2010 Report





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Burroughs Wellcome Fund

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About the Burroughs Wellcome Fund

The Burroughs Wellcome Fund is an

independent private foundation dedicated to advancing the biomedical sciences by supporting research and other scientific and educational activities. Within this broad mission, BWF seeks to accomplish two primary goals—to help scientists early in their careers develop as independent investigators, and to advance fields in the biomedical sciences that are undervalued or in need of particular encouragement.

Financial support is channeled primarily through competitive peer-reviewed award programs. Grants are made primarily to degree-granting institutions on behalf of individual researchers. To complement these competitive award programs, grants are also made to nonprofit organizations conducting activities intended to improve the general environment for science.

BWF was founded in 1955 as the corporate foundation of Burroughs Wellcome Co., the U.S. branch of the Wellcome pharmaceutical enterprise, based in the United Kingdom. In 1993, BWF received a \$400 million gift from the Wellcome Trust to become a fully independent foundation. **Legacy** The Wellcome enterprise began in 1880 by two young American pharmacists, Henry Wellcome and Silas Burroughs, who moved to London to manufacture and sell "compressed medicines"—that is, pills—which they believed could replace the potions and powders of the day.

The firm prospered. After Burroughs died in 1895, Wellcome directed the growth of the company into an international network with subsidiaries in numerous countries on several continents. As the business grew, Wellcome held firm to his belief that research was fundamental to the development of excellent pharmaceutical products and established the industry's first research laboratories.

When Wellcome died in 1936, his will vested all of the corporate shares in a new organization—the Wellcome Trust—devoted to supporting research in medicine and allied sciences and to maintaining museums and libraries dedicated to these fields. The Trust grew to become the world's largest charitable foundation devoted exclusively to the biomedical sciences.

The importance of curiosity-driven research, as endorsed by Henry Wellcome, guides the mission of the Burroughs Wellcome Fund and its commitment to the belief that fostering research by the best and brightest scientists offers the fullest promise for improving human health.

Burroughs Wellcome Fund Research Triangle Park, North Carolina



President's Message

We believe at the Burroughs Wellcome Fund, just as do all our peers in the donor community, that our grants and gifts make a positive difference. We put this belief to the test this past year when we reviewed the progress of our many awardees. We were pleased to see that, indeed, our awardees have and are continuing to make important contributions in their respective fields. The positive outcome of these studies made it particularly upsetting when the downturn in the economy and our endowment forced us to suspend a majority of our grant programs and reduce payouts to many awardees in fiscal year 2009-2010.

Our optimism, though, has been restored this past year as the increase in our endowment has enabled us to again offer our programs and to provide a full payout to our awardees.

During this past year of reduced grant activity, we focused much of our attention on strategic planning that concluded in February. We charted our course for the next five years, concluding that our mission will remain the same—to advance the biomedical sciences by supporting research and other scientific and educational activities. We will continue to fund areas considered important, yet underfunded, while emphasizing career development in those areas.



John E. Burris, Ph.D.

The distribution of BWF's grants will remain primarily in our competitive programs. Other funds will be awarded to catalyze areas of interest or to advance science and education through support for meetings, policy, and other activities. A distribution of funds by focus area is on the next page.

One significant change to the Fund's program is that the Clinical Scientist Award in Translational Research has been discontinued. Since translational research has been emphasized by the Federal government and backed by large amounts of funding, the Board felt there was no

"The Burroughs Wellcome Fund remains committed to funding the next generation of scientists and researchers so that they can translate the excitement of science into the rewards that research and education bring to us all." longer significant need in this particular area. We will continue, though, to provide modest ad hoc grant support as part of our long-term interest in this field.

The BWF did not suspend all its grantmaking this past year. It was the first year for the Career Awards for Science and Mathematics Teachers, and we selected five outstanding science and mathematics teachers in North Carolina. We are pleased to be able to partner with the State Board of Education and the Department of Public Instruction in this recognition of the professionalism of precollege teachers.

We also held a travel grant program for graduate students and postdocs. The success of that experiment has led us to launch an expanded program of travel grants in 2010-2011 for interdisciplinary collaborations for scientists who travel to work in laboratories in different disciplines than their own. Recognizing the importance of databases in answering biological questions, we also funded an initiative to create a pan-fungal database. We expect that it will become a valuable tool for researchers in the field of mycology, and also for many others interested in comparative biology.

We continued to sponsor meetings and in June 2010, we partnered with the Keck Foundation and the Schwartz Foundation to convene interdisciplinary researchers in physics and biology to learn more about the exciting science at the interfaces of these disciplines and to encourage more interactions.



BWF distributed \$19.95 million in grants during fiscal year 2010. In December 2010, we again partnered with the March of Dimes to hold a preterm birth meeting to bring together researchers to catalyze new areas of research in preterm birth. In the February 11, 2010 issue of the *New England Journal of Medicine* the previous preterm birth meeting was reviewed and the challenges of understanding prematurity were outlined. We expect that these meetings, coupled with a new program, the Preterm Birth Initiative, will help untangle the mechanisms behind prematurity, as we further understand the mechanisms behind full-term delivery.

In the science communications, we have been providing support for ScienceOnline, an annual meeting that has become an international event for science bloggers and other communicators who use new media technology to reach their audiences. We have begun our own new media resource, as we now include audiocasts in our newsletter, available as podcasts on iTunes.

For all of us in the foundation world, this past year has been a challenging one. As we emerge from a time of funding stress, we do so with a renewed optimism about the positive effect we have on scientific understanding and progress. Foundations can stimulate interactions, can try new areas for emphasis, and can react quickly to changing opportunities. We also remain clearly connected to each other and the human interactions that are so critical for progress. By way of example, I recently heard from one of our awardees, Dana Pe'er of Columbia University who related how her December 2010 paper in *Cell* on dysregulation in melanoma was a collaborative effort with Levi Garraway of Dana Farber, another BWF awardee, and had originated with a discussion at a poster session at a Fund meeting.

Even in these difficult times, we remain excited about the research our awardees conduct and the potential it brings. The Burroughs Wellcome Fund remains committed to funding the next generation of scientists and researchers so that they can translate the excitement of science into the rewards that research and education bring to us all.

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John E. Burris, Ph.D. President Burroughs Wellcome Fund

Information for Applicants

The Burroughs Wellcome Fund makes

90 percent of our grants through competitive award programs that support investigators in targeted areas of basic biomedical research relevant to human health.

Most of BWF's award programs are open only to citizens or permanent residents of the United States and Canada. (Programs with different requirements are noted in the descriptions that follow.) Awards are made with the advice of our advisory committees, which are comprised scientists and educators selected for their expertise in the program areas.

Most grants are made only to degree-granting institutions on behalf of individual researchers, who must be nominated by their institution. Institutions receiving grants must be tax-exempt 501(c)(3) organizations. Government agencies, such as the National Institutes of Health and the Centers for Disease Control and Prevention, generally are not eligible for grants. Throughout the following program descriptions, references to M.D. and Ph.D. degrees include all types of medical and scientific doctoral degrees.

BWF does not support activities that are primarily related to health care and health care policy. We generally do not provide support for research projects or other activities outside our competitive programs, nor do we generally support endowments, development campaigns, ordinary operating expenses, capital facilities and equipment, or publications.

BWF believes that diversity within the scientific community enhances the well-being of the research enterprise; therefore, we encourage applications from women and from members of underrepresented minority groups.

Visit www.bwfund.org for current information.

Biomedical Sciences

Research in the medical sciences provides a firm foundation for improving human health. The Burroughs Wellcome Fund is committed to fostering the development of the next generation of academic medical scientists. By providing funding to help bridge the gap between the postdoctoral and early faculty years, BWF hopes to bolster the careers of the most promising up and coming scientists. But BWF's support doesn't stop with its funding. Through biennial meetings and mentoring networks, BWF helps provide vital career advice to give scientists, early in their careers, the information they need to be successful.

Career Awards for Medical Scientists

Five-year awards for physician scientists provide \$700,000 to bridge advanced postdoctoral/fellowship training and the early years of faculty service. This award addresses the on-going problem of increasing the number of physician scientists and will help facilitate the transition to a career in research.

Collaborative Research Travel Grants

Provide up to \$15,000 in support for researchers from degree-granting institutions to travel to a laboratory to acquire a new research technique or to facilitate a collaboration. Consideration is given to applicants who hold a Ph.D. or are studying for a Ph.D. in mathematics, physics, chemistry, computer science, statistics, or engineering who are interested in investigating research opportunities in the biological sciences or to biologists interested in working with physical scientists, mathematicians, engineers, chemists, statisticians, or computer scientists to incorporate their ideas and approaches to answering biological questions.

Program Outcomes

Performance based on selected outcomes of grantees from Burroughs Wellcome Fund's Career Awards in the Biomedical Sciences (1995-2006) and Career Awards in the Medical Sciences (2007-date) programs.

Background

"Career Development" has been a major theme of the Burroughs Wellcome Fund (BWF) since it became an independent foundation in 1994. Shortly thereafter, BWF's first foray into career development was the Career Awards in the Biomedical Sciences (CABS) which provided bridging support for young scientists to help them make the critical transition from postdoctoral fellow to independent investigator. This program was modeled after one of the first bridging award programs, the Markey Charitable Trust Scholars Program, that funded 113 scholars from 1985 through 1991. The Markey program set the gold standard for bridging awards. The results of an extensive evaluation of the Markey program were published in 2006 by the The National Academies Press.¹ The data from that study showed that the Markey Scholars were highly productive, met the goals of the program, and that the selection process was effective in identifying candidates that could advance quickly to independence.

The first CABS recipients were approved by the Board in April 1995 with the primary goal of helping awardees achieve research independence by obtaining a tenuretrack faculty position within the academic research environment. The program was part of the BWF grants portfolio from 1995 to 2006 and provided support to 241 young scientists for a financial commitment in excess of \$100 million.

BWF's Evaluation Philosophy

BWF's core mission is "the advancement of the medical sciences by supporting research and other scientific and educational activities." To accomplish this mission BWF has focused on investing in human capital through the development of outstanding scientists early in their careers and the development of investigators in targeted areas of science that are undervalued or under funded. Since 1994, BWF programs have been developed to accomplish this mission.

Because of the large financial commitment the Board made to the CABS program, an evaluation strategy was put into place early in the program's history. The program staff operated under the assumption that the BWF Board wanted to know whether the program was meeting its goal of fostering independence. The basic evaluation strategy, which has been carried forward to this day, includes terrain mapping by the BWF Board, annual scientific advisory committee meetings, review of progress reports, awardee convening activities, and evaluation of faculty offer letters. In addition, certain key outcomes are looked at which include time to independence, start-up packages, major awards, significant scholarly publications, and grant support. The ultimate acid test, however, is whether awardees obtain tenure and sufficient funding to support independence at mid-career.

BWF's evaluation strategy has been graphically displayed in former BWF program officer Martin Ionescu-Pioggia and consultant Georgine Pion's 2006 paper.² The figure, known as the evaluation pyramid, demonstrates how information flows from the base of the pyramid to the BWF Board demonstrating the higher activity or group involvement the greater the impact. It should be noted that the ultimate decisions are made by the BWF Board but Program Scientific Advisory Committees have more impact on decisions than evaluation and/or outcomes studies.

CABS Outcomes

Three formal outcomes studies have been done on the CABS program. Two of the studies have been published.

- The Pion and Ionescu-Pioggia study which was published in 2003³ looked at outcomes for the first five years (1995-1999) of the program. At the time of the writing, 77 percent of the 101 awardees including all of the first two cohorts (1995 and 1996) had received tenure-track faculty appointments and of those 78 percent had attracted external funding. The reported results indicate that the program was fulfilling its aim to foster active and productive academic research careers. An interesting outcome from this study was that of the 33 awardees who had completed the program, the time from last degree to first faculty appointment was 5.1 years for Ph.D.s (n=18) and 7.2 years for physician scientists (n=15).
- 2. An unpublished comparative study done in 2005 by Pion and Ionescu-Pioggia⁴ looked at four award cycles, 1996-1999, and compared outcomes among three groups: awardees (n=37); finalists who did not receive an award (n=22); and those that were disapproved (n=126). The analyses indicated that the awardees typically outperformed those who applied but did not receive an award and provided evidence that the program was a sound investment for the BWF.
- 3. The Pion and Cordray comparative study was published in 2008.⁵ Using propensity analysis the authors addressed the impact of the CABS program by examining outcomes among three comparison groups who applied to the program from 1996 to 1999. Even though awardees performed better than the comparison groups, the authors concluded that it was almost impossible to remove selection biases from program biases. Strategies were offered to better improve outcome measurements.



Since the three formal studies looked at outcomes from 1995 through 1999, an additional analysis, looking at selected outcomes, was done in March 2010 for the 2001–06 classes.

The **2001** award year produced 175 eligible proposals and 23 awardees. Two individuals left the program from the 2001 class—a physician scientist that took a faculty position at the Pasteur Institute in Paris and another awardee who left the program to work on a Gates Grand Challenge project. The remaining 21 all transitioned to tenure-track faculty appointments and 12 currently have tenure. All except two have current funding from NIH or NSF.

For **2002**, 177 proposals were received and 17 awards made. Fourteen of the 17 have received tenure-track faculty appointments including three at Canadian institutions (two at the University of British Columbia and one at the University of Toronto). Seven of the 14 are currently associate professors and the remaining seven are assistant professors. Nine of the 11 awardees with US faculty appointments have current NIH funding. Of the three remaining awardees, one left the program for a research position in China and another left the program to take a position with Novartis. A third awardee has not transitioned and is currently a postdoctoral fellow at Harvard.

The **2003** award year produced 179 eligible proposals and 13 awards. All of the awardees have transitioned to a tenure-track faculty appointment and two are currently associate professors. Eleven of the 13 have current funding from NIH or NSF. There are two in this cohort that have been particularly successful in obtaining NIH funding. One currently has NIH funding, which includes a New Investigator Award, totaling \$3,716,836 and another has \$2,528,867 in NIH funding. At the application deadline for the **2004** award year, 167 eligible applications were received and 16 awards were made. Of the 16 awardees, one left the program after the postdoctoral portion of the award to become a science writer. The remaining 15 have remained in academic science and all have tenure-track positions—14 at US institutions and one at a Canadian institution (University of Toronto). Five of the 15 currently have tenure. Of the 14 awardees with US faculty appointments, 12 have NIH support. Among the group there are 14 ROIs (range 0-3; median 1) and total NIH support of \$14,127,090. Five currently have NIH support in excess of \$1 million. In addition, three of the 2004 cohort have received Howard Hughes Medical Institute's Early Career Scientist awards.

Award year **2005** was the next to the last CABS' awardee class. At the application deadline 173 proposals were received and 22 awards made. Eighteen have tenuretrack faculty appointments (one is at the University of British Columbia) and all 18 are assistant professors. Of the remaining four, two are postdoctoral fellows, one is at Janelia Farms, and one is with the intramural program at NIH. Twelve of the assistant professors have current NIH or NSF support.

The last class, **2006**, was made up of 24 young scientists who were selected from 177 proposals. Nineteen have become independent investigators—16 have tenure-track faculty appointments at degree granting institutions and three are at research institutes but have faculty appointments at a closely affiliated degree granting institution. Two are still in postdoctoral positions and have not transitioned. Of the three that did not complete the program, one is with the intramural program at NIH, one is working in science publishing, and other is working in Japan. Three awardees have ROIs and three have an NIH New Innovator award.

Other Outcomes

One hundred awardees in the 2001-2006 classes transitioned to become independent investigators. Sixty-seven were Ph.D.s and 33 were physician scientists. Of the Ph.D.s who accepted faculty positions, 92 percent transferred institutions while 45 percent of the physician scientists made such a transfer.

The publication record was examined for the 2001, 2002, and 2004 classes. Forty-nine awardees contributed to 1,074 publications for an average of 22 papers per awardee (range: 2 to 60; median: 20). Twenty-one (44%) of the awardees had papers in one of the *Nature* publications and 12 (24%) had a publication in *Science*. An interesting observation is that one in three of the awardees had published in *Public Library of Science* (*PloS*).

Summary Outcomes for the CABS Program (1995 – 2006)

The primary goal of the program, a tenure-track academic appointment, has obviously been met. Ninety-two percent received tenure-track faculty appointments or the equivalent and only 16 left the program before completion and those awardees who left the program before completion have remained in science. Of the four who have yet to transition, one as of this writing (6/2010) has a tenure-track faculty offer in hand.

- 241 awards made
- >\$100,000,000 financial commitment
- 16 awardees left program before completing award
 - 5 joined the NIH intramural program
 - · 2 took positions in the pharmaceutical industry
 - 2 went to Janelia Farms
 - 3 took faculty positions outside North America
 - 2 became science writers
 - 1 left to work on Gates' Grand Challenges project
 - 1 left because of family reasons (now a science writer)
- 221 received tenure-track faculty appointments
- 4 have yet to transition

Mid-Career Outcomes for the First CABS Class (1995)

As of June 2010, the first CABS class continues to do very well. Three of the awardees from this cohort are currently serving on BWF advisory committees.

14 Awardees

- Gender: 4 females; 10 males
- Degree: 3 M.D.s; 4 M.D., Ph.D.s; 7 Ph.D.s

Current Position as of April 2010

- Professor:
- HHMI Investigator/Professor: 2
- Associate Professor: 5
- Associate Member Research Institute: 1
- President Pharmaceutical Company: 1
- Elementary School Teacher:

Current Institutions as of April 2010

Columbia:	1
Dartmouth	1
Duke:	1
Harvard:	2
Northwestern:	1
University of Chicago:	2
University of Dundee:	1
University of Washington:	1
Vanderbilt:	1

A Pivotal Report: Bridges to Independence

Sponsored by the National Research Council and published in 2005 by the National Academies Press,⁶ this publication represents the work done by the Committee on Bridges to Independence chaired by Thomas R. Cech. The report made numerous recommendations including the establishment of a NIH program to support scientists moving into their first independent positions. "The program should make 200 grants annually of \$500,000 each payable over five years. The award amount and duration is similar to the BWF Career Awards, which have shown success at fostering the independence of new investigators."

This document was the catalyst for the K99/R00 mechanism and started BWF thinking about a new direction for the CABS program.

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A look at the last CABS cohort vis-á-vis the first NIH K99/R00 cohort

Just as BWF's CABS program was patterned after Markey's Scholars Program, NIH's K99/R00 program was patterned after BWF's CABS program. The major differences (and similarities) between the CABS program and the K99 mechanism follow.

CABS	K99
Five year award – 2 year mentored phase plus a three year independent phase	Five year award – 2 year mentored phase plus a three year independent phase
Total award ~ \$500,000	Total award ~ \$500,000
Awards per year ~ 20	Awards per year ~ 200
Institutional nomination	Open nomination
Interview finalists	No interviews
Awardee must be at a degree-granting institution	Awardee may be at most US profit, non-profit, or public institutions
US/Canadian citizen	No citizenship requirement
Must have at least 1 year but no more than 4 years of post-doctoral training	Must not have more than 5 years of postdoctoral training
Must have tenure-track appointment for indepen- dent phase of award	Does not require a tenure- track appointment for independent phase of award

The last CABS cohort (n=24) was approved by the BWF Board in May 2006 and the first K99 cohort (n=58) was announced by NIH in November 2006. Award start dates were September 1, 2006, for the CABS grantees and December 1, 2006, for the K99 grantees. One applicant applied for both a CABS award and the K99 and was successful with both applications. The individual turned down the K99 and accepted the CABS award so the actual number for the first K99 cohort is 57.

Current Selected NIH support

CABS	K99/R00
R0I = 3	R0I = 3
New Innovator Award = 3	R21 = 1
R21 = 1	
R03 = 1	
K08 = 1	
K21 = 1	

Eight of the K99/R00 awardees also applied for a BWF Career Award between 2003 and 2006: seven applied for a CABS award and one for a CASI award (Career Awards at the Scientific Interface). The CASI award provides bridging support for young scientists trained in engineering or the physical, chemical, or mathematical sciences. Ten of the K99 awardees have Ph.D.s in chemistry, physics, or engineering. One K99 awardee applied for both a CASI award and a CABS award. Another candidate applied for both a K99 and the CABS award, was successful with both applications, and chose the CABS award.

Awardees from both programs tend to change institutions for the independent investigator portion of the award. Of the 50 K99 awardees that transitioned, 14 did not change institutions. For the CABS awardees that transitioned 16 percent did not change institutions. For the CABS awardees who are now independent, the time from their last doctorate to independence averaged 5.5 years (median = 5 years; range 2 to 10 years). This could not be determined for the K99 awardees.

Both the Bridges to Independence program and the CABS program appear to have met their goal of moving young scientists to independence, however, the goal (tenure for the CABS awardee) for demonstrating the success of the programs cannot be determined until mid-career when we see where these awardees are and what they are doing.



CABS = 24 awardees, K99 = 57 awardees





* BWF awardees whose primary appointment is at research a research institute have a secondary appointment at a degree granting institution.



Career Awards for Medical Scientists (CAMS)

Because of NIH's Bridges to Independence program (K99/R00 award), introduced in 2006, the CABS program was reformulated to a physician scientist only program and renamed Career Awards for Medical Scientists (CAMS). The focus of the CAMS program is the physician scientist who is making the transition from a mentored position to that of an academic independent investigator. The program provides \$700,000 in support over five years.

The CAMS program has gone through three award cycles (2007, 2008, and 2009) and a total of 42 awards have been made. The program was suspended for the 2009-2010 award cycle but is scheduled to resume for the 2010-2011 cycle.

CAMS Outcomes

For the three award cycles, 395 eligible proposals were received and 42 awards were made. Thirty of the awardees are M.D., Ph.D.s, 11 are M.D.s, and one is a D.D.S., Ph.D. Thirty-five currently have tenure-track faculty appointments. One of the faculty appointments is at McGill. Of the 35 awardees who accepted faculty appointments, nine changed institutions.

For the U.S. appointments the average salary is \$155,642 (range \$80,000 to \$350,000). The average start-up, less salary, is \$712,786 (range \$120,000 to \$2,200,000). In addition to start-up money and salary, many received additional support in the form of signing bonuses, childcare help, money for shared equipment, cost-of-living supplements, and meeting expenses. Also, many received housing and relocation allowances.

Only 14 of the 42 awardees have active K awards (K08 = 11, K23 = 2, K21 = 1). Six of the 35 assistant professors have ROIs. One 2007 awardee has active NIH grants totaling \$5,359,871.

Where does BWF go from here?

In some instances using sophisticated analyses and methods to evaluate programs may cloud the evaluation picture to such an extent that the reported outcomes may bear little resemblance to reality. With this in mind the CABS program will continue with the evaluation strategy that has been in place for a number of years. This includes:

- Annual scientific advisory committee and program staff review of the awardees' progress through written progress reports. Progress reports and start-up packages are also used to identify specific outcomes.
- Board members serving as liaisons to the program. This provides consistency across programs and assures that each program meets the goals set by the Board.
- Convening activities which provide opportunities for the Board, advisory committee, and staff to monitor progress.

For the CAMS program we will continue a similar strategy to that used for the CABS program, but we will look more closely at the awardee's publication record, funding, and time to tenure.

Summary

BWF is committed to the continued career development of young biomedical and physician scientists. By identifying and measuring outcomes and providing opportunities for candid feed-back from our awardees, BWF is able to identify areas where adjustments to its' career development portfolio should be made. These adjustments, hopefully, will have a positive impact on the research environment that BWF supports.

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Infectious Diseases

The Burroughs Wellcome Fund has supported research in infectious disease since 1981, when it began funding modern molecular approaches to understanding what have been called the great neglected diseases—malaria, the pathogenic fungi, and human parasites—that primarily affect people in underdeveloped countries. Since that time, much more attention has been paid to the urgent needs of these fields. In 2000, the Fund decided to turn its attention to the larger issues of human-pathogen interactions in these infectious diseases and others, opening the door for funding work in bacterial and viral diseases. BWF's Investigators in the Pathogenesis of Infectious Disease program is designed to incorporate elements of previously funded areas of research, and to focus primarily on the interaction of pathogens with their human hosts.

Investigators in the Pathogenesis of Infectious Disease

Five-year awards provide \$500,000 for opportunities for accomplished investigators at the assistant professor level to study infectious disease pathogenesis, with a focus on the intersection of human and microbial biology. The program is intended to shed light on the overarching issues of how human hosts handle infectious challenge. The awards are intended to give recipients the freedom and flexibility to pursue new avenues of inquiry and higher-risk research projects that hold potential for advancing signifi- cantly the biochemical, pharmacological, immunological, and molecular biological understanding of how infectious agents and the human body interact.

Program Outcomes

Pathogenesis of Infectious Diseases

Research in the infectious diseases has historically focused on the pathogen, but understanding these diseases requires an understanding of the host and microbe and, often, the microbe's vectors and reservoirs as a system. New insights into immunity and regulatory elements involved in the host/microbe conversation make this a remarkable time for new discovery. The Burroughs Wellcome Fund developed the Investigators in the Pathogenesis of Infectious Disease Award program to allow researchers early in their careers to broaden their work away from the "bug-by-bug" approach and into the fertile ground where the biology and ecology of humans and microbes meet.

Seven rounds of the Pathogenesis program have been run since it was launched in 2001, and 78 Investigators have been funded. The program's funding rate over time is 8.6 percent, and a total investment of \$36,900,000 has thus far been made and 911 applications have been received. Awardees include 53 men and 25 women for a gender ratio of two to one, similar to that seen among assistant professors in the fields from which the program draws. Over time, and in most calendar years, applications to all of the Fund's assistant professor programs (this one and the retired New Investigators programs in Mycology, Parasitology, Pharmacology, and Toxicology) have reflected the assistant professor pool.



We expect to see this number changing in the next several years as more newly trained women enter the professoriate. NIH data shows that women now have slightly more than half of all pre-doctoral institutional training grant positions and postdoctoral institutional training grant positions, 61 percent of all individual pre-doctoral NRSAs, 48 percent of individual postdocs NRSAs and 46 percent of NIH mentored research career awards. Currently, established women scientists hold 29 percent of research project grants, including 26 percent of ROIs. Application success rates for research project grants were 1.2 percent higher for men than women over the last 5 years, down from 2.0 percent in the five years prior to that. Twenty percent of awardees are clinician scientists and 80 percent are Ph.D.s. Of the clinically trained, five have an M.D., six have an M.D./Ph.D. and three have a D.V.M./Ph.D.

Seventy two awardees work in the United States and five in Canada. One has dropped the award and moved to an institution in Switzerland. Awardees are citizens of 15 countries. Fifty one, including three dual citizens, are American citizens. Five, including one with dual nationalities, are Canadian citizens. With six awardees, the United Kingdom has more citizens in the program than Canada. Four awardees are citizens of China, two each are citizens of Australia (including one dual citizen), India, Germany, and Taiwan. Argentina, Brazil, France, Japan, Morocco, Spain and Yugoslavia each also have a citizen in the program.

In late 2009, to better understand the career development of top early career investigators in this field, we asked the Investigators in the Pathogenesis of Infectious Disease to send us their long form CVs. All 78 complied.

No more than three awardees attended the same college. Only Harvard and China's Fudan University have produced three awardees. Cambridge, Oberlin, Penn State, Rice, Stanford, University of California Los Angeles, University of Glasgow, University of Toronto, University of North Carolina at Chapel Hill, University of Washington and China's University of Science and Technology produced two awardees each. Only seven are graduates of small liberal arts colleges. Sixteen (including the three from Harvard) graduated from private research universities. Most awardees are graduates of U.S. state, Canadian provincial, or other countries' national universities with recognized research programs.

Eleven reported receiving nationally competed individual pre-doctoral fellowships. At the postdoctoral level, six Pathogenesis awardees have also held the Fund's Career Award in the Biomedical Sciences. All six are women: Jody Baron at University of California – San Francisco, Akiko Iwasaki at Yale, Meta Kuehn at Duke, Karen Guillemin at the University of Oregon, Lora Hooper at the University of Texas – Southwestern and Erica Saphire at Scripps Research Institute.

Awardees report membership in 48 specialty professional societies. 77 percent of awardees providing data on society memberships belong to the American Society for Microbiology. Though the Journal of Biological Chemistry is highly represented in awardee publications, only two awardees are members of the American Chemical Society. Only 20 percent of the physicians supported through the program report membership in the Infectious Disease Society of America.

Top Societies for Pathogenesis Awardees	Awardee Members
Am. Soc. Microbiology	47
Am. Soc. Virology	13
Am. Assoc. Immunologists	9
Am. Soc. Biochemistry & Molecular Biology	8
Am. Soc. Cell Biology	7
Infectious Disease Soc. Am.	6
Am. Soc. Tropical Medicine & Hygiene	5

Funding

One mark of emerging leadership is receiving other prestigious grants. Eight BWF awardees held the Ellison Medical Foundation's now retired New Scholar in Global Infectious Disease Awards. When Ellison ended their investment in infectious disease, the Fund adopted their awardees into our "BWF family" and began including them in our career development activities, so many of these fellows became familiar with BWF before applying for our awards. Four awardees have been appointed Howard Hughes Investigators since getting the Pathogenesis award. Five awardees are CIHR New Investigators, and five have the Beckman Young Investigator Award. Seven are Searle Scholars. Three have received Pew Scholar Awards and three have awards from the Cancer Research Institute. Three have been selected by Federal agencies for the Presidential Early Career Award in Science and Engineering and have gone to the White House to meet the President. Two have received NSF's equally prestigious CAREER Award. Two have the American Heart Association's early faculty award. One has the Camille Dreyfus Teacher Scholar Award. Two have awards at each of the Donaghue Foundation, the Sloan Foundation, and the American Cancer Society.

The aggregate current funding of our 78 current and past awardees is more than \$258 million. (Not all awardees provided funding data, so this number is low.) No awardee was currently unfunded at the time these numbers were compiled.

Teaching is a fundamental part of most faculty jobs, and service as a course director or co-director and involvement in course development are markers of leadership. All but two awardees report spending time on teaching, but 17 awardees have not yet served as course directors or co-directors. Two awardees, both funded in 2002, report having played director roles in seven courses. Three awardees have led five courses, and five awardees have led four courses. Four have directed three courses. Fourteen have led two classes and 27 have only led once. Six awardees provide no information on teaching.

Fifty-five awardees report on training postdocs. Between them, they have been advisors to 289 fellows, 169 of them still in training. Together, the 18 women who report training postdocs have trained 86 people, with a median of 5 per lab. The 37 men who report training postdocs have trained 203 people with a median of 5 per lab, as well. Sixty-one awardees report training 370 graduate students for the Ph.D. Twenty-five women have trained 165 graduate students and thirty six men have trained 205 graduate students. Both genders have trained a median of five Ph.D. students per lab. Though the medians are similar, the averages differ: the average female awardee has trained 6.6 students while the average male awardee has trained 5.7.

Thirty-three awardees report patent activities, together producing or applying for 94 patents. The seventy-eight awardees have published more than 2,708 research papers in peer reviewed journals. The median number of research papers across all awardees is 27, though it should be noted that awardees range from brand new assistant professors to full professors and work in a variety of fields where publishing rates differ.

Successful applicants have ranged from new appointees to those on the brink of promotion since the program's inception. The graph above shows the range of dates of appointment for successful applicants for each round of the program. For some applicants, the Pathogenesis award is their first major piece of funding. Because many awardees are nearly at tenure when their award begins, it is not possible to make any general statement about how the program impacts awardee's tenure and promotion.

Awardees in the Pathogenesis of Infectious Disease program are strong early and early-mid term faculty at top institutions. They are successful, and measures of their success include their performance in publishing peer reviewed research, obtaining funding, seeking and obtaining patents for new inventions, and training students and postdoctoral fellows. They are taking leadership roles at their home institutions as clinical and classroom teachers, serving the broader research community through active work on behalf of leading journals, and participating in peer review as members of study sections.

It is difficult to measure the impact of the Fund's assistant professor level grants because several elite funders are available to support strong researchers at this career stage. The success of BWF awardees in gaining other prestigious grants at this career stage may be an indicator of their quality, but the real measure of the program's success will be how the Investigators in the Pathogenesis of Infectious Disease distinguish themselves as leaders in the coming years.



Distribution of Seniority at Application

Interfaces in Science

The biological sciences are changing. Advances in genomics, quantitative structural biology, modeling of complex systems, and nanotechnology have opened up new realms of research for ambitious investigators with backgrounds in physics, mathematics, computer science, and engineering who want to explore the new frontier of biology. In recognition of the vital role such cross-trained scientists will play in furthering biomedical science, the Burroughs Wellcome Fund has made a major investment in the training and support of young investigators with backgrounds in the physical, chemical, or computational sciences whose work addresses biological questions and who are dedicated to pursuing a career in academic research.

Career Awards at the Scientific Interface

Five-year awards provide \$500,000 to bridge advanced postdoctoral training and the first three years of faculty service. These awards are intended to foster the early career development of researchers with backgrounds in the physical/mathematical/computational sciences whose work addresses biological questions. BWF has moved to a self-nomination format for this award only.

Program Outcomes

Recognizing that the future of biology would unfold at its boundaries with the physical and mathematical sciences, the Burroughs Wellcome Fund launched the Career Awards at the Scientific Interface in 2001. Since then, a total of 69 awards have been made, representing an investment of more than \$34 million. The following provides data on the applicant pool for the program, awardee demographics and faculty transitions, as well as several measures of research and academic productivity for those who are already in faculty positions.

Applications

Modeled closely on BWF's Career Awards in the Biomedical Sciences (CABS) program, which provided bridging funds from the postdoctoral period to an early faculty position, this program is distinguished by the requirement that applicants have doctoral level training or evidence of significant expertise in a computational, theoretical, or physical science discipline outside of biology. The program also extends limited eligibility to foreign nationals holding temporary visas, as in these fields, the majority of postdocs (and therefore, faculty candidates) in the United States are on temporary visas. The chart below shows the number of applications over the history of the program. The sharp increase in 2008 for the FY2009 cycle reflects the additional nomination slot that was allowed beginning that year. The number of institutions submitting candidates has nearly doubled since the program's inception. During the 2009 cycle 85 institutions nominated at least one candidate.

Distribution of Doctoral Training Disciplines among CASI Awardees, 2002-2009.



Awards: Demographic Profile

The 69 successful applicants to the program have come from 30 different institutions with Harvard and Stanford having the most at eight and Rockefeller Institute with seven awardees. The table below shows the demographics of the awardees.

Awardee Demographics

Female Awardees	25/69 (36%)
Under-represented Minorities	2/69 (3%)
Temporary Visa Holders	14/69 (20%)

Physics is the discipline represented the most in awardees at 38 percent. Chemistry is second at 22 percent. The distribution of biological areas in which the awardees are working is led by cell/molecular biology at 28 percent and neuroscience at 19 percent.

Faculty Transitions

As of April 2010, 58 of the 69 awardees have been appointed to tenure track faculty positions. BWF staff review the faculty offer letter for every transition, providing context for the salary range, startup, teaching commitment, space, and other aspects of the offer. In most cases the offer is approved immediately, in some cases the awardee is advised to seek more specificity or better terms. Of the 58, 28 have been recruited to physical science departments and 10 to engineering departments. It is clear that many of those awardees trained in physics and chemistry are being hired in other departments.

The 58 awardees have been hired by 32 different institutions. Stanford and Georgia Tech have hired the most at four each.

Average salaries and startup conditions for awardees are shown in the table below, however bear in mind this represents faculty transitions taking place from 2002-2009. For awardees appointed in engineering departments, average salaries were higher than those appointed in physical science or biological science departments (note that 12-month, not nine-month salaries are shown), while biological science start-up packages averaged higher. Broader ranges for salaries and start-up packages were seen in the physical sciences. Overall, the total length of the postdoctoral training period averaged between 4-4 ¹/₂ years. Among the 69 awardees, two have opted not to pursue a faculty position and have 'resigned' their BWF award. One of these is now working for Goldman-Sachs, and the other is in law school following a stint at the U.S. Patent office. Clearly these awardees, with deep training and experience in several disciplines, have many career options beyond academia. One other award was cancelled due to lack of progress after the awardee moved into a faculty position. Overall, for those who are no longer in a postdoctoral position, the rate of transition to a tenure-track faculty position is 98 percent.

CASI Faculty Appointment Data as of April 2010			
	Range	Average	
Biological Science/Medical School Departments (n=20)			
12-month salary	\$78-116 K	\$98 K	
Startup funds	\$150 K-2.5 Mil	\$808 K	
Total months postdoc before moving to faculty position	29-76	49	
Mathematics/Physical Science Departments (n=28)			
12-month salary	\$65-116 K	\$96 K	
Startup funds	\$10 K-2.4 Mil	\$716 K	
Total months postdoc before moving to faculty position	25-108	52	
Engineering Departments (n=10)			
12-month salary	\$104-136 K	\$116 K	
Startup funds	\$385 K-1.1 Mil	\$720 K	
Total months postdoc before moving to faculty position	26-83	53	
Overall (n=58)			
12-month salary	\$65-136 K	\$100 K	
Startup funds	\$10 K-2.5 Mil	\$756 K	
Total months postdoc before moving to faculty position	25-108	51	

Junior Faculty Outcomes And Activity

Beyond achieving a transition into a faculty position, CASI awardees are expected to succeed as independent investigators. BWF staff examined recent progress reports, and also asked awardees to respond to an online survey to report their more recent accomplishments and activities. The data that follow set a baseline for this awardee group, and does not compare them to a control group.

A. Funding

The table below shows the federal and foundation funding profile for the 23 awardees who moved to a faculty position in 2006 or earlier, as well as for the 11 who moved in 2007. Of the earlier group, a little over half have an NIH ROI, compared to 36 percent of the later group. Two received NIH Pioneer Awards, and one received an NIH New Innovator Award (considered an ROI-equivalent). An additional group transitioned to faculty positions in 2008-2010, but it is too early to assess their progress.

B. Publications

We asked awardees to provide citations for up to three papers, published since their awards, which they viewed as being of highest impact. The table below shows the journals in which these papers appeared most frequently.

Distribution of CASI Papers		
# Papers	Journal	
16	Nature	
15	Nature specialty journals	
13	Proceedings of the National Academy of Science	
7	Biophysical Journal	
6	Science	
6	PLoS journals	
4	Physical Review Letters	
3	Cell	
3	Journal of Cell Biology	
3	Neuron	
61	Others- 2 or fewer papers/journal	

137 **Total Reported**

Grant Funding Held by CASI Awardees			
Federal Grants	Year Appointed 2006 or Earlier (n=23)	to Faculty 2007 (n=11)	
ROI or equivalent	12 (52%)	4 (36%)	
2 x ROI	2		
NSF Career or other grant	6 (26%)	6 (55%)	
2 x NSF	3		
R0I + other federal	9	2	
Other federal (DOE, DOE,			
NIH non-ROI)	3		
No federal funding	5 (22%)	2 (18%)	
Foundation Grants			
One grant	15 (65%)	7 (64%)	
Two or more grants	11	7	
Sloan	5	2	
HHMI	3		
Searle	2		
No foundation funding	8 (35%)	4 (36%)	
No federal or foundation funding	1	1	

C. Promotion to Tenure

Most CASI awardees have little difficulty securing a tenure-track faculty position. Indeed, most of them receive multiple offers from very prestigious institutions. Thus far, just five of the awardees have completed the tenure process. Four of them received tenure. The one who did not receive tenure is now a research professor, with National Science Foundation funding. Five expect to go through the process during 2010, and an additional six in 2011.

D. Patents

One measure of innovation is patent applications. Fourteen of the CASI awardees reported that they held a patent, and four held multiple patents. Eleven awardees indicated that they are collaborating with industry. One awardee is an outlier: he holds 30 patents and has started two companies.

E. Curriculum development

BWF expects its awardees to make significant contributions to the interdisciplinary culture at their institutions. At least 30 of the CASI awardees have developed at least one interdisciplinary course, and nine have developed two or more. The table below shows the distribution of these courses across departments. Some courses were cross-listed in several departments.

Distribution of New Interdisciplinary Courses Developed by CASI Awardees

f Courses	Department
14	Biological science
10	Mathematics/statistics
10	Engineering
6	Physics
5	Computer science
4	Chemistry
1	Bioinformatics
1	Epidemiology
1	Biophysics

F. Leadership Roles

BWF fully expects that its awardees will become thought leaders in their fields. Figure 1 shows the array of leadership roles assumed by CASI awardees who were appointed to faculty positions after 2007. A clear progression is seen in Figure 2, as those who were in faculty positions prior to 2007 have begun serving on NIH study sections, NSF review panels, and are more likely to be organizers of scientific meetings.



Figure 1: Leadership Roles for CASI Awardees Appointed to Faculty Positions after 2007

Figure 2: Leadership Roles for CASI Awardees Appointed to Faculty Positions in 2007 or Earl



G. Methods Used

The CASI program was conceived as encompassing a wide range of computational, physical, and theoretical approaches in addition to wet-lab biological experimentation. The chart below shows the types of methods used by current CASI awardees. Nearly all of them are doing experiments, and almost as many are using computation.



Research Approaches Used by CASI Awardees

Summary and Plans for Further Analysis

The CASI program has remained quite robust throughout its history. The applicant pool is deep, and more institutions are putting up qualified candidates every year. Most awardees receive multiple faculty offers and are given significant resources to begin their independent research careers. The outcomes presented here indicate that BWF CASI awardees are succeeding in getting independent funding for their work, are publishing in high-impact journals, and are assuming leadership roles in their fields. These data are meant to serve as a baseline only, without a formal comparison group.

Population and Laboratory Based Sciences

The Burroughs Wellcome Fund launched an institutional award program in 2008 supporting graduate education in programs that will train students for simultaneous expertise in both population approaches (for example, epidemiology) and science done "at the bench." These students should emerge well-positioned to take on complex problems currently beyond the reach of most traditionally trained individual investigators.

Institutional Program Unifying Population and Laboratory Based Sciences

Five-year awards provide \$2.5 million to unite populationlevel and laboratory-based biological sciences. The award supports the training of researchers working between existing research concentrations in population approaches to health and in basic biological sciences. The goal is to establish interdisciplinary training programs by partnering researchers working in disparate environments and intellectual frameworks.

Reproductive Sciences

Many health and social problems in the United States can be attributed to preterm births. The Burroughs Wellcome Fund launched an award initiative in 2009 to expand the limited understanding of the biological mechanisms underlying childbirth and spontaneous preterm birth using multidisciplinary approaches.

Preterm Birth Initiative

Awards will bring together a diverse interdisciplinary group with expertise in genetics/genomics, immunology, microbiology, and proteomics along with the more traditional areas of parturition research such as maternal fetal medicine, obstetrics, and pediatrics to address the scientific issues related to preterm birth. The formation of new connections between reproductive scientists and investigators who are involved in other areas will give preterm birth research a fresh look. Full research grants will provide up to \$600,000 over a four-year period.

Science Education

Engaging children in science has been a focus of the Burroughs Wellcome Fund since it became an independent, private foundation in 1994. We are convinced that all children, regardless of their future career path, need basic science literacy to participate fully in civic life.

We believe that the best method for achieving the goal of science literacy is to get students involved in the scientific process and let them do what comes naturally: ask questions and participate in hands-on activities and experiments that convey basic scientific principles.

Career Awards for Science and Mathematics Teachers

Five-year awards provide \$175,000 to eligible science or mathematics teachers in the North Carolina public primary and secondary schools. The purpose of this award is to recognize teachers who have demonstrated solid knowledge of science or mathematics content and have outstanding performance records in educating children. The award is a partnership between the North Carolina State Board of Education and BWF.

Student Science Enrichment Program

Three-year awards provide up to \$180,000 to North Carolina nonprofit organizations, including public/ private schools, universities, colleges, and museums. This program supports creative inquiry-based science enrichment activities that occur outside the typical school day for K-12 students. The program's goals are to nurture students' enthusiasm about science, expose them to the excitement of scientific discovery, and interest them in pursuing careers in research or a variety of other careers in science.

Program Outcomes

Demonstrating the Value of Inquiry-Based Science in Afterschool Programs

The threat of American schools reducing the amount of instructional time to below 180 days should cause outcries from students, their parents and other education stakeholders who know the value of continuous, productive learning. Although knowing that our current economic climate is presenting financial challenges for our schools and school systems, it still is not wise today or at any other time to sacrifice quality learning for our students whose academic standings are behind the curve when compared to students in other countries. If indeed such a reduction does occur, education funders should consider the obvious, reach students where they spend most of their time-outside the classroom-and get them engaged in doing science that can impact their own communities. A National Research Council report called. How People Learn, shows that students spend the majority of their time (53 percent) within the home and community compared to only 14 percent in school.1 Foundations should help make strategic connections for students to the world outside of the classroom in a number of exciting ways.

One Foundation's Journey

We know a lot about learning, but we either lack the will or the wisdom to apply this knowledge in helping make all students in America successful in and out of school. As a foundation with the desire to increase the pipeline of students considering careers in the sciences or science-related fields, the Burroughs Wellcome Fund (BWF) accepted the challenge of impacting students through afterschool science programs. In 1996, the Student Science Enrichment Program (SSEP) was created to engage talented scientists and science teachers to expose North Carolina's students to the wonders of science and the satisfying ability to solve problems. SSEP award recipients range from K-12 public and private schools, universities, and colleges to museums and community groups such as the Boys and Girls Clubs. BWF requires programs to enable students to participate in hands-on science activities such as studying water

quality or DNA, building robots and making them function, and growing gardens to study the value of nutrition. Pursuing inquiry-based avenues of exploration is an educational approach that BWF believes to be an effective way to increase students' understanding and appreciation of the scientific process that can be applied to any subject area.

SSEP activities must take place in out-of-school settings such as afterschool, summers, holidays, and tracked-out times for year-round schools. Many of the high school programs are career-oriented, while others are practical programs intended to provide creative science and mathematics enrichment experiences to excite students in wanting to learn more. We strive to reach students who have shown exceptional skills and interest in science and mathematics, as well as those perceived to have high potential in critical thinking and innovation. To increase academic achievement, programs must demonstrate a well-defined structure that aligns with the school-day curriculum, have a well-trained staff to interact with students, and utilize processes for student follow up. SSEP also serves as a structure to engage scientists in K-12 learning. SSEP grants provide up to \$60,000 per year for three years. To date, we have made 141 SSEP awards to 69 different N.C. organizations, and reached 33,000 students.

Program Evaluation Helps to Identify Strengths and Weaknesses

To demonstrate the effectiveness of BWF's investments in science education, we adopted an evaluation plan for SSEP at the program's inception in 1996, utilizing independent external evaluators to assess the progress of grant recipients on an annual basis and align their performance with the overall goals of SSEP. The strategies used to assess SSEP outcomes center on collecting student self reported data and that of program directors as they relate to the following three program goals:

- Goal 1: Improving students' competence in science
- Goal 2: Nurturing students' enthusiasm for science
- **Goal 3:** Interesting students in pursuing careers in research and other science-related areas

A cumulative database of program-level data and studentlevel data was developed utilizing data from the 2003-04 school year through the 2006-07 school year. The study explored the possible relationships between programlevel characteristics and student outcomes during this four-year data collection. The data, captured through surveys from 2,162 middle school and high school students and annual progress reports, provide demographics of these student participants, their attitudes, and their interests regarding science; the types of project activities being used; and progress toward achieving program goals. BWF uses the evaluations to guide program changes and development. SSEP applicants are required to submit a proposed evaluation plan to help them develop desired outcomes for students they will reach. This plan must define these expected outcomes, how program activities will help students meet their goals, and explain who will conduct the evaluation and at what cost.

The ongoing program evaluation reveals a number of findings, including the need to: 1) continue making strategic efforts to reach minority students; 2) recognize the value of students' attitudes in creating effective programs; and 3) seek ways to strengthen students' confidence in learning. Below is a look at findings as they relate to SSEP goals.

Goal 1: Improving Students' Competence in Science

In the SSEP evaluation, it was evident that over 85 percent of North Carolina student participants stated they understand science better. Although the student feedback survey data do not provide direct evidence of change in students' competence in science, there were good indicators of self perception of increased competence.



Impact on Self Perception of Science Competence

Goal 2: Nurturing Students' Enthusiasm for Science

Since SSEP's inception, we have found that the best ways to determine if students are learning and enjoying their experiences is whether or not they will invite their friends to participate and/or share what they are doing with their families. Over 90 percent of students reported their desire to do these things.

Students' Enthusiasm for Science



Goal 3: Interesting students in pursuing careers in research and other science-related areas

High school programs mainly target students who may have strong interests in careers in science. SSEP surveys typically will ask students about their interest in taking more science in preparation for a career as a scientist. We found that a number of students were unclear of what scientists do, had never spoken with a scientist, or seen a scientist at work. Based on these data early on, BWF required scientists and science teachers to be heavily engaged in working with students. Since 2004, an average of 50 percent of student participants in a sample size of 654 stated they learned about the nature of scientific work. More so, over 70 percent of students changed their feelings about science learning.



Changed Feelings about Science Learning

BWF has collected other data that have changed the framework of SSEP guidelines and what we now require of program directors. In particular, the following attributes of successful SSEP projects are helping to better define for applicants what we want to see in their applications:

- Programs must use a curriculum that is appropriate for targeted students.
- Programs must offer "minds-on" as well as hands-on inquiry based activities.
- Programs must involve scientists and science teachers.
- Programs must provide students with opportunities to discuss their work and present it to others.
- Programs must have a large applicant pool from which to draw, in order to ensure participation by quality students.
- Programs must maintain an on-going relationship with students, as it has been demonstrated that programs that continue throughout the school year make a bigger impact.

SSEP directors are consistently asked to give an approximate number of hours the average student participates in program activities. Data collected during the first 10 years of the program are still relevant today. Figure 1 shows a sample size of 49 programs that reflects outcome data from projects from 1996 to 2006. The number of student contact hours for each subgroup ranged from eight to 250. Over 75 percent of students had over 20 hours of contact time.

BWF has found over time that biology is the most popular subject area offered by SSEP projects. Figure 2 examines other subjects generally offered by SSEP afterschool projects. We anticipate this listing will expand now that elementary schools are eligible to apply for SSEP grants.

What's Next?

What does all this mean for the Burroughs Wellcome Fund? We are reaching some students who would have never considered giving up their summers or afterschool time to do science. We are increasing the pipeline of young people who may potentially become tomorrow's future scientists of America. We are providing creative and fun ways for students to learn critically, to solve problems, and to hang out with their friends and meet new ones. We are providing a venue for scientists to become engaged with K-12 students.

We view the outcome data for SSEP as good news, but we also recognize that there is still much work to be done in reaching North Carolina students. There are over 1.4 million students in K-12 public schools in this state, and SSEP has only reached 33,000 of them. Therefore, we are building partnerships and working with other afterschool providers to integrate more science, technology, engineering, and mathematics into their programs. The North



Figure 1: Average Hours of Student Participation (49 Project Subgroups)

Carolina Science Mathematics and Technology Education Center (www.ncsmt.org), created by BWF, provides a listing of available resources to help communities connect with scientists to do this work. A statewide alliance called the North Carolina Center for Afterschool Programs (NC CAP) (www.nccap.net) is part of a national movement of the Afterschool Alliance to improve the quality of afterschool activities and training for providers. BWF is working with organizations such as the N.C. Department of Juvenile Justice and Department of Health and Human Services through NC CAP to reach students in considerable need of quality out-of-school experiences. Further on the national front, Grantmakers for Education, a membership organization that strengthens education philanthropy in the United States, has an Out-of-School Time Funder Network that is focusing on STEM (science, technology, engineering, and mathematics) learning.

We want to spread the word about the Student Science Enrichment Program evaluation and to share the tools used to capture data from students and directors of these out-of-school time programs, which range from university scientists to directors of community Girls and Boys Scout programs. Access these tools and more at www.bwfund.org/pages/165/Evaluation. A publication describing the first ten years of BWF's science education program area is also included on the Burroughs Wellcome Fund's website.

Bibliography

1. National Research Council, How People Learn: Brain, Mind, Experience and School, 2000.



Figure 2: Subject Areas Explored (49 Project Subgroups)

Note: Percentages add to more than 100% since most subgroups explored more than one subject.
Translational Research

Physician-scientists play a crucial role in the continuum of research that ensures a free flow of information and new treatments from the laboratory to the patient bedside and back again. BWF created the Clinical Scientist Awards in Translational Research to foster the productivity of independent physicianscientists at the mid-career level who will strengthen translational research in academic health centers, both through their own studies as well as their mentoring of the next generation of physician-scientist trainees. With the increase in federal support for translational programs, BWF discontinued the award in 2010.

BWF continues to support activities that impact the environment in which translational research is conducted. Of particular interest are efforts that provide career development resources to young investigators.

Program Outcomes

Clinical Scientist Awards in Translational Research Program Outcomes 2010

When BWF launched its Translational Research focus area in 1997, translational research was a new idea. BWF entered this field ahead of others and helped to define it. Translational research—moving basic discoveries, which may have been inspired by clinical experience, into first-in-humans studies—was harder to fund and harder to do than pure basic science. The program area was a natural expression of BWF's corporate legacy in the intelligent development of therapeutics—the sort of work that led to the Hitchings-Elion Nobel prize.

Prior to 1997, BWF offered a Scholar Award in Experimental Therapeutics that provided modest funding to mid-career investigators. In 1998, partially in response to the NIH Director's Panel on Clinical Research¹, BWF launched a new program, Clinical Scientist Awards in Translational Research. Despite the burgeoning opportunities to translate discoveries into therapies afforded by the impending completion of the human genome sequence as well as a proposed doubling of the NIH budget, physician-scientists aiming to establish careers in academic medicine faced significant disincentives. Among them were high levels of medical school debt combined with the need for extended training in both clinical medicine and clinical science, the difficulty obtaining research funding to protect time for research, the excessive regulatory burden surrounding research involving human subjects, and the lure of private practice², ³, ⁴, ⁵. BWF's program sought to address these disincentives by providing generous funding (\$750,000 over five years) in order to protect the time of established, independent physician-scientists at the mid-career stage. As such, the program was distinguished from BWF's other awards targeted at the early career stage.

Among the strategic goals of the program were the following:

- 1. Protecting award recipients' time for research (75% required)
- 2. Encouraging movement toward human subjects research and clinical studies
- Identifying and rewarding proven mentors; increasing capacity for mentoring the next generation of physician scientists
- 4. Establishing leaders of the next generation of academic medicine

The program advisory committee loosely defined "translational research" as that which would conceivably require Institutional Review Board (IRB) approval within the five-year award period. They have worked hard to select candidates who had a clear vision for how basic, mechanistic discoveries might be advanced toward the first testing in humans, and those who were likely to serve as effective mentors for the next generation of physician scientists. This report will describe the characteristics of the program, and then describe outcomes related to the program goals stated above.

Characteristics of Applicants and Awardees

The program was highly competitive; with an award rate of just 9 percent over 11 cycles, from 1998 to 2009. In the most recent cycle, applicants came from 52 institutions. The program made a total of 97 awards, with a total financial commitment of \$72.75 million. The number of institutions holding at least one of these awards is 41. Over the history of the program the awards are evenly split among M.D.s and M.D./Ph.D.s, although not surprisingly M.D./Ph.D.s enjoy a more favorable ratio of success. In 2009, they represented just 48 percent of the applicant pool but received 3 of the 4 awards. In 2009, the program received the highest percentage of applications from women at 32 percent. Over the history of the program, 19 percent of the awards have gone to women. BWF has been sensitive to issues affecting the career advancement of women in academic medicine⁶, ⁷, ⁸, and has encouraged institutions to nominate female

candidates for the award, which had little effect on the number of female nominees. It was not until an additional nomination slot for female candidates was added in 2007 that the proportion of women nominated began to approach the level of their appointment to the rank of assistant professor.

The program did not focus on any particular disease area or subspecialty of medicine. Figure 1 shows the distribution of the 97 awards across the different clinical areas addressed in their BWF-funded work.

Awards: Outcomes and Activity

In 2008 and 2010, BWF surveyed the awardees to ascertain 'corporate' progress toward the program goals. The survey asked awardees to identify their highest-impact work, to report on their leadership roles within and external to their institutions, as well as to report on their activity in translating their work by launching clinical studies. Finally, they were asked to report on their training activities.



Distribution of Clinical Areas of Proposal Focus (97 Total Awards)

Awardees were asked to cite their three highest-impact publications. Of 70 awardees responding, 32 listed a paper in Nature or a Nature specialty journal, 18 reported a publication in Proceedings of the National Academy of Science, 10 reported a paper in Science, and 8 reported a paper in the New England Journal of Medicine (See table below). An appropriate comparison group is difficult to identify, however these rates of publication in high-impact journals is comparable to that of BWF's career awards programs⁹, ¹⁰, a population of largely Ph.D. awardees with no clinical responsibilities. We can therefore conclude that this group of clinical investigators is producing high-impact scientific work at a rate similar to BWF's other programs.

Publications: Top Three in Impact

Papers	Journal	Awardees (71)
21	Nature	32/70 (45%)
26	Nature specialty journals	
24	PNAS	18/70 (25%)
21	J. Clinical Investigation	17/70 (24%)
11	Science	10/70 (14%)
10	New England Jour. of Med.	8/71 (11%)
7	Blood	4/71 (6%)
7	Cancer Research	5/71 (7%)
5	Cell	4/71 (6%)
79	Others (4 or fewer papers)	
211	Total Reported	

The program aimed to select the very best physician scientists for this award, and we expected that they would go on to win other prestigious awards. Eight of these awardees have since been named HHMI Investigators, nine have been named Doris Duke Distinguished Clinical Scientists, and three have received the NIH Pioneer award. In 2009, one received one of the inaugural Transformative ROI awards from NIH, and in perhaps the greatest outcome yet for a BWF awardee, Dr. Brian Druker won the 2009 Lasker-DeBakey Clinical Medical Research Award. To assess the impact of this group the following observations were distilled from the survey responses (n=90), and updated, where possible, with information gleaned 18 months later from 2009 progress reports (n=47):

Human Subjects Research:

- 83.5 percent of awardees had co-authored a paper involving human subjects in 2005-2008
- 91 percent of awardees had grant support for research involving human subjects in 2008
- 2009 UPDATE: 22/47 were currently conducting a clinical study. Six mentioned that they held an Investigational New Drug (IND) exemption.

Institutional Leadership:

- 54/80 had leadership role within their institutions (department chair, program director, etc.)
- 75/90 were in an institution with a CTSA (two were CTSA PIs) in 2008
- 2009 UPDATE: the number of awardees based within a CTSA institution has now increased to 80/91 awardees

Involvement in Training:

As shown in the table below, awardees train on average more Ph.D.s than M.D.s and M.D./Ph.D.s combined. When the 2008 survey data is compared to 2009 progress report data, this gap is widening, although it probably cannot yet be considered a trend.

Types of Trainees in Awardee Groups

Д	Average number of trainees/awardee			
Type of trainee	2008	2009		
(includes students and fellow	(90 awardees)	(47 awardees)		
Ph.D.	4.7	5.0		
M.D. and M.D./Ph.D.	3.7	3.0		
All degrees	8.4	8.0		

Industry Involvement:

According to the 2008 survey, 20 percent of the awardees had industry support. Among 47 active awardees in 2009, 36 percent indicated they were consulting with or collaborating with industry. Four had started their own companies. Eight mentioned in their reports that they were involved in either patenting or licensing a discovery. Twenty of the awardees specifically mentioned that they had no involvement with industry. Interestingly, this number included all but one of the female awardees.

Environment for Translational Research:

The consensus among BWF awardees in 2008 was that the overall environment for translational research had improved, but that major obstacles still remained. Chief among them were the regulatory burden for research involving human subjects, the flat NIH funding payline, the need for infrastructure to support clinical studies, and the need for a clearer path to commercialization of potential therapies. Since then, it appears that a greater proportion of awardees have taken steps to turn their discoveries into therapies, evidenced by the increased involvement in clinical studies and with industry. This correlates with the launch of the NIH-funded Clinical and Translational Science Awards (CTSAs), however it is unclear to what degree our awardees are now involved in their institutional CTSA programs.

Summary and Plans for Further Analysis

The data presented here are meant to serve as a baseline, as there is no comparison group. At the May Board meeting, we will expand on the data presented here, to include an analysis of the awardees' highest-impact publications as well as an update on their leadership roles and progress in translation. We will also report on their perceptions of the impact of the CTSA programs on their work. BWF's Clinical Scientist Awards in Translational Research is an example of a truly catalytic program. 'Translational research' is now beyond mainstream; indeed it has become a major theme in NIH funding and at academic health centers. BWF's early entry into this area provided 'proof-of-principle' and paved the way for a scaled-up investment from others.

Bibliography

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- 3. Ley and Rosenberg, NEJM 346:368-372 2002
- 4. Nathan, D. JAMA 287:2424-2427, 2002
- 5. Sung, et al JAMA 289:1278, 2003.
- 6. Nonnemaker NEJM 342:399-405
- 7. Andrews, N, NEJM 357:1887-8, 2007.
- 8. Tesch et al JAMA 273:1022-5, 1995
- 9. Sung, N. Report to BWF Board May 2010
- 10. Simpson, R. Report to BWF Board, May 2010

Science and Philanthropy

The Burroughs Wellcome Fund makes noncompetitive grants for activities and career development opportunities for scientists that fall outside of our competitive award programs, but are closely related to our targeted areas.

We place special priority on working with nonprofit organizations, including government agencies, to leverage financial support for our targeted areas of research, and on encouraging other foundations to support biomedical research. Proposals should be submitted to BWF by email. Mailed requests should be no more than five pages.

Applicants should describe the focus of the activity, the expected outcomes, and the qualifications of the organization or individuals involved; provide certification of the sponsor's Internal Revenue Service tax-exempt status; and give the total budget for the activity, including any financial support obtained or promised. Proposals are given careful preliminary review, and those deemed appropriate are presented for consideration by BWF's Board of Directors.

Applications are accepted throughout the year.

Report on Finance

The Burroughs Wellcome Fund's investments totaled \$608.0 million at August 31, 2010, the end of our fiscal year. BWF's primary financial goal is to pursue an investment strategy that will support annual spending needs and maintain a constant real level of assets over the long term. To achieve this goal, a high percentage of our investments are placed in strategies that derive the bulk of their returns from exposure to U.S. and international capital markets. Hence, fluctuations in BWF's investment results will be due largely to variability in capital market returns.

BWF's investment policies are developed with the recommendations and review of the Investment Committee, which is appointed by and reports to BWF's Board of Directors. The committee, which meets three times a year, has seven voting members, including four representatives from outside BWF and three representatives of our board. The board's chair, BWF's president, and BWF's vice president for finance also serve on the committee as nonvoting members.

As part of BWF's investment strategy, we have established "allocation targets"—that is, percentages of our total assets to be invested in particular asset classes. Investment managers hired by BWF pursue more focused mandates within each sector. As of the end of the fiscal year, BWF's asset mix and market values were:

- U.S. large capitalization equity assets had a market value of \$111.2 million. The sector's target allocation was 25 percent, and actual holdings stood at 18.3 percent.
- U.S. small capitalization equity assets had a market value of \$84.2 million. The sector's target allocation was 18 percent, and actual holdings stood at 13.8 percent.

- International equity assets had a market value of \$144.4 million. The sector's target allocation was 32 percent, and actual holdings stood at 23.8 percent.
- Fixed income assets had a market value of \$124.9 million. The sector's target allocation was 22 percent, and actual holdings stood at 20.5 percent.
- Cash equivalent assets had a market value of \$16.0 million. The sector's target allocation was 3 percent, and actual holdings stood at 2.6 percent.
- Alternative assets had a market value of \$127.3 million. The sector did not have a target allocation, and actual holdings stood at 21.0 percent. The maximum permitted allocation to alternative assets stood at 20.0 percent at cost.

The total market value of BWF's investments increased by \$21.2 million, or 3.6 percent, from the end of the previous fiscal year. This increase in assets was due to decent returns for most asset classes during the year. BWF's total investment return before investment management fees for the fiscal year was +8.3 percent. Returns in all three equity sectors as well as for bonds were positive for the fiscal year. The U.S. large capitalization equity sector returned +5.2 percent, the U.S. small capitalization equity sector had a +8.3 percent result, the international equity sector posted a return of +4.2 percent for the fiscal year, and fixed income produced a +13.6 percent result.

As of August 31, 2009, BWF employed 11 marketable securities investment managers. In the U.S. large capitalization equity sector, the managers were AXA Rosenberg Investment Management; LSV Asset Management; and Enhanced Investment Technologies. State Street Global Advisors, WCM Investment Management and FAF Advisors managed U.S. small capitalization equities. Pacific Investment Management Company and Smith Breeden Associates were the fixed income managers. Capital Guardian Trust Company; Northern Cross; and Hansberger Global Investors managed international equities. BWF also held investments in seven venture capital funds: Intersouth Partners IV, V and VI, Spray Venture Funds I and II, Mission Ventures II and A. M. Pappas Life Science Ventures II. Barlow Partners and Winston Partners managed funds of equity oriented hedge funds. Blackrock Alternative Advisors and Franklin Street Partners managed funds of absolute return strategies. Pacific Investment Management Company managed an absolute return strategy. Finally, Hamilton Lane Advisors managed a fund of private equity strategies.

Statements of Financial Position

August 31, 2010 and 2009

(All dollar amounts presented in thousands)

	2010	2009
Assets		
Cash and cash equivalents	\$ 41,048	\$ 23,983
Marketable securities	581,062	566,868
Accrued interest and dividends receivable	1,606	1,484
Federal excise tax receivable	92	240
Other assets	47	42
Property and equipment, net	10,017	10,367
Total assets	\$ 633,872	\$ 602,984
Liabilities and Net Assets		
Transactions payable, net	\$ 15,056	\$ 6,052
Accounts payable and other liabilities	960	17
Deferred federal excise taxes	_	118
Unpaid awards	91,519	108,801
Total liabilities	107,535	114,988
Unrestricted net assets	526,337	487,996
Total liabilities and net assets	\$ 633,872	\$ 602,984

Statements of Activities

August 31, 2010 and 2009

(All dollar amounts presented in thousands)

	2	010		2009
Revenues				
Interest and dividends, less investment expenses of \$2,768 and				
\$2,116 in 2010 and 2009, respectively	\$9,	647	\$	10,867
Net realized gain (loss) on sale of marketable securities	44,	537		(98,001)
Total revenues	54,	184		(87,134)
Expenses				
Program services	2,	721		23,570
Management and general	4,	966		5,220
Total expenses before net unrealized appreciation				
and deferred federal excise tax	7,	687		28,790
Net unrealized appreciation (depreciation) of marketable				
securities, net of provision for deferred federal excise taxes				
of \$0 and \$107 in 2010 and 2009, respectively	(8,2	156)		5,238
Change in net assets	38,	341	(110,686)
Net assets at beginning of year	487,	996		598,682
Net assets at end of year	\$ 526,	337	\$	487,996

For full audited financials visit bwfund.org/annualreport.

Grants Index

BWF makes all grants to nonprofit organizations. For most of the programs, the name of the individual on whose behalf the grant is made is listed first, the title of the award recipient's project is listed second, and the name of the organization that received the money is listed third. In the competitive grant sections, new awardees for FY 2009 are listed in red.

For programs that may have coaward recipients, the award recipients and their organizations are listed first, followed by the project title. For grants made directly to organizations and not on behalf of an individual, the name of the organization is listed first, followed by the title of the project or a brief description of the activity being supported. In addition to making competitive awards, BWF makes noncompetitive grants—Ad Hocs—for activities that are closely related to our major focus areas. These grants are intended to enhance the general environment for research in the targeted areas.

For full audited financials visit bwfund.org/annualreport.

Program Summary

August 31, 2010

	Approved	Paid	Transferred / Cancelled *
Biomedical Sciences			
Career Awards in the Biomedical Sciences	\$ 18,682	\$ 2,874,141	\$ 651,125
Career Awards in the Medical Sciences	575,681	2,485,312	789,000
Hitchings-Elion Fellowship	_	84,000	-
Research Travel Grant	247,690	238,980	3,000
Ad Hocs	525,213	595,750	250,000
Total	\$ 1,367,266	\$ 6,278,183	\$ 1,693,125
Infectious Disease			
Investigators in Pathogenesis of Infectious Disease	\$ –	\$ 2,610,000	\$ –
Ad Hocs	1,500,792	859,748	95,000
Total	\$ 1,500,792	\$ 3,469,748	\$ 95,000
Interfaces in Science			
Career Award at the Scientific Interface	\$ 365,537	\$ 2,620,310	\$ 206,000
Ad Hocs	126,000	305,500	-
Total	\$ 491,537	\$ 2,925,810	\$ 206,000
Population Sciences			
Institutional Program Unifying Population			
and Laboratory-Based Sciences	\$ –	\$ 939,000	\$ –
Total	\$ –	\$ 939,000	\$ -
Reproductive Sciences			
Preterm Birth Initiative	\$ 490,000	\$ 490,000	_
Total	\$ 490,000	\$ 490,000	-

Program Summary

August 31, 2010

	Approved	Paid	Transferred/ Cancelled*
Science and Philanthropy			
Science and Philanthropy	\$ 153,000	\$ 138,000	_
Total	\$ 153,000	\$ 138,000	-
Science Education			
Student Science Enrichment Program	\$ 1,440,000	\$ 1,459,162	\$ –
Career Award for Science and Mathematics Teachers	\$ 875,000	\$ 150,000	\$ –
Ad Hocs	344,463	627,757	2,500,000
Total	\$ 2,659,463	\$ 2,236,919	2,500,000
Translational Research			
Clinical Scientist Award in Translational Research	\$ –	\$ 3,262,500	\$ –
Ad Hocs	\$ 166,500	206,500	-
Total	\$ 166,500	\$ 3,469,000	\$ –
Grand Total [†]	\$ 6,828,558	\$19,946,661	\$ 4,494,125

* The "Transferred/Cancelled" totals reflect grants made to award recipients who changed institutions, modified the terms of their grant at their current institution, or both changed institutions and modified their grant. In these cases, BWF's policy has been to cancel the remaining portion of the original grant and, as necessary, approve a new grant, which is why in the following index an approved amount has been noted, but the recipient is not a new awardee. When the award recipient has changed institutions, the new grant is made to the new institution; when the award recipient has not moved but has modified the terms, the new grant is made to the current institution.

[†]To more accurately reflect the total amount that BWF approved in actual "new" dollars during this fiscal year, the "Transferred/Cancelled" total must be deducted from the "Approved" total.

Biomedical Sciences

Career Awards in the Biomedical Sciences

Derek W. Abbott, M.D., Ph.D.

Case Western Reserve University School of Medicine Regulation of innate immunity via non-traditional ubiquitin linkages

Geoffrey K. Aguirre, M.D., Ph.D.

University of Pennsylvania School of Medicine fMRI studies of the process architecture of face perception

Karl Mark Ansel, Ph.D.

University of California-San Francisco Endogenous RNA interference and gene silencing in T cell differentiation

Kaveh Ashrafi, Ph.D.

University of California-San Francisco School of Medicine Comprehensive analysis of regulatory mechanisms of fat biology

Aaron P. Batista, Ph.D.

University of Pittsburgh Neural gating within the cerebral cortex during sensory-motor behavior

Diana M. Bautista, Ph.D.

University of California-Berkeley Molecular and cellular mechanisms of mechanotransduction in mammalian sensory neurons

Thomas G. Bernhardt, Ph.D.

Harvard Medical School Coordinating cell division and chromosome segregation in *Escherichia coli*

Bradley E. Bernstein, M.D., Ph.D.

Harvard Medical School Proteomic studies of post-translational histone modifications

Michael D. Blower, Ph.D. Harvard Medical School Analysis of the role of RNA in spindle assembly

David L. Brody, M.D., Ph.D. Washington University School of Medicine Amyloid-beta and apolipoprotein E in traumatic brain injury

Richard K. Bruick, Ph.D. University of Texas Southwestern Medical Center-Dallas Investigation of hypoxia sensing and signaling pathways

William (Bil) M. Clemons, Ph.D.

California Institute of Technology Structural studies of complexes involved in protein translocation and synthesis Leah E. Cowen, Ph.D.

University of Toronto Faculty of Medicine Hsp90 and the evolution of pathogens and their hosts

Nika N. Danial, Ph.D.

Harvard Medical School Integration of glycolysis and apoptosis by the pro-apoptotic protein BAD

Seth J. Field, M.D., Ph.D.

University of California-San Diego School of Medicine Comprehensive analysis of phosphoinositide function

Ira M. Hall, Ph.D.

University of Virginia School of Medicine Investigation of DNA copy-number fluctuation and epigenetic inheritance using genomic microarrays

Chyi-Song Hsieh, M.D., Ph.D.

Washington University School of Medicine Determining the antigen specificity of CD25+ CD4+ regulatory T cells

Christina M. Hull, Ph.D.

University of Wisconsin Medical School Cell identity, sexual development, and virulence in the human fungal pathogen *Cryptococcus neoformans*

Leslie S. Kean, M.D., Ph.D.

Emory University School of Medicine Innate immunity and transplantation tolerance: Defining the role of natural killer (NK) cells in allograft rejection

Tobias R. Kollmann, M.D., Ph.D.

University of British Columbia Faculty of Medicine Induction of protective immunity to listeria in neonates

Steven T. Kosak, Ph.D.

Northwestern University Feinberg School of Medicine Genomic organization of hematopoietic differentiation

Mondira Kundu, M.D., Ph.D.

University of Tennessee Health Science Center College of Medicine Role of Ulk1 and autophagy in erythroid maturation

Cheng-Yu Lee, Ph.D.

University of Michigan-Ann Arbor Genetic regulation of neural stem cell self-renewal

Yaping Joyce Liao, M.D., Ph.D.

Stanford University School of Medicine Neurophysiological dysfunction in calcium channelopathies

George Y. Liu, M.D., Ph.D.

University of California-Los Angeles Role of Group B *Streptococcal* hemolysin/cytolysin and pigment in the pathogenesis of invasive neonatal infections

Stephen B. Long, Ph.D.

Memorial Sloan-Kettering Cancer Center Atomic structures of open and closed voltage-dependent potassium channels and other eukaryotic membrane proteins

Stephanie A. Pangas, Ph.D.

Baylor College of Medicine Defining the role of TGFb superfamily in ovarian cancer through mouse models

Feroz R. Papa, M.D., Ph.D.

University of California-San Francisco Connection between endoplasmic reticulum stress and type 2 diabetes

Michael G. Poirier, Ph.D.

Ohio State University Study of DNA accessibility within nucleosome arrays

Margot E. Quinlan, Ph.D.

University of California-Los Angeles Collaboration between two actin nucleators – Spir and Capu

Oliver J. Rando, M.D., Ph.D.

University of Massachusetts Medical School Time scales of epigenetic inheritance: How and why

Kyu Y. Rhee, M.D., Ph.D.

Weill Medical College of Cornell University Enzymes of intermediary metabolism in *Mycobacterium tuberculosis*: Anti-mycobacterial targets of nitric oxide

Pardis C. Sabeti, M.D., D.Phil.

Harvard University Evolutionary genomics and its applications to human disease

Alvaro Sagasti, Ph.D.

University of California-Los Angeles Development of morphological diversity in trigeminal sensory neurons

Alan Saghatelian, Ph.D.

Harvard University Identifying functional connections between the proteome and metabolome by global metabolite profiling

Sara L. Sawyer, Ph.D.

University of Texas-Austin Using rapid evolution to identify intracellular proteins interacting with retrotransposons in yeast

Kristin E. Scott, Ph.D.

University of California-Berkeley Taste representation in *Drosophila* brain

Michael D. Shapiro, Ph.D.

University of Utah Genetic and developmental basis of skeletal diversity in ninespine sticklebacks

Benjamin P. Tu, Ph.D.

University of Texas Southwestern Medical Center-Dallas Logic of the yeast metabolic cycle

Amy J. Wagers, Ph.D.

Joslin Diabetes Center Dynamic circulation of hematopoietic stem cells: implications for stem cell function

Loren D. Walensky, M.D., Ph.D.

Harvard Medical School Targeting protein interactions in vivo using chemically reinforced helical peptides

John B. Wallingford, Ph.D.

University of Texas-Austin Molecular control of cell motility during vertebrate gastrulation

David M. Weinstock, M.D.

Harvard Medical School Defining individual DNA double-strand break repair capacity using zinc-finger nucleases

Karen M. Zito, Ph.D.

University of California-Davis Regulation of synapse formation in the mammalian cortex

Career Awards in the Medical Sciences

Antonios O. Aliprantis, M.D., Ph.D. Harvard Medical School Novel regulators of the osteoclast differentiation program

Robert Baloh, M.D., Ph.D. Washington University Mechanism of peripheral neuropathy from Mitofusin 2 mutations

James Elliott Bradner, M.D. Harvard Medical School Design and characterization of highly potent inhibitors of HDAC6

Kathleen H. Burns, M.D., Ph.D.

Johns Hopkins University School of Medicine Investigating the role of retrotransposons in hematopoietic neoplasias

Daniel Cahill, M.D., Ph.D.

University of Texas M.D. Anderson Cancer Center Translational molecular genetic analyses of chemotherapeutic resistance in human brain tumors

Clark C. Chen, M.D., Ph.D.

Harvard Medical School Molecular basis and therapeutic implications of genome instability during brain tumor progression

Alice Siau-In Chen-Plotkin, M.D.

University of Pennsylvania School of Medicine Genomic approaches to frontotemporal dementia

Sandeep Robert Datta, M.D., Ph.D. Harvard Medical School Characterization of neural circuits that drive innate behaviors

Arlene Dent, M.D., Ph.D.

Case Western Reserve University Acquisition of immunity to blood stage Falciparum malaria in infants

Mahalia Sabrina Desruisseaux, M.D.

Albert Einstein College of Medicine of Yeshiva University Neuroparasitology: neurological complications of cerebral malaria

Jay F. Dorsey, M.D., Ph.D.

University of Pennsylvania Identification of mSin3b and Mad4 as novel p53 target genes directing p53-mediated transcriptional repression

Chester Drum, M.D., Ph.D.

Massachusetts Institute of Technology Protein nanoparticles for small molecule drug delivery

Benjamin Levine Ebert, M.D., Ph.D.

Harvard Medical School Genomic approaches to disorders of erythroid differentiation

Brian Todd Edelson, M.D., Ph.D.

Washington University Macrophage and dendritic cell development

Rene L. Galindo, M.D., Ph.D.

University of Texas Southwestern Medical Center-Dallas Genetic dissection of the Rhabdomyosarcoma initiator PAX-FKHR and PAX-related signaling in skeletal muscle development

Wendy Sarah Garrett, M.D., Ph.D.

Harvard School of Public Health Novel effectors and regulators of inflammation, chronic infection, and carcinogenesis in the colon

Pradipta Ghosh, M.D.

University of California-San Diego Modulation of G-protein activity during oncogenic and metastatic progression

Jeffrey Parker Henderson, M.D., Ph.D.

Washington University School of Medicine Iron acquisition by bacterial siderophores as a pathogenic determinant in urinary tract infections

Darnell Kaigler, D.D.S., Ph.D.

University of Michigan-Ann Arbor Cell therapy for the treatment of alveolar bone defects

Lu Quang Le, M.D., Ph.D.

University of Texas Southwestern Medical Center-Dallas Cell of origin and tumor microenvironment in NF1-associated neurofibroma development

Michael Z. Lin, M.D., Ph.D.

Stanford University School of Medicine Elucidating mechanisms of synaptic plasticity and learning by visualizing and controlling local protein turnover

Roger Lo, M.D., Ph.D.

University of California-Los Angeles Melanoma in the skin: initiation, progression, and crosstalk with dermal fibroblasts

Ravindra Majeti, M.D., Ph.D.

Stanford University Identification and targeting of human acute myeloid leukemia stem cell-specific cell surface molecules

Emanual Maverakis, M.D.

University of California-Davis gC399tr an inhibitor of autoimmunity

Heather Christy Mefford, M.D., Ph.D.

University of Washington School of Medicine Novel genomic rearrangements in developmental pediatric disorders

Eric Matthew Morrow, M.D., Ph.D.

Brown University Identification of autism genes in special founder populations using high-density SNP microarrays

Ken Nakamura, M.D., Ph.D.

University of California-San Francisco Physiologic and pathologic interactions of alpha-synuclein with mitochondria in Parkinson's disease

Christopher Newton-Cheh, M.D.

Harvard Medical School Genomic dissection of QT interval duration and sudden death

Dao Nguyen, M.D.

McGill University Stringent response in Pseudomonas aeruginosa biofilm formation and antibiotic tolerance

Quyen T. Nguyen, M.D., Ph.D.

University of California-San Diego Testing surgery guided by molecular fluorescence imaging

Robert M. Plenge, M.D., Ph.D.

Harvard Medical School Genotype-phenotype studies of rheumatoid arthritis susceptibility genes

Anil Potti, M.D.

Duke University Medical Center Gene expression patterns coupled with signatures of oncogenic pathway deregulation provide a novel approach to targeted therapeutics in non-small cell lung carcinoma

David Tevis Pride, M.D., Ph.D.

Stanford University Bacteriophage communities in oral health and disease

Frank J. Probst, M.D., Ph.D.

Baylor College of Medicine Generation of mouse models for X-linked diseases

Agata Smogorzewska, M.D., Ph.D.

Rockefeller University Role of the Fanconi Anemia and other DNA crosslink repair pathways in genome maintenance and cancer prevention

Matthew Vander Heiden, M.D., Ph.D.

Massachusetts Institute of Technology Metabolic control of cancer cell proliferation by pyruvate kinase M2

Mark Nan Wu, M.D., Ph.D.

Johns Hopkins University School of Medicine Identification of novel genes that regulate sleep in Drosophila melanogaster

Ann C. Zovein, M.D.

University of California-Los Angeles Hemogenic endothelium: hematopoietic stem cell emergence from the vasculature

Hitchings-Elion Fellowship

Alan J. Herr, Ph.D. University of Washington Probing the pathway of RNA mediated defense with viral suppressor genes

Research Travel Grants

Kelly Barnes, Ph.D.

Washington University School of Medicine Cortico-basal ganglia functional connectivity: method development and novel data

Juan Bournat, Ph.D.

Baylor College of Medicine Effect of GDF3 on adiposity

Andrew Cameron, B.S.

University of British Columbia Physiological and genetic responses to osmotic stress in Campylobacter jejuni pathogenesis

Yvan Chanthery, B.A.

University of California-San Francisco Mycn as a critical target of PI3K/mTOR inhibitors in NBL-advances in neuroblastoma research conference

Yi-Ren Chen, B.S.

Stanford University School of Medicine Presenting at the 2010 North American Neuro-Ophthalmology Society Meeting

Jessica Church-Lang, Ph.D.

Washington University School of Medicine Collaborative research on the neural mechanisms of Tourette Syndrome

Allison Churnside, B.A.

University of Colorado-Boulder Travel to AFM BioMed Conference 2010

Weiguo Cui, M.D., Ph.D.

Yale University School of Medicine Role of innate signals and transcriptional regulation in memory CD8 T cell development

Heather Dean, Ph.D.

New York University Present at the conference AREADNE 2010

Michael DeGiorgio, M.Sc.

University of Michigan-Ann Arbor 2010 annual meeting of the Society for Molecular Biology and Evolution

Dawn Delfin, Ph.D.

Ohio State University College of Medicine and Public Health Claudin-5: investigating the role of the first tight junction protein downregulated in heart failure

Ann Demogines, Ph.D.

University of Texas-Austin Causes and consequences of accelerated evolution in human DNA repair genes

Eric Domyan, B.S.

University of Wisconsin Medical School Understanding the role of BMP signaling in early respiratory and digestive development

Jenny Draper, B.S.

University of California-Santa Cruz Cold Spring Harbor Molecular Genetics of Bacteria & Phages conference

Michael Eastwood, B.S.

University of Toronto Faculty of Medicine Sporoptosis: a novel developmentally-programmed nuclear destruction event in yeast

Gretchen Ehrenkaufer, Ph.D.

Stanford University Medical Center Gene expression during development in Entamoeba

Margaret Elvekrog, M.A.

Columbia University Travel to single molecule approaches to biology Gordon Research Conference

Suzette Farber-Katz, M.Sc.

University of California-San Diego School of Medicine Presentation at American Society of Cell Biology 2010 national meeting

Ashleigh Fritz, B.S.

Stowers Institute for Medical Research Comparative invertebrate embryology summer course at Friday Harbor Laboratory

Kristin Gerhold, B.S.

University of California-Berkeley Utilizing the skin-nerve preparation to elucidate the molecular mechanism of tingling paresthesia

Sam Getchell, B.S. University of Pennsylvania School of Medicine In vitro fluorescence correlation spectroscopy on Mad2

Hany Girgis, Ph.D.

Massachusetts General Hospital Systems-level analysis of protein-protein interactions in human mitochondria

Paul Greer, Ph.D.

Harvard Medical School Elucidation of neural circuits underlying olfactory-mediated behaviors

William Gustafson, M.D., Ph.D.

University of California-San Francisco Advances in neuroblastoma research meeting Stockholm, Sweden: Mycn signaling in neuroblastoma

Jill Haenfler, B.S.

University of Michigan-Ann Arbor Activation of notch signaling by unrestrained cortical aPKC

Dan Han, Ph.D.

University of California-San Francisco School of Medicine IRE1a kinase activation modes control alternate endoribonuclease outputs to determine cell fate

Kathryn Hastie, B.A.

Scripps Research Institute Arenavirus glycoproteins: architecture, receptor binding sites and immune evasion

John Herriges, B.S.

University of Wisconsin-Madison 2010 FASEB conference on lung epithelium in health and disease

Brendan Hickey, M.Sc.

Brigham and Women's Hospital Professional training at Cold Spring Harbor

Martha Hosotani, M.Sc.

University of Colorado-Boulder Single-molecule studies of the RecBCD helicase

Max Jan, B.A.

Stanford University Presentation at 2011 International Society for Stem Cell Research annual meeting

Emily Kelly, Ph.D.

University of Rochester Medical Center Applying enzyme activity assays to visual plasticity with Dr. Nicholas Seeds

Chaoyuan Kuang, B.S.

University of Michigan-Ann Arbor Neural tumor transplant in Drosophila

Vinh Lam, Ph.D.

California Institute of Technology Monitoring the global conformation of SRP during co-translational targeting

Abraham Langseth, B.S.

University of California-San Francisco School of Medicine Wnt regulation of oligodendrocyte progenitor cell production Jeffrey Lee, Ph.D. University of Toronto Neutralizing ebolavirus: structural insights into the envelope glycoprotein

Andrew Lee, B.S. Stanford University Wnt mediated self renewal of cardiac progenitor cells

Daniel Lieber, A.B. Massachusetts General Hospital Integrated map of the mitochondrial reactome

Jill Marinis, B.S. Case Western Reserve University School of Medicine Mechanisms by which MEKK4 and TRAF4 regulate downstream NOD2 signaling

Michael Miller, B.A. Dartmouth Medical School Infectious prion H-bonded core by H/D exchange mass spectroscopy

Albert Misko, B.S. Washington University Role of mitochondrial trafficking in axonal stability

Rebekah Nash, B.S. University of North Carolina-Chapel Hill Structural studies of the Tral helicase required for resistance plasmid transfer

Matthew Nassar, B.A. University of Pennsylvania School of Medicine Are belief-updating policies genetically determined?

Lori Neal, B.S. University of Wisconsin-Madison Evaluation of Toxoplasma gondii STAg as a treatment for cerebral malaria

Michelle Ng, Ph.D. University of California-San Diego School of Medicine Presenting research on golgi protein Golph3L at the ASCB Annual Meeting 2010

Thang Nguyen, B.S. California Institute of Technology Amide proton exchange to map the interface between cpSRP43 and cpSRP54, and between cpSRP43 and LHCP

Whitney Nolte, B.S. Harvard University Attending a proteolytic enzyme conference

Peter Noseworthy, M.D. Massachusetts General Hospital Finnish sudden cardiac death study (Finn-SCD) Olga Pavlova, Ph.D.

Rutgers, the State University of New Jersey-New Brunswick Structure and functional analysis of bacteriophage encoded inhibitors of transcription

Sara Peyrot, Ph.D. University of Texas-Austin Training in molecular embryology of the mouse

Justine Pompey, B.A. Stanford University Attendance at Keystone RNAi meeting

John Powers, Ph.D. Harvard Medical School Lin28 induction of blast crisis in a murine model of Ph+ Chronic Myeloid Leukemia

Callie Preast, B.S. Emory University School of Medicine Analysis of ZC3H14, an RNA binding protein required for proper brain function

Mark Pryjma, B.S. University of British Columbia The DccRS signal transduction system in C. jejuni pathogenesis

Scott Purcell, Ph.D. Washington University School of Medicine Frontiers in Reproduction course

Marta Radman-Livaja, Ph.D. University of Massachusetts Medical School Keystone symposia/dynamics of eukaryotic transcription during development

Brian Reikie, B.S. University of British Columbia Defining immune abnormalities and their consequences in the HIV exposed but uninfected child

Nicole Robbins, B.S. University of Toronto

Regulation of fungal drug resistance by lysine deacetylases

Annah Rolig, B.S.

University of California-Santa Cruz Influence of Helicobacter pylori chemotaxis and normal flora on inflammation

Kevan Salimian, B.S. University of Pennsylvania School of Medicine Mapping aurora B binding sites using ChIP on CHIP technology

James Schafhauser, M.Sc.

McGill University Understanding HAQ mediated biofilm antibiotic tolerance and its regulation by the stringent response

Erica Schoeller, B.S. Washington University School of Medicine Functional significance of insulin in murine testes and sperm

Erik Settles, Ph.D. University of Wisconsin-Madison STAg treatment and protection of dengue infected mice

Rebecca Shapiro, B.S.

University of Toronto Molecular mechanisms of temperature-dependent morphogenesis in Candida albicans

Kinga Smolen, M.Sc.

University of British Columbia The HIV-exposed uninfected infant: a key resource for successful HIV vaccine design

Sharon Soucek, B.S.

Emory University School of Medicine A role for poly(A) binding proteins in mRNA splicing

Deepa Srikanta, Ph.D. Washington University School of Medicine Molecular mycology: current approaches to fungal pathogenesis

Eli Stahl, Ph.D.

Brigham and Women's Hospital Genome-wide association study of rheumatoid arthritis in European and Japanese population samples

Marvaretta Stevenson, M.D.

Duke University Medical Center Age and gender specific genomic profiles in non-small cell lung cancer

Sydney Stringham, B.S. University of Utah Investigation of chromosomal inversions in ninespine sticklebacks

James Sun, M.Sc. Massachusetts Institute of Technology Genome-wide estimation of the microsatellite mutation rate in humans

Zachary Szpiech, B.S.

University of Michigan-Ann Arbor 2010 annual meeting of the Society for Molecular Biology and Evolution

Justine Tigno-Aranjuez, Ph.D.

Case Western Reserve University School of Medicine Regulation of NOD2 signaling pathways through ITCH-mediated polyubiquitination of cIAP1

Izumi Toyoda, D.V.M.

Stanford University School of Medicine Application of in vivo optical imaging in a model of temporal lobe epilepsy

Marie-Ève Tremblay, Ph.D.

University of Rochester Medical Center Training in optical imaging of intrinsic signals in Dr. Trachtenberg's laboratory

Sascha Tuchman, M.D.

Duke University Medical Center Gene expression profiling individualizes therapy for multiple myeloma

Mirjam Urb, M.Sc.

McGill University New murine model for Aspergillus fumigatus airway colonization

Ghyslaine Vanier, Ph.D.

McGill University Transcriptional profiling of Aspergillus fumigatus in response to mast cells

Anica Wandler, B.S.

University of Oregon Mechanisms and models of cancer meeting

Iga Wegorzewska, B.S.

Washington University Defining the role of TDP-43 in neurodegenerative disease pathways

Katherine Wert, M.Sc.

Columbia University College of Physicians and Surgeons Transplantation of ES Cells restores visual function in a retinitis pigmentosa mouse model

Georgia Woods, Ph.D.

University of California-Davis Workshop on schizophrenia and related disorders

Mengshu Xu, B.S.

University of Toronto Faculty of Medicine Developmental control of H1 linker histone function in Saccharomyces cerevisiae

Kelvin Yen, Ph.D.

University of Massachusetts Medical School 2010 Gordon Conference and Research Seminar on the Biology of Aging

Yan Zhang, M.D., Ph.D. California Institute of Technology Keystone Symposia, AAA and related ATP-driven protein machines: structure, function and mechanism

Hao Zhu, M.D.

Children's Hospital Boston Lin28/let-7 microRNA pathway in cancer, stem cells and metabolism

Ad Hoc

American Society for Cell Biology Support for the annual meeting

American Society for Cell Biology Support for the Minorities Affairs Committee

Association of Military Surgeons of the United States Support for the Sir Henry Wellcome Medal and Prize (2009-2013)

California State East Bay Educational Foundation California State University-East Bay

Support for the 2010 College of Science Scholarship Fund

Federation of American Societies for Experimental Biology Support for the summer conference

Federation of American Societies for Experimental Biology Support for the summer conference on Lung Epithelium in Health and Disease

Harvard Medical School

Support for Research in Encoding and Decoding of Neural Ensembles conference

Hospital for Sick Children Support for the Annual Canadian Human Genetics Conference

Marine Biological Laboratory Support for the 2010-2012 sessions of the Frontiers in Reproduction course

Marine Biological Laboratory Support for the 2010 Frontiers in Reproduction symposium

Massey College

Gairdner Foundation Support for three major symposiums to bring internationally recognized biomedical scientists (Gairdner awardees) to Canada

McGill University Support for the annual international CEA symposium

Medical College of Virginia Foundation

Support for an undergraduate summer research experience in microbiology and infectious disease, as well as to provide an integrated series of seminars that illustrate the spectrum of local and global issues in infectious disease

National Postdoctoral Association

Support for the National Postdoctoral Association's Leadership Capacity-Building Project and annual meeting for

National Postdoctoral Association

Support for the annual National Institute of Environmental Health Sciences Biomedical Career Fair

National Postdoctoral Association

Support for the creation of an Amazon.com-like site to help graduate students select graduate schools

Society for Gynecologic Investigation Support for the annual meeting

Support for postdoctoral travel awards to the annual meeting

Society for the Advancement of Chicanos and Native Americans in Science

Support for travel grants for graduate and postdoctoral students to attend the national conference

Society for the Study of Reproduction

Support for Minority Affairs Committee activities

Society for the Study of Reproduction

Support for outreach activities during the annual meeting

Teratology Society

Support for co-sponsorship of the poster session reception during the annual meeting

University of California-San Francisco

Support for the 2009 RSDP scholar's annual research conference/retreat

University of California-San Francisco

Support for the 2010 RSDP scholar's annual research conference/retreat

University of California-San Francisco School of Medicine

Support for a Reproductive Scientist Development Program junior faculty scholar

Vanderbilt University School of Medicine

Research consortium on preterm birth

Infectious Diseases

Investigators in Pathogenesis of Infectious Disease

David Artis, Ph.D. University of Pennsylvania Tracking helminth-specific immune responses in vivo

Jody L. Baron, M.D., Ph.D.

University of California-San Francisco School of Medicine Understanding immunopathogenesis of Hepatitis B virus

Choukri Ben Mamoun, Ph.D.

Yale University Function and regulation of host and parasite nutrient transporters during malaria infection

Richard J. Bennett, Ph.D.

Brown University Phenotypic variation and host adaptation by the human fungal pathogen *Candida albicans*

Helen E. Blackwell, Ph.D.

University of Wisconsin-Madison Interception of bacterial quorum sensing with synthetic ligands

Matthew S. Bogyo, Ph.D.

Stanford University School of Medicine Chemical mapping of proteolytic networks involved in *Toxoplasma gondii* pathogenesis

Miriam Braunstein, Ph.D.

University of North Carolina-Chapel Hill Identification of in vivo-secreted proteins of *Mycobacterium tuberculosis* with roles in host-pathogen interactions

John H. Brumell, Ph.D.

University of Toronto Recognition of bacteria in the cytosol of mammalian cells by protein conjugation systems

James R. Carlyle, Ph.D.

University of Toronto MHC-independent recognition of infected cells by natural killer cells of the innate immune system

Benjamin K. Chen, M.D., Ph.D.

Mount Sinai School of Medicine Dissemination of HIV through virological synapses

Jen-Tsan Ashley Chi, M.D., Ph.D.

Duke University Medical Center Sequence determinant of the *Plasmodium falciparum* gene regulation by human microRNAs

Andrew Darwin, Ph.D.

New York University School of Medicine Mechanisms of *Pseudomonas aeruginosa* tolerance to secretininduced stress during host infection

K. Heran Darwin, Ph.D.

New York University School of Medicine Ubiquitin-like proteins in bacterial pathogens

Dana A. Davis, Ph.D.

University of Minnesota-Twin Cities Control of phenotypic switching and pathogenesis by the Mds3 protein

Tatjana Dragic, Ph.D.

Albert Einstein College of Medicine of Yeshiva University Entry and intracellular trafficking of Hepatitis C virus

Manoj T Duraisingh, Ph.D.

Harvard School of Public Health Epigenetic control of virulence gene expression in Plasmodium falciparum

Peter J. Espenshade, Ph.D.

Johns Hopkins University Oxygen-sensing and adaptation to host tissue hypoxia in the human fungal pathogen Cryptococcus neoformans

Michael R. Farzan, Ph.D.

Harvard Medical School Parallel identification of obligate viral receptors

David A. Fidock, Ph.D.

Columbia University Medical Center *Plasmodium falciparum* transmembrane proteins and their role in parasite susceptibility to heme-binding antimalarials

Michael J. Gale, Jr., Ph.D.

University of Washington Control of hepatitis C virus replication

Stephen Girardin, Ph.D.

University of Toronto Nod-like receptor Nod9 links mitochondrial dynamics and innate immunity to bacterial pathogens

Britt Glaunsinger, Ph.D.

University of California-Berkeley Global modulation of cellular gene expression by an oncogenic human herpesvirus

Michael S. Glickman, M.D.

Memorial Sloan-Kettering Cancer Center Role of regulated intramembrane proteolysis in controlling *Mycobacterium tuberculosis* virulence and cell envelope composition

Karen J. Guillemin, Ph.D.

University of Oregon Regulation of gut epithelial cell homeostasis by the microbiota

Chuan He, Ph.D. University of Chicago How *Staphylococcus aureus* senses host immune defenses

Kent L. Hill, Ph.D.

University of California-Los Angeles Cell-cell communication and social motility in pathogenesis and development of African trypanosomes

Lora V. Hooper, Ph.D.

University of Texas Southwestern Medical Center-Dallas Innate immune responses to commensal bacteria at gut epithelial surfaces

Akiko Iwasaki, Ph.D.

Yale University Stromal cell contributions in innate and adaptive immune responses to mucosal viral infection

Eckhard Jankowsky, Ph.D.

Case Western Reserve University Molecular mechanisms of pathogen identification by the pattern recognition receptors RIG-I and MDA5

Robert F. Kalejta, Ph.D.

University of Wisconsin-Madison Cellular and viral determinants of human cytomegalovirus lytic and latent replication cycles

Barbara I. Kazmierczak, M.D., Ph.D.

Yale University Role of injury in *Pseudomonas aeruginosa* pulmonary infection

D. Borden Lacy, Ph.D.

Vanderbilt University Medical Center Structural mechanisms of *Heliobacter pylori* pathogenesis

Manuel Llinas, Ph.D.

Princeton University Global analysis of the *Plasmodium falciparum* metabolome

John D. MacMicking, Ph.D.

Yale University School of Medicine Immune control of human phagosomal pathogens by a novel GTPase superfamily

Yorgo Modis, Ph.D.

Yale University Cell entry and innate immune recognition of flaviviruses

Denise M. Monack, Ph.D.

Stanford University Host-pathogen interactions during persistent *Salmonella* infection

Andrew S. Neish, M.D.

Emory University School of Medicine Transgenic analysis of prokaryotic effector proteins in the eukaryote, *Drosophila melanogaster*

Kim Orth, Ph.D.

University of Texas Southwestern Medical Center-Dallas VopL, a Vibrio effector that nucleates actin

John S. Parker, BVMS., Ph.D.

Cornell University College of Veterinary Medicine Reovirus-induced apoptosis: the role of the viral outer-capsid protein mu1

Lalita Ramakrishnan, M.D., Ph.D.

University of Washington School of Medicine Forward genetic screens in the zebrafish to identify host determinants of susceptibility to tuberculosis

Ana Rodriguez, Ph.D.

New York University School of Medicine Role of hypoxanthine degradation in malaria-induced pathogenesis

Maya Saleh, Ph.D.

McGill University Regulation and molecular mechanisms of NLR-mediated innate immunity

Erica O. Saphire, Ph.D.

Scripps Research Institute Arenavirus GP: architecture, receptor binding sites, and immune recognition

Karla Fullner Satchell, Ph.D.

Northwestern University Mouse model for the role of toxins in cholera pathogenesis

Luis M Schang, D.V.M., Ph.D.

University of Alberta Silencing and antisilencing in the regulation of viral gene expression

Neal Silverman, Ph.D.

University of Massachusetts Medical School Intracellular bacterial recognition in the *Drosophila* innate immune response

Eric Skaar, Ph.D.

Vanderbilt University Medical Center In vivo identification of Staphylococcus aureus proteins that defend against host neutrophils.

Gregory A. Smith, Ph.D.

Northwestern University Feinberg School of Medicine Coordination of herpesvirus assembly and transport in axons of sensory neurons

Vanessa Sperandio, Ph.D.

University of Texas Southwestern Medical Center-Dallas Interkingdom signaling in bacterial pathogenesis

Adrie J.C. Steyn, Ph.D.

University of Alabama-Birmingham Carbon monoxide and *Mycobacterium tuberculosis* persistence.

Timothy L. Tellinghuisen, Ph.D.

Scripps Research Institute Subversion of a host kinase and vesicle trafficking components for the production of infectious hepatitis C virus

Billy Tsai, Ph.D.

University of Michigan Medical School How cholera toxin hijacks cellar machineries to transport across the ER membrane

Raphael H. Valdivia, Ph.D.

Duke University Role of secreted bacterial proteases in chlamydial pathogenesis

Linda F. van Dyk, Ph.D.

University of Colorado Health Sciences Center Analyzing the role of tumor suppressors in the control of virus infection and inflammation

Russell Vance, Ph.D.

University of California-Berkeley Innate immune cytosolic immunosurveillance pathways for sensing bacterial pathogens

Andres Vazquez-Torres, D.V.M., Ph.D.

University of Colorado at Denver and Health Sciences Center-Fitzsimons Campus Effects of nitrosative stress on bacterial two component regulatory systems in innate host defense

David Wang, Ph.D.

Washington University School of Medicine Genomics-based approach to novel viral etiologies of diarrhea

Sean P. Whelan, Ph.D.

Harvard Medical School Exploration of the interaction of RNA viruses with their host cells

Marvin Whiteley, Ph.D. University of Texas-Austin Mechanistic insight into host modulation of bacterial group activities

Dong Yu, Ph.D.

Washington University School of Medicine Modulation of the DNA damage response by human cytomegalovirus

Ning Zheng, Ph.D. University of Washington Viral hijacking of host ubiquitin ligase machinery

Ad Hoc

American Society for Microbiology Support for the Third Beneficial Microbes Conference

American Society for Microbiology Support for the Candida and Dimorphic Fungal Pathogens meeting

American Society for Microbiology

Support for the American Society for Microbiology Kadner Institute and the Scientific Writing and Publishing Institute

American Society of Tropical Medicine and Hygiene

Support for the American Society of Tropical Medicine and Hygiene annual meeting

American Society of Tropical Medicine and Hygiene

Support for the American Committee of Molecular, Cellular and Immunoparasitology's scientific program at the American Society of Tropical Medicine and Hygiene annual meeting

Association for Women in Science

Support for renewal of membership dues

Association for Women in Science

Support for an internship for 2010

California Institute of Technology

Support for WormBook an online open-access publication

Cornell University College of Veterinary Medicine

Support for Alex Amaro to be brought on as a postdoc in the laboratory of PATH Awardee John Parker

Duke University Medical Center

Support for PATH awardees, Drs. Andrew and Heran Darwin, to present seminars at Duke University Medical Center

Federation of American Societies for Experimental Biology

Support for the summer research conference on microbial pathogenesis

Foundation for the National Institutes of Health, Inc.

Support for travel scholarships for 20 graduate students and postdoctoral fellows to the Ecology and Evolution of Infectious Diseases meeting

Fundacio Clinic per a la Recera Biomedica

Support for the Malaria Eradication Research Agenda (malERA) initiative

Genetics Society of America

Support for four travel grants for students and postdoctoral fellows to attend the Genetics Society of America conference

Gordon Research Conferences

Support for the 2010 Host-Parasite Interactions Gordon Research Conference

Gordon Research Conferences

Support for the Gordon Research Conference on Cellular and Molecular Fungal Biology

Gordon Research Conferences

Support for Gordon Research Conference on immunology of fungal infections

Gordon Research Conferences

Support for the Gordon Research Conference on phagocytes

Grants Managers Network

Support for the Grants Managers Network

Institute of Medicine

Support for activities of the Forum on Microbial Threats for a three-year period

Institute of Medicine

Support for "One Health" and the Enhanced Integration of Human, Animal, and Environmental Health Sciences consensus study

Keystone Symposia

Support for the 2010 Keystone Symposia: Cell Biology of Virus Entry, Replication and Pathogenesis, Viral Immunity, and Malaria: New Approaches to Understanding Host-Parasite Interactions

Marine Biological Laboratory

Support for the Marine Biological Laboratory's Molecular Mycology course 2009-2011

Marine Biological Laboratory

Support for the Biology of Parasitism Course at the Marine Biological Laboratory from 2011-2014

McMaster University

Support for the annual meeting of the Canadian Society of Microbiologists

Medical University of South Carolina

Support for Tamara Doering, New Investigator in Molecular Pathogenic Mycology awardee, to present a seminar

Michigan State University

Support for a meeting "Consensus Gathering: MRI Findings in Pediatric Cerebral Malaria"

Mid-Atlantic Microbial Pathogenesis Meeting

Support for the Mid-Atlantic Microbial Pathogenesis Meeting

New York University

Support for the Cold Spring Harbor/ Wellcome Trust conference "Infectious Disease Genomics and Global Health"

New York University School of Medicine Support for PATH Awardee Eric Skaar to present a seminar

North Carolina Biotechnology Center Support for the workshop "Discovery to Product Development"

Rockefeller University

Support for PATH awardee, Kim Orth to present a seminar at Rockefeller University

Scripps Research Institute

Support for PATH awardee Sean Whelan to present a seminar

Society of Toxicology

Support for the annual meeting

Stanford University School of Medicine

Support for PATH awardee Maya Saleh to give a seminar

Tufts University School of Medicine

Support for PATH awardee Russell Vance to present a seminar

University of California-San Francisco

Support for collaboration over the next two years by funding travel and living expenses for students

University of Cincinnati

Support for the International Workshops on Opportunistic Protists

University of Edinburgh

Support for the Helminth Parasite meeting

University of Georgia College of Veterinary Medicine

Support for the 2010 National Veterinary Scholar

University of Georgia College of Veterinary Medicine

Support for the Burroughs Wellcome Fund summer DVM/Ph.D. course titled "Becoming faculty: a short course on launching a scientific career"

University of Massachusetts Medical School

Support for PATH awardee, Neal Silverman to present a seminar at the National Institute of Allergy and Infectious Diseases

University of Minnesota College of Veterinary Medicine

Support for the BWF/HHMI partnership veterinary student training program – 2010 BWF-HHMI Fellow, Jill Schappa/Mentor Jaime Modiano

University of Nebraska Medical Center

Support for the International Conference on Gram Positive Pathogens

University of North Carolina-Chapel Hill

Support for PATH awardee, Thomas Zahrt to present a seminar

University of North Carolina-Chapel Hill

Support for PATH Awardee Eric Skaar to present a seminar

University of North Carolina-Chapel Hill School of Medicine

Support for PATH awardee Heran Darwin to present a seminar

University of North Carolina-Chapel Hill School of Medicine

Support for the Third Southeastern Mycobacteria

University of Oregon

Support for a West Coast Helicobacter Symposium

University of Pennsylvania

Support for the development of a Pan Fungal data resource

University of South Florida College of Public Health

Support for a regional scientific meeting of global health programs to discuss how programs can begin to interact in ways mutually beneficial for research, training, and mentoring

University of Texas Southwestern Medical Center-Dallas

Support for PATH awardee Erec Stebbins to present a seminar

University of Texas Southwestern Medical Center-Dallas

Support for former PATH advisory committee member, Arturo Casadevall, to present a seminar

University of Toronto

Support for PATH awardee Akiko Iwasaki, to present a seminar at the University of Toronto's 25th Anniversary Celebration and Symposium

University of Wisconsin-Madison

Support for CASI awardee Julie Biteen to present a seminar

University of Wisconsin-Madison School of Veterinary Medicine

Support for the BWF/HHMI partnership veterinary student training program - 2010 BWF-HHMI Fellow, Meghan Vermillion and mentor Thaddeus Golos, Ph.D.

Walter and Eliza Hall Institute of Medical Research

Support for a protozoan databases workshop at the International Congress on Parasitology

Washington University

Support for the 17th annual Midwest Microbial Pathogenesis Conference

Washington University

Support for PATH awardee, Manuel Llinas, to present a seminar at Washington University School of Medicine

Wellcome Trust Sanger Institute

Support for the Genomic Epidemiology of Malaria Conference

Yale University

Support for PATH awardee, Yorgo Modis, Ph.D., to present a seminar at the National Institute of Allergy and Infectious Diseases

Yale University

Support for PATH Advisory Committee member, Margaret Kielian, to present a seminar at Yale University

Yale University School of Medicine

Support for PATH Awardee, Harmit Malik, Ph.D., to present a seminar at Yale University School of Medicine

Interfaces in Science

Career Award at the Scientific Interface

Emre Aksay, Ph.D. Weill Medical College of Cornell University Neural mechanisms for control of eye position

David Biron, Ph.D. University of Chicago Understanding small neural circuits

Julie S. Biteen, Ph.D. University of Michigan-Ann Arbor Superresolution imaging in live cells using single-molecule active-control microscopy

Rachel B. Brem, Ph.D. University of California-Berkeley Genetics of transcription in budding yeast

Jasna Brujic, Ph.D. New York University Mechanical networks in biology: from proteins to cells

Nicolas E. Buchler, Ph.D. Duke University Gene duplication and the evolution of function in regulatory networks

Lynette Cegelski, Ph.D. Stanford University Mapping the structural and functional landscape of the microbial extracellular matrix

Yann R. Chemla, Ph.D. University of Illinois-Urbana-Champaign Single-molecule study of bacteriophage DNA packaging and mitochondrial protein import

Derek Cummings, Ph.D. Johns Hopkins University Natural and vaccine-induced immunity and spatiotemporal dynamics of epidemic dengue

Rhiju Das, Ph.D. Stanford University High resolution prediction of new RNA folds Alfredo Dubra-Suarez, Ph.D.

University of Rochester Understanding glaucoma through structural and functional in vivo cellular imaging of the retina

Alexander Dunn, Ph.D. Stanford University Single molecule characterization of the energetic landscape underlying myosin force generation

Ofer Feinerman, Ph.D. Rockefeller University Cellular heterogeneity and cooperativity shape decision-making in the immune system

Surya Ganguli, Ph.D. University of California-San Francisco Expression and acquisition of sequence memory in neuronal networks

Margaret L. Gardel, Ph.D. University of Chicago Dynamic force generation in cell migration

Timothy J. Gardner, Ph.D. Boston University Tracking neural programs for song

Andrea Mitchell Goforth, Ph.D. Portland State University Bimodal, luminescent/magnetic nanoparticle assemblies targeted to alpha-4-beta-1 integrin for tumor imaging and therapy

Daniel I. Goldman, Ph.D. Georgia Institute of Technology Dynamic locomotion on challenging substrates

Ming Hammond, Ph.D. University of California-Berkeley Large-scale discovery and analysis of regulatory RNAs using computational and chemical approaches

Christine E. Heitsch, Ph.D. Georgia Institute of Technology A combinatorial and computational approach to deciphering the biological information encoded by single-stranded nucleotide sequences

Ajit P. Joglekar, Ph.D.

University of North Carolina-Chapel Hill Building a mechanistic model of the structure and function of a kinetochore-microtubule attachment

Harold D. Kim, Ph.D.

Georgia Institute of Technology Understanding the mechanisms of sensitivity in gene expression

Gavin M. King, Ph.D.

University of Missouri-Columbia Dynamic structural biology of ion channel proteins: an ultra-stable atomic force microscope study

Mary L. Kraft, Ph.D.

University of Illinois-Urbana-Champaign Composition analysis of the influenza virus pre-envelope by multiple isotope imaging mass spectrometry (MIMS)

Jeffrey R. Kuhn, Ph.D.

Virginia Polytechnic Institute and State University Total internal reflection fluorescence microscopy of actin branching dynamics in vivo

Edo L. Kussell, Ph.D.

New York University Evolution of microbial physiologies

Alison L. Marsden, Ph.D.

University of California-San Diego Engineering new treatments for cardiovascular disease via optimal design and physiologic simulation

Laura A. Miller, Ph.D.

University of North Carolina-Chapel Hill Developmental and evolutionary biofluid dynamics: case studies in locomotion and heart development

Celeste M. Nelson, Ph.D.

Princeton University Biophysical dynamics in the regulation of tissue morphogenesis

Dana Pe'er, Ph.D. Columbia University Systems approach to elucidate integration of signal and decision in cells

Joshua B. Plotkin, Ph.D.

University of Pennsylvania Novel methods to compute selection pressures on proteins at the genome-wide scale

Astrid A. Prinz, Ph.D.

Emory University Models of activity-dependent homeostatic regulation in neural networks on the basis of brute force exploration of high-dimensional parameter spaces

Arjun Raj, Ph.D.

University of Pennsylvania Stochastic gene expression in development: from phenomena to function

Benjamin J. Raphael, Ph.D.

Brown University High-resolution analysis of tumor genome architectures

Aviv Regev, Ph.D.

Massachusetts Institute of Technology From modules to mechanisms: the function and evolution of molecular networks

Jason T. Ritt, Ph.D.

Boston University Active sensing in natural and robotic organisms

Michael Rust, Ph.D.

Harvard University Nonlinear dynamics underlying the cyanobacterial circadian clock

Sridevi Vedula Sarma, Ph.D.

Johns Hopkins University Improved therapies for Parkinson's disease using advanced engineering methods

Georg Seelig, Ph.D.

University of Washington Nucleic acid logic circuits for conditional gene regulation

Eric T. Shea-Brown, Ph.D.

University of Washington Neurobiological dynamics of timing and decisions

Alexander Sher, Ph.D.

University of California-Santa Cruz Investigation of retinal processing through large-scale multielectrode recordings

Hadley D. Sikes, Ph.D.

Massachusetts Institute of Technology Well-defined, supramolecular assemblies of redox enzymes via templated self-assembly for use in mechanistic electron transport studies and targeted apoptosis

Jan M. Skotheim, Ph.D.

Stanford University A systems level approach to cell cycle control: from molecules to motifs to physiology

Megan T. Valentine, Ph.D.

University of California-Santa Barbara Establishing the mechanism of kinesin processivity

Daniel A. Wagenaar, Ph.D.

California Institute of Technology Neural circuitry and mechanisms of multisensory integration in a predatory invertebrate

Lauren J. Webb, Ph.D.

University of Texas-Austin Electrostatic fields at the protein-protein interface

Joshua S. Weitz, Ph.D. Georgia Institute of Technology Evolutionary ecology of bacterial viruses

Ahmet Yildiz, Ph.D.

University of California-Berkeley Molecular mechanism of dynein in vitro and in living cells

Ad Hoc

Biophysical Society

Support for a special symposium for young researchers and the postdoc and graduate student breakfasts at the annual meeting

City University of New York

Support for a semester-long program in spring 2011 – "Theoretical Physics and the Phenomena of Life: Optimization and Emergent Behavior"

Georgia Institute of Technology

Support for a soft matter workshop

Gordon Research Conferences

Support for "Sensory Coding in the Natural Environment"

Kavli Institute for Theoretical Physics

Support for the KITP Interdisciplinary Biology Initiative

Marine Biological Laboratory

Support for the course "Physiology: Modern Cell Biology Using Microscopic, Biochemical and Computational Approaches" (2008-2010)

New York University

Support for Aspen Center for Physics conference "Populations, Evolution, and Physics"

Rosalind Franklin Society

Support for women scientists in the life sciences through annual meeting and its outreach efforts

University of California-San Diego

Support for the 7th International Congress of Biological Physics

Population and Laboratory Reproductive Sciences **Based Sciences**

Institutional Program Unifying Population and Laboratory-based Sciences

Emory University Kenneth L Brigham, M.D. Human health: molecules to mankind (M2M)

University of Texas-Houston Health Science Center

C. Thomas Caskey, M.D. The Houston laboratory and population sciences training program in gene-environment interaction

University of California-Los Angeles

Simin Liu, M.D., Sc.D. University of California-Los Angeles inter-school program in metabolic diseases

Preterm Birth Initiative

Kjersti M. Aagaard-Tillery, M.D., Ph.D.

Baylor College of Medicine Contributions of maternal-fetal mitochondrial genome and microbiome interactions to preterm birth

Vikki M. Abrahams, Ph.D.

Yale University Role of placental Nod-like receptors in infection-associated preterm labor

Julie Baker, Ph.D.

Stanford University Genomic networks that guide trophoblast invasion and disease

Ronald W. Davis, Ph.D.

Stanford University **Unexplained Preterm birth**

Michal Elovitz, M.D.

University of Pennsylvania Targeting novel pathways in cervical remodeling for predicting prematurity: a combined biomarker and genomics approach

Michael Douglas House, M.D.

Tufts Medical Center Beyond cervical length: development of a patient-specific model of cervical mechanical function in pregnancy

Mala S. Mahendroo, Ph.D.

University of Texas Southwestern Medical Center-Dallas Assessment of cervical ripening by sodium magnetic resonance imaging

Jeffrey C. Murray, M.D.

University of Iowa Genomic signatures of gene expression and alternative splicing in preterm birth

Indira Mysorekar, Ph.D.

Washington University School of Medicine Occult infections in the etiology of preterm birth

Carl P. Weiner, M.D., M.B.A.

University of Kansas Medical Center Initiator-effector gene sets regulating myometrial contractility during term and preterm labor

Science Education

Student Science Enrichment Program

Appalachian State University Appalachian student experience-based education (AppalSEED) academy: Integrating science across the high school curriculum

Bladen County Schools Excite Sci Summer Science Epic

Campbell University HISS – High School Science Seminars

Catawba College Catawba Conservation Camp

Cherokee Boys Club, Inc. Sensational Science Saturdays at Cherokee Elementary School

Cherokee Middle School CSI:Cherokee Science Investigation

Contemporary Science Center Contemporary Science Center at the Museum of Life and Science Field Studies Program

Duke University RoboCupJunior: Exhibitions of problem solving, teamwork, and creativity

Duke University LASST: Leadership Academy for Students in Science and Technology

Durham Academy Mars Outreach for NC Students (MONS)

East Carolina University Partnering with Industrial and Regional Assets for Teaching and Enrichment in Science (PIRATES) Summer Camp

Elizabeth City State University Teaching Earth Science to Inspire New Geologist

Foundation of the Carolinas Sixth Grade Science Sleuths

Friday Institute for Educational Innovation Geosciences in Middle Schools Lenoir-Rhyne College North Carolina Stream Investigation Project

Meredith College STEM Experience for Middle School Students

Montreat College Center for Learning and Investigation in Backcountry Ecosystems: Climate Education and Research Program

North Carolina A&T State University Science and Technology Enrichment Program

North Carolina A&T State University Students Hots On The Sciences (S.H.O.T.S.): Program Continuation

North Carolina Central University Students Making Another Science Success Story (SMASSS)

North Carolina Mathematics and Science Education Network Pre-College Experiences for Reaching Students Interested in Science Teaching (PERSIST)

North Carolina School of Science and Mathematics Foundation Labs For Learning

North Carolina Society of Hispanic Professionals Good Stewards of the Environment Program

North Carolina State University North Carolina Floating Classroom Program

Pisgah Astronomical Research Institute Space Science Lab

Schiele Museum of Natural History and Planetarium, Inc. Environmental Science Partnership

Scotland County Schools Project QuEST (Quality Education through Science Teams)

Shodor Education Foundation Inc. Computing MATTERS: Sowing the Seeds of SUCCEED

Southeastern Community College Summer Science Camp in Invasive Species **University of North Carolina-Asheville** Bug Camp: A Summer Experience in Science Investigation

University of North Carolina-Chapel Hill Climate Leadership and Energy Awareness Program

University of North Carolina-Wilmington Camp Bones: A science enrichment program for diverse middle school students that provides a foundation for careers in Nursing

Wake Forest University Cherokee MedCaT Academy Medical Career and Technology:

Enriched Student Experiences in Health Careers

Webb A. Murray Elementary School Adventure de Ciencia: Connecting science content to our world!

West Marion Elementary School G.O.A.L. – Get Outside And Learn

Career Award for Science and Mathematics Teachers

William Hendrickson Warren New Tech High School Warren County Schools

Matthew Mitchell Sears Hillside New Tech High School Durham Public Schools

Tamica Stubbs E.E. Waddell High School Charlotte-Mecklenburg School District

Claudia Walker Murphey Traditional Academy Guilford County Schools

Jennifer Williams Brevard High School Transylvania County Schools

Ad Hoc

Afterschool Alliance

Support for the Director of Science, Technology, Engineering, and Mathematics policy position

Alleghany High School

Grant to provide professional development opportunities for Career Award applicant, Michelle Beard

American Society for Cell Biology

Support for the printing and distribution of the publication, *Cell Biology: the Next 50 Years*

Association of American Colleges and Universities Support for the integration of Project Kaleidoscope into the Association of American Colleges and Universities

Cane Creek Middle School Grant to provide professional development opportunities for science teacher Linda Walker

DonorsChoose General support

Gallberry Farm Elementary School Grant to provide professional development opportunities for science teacher Jennifer Graham

Grantmakers for Education General support

Health Research and Education Foundation Project SEED

James B. Hunt Jr. Institute for Educational Leadership and Policy General support

Morehead Planetarium and Science Center Support for the North Carolina Science Festival

National Academy of Sciences Support for the symposium, "Beyond Bio2010: Celebration and Opportunities"

National Association of Academies of Science Support for the Breakfast with Scientists

North Buncombe High School

Grant to provide professional development opportunities for teacher Michael Bowman

North Carolina Association of School Administrators Continued support for the Dropout Prevention Coalition and the school district training titled "Using Analytics to Raise Achievement and Close Gaps in Mathematics"

North Carolina Chamber

Support for the Second Annual Education Summit

North Carolina Community Foundation/North Carolina Network of Grantmakers

Support for regional meetings and other activities focused on the connection between jobs and education throughout the state

North Carolina Community Foundation/North Carolina Network of Grantmakers

General support

North Carolina Museum of Natural Sciences

General support of the 2010 North Carolina International Science Challenge

North Carolina New Schools Project

Support for the North Carolina Student STEM Symposium

North Carolina School of Science and Mathematics Foundation Support for participation in the Singapore International Mathematics Challenge

North Carolina School of Science and Mathematics Foundation Support for the annual fund

North Carolina School of Science and Mathematics Foundation

Support for the Student Academy of Science students to participate in the American Junior Academy of Science/AAAS meetings

North Carolina Science Fair Foundation

General support of the 2010 North Carolina Science and Engineering Fair

North Carolina Science Leadership Association

Support for the first year of the North Carolina Science Leadership Fellows Program

North Carolina Science Teachers Association

Support for the North Carolina Science Teacher Association's Professional Development Institute

North Carolina State University

Support for the K-12 outreach conference

North Carolina State University Foundation Support for Race to the Top Initiative

Public School Forum of North Carolina General support

Public School Forum of North Carolina Support for the North Carolina Center for Afterschool Program's work

Southern Illinois University Foundation General support

Stanford University Support for the Bio-X undergraduate summer research program

University of North Carolina Center for Public Television Support for Wired for Music

University of North Carolina-Chapel Hill Support for DNA Day

University of North Carolina-Chapel Hill

Support for the annual North Carolina Alliance to Create Opportunity through Education (NC OPT-ED) Alliance Day

University of North Carolina-Chapel Hill School of Education

Support for the evaluation of the Career Award for Science and Mathematics Teachers program

Wilson County Schools

Support for the NC Leadership and Assistance for Science Education Reform Demonstration and Professional Development Center

Translational Research

Clinical Scientist Award in Translational Research

Jayakrishna Ambati, M.D. University of Kentucky Target-independent suppression of angiogenesis by siRNAs

Mark Stuart Anderson, M.D., Ph.D. University of California-San Francisco Translating AIRE-control of immune tolerance to human autoimmunity

Richard J Auchus, M.D., Ph.D. University of Texas Southwestern Medical Center-Dallas Pharmacogenomics of hypertension

Arul M. Chinnaiyan, M.D., Ph.D. University of Michigan-Ann Arbor Autoantibody profiles for cancer diagnosis, prognosis, and therapy

Bruce E. Clurman, M.D., Ph.D.

University of Washington Diagnostic and therapeutic approaches to cell cycle-associated cancer

Kathleen Loretta Collins, M.D., Ph.D. University of Michigan-Ann Arbor Viral mechanisms of persistence in HIV infected people

Kenneth R. Cooke, M.D.

Case Western Reserve University School of Medicine Acute lung injury after SCT: from laboratory insights to novel strategies for diagnosis and treatment

Laurence Cooper, M.D., Ph.D.

University of Texas M.D. Anderson Cancer Center Tumor-specific alloantigen-anergic donor-derived T-cell therapy after hematopoietic stem-cell transplantation

James E. Crowe, Jr., M.D.

Vanderbilt University School of Medicine Immunology and cell biology of human metapneumovirus infections

Kenneth Cusi, M.D.

University of Texas Health Science Center-San Antonio Non-alcoholic fatty liver disease in type 2 diabetes: a novel intervention strategy targeting metabolic & molecular defects

Michael R. DeBaun, M.D. Washington University Cysteinyl leukotriene receptor inhibitors: a target for decreasing sickle cell disease-related morbidity

Michael S. Diamond, M.D., Ph.D. Washington University Epitope-based immunogens and diagnostics for dengue virus

Dean W. Felsher, M.D., Ph.D. Stanford University School of Medicine Pre-clinical validation of g-quadruplex drugs that target MYC to treat cancer

Joseph G. Gleeson, M.D.

University of California-San Diego School of Medicine Causes and pathogenesis of cerebellar malformation syndromes in humans: bedside to bench

Jeffrey S. Glenn, M.D., Ph.D.

Stanford University School of Medicine Hepatitis C virus: from molecular virology to effective pharmacologic eradication

William M. Grady, M.D.

University of Washington Novel biomarkers for the prevention and treatment of colon cancer

Thomas Richard Hawn, M.D., Ph.D.

University of Washington Variation and regulation of innate immunity to Mycobacteria

Robert O. Heuckeroth, M.D., Ph.D.

Washington University Genetic and non-genetic risk for Hirschsprung disease

Anna Huttenlocher, M.D.

University of Wisconsin-Madison Diagnosis and treatment of autoinflammatory disease

S. Ananth Karumanchi, M.D.

Harvard Medical School Soluble endoglin in the pathogenesis and prediction of preeclampsia

Francis Lee, M.D., Ph.D. Weill Medical College of Cornell University Role of BDNF in therapeutic strategies for affective disorders

Ernst Robert Lengyel, M.D., Ph.D.

University of Chicago Development of novel therapeutic and diagnostic strategies for ovarian cancer

Dean Y. Li, M.D., Ph.D. University of Utah Therapeutic potential of vascular guidance cues

Ali J. Marian, M.D. University of Texas Health Science Center-Houston Molecular genetics and pathogenesis of human arrhythmogenic right ventricular cardiomyopathy/dysplasia

Daniel L. Marks, M.D., Ph.D. Oregon Health and Science University Maternal nutrition and fetal metabolic programming

Ari Melnick, M.D. Weill Medical College of Cornell University Differentiation therapy for B-cell lymphomas

Branch Moody, M.D. Harvard Medical School Human T-cell responses to CD1 and lipid antigens from M. tuberculosis

Richard J. O'Brien, M.D., Ph.D. Johns Hopkins University School of Medicine Alzheimers disease and synaptic transmission

Jonathan R. Pollack, M.D., Ph.D.

Stanford University Pathogenesis and diagnosis of clinically-indolent prostate cancer

Kerry J. Ressler, M.D., Ph.D. Emory University Neurobiology of fear, neuroplasticity and posttraumatic stress disorder

Annabelle Rodriguez, M.D.

Johns Hopkins University School of Medicine Deficiency of the lipoprotein receptor, scavenger receptor class B type I, in women with infertility **Theodora S. Ross, M.D., Ph.D.** University of Michigan-Ann Arbor Abnormal HIP1 and cancer biology

Charles M. Rudin, M.D., Ph.D.

Johns Hopkins University Novel therapeutic strategies for small cell lung cancer

Jean E. Schaffer, M.D. Washington University Lipotoxic cardiomyopathy: from molecular mechanisms to human disease

Norman E. Sharpless, M.D. University of North Carolina-Chapel Hill The p16INK4 a tumor suppressor in stem cell aging

Warren D. Shlomchik, M.D. Yale University

Memory T cells for improved immune reconstitution and GVL in allogeneic hematopoietic stem cell transplantation

Pradeep Singh, M.D.

University of Washington Gallium as an antimicrobial and anti-biofilm agent: a trojan horse strategy that disrupts bacterial iron metabolism

Jeffrey A. Toretsky, M.D.

Georgetown University Novel cancer therapeutics based upon oncogenic fusion-protein transcription factors

Russell Van Gelder, M.D., Ph.D. University of Washington Pathogenesis of inflammatory eye disease

Stephanie Ware, M.D., Ph.D.

University of Cincinnati Uncovering novel genetic causes and risks in congenital heart disease patients

Edus Houston Warren, M.D., Ph.D.

University of Washington Toward immune therapy for colon cancer: identification of antigens recognized by CD8+ T lymphocytes on colon cancer stem cells

William Weiss, M.D., Ph.D.

University of California-San Francisco Combination therapy against EGFR and PI3-kinase in glioma **Cassian Yee, M.D.** University of Washington Adoptive therapy of cancer: strategies to augment the antigenspecific T cell response

Kang Zhang, M.D., Ph.D. University of California-San Diego Define novel genes for diabetic microvascular complications

Ad Hoc

American Association for Cancer Research Support for "Translational Cancer Research Workshop for Ph.D.'s"

American Medical Informatics Association Support for the first Summit on Clinical Research Informatics

American Society for Clinical Investigation/Association of American Physicians Support for joint meeting

Association for Clinical Research Training Support for annual meeting

Clinical Research Foundation

Support for annual meeting

Federation of American Societies for Experimental Biology

Support for an initiative to facilitate interactions between basic and clinical researchers to promote collaborative translational research

Institute of Medicine

Support for the Clinical Effectiveness Research Innovation Collaborative

Institute of Medicine Support for the Forum on Drug Discovery, Development, and Translation

University of North Carolina-Chapel Hill Lineberger Comprehensive Cancer Center Support for the annual symposium

University of North Carolina-Wilmington Support for the workshop "Permanent Innovation"

University of Western Ontario

Support for the 2009 Clinician Investigator Trainee Association of Canada's general meeting and international workshop

University of Western Ontario

Support for the 2010 Clinician Investigator Trainee Association of Canada's general meeting and international workshop
Science and Philanthropy

American Association for the Advancement of Science Support for the 2010 Mass Media Science and Engineering Fellowship Program

Carolinas Chapter-Meeting Professionals International Support for the Lecture Series, in memory of Catherine Voron

Contemporary Science Center Support for the ScienceOnline2010 conference

Council on Foundations Support for 2010 activities

Foundation Center General support

Four Oaks Middle School General support

Friends of the Mountains to Sea Trail, Inc. General support

Health Research Alliance, Inc. General support for 2010-11

Marine Biological Laboratory

Support for the Luigi Mastroianni and Sheldon Segal Scholarship Fund to support students in the Frontiers in Reproduction course

National Humanities Center

Support for the "On the Human" Website, a scholarly project to examine how advances in science are enlarging the terms through which human life are discussed

Universidad Peruana Cayetano Heredia

Support for the laboratory of Single Molecule Biophysics and the work of Piere Rodriguez to study transcription elongation by RNA polymerase of Mycobacterium tuberculosis and other multidrug resistant strains

University of California-Berkeley College of Chemistry

Support for the Nacho Tinooco research symposium

University of California-San Diego

Support for the Caltech-University of California-San Diego Medical Scholars Program

Watauga Education Foundation

General support

Advisory Committees

The Burroughs Wellcome Fund uses advisory committees for each competitive award program to review grant applications and make recommendations to BWF's Board of Directors, which makes the final decisions. We select members of these committees for their scientific and educational expertise in the program areas. In addition, BWF uses a financial advisory committee to help in developing and reviewing the BWF's investment policies. This committee is appointed by and reports to the Board of Directors.

Career Awards at the Scientific Interface

James B. Bassingthwaighte, M.D., Ph.D. Professor of Bioengineering and Radiology University of Washington

William Bialek, Ph.D.

John Archibald Wheeler/Battelle Professor, Department of Physics Associate Director, Lewis-Sigler Institute for Integrative Genomics Princeton University

Emery N. Brown, M.D., Ph.D. (Co-chair)

Professor, Computational Neuroscience and Health Sciences and Technology MIT-Harvard Division of Health Science and Technology Massachusetts Institute of Technology Professor of Anaesthesia Harvard Medical School

Julio M. Fernandez, Ph.D. Professor of Biological Sciences Columbia University

Nancy J. Kopell, Ph.D. William Goodwin Aurelio Professor of Mathematics and Science Boston University

John Kuriyan, Ph.D. Investigator, Howard Hughes Medical Institute Chancellor's Professor Department of Molecular and Cell Biology Department of Chemistry University of California-Berkeley

Wendell Lim, Ph.D.

Professor Department of Cellular and Molecular Pharmacology Department of Biochemistry and Biophysics University of California-San Francisco

Gene Myers, Ph.D. Group Leader HHMI Janelia Farm Research Campus

Rob Phillips, Ph.D. Professor of Applied Physics and Bioengineering California Institute of Technology **Stephen R. Quake, Ph.D.** Professor and Co-chair Department of Bioengineering Stanford University

Eric D. Siggia, Ph.D.

Professor of Physics Rockfeller University

Raimond L. Winslow, Ph.D. (Co-chair) Director, Institute for Computational Medicine Professor, Department of Biomedical Engineering Johns Hopkins University

Career Awards for Science and Mathematics Teachers

Hon. Larry Bell North Carolina General Assembly House of Representatives

Barnett Berry, Ph.D. President Center for Teaching Quality

Enriqueta C. Bond, Ph.D.

Past President Burroughs Wellcome Fund

Gladys Graves (chair) Past Director North Carolina Teaching Fellows Program

Angela Quick, Ed. S. Deputy Chief Academic Officer State Board of Education

Pat Shane, Ph.D. Associate Director University of North Carolina-Chapel Hill Center for Mathematics and Science Education

Dave Smith Director Center for Inquiry Based Learning

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Career Awards for Medical Scientists

Jack Antel, M.D. Professor of Neurology and Neurosurgery McGill University

Aravinda Chakravarti, Ph.D.

Director, Center for Complex Disease Genomics McKusick - Nathans Institute of Genetic Medicine Johns Hopkins University School of Medicine

Piet de Groen, M.D. Professor of Medicine Mayo Clinic College of Medicine

H. Shelton Earp, III, M.D. Professor and Director, Lineberger Comprehensive Cancer Center University of North Carolina-Chapel Hill School of Medicine

Roderick R. McInnes, M.D., Ph.D. (Cochair) Director, Lady Davis Research Institute - Jewish General Hospital Alva Chair in Human Genetics Professor of Genetics & Biochemistry McGill University

Elizabeth McNally, M.D., Ph.D. Professor of Medicine and Human Genetics University of Chicago *BWF Clinical Scientist Awardee in Translational Research – 2001*

Louis J. Muglia, M.D., Ph.D. Edward Claiborne Stahlman Professor Vice Chair for Research Affairs Department of Pediatrics Director, Vanderbilt Institute for Child Health Research Vanderbilt University Medical Center *BWF Career Awardee in the Biomedical Sciences – 1995*

Jeffrey A. Whitsett, M.D. (Cochair) Chief, Section of Neonatology, Perinatal and Pulmonary Biology University of Cincinnati Children's Hospital

J. Lindsay Whitton, M.D., Ph.D. Professor, Immunology and Microbial Science Scripps Research Institute

John York, Ph.D. Investigator, Howard Hughes Medical Institute Professor, Pharmacology and Cancer Biology Duke University Medical Center *BWF Career Awardee in the Biomedical Sciences – 1995*

Clinical Scientist Awards in Translational Research

Andrea Dunaif, M.D.

Charles F. Kettering Professor of Medicine Chief, Division of Endocrinology, Metabolism, and Molecular Medicine Northwestern University Feinberg School of Medicine

Garret A. FitzGerald, M.D.

Chair, Dept. of Pharmacology Director, Institute for Translational Medicine and Therapeutics University of Pennsylvania

Lisa M. Guay-Woodford, M.D.

Professor, Depts. of Medicine, Pediatrics, and Genetics Director, Division of Genetics and Translational Medicine University of Alabama-Birmingham School of Medicine

Gail Jarvik, M.D., Ph.D. Head, Division of Medical Genetics Arno G. Motulsky Professor of Medicine and Genome Sciences University of Washington Medical Center

Shannon C. Kenney, M.D. Wattawa Bascom Professor of Cancer Research University of Wisconsin-Madison

H. Kim Lyerly, M.D. (Cochair) Director, Duke Comprehensive Cancer Center George Barth Geller Professor for Research in Cancer Duke University Medical Center

Justin C. McArthur, M.B.B.S., M.P.H. Professor and Interim Chair, Dept. of Neurology Professor, Depts. of Pathology and Epidemiology Johns Hopkins University School of Medicine

Beverly S. Mitchell, M.D. George E. Beckman Professor of Medicine Deputy Director, Comprehensive Cancer Center Stanford University

Steven S. Rosenfeld, M.D., Ph.D. Professor of Neurology Director, Division of Neuro-Oncology Columbia University

Christine E. Siedman, M.D. Investigator, Howard Hughes Medical Institute Professor of Medicine and Genetics Harvard Medical School

Arthur Weiss, M.D., Ph.D.

Ephraim P. Engleman Distinguished Professor of Rheumatology Professor of Medicine, Microbiology and Immunology University of California-San Francisco

Michael J. Welsh, M.D. (Cochair) Investigator, Howard Hughes Medical Institute Professor, Departments of Internal Medicine, Physiology, and Biophysics University of Iowa Carver College of Medicine

Collaborative Research Travel Grants

Matthew Redinbo, Ph.D. Professor and Chair, Department of Chemistry University of North Carolina-Chapel Hill *BWF Career Awardee in the Biomedical Sciences – 1999*

Keith Weninger, Ph.D. Associate Professor, Department of Physics North Carolina State University BWF Career Awardee at the Scientific Interface – 2001

John York, Ph.D. Investigator, Howard Hughes Medical Institute Professor, Pharmacology and Cancer Biology Duke University Medical Center *BWF Career Awardee in the Biomedical Sciences – 1995*

Institutional Program Unifying Population and Laboratory Based Sciences

Mark Boguski, M.D., Ph.D. Novartis

Rita Colwell, Ph.D. (Chair) Distinguished Professor University of Maryland College Park Johns Hopkins University Bloomberg School of Public Health

King K. Holmes, M.D., Ph.D. Professor University of Washington

Timothy Hughes, Ph.D. Professor University of Toronto

Frederick A. Murphy, D.V.M., Ph.D. Professor University of Texas Medical Branch-Galveston **Leona D. Samson, Ph.D.** Ellison American Cancer Research Professor Massachusetts Institute of Technology

H. Steven Wiley, Ph.D. Director, Biomolecular Systems Pacific Northwest National Laboratories

Lynn Zechiedrich, Ph.D.

Associate Professor Baylor College of Medicine

Investigators in the Pathogenesis of Infectious Disease

Terence S. Dermody, M.D. Professor of Pediatrics and Microbiology and Immunology Vanderbilt University School of Medicine

Robert W. Doms, M.D., Ph.D. Chair of Microbiology University of Pennsylvania School of Medicine

William E. Goldman, Ph.D. Professor and Chair, Microbiology and Immunology University of North Carolina-Chapel Hill

Kasturi Haldar, Ph.D. Julius Nieuwland Chair of Biological Sciences Director, Center for Rare and Neglected Diseases University of Notre Dame

Brigitte T. Huber, Ph.D. Professor of Pathology-Medical Tufts University School of Medicine

Margaret Kielian, Ph.D. Professor of Cell Biology Albert Einstein College of Medicine of Yeshiva University

Anne Moscona, M.D. Professor of Pediatrics, Microbiology and Immunology Weill Medical College of Cornell University

David G. Russell, Ph.D. (Chair) Professor and Chair of Microbiology and Immunology Cornell University College of Veterinary Medicine

Joseph W. St. Geme, III, M.D. Professor and Chair of Pediatrics Professor of Molecular Genetics and Microbiology Duke University Medical Center

Preterm Birth Initiative

Jay D. Iams, M.D. Frederick P. Zuspan Professor and Endowed Chair, Division of Maternal Fetal Medicine Vice Chair, Department of Obstetrics and Gynecology Ohio State University Medical Center

Louis J. Muglia, M.D., Ph.D. (Chair) Edward Claiborne Stahlman Professor Vice Chair for Research Affairs Department of Pediatrics Director, Vanderbilt Institute for Child Health Research Vanderbilt University Medical Center

Jerome F. Strauss, III, M.D., Ph.D. (BWF Board Liaison) Dean, School of Medicine Executive Vice President for Medical Affairs Virginia Commonwealth University

Jenny Ting, Ph.D. Alumni Distinguished Professor of Microbiology and Immunology Lineberger Comprehensive Cancer Center University of North Carolina at Chapel Hill

Jeffrey A. Whitsett, M.D. Chief, Section of Neonatology, Perinatal and Pulmonary Biology University of Cincinnati Children's Hospital

Student Science Enrichment Program

Yolanda S. George Deputy Director, Education and Human Resources Programs American Association for the Advancement of Science

G. Thomas Houlihan, Ed.D. President & CEO Institute for Breakthrough Performance

Matty Lazo-Chadderton Director, Hispanic/Latino Affairs President Pro Tempore's Office North Carolina Senate

William McNeal Executive Director North Carolina Association of School Administrators **Greg Mitchell** Environmental Science Teacher

Willie Pearson, Jr., Ph.D. Professor of Sociology School of History, Technology and Society Georgia Institute of Technology

Brenda Wojnowski, Ed.D. Consultant Wojnowski and Associates

Terri L. Woods, Ph.D. Associate Professor of Geology East Carolina University

Margaret M. Young, Ph.D. Associate Professor Department of Biology Elizabeth City State University

Investment Committee

Michael Even Numeric Investors

Geoff Gerber, Ph.D. (Chair) BWF Board of Directors

James Hirschmann Western Asset Management

Melissa Hieger

Dyann F. Wirth, Ph.D. BWF Board of Directors

Walter Niemasik Snyder Capital Management

Chris Viehbacher BWF Board of Directors

Note: The committee is composed of four members from outside BWF and three members from BWF's Board of Directors. The board's chair, BWF's president, and BWF's vice president for finance also serve on the committee as nonvoting members.

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Board of Directors

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Deborah S. Harville Program Assistant

Debra J. Holmes Senior Program Associate

Jean A. Kramarik Senior Program Associate

Victoria McGovern, Ph.D. Senior Program Officer

Melanie Scott Senior Program Associate and Database Specialist

Rolly L. Simpson Jr. Senior Program Officer

Nancy S. Sung, Ph.D. Senior Program Officer

D. Carr Thompson Senior Program and Communications Officer

Kendra Tucker Programs Assistant and Data Specialist

Debi Vought Senior Program Associate

Program Contact Information

Biomedical Sciences; Reproductive Sciences

Rolly Simpson Program Officer rsimpson@bwfund.org

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Infectious Diseases; Population and Laboratory Based Sciences

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Interfaces in Science; Translational Research

Nancy S. Sung, Ph.D. Senior Program Officer nsung@bwfund.org

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Finance and Administration

Ken Browndorf Senior Asset and Accounting Manager

Jennifer Caraballo Accountant

Sammy Caraballo Systems and Web Engineer

Brent Epps Facilities and Administrative Assistant

Barbara Evans Administrative Meeting Assistant

Lori Hedrick Meeting Professional

Wendell Jones Technology Coordinator

Glenda H. Oxendine Manager, Facilities and Administration

Betsy Stewart Administrative Assistant

Communications/Media

Russ Campbell Communications Officer news@bwfund.org

Program Information

The most up-to-date information about our programs, including complete application information, can be found on our website at www.bwfund.org.

Burroughs Wellcome Fund

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