for health impacts individually rather than as mixtures, thus ignoring possible interactions between chemicals. This study found that at relatively low concentrations, chemical mixtures can have striking effects on normal cell function that are missed by evaluating individual chemicals. Since human exposure to common chemicals is virtually always to a mixture, it is not possible to know if a chemical is safe until it is evaluated in its typical context as one component of a mixture, and in conjunction with other chemicals to which individuals are similarly and commonly exposed. In this light, expanding the emphasis from single chemical screening to real world scenarios of exposure is a critical need. Results of this study were published in Society of Toxicology (2018).

- Low doses of curcumin, the main ingredient in the spice turmeric, reverse many of the major changes caused by exposure to bisphenol-A (BPA). BPA exposure has long been thought to be a risk factor for developing breast cancer and other developmental changes, including fetal abnormalities and possibly male cancers such as prostate cancer. Researchers found that BPA exposure induces aberrant expression of multiple checkpoints that regulate cell survival, proliferation and apoptosis, and that such changes can be effectively ameliorated. These findings were published in Carcinogenesis (2013).

Environmental Causes of Breast Cancer Across Generations

The *Three Generations Study* leverages a large study of families whose mothers enrolled in the Child Health and Development Studies when they were pregnant between 1959 and 1967. The study looks at causes of breast cancer and other diseases affecting women that may pass from one generation to the next or be caused by things in the environment. CBCRP invested $4,975,867 to fund **Barbara Cohn** and her team at the **Public Health Institute** to test the idea that prenatal exposure to environmental chemicals increases the risk of breast cancer. Cohn assessed data from 9,300 women whose mothers had been tracked in the initial study and identified 118 women (now adults) diagnosed with breast cancer. This research produced a number of significant findings, including the following:

- Researchers prospectively assessed over 1,800 women to evaluate the association between diabetes mellitus and parental tobacco smoking during gestation and found that daughters' risk of diabetes mellitus was increased in association with either both parents smoking or only the mother smoking during gestation. Findings were published in the Journal of Developmental

Origins of Health and Disease (2015).

- For the first time researchers were able to show that women who had been exposed to significant levels of dichlorodiphenyltrichloroethane (DDT) in their mother's womb were four times as likely to develop breast cancer as their peers who had been exposed to only a small quantity of the pesticide. Findings were first published in the Journal of Clinical Endocrinology and Metabolism (2015). A follow up study published in the Journal of the National Cancer Institute (2019) further strengthened the concept that breast cancer risk could be affected by the developmental timing of exposure to DDT.

- Data analysis revealed generational differences in perfluorinated compounds (PFC) levels that are consistent with manufacturing practices of the time. African Americans in both generations were found to have higher levels of PFC, organochlorine pesticides and PCBs, confirming disparities in exposure and burden compared to other races. Findings were published in Journal of Exposure Science & Environmental Epidemiology (2019).

- Women born to mothers with high levels of poly- and perfluoroalkyl substances (PFAS) in archived perinatal serum who also had high cholesterol had a 3.6-fold increase risk of breast cancer. Findings were published in Reproductive Toxicology (2020).

- In examining the link between gestational biomarkers and breast cancer, researchers found markers of increased risk from higher placental volume and rapid second trimester gestational weight gain. Findings in this prospective study add strong support for the fetal and placental origins of disease hypotheses. Results were published in Reproductive Toxicology (2020).

- Mammographic breast density, an important intermediate marker of breast cancer risk, may be affected by intrauterine environmental exposures (such as to the pesticides like DDT) in women with an underlying susceptibility as a proxy for maternal breast cancer history. Results were published in Reproductive Toxicology (2020).

- Studies measuring DDT exposure during key windows of susceptibility including the intrauterine period suggest that DDT exposure is associated with breast cancer risk. Researchers investigated whether DDT changed DNA methylation and found three genes, previously implicated in pubertal development and breast cancer susceptibility, were affected by exposure to DDT. Their findings suggest prenatal DDT exposure may have life-long consequence through alteration in genes relevant to breast cancer. Results were published in Reproductive Toxicology (2020).

Environmental Exposures & Breast Cancer in a Large, Diverse Cohort

The California Teachers Study (CTS), started in 1995, is a large ongoing study of breast cancer among 133,479 female California professional school employees. The CTS cohort was established by investigators interested in links between environmental exposures, genetics, nutrition, and breast cancer. This SRI leveraged data from this large, existing California-based cohort to investigate key environmental exposures that could increase risk for breast cancer. CBCRP funded **Peggy Reynolds** of the **Cancer Prevention Institute of California** for $4,863,028 to use data that had already been collected through the CTS to investigate the risk of breast cancer associated with both older and newer persistent organic pollutants of human health concern, including DDT, polychlorinated biphenyls, polybrominated diphenyl ethers, and other brominated flame retardants.

Investigations did not find an association between exposure to a range of persistent organic pollutants and increased breast cancer risk or breast density, which is a strong predictor of breast cancer. Study

limitations may have played a part in this, and researchers are hoping to pursue further investigation. Findings can be found in Environment International (2019) and International Journal of Environmental Research and Public Health (2020).

SRI Evaluation

CBCRP has undertaken an evaluation to understand how the SRI research grants increased knowledge about the prevention of breast cancer by focusing on environmental exposures and health disparities. Results of this evaluation are being used to inform CBCRP's third round of Program Initiatives, Preventing Breast Cancer: Community, Population, and Environmental Approaches. The evaluation has employed document analysis, database extraction, surveys/interviews, and focus groups and is assessing short, medium and long-term outcomes.

Overall, the evaluation showed that SRI grants helped broadened the definition of prevention, contributing to the field with findings on the body's accumulation of bioactive chemicals, endocrine disruptors, intersectionality of factors leading to health/disease, and effects at different developmental stages or 'windows.'

In considering short, medium and long-term goals of the SRI, the evaluation found:

- In the short term, the evaluation found that CBCRP played a critical role in funding research that is not being prioritized by other funders. Additionally, the topics are relevant and important for broadening the scientific understanding of breast cancer prevention.
- In the medium term, the evaluation found that the SRI provided opportunities to inform public policy and bring a larger public health lens to breast cancer prevention, create new funding opportunities for grantees, and increase publications on breast cancer prevention.
- It is too early to understand the full long-term impact of the SRI; however, early signs indicate that ongoing investment in program directed grants shows promise, that research funded through SRI may serve to shape public policy into the future, and that this funding attracts junior and experienced researchers to pursue breast cancer prevention research despite the lack of funding and job stability associated with this specialization.

While the evaluation of SRI is not yet complete, overall it indicates that the approach of directing program funds to research that fills important gaps in the field related to breast cancer prevention makes important contributions to breast cancer science and public health.

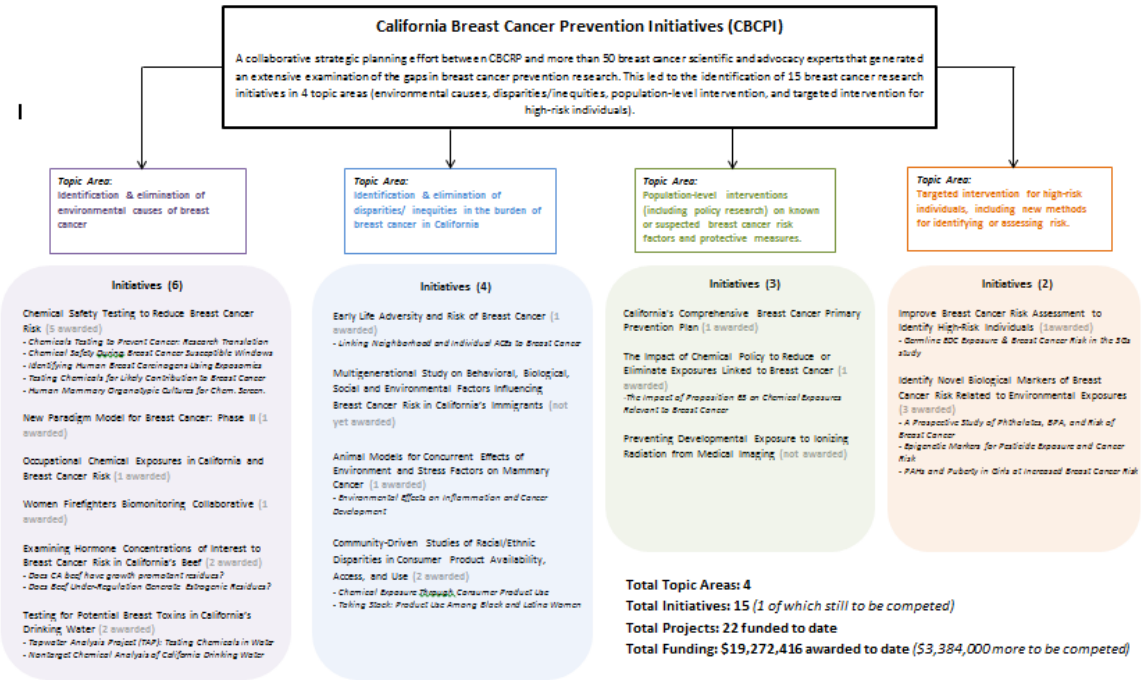
California Breast Cancer Prevention Initiatives

In March 2010, the Council decided to build on the existing SRI by devoting 50% of CBCRP research funds between 2011 and 2015 to program-initiated research. This new effort was titled the California Breast Cancer Prevention Initiatives (CBCPI). The ultimate goal of this funding strategy is to support research that not only increases knowledge about these questions, but also points to solutions that will reduce the suffering from breast cancer and move science closer to eliminating the disease.

A collaborative strategic planning effort between CBCRP and more than 50 breast cancer scientific and advocacy experts generated an extensive examination of the gaps in breast cancer prevention research. This led to the identification of 15 breast cancer research initiatives under 4 topic areas, 14 of which have already been funded, as described in Figure 5. Within each initiative there are one or more research projects that have been funded, depending on the research needs identified in the process. Approximately $22 million has been dedicated to supporting directed, coordinated, and collaborative research projects to pursue approaches to the following four topic areas:

1. Identification and elimination of environmental causes of breast cancer;
2. Identification and elimination of disparities/inequities in the burden of breast cancer in California;
3. Population-level prevention interventions (including policy research) on known or suspected breast cancer risk factors and protective measures; and
4. Targeted prevention interventions for high-risk individuals, including new methods for identifying or assessing risk.

Figure 4. California Breast Cancer Prevention Initiative by Topic Area



Highlights of these topic areas and their related initiatives and research projects follow.

Identify and eliminate environmental causes of breast cancer

Chemical Safety Testing to Reduce Breast Cancer Risk

This initiative aimed to advance the science of chemical testing and the understanding of biological pathways to breast cancer with the ultimate goal of developing policies related to breast cancer prevention. Research projects under this initiative include the following:

- **Chemicals Testing to Prevent Cancer: Research Translation**: **Megan Schwarzman of UC Berkeley** facilitated an exchange among the CBCRP chemical safety testing grantees, advocates, and regulatory scientists to discuss strategies to improve chemical testing and the translation of new approaches into action. Findings were published in Computational Toxicology (2018) and the Journal of Exposure Science & Environmental Epidemiology (2019).

- **Chemical Safety During Breast Cancer Susceptible Windows: Barbara Cohn of Public Health Institute** designed an environmental chemical safety testing strategy to discover the chemical pathways that might trigger breast cancer that led to a validated, high-resolution metabolic phenotyping strategy utilizing complimentary measures by gas-chromatography (GC)

and liquid-chromatography (LC) with ultra-high resolution mass spectrometer (MS) detection. It was the first study to examine environmental chemical pathways to breast cancer across three generations from thousands of chemical exposures. The findings were published in the Computational and Structural Biotechnology Journal (2019), and in Reproductive Toxicology (2019). In 2020 findings were published in three different articles in Reproductive Toxicology.

- **Identifying Human Breast Carcinogens Using Exposomics: Martyn Smith of UC Berkeley** was able to show that there are estrogenic and anti-estrogenic chemicals in women's blood that are not natural hormones, but are present at low levels and are difficult to identify by existing methods. He identified and prioritized a list of chemicals that are related to breast cancer risk in humans. Using a comprehensive measure of estrogenic activity, he added to the list of known estrogen receptor modulators that are present in Californian women and measured them in relation to breast cancer risk. Findings were published in Environmental Health Perspectives (2016).

- **Testing Chemicals for Likely Contribution to Breast Cancer: Susan Fisher of UCSF** developed new model systems for identifying the effects of environmental chemicals in breast tissue and sought out and validated biomarkers of exposure. New tests such as these are needed to provide a better, non-invasive assessment of exposure of girls and women to these chemicals. Findings were published in Proceedings of the National Academy of Sciences of the United States of America (2016).

- **Human Mammary Organotypic Cultures for Chemical Screening: Paul Yaswen of Lawrence Berkeley National Laboratory** developed a relevant human mammary cell culture model that enables researchers to better distinguish potential breast carcinogens from non-carcinogens. This is crucial for screening the backlog of chemicals already in homes and workplaces, as well as newly developed chemicals, and reducing or eliminating the use of those chemicals that pose the greatest risks. Findings were published in Toxicology In Vitro (2017), Environmental Health Perspectives (2015 and 2016), in Breast Cancer Research and Treatment (2019), and in Archives of Toxicology (2020).

New Paradigm Model for Breast Cancer: Phase II

In 2009, CBCRP funded **Robert Hiatt of UCSF** to create a conceptual framework that extends complexity theory to the study of breast cancer causation for postmenopausal women. The research focused on bridging social, environmental, and disparities work to develop a model of breast cancer that helps inform precautionary policy decisions, refocus translational research, and provide insights into interventions to prevent the disease. A new heuristic device that visually illustrates the interconnected and non-linear relationships among breast cancer risk factors was developed as shown in Figure 6. Dr. Hiatt was funded for a second phase of research to include a broader range of considerations in the complex contributors to breast cancer risk. Some of these refinements included enhancing the current model, developing a parallel model for premenopausal breast cancer, and creating a parallel model for rodent mammary cancer research that might help bridge animal and human research. Findings were published in Cancer

Figure 5: Interaction of Breast Cancer Risk Factors

Epidemiology, Biomarkers & Prevention (2020). The conceptual model can be viewed here: https://www.cbcrp.org/research-topics/causal-model.html.

Occupational Chemical Exposures in California and Breast Cancer Risk

Occupational exposure to breast carcinogens is likely to be an area of considerable concern. However, there is very limited data on where women work in California and what their potential occupational exposures are. An important first step towards furthering our understanding of breast cancer risks associated with occupational chemical exposures is to map out what women's employment looks like in California, what the significant chemical exposures are in the jobs where substantial numbers of women work, what differences in exposures there are between different races and different ages, and what the gaps are in our knowledge.

Robert Harrison of Public Health Institute and Peggy Reynolds of UCSF were funded to conduct the first phase of this investigation. In reviewing the 161 different formal occupations that 6,609,127 California women are employed in they found more than 1,000 breast carcinogens that women working in California may be exposed to, including solvents, cleaning products, fragrance and endocrine disruptors. Women of color in both formal and informal jobs may be exposed to a disproportionate level of breast carcinogens. Findings from this investigation and a tool to understand chemical exposures in the workplace can be found here: http://cbcrp.org/worker-exposure/.

Women Firefighters Biomonitoring Collaborative

Women firefighters in San Francisco are concerned that occupational exposures may be increasing their risk for breast cancer. In 2012 they formed the Woman Firefighter Biomonitoring Collective to compare levels of chemicals in the bodies of women firefighters compared to civilian workers in San Francisco. **Rachel Morello-Frosch of UC Berkeley, Heather Buren of United Fire Service Women, and Tony Stefani (unaffiliated)** were funded to collect and analyze biospecimens from 86 firefighters and 84 non-firefighters for the presence of perfluoroalkyls (PFAS), report back to participants, and educate the broader community on their findings. All participants in the study had some forms of PFAS in their bodies, but two specific types of PFAS were detected at higher rates in firefighters compared to non-firefighters, likely from fire-fighting foams and other exposures. Two reports from this study were published in Environmental Science and Technology (2020). The detection methods developed in this project are being leveraged in a follow-on study currently funded by CBCRP comparing three cohorts: firefighters, nurses (who face known occupational breast cancer risk factors), and office workers.

Examining Hormone Concentrations of Interest to Breast Cancer Risk in California's Beef

The goal of this initiative is to improve understanding and quantify exposures to various concentrations of both endogenous and exogenous hormones of interest for breast cancer risk from food animal production (beef) and well water. Two projects have been recently funded under this initiative. **Gina Solomon of Public Health Institute** is conducting tests using state-of-the-art methods to assess at least 100 samples of beef purchased from many different stores in three major regions of California: the San Francisco Bay area, Fresno area, and Los Angeles area. The team will combine the testing with analysis of dietary data to focus sampling on cuts of meat consumed by women from multiple ethnic groups in California. Currently there is insufficient publicly-available information to define the levels of HGP (slow-release hormonal growth promotants that are used widely in beef production to increase the rate of muscle deposition) in beef consumed by Californians. **Russell Hovey of UC Davis** is sampling conventional, organic and "no added hormone" ground beef and steak at eight different California retail outlets to measure the presence of slow release hormonal growth promotant levels (HGP). The data will be used to determine the potential intake of HGP by girls and women in different regions who consume beef products, and to predict the potential impact on their risks for developing breast cancer.

Testing for Potential Breast Toxins in California's Drinking Water

California's public water supplies come from diverse sources and are subject to varying degrees and types of treatment. Differential exposures to environmental contaminants via drinking water may contribute to breast cancer risk. **Thomas Young of UC Davis** is testing tap water from 120 California households and comparing samples of bottled water to assess levels of breast carcinogens and endocrine disruptors.

Identify & eliminate disparities/ inequities in the burden of breast cancer in California

Early Life Adversity and Risk of Breast Cancer

This initiative aims to retrospectively investigate whether childhood adversity contributes to increased breast cancer risk, risk of specific breast cancer subtypes, and/or major risk factors for breast cancer. **Barbara Cohn of Public Health Institute** is leading the *Linking Neighborhood and Individual ACEs to Breast Cancer* research project, which explores the connection between adverse childhood experiences (ACEs), age of menarche, breast density at ages 40-50, and incidence of breast cancer before age 55.

Animal Models for Concurrent Effects of Environment and Stress Factors on Mammary Cancer

This initiative aims to investigate the combined effect of environmental chemicals and stress factors on the development of mammary cancer using animal models with the objective of developing new animal studies testing the effects of concurrent exposure to environmental chemical(s) and social stressors on the development of mammary cancer, with consideration of the timing of exposure/impact risk, and the duration of exposure/impact risk. **Donald Lamkin of UCLA** has begun a study to pursue the Environmental Effects on Inflammation and Cancer Development project to examine the combined effect of a suspect environmental chemical and an environmental social stressor on inflammatory signaling and tumor development in mouse models of breast cancer.

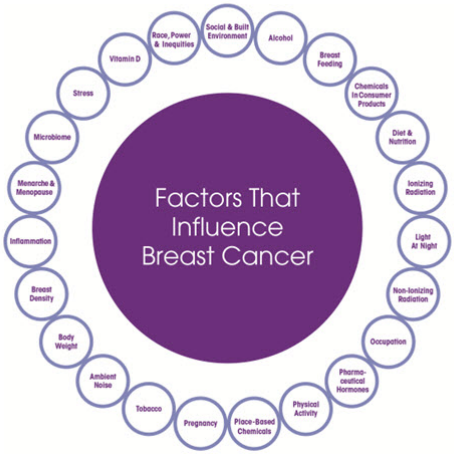
Community-Driven Studies of Racial/Ethnic Disparities in Consumer Product Availability, Access, and Use

The goal of this initiative is to advance our understanding of racial/ethnic disparities in consumer product availability, access, and use among California women and girls. These disparities may lead to differences in exposures to chemicals that may impact breast cancer risk. Research projects under this initiative include the following:

- **Chemical Exposure Through Consumer Product Use: Kim Harley of UC Berkeley, Phyllis Clark of The Healthy Heritage Movement, Julia Liou of Asian Health Services, Paula Johnson of California Department of Public Health, and Norman Moraga of Clinica de Salud del Valle de Salinas** brings together five distinct organizations to investigate and address the disparities of chemical exposure from personal care products use across multiple racial/ethnic groups.

- **Taking Stock: Product Use Among Black and Latina Women**: **Bhavna Shamasunder of Occidental College and Janette Robinson Flint of Black Women for Wellness** are conducting this community-driven pilot study to determine whether black and Latina women use different products at different frequencies than other women and whether these products contain a mixture of chemicals that cumulatively affect breast cancer risk.

Figure 6. Breast Cancer Risk Factor Investigated in Pathways to Primary Prevention



Population-level interventions (including policy research) on known or suspected breast cancer risk factors and protective measures

California's Comprehensive Breast Cancer Primary Prevention Plan

Nancy Buermeyer of Breast Cancer Prevention Partners led the creation of the comprehensive Paths to Prevention: The California Breast Cancer Primary Prevention Plan, which serves as a road map for legislators, local and state regulators, community members, and advocates to work toward preventing breast cancer in California. The plan is the first ever comprehensive primary prevention plan for breast cancer in the world. It is distinct from other efforts in that it focuses on primary prevention rather than improved detection and prognosis, and focuses on systems change rather than personal behavior change. The plan builds on extensive scientific and community wisdom and expertise. It was developed through an extensive literature review, study groups on specific risk factors, which are pictured in Figure 7, and the input of impacted communities through the state. Implementing the plan has the potential to make California the state with the lowest breast cancer rate in the country. Ultimately, it is hoped that this project can serve as a model for other states and eventually the country.

The Impact of Chemical Policy to Reduce or Eliminate Exposures Linked to Breast Cancer

This initiative aims to identify effective policy or market-based interventions to reduce exposure to chemicals that may cause or contribute to breast cancer including known and suspected mammary gland carcinogens, mammary gland toxicants, endocrine disruptors, and/or chemicals with similar properties or similar mechanisms of action. **Megan Schwarzman of UC Berkeley** is funded to lead *The Impact of Proposition 65 on Chemical Exposures Relevant to Breast Cancer*, which investigates whether and how California's Safe Drinking Water and Toxic Enforcement Act of 1986 (commonly known as Proposition 65) has reduced population-level exposures to chemicals relevant to breast cancer in California and beyond. She is finding that Proposition 65 may play a role in driving industry decisions in indirect ways, such as in reformulation of products. In interviews, manufacturers emphasize that they reformulate their products to avoid having to warn customers. Studies to show effects of proposition 65 on population level exposures to carcinogens such as diesel and phthalates are ongoing.

Targeted intervention for high-risk individuals, including new methods for identifying or assessing risk

Improve Breast Cancer Risk Assessment to Identify High-Risk Individuals

This initiative aimed to advance the science of breast cancer risk modeling/assessment through funded projects that include a wider range of known and suspected risk factors and take into consideration cumulative effects and timing of environmental exposure(s). **Barbara Cohn of Public Health Institute** is leading the *Germline EDC Exposure & Breast Cancer Risk in the 3Gs study* to determine whether the presence of endocrine disrupting chemicals in the blood of grandmothers when they were pregnant predict age at menarche in the granddaughter's.

Identify Novel Biological Markers of Breast Cancer Risk Related to Environmental Exposures

This initiative aimed to investigate upstream biomarkers of breast cancer risk and identify novel biomarkers of previous exposure to chemicals known or suspected to contribute breast cancer. The goal of this initiative was to pursue innovative approaches using tissue culture, animal models, or human samples to identify and characterize novel biomarkers of breast cancer susceptibility or risk that have the potential to identify individuals (or communities) with high risk and inform intervention strategies to lower risks. Research projects under this initiative are underway. They include:

- **A Prospective Study of Phthalates, BPA, and Risk of Breast Cancer: Anna Wu of University of Southern California** is investigating the role of phthalates (PHTH) and bisphenol A (BPA) in relation to risk of breast cancer using a nested case-control study within the Multiethnic Cohort Study (MEC).

- **Epigenetic Markers for Pesticide Exposure and Cancer Risk: Hanna Park of UC Irvine** is working to identify blood DNA methylation-based markers for pesticide exposure and determine if these markers are associated with breast cancer risk factors such as age at menopause and breast density. The specific pesticides that are being assessed in this study are organophosphate pesticides (OPs, the most commonly used insecticides in the U.S.) and glyphosate (the most commonly used herbicide). This research is informing the Markers for Environmental Exposures (MEE) Study, a cross-sectional study that links biospecimens to environmental exposures and health effects. Details of the study were published in the International Journal of Environmental Research and Public Health (2020).

- **PAHs and Puberty in Girls at Increased Breast Cancer Risk: Esther John of Stanford University** is evaluating whether the progressively earlier age of puberty over the past few decades may be linked to exposure to polycyclic aromatic hydrocarbons (PAHs) by testing blood and urine and evaluating questionnaires.

Preventing Breast Cancer: Community, Population, and Environmental Approaches

Prevention is a strategic priority, yet CBCRP has historically received a dearth of proposals in this area. In 2015, the program launched its third round of Program Initiatives, continuing the focus on environmental contributors, health disparities, and population-level prevention as focus areas. In order to garner more cutting-edge fundable prevention research proposals, CBCRP devised the Global Challenge to Prevent Breast Cancer. This effort crowd sourced new ideas for breast cancer primary prevention research that could be implemented in California and would advance in a significant way within five years.

CBCRP launched The Global Challenge to Prevent Breast Cancer on September 21, 2018. The challenge was a signature commitment to the Biden Cancer Initiative's effort to double the rate of progress against cancer, and the launch coincided with the Biden Cancer Summit held that day. Through a website, the Global Challenge laid out the scope of the challenge, identifying that submissions needed to:

- address *primary* prevention of breast cancer (preventing breast cancer before it occurs);
- focus on prevention, not just understanding the causes of breast cancer; and
- be aimed at reducing breast cancer in whole populations, not just in groups at highest risk.

In total, CBCRP received 46 submissions from 12 countries across the globe. Summaries of these entries can be viewed online at http://cabreastcancer.org/global-challenge/ideas.html. These applications were judged first by members of an evaluation panel composed of respected researchers and advocates. Ten finalists were selected, who presented their research ideas to a selection committee at a public event. At this public event, people who submitted ideas gave brief presentations before a live and online audience of more than 350 people.

The judges scored presentations for their boldness, impact, and relevance and chose the two winners (one each from a scientists and a lay-person). In addition, audience members were able to vote online during the keynote presentation to select the Audience Choice winner. Winners and finalists are listed in Table 8. Videos of the Global Challenge Idea Showcase and Competition can be viewed at http://cabreastcancer.org/global-challenge/video.html.

All of the creative ideas submitted became pieces of the puzzle for the expert committee to consider when designing future Preventing Breast Cancer: Community, Population, and Environmental Approaches initiatives. All finalists were invited to publish their challenge submission in a special issue of the International Journal of Environmental Research and Public Health.

Table 8. Winners and Finalists in the Global Challenge to Prevent Breast Cancer

Status	Winner/ Finalist	Co-Applicants	Idea Title
Grand Prize (Researcher)	Victoria L. Seewaldt	Rama Natarajan et al.; the SoCal STEM and Community Outreach Team	Environmental Exposures during Puberty: Window of Breast Cancer Risk and Epigenetic Damage
Grand Prize (Advocate)	Nancy Buermeyer	Janet Nudelman	California Ports: Air Pollution Interventions and Breast Cancer Risk in Local Communities
Audience Choice Award	Michele Atlan	Josh Neman	Targeted Transdermal Delivery of Curcumin for Breast Cancer Prevention
Finalist	Vincent Bessonneau	Ruthann A. Rudel	Mapping the Human Exposome to Uncover the Causes of Breast Cancer
Finalist	Gertrude C. Buehring	Hannah M. Sans	Breast Cancer Gone Viral? Review of Possible Role of Bovine Leukemia Virus in Breast Cancer, and Related Opportunities for Cancer Prevention
Finalist	Barbara A. Cohn	Mary Beth Terry	Environmental Influences on Mammographic Breast Density in California: A Strategy to Reduce Breast Cancer Risk
Finalist	Hannah Lui Park		Epigenetic Biomarkers for Environmental Exposures and Personalized Breast Cancer Prevention
Finalist	Andrea R. Hindman	Jessica S. Helm	Keeping Abreast of Prevention in Chemical Safety Testing
Finalist	Laura Markuly		Low Dose Naltrexone (LDN): The New Breast Cancer Prevention
Finalist	Thea D. Tlsty		The Mother of All Primary Prevention Assays

Policy Initiative

As an outcome of the 2010 strategic plan, in 2015, CBCRP launched the Policy Initiative to close the gap between research and policy (both public and private), with the goal of funding research that contributes to creating an environment in California that leads to less breast cancer. The CBCRP Council initially set aside $150,000 per year for policy projects, which was increased to $260,000 in 2018.

The Policy Initiative is designed to be a rapid-response mechanism, with on-call research teams that have been pre-selected through a rigorous peer-review process. Research topics can be nominated by the public or by the Policy Research Advisory Group (PRAG), which is composed of California-based policymakers, representatives of organizations involved in breast cancer-related policy development, and advocates. The PRAG recommends selected topics to the CBCRP Council for approval. Once a topic is

approved, CBCRP sends a request for bid to the appropriate team. Projects are designed to be brief (typically a six-month research project period, followed by a dissemination and public engagement period).

To date, the Policy Initiative has funded the following four projects:

1. **Barriers to Breast Cancer Care in California: Ninez Ponce of UCLA Center for Health Policy Research** investigated the economic, emotional, and structural obstacles that women face when pursuing breast cancer treatment and follow-up care in California. Her team found three main issues that are preventing women from receiving life-saving, life-extending treatment for breast cancer: limited public health care, lack of patient navigators, and lack of continuity of care. The findings were presented to the California Legislature in January 2017. The gaps identified in this project were partially addressed through legislation to remove treatment caps in place for the Breast and Cervical Cancer Treatment Program (AB 1810 (Committee on Budget, Chapter 34, Statutes of 2018)). Findings are available in the 2018 report: *Addressing Barriers to Breast Cancer Care in California: The 2016-2017 Landscape for Policy Change*. 2018. http://healthpolicy.ucla.edu/publications/search/pages/detail.aspx?PubID=1595

2. **Enhance Implementation of California's Green Chemistry Initiative:** Under the Green Chemistry Initiative, in 2008, the California legislature enacted two groundbreaking laws designed to protect Californians from toxic chemicals in products and provide the public with more information about chemical hazards: the Safer Consumer Products Program and Toxics Information Clearinghouse for data on chemical Hazard Traits. After ten years of progress, **Gina Solomon of Public Health Initiative and Peggy Reynolds of UCSF** evaluated the program's effectiveness. They found strengths, such as advancing the public's right to know what is in their products, but also weaknesses that influence the safety of products. Findings were presented in a legislative briefing in January 2019 and in a joint hearing of the Assembly Committee on Environmental Safety & Toxic Materials and the Senate Committee on Environmental Quality. Following the hearing, SB 392 was introduced by Senator Ben Allen, which included many of the recommendations from the report. The findings and recommendations were also published in *California's Green Chemistry Initiative at Age 10: An Evaluation of Its Progress and Promise*. 2018. (http://bit.ly/CAGreenChemistry) and "The California Safer Consumer Products Program: Evaluating a Novel Chemical Policy Strategy" published in New Solutions, May 2019 (https://doi.org/10.1177%2F1048291119850105).

3. **Barriers to Metastatic Breast Cancer Care in California:** Ninez Ponce of UCLA is expanding findings in her first Policy Initiative project to look at the specific considerations for metastatic breast cancer. This study is still underway.

4. **Awareness of Alcohol as a Risk Factor for Breast Cancer:** Alcohol use is the third largest contributor to cancer cases among U.S. women, and female breast cancer accounts for nearly 80% of the 50,110 alcohol-attributable cases of cancer. Despite the well-documented link between alcohol use and breast cancer, many people are unaware of how drinking can increase their risk. **Priscilla Martinez of Public Health Institute and Peggy Reynolds of UCSF** are investigating ways to better inform young women about the link between drinking and risk of breast cancer. This study is still underway.

Table 9: Program-Initiated Awards with Projects Completed in 2015–2020

Initiative	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
SRI 1: Understanding Racial and Ethnic Differences in Stage-Specific Breast Cancer Survival	2011	California Breast Cancer Survivorship Consortium – USC AABCS	Anna Wu	University of Southern California	$1,006,035
SRI 3: Piloting an Integrated Approach to Understanding Behavioral, Social and Physical Environment Factors and Breast Cancer among Immigrants	2011	Immigrant Experience & Breast Cancer Risk in Asians	Scarlett Gomez	Cancer Prevention Institute of California	$705,711
SRI 5: Making Chemicals Testing Relevant to Breast Cancer	2011	Xenoestrogen-Specific Perturbations in the Human Breast	Shanaz Dairkee	California Pacific Medical Center Research Institute	$899,961
SRI 8: Environmental Causes of Breast Cancer across Generations	2012	Environmental Causes of Breast Cancer across Generations	Barbara Cohn	Public Health Institute	$4,975,867
SRI 9: Environmental Exposures & Breast Cancer in a Diverse Cohort	2010	Persistent Organic Pollutants & Breast Cancer Risk	Peggy Reynolds	Cancer Prevention Institute of California UCSF	$4,828,308
CBCPI 0: Initiative Coordination	2010	Partnership to Advance Breast Cancer Research	Tracey Woodruff	UCSF	$1,406,639
CBCPI 3: Women Firefighters Biomonitoring Collaborative Study	2013	Women Firefighters Biomonitoring Collaborative	Rachel Morello-Frosch Heather Buren Tony Stefani	UC Berkeley United Fire Service Women SF Fire Department	$788,489

Initiative	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CBCPI 5: Chemical Safety Testing to Reduce Breast Cancer Risk	2015	Chemical Testing to Prevent Cancer: Research Translation	Megan Schwarzman	UC Berkeley	$216,311
		Chemical Safety During Breast Cancer Susceptible Windows	Barbara Cohn	Public Health Institute	$1,212,557
		Identifying Human Breast Carcinogens Using Exposomics	Martyn Smith	UC Berkeley	$1,071,876
		Testing Chemicals for Likely Contribution to Breast Cancer	Susan Fisher Zena Werb	UCSF	$1,125,000
		Human Mammary Organotypic Cultures for Chemical Screening	Paul Yaswen	Lawrence Berkeley National Laboratory	$1,569,791
CBCPI 6: Paradigm Model for Breast Cancer Follow On	2014	New Paradigm of Breast Cancer Causation & Prevention-Phase 2	Robert Hiatt	UCSF	$811,840
Policy	2018	Rapid Response for Environmental Research (RaRE Research)	Gina Solomon	Public Health Institute	$145,000
Policy	2019	Access to Breast Cancer Oncology Care in California	Ninez Ponce	UCLA	$157,231

Table 10: Program-Initiated Awards with Projects in Progress in 2015–2020

Initiative	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CBCPI 2: Testing for Potential Breast Toxins in California's Drinking Water	2019	Tapwater Analysis Project (TAP): Testing Chemicals in Water	Gina Solomon	Public Health Institute	$674,623
		Nontarget Chemical Analysis of California Drinking Water	Thomas Young	UC Davis	$753,009
CBCPI 4: Occupational Chemical Exposures in California and Breast Cancer Risk	2016/ 2018	Occupational Chemical Exposures in California and Breast Cancer Risk	Robert Harrison	Public Health Institute	$1,214,121
CBCPI 7: Early Life Adversity and Risk of Breast Cancer	2017	Linking Neighborhood and Individual ACEs to Breast Cancer	Barbara Cohn	Public Health Institute	$754,299
CBCPI 9: Animal Models for Concurrent Effects of Environment and Stress Factors on Mammary Cancer	2017	Environmental Effects on Inflammation and Cancer Development	Donald Lamkin	UCLA	$629,205
CBCPI 10: Community-Driven Studies of Racial/Ethnic Disparities in Consumer Product Availability, Access, and Use	2018	Taking Stock: Product Use Among Black and Latina Women	Bhavna Shamasunder	Occidental College	$445,976
			Janette Robinson Flint	Black Women for Wellness	
		Chemical Exposure through Consumer Product Use	Kim Harley	UC Berkeley	$420,200
			Phyllis Clark	Healthy Heritage Movement	
			Julia Liou Lisa Fu	Asian Health Services	

Initiative	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CBCPI 11: The Impact of Chemical Policy to Reduce or Eliminate Exposures Linked to Breast Cancer	2017	The Impact of Proposition 65 on Chemical Exposures Relevant to Breast Cancer	Megan Schwarzman	UC Berkeley	$808,284
CBCPI 12: California's Comprehensive Breast Cancer Primary Prevention Plan	2016	California Breast Cancer Primary Prevention Plan	Nancy Buermeyer	Breast Cancer Prevention Partners	$423,398
CBCPI 14: Improve Breast Cancer Risk Assessment to Identify High-Risk Individuals	2017	Germline EDC Exposure & Breast Cancer Risk in the 3Gs Study	Barbara Cohn	Public Health Institute	$946,960
CBCPI 15: Identify Novel Biological Markers of Breast Cancer Risk Related to Environmental Exposures	2016	PAHs and Puberty in Girls at Increased Breast Cancer Risk	Esther John	Cancer Prevention Institute of California; Stanford University	$1,519,884
		A Prospective Study of Phthalates, BPA, and Breast Cancer	Anna Wu	University of Southern California	$1,510,809
		Epigenetic Markers for Pesticide Exposure and Cancer Risk	Hannah Lui Park	UC Irvine	$1,249,970
Preventing Breast Cancer 0: Initiative Coordination	2017	Science Convener for Program Initiatives	Gina Bartlett	Consensus Building Institute, Inc.	$1,205,252
Preventing Breast Cancer	2017	Ambient Air Toxics and Breast Cancer Risk	Julia Heck	UCLA	$357,711
Policy	2020	Awareness of Alcohol as a Breast Cancer Risk Factor	Priscilla Martinez	Public Health Institute	$152,378

Initiative	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
Policy	2019	Barriers to Metastatic Breast Cancer Care in California	Ninez Ponce	UCLA	$100,000

2) Investigator Initiated Research

The Community Impact of Breast Cancer

California's great strength comes from the diversity of the people who live here. But these differences in ethnicity, race, culture, language, sexual orientation, immigration history, and socioeconomic status also contribute to disparities in prevention, detection, treatment, and care of people with or at risk for breast cancer.

CBCRP encourages research that addresses disparities and the burden of breast cancer among California's diverse communities. CBCRP seeks to address these disparities by investing in research that answers critical questions, such as the following:

- How do poverty, race/ethnicity, and social factors affect incidence and mortality for breast cancer?
- What are the sociocultural, behavioral, and psychological issues faced by women at risk for or diagnosed with breast cancer?
- What services are needed to improve access to care in order to improve quality of life and reduce suffering?
- What policies can help reduce disparities related to prevention, detection, and treatment of breast cancer?

This section highlights the research that focuses specifically on the community impact of breast cancer. Over the past five years, CBCRP has funded innovative research, including efforts to meet the specific cultural needs of different racial and ethnic groups facing breast cancer, such as identifying ways to remove barriers to breastfeeding in young mothers, and identifying approaches to address the breast cancer needs of California's rural populations.

CBCRP invested $10.4 million in 37 investigator-initiated community impact research projects that were conducted between 2015 and 2020. Below are highlights of a selection of research projects CBCRP has funded, followed by Tables 11 and 12, which list research projects that were concluded between 2015 and 2020 and in progress for all research related to community impact of breast cancer.

Highlights of Projects Completed in 2015-2020

Meeting the Self-Care Needs of Latinas after Breast Cancer
The end of active treatment is often a difficult transition for breast cancer survivors filled with fears of recurrence and uncertainty about the future. This difficult transition occurs at the same time that survivors lose the regular support of their treatment team. After treatment, Spanish-speaking Latina breast cancer survivors suffer worse quality of life and more pain, depression, fatigue, and concerns about work, finances, and health insurance compared to whites. These women lack culturally and linguistically

appropriate information on recommended health care and self-care following active cancer treatment and skills to manage their symptoms after treatment. This community-based participatory research project, led by **Carmen Ortiz of Circulo de Vida Cancer Support and Resource Center** and **Anna Napoles of UCSF**, assessed post-treatment symptom management, psychosocial, and informational needs of Spanish-speaking Latina breast cancer survivors. They found that physical and psychosocial symptoms are common among these survivors and women lack information to manage cancer after effects. They need culturally appropriate survivorship care programs that address symptom management, psychosocial distress, and information on follow-up care, healthy lifestyles, and strategies for coping with role reintegration. The research team is using their findings to develop a prototype of a survivorship care program. Findings were published as a chapter in Advancing the Science of Cancer in Latinos (2018) and The Journal of Community and Supportive Oncology (2017).

Breastfeeding to Reduce Breast Cancer in Young Mothers

Breastfeeding is significantly protective against breast cancer, especially against aggressive types, yet very little research or health education promoting breastfeeding for breast cancer prevention has been done. The burden of breast cancer mortality among low-income women, women of color, and younger women, is disproportionately high. Promoting and supporting breastfeeding for adolescent mothers of color and low-income mothers is an important effort. While younger age at first birth is protective against some types of breast cancer, the risk pattern for the most aggressive breast cancers is the opposite: younger mothers are at significantly higher risk. To promote breastfeeding in adolescent mothers, **Alison Chopel of Public Health Institute and Danielle Soto of Brighter Beginnings** identified social and structural barriers to and motivators of breastfeeding that young mothers may encounter. They found that young mothers experience stigma in multiple settings, and this acts as a major barrier to breastfeeding that likely contributes to disproportionately low rates of breastfeeding among young mothers. While some barriers and facilitators were similar to those experienced by mothers of all ages, participants in the study reported multiple overlapping stigmas, requiring more support. They suggest stigma reduction interventions may be an important way to address barriers. Findings were published in the Journal of Human Lactation (2019)

Using Telenavigators to Support Rural Breast Cancer Patients

California is home to some of the world's finest medical institutions, but access to care is widely uneven. Rural areas can be especially challenging because of distance to health care centers, lack of access to affordable and reliable transportation, and other barriers. Frontier areas (the least densely populated rural areas) may lack access to mammograms, surgery facilities, and cancer treatment services. **Scarlett Gomez of Cancer Prevention Institute of California and Susan Ferrier of Connecting to Care** explored whether it was feasible to recruit and train rural/frontier peer telenavigators to increase access to needed support and resources. They piloted this program in rural Nevada County and the frontier counties of Modoc and Plumas. These telenavigators can provide breast cancer patients with information and tailored cognitive behavioral stress management programs. Stress management support can be critical for women who experience social isolation in these areas.

Table 11: Community Impact of Breast Cancer Projects Completed in 2015–2020*

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Full Research Award	2011	Sister Survivor: Improving Access to Survivorship Care Plan	Kimlin Ashing Carolyn Tapp Florence Britton Isis Pickens	Beckman Research Institute of the City of Hope Women of Color Breast Cancer Survivors Support Project	$931,337
CRC Full Research Award	2014	Engaging Underserved Women in Health Research	Galen Joseph Alyssa Nickell	UCSF Shanti Project, Inc.	$747,139
CRC Pilot Award	2013	Latinas' Experiences of Breast Cancer Treatment	Carla Gomez Meghan Halley	Palo Alto Medical Foundation Research Institute	$212,648
CRC Pilot Award	2013	Meeting the Self-Care Needs of Latinas after Breast Cancer	Anna Napoles Carmen Ortiz	UCSF Circulo de Vida Cancer Support and Resource Center	$191,431
CRC Pilot Award	2014	Exploring Rural Disparities in Breast Cancer Mortality	Brenda Elvine-Kreis Terry Uyeki	Humboldt Community Breast Health Project Humboldt State University Sponsored Programs Foundation	$217,102
CRC Pilot Award	2015	Breastfeeding to Reduce Breast Cancer in Young Mothers	Alison Chopel Danielle Soto	Public Health Institute Brighter Beginnings	$174,617

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Pilot Award	2015	Using Telenavigators to Support Rural Breast Cancer Patients	Scarlett Gomez Susan Ferrier	Cancer Prevention Institute of California Connecting to Care	$14,900
CRC Pilot Award	2015	Building Mixtec Community Capacity for Breast Health, Phase 2	Annette Maxwell Sandra Young	UCLA Mixteco/Indigena Community Organizing Project	$193,440
CRC Pilot Award	2016	TRIBAL	Moon Chen Emmett Chase	UC Davis Kimaw Medical Center	$175,000
CRC Pilot Award	2016	Using Telenavigators to Support Rural Breast Cancer Patients	Scarlett Gomez Susan Ferrier	Cancer Prevention Institute of California UCSF Connecting to Care	$201,074
CRC Pilot Award	2017	Latino Community Education Tool on Hereditary Breast Cancer	Ysabel Duron Laura Fejerman	Latinas Contra Cancer UCSF	$36,895
CRC Pilot Award	2017	Impact of Neighborhoods and Navigation on Survivorship	Alyssa Nickell Salma Shariff-Marco	Shanti Project, Inc. Cancer Prevention Institute of California; UCSF	$182,099
IDEA	2013	Breast cancer and neurocognitive outcomes	Sunita Patel	Beckman Research Institute of the City of Hope	$267,092

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
Translational Research Award	2014	Intervening on Reproductive Health in Young BC Survivors	Irene Su	UC San Diego	$968,782
Translational Research Award	2015	Translating a Stress Management Program for Latinas	Steven Gregorich	UCSF	$942,767
Translational Research Award	2016	Implementing Systematic Distress Screening in Breast Cancer	Erin Hahn	Kaiser Permanente Southern California	$1,195,383
Conference Award	2016	Breast Cancer Care: Pilot Forum For Mental Health Providers	Irene Wapnir	Stanford University	$25,000
Conference Award	2017	Annual Breast Cancer Conference	Donna Randall	Cancer Prevention Institute of California	$25,000
Community-Led Conference Award	2019	7th Annual Metastatic Breast Cancer Conference	Sharon Schlesinger	Susan G. Komen Foundation	$25,000

* Grant titles in this table may appear to repeat due either phased research (a pilot grant followed by a full research grant) or due to continuation grants being given.

Table 12: Community Impact of Breast Cancer Projects in Progress in 2015–2020

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Full Research Award	2016	Building Mixtec Community Capacity for Breast Health, Phase 3	Annette Maxwell Sandra Young	UCLA Mixteco/Indigena Community Organizing Project	$723,500
CRC Pilot Award	2018	Physical Activity Intervention for Young Cancer Survivors	Sheri Hartman Stori Nagel	UC San Diego Social Good Fund	$178,111
CRC Pilot Award	2018	Project SOAR: Speaking Our African American Realities	Annette Stanton Tammie Denyse	UCLA Carrie's Touch African American Breast Cancer	$176,342
CRC Pilot Award	2019	Nail Salon Worker Leadership and Reducing Breast Cancer Risk	Charlotte Chang Lisa Fu	UC Berkeley Asian Health Services	$175,586

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Pilot Award	2019	Ethnic Enclave Effect on Vietnamese American Women with Brea	Lihua Liu Hai Hoang	University of Southern California BPSOS Center for Community Advancement	$150,867
CRC Pilot Award	2019	Creating Bridges to Women's Health Care in Young Survivors	Irene Su Helen Palomino	UC San Diego Cancer Resource Center of the Desert	$177,870
CRC Pilot Award	2019	Cancer Navigation for Vietnamese Americans (CANVAS)	Sora Tanjasiri Becky Nguyen	UC Irvine Vietnamese American Cancer Foundation	$153,343
CRC Pilot Award	2020	Rural Latinas' breast cancer narratives: Metaphor analysis as a window into cultural values	Dalia Magana Candice Adam-Medefind	UC Merced Healthy House within a Match Coalition	$167,287
CRC Pilot Award	2020	Peer Navigation for African American Women during the Breast Cancer Peri-Diagnostic Period	Lisa Goldman Rosas Starla Gay	Stanford University Roots Community Health Center	$184,077
Translational Research Award	2020	Adverse Health Outcomes in Breast Cancer Survivors exposed to Pain Medications	Reina Haque	Kaiser Foundation Research Institute	$907,122

Etiology and Prevention

Despite progress in understanding the underlying environmental and biological causes of breast cancer, significant gaps remain. CBCRP's grants in etiology and prevention aim to answer questions such as: What environmental and biological factors interact to increase the risk of developing breast cancer? What approaches can be used to reduce or eliminate breast cancer risk? How are different communities in California affected by environmental and lifestyle contributors to breast cancer?

Specific topics of interest for research in these areas include topics such as the following:

- **Etiology: The role of environment and lifestyle —** We CBCRP encourages studies on breast cancer initiation that may be due to environmental exposures that subject women to agents that they, as individuals, cannot control. Other key topics of interest include breast cancer causes related to lifestyle (e.g., diet, exercise) and the underlying metabolic, hormonal, and environmental interactions. Studies on causative gene-environment interactions specific to breast cancer, especially those having the potential to lead to prevention strategies, are encouraged.

- **Prevention and risk reduction: Ending the danger of breast cancer —** Research exploring methods to prevent breast cancer or reduce risk, including elimination of external causative factors and the identification of surrogate markers for use in prevention trials are encouraged. Examples include nutritional factors, xenoestrogens, exercise, studies of genetic variation, and methods to modify known breast cancer genes and risk factors.

The past five years have offered several significant advances in these research areas. CBCRP has funded research into better understanding environmental exposures to potential breast carcinogen in diverse populations.

CBCRP invested $9.9 million in 27 investigator-initiated etiology and prevention research projects that were conducted between 2015 and 2020. Below are highlights of a selection of research projects CBCRP has funded. Tables 13 and 14 list research projects that were concluded between 2015 and 2020 and in progress for all research related to etiology and prevention.

Highlights of Projects Completed in 2015-2020

Peer-to-Peer Reduction of Pesticide Exposure to Latina Youth
California is the leading agricultural state in the nation, with more than 185 million pounds of pesticides used each year. Many of these pesticides are probable or possible carcinogens, and some are "endocrine disruptors" that mimic or block the function of hormones such as estrogen, which can increase risk for breast cancer. Currently, there is little data on the health impact of these pesticides on women and girls living in agricultural communities. To address this gap, **Kim Harley of UC Berkeley** and **Jose Camacho and Kimberly Parra of Clinica de Salud del Valle de Salinas** partnered to explore questions of what adolescent girls in these communities are exposed to and what, if any, behaviors impact these exposures. Nearly 100 Latina girls between the ages of 14 and 16 who live in the Salinas Valley wore silicone wristbands for a week to assess pesticide exposure. Researchers found that more than half of the girls were exposed to fipronil sulfide, cypermethrin, dichlorodiphenyldichloroethylene (DDE), dacthal, and/or trans-permethrin. Living within 100 meters of active agricultural fields, having carpeting in the home and having an exterminator treat the home in the past six months were associated with higher odds of detecting certain pesticides, and daily home cleaning and using doormats in their home entryway appeared to decrease exposure. The results suggest that both nearby agricultural pesticide use and individual behaviors are associated with pesticide exposures. Their findings were published in Science of the Total Environment (2019).

Getting a Jump on Cancer with a Genomic Risk Classifier
Increased access to screening mammography has allowed for greater detection of breast cancer but may also be resulting in overdiagnosis and overtreatment. Mammography can detect changes in breast tissue but do a poor job of distinguishing cancer cells from lesions indicating ductal carcinoma in situ (DCIS), which may never progress to breast cancer. **Robert West of Stanford University** used breast cancer genomic data to better refine the current risk classification system of pre-invasive breast neoplasia. Initial research indicates potential to better classify and identify which lesions detected by mammography pose a greater risk and, therefore, a greater need for intensive treatment. Findings were published in Breast Cancer Research (2015), Statistical Methodology (2015), Journal of the American Medical Informatics Association (2017), and Clinical Cancer Research (2018).

Assessing Breast Health in Urban Oil Drilling Communities
California is a global national leader in fossil fuel extraction, especially in Southern California. In South Los Angeles, many working poor Latino families live, work, and go to school near Las Cienagas, a large, active oil field. Residents are concerned about the health impact and breast cancer risk from exposures.

Nancy Halpern Ibrahim of Esperanza Community Housing partnered with **Jill Johnston of University of Southern California** to collect preliminary data on exposure to oil-related toxic metals using toenails and mammograms to assess whether living near oil drilling sites in South Los Angeles alters breast density, a strong risk factor and biomarker of breast cancer. This study is the first of its kind to collect primary data on breast health in an environmental justice community affected by oil drilling.

In Vivo Impact of Xenoestrogen Exposure on the Human Breast

Consumer products often contain manufactured chemicals such as phthalates and parabens that can mimic the natural hormone estrogen. Exposures to these "xenoestrogens" ("XEs") have been linked to mammary cancer in rodents and are shown to cause pre-cancerous changes in normal human breast cell cultures grown in the laboratory. Following up on their CBCRP-funded pilot study that measured changes in XE exposure on normal human breast cells from changing personal care product use, **Shanaz Dairkee of California Pacific Medical Center Research Institute and Polly Marshall of Breast Cancer Over Time** sought to validate their findings by increasing the number and diversity of study participants, adding a control group and including a carcinogenesis-relevant gene expression profile to the biological features studied in the cultured cells. The study aims to provide key insights into the biological processes of cancer development by studying the role of XEs in cellular changes that precede the genesis of breast cancer. This would be one of the first studies to examine impact (changes in cells, changes in gene expression) of xenoestrogens on healthy breast tissue.

Internal Chemical Exposure Study among Mexican Immigrants

Breast cancer risk for Latinas increases the longer they have lived in the United States and the more generations it has been since their ancestors moved here. Some of these risk factors are understood, but not all of them. **Laura Fejerman of UCSF** investigated possible contributing factors by evaluating reactive electrophiles (substances attracted to electrons that damage DNA and proteins) and hormone receptor disruptors (chemicals that mimic the effect of estrogen or androgen on cell receptors). She tested blood from 90 Mexican American women who participated in the San Francisco Bay Area Breast Cancer Study, a population-based case-control study of women aged 35 to 79 years, and found that genetic ancestry and alcohol intake might in part be associated with breast cancer risk through mechanisms linked to the endocrine system. Findings were published in Carcinogenesis (2016).

Table 13: Etiology and Prevention Projects Completed in 2015–2020*

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Full Research Award	2012	HERMOSA: Hlth & Enviro Res on Make-up of Salinas Adolescents	Kim Harley Kimberly Parra	UC Berkeley Clinica de Salud del Valle de Salinas	$691,526
CRC Full Research Award	2013	Reporting Personal Levels of Environmental Chemicals: Impact	Barbara Cohn Laurie Havas	Public Health Institute	$756,093

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Pilot Award	2013	Is Cost of Beauty Putting Black women at Risk? IEAAWC Study	Susanne Montgomery	Loma Linda University	$218,500
			Phyllis Clark	Healthy Heritage Movement	
			Eudora Mitchell	Quinn Community Outreach Corporation	
CRC Pilot Award	2013	Using CBPR to Promote Environmental Justice in Wilmington, CA	Annette Maxwell	UCLA	$187,500
			Jesse Marquez	Coalition for a Safe Environment	
CRC Pilot Award	2013	Cadmium and Arsenic Exposure in a Mining Impacted Community	Joanne Hild Jane Sellen	Sierra Streams Institute	$202,989
			Peggy Reynolds	Cancer Prevention Institute of California	
CRC Full Research Award	2015	Peer-to-Peer Reduction of Pesticide Exposure to Latina Youth	Kim Harley	UC Berkeley	$650,163
			Kimberly Parra Jose Camacho	Clinica de Salud del Valle de Salinas	
CRC Pilot Award	2015	Impact of Reducing Chemical Exposure to the Human Breast	Polly Marshall	Breast Cancer Over Time	$244,752
			Shanaz Dairkee	California Pacific Medical Center Research Institute	
CRC Pilot Award	2015	Cadmium Exposure in a Mining Impacted Community	Joanne Hild Jane Sellen	Sierra Streams Institute	$202,110
			Peggy Reynolds	Cancer Prevention Institute of California	
CRC Pilot Award	2015	ReThink Plastic	Barbara Cohn Marie Loverde	Public Health Institute	$171,408
			Sandra Curtis	Earth Island Institute	

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Pilot Award	2017	Dirt Alert: Legacy Mining Contaminant Exposure in Preschool	Joanne Hild Peggy Reynolds	Sierra Streams Institute Cancer Prevention Institute of California UCSF	$179,659
CRC Pilot Award	2018	Assessing Breast Health in Urban Oil Drilling Communities	Jill Johnston Nancy Halpern Ibrahim	University of Southern California Esperanza Community Housing	$197,740
IDEA	2012	Maternal Folic Acid Intake, Mammary Development, and Cancer	Joshua Miller Russell Hovey	UC Davis	$149,944
IDEA	2012	Predicting BRCA1 Mutation Status from Tumor Pathology	Ann Hamilton	University of Southern California	$245,821
IDEA	2013	Getting a Jump on Cancer with a Genomic Risk Classifier	Robert West	Stanford University	$251,119
IDEA	2013	Internal Chemical Exposure Study among Mexican Immigrants	Laura Fejerman	UCSF	$124,414
IDEA	2014	Breast Cancer and the Human Oral Microbiome	Michael Campbell	UCSF	$187,221
IDEA	2014	Persistent Organic Pollutants and Mammographic Density	Eunjung Lee	University of Southern California	$247,534
Conference Award	2015	GIS for Community Impact: From Technology to Translation	Janice Barlow	Zero Breast Cancer	$19,847
Conference Award	2019	Women's Health and Environmental Justice	Janet Pregler	UCLA	$25,000

* Grant titles in this table may appear to repeat due either phased research (a pilot grant followed by a full research grant) or due to continuation grants being given.

Table 14: Etiology and Prevention Projects in Progress in 2015–2020*

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Full Research Award	2017	Women Worker Biomonitoring Collaborative (WWBC)	Rachel Morello-Frosch Heather Buren Erin Carrera	UC Berkeley Breast Cancer Prevention Partners	$790,314
CRC Pilot Award	2017	Reducing Breast Cancer Risk in Korean American Women	June Lee Janice Tsoh	Korean Community Center of the East Bay UCSF	$176,089
CRC Full Research Award	2018	In Vivo Impact of Xenoestrogen Exposure on the Human Breast	Shanaz Dairkee Polly Marshall	California Pacific Medical Center Research Institute Breast Cancer Over Time	$971,998
CRC Full Research Award	2018	Reducing Latina Womens Exposure to Cleaning Chemicals	Kim Harley Norma Morga	UC Berkeley Clinica de Salud del Valle de Salinas	$740,898
CRC Full Research Award	2019	Breast Cancer Risks from California's Gold Mining Legacy	Peggy Reynolds Joanne Hild	UCSF Sierra Streams Institute	$590,787
CRC Pilot Award	2020	GRAton PEsticides (GRAPE): Exposure potential from groundwater and air in California Wine Country	Jane Sellen Peggy Reynolds	Pesticide Action Network - North America UCSF	$190,029

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Full Research Award	2020	Breast Health and the Environment among Latinas in Los Angeles (BELLA) Study	Jill Johnston Nancy Ibrahim	University of Southern California Esperanza Community Housing	$908,051
IDEA	2019	Enhancing Muscle Strength and Immunity in Breast Cancer	Joanna Davies	San Diego Biomedical Research Institute	$285,838
Translational Research Award	2019	Ambient Air Toxics and Breast Cancer Risk, Phase 2	Julia Heck	UCLA	$510,057
Community-Led Conference Award	2020	Nail Salon Worker Health and Safety Research Conference	Lisa Fu	Asian Health Services	$25,000
Conference Award	2020	Breast Cancer and the Environment Workshop	Michele Rakoff	Breast Cancer Care and Research Fund	$25,000

* Grant titles in this table may appear to repeat due either phased research (a pilot grant followed by a full research grant) or due to continuation grants being given.

Detection, Prognosis, and Treatment

Until we learn how to prevent all breast cancers, research on detection, prognosis, and treatment is critical. CBCRP funds research focused on utilizing novel imaging technologies for detection and developing new biomarkers and genomic/proteomic approaches for more accurate diagnosis and prognosis. CBCRP supports research on less toxic and more individualized therapies, mechanisms of drug resistance, and evaluations of alternative medicines and natural products. Specific topics for research in this area might include the following:

- **Imaging, biomarkers, and molecular pathology: Improving detection and diagnosis —** CBCRP encourages research into new, cost-effective technological and biological approaches for molecular imaging and new approaches for tumor analysis at the individual patient level. This includes advanced types of molecular classification, new biomarker development, and improved technologies for patient diagnosis and prognosis, especially using techniques to replace the current practice of screening mammography and biopsy.
- **Innovative treatment modalities: Search for a cure —** Promising leads from biology-based studies are encouraged to begin translating research findings into clinical applications. Examples include immunotherapy, delivery technologies, gene therapy, new drug development/testing, and new approaches to clinical decision-making. Testing investigational anti-breast cancer agents for mechanism of action and identifying target patient populations are encouraged.

CBCRP invested $12.7 million in 46 investigator-initiated detection, prognosis, and treatment research projects that were conducted between 2015 and 2020. Below are highlights of a selection of research projects CBCRP has funded. Tables 15 and 16 list research projects that were completed between 2015 and 2020 and in progress for all research related to detection, prognosis, and treatment.

Highlights of Projects Completed in 2015-2020

Sulindac-Derived Compounds for Breast Cancer Therapy
Resistance of breast cancer to available therapies and lack of treatment for triple-negative breast cancer represent critical unmet medical needs in the treatment of breast cancer. **Xiao-kun Zhang of Sanford Burnham Prebys Medical Discovery Institute** sought to build on his previous discovery that nonsteroidal anti-inflammatory drug Sulindac and Sulindac-derived compounds (analogs) could bind to the truncated retinoid X receptor-alpha (tRXRa) and inhibit its oncogenic activities, leading to the growth inhibition of breast cancer cells. Through this study he and his team designed and synthesized over 40 Sulindac analogs. The analogs were evaluated for their binding to RXRa and induction of breast cancer cell apoptosis, and some of them show promise to treat TNBC. One of these, K-80003, which displays very desirable toxicological and pharmacological profiles, is under evaluation by FDA for clinical trial against cancers and has a pending patent application. Findings were widely published in Acta Pharmacol Sin (2014), Carcinogenesis (2014), Cancer Research (2015), Protein & Cell (2015), Acta Biochimica et Biophysica Sinica (2015), The British Journal of Pharmacology (2016), and Bioorganic & Medicinal Chemistry (2016).

Technologies for Augmented Reality Breast Surgery
One quarter of women who undergo breast lumpectomy to treat early-stage breast cancer in the United States undergo a repeat surgery due to concerns that residual tumor was left behind. This has led to a significant increase in women choosing mastectomy operations in the United States. In order to reduce the number of repeated surgeries by improving surgeons' ability to determine tumor extent, **Bruce Daniel of Stanford University** sought to develop a method to project highly accurate pre-operative breast MRI data onto the patient at the time of surgery, thereby improving the ability to plan lumpectomy, and eventually guide surgery. The research team was able to develop and pilot test a mixed-reality system that projects a 3D “hologram” of images from a breast MRI onto a patient. First results from breast cancer surgeries have shown that mixed-reality guidance can indeed provide information about tumor location, which has the potential to improve the lives of many patients. Further research is needed, but initial findings are promising. Findings were published in the Institute of Electrical and Electronics Engineering (2017).

Cardiovascular Toxicity Following Aromatase Inhibitor Use
Aromatase inhibitors (AIs) are becoming the cornerstone in breast cancer treatment among post-menopausal survivors with hormone-positive disease. However, emerging research raised concern that AIs could increase the risk for cardiovascular disease, a major cause of death in breast cancer survivors. **Reina Haque of Kaiser Foundation Research Institute** investigated this possible connection. While accounting for women's other potential cardiovascular risk factors as well as medication used to treat high blood pressure and high cholesterol, she was able to determine that the use of AIs was not associated with an increased risk of fatal cardiovascular events, including heart attacks or stroke, compared with tamoxifen, another commonly prescribed anti-cancer drug that works on hormones and which has been associated with a serious risk of stroke. Findings were published in Cancer (2015), JAMA Oncology (2016), and Breast Cancer Research and Treatment (2019).

Intranasal Drug Delivery for Brain Metastatic Breast Cancer
Historically, there has been no effective therapy for breast cancer that has spread to the brain. A major roadblock is that the usual breast cancer drugs are not able to penetrate the blood-brain-barrier and, therefore, do not reach metastases in the brain. The current gold standard chemotherapy for a certain type

of brain tumor is temozolomide (TMZ), which is given orally and crosses the blood-brain-barrier reasonably well, but can cause harmful bone marrow suppression. The natural product perillyl alcohol (POH), which is found in many plants including fruits, is fairly potent in treating cancer, but can cause severe intestinal side effects when taken orally. Recent research found that this agent could be inhaled with little to no side effects and with promising results. Conducting experiments on mice, **Axel Schonthal of University of Southern California** found preliminary promising results when injecting a TMZ-POH combination in mice led to not only reduced metastatic spread of cancer cells but also reduction in metastasis in the brain and elsewhere. Researchers hope to expand these trials to larger samples and investigate ways to deliver the medication through nasal inhalation. Findings were published in Molecular Cancer Therapies (2014) and The American Journal of Cancer Research (2015).

Predicting Breast Cancer Recurrence to Improve Care

Better breast cancer screening has led to better detection of breast cancer. However, some types of breast cancers pose no significant health threats because they rarely spread and are not expected to become symptomatic. Unfortunately, current screening practices are unable to determine which detected breast cancers pose actual risks, leading to significant overtreatment. **Laura Esserman of UCSF** sought to find predictors that enable more personalized breast cancer treatment. In particular, she investigated whether there are molecular and pathologic features that would allow clinicians to safely recommend less therapy for those who were not at high risk for progression of cancer. Using the 70-gene MammaPrint assay, the first genomic test that analyzes the activity of certain genes in early-stage breast cancer to be cleared by the U.S. Food and Drug Administration, Esserman was able to define a group of "ultralow risk" patients whose prognosis for dying from breast cancer is low enough that they can forego aggressive treatments. Results were published in Breast Cancer Research and Treatment (2017), the Journal of the American Medical Association Oncology (2017), and the Journal of the National Cancer Institute (2018).

Table 15: Detection, Prognosis and Treatment Projects Completed in 2015–2020

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
CRC Pilot Award	2014	API-Friendly Resources for BC Clinical Trials	Fe Seligman	Operation Samahan Inc.	$195,540
			Vanessa Malcarne	San Diego State University Research Foundation	
			Georgia Sadler	UC San Diego	
IDEA	2012	Genetic Predictors of Chemotherapy Toxicity in Breast Cancer	Deanna Kroetz	UCSF	$99,998
IDEA	2013	Vitamin D Signals Via a Novel Pathway to Inhibit Metastasis	Brian Feldman	Stanford University	$236,068
IDEA	2013	Expression Profiling of Circulating Tumor Cells	Julie Lang	University of Southern California	$244,591
IDEA	2013	Imaging, Genomics, and Glycoproteomics for Cancer Detection	Sharon Pitteri	Stanford University	$235,348

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
IDEA	2013	Intranasal Drug Delivery for Brain Metastatic Breast Cancer	Axel Schonthal	University of Southern California	$242,382
IDEA	2014	Gut Microbiota in Association with Chemotherapy Treatment	Anna Wu	University of Southern California	$246,936
IDEA	2014	A Novel TNBC Therapeutic Opportunity: Cystine Addiction	Luika Timmerman	UCSF	$187,330
IDEA	2014	CT Guided DOT for Breast Cancer Imaging	Changqing Li	UC Merced	$187,500
IDEA	2014	Drug to Block Double-Strand Break Repair in Breast Cancer	Gilbert Chu	Stanford University	$160,500
IDEA	2014	Sulindac-Derived Compounds for Breast Cancer Therapy	Xiao-Kun Zhang	The Burnham Institute for Medical Research	$292,498
IDEA	2015	Unique Camel-Human Hybrid mAbs against Pro-Invasive MMP-14	Xin Ge	UC Riverside	$241,174
IDEA	2015	Exploiting Senescence for Breast Cancer Prevention and Treat	Charles Spruck	The Burnham Institute for Medical Research	$292,500
IDEA	2015	Identification of Novel Breast Cancer Therapeutic Antibodies	Gary Johanning	SRI International	$299,273
IDEA	2015	Localized Probability of Mammographic Masking	John Shepherd	UCSF	$124,112
IDEA	2015	High-resolution Dynamic PET for Breast Tumor Differentiation	Guobao Wang	UC Davis	$186,042
IDEA	2016	Technologies for Augmented Reality Breast Surgery	Bruce Daniel	Stanford University	$232,647
IDEA	2016	Preclinical Analysis of MAD28 in Inflammatory Breast Cancer	Emmanuel Theodorakis	UC San Diego	$210,715
IDEA	2017	Targeting Metastatic TNBC by Scavenging Blood Glutamate	Zena Werb	UCSF	$188,680
IDEA	2017	Novel Compound to Target Breast Cancer Stem Cells	Dieter Wolf	The Burnham Institute for Medical Research	$286,845

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	Dollars
IDEA	2017	A New Targeted Therapy for Breast Cancer	Xiaohua Wu	Scripps Research Institute	$290,250
Translational Research Award	2012	Using Epigenetic Changes to Stratify DCIS Biopsies	Thea Tlsty	UCSF	$750,000
Translational Research Award	2012	Predicting Breast Cancer Recurrence to Improve Care	Laura Esserman	UCSF	$793,022
Translational Research Award	2013	Cardiovascular Toxicity Following Aromatase Inhibitor Use	Reina Haque	Kaiser Foundation Research Institute	$465,258
Translational Research Award	2015	STOP Heart Disease in Breast Cancer Survivors	Marc Goodman	Cedars-Sinai Medical Center	$469,122
Translational Research Award	2016	Preventing Tumor Progression in Women with High-Risk DCIS	Thea Tlsty	UCSF	$948,305
Conference Award	2015	UCSF Breast Oncology Program Scientific Retreat	Laura van't Veer	UCSF	$12,000
Conference Award	2017	UCSF Breast Oncology Program Scientific Retreat 2017	Lamorna Brown-Swigart	UCSF	$21,021

Table 16: Detection, Prognosis and Treatment Projects in Progress in 2015–2020

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	
IDEA	2018	Improving Health of Women on Aromatase Inhibitors	Catherine Carpenter	UCLA	$187,403
IDEA	2018	Targeting IGF2 and Androgen Receptors for TNBC Therapy	Nalo Hamilton	UCLA	$187,436
IDEA	2018	Dietary Asparagine Limitation to Augment Immune Therapy	Simon Knott	Cedars-Sinai Medical Center	$255,867
IDEA	2018	Metformins in Triple-Negative Breast Cancer Immunotherapy	Richard Pietras	UCLA	$187,358
IDEA	2018	Targeting Tumor-Initiating Niche to Overcome Chemoresistance	Jing Yang	UC San Diego	$187,500

Award Type	Fund Year	Title	Investigator(s)	Institution(s)	
IDEA	2019	Novel Ab-(IL-12) Fusion Proteins for Breast Cancer Therapy	Manuel Penichet	UCLA	$187,500
IDEA	2019	Non-Contrast MRI Breast Cancer Screening	Rebecca Rakow-Penner	UC San Diego	$187,501
IDEA	2019	Tumor and Liquid Biopsy-Based Biomarkers for Immunotherapy	Laura van't Veer	UCSF	$187,500
IDEA	2019	Immunotherapeutic Exosomes for Triple Negative Breast Cancer	Yong Zhang	University of Southern California	$247,500
IDEA	2020	Viro-Immunotherapy for Triple Negative Breast Cancer	Shyambabu Chaurasiya	Beckman Research Institute of the City of Hope	$263,614
IDEA	2020	Pharmacological Targeting of Cholinergic Receptors as a Novel Breast Cancer Immunotherapy	Brian Eliceiri	UC San Diego	$195,000
IDEA	2020	Targeting FBXO44/SUV39H1 Silencing of LINE-1 Retrotransposons to Prevent Breast Cancer Recurrence	Charles Spruck	Sanford Burnham Prebys Medical Discovery Institute	$292,500
IDEA	2020	A Genomic Insert of Immune Suppression for the Negative Prediction of Cancer Survival	Paola Betancur	UCSF	$194,547
Translational Research Award	2020	A Novel Agent to Treat Breast Cancer Brain Metastases	Melanie Hayden Gephart	Stanford University	$1,078,117

Biology of the Breast Cell

Although basic science research in cancer is well-supported by other agencies, there remains a critical need to understand the pre-neoplastic, causative events of breast cancer at the tissue level, including the stroma. The genetic changes in disease progression and the tumor heterogeneity need clarification at the basic science level. CBCRP encourages breast cancer stem cell research. Specific topics for research in this area might include the following:

Biology of the normal breast: The starting point — Research should explore aspects of normal breast biology (e.g., aging) that are linked to the earliest stages of breast cancer, and which could provide insights into new approaches to prevent, detect, or treat the disease.

Pathogenesis: Understanding the disease — Research must specifically focus on breast cancer tumor and stromal biology, including:

- Studies of relevant proteins and genes with an emphasis on their relationship to the actual disease; and
- Studies on elucidating key cell signaling, growth control, cell cycle, and apoptosis pathways.

CBCRP especially encourages new research on the process of metastasis and the development of tools and models to better understand the key metastatic events that affect patient survival.

CBCRP invested $2.7 million in 13 investigator-initiated research conducted on the biology of the breast cell between 2015 and 2020. Below are highlights of a selection of research projects CBCRP has funded. Tables 17 and 18 lists research projects that were completed between 2015 and 2020 and in progress for all research related to biology of the breast cell.

Highlights of Projects Completed in 2015-2020

Mechanical Stressors and Age as Regulators of Telomerase
While there is no one cause of breast cancer, as women age, the cells responsible for maintaining healthy breast tissue stop responding to their immediate surroundings, including mechanical cues that should prompt them to suppress nearby tumors. **Mark LaBarge of Lawrence Berkeley National Laboratory** sought to identify safe, effective interventions that can prevent breast cancer progression from pre-malignant lesions to primary or metastatic cancer by examining mechanical stressors and age-regulated telomerase activity in normal human mammary epithelial cells (telomeres are the protective caps on the ends of the strands of DNA called chromosomes). He invented the qTRAP assay, which can help quantitatively compare the impact of cells and conditions on telomerase activity. He also demonstrated YAP, a protein that controls the rate of transcription of genetic information, increases telomerase activity, and that telomerase activity can be decreased by the inhibitor of YAP/TEAD, verteporfin, which is a clinically approved molecule. Findings were published in Gerontology, Molecular Biology of the Cell (2015) and Frontiers in Cell and Development Biology (2015).

Systemic Metabolic Reprogramming by BC-Secreted microRNAs
One emerging hallmark of cancer is the altered use of energy to fuel rapid growth of tumor. Using various mechanisms, cancer cells often have enhanced abilities to utilize nutrients such as glucose and amino acids. However, cancer cells compete for access to these nutrients with non-cancerous cells co-residing in the tumor microenvironments. **Emily Wang of Beckman Research Institute, City of Hope and UC San Diego** researched how breast cancer-secreted microRNAs (miRNA – a cellular RNA fragment that prevents the production of a particular protein) alter nutrient metabolism in normal non-cancerous cells, and the effect of this action on breast cancer metastasis. She found that cancer cells can suppress glucose uptake by non-cancerous cells in the pre-metastatic niche and that cancer-cells secrete miR122, a specific miRNA that facilitates metastasis by increasing nutrient availability in the pre-metastatic niche. She also found that by modifying glucose utilization by recipient premetastatic niche cells, cancer-derived extracellular miR-122 changes systemic energy metabolism to facilitate disease progression, showing novel insights into the dynamic communication between cancer and the host during disease progression. Building off these findings, she also discovered that oral administration of plant miRNA can inhibit cancer growth in mammals. Findings were published in Nature Cell Biology (2015), Clinical Cancer Research (2016), Cell Research (2016), and Cancer and Metastasis Reviews (2016).

Targeting Breast Cancer Metastasis to Bone

Most breast cancer deaths result from metastasis, a process in which cancer cells depart from the tumor in the breast and travel through the bloodstream to colonize and undermine the function of distant organs. Currently, there is no cure for metastatic breast cancer, which is most commonly found in bones. Building off previous work studying breast cancer cell responses in bone tissue fragments, **Christopher Contag of Stanford University** sought to adapt his model system for testing therapies to prevent and treat breast cancer metastasis to bone by measuring the response of breast cancer cells to treatment agents as they grow within the bone fragments. This effort led to the development of a validated platform to evaluate new, more effective therapies to prevent and treat breast cancer metastasis to bone. Findings were published in the Journal of Visualized Experiments (2015), Neoplasia (2015) and Breast Cancer Research (2017).

Table 17: Biology of the Breast Cell Projects Completed in 2015–2020

Award Type	Year Funded	Title	Investigator(s)	Institution(s)	Dollars
IDEA	2012	Establishing Cell Lifespans in Cancer and Normal Breast	Alexander Borowsky	UC Davis	$155,728
IDEA	2014	Mechanical Stressors and Age as Regulators of Telomerase	Mark LaBarge	Lawrence Berkeley National Laboratory	$209,130
IDEA	2014	Systemic Metabolic Reprogramming by BC-Secreted microRNAs	Shizhen Emily Wang	Beckman Research Institute of the City of Hope UC San Diego	$233,268
IDEA	2014	Targeting Breast Cancer Metastasis to Bone	Christopher Contag	Stanford University	$237,448
IDEA	2015	Cell-free Tumor DNA in CSF Decodes Breast Cancer Brain Mets	Melanie Hayden Gephart	Stanford University	$236,541
IDEA	2017	Cancer Stem Cell-Mediated Immune Escape	Kuan-Hui Chen	UC Riverside	$187,500
IDEA	2017	Targeting Internal Ribosome Entry Site Transacting Factors	Mark Pegram	Stanford University	$233,311
IDEA	2017	Targeting Heterochromatic RNAs in High Risk Breast Cancer	Inder Verma Tony Hunter	Salk Institute for Biological Studies	$291,000

Table 18: Biology of the Breast Cell Projects in Progress in 2015–2020

Award Type	Year Funded	Title	Investigator(s)	Institution(s)	Dollars
IDEA	2018	Adipose-Rich Microenvironment in Breast Cancer	Fahumiya Samad	San Diego Biomedical Research Institute	$288,000
IDEA	2019	Unraveling the Mutagenic Mechanisms of Breast Cancer	Remi Buisson	UC Irvine	$125,000
IDEA	2019	Mechanisms Underlying Cellular Addiction to HER2	Mark Moasser	UCSF	$186,874
IDEA	2019	Defining the Metastasis-initiating Cancer Stem Cells	Olga Razorenova	UC Irvine	$184,337
IDEA	2020	Targeting Immunometabolism to Increase the Efficacy of Breast Cancer Immunotherapy	Michael Campbell	UCSF	$195,500
IDEA	2020	Cell Surface Enablers of Breast Cancer Metastasis	Zena Werb	UCSF	$130,000

Emergency COVID-19 Research Seed Funding

In light of the emergence and spread of the coronavirus disease 2019 (COVID-19) in California and beyond, the statewide funding programs of the UCOP Research Grants Program Office (California Breast Cancer Research Program (CBCRP), Tobacco-Related Disease Research Program (TRDRP), California HIV/AIDS Research Program (CHRP), and the Type 1 Diabetes Research Fund together offered up to $2 million to immediately support urgent research to mitigate the pandemic.

Projects of a maximum of $25,000 direct costs and 6 months duration were chosen based on the potential to (a) generate rigorous, actionable science by qualified teams with essential infrastructure support; (b) yield measurable, short-term outcomes that, when taken to scale, can help blunt the impact of the COVID-19 outbreak; (c) address the needs of vulnerable populations, including those with the co-morbid conditions of HIV infection, COPD or other lung diseases, cardiovascular disease, diabetes, or cancer, as well as the medically underserved. Eighty-five seed awards were selected for funding, 35 of which were supported by CBCRP funding. These projects support CBCRP's mission by investigating issues important to cancer patients and the underserved, and have already begun to yield results. Christine Chambers of UCSD investigated the risk/safety of breast feeding following viral exposure. She found preliminarily that the although the virus can be detected in the breast milk of a subset of patients, it did not appear to be active. She published this finding in JAMA (2020). Larger studies will be necessary to confirm this finding

Projects in this initiative supported with CBCRP funding are described in Table 19. A full listing of funded grants can be seen here: https://uckeepresearching.org/rgpo/.

Table 19: COVID-19 Seed Funding

Principal Investigator	Institution Name	Project Title
Eleni Jaswa	UCSF	ASPIRE: Assessing the Safety of Pregnancy In the Coronavirus Pandemic: Prospective Cohort Study
Alysson Muotri	UC San Diego	Blocking the impact of SARS-CoV-2 in neurodevelopment
Eric Small	UCSF	Does a Cancer Diagnosis Increase the Risk of SARS-C0V-2 Infection?
Monica Gandhi	UCSF	Evaluation of the Interplay between HIV and COVID-19 in a Large Urban Safety-net HIV Clinic
Stuart Gansky	UCSF	Pilot Trial of Antiseptic Gargling for SARS-CoV-2 Transmission Prevention in Health Care Workers
Jyu-Lin Chen	UCSF	Rapid Response Nursing Triage Outcomes for COVID-19 – RN TO COVID study
Erik Kistler	UC San Diego	Serum amylase levels as predictive of outcome in severely ill COVID-infected patients
Patrick Mercier	UC San Diego	A Discrete Digital COVID-19 Wearable Symptom Tracker
Kevin Morris	Beckman Research Institute of the City of Hope	A functional neutralization assay for discovery of SARS-CoV-2 protected people in California
Reginald Penner	UC Irvine	A Virus BioResistor to Detect Anti-SARS-CoV-2 Antibodies for COVID-19 Disease Status Monitoring
Ralph Wang	UCSF	Emergency Provider COVID-19 Cohort Study (EPCOT)
Christina Chambers	UC San Diego	Evaluating the Effects of COVID-19 Infection in Pregnancy and Lactation
Su-Ying Liang	Palo Alto Medical Foundation Research Institute	Impact of COVID-19 on Cancer Care Management
Judith Varner	UC San Diego	PI3Kgamma inhibitor IPI549 as a therapeutic for COVID-19
Bradley Pollock	UC Davis	Prospective Cohort Study of Health Care Workers to Determine Natural History of COVID-19 Infection
Michael Springborn	UC Davis	Quantifying demographic differences in social distancing and impacts of COVID-19 across the U.S.
Shuvo Roy	UCSF	Reusable Viral Filtration Filter for PPE

Principal Investigator	Institution Name	Project Title
Keith Mostov	UCSF	Secretory IgA for Passive Mucosal Immunization against SARS CoV-2
Rita Hamad	UCSF	Socioeconomic and geographic disparities in COVID-19 infections in San Francisco
Randall Kuhn	UCLA	A data-driven response to coronavirus among homeless clients in LA County
Mark Yarborough	UC Davis	Assessing the outcomes and disparity implications of triage policies allocating scarce resources
Alicia Fernandez	UCSF	Barriers and Facilitators of COVID-19 Public Health Measures Among High Risk Latino Immigrants
Robin Petering	Lens Collective LLC	Connecting persons experiencing homelessness to COVID-19 services through intelligent messaging
Lia Fernald	UC Berkeley	Effects of COVID-19 Mitigation Strategies on Economically-Disadvantaged Families in California
Maria-Elena Young	UC Merced	Health and economic impact of the COVID-19 pandemic on Latino immigrant families in rural California
Paul Ong	UCLA	Identifying Californian neighborhoods most at risk from the economic impacts of COVID-19
Margaret Handley	UCSF	Improving Uptake of Health Messaging Among English as a Second Language Communities in California
May Sudhinaraset	UCLA	In the Shadows: The Social, Economic, and Health Impacts of COVID-19 among Undocumented Immigrants
Mindy Hebert-Derouen	UCSF	Mobile data collection for resource allocation in response to the pandemic induced recession
Aladdin Shadyab	UC San Diego	Outcomes in Older COVID-19 Patients with Comorbidities in the Geriatric Emergency Department
Edward Flores	UC Merced	Protecting Food-Chain Workers (and the Public) at the Heart of California
Brenda Eskenazi	UC Berkeley	Psychosocial consequences of COVID-19 in an agricultural Latino community in Salinas Valley
James Murphy	UC San Diego	Reducing disparities in telemedicine among cancer patients during the COVID-19 pandemic

Principal Investigator	Institution Name	Project Title
Neeta Thakur	UCSF	Social and Economic Barriers to COVID19 Testing and Self-Isolation in Vulnerable Populations
Chunyan Yang	UC Berkeley	Understanding Chinese American Adolescents' Risk and Resilience Trajectories in COVID-19 Pandemic

Impact Beyond CBCRP

CBCRP investigators have been pushing the breast cancer research agenda throughout the world by publishing over 2,000 papers stemming from their CBCRP funding. These papers have proven to have strong influence on the field through their quality and strength of citations. When journal articles supported by CBCRP funding are compared to those supported by institutions in the Association of American Universities (AAU), a group of 65 leading research universities in the U.S. and Canada, in the SciVal database by Elsevier, CBCRP articles are cited more often on average and are published in highest quality journals to a greater degree, as shown in Figures 8 and 9.

Figure 7: Field-weighted Citation Impact of CBCRP and AAU Journal Articles Published between 2011-2019 (Source: SciVal, Sept. 2020)

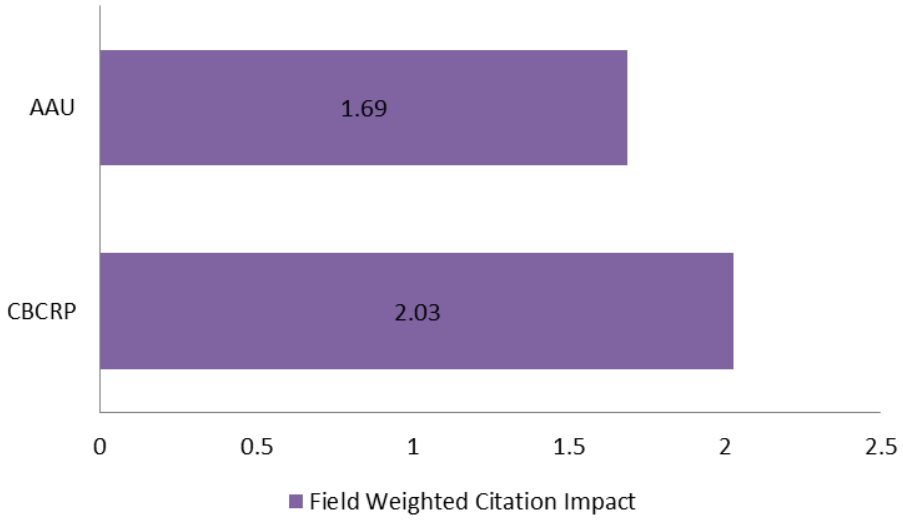
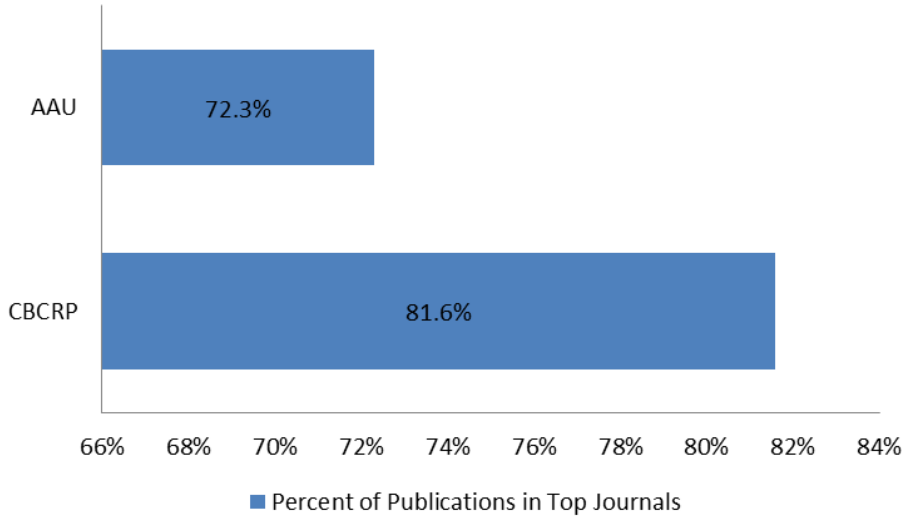


Figure 8: Percent of CBCRP and AAU Articles Published in Top Quartile of CiteScore Rated Journals between 2011-2019 (Source: SciVal, Sept. 2020)



C. Improving CBCRP through Evaluation

CBCRP has a long history of ensuring that research funds are allocated and used effectively by routinely evaluating their work. Since 1999, it has been common practice to utilize both internal and external evaluators to understand the strengths and challenges of different funding opportunities, as well as to understand if the funding led to the hoped for results. The results of these evaluations are used to update or reprioritize funding allocations and mechanisms or to initiate new programs. Evaluations are published publicly in an effort to be transparent and to share learnings.

In addition to the evaluations CBCRP conducted on QuickStart, the Special Research Initiatives, and Translational Awards, in 2018 an evaluation was undertaken on overall operations of the UCOP Research Grants Program Office (RGPO), which houses CBCRP.

By 2018, RGPO's budget had grown to the point that it was more than one-sixth of the total UCOP budget. At the same time, staffing levels at CBCRP and other RGPO research programs had remained stable, stretching staff capacity considerably. UCOP had also been heavily scrutinized in previous years due to a perceived lack of transparency in budgets and spending. These combined factors led UCOP to conduct an assessment of whether the current RGPO arrangements were serving the research institutions and the state in the best ways possible.

To conduct the evaluation, an independent consulting group interviewed RGPO staff and more than 50 stakeholders and surveyed numerous background documents to assess whether any changes should be recommended to improve the department. Current and projected income, pros and cons of continuing to house RGPO at UCOP or move it to either a UC campus or create a new distinct UC entity, and challenges of adhering to strict overhead expense limits were central themes of the investigation. Key findings included the following:

1. If the past decade's 3.31% annualized decline in per capita cigarette sales holds true for the next decade, and California's official projected population growth through 2030 (0.84%) actualizes, CBCRP can expect allocations to decline by approximately $3.95 million, or 37%, from FY19 levels by FY28.
2. Given the relatively fixed nature of administrative costs, CBCRP may be hard-pressed to remain under the 5% statutory cap on administrative expenses – and to keep award sizes at desirable levels – unless applications and/or success rates drop accordingly, or alternative sources of revenue are uncovered.
3. To date, efforts to develop new revenue streams have proved only minimally effective, with donations from AmazonSmile reaching only $529 over one year. In addition, CBCRP has historically received funding from voluntary tax contributions on personal California income tax forms and individual donations. Total checkoff allocations have fallen in both nominal and real terms over the past decade and were just 1.6% of the program's total allocation for FY19, down from a high of 5.7% at the start of the decade.
4. Stakeholders feel that the RGPO should remain within the UC Office of the President and make strategic changes over time to its structure and operating model to ensure financial and functional sustainability over the long-term.

In light of these findings, RGPO is continuing to be administered as a unit within the Academic Affairs Division, Office of Research & Innovation within UCOP. Further investigation into potential additional funding sources is still underway.

IV. Relationship between Federal and State Funding for Breast Cancer Research

CBCRP is distinct from research programs funded by the federal government in both the sources of funding and in the types of research funded.

CBCRP's Source of Funding: Unique Among the Nation's Breast Cancer Research Agencies
The primary source of funding for CBCRP is a 45% share of revenue from a 2¢ State tax on cigarettes. This source of funding is unique among agencies that fund breast cancer research across the nation. See Table 20 for a description of CBCRP income between July 1, 2015 and June 30, 2020.

Table 20: CBCRP Income, 2015–2020

Fiscal Year	2015–2016	2016–2017	2017–2018	2018-2019	2019–2020	5-Year Summary
Breast Cancer Research Account (007) ALLOCATION	$9,500,000	$5,086,000	$7,159,000	$10,628,000	$10,614,000	$42,987,000
California Breast Cancer Research Fund (0945) ALLOCATION	$421,000	$421,000	$178,000	$178,000	$178,000	$1,376,000
EXTERNAL FUNDING*	$216,000	$216,000	$216,000	$216,000		$864,000
PRIVATE DONATIONS	$30,036	$58,144	$28,094	$16,700	$136,283	$269,257
TOTAL FUNDS	$10,167,036	$5,781,144	$7,581,094	$11,038,700	$10,928,283	$45,496,257

In contrast, funding for breast cancer research at other programs in the U.S. comes from a variety of different sources:

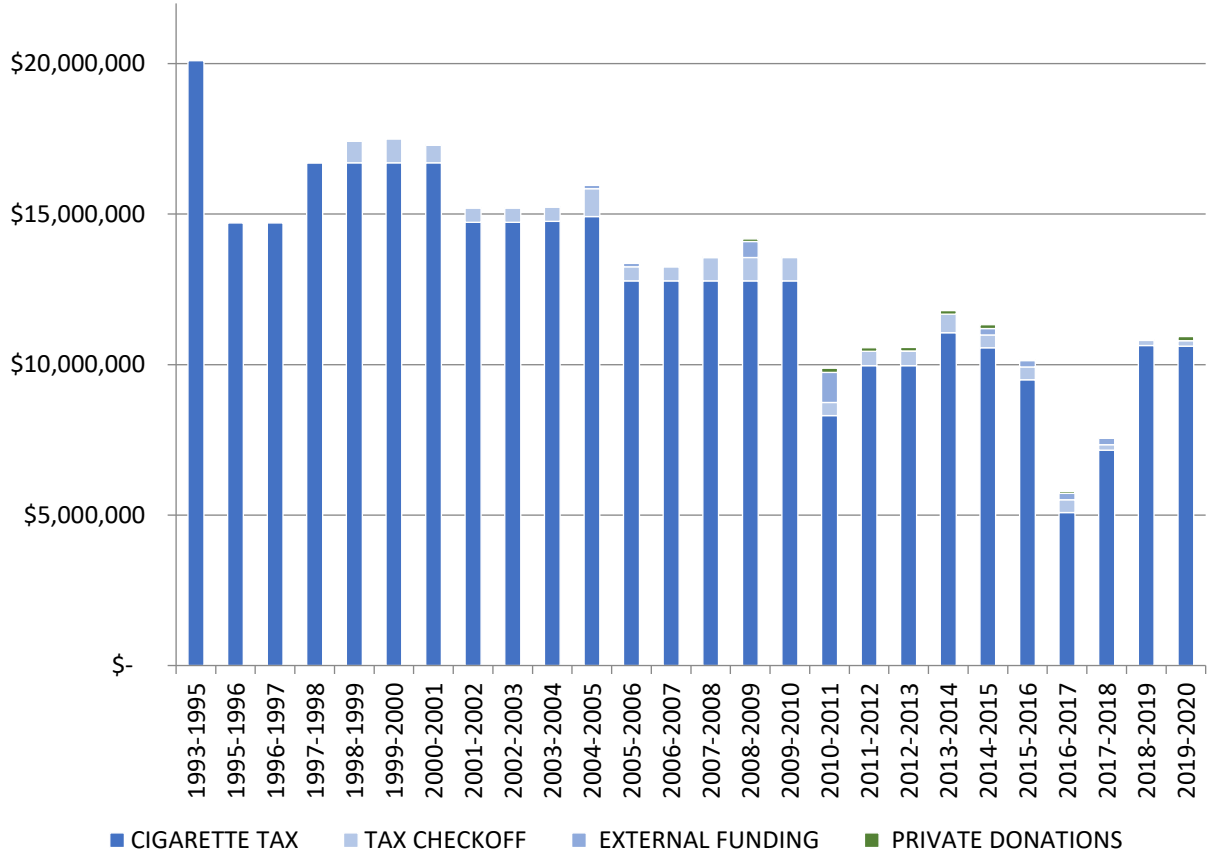
- **Federal Agencies** (National Institutes of Health, Department of Defense) receive funding through Congress from the national budget and from the public's voluntary purchase of more expensive postage stamps;
- **National Voluntary Health Organizations** (such as the American Cancer Society, Komen Foundation, Breast Cancer Research Foundation) receive funding through charitable contributions from individuals, corporations, and foundations;
- **Regional Nonprofit Organizations** (such as the Entertainment Industry Foundation, The Wellness Foundation) also receive funding through charitable contributions; and
- **State Agencies** (such as the New Jersey Breast Cancer Research Fund, Illinois Ticket for the Cure State Lottery, and the Cancer Prevention and Research Institute of Texas, the latter of which includes breast cancer) receive funding from state general funds, auto license fees, lottery ticket sales, and voluntary donations on individual state income tax returns.

The California Breast Cancer Research Program's primary source of funds, a State cigarette tax, is declining due to reductions in smoking. CBCRP does not receive funds from any taxes on non-cigarette tobacco products, such as cigars, chewing tobacco, or e-cigarettes, which are increasing in sales. CBCRP is the only research program funded by a California state tobacco excise tax that derives income solely from cigarette sales and not from other tobacco products. This fact leaves CBCRP's largest resource stream the most vulnerable to the recent steep decline in traditional cigarette usage and sales. This would best be remedied by taxing the same products (cigarettes and other tobacco products) for all of the programs, rather than only cigarettes for CBCRP. CBCRP relies on additional funding sources to address a portion of this gap.

CBCRP also receives funding from the income tax checkoff program, which allows individuals to make voluntary donations on state income tax returns. This was a result of legislation passed by the California State Legislature that authorized donations for five years. In 2017, SB 440 was passed, extending the tax checkoff option to 2024, providing additional years of fairly reliable funding for the program.

To increase these sources of revenue, CBCRP conducts a public outreach and fundraising effort, the Community Partners Program. This effort, begun in 2002, has led to an increase in donations to CBCRP from individuals, businesses, and foundations. CBCRP's Community Partners Program is discussed more fully in the Section V: Activities to Increase Funding for Breast Cancer Research and Awareness of Breast Cancer Research. See Figure 9 for an overview of CBCRP's sources of revenue since the program's inception.

Figure 9: CBCRP Funding Sources, 1994–2020



CBCRP's Unique Funding Contribution to Breast Cancer Research
Since 2015, several federal funding sources have increased their cancer research allocations. For example, the Department of Defense increased its annual breast cancer research funding allocation from $120 million in 2015 to $150 million in 2020. In 2016, the National Cancer Institute launched its Cancer Moonshot initiative, which allocated $1.8 billion in cancer research funding over seven years. These increases in cancer research funding are important; however, the funding priorities focus on more traditional research in treatment and survivorship.

CBCRP remains committed to funding research that is often not considered in these large, national funding streams. We are committed to using the funds provided by the State of California in the most efficient and cost-effective manner, and to adhering to the Program's mandate as defined by the California Legislature. One of CBCRP's mandates is to "fund innovative and creative research, with a special emphasis on research that complements, rather than duplicates, the research funded by the federal government." CBCRP fulfills this mandate in four ways:

1. By funding breast cancer research areas that could have a major impact on breast cancer—including leading to prevention and cure—that are not getting sufficient attention from the federal government;
2. By having expert reviewers from across the U.S. review grant applications for their innovation and impact;
3. Before funding a grant application, reviewing it for overlap with current and pending funding from other agencies; and
4. By taking a leadership role in reducing duplication in state, federal, and international breast cancer research funding.

These four ways of assuring that CBCRP-funded research does not duplicate federally-funded research are each discussed in more detail below.

Funding Promising Areas of Research That Have Not Received Sufficient Attention
The federal government's method for funding research has resulted in some promising areas of breast cancer research being under-funded. The federal government funds most health-related research through the National Institutes of Health (NIH). Most research proposals submitted to the NIH address scientific questions in which the investigators have theoretical and empirical interest, even though there may be no immediate connection to particular diseases. This is the "plant many seeds" approach that has born many truly innovative and groundbreaking discoveries.

CBCRP employs a different and complementary approach, which is to fund scientifically meritorious research that is focused on speeding progress in preventing and curing breast cancer specifically. CBCRP's Research Council sets the Program's funding priorities, taking into account:

- Perspectives from national breast cancer experts;
- Input from California advocates and activists, healthcare providers, public health practitioners, community leaders, biotechnology scientists, and academic researchers; and
- Analyses of current literature on breast cancer and current gaps in knowledge.

The Research Council attempts to identify important research questions that could lead to breakthroughs and that have not received sufficient attention. CBCRP is conducting program-initiated research to fill a significant gap in breast cancer research. CBCRP is addressing three overlapping research questions that California is uniquely positioned to address through program-initiated research. They are the environment's role in breast cancer, the reasons for the unequal burden of breast cancer among various populations of women, and breast cancer prevention. More information on these projects is found in Section III.B.1.

Identifying Innovative Research with Potential for High Impact
To allow the Program's expert reviewers to differentiate applications that are especially innovative and that have the most potential impact on breast cancer, CBCRP created its own scoring system. The scoring system has improved the Program's ability to choose the most innovative research for funding.

In the past, most research funding agencies, including the NIH, scored funding proposals with a single score based solely on scientific merit. With this method, an application with a research plan to test an idea that was not particularly novel could receive the same score as an application with a flawed research plan to test a novel idea. CBCRP's scoring method, based on the recommendations of an NIH Advisory Committee, can distinguish these two applications. CBCRP scores applications separately for innovation, impact, approach, and qualities that are specific to the award type. The separate scores are then used to inform funding decisions. For example, under CBCRP's "impact" criterion, researchers are required to describe the steps necessary to turn their research into products, technologies, interventions, or policies that will have an impact on breast cancer, and describe where their study fits into this critical path. Since CBCRP developed its pioneering scoring system, the NIH has also abandoned the single scientific merit score and developed a system that rates specific application qualities such as innovation and significance.

Reviewing Grant Proposals for Overlap with Federal Funding
As a final step to ensure that CBCRP-funded research doesn't duplicate federally-funded research, breast cancer science experts in other states and CBCRP program officers review all grants recommended for funding for overlap with current and pending federal grants. If overlap with federal funding is found, the overlapping grant (or portion of the grant) is not funded.

Taking a Leadership Role to Reduce Duplication in Federal, State, and International Funding
CBCRP plays a leadership role in an international effort to reduce duplication in cancer research. This effort, the International Cancer Research Partnership (ICRP), includes more than $50 billion in cancer research funding distributed by over 100 government and charitable research funding agencies in the U.S., United Kingdom, Canada, the Netherlands, Australia, and Japan. The organizations that make up the ICRP are working to speed progress by increasing communication and avoiding duplication among agencies that fund cancer research.

One way ICRP pursues these goals is through a research classification system to encourage agencies to report their funding in an accessible and meaningful way. The ICRP web site (https://www.icrpartnership.org/) includes research abstracts from more than 75,000 research projects totaling more than $50 billion in research. The online database is searchable by cancer type, scientific area, funding organization, and other criteria. The web site allows scientists to identify possible collaborators and plan their research based on current research, as well as facilitate dialogue among cancer researchers. Access to information about ongoing research also aids research-funding organizations in strategic planning. The web site also is a useful tool for other groups. Policy makers may use the database during the formulation of new health care and service delivery policies. Healthcare professionals, patients, survivors, and advocates may review the current status of funded research. CBCRP requires that Principal Investigators consult ICRP's database and describe how their proposals are distinct from work that is already funded to ensure that their proposals are truly breaking new ground.

ICRP has also taken international coordination to a higher level. In addition to an updated report on the overall cancer research funding trends in the U.S, U.K., Canada, France, and the Netherlands, the partnership has published evaluations of international funding trends on topics that include metastatic breast cancer, environment and breast cancer, as well as operational best practices https://www.icrpartnership.org/publications.cfm. ICRP partners are actively exploring additional opportunities to analyze research outcomes, identify prospects for collaboration, and refine best operational practices across funding agencies.

V. Activities to Increase Funding for Breast Cancer Research and Awareness of Breast Cancer Research

Funding for CBCRP from the State tobacco tax decreases every year. Moreover, current funds are not sufficient to do all that needs to be done. During 2015–2020, CBCRP turned down investigator-initiated grant applications requesting a total of $26,159,984 that were rated by expert reviewers as having sufficient scientific merit for funding. Commitment and action are needed to ensure present funding sources and increase funds from new sources. CBCRP does this by increasing awareness of breast cancer research through public education and highlighting projects that have the potential to affect the lives of underserved communities with our Faith Fancher Research Award. CBCRP also actively fundraises through a California state voluntary contribution funds program, private foundations, and donations from the public. Progress in these areas is highlighted in this section.

Increasing Voluntary Donations to the California State Income Tax Checkoff Program
To address the pressing need to increase funds, CBCRP established the Community Partners Program, which pursues two goals:

- Increasing donations to CBCRP through the California income tax voluntary contribution program and new sources; and
- Increasing public awareness of breast cancer, breast cancer research, and the California Breast Cancer Research Program.

CBCRP conducts outreach campaigns focused on raising awareness of breast cancer research results and the Program's work to encourage donations through state tax return contributions. A special CBCRP website, "405–Check the Box Fund the Fight" (http://www.endbreastcancer.org), informs stakeholders about fundraising progress. It also summarizes progress researchers achieved with the grants funded via contributions made on state income tax returns. CBCRP has used Google, Facebook, and YouTube ads to alert California taxpayers to these resources.

CBCRP also conducted a combined outreach effort, named Checkoff California, with other California nonprofit organizations who receive these contributions. Together, CBCRP and these nonprofit organizations created a social media marketing campaign to alert the public to the income tax checkoff program that included a presence on Facebook, Twitter, and a website highlighting all nonprofit organizations included in the income tax checkoff program.

The Community Partners Program has led to growth and diversification in donations to CBCRP. An average of 26,000 individuals annually donated over $2.2 million to CBCRP during 2015–2020 through the state income tax checkoff program. This made CBCRP one of the checkoff program's top beneficiary organizations. The grants that were funded in part through voluntary tax contributions are listed in Table 21.

Table 21: Grants funded in part through voluntary tax contributions

Grant Title	Investigator(s)	Institution(s)
Preventing Tumor Progression in Women with High-Risk DCIS	Thea Tlsty	UCSF
Technologies for Augmented Reality Breast Surgery	Bruce Daniel	Stanford University

Grant Title	Investigator(s)	Institution(s)
Preclinical Analysis of MAD28 in Inflammatory Breast Cancer	Emmanuel Theodorakis	UC San Diego
Latino Community Education Tool on Hereditary Breast Cancer	Ysabel Duron Laura Fejerman	Latinas Contra Cancer UCSF
Women Worker Biomonitoring Collaborative (WWBC)	Rachel Morello-Frosch Heather Buren Erin Carrera	UC Berkeley Breast Cancer Prevention Partners
A new targeted therapy for breast cancer	Xiaohua Wu	The Scripps Research Institute
Physical activity intervention for young cancer survivors	Shari Hartman Stori Nagel	UC San Diego Haus of Volta
Reducing Latina Women's Exposure to Cleaning Chemicals	Kim Harley Norma Morga Erin Carrera	UC Berkeley Clinica de Salud del Valle De Salinas Breast Cancer Prevention Partners
Metformins in Triple-Negative Breast Cancer Immunotherapy	Richard Pietras	UCLA
Adipose-rich microenvironment in breast cancer	Fahumiya Samad	San Diego Biomedical Research Institute
Unraveling the mutagenic mechanisms of breast cancer	Remi Buisson	UC Irvine
Breast Cancer Risks from California's Gold Mining Legacy	Peggy Reynolds Joanne Hild	UCSF Sierra Streams Institute
Non-contrast MRI Breast Cancer Screening	Rebecca Rakow-Penner	UC San Diego
Viro-immunotherapy for Triple Negative Breast Cancer	Shyambabu Chaurasiya	Beckman Research Institute of the City of Hope
Targeting immunometabolism to increase the efficacy of breast cancer immunotherapy	Michael Campbell	UCSF
GRAton PEsticides (GRAPE): Exposure potential from groundwater and air in California Wine Country	Jane Sellen Peggy Reynolds Nichole Warwick	Pesticide Action Network UCSF Sonoma Safe Ag Safe Schools

Foundation and Government Funding

CBCRP has been successful in securing grant funds from the National Institute for Environmental Health Sciences and the National Cancer Institute for QuickStart (Award number *R25CA188482),* which is described in Section II.A: Collaborating with Breast Cancer Advocates .

Donations from the Public
Californians continue to demonstrate enthusiasm for CBCRP's research. Thanks to many generous individuals, CBCRP received nearly $270,000 in donations during 2015–2020. Donations can be accepted through the following website: https://www.cbcrp.org/support-us/.

The following organizations and businesses also raised funds for CBCRP through events and campaigns: United Way of the Bay Area; Wells Fargo Community Support Campaign; AT&T Employee Giving Campaign; Bank of America Employee Giving Campaign; Campolinda High School, Moraga CA; Community Foundation for Monterey, Diablo Valley Volleyball Club; DnD Precision; Ella+Mia; Kaiser Permanente Community Giving Campaign; Spectrum Clubs, Inc.; Lighthouse Quilters Guild; Chevron Humankind Matching Community Gift Campaign; Microsoft Matching Gifts Program, Network for Good, Pinkalicious Divas, Lighthouse Quilters Guild, Rockbridge County High School, Lexington VA; Santa Monica Catholic High School; Shell Oil Company Foundation Matching Gifts; Truist; the United Way (Bay Area, California Capital Region, Greater Cleveland, Greater Philadelphia and Southern New Jersey, Wine Country, Silicon Valley, Southeastern Pennsylvania), W.M. Keck Foundation, Wells Fargo Community Giving and Support Campaigns; Women of Color Breast Cancer Survivors; YourCause/PG&E Corporation Foundation Matching Gifts; and YP Lending LLC. DBA L'etoile Sport. CBCRP also received donations from individuals directly and through Amazon Smile purchases. The program has also received bequests between 2015 and 2020 from the Dorothy A Raulin Estate and the Walter Brown Trust.

Honoring a Pioneer in CBCRP Visibility and Fundraising: The Faith Fancher Research Award
Faith Fancher was a long-time television news anchor and personality with KTVU (Oakland) who waged a very public battle against breast cancer. She also was the founding member of the CBCRP Executive Team, which formed in 2001 to help raise the visibility and fundraising profile of the Program. Faith passed away in October 2003 after a six-year struggle with breast cancer. In Faith's honor, CBCRP created the annual Faith Fancher Research Award. The award is presented each year to a researcher or research team embarking on a CBCRP-funded breast cancer study that reflects the values that Faith held most closely and extends the work that Faith did for all women facing breast cancer. The recipients of the Faith Fancher Research Award in 2015-2020 are highlighted in Table 22.

Table 22: Recipients of the Faith Fancher Research Award, 2015-2020

Year	Title	Investigator(s) and Institution (s)
2015	Peer-to-Peer Reduction of Pesticide Exposure to Latina Youth	Kim Harley at UCB and Kimberly Parra at Clinica de Salud del Valle Salinas
2016	Tribal Research Initiative for Breast cancer Awareness and Learning (TRIBAL)	Emmett Chase at the K'ima:w Medical Center and Moon Chen at UC Davis
2017	Dirt Alert: Legacy Mining Contaminant Exposure in Preschool	Joanne Hild at Sierra Streams Institute and Peggy Reynolds at Cancer Prevention Institute of California
2018	Project SOAR: Speaking Our African American Realities	Annette Stanton at UCLA and Denyse Tammie at Carrie's TOUCH, Inc.
2019	Nail Salon Worker Leadership and Reducing Breast Cancer Risk	Charlotte Chang at UC Berkeley and Lisa Fu at Asian Health Services
2020	Peer navigation for African American women during the breast cancer peri-diagnostic period	Lisa Goldman Rosas at Stanford University and Starla Gay at Roots Community Health Center

VI. Looking Forward

Since CBCRP was created 27 years ago, we have made great progress moving forward the field of breast cancer research, especially related to prevention and racial inequities. The Preventing Breast Cancer: Community, Population, and Environmental Approaches Initiative, CBCRP's current strategic initiative to advance breast cancer research, is poised to both deepen and broaden these kinds of research initiatives and has already expanded the network of researchers around the world aware of and contributing to our mission.

With technological developments, there are exciting opportunities to make significant research advancements. For example, the expanded access to big data sets will encourage greater collaboration between research labs, institutions, and researchers in order to process and interpret how these complex information sets can be applied to breast cancer research. CBCRP has already funded research efforts that pilot how to use these kinds of complex data sets, and in the years ahead can be expected to further advance the types of research that are possible.

The organization is also expanding its leadership in funding research that advances real-world public policy improvements. Breast Cancer Prevention Partners' release of the CBCRP-funded California Breast Cancer Prevention Plan is a launching point to apply our foundational scientific understanding of breast cancer prevention to recommendations for changes in community interventions and public policy. We envision projects like this and others will model how to translate science into real world applications in California and beyond.

CBCRP's commitment to cutting edge research, community involvement, innovative partnerships, and streamlined operations are all foundational to the program remaining a global leader in breast cancer research. We are committed to ongoing learning, adapting to a quickly changing world, and staying grounded in research that responds to the needs and concerns of California's large and diverse population.

VII. Appendices

A. Appendix 1: California Breast Cancer Research Program Council (2015–2020)

Chairs
Ana Navarro (2019-2021)
Joan Venticinque (2018-2019)
Lori Marx-Rubiner (2017-2018)
Marjorie Kagawa-Singer (2016-2017)
Sharima Rasanayagam (2015-2016)

Vice-Chairs
Rati Fotedar (2020-2021)
Thu Quach (2019-2020)
Ana Navarro (2018-2019)
David Wellisch (2017-2018)
Lori Marx-Rubiner (2016-2017)
Marjorie Kagawa-Singer (2015-2016)

Advocates
Abigail Arons, M.P.H., Breast Cancer Action (2019-2023)
Michele Atlan, Breast Cancer Care and Research Fund (2019-2023)
Colleen Carvalho, Bay Area Cancer Connections (2019-2023)
Rose Marie Colbert, ABC/African American Community Group of the Central Coast (2015-2018)
Ghecemy Lopez, Celebrate Life Cancer Ministry (2016-2019)
Joann Loulan, Breast Cancer Action (2016-2019)
Lori Marx-Rubiner, Breast Cancer Social Media (2015-2018)
Janice Mathurin, West Fresno Health Care Coalition (2013-2016)
Dolores Moorehead, Women's Cancer Resource Center (2017-2021)
Sharima Rasanayagam, Ph.D., Breast Cancer Fund (2012-2017)
Joan Venticinque, Cancer Patient Advocacy Alliance (2015-2021)
Patricia Wu, Ed.D, Dr. Susan Love Research Foundation (2017-2020)

Scientists/Clinicians
Rati Fotedar, Ph.D., San Diego Community College District (2019-2023)
Richard Jackson, M.D., M.P.H., F.A.A.P. UCLA (2015-2016)
Marjorie Kagawa-Singer, Ph.D., UCLA (2014–2017)
Sharon Lum, M.D., Loma Linda University (2018-2022)
Ana Navarro, Ph.D., UCSD Cancer Center (2016-2021)
Robert Oshima, Ph.D., Sanford Burnham Prebys Medical Discovery Institute (2016-2019)
Sharon Pitteri, Ph.D., Stanford University (2019-2023)
Veronica Vieira, D.Sc. UC Irvine (2017-2021)
Kristiina Vuori, M.D., Ph.D., Sanford-Burnham Medical Research Institute (2013-2016)
David Wellisch, Ph.D., UCLA David Geffen School of Medicine (2013-2016)
Jeffrey Wasserman, Ph.D., RAND Corporation (2015-2018)

Industry Representatives
Lisa Eli, Ph.D., Puma Biotechnology, Inc. (2016-2019)
Marjorie Green, M.D., Genentech (2013-2016)
K. Alice Leung, Sapientiae (2013-2016)
Christine Meda, M.S., IncelDx Inc. (2019-2023)
Stina Singel, M.D., Ph.D, Genentech (2016-2019)
Melanie Smitt, M.D., Genentech (2019-2023)

Medical Specialists
Jon Greif, DO, FACS, Bay Area Breast Surgeons, Inc. (2012-2016)
Francine Halberg, M.D., Marin General Hospital (2016-2019)
Ujwala Rajgopal, M.D.' MD Professional Corporation (2019-2022)

Nonprofit Health Organization Representatives
Dave Hoon, Ph.D., John Wayne Cancer Institute at Providence Saint John's Health Center (2015-2018)
Sarah Hutchinson, ACT for Women and Girls (2016-2017)
Thu Quach, Ph.D., Asian Health Services (2017-2020)
Eileen Schnitger, Women's Health Specialists of California (2015-2016)
Tasha Stoiber, Ph.D., Environmental Working Group (2018-2022)

Ex Officio
Svetlana Popova, M.D., M.P.H., Every Woman Counts Program (2019-ongoing)

B. Appendix 2: California Breast Cancer Research Program Staff (2015–2020)

Current Program staff

Marion H. E. Kavanaugh-Lynch, M.D., M.P.H. Director
Nicholas Anthis, D. Phil., Environmental Health & Health Policy Sciences Program Officer
Katherine McKenzie, Ph.D., Clinical and Prevention Sciences Program Officer
Lisa Minniefield, Program Specialist
Senaida Poole, Ph.D., Community Initiatives & Public Health Sciences Program Officer

Former staff between 7/1/2015–6/30/2020

Carmela Lomonaco, Ph.D., Environmental Health & Health Policy Sciences Program Officer
Lyn Dunagan, Project Coordinator

C. Appendix 3: Steering Committee and Strategy Advisors lists

California Breast Cancer Prevention Initiative Steering Committee

Co-Chairs:

Tracey Woodruff, M.P.H., Ph.D., UCSF
Marion (Mhel) Kavanaugh-Lynch, M.D., M.P.H., California Breast Cancer Research Program

Members:
Julia G. Brody, Ph.D., Silent Spring Institute
Richard Clapp, D.Sc., MPH, Boston University School of Public Health
Jeanne Rizzo, R.N., Breast Cancer Fund
Saraswati Sukumar, Ph.D., Johns Hopkins Medical Institute
Beti Thompson, Ph.D., Fred Hutchinson Cancer Research Center
David Williams, Ph.D., Harvard University

Co-investigator:
Marj Plumb, Dr.P.H., Co-Investigator, Plumbline Consulting and Coaching, Inc.

Ex-Officio Members:
Marc Hurlbert, Ph.D., Avon Foundation for Women
Kimberly Sabelko, Susan G. Komen for the Cure

California Breast Cancer Prevention Initiative Strategy Advisors
Electra D. Paskett, Ph.D., Ohio State University
Jessica Schifano, J.D., M.P.H., U.S. Department of Labor, Occupational Safety & Health Administration
Sarah Gehlert, Ph.D., University of Chicago
George Sawaya, M.D., UCSF
Judy E. Garber, M.D., MPH, Dana Farber Cancer Institute
Kala Visvanathan, M.B.B.S., FRACP, M.H.S., Johns Hopkins Medical Institute
Lisa A. Bero, Ph.D., UCSF
Nsedu Obot Witherspoon, M.P.H., Children's Environmental Health Network
Toshihiro Shioda, M.D., Ph.D., Harvard Medical School
William H. Dow, Ph.D., UC Berkeley
Marjorie Kagawa-Singer, Ph.D., UCLA
Rachel Morello-Frosch, Ph.D., M.P.H., UC Berkeley
Sue Fenton, Ph.D., National Institute of Environmental Health Sciences

Preventing Breast Cancer: Community, Population, and Environmental Approaches Initiative Steering Committee
Marion H.E. Kavanaugh-Lynch, MD, MPH, California Breast Cancer Research Program
Susan Braun, The V Foundation
Julia G. Brody, PhD, Silent Sprint Institute
Ross Brownson, PhD, Washington University in St. Louis Brown School and School of Medicine
Sarah Gehlert, MA, MSW, PhD, University of South Carolina and University of Southern California
Jeanne Mandelblatt, MD, MPH, Lombardi Comprehensive Cancer Center; Georgetown University
Shyrea Thompson, IRIS
David R. Williams, Ph.D., Harvard University
Lori L. Wilson, MD, FAC, Howard University Hospital

Preventing Breast Cancer: Community, Population, and Environmental Approaches Initiative Strategy Advisors

Deborah Bowen, PhD, University of Washington
Shiuan Chen, PhD, Beckman Research Institute of the City of Hope
Mark Clanton, MD, MPH, FAAP, American Cancer Society
Gwen Darien, National Patient Advocate Foundation
Suzanne Fenton, PhD, MS, NIEHS/NIH
Debra Flores, MBA, Valley Children's Healthcare
Marthe R. Gold, MD, MPH, New York Academy of Medicine
Nikia Hammonds-Blakeley, MBA, PhD, The CHAMPION Promise Foundation
Richard Jackson, MD, MPH, FAAP, Center of Occupational and Environmental Health, UCLA
Jon Kerner, PhD , retired
K. Alice Leung, MBA, BS, Sapientiae
Rodney Lyn, PhD, MS, Georgia State University
Rachel Morello-Frosch, PhD, MPH, UC Berkeley
Amelie Ramirez, DrPH, South Texas Research Center
Gina Solomon, MD, MPH, UCSF
Mary Beth Terry, PhD, Columbia University
Mary White, PhD, MPH, RN, Centers for Disease Control and Prevention
Amy Wu, Journalist, Advocate, and Young Survivor
Nerissa Wu, PhD, California Department of Public Health

Policy Research Advocacy Group

Garen Corbett, M.S., University of California Office of the President, UC Berkeley
Angela Gilliard, J.D., University of California Office of the President
Citseko Staples Miller, American Cancer Society Cancer Action Network
Diane Griffiths, Office of Senator Robert M. Hertzberg
Usha Ranji, M.S., Kaiser Family Foundation
Nancy Buermeyer, Breast Cancer Prevention Partners
Karren Ganstwig, Los Angeles Breast Cancer Alliance
Michael Lipsett, CA Department of Public Health, retired

D. Appendix 4: CBCRP 2015-2020 Research Review Committees

Reviewer Role	Reviewer	Title	Affiliation	Location
Clinical, Prevention and Biological Sciences 2015				
Chairs	Leena Hilakivi-Clarke, Ph.D.	Associate Professor, Oncology	Georgetown University	Washington, DC
	Fredika Robertson, Ph.D.	Executive Director, Clinical Research Sciences	Virginia Commonwealth University	Richmond, VA
Scientific	Qihong Huang, M.D., Ph.D.	Associate Professor	The Wistar Institute	Philadelphia, PA
	Shelley Hwang, M.D., MPH	Professor of Surgery	Duke University	Durham, NC
	Cheryl Jorcyk, Ph.D.	Professor	Boise State University	Boise, ID
	Peter Kabos, MD	Assistant Professor	University of Colorado, Denver	Aurora, CO
	Lina Mu, M.D., Ph.D.	Associate Professor	State University of New York at Buffalo	New York, NY
	Jose Russo, M.D.	Professor	Fox Chase Cancer Center	Philadelphia, PA
	Edward Sauter, M.D., Ph.D.	Director, Cancer Treatment and Prevention Center	University of Texas at Tyler	Tyler, TX
	Natalie Serkova, Ph.D.	Director, Colorado Cancer Imaging Core	University of Colorado	Aurora, CO
	Eva Marie Sevick, Ph.D.	Professor and Director	University of Texas	Houston, TX
	Patricia Thompson Carino, Ph.D.	Professor, Dept. of Pathology Assoc Dir. for Basic Res.	State University of New York at Stony Brook	Stony Brook, NY
	Douglas Yee, M.D.	Professor of Medicine and Pharmacology	University of Minnesota	Minneapolis, MN
	Siyuan Zhang, M.D., Ph.D.	Nancy Dee Assistant Professor	University of Notre Dame	Notre Dame, IN

Reviewer Role	Reviewer	Title	Affiliation	Location
Advocate	Lisa DeFerrari, M.B.A.	Advocate	The Virginia Breast Cancer Foundation	Henrico, VA
	Valerie Fraser	Advocate	Michigan Breast Cancer Coalition	Huntington Woods, MI
	Eunice Hostetter	Advocate	Susan G. Komen Foundation	Kirkland, WA
	Kimberly Newman-McCown	Advocate	VWR International, LLC	Radnor, PA
	Carrie Wells	Advocate	Survivors' Retreat	Baltimore, MD
Ad Hoc	Gloria Bachmann, M.D., M.M.S.	Professor, Int. Chair, Assoc. Dean for Women's Health	Robert Wood Johnson Foundation	New Brunswick, NJ
	Ralf Landgraf, Ph.D.	Associate Professor	University of Miami	Miami, FL
Advocate Observer	Eveline Chang, M.S.W.	Manager of Program Development	Women's Cancer Resource Center	Oakland, CA
Community Impact 2015				
Chair	Shiraz I Mishra, MBBS, Ph.D..	Professor, Department of Pediatrics and Family and Community Medicine	University of New Mexico	Albuquerque, NM
Scientific	Monica Ramirez-Andreotta, Ph.D.	Assistant Professor	University of Arizona	Tucson, AZ
	Beti Thompson, Ph.D.	Professor	Fred Hutchinson Cancer Research Center	Seattle, WA
	Grace Sembajwe, Sc.D.	Associate Professor	Hunter College	New York, NY
	Reginald Tucker-Seeley, Sc.D.	Assistant Professor	Harvard University	Boston, MA
	Armin Weinberg	CEO	Life Beyond Cancer Foundation	Houston, TX
	Sacoby Wilson, Ph.D., M.S.	Assistant Professor	University of Maryland	College Park, MD

Reviewer Role	Reviewer	Title	Affiliation	Location
Advocate	Patricia O'Brien	Volunteer	Vermont Cancer Network	Burlington, VT
	Vernal Branch	Independent Research Patient Advocate	Cancer Coalition of Virginia	Richmond, VA
Ad Hoc	Janell Mensinger, Ph.D.	Assistant Professor	Drexel University	Philadelphia, PA
Advocate Observer	Vivian Lee	Board Member	Breast Cancer Connections	Palo Alto, CA
Clinical Prevention and Biological Sciences, 2016				
Chair	Douglas Yee, M..D.	Professor	University of Minnesota	Minneapolis, MN
Scientific	Patrick Bolan, Ph.D.	Associate Professor	University of Minnesota	Minneapolis, MN
	Abenaa Brewster, M.D., M.H.S.	Professor	UT MD Anderson Cancer Center	Houston, TX
	Qihong Huang, M.D., Ph.D.	Associate Professor	The Wistar Institute	Philadelphia, PA
	Shelley Hwang, M.D., M.P.H.	Professor	Duke University	Durham, NC
	Peter Kabos, M.D.	Assistant Professor	University of Colorado	Aurora, CO
	Amos Sakwe, Ph.D.	Assistant Professor	Meharry Medical College	Nashville, TN
	Eva Marie Sevick, Ph.D.	Professor and Director	University of Texas Health Sciences Center	Houston, TX
	Brayan Welm, Ph.D.	Associate Professor	University of Utah	Salt Lake City, UT
	Siyuan Zhang, M.D., Ph.D.	Assistant Professor	University of Notre Dame	South Bend, IN
Advocate	Candy Ciamillo, R.N., B.S.N., M.S.N., A.N.P., C.P.H.Q.	Advocate	Johns Hopkins Breast Cancer Center	Baltimore, MD

Reviewer Role	Reviewer	Title	Affiliation	Location
	Valerie Fraser	Advocate	Inflammatory Breast Cancer International Consortium	Huntington Woods, MI
	Eunice Hostetter	Advocate	Susan G. Komen Foundation	Kirkland, WA
	Kimberly Newman-McCown	Advocate	Susan G. Komen Foundation	New Brunswick, NJ
Ad Hoc	Gloria Bachmann, M.D., M.M.S.	Professor, Int. Chair, Assoc. Dean for Women's Health	Robert Wood Johnson Foundation	New Brunswick, NJ
Advocate Observer				
Community Impact 2016				
Chair	Tom Webster, D.Sc.	Professor	Boston University	Boston, MA
Scientific	Sherrie Flynt Wallington, Ph.D.	Asst. Prof. of Oncology; Prog. Dir., Health Disparities	Georgetown University	Washington, DC
	Laundette Jones, Ph.D.	Assistant Professor	University of Maryland	Baltimore, MD
	Grace Sembajwe, D.Sc.	Professor	Hunter College	New York, NY
	Armin Weinberg, Ph.D.	Clinical Professor Adjunct Professor Adjunct Professor	Baylor College Rice University Texas A&M University	Houston, TX
Advocate	Patricia O'Brien, Ph.D.	Advocate	Vermont Cancer Network	Burlington,VT
	Susan Pelletier	Advocate	Vermont Breast Cancer Coalition	Stockbridge, VT
Advocate Observer	Ghecemy Lopez, M.A.Ed.	Cancer Information Resource Navigator	USC Norris Comprehensive Cancer Center	Los Angeles, CA
Identify Novel Biomarkers of Breast Cancer Risk Related to Environmental Exposures, 2016				

Reviewer Role	Reviewer	Title	Affiliation	Location
Chair	Melissa Troester, Ph.D.	Associate Professor.	University of North Carolina	Chapel Hill, NC
Scientific	Christine B. Ambrosone, Ph.D.	Senior Vice President for Population Sciences, Chair Dept. Cancer Prevention and Control	Roswell Park Cancer Institute	Buffalo, NY
	Robert Clarke, Ph.D., D.Sc.	Dean for Research, Professor of Oncology	Georgetown University	Washington, DC
	Gertraud Maskarinec, M.D., Ph.D.	Professor	University of Hawaii Cancer Center	Honolulu, HI
	Sallie Smith Schneider, Ph.D.	Director, Biospecimen Resource and Molecular Analysis Facility	Baystate Medical Center	Springfield, MA
	Laura N. Vandenberg, Ph.D.	Assistant Professor	University of Massachusetts Amherst	Amherst, MA
Advocate	Marjorie Gallece	Manager	Williamson County Client Services Breast Cancer Resource Center	Austin, TX
	Candace Zito-Gihooly	Advocate	Breast Cancer Network of Strength	Cary IL
Ad Hoc	Costel C. Darie	Associate Professor	Clarkson University	Potsdam, NY
	David Dix	Director, Office of Science Coordination and Policy	US Environmental Protection Agency	Washington, DC
	Leena Hilakivi-Clarke	Professor	Georgetown University	Washington, DC
Impact of Chemical Policy to Reduce or Eliminate Exposures Linked to Breast Cancer, 2016				
Chair	Rachel Massey, M.Sc., MPA	Senior Associate Director and Policy Program Manager	University of Massachusetts Lowell	Lowell, MA
Scientific	Nicholas Ashford, Ph.D.	Professor	Massachusetts Institute of Technology	Cambridge, MA

Reviewer Role	Reviewer	Title	Affiliation	Location
	Dorie Apollonio, Ph.D.	Associate Professor	UC San Francisco	San Francisco, CA
Advocate	Christine Carpenter, Ed.S.	Advocacy Chair	Cedar Valley Cancer Committee's Beyond Pink TEAM	Cedar Falls, IA
California's Breast Cancer Primary Prevention Plan 2016				
Chair	Robert Daly, MD	Chief Fellow	University of Chicago	Chicago, IL
Scientific	Beverly Levine, Ph.D.	Research Associate	Wake Forest University	Winston-Salem, NC
	Mary C. White, Sc.D., M.P.H.	Chief	Centers for Disease Control and Prevention	Atlanta, GA
Advocate	Roberta Gelb	Advocate	Chelsea Office Systems,Inc.	New York, NY
Policy Initiative 'Policy Teams' Request for Qualifications, 2016				
Chair	Diana Petitti, M.D., M.P.H.	Adjunct Professor	Arizona State University	Phoenix, AZ
Scientific	Sally McCarty, M.A.	Senior Research Fellow	Georgetown University	Washington, DC
	Joel Tickner, Sc.D.	Associate Professor	University of Massachusetts Lowell	Lowell, MA
Advocate	Christine Carpenter, Ed.S.	Advocacy Chair	Beyond Pink TEAM	Cedar Falls, IA
Community Impact 2017				
Chair	Beti Thompson, Ph.D..	Professor	Fred Hutchinson Cancer Research Center	Seattle, WA

Reviewer Role	Reviewer	Title	Affiliation	Location
Scientific	Farrah Jaquez, Ph.D.	Associate Professor	University of Cincinnati	Cincinnati, OH
	Laundette Jones, Ph.D.	Associate Professor	University of Maryland	Baltimore, MD
	Usha Menon, Ph.D., R.N., F.A.A.N.	Associate Dean	University of Arizona	Tucson, AZ
	Sacoby Wilson, Ph.D., M.S.	Assistant Professor, Director, Community Engagement, Environmental Justice and Health	University of Maryland-College Park	College Park, MD
Advocate	Patricia O'Brien, Ph.D.	Advocate	Vermont Cancer Network	Burlington, VT
California Advocate Observer	Patricia Wu	Advocate	Dr. Susan Love Research Foundation	Los Angeles, CA
Clinical Prevention and Biological Sciences 2017				
Chair	Douglas Yee, M.D.	Professor	University of Minnesota	Minneapolis, MN
Scientific	Abenaa Brewster, M.D., M.H.S.	Professor	UT MD Anderson Cancer Center	Houston, TX
	Qihong Huang, M.D., Ph.D.	Associate Professor	The Wistar Institute	Philadelphia, PA
	Neil Johnson, Ph.D.	Assistant Professor	Fox Chase Cancer Center	Philadelphia, PA
	Peter Kabos, M.D.	Assistant Professor	University of Colorado	Aurora, CO
	Ruth Keri, Ph.D.	Professor	Case Western Reserve University	Cleveland, OH

Reviewer Role	Reviewer	Title	Affiliation	Location
	Rita Nanda, M.D.	Assistant Professor	University of Chicago	Chicago, IL
	Amos Sakwe, Ph.D.	Assistant Professor	Meharry Medical College	Nashville, TN
	Patricia A. Thompson Carino, Ph.D.	Professor	Stony Brook School of Medicine	Stony Brook, NY
Advocate	Valerie Fraser	Advocate	Inflammatory Breast Cancer International Consortium	Huntington Woods, MI
	Eunice Hostetter	Advocate	Susan G. Komen Foundation	Kirkland, WA
	Carrie Wells	Advocate	Survivors' Retreat	Baltimore, MD
Ad Hoc	Lina Mu, M.D., Ph.D.	Associate Professor	State of New York – Buffalo, NY	Buffalo, NY
	Abram Recht, M.D.	Professor	Beth Israel Deaconess Medical Center	Boston, MA
Advocate Observer	Amy Delson, AIA	Advocate	Bay Area Cancer Connections	Atherton, CA
The Impact of Proposition 65 to Reduce or Eliminate Exposures Linked to Breast Cancer, 2017				
Chair	Joel Tickner, Sc.D.	Associate Professor	University of Massachusetts	Lowell, MA
Scientific	Cary Coglianese, J.D., Ph.D.	Professor	University of Pennsylvania	Philadelphia, PA
	Jessica Schifano, J.D., M.P.H.	Health Scientist	U.S. Department of Labor	Washington, D.C.
Advocate	Anna Cluxton	Advocate	Young Survival Coalition	Columbus, OH

Reviewer Role	Reviewer	Title	Affiliation	Location
Animal Studies to Investigate Concurrent Effects of Environmental Chemicals and Stress Factors on Mammary Cancer 2017				
Chair	Leena Hilakivi-Clarke, Ph.D.	Professor	Georgetown University	Washington, DC
Scientific	Deborah A. Cory-Slechta, Ph.D.	Professor and Acting Chair, Environmental Medicine	University of Rochester	Rochester, NY
	Gretchen Hermes, M.D., Ph.D.	Instructor in Psychiatry	Yale University	New Haven, CT
Advocate	Carrie Wells	Advocate	Survivors' Retreat	Baltimore, MD
Adverse Childhood Experiences and Breast Cancer Risk 2017				
Chair	Sarah Gehlert, Ph.D.	Dean	University of South Carolina	Columbia, SC
Scientific	Christopher P. Fagundes, Ph.D.	Director, BMED Lab Assistant Professor	Rice University	Houston, TX
	Natalie Bea Slopen, ScD.	Assistant Professor	University of Maryland	College Park, MD
Advocate	Eunice Hostetter	Advocate in Science	Susan G. Komen for the Cure	Kirkland, WA
Science Convener for Program Initiatives Full Program-Directed Solicitation 2017				
Chair	Eileen Hanlon, M.H.S., M.S.W..	Associate Director	Social Marketing and Communication	Washington, DC
Scientific	Marj Plumb, Dr.P.H., MNA	Director	Coalitions for a Strong Nebraska	Omaha, NE

Reviewer Role	Reviewer	Title	Affiliation	Location
	Lisa Stevens, Ph.D.	Deputy Director of Planning and Operations, Center for Global Health	National Cancer Institute	Washington, DC
Advocate	Vernal Branch	Patient Research Advocate	Cancer Action Coalition of Virginia	Richmond, VA
Community Impact 2018				
Chairs	Shiraz Mishra, Ph.D.	Professor	University of New Mexico	Albuquerque, NM
	Sussan Pelletier	Advocate	Vermont Breast Cancer Coalition	Stockbridge, VT
Scientific	Deborah Bowen, Ph.D.	Professor	University of Washington	Seattle, WA
	Grace Sembajwe, D.Sc.	Associate Professor	Hunter College	New York, NY
	Janell Mensinger, Ph.D.	Associate Research Professor	Drexel University	Philadelphia, PA
	Chiranjeev Dash, M.D., Ph.D.	Assistant Professor	Georgetown University	Washington, DC
	Sandra Deming Halverson, Ph.D.	Adjunct Research Assistant Professor	Vanderbilt University	Nashville, TN
	Emma Tsui, Ph.D.	Assistant Professor	CUNY	New York, NY
	Kathryn Kash Murphy, Ph.D.	Principal	KM Behavioral Consulting LLC	Spring Hill, FL
Advocate	Beverly Canin	Advocate	Breast Cancer Option, Inc	Rhinebeck, NY
	Valerie Fraser.	Advocate	Inflammatory Breast Cancer International Consortium	Huntington Woods, MI

Reviewer Role	Reviewer	Title	Affiliation	Location
	Jo Ann Tsark	Director, Community Engaged Research	University of Hawaii	Honolulu, HI
Advocate Observer	Denise Jenkins	Advocate	Women's Cancer Resource Center	Oakland, CA
Clinical Prevention and Biological Sciences 2018				
Chair	Patricia A. Thompson Carino, Ph.D.	Professor and Associate Director for Basic Research Center	Stony Brook School of Medicine	Stony Brook, NY
Scientific	Jia Chen, Sc.D.	Professor	Icahn School of Medicine at Mount Sinai	New York, NY
	Chi-Chen Hong, Ph.D.	Professor	Roswell Park Comprehensive Cancer Center	Buffalo, NY
	Erik Nelson, Ph.D.	Assistant Professor	University of Illinois	Urbana, IL
	Ruth Keri, Ph.D.	Professor	Case Western Reserve University	Cleveland, OH
	Amos Sakwe, Ph.D.	Assistant Professor	Meharry Medical College	Nashville, TN
	Sallie Smith Schneider, Ph.D.	Director, Biospecimen Resource and Molecular Analysis Facility	Baystate Medical Center	Springfield, MA
	Rulla Tamimi, Sc.D.	Associate Professor	Dana Farber/Harvard	Boston, MA
Advocate	Ann Fonfa	Advocate	Annie Appleseed Project	Delray Beach, FL
	Sherry Meeks, M.S, M.P.H.	Advocate	University of Central Oklahoma	Edmond, OK

Reviewer Role	Reviewer	Title	Affiliation	Location
	Beverly Parker, M.S.W., Ph.D.	Advocate	Living Beyond Breast Cancer	Naperville, IL
Ad Hoc	Rita Nanda, M.D.	Assistant Professor, Associate Director, Breast Medical Oncology	University of Chicago	Chicago, IL
	David Mankoff, M.D., Ph.D.	Vice-Chair for Research, Department of Radiology	University of Pennsylvania	Philadelphia, PA
Advocate Observer	Lorie Petitti, M.B.A.	Advocate	Breast Cancer Care and Research Fund	Santa Monica, CA
CBCPI Paradigm 2018				
Chair	Sarah Gehlert, Ph.D.	E. Desmond Lee Professor of Racial and Ethnic Diversity	Washington University	St. Louis, MO
Scientific	Anthony Gatrell, Ph.D.	Dean of the School of Health and Medicine	Lancaster University	Lancaster,
	Julie Goodman, Ph.D., DABT, FACE	Principal	Gradient	Cambridge, MA
Advocate	Vernal Branch	Patient Research Advocate	Cancer Action Coalition of Virginia	Richmond, VA
Community-Driven Pilot Studies to Explore Racial/Ethnic Disparities in Consumer Product Availability and Use Request for Proposals 2018				
Chair	Grace Sembajwe, Sc.D.	Associate Professor	CUNY Hunter College	New York, NY
Scientific	Sacoby Wilson, Ph.D., M.S.	Assistant Professor, Director, Community Engagement, Environmental Justice and Health	University of Maryland-College Park	College Park, MD
	Sherrie Flynt Wallington, Ph.D.	Assistant Professor	Georgetown University Medical Center	Washington, DC

Reviewer Role	Reviewer	Title	Affiliation	Location
Advocate	Susan Pelletier	Patient Advocate	Vermont Breast Cancer Coalition	Stockbridge, VT
Clinical Prevention and Biological Sciences 2019				
Chair	Patricia A. Thompson Carino, Ph.D.	Professor and Associate Director for Basic Research Center	Stony Brook School of Medicine	Stony Brook, NY
Scientific	Erik Nelson, Ph.D.	Assistant Professor	University of Illinois	Urbana, IL
	William Redmond, Ph.D.	Associate Member and Director, Immune Monitoring Laboratory	Providence Cancer Institute	Portland, OR
	Amos Sakwe, Ph.D.	Associate Professor	Meharry Medical College	Nashville, TN
	Natalie Serkova, Ph.D.	Professor	University of Colorado – Anschultz Medical Campus	Denver, CO
	Sallie Smith Schneider, Ph.D.	Director, Biospecimen Resource and Molecular Analysis Facility	Baystate Medical Center	Springfield, MA
Advocate	Lisa DeFarrari, MBA	Advocate	Virginia Breast Cancer Foundation	Richmond, VA
	Ann Fonfa	Advocate	Annie Appleseed Project	Delray Beach, FL
	Beverly Parker, M.S.W., Ph.D.	Advocate	Living Beyond Breast Cancer	Naperville, IL
Ad Hoc	Eva Sevick, Ph.D.	Professor and Chair of Cardiovascular Disease Research, Cnter for Molecular Imaging	University of Texas Health Science Center at Houston	Houston, TX
Advocate Observer	Jennifer Scott, MA	Director of Development	UCLA School of Public Health	Los Angeles, CA

Reviewer Role	Reviewer	Title	Affiliation	Location
Community Impact 2019				
Chairs	Carolyn Gotay, Ph.D.	Professor Emeritus of Population and Public Health	University of British Columbia	Vancouver, BC
	JoAnn Tsark, M.P.H.	Co-Director, Community Engagement Core for Ola HI	University of Hawaii	Honolulu, HI
Scientific	Sandra Deming Halverson, Ph.D.	Adjunct Research Assistant Professor	Vanderbilt University	Nashville, TN
	Farrah Jacquez, Ph.D.	Associate Professor	University of Cincinnati	Cincinnati, OH
	Grace Sembajwe, D.Sc.	Associate Professor	Northwell Health	Great Neck, NY
	Emma Tsui, Ph.D.	Assistant Professor	CUNY	New York, NY
	Karriem Watson, DHS.	Associate Director Community Outreach and Engagement	University of Illinois	Chicago, IL
Advocate	Valerie Fraser.	Advocate	Inflammatory Breast Cancer International Consortium	Huntington Woods, MI
	Susan Pelletier	Advocate	Vermont Breast Cancer Coalition	Stockbridge, VT
Advocate Observer	Michele Atlan	Advocate	Breast Cancer Care & Research Fund	Los Angeles, CA
CBCPI Hormones in Beef & Chemicals in Drinking Water Review Panel 2019				
Chair	Jessica Schifano, J.D. M.P.H.	Health Scientist	Occupational Safety and Health Administration	Washington, DC

Reviewer Role	Reviewer	Title	Affiliation	Location
Scientific	John (Jay) Nuckols, Ph.D.	Emeritus Professor	Colorado State University	Fort Collins, CO
	Carsten Prasse, Ph.D.	Assistant Professor	Johns Hopkins University	Baltimore, MD
	Laura Vandenberg, Ph.D.	Associate Professor	University of Massachusetts, Amherst	Amherst, MA
Advocate	Patricia O'Brien	Advocate	Vermont Cancer Network	Burlington,VT
Ad Hoc	Kerri Gehring, Ph.D., M.S.	Professor, Meat Services	Texas A&M University	College Station, TX
	Keeve Nachan, Ph.D., M.H.S.	Assistant Professor	Johns Hopkins University	Baltimore, MD
Clinical Prevention and Biological Sciences 2020				
Chair	Patricia A. Thompson Carino, Ph.D.	Professor and Associate Director for Basic Research Center	Stony Brook School of Medicine	Stony Brook, NY
Scientific	Abenaa Brewster, M.D., M.H.S.	Professor	UT MD Anderson Cancer Center	Houston, TX
	Chi-Chen Hong, Ph.D.	Associate Professor of Oncology	Roswell Park Comprehensive Cancer Center	Buffalo, NY
	Erik Nelson, Ph.D.	Assistant Professor	University of Illinois	Urbana, IL
	William Redmond, Ph.D.	Associate Member and Director, Immune Monitoring Laboratory	Providence Cancer Institute	Portland, OR
	Sallie Smith Schneider, Ph.D.	Director, Biospecimen Resource and Molecular Analysis Facility	Baystate Medical Center	Springfield, MA

Reviewer Role	Reviewer	Title	Affiliation	Location
	Adetunji T. Toriola, M.D., Ph.D.	Associate Professor of Surgery	Washington University	St. Louis, MO
	Siyuan Zhang, M.D., Ph.D.	Dee Associate Professor	Notre Dame University	Notre Dame IN
Advocate	Ann Fonfa	Advocate	Annie Appleseed Project	Delray Beach, FL
	Eunice Hostetter	Advocate	ACS Cancer Action Network	Seattle, WA
	Susan Siegle	Advocate	Virginia Breast Cancer Foundation	Richmond, VA
Advocate Observer	Stacey Tinianov	Director of Advocacy & Engagement at Citizen	Citizen	Santa Clara, CA
Community Impact 2020				
Chairs	Carolyn Gotay, Ph.D.	Professor Emeritus of Population and Public Health	University of British Columbia	Vancouver, BC
	JoAnn Tsark, M.P.H>	Co-Director, Community Engagement Core for Ola HI	University of Hawaii	Honolulu, HI
Scientific	James Butler III, Dr.P.H., Med	Associate Professor	University of Maryland College Park	College Park, MD
	Steven Fu, M.D., MSCE	Director, Center for Care Delivery & Outcomes Research – VA Professor	Minneapolis VA Health Care System University of Minnesota	Minneapolis, MN
	Sandra Deming Halverson, Ph.D.	Adjunct Research Assistant Professor	Vanderbilt University	Nashville, TN
	Anna Goodman Hoover, Ph.D.	Deputy Director	University of Kentucky	Lexington, KY

Reviewer Role	Reviewer	Title	Affiliation	Location
	Irene M. Tami-Maury, D.M.D., M.Sc. Dr. PH	Assistant Professor	University of Texas Health Sciences Center	Houston, TX
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	Karriem Watson, DHS	Associate Director Community Outreach and Engagement	University of Illinois	Chicago, IL
Advocate	Jane Segelken, M.A., M.S.W..	Advocate	Cayuga Family Medicine	Ithaca, NY
Ad Hoc	Laura Hamasaka	Public Health/Health Equity Consultant	National Association of Chronic Disease	Washington, DC
Advocate Observer	Ada Osoy	Advocate	Living Beyond Breast Cancer	Pasadena, CA
CBCPI Hormones in Beef & Well Water 2020				
Chair	Keeve Nachman, Ph.D., M.H.S.	Director, Food Production and Public Health Programs Assistant Professor	Johns Hopkins University	Baltimore, MD
Scientific	Kerri Gehring, Ph.D, M.S..	Professor, Meat Services	Texas A&M University	College Station, TX
	Jon Sobus, Ph.D.	Physical Scientist	Environmental Protection Agency	Durham, NC
	Laura Vandenberg, Ph.D.	Associate Professor	University of Massachusetts, Amherst	Amherst, MA
Advocate	Lisa DeFarrari, M.B.A.	Advocate	Virginia Breast Cancer Foundation	Charlottesville, VA