

Report of the Advisory Mission on Advanced Human Capital Training Requested by the Ministry of Education of Chile

Executive Summary

The United States National Academy of Sciences (NAS), in response to a request from Sally Bendersky, Chief of the Division of Higher Education, Ministry of Education of the Government of Chile, convened a panel of five scientist/educators to “provide expert advice to the Ministry of Education on the best way to incorporate the potential of extensive advanced human capital building abroad into the scientific and technology environment in Chile, showing the essential components that Chile will need to address for a strong and sustainable capacity to introduce knowledge in the solution of its cultural, social and economic problems.” This group, in the spirit of other visiting committees, is not an agent of the NAS; its report has not been reviewed outside of the five-member panel, and the NAS is not responsible for its content. All of the participants, however, have considerable experience in these kinds of evaluations and we believe that our report is representative of a general consensus that would have come from any similar group.

As Professor Martin Chrispeels, Chair of the Program Committee of the Iniciativa Científica Milenio (ICM), pointed out on the occasion of the 2008 Board Meeting of the ICM, “Decision makers in countries like Chile that are well on the way to become fully developed, are keenly aware that science and technology are the drivers of economic development. To prosper economically, these countries need to ensure that they have a strong scientific, technological, and engineering capacity. The present period of economic prosperity in Chile brought about by the high price of copper and other exports, has resulted in a proposal to send large numbers of young Chileans abroad for science training at the doctoral and postdoctoral level. Now is, therefore, a good time to take stock of Chilean science and formulate policies that will increase Chile’s scientific capacity and impact.”

As a first step to achieve its goal, the Government of Chile has created the *Bicentennial Fund for the Training Abroad of Advanced Human Capital*, to enhance the numbers of young Chilean scientists and technologists who have experienced training abroad.

Our advisory mission visited Santiago de Chile from September 28 to Oct 3, 2008. We met with representatives from the Ministries of Education and the Economy, several agencies directly involved in the funding and development of research and students in Chile, representatives from the Universities, the Chilean Academy of Sciences and graduate students from five Chilean research universities. Below is a summary of our conclusions and recommendations.

1. The Chilean university system and the overall level of research in Chile has improved significantly in the last decade and is one of the best in Latin America, but it has not yet reached the quality found in the most developed countries.
2. We applaud Chile's interest in increased investment in advanced training. Properly implemented, the Bicentennial Fund program could substantially and positively impact advanced human capital in Chile and provide an opportunity to transform a generation of engineers, scientists, teachers, and technicians in Chile. However, in its present form, this program does not optimize its potential and runs the risk of devaluing and possibly damaging some of the best aspects of the current system.
3. Care must be taken to provide for the means, including infrastructure, to ensure the return and proper utilization of scientists after completion of postdoctoral fellowships, graduate programs, or other opportunities abroad created by the Bicentennial Fund. Such infrastructure means both employment and research and development capabilities. We propose several ways to broaden the program so as to optimize all of these goals within the constraints of using U.S. dollars spent abroad while increasing the numbers of educated scientists, technicians, and scholars in Chile.
4. We support Chile's goal to develop and grow in targeted areas that are critical for the Chilean economy. Experience has shown, however, that the long-term success of such endeavors critically depends on broad programs in basic research. Balance is important.
5. We urge that any program designed to improve doctoral level human capital in Chile be coordinated with the Chilean scientific, university, and industry communities. External or international assessment of Chilean doctoral programs is recommended as a means to raise the level of these programs. The development of human capital is best viewed in a systematic way so that the large increase in trained people can be utilized effectively.
6. Universities and industry will have to change to take advantage of this important new program. This includes committing to faculty renewal, new modes of education, upgrading quality of technical staff, and engaging in new models of cooperation and collaboration.

I. Introduction

In May, 2008, the Government of President Michelle Bachelet decided to invest in an ambitious program to increase the national capacity to solve our problems of cultural and socioeconomic development through the generation and application of knowledge. This program, The Bicentennial Fund for the Training Abroad of Advanced Human Capital, will focus on the advanced training of a large number of Chileans through international collaboration with foreign institutions. The amount that will be expended is approximately 250 million US dollars per year for at least 5 years.

Sally Bendersky, Chief of the Division of Higher Education of the Ministry of

Education requested that the NAS to organize a mission of experts to visit Chile, meet with the authorities responsible for the program and with scientists and academic leaders in Chile, and provide the Minister of Education with a report that would contain their advice and possibly the recommendation of future steps that could help to evaluate the most effective way to improve our national capacity for advanced studies, research and innovation through advanced training of human resources. Thus, the main objective of this mission is to provide expert advice to the Ministry of Education on the best way to incorporate the potential of extensive advanced human capital building abroad into the scientific and technology environment in Chile, showing the essential components that Chile will need to address for a strong and sustainable capacity to introduce knowledge in the solution of its cultural, social and economic problems.

Specifically, the mission was asked to:

1. Provide an overall impression of the current state of development of advanced human capital in Chile through research and postgraduate studies.
2. Make recommendations regarding the issues and activities that should be addressed and considered in the training of advanced human resources in Chile and outside of the country.
3. Make recommendations regarding the international assessment of postgraduate programs in Chile with the intention of identifying actions and mechanisms that can raise the level and capacity of these programs.
4. Make suggestions about new mechanisms of collaboration that can be established with international institutions and agencies, especially in the U.S.A., that can help attain development goals in research and innovation in the country.
5. Make suggestions of possible policies and actions to enhance the value of the advanced Chilean human capital in the country.

Accordingly, a panel of five scientists/educators convened by the U.S. National Academy of Sciences (CV's in Appendix A) met during the week of September 29-October 3 with representatives from the Ministries of Education and the Economy, several agencies directly involved in the funding and development of research and students in Chile, representatives from the Universities, the Chilean Academy of Sciences and graduate students from five Chilean research universities (Appendix B).

We heard about the three pillars of the campaign for Innovation in Chile, the improvement of human capital, business innovation and science with a strategic orientation.

II. The Current State of Advanced Human Capital in Chile

Graduate programs in Chile are growing and strengthening. The quality and quantity of publications as a metric of success looks quite good in comparison with that in other countries in similar stages of cultural and socioeconomic development. There are some world class scientists and world class science programs in Chile. The results of increases in funding for both students and programs in terms of performance are apparent. Because these changes are recent, quality varies from excellent in some areas to barely satisfactory in others. It is clear, in addition, that production of world-class science and technology demands world-class infrastructure, and that is going to require significant and increasing investment.

III. Training Outside of Chile

With respect to current plan for training abroad, we agree that the program should not only provide for training of doctoral and post-doctoral students as fellows abroad, it should include opportunities for training of teachers (e.g. teachers of English and other languages) and technicians whose skills would be enhanced by enrollment in training programs abroad.

Broadening the Program

We are convinced that the program should be broader in scope, i.e, it should not just be targeted to graduate students who will study for masters, engineering or doctorate degrees enrolled in foreign universities. Experience indicates that these are the most risky investments in the sense that these students are the people least likely to return to Chile, especially if research employment opportunities in Chile are limited. We recommend that the program be broadened to include support for postdoctoral scholars who have received degrees in Chile, sabbaticals for senior researchers and faculty, support for graduate students enrolled in Chilean universities to collaborate with researchers at foreign universities but with their degrees granted by the Chilean university, and creation of opportunities for undergraduates to spend time working with researchers abroad to better prepare them for graduate studies either within Chile or abroad. There are programs in other countries, especially at major research centers that, themselves, do not grant degrees, but encourage both undergraduate and graduate students from other countries to come work with their staff. Programs have also been developed to send students to specific universities and departments either as part of broad collaborative projects or collaborations between individual researchers. These can be very cost effective while helping students prepare for graduate school.

The Undergraduate Experience

Student success in graduate and post-graduate school is strongly aligned with the undergraduate experience. One critical ingredient to the success of the Bicentennial Fund program to address Chile's needs for new generations of research-minded, technology

savvy innovators is the recognition of the undergraduate-graduate education continuum as foundational to a comprehensive and systemic approach to Higher Education. This requires strengthening undergraduate education by introducing flexibility and modernizing curricular options, and more importantly by fostering an academic environment that encourages and nurtures different modes of scientific inquiry, independent thinking and creativity, that is the integration of research and education in engineering and science at all levels within the university. Excellence in the modern research university relies on the intellectual caliber, engagement and collective optimism of the community of faculty, graduate and undergraduate students working together. These principles guide our recommendation that the Bicentennial Fund program adopt a diversified portfolio of “training abroad” opportunities to include faculty and research staff sabbaticals, undergraduate research fellowships, joint programs between foreign and Chilean universities, and graduate exchange and non-degree training scholarships.

Return to Chile

While we understand that the Bicentennial Fund program requires students to come back or pay a very large penalty, we believe that this strategy may prove counterproductive in the long term. First, students should be incentivized to come back, not penalized if they choose not to return. Second, the country may not want to reabsorb every single candidate that went abroad. Ideally only those that did well should be actively recruited and sought after to return to Chile; populating universities, schools and industry with mediocre people is not a wise strategy. Finally, the country needs to introduce a robust and sustainable plan to recapture the trained talent back into the workforce in a way that their return really makes a difference, for example by helping transform and improve the standards in Chilean institutions and industry, by bringing new levels of creativity and ingenuity, etc. We suggest that the same pool of funds (in US dollars) used to send people abroad also be used to supplement the education of these students by providing start-up funds for returning PhDs . The money can be kept in the US, as most equipment, supplies, reagents, etc. are often purchased from abroad. We also strongly recommend that the Bicentennial Fund program should incentivize not only the individual’s interest in returning to Chile but also a Chilean institution’s interest in employing them. For example, providing matching funds, seed-funds, etc. would go a long way toward establishing meaningful partnerships between the Bicentennial Fund program and Chilean universities and industry.

The program needs to be implemented in a manner that does not devalue graduate studies at Chilean Universities, nor deplete the pool of qualified graduate students on which high quality programs in Chile depend.

IV. Assessment of Chilean Graduate Programs

The current accreditation of PhD programs provided by the National Accreditation Committee of the Higher Education Council, Ministry of Education, is important, particularly in its role of assuring the establishment of and adherence to certain program standards of quality. The forthcoming U.S. National Research Council

“Assessment of Research-Doctorate Programs” should be very helpful in providing quantitative data that can be used for comparison to help evaluate programs in Chile. The data, organized by program, include publications, citations, time to degree, extent of support, etc., and will be available for all of the significant research doctorate programs in the U.S.

An equally important role of accreditation should be to help make PhD programs at Chilean universities stronger. Toward this end, it is customary in major research universities, world-wide, to have highly qualified external assessment committees review the performance of departments and programs. These reviews are made to both assess the research activities of the department, their graduate and undergraduate academic programs, and the status of facilities and resources available for the department’s activities. We recommend that the research universities of Chile follow suit and that such reviews be provided periodically to the University administration.

Improvements in the quality of graduate programs in Chile can also be achieved by broadening the Bicentennial Fund program as recommended in the section above. The additional strategies suggested will have the added benefit of enhancing and not devaluing graduate programs at Chilean universities, and will help to maintain the pool of qualified graduate students on which high quality programs in Chile depend. It is critical that doctoral programs at Chilean universities remain competitive in their ability to attract outstanding students for graduate studies and that the doctoral candidates graduating from these programs have the same opportunities for employment in Chile anticipated for those trained abroad.

V. International Collaboration

There are many opportunities to improve existing and develop new mechanisms of international collaboration and all should be explored. We particularly endorse programs that will foster the involvement of Chilean students in qualified research programs abroad while they pursue their studies at Chilean universities. In the best circumstances, these would be collaborative efforts between Chilean advisors and their foreign counterparts (what is locally known as a “sandwich program.”) This kind of program should involve visits to Chile by the international collaborators as well as visits, including sabbaticals, from Chile by the faculty. Many such programs exist already. In astronomy and astrophysics, for example, there is the Smithsonian Predoctoral Fellowship program that allows and encourages graduate students to work with researchers at the Smithsonian Astrophysical Observatory. Similarly there are the Princeton-Catolica Postdoctoral Fellowships through which a postdoctoral fellow spends part of his/her time at Princeton University and part at the Pontificia Universidad Catolica.

Graduate students, postdoctoral fellows and other researchers who come with their own support are generally welcomed at universities and other research organizations.

VI. Targeted Programs

It will be critical to find the right balance between focused or mission-linked research and fundamental or curiosity-driven research. Mission-linked research allows the nation to address problems and pursue scientific opportunities unique to Chile and key to acceleration of economic development and industry competitiveness. Obvious examples for which Chile is already known internationally but where continued research and innovation are critical to remaining competitive in the global market place are wine, fruits, and aquaculture enhanced by the highly successful cooperative and collaborative program between Chilean universities and the University of California, Davis. Protection of the environment and natural resource base upon which so many industries in Chile depend provides another important target for research potentially unique to Chile and critical to informing policy. However, care must be taken to not define targeted areas too narrowly and to allow the researchers maximum latitude to define and pursue the scientific questions they consider key to the success of their missions. Going one step further, a significant portion of the funds and training should be available in support of broad programs in basic research based on the experience that breakthroughs in science cannot be predicted or predetermined. Whether mission-linked or curiosity-driven, the programs must be subject to the same high standards of quality.

We found the academic officers (Rectors, Vicerectors) in the research universities enthusiastic about opportunities for advanced training that would enhance educational training and programs in Chile. These included: short term training programs for doctoral and master's students; joint degree programs; international conferences and meetings; postdoctoral training abroad for Chilean PhD's.; sabbaticals leaves for faculty renewal; and visits of foreign scholars. As noted above, international collaborative projects were viewed as especially attractive.

VII. Advancing Human Capital In Chile

In summary, taking advantage of the resources to be provided by the Bicentennial Fund requires major change by all of the participants and stakeholders. Students, universities, industry and government will need to respond to make the most of this important opportunity. In this regard, the Bicentennial Fund program should catalyze the important change in the intellectual background and knowledge production of this rapidly developing country that has already begun so well.

Support of graduate students needs to be appropriate and sufficient to ensure that students making good progress can complete their doctoral work.

Renewal and development of Chile's research and development infrastructure is essential to the success of this program. Chilean industry, universities and research centers must be able to profitably absorb and utilize the increase in educated human capital produced by the program.

Respectfully Submitted, November 1, 2008

Ana Barros
John Brauman
R. James Cook
John Huchra
Charles Zuker

CV's for Members of the Mission

Anna P. Barros

Professor Ana P. Barros was born in Africa, grew up in Angola and Portugal, and has lived almost all of her adult life in the United States. She attended the Faculty of Engineering of the University of Porto where she obtained a summa cum laude Diploma in Civil Engineering with majors in Structures and Hydraulics in 1985, and a M.Sc. degree in Ocean Engineering in 1988 with a thesis focusing on numerical modeling of sediment transport in estuaries and coastal regions. In 1990, Dr. Barros completed and M.Sc. degree in Environmental Science Engineering at the OHSU/OGI School of Science and Engineering. She earned a Ph.D. in Civil Engineering from the University of Washington, Seattle in 1993. Her graduate studies were supported in part by fellowships from the Portuguese Foundation for Science and Technology (FCT/JNICT), and NASA's Graduate Fellowship program.

Dr. Barros was in the engineering faculty at the University of Porto, Penn State University, and Harvard University before joining Duke University in 2004. The primary themes of her research are the physics of water cycle processes in mountainous regions with a focus on cloud formation and precipitation; remote sensing of the environment using microwave and infrared sensors; long-range predictability and risk analysis of natural hazards; computational environmental fluid mechanics and nonlinear dynamics; and the development and application of information technology as a research tool and in the operation of complex engineering systems. Through model development, field and laboratory experiments, and data analysis, her goal is to facilitate and promote bridges across environmental science and engineering, physics, applied mathematics, and information sciences. Her primary research interests are in Hydrology, Hydrometeorology and Environmental Physics with a focus on water-cycle processes in the coupled land-atmosphere-biosphere system particularly in regions of complex terrain, the study of multiscale interface phenomena in complex environments across the Earth Sciences, remote sensing of the environment (precipitation, clouds, soil moisture, and vegetation), climate predictability and risk assessment of natural hazards. Prof. Barros is especially proud of having involved dozens of students in undergraduate research, a great majority of which continued their studies to earn graduate degrees in science and engineering.

Dr. Barros is a member of the National Academies' Climate Research Committee (CRC), and a member of the US National Committee for the International Hydrology Program (IHP) of the UNESCO. The CRC is a standing committee that sits under the Board on Atmospheric Sciences and Climate, and is responsible for developing, coordinating, and providing oversight for a broad spectrum of climate-related activities across the National Academies. The CRC also functions as the U.S. National Committee for the World Climate Research Programme (WCRP), and functions as a liaison between WCRP and the US Climate Change Science Program. In the past, Dr. Barros served in the Space Studies Board of the National Research Council, and in several committees of the Water Science and Technology Board and the Board of Atmospheric Sciences and Climate. She

served as an elected member of the Council of the American Meteorological Society, and serves currently in several committees within the American Meteorological Society and the American Geophysical Union. Prof. Barros was a member of the NOAA's Climate and Global Change Program advisory panel, and serves or has served in several working groups at NASA and NSF. Dr. Barros is an active member of several professional organizations including the IEEE, ASCE, AGU, AMS, ASEE, AAAS, EGS and AWRA. Prof. Barros serves in the editorial boards of the Journal of Hydrology and Natural Hazards and Earth Systems Science, and she is the Chief Editor of the Journal of Hydrometeorology.

Dr. Barros received early career young investigator awards from NSF and NASA in 1995 and 1996. She was a George W. Merck Faculty Fellow at Harvard University 1999-2003, and Packard Fellow nominee from Penn State University. She received the Prize Foundation A. Almeida in Engineering in 1985, and the Lorenz G. Straub Award for her Ph.D. thesis in 1993. Dr. Barros is a Senior Member of the IEEE, and a Fellow of the American Meteorological Society.

John I. Brauman

John Brauman was born in Pittsburgh, PA in 1937. He attended M.I.T. (S.B., 1959) and the University of California at Berkeley (Ph.D., 1963). He was a National Science Foundation Postdoctoral Fellow at UCLA, then took a position at Stanford University where he is J. G. Jackson - C. J. Wood Professor of Chemistry, Emeritus. He was Department Chair of Chemistry, Associate Dean for Natural Sciences, and has been Associate Dean of Research since 2005-. He also currently serves as the Home Secretary of the National Academy of Sciences.

Brauman has received a number of awards including the American Chemical Society Award in Pure Chemistry, Harrison Howe Award, Guggenheim Fellowship, R. C. Fuson Award, Arthur C. Cope Scholar Award, the James Flack Norris Award in Physical-Organic Chemistry, the National Academy of Sciences Award in Chemical Sciences, the Linus Pauling Medal, the Willard Gibbs Medal, and the National Medal of Science. He is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, the American Philosophical Society, a Fellow of the American Association for the Advancement of Science, and an Honorary Fellow of the California Academy of Sciences. He received the Dean's Award for Distinguished Teaching from Stanford University in 1976. Brauman has served on many national committees and advisory boards. He was Deputy Editor for Physical Sciences for *SCIENCE* from 1985 to 2000 and is currently the Chair of the Senior Editorial Board.

Brauman's research has centered on structure and reactivity. He has studied ionic reactions in the gas phase, including acid-base chemistry, the mechanisms of proton transfers, nucleophilic displacement, and addition-elimination reactions. His work includes inferences about the shape of the potential surfaces and the dynamics of reactions on these surfaces. He has made contributions to the field of electron photodetachment spectroscopy of negative ions, measurements of electron affinities, the study of dipole-supported electronic states, and multiple photon infrared activation of ions. He has also studied mechanisms of solution and gas phase organic reactions as well as organometallic reactions and the behavior of biomimetic organometallic species.

R. James Cook

R. James Cook is dean and professor emeritus, Washington State University (WSU), Pullman, WA, a title he assumed effective September 1, 2005, after serving since August, 2003 as interim dean of the WSU College of Agricultural, Human and Natural Resource Sciences. From April 1, 1998 until his appointment as interim dean, he held the R. J. Cook Endowed Chair in Wheat Research at WSU, a position endowed with a \$1.5 million gift from the Washington wheat growers through their Commission to the WSU Foundation. Prior to this appointment, he worked as a Research Plant Pathologist with USDA-Agricultural Research Service (ARS) at Pullman from 1965 through March of 1998, conducting research on biological and ecological approaches to manage root diseases of Pacific Northwest wheat. In addition to his 200 scientific journal articles and reviews, he has co-authored three books, two on biological control of plant pathogens and one book on wheat health management.

During his 40 year career in research, teaching, and administration, he served in several elected offices of professional scientific societies, including as President of the American Phytopathological [Plant Pathology] Society in 1983/84 and of the International Plant Pathology Society from 1985/1990. From October 1, 1993 through March 31, 1996, and while maintaining his research program at Pullman, he served in Washington DC on a 50% appointment as Chief Scientist for the U. S. Department of Agriculture's \$100 million National Research Initiative Competitive Grants Program. He has also served as a member of the U.S. delegation to the Organization for Economic Cooperation and Development (OECD) in the early 1990s on safety of agricultural biotechnology, 2 years on the U.S. Secretary of Agriculture's Advisory Committee on Agricultural Biotechnology, and on the panel that produced the National Academy of Sciences' 2002 report, *Countering Agricultural Bioterrorism*. Upon his retirement in late 2005, he was immediately appointed by the governor of Washington State to a three-year term as citizen trustee on the Board Authority for the Washington State Life Science Discovery Fund, a \$35 million annual competitive grants program funding research for improvement of human health and economic development in the State. Since April 30, 2007, he has been serving as one of 12 members of the founding Board of Directors of the new Washington State Academy of Sciences.

His awards include: NATO Research Fellow to Australia, 1964-65; Guggenheim Fellow to Australia, 1973-74; Fellow, of the Japanese Society for Promotion of Science, 1983; Superior Service Award, Distinguished Service Award, Agricultural Research Service (ARS) Distinguished Scientist of the Year, and ARS Science Hall of Fame, from the U.S. Department of Agriculture; Fellow, Award of Distinction, and Ruth Allen Award from the American Plant Pathology Society; Fellow, Crop Science Society of America; Fellow, American Society of Agronomy; and Fellow of the American Association for the Advancement of Science. He was elected to the National Academy of Sciences in 1993. Dr. Cook holds BSc (1958) and MSc. (1961) degrees from North Dakota State University and a PhD (1964) from the University of California, Berkeley. He holds honorary doctorates from North Dakota State University and the University of Torino, Italy.

John Peter Huchra

Personal information:

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Education and Positions:

B.S., Physics, Massachusetts Institute of Technology, 1970.
Ph.D., Astronomy, California Institute of Technology, July 1976.
Center Fellow, Harvard-Smithsonian Center for Astrophysics, 1976-1978.
Astronomer, Smithsonian Astrophysical Observatory, 1978-1989.
Senior Astronomer, Smithsonian Astrophysical Observatory, 1989-2005.
Lecturer, Harvard University (Department of Astronomy) 1979 - 1984.
Professor of Astronomy, Harvard University, 1984-2002.
Robert O. & Holly Thomis Doyle Professor of Cosmology 2002 |
Visiting Scientist, Space Telescope Science Institute, 1986, 1990.
Centennial Lecturer, Utah State University 1987.
Visiting Lecturer, University of Minnesota 1988.
Associate Director, SAO-OIR Division 1989-1998
Associate Director, Harvard College Observatory 1990-1998
Vaughan Visiting Professor, University of Texas 1991.
Visiting Professor, Caltech 1991.
Visiting Professor, U. C. Santa Cruz 1993.
Director, F.L. Whipple Observatory 1994-1998.
Lyman Spitzer Lecturer, Princeton, 1997.
Scientific Editor, Astrophysical Journal 1998-2003.
Raymond and Beverly Sackler Distinguished Astronomer, Cambridge University 2003 --
Interim Director, Harvard-Smithsonian CfA, 2004.
Vice Provost for Research Policy, Harvard University 2005-6.
Senior Advisor to the Provost on Research Policy 2006-8.

Honors

A.A.A.S. Newcomb-Cleveland Award 1989
Member, American Academy of Arts and Sciences 1991 ---
Aaronson Prize 1992
Fellow of the American Physical Society 1992 ---
Member, National Academy of Sciences 1993 ---
Fellow of the American Association for the Advancement of Science 1994 ---
NASA Group Achievement Award for 2MASS 2000
National Associate of the National Academy of Sciences 2001 ---
Maria & Eric Muhlmann Award of the ASP (2MASS Team) 2006

Selected National and International Committees & Organizations

Space Telescope Working Group on Galaxies and Clusters of Galaxies 1984 - 1985
Arecibo Observatory Scientific Advisory Committee 1985 - 1988
American Institute of Physics Committee on Publishing Policy 1988-1995
NOAO Future Directions Committee 1986-87
Space Telescope Institute Council 1987-95; 2007-10
N.S.F. Science and Technology Research Centers Site Review Panel 1988
NAS/NRC Astronomy and Astrophysics Survey, Optical Panel 1989-90
Arecibo Advisory Board and Visiting Committee 1989-92
Hubble Space Telescope Time Allocation Committee Cycles 3, 9 and 17
US Gemini Science Advisory Committee 1993-95
Gemini Directorship Search Committee, Chair 1993-4
US National Committee for the IAU 2000-2009, Vice Chair 2001-4, Chair 2005 -7
NAS Watson Prize Committee 1993
ESO Visiting Committee 1993-6
NAS/NRC Committee on Astronomy and Astrophysics 1994-2001; Co-Chair 1997-2001
Canadian Astronomical Facilities Review 1995-6
STScI Director's Advisory Committee 1995 (Hubble Deep Field)
AURA Board of Directors/Member Representative (Harvard) 1995-2009
 Executive Committee 1995-6
 Board of Directors 1997-2004 Chair 2001-2004
APS Astrophysics Division Executive Committee 1996-97
NAS/NRC Board on Physics and Astronomy 1997-2003; Chair 2000-2003
AAS Committee on Astronomy and Public Policy 1998-2003; 2006---
Netherlands Organization for Scientific Research, NRFA Review 1999
NRC/NAS AASC Steering Committee 1999-2000
PPARC VISTA External Review Committee 1999-2002
NAS/NRC Committee on Physics in the Universe 2000-2002
Caltech Physics, Math & Astronomy Visiting Committee 2000-2006
Advisor, NRC Division on Engineering and Applied Physics 2001-4
W. M. Keck Observatory Visiting Committee (Chair) 2001-2
Institute for Astronomy (Hawaii) Visiting Committee (Chair) 2001
University of Michigan Astronomy External Review Committee 2002
M.I.T. Physics Department Visiting Committee 2002-10
NSF MPS Advisory Committee 2003-6
AAAS Program Committee 2004-7
Brookhaven Science Associates Board of Directors 2005---
NSF Astronomy Senior Review 2005-6
Ohio State Review of the School of Mathematics & Physical Sciences 2007-8
NASA Advisory Committee Astrophysics Subcommittee 2008-10
American Astronomical Society
 Publications Board Chair 1986-1988
 Councillor 1998-2001
 President Elect 2007-8
 President 2008-10

Charles S. Zuker

DATE OF BIRTH: June 27, 1957; Arica, Chile

EDUCATION

Universidad Catolica de Valparaiso; Chile B.Sc. 1973-1977 Biology

Massachusetts Inst. of Technology; Boston Ph.D. 1977-1983 Molecular Biology

RESEARCH AND/OR PROFESSIONAL EXPERIENCE

2007- Tamara and Kevin Kinsella Chair in Neurobiology

2005- Distinguished Professor, University of California, San Diego

1993 - present Professor and Investigator; Howard Hughes Medical Institute;
Departments of Biology and Neurosciences, School of Medicine University of
California, San Diego

1989 - 1992 Associate Professor and Associate Investigator Howard Hughes Medical
Institute, UCSD

1986 - 1989 Assistant Professor; Department of Biology, UCSD

1983 - 1986 Postdoctoral Fellow; Department of Biochemistry; University of California,
Berkeley (Gerry Rubin)

1977 - 1983 Graduate Student; Department of Biology; Massachusetts Institute of
Technology (Harvey Lodish)

Honors (selected)

1988-1991 McKnight Foundation Fund for Neuroscience Award

1988-1992 Pew Scholars Award

1988-1990 Alfred P. Sloan Award in Neurosciences,

1989-1991 March of Dimes Basil O'Connor Award

1999 Cogan Award for Vision Research (ARVO)

1999 Alcon Award for Vision Research

1999 University Lecture, UT Southwestern, Dallas, TX

2001 Elected Member, American Academy of Arts and Sciences

2002 UC Office of the President "Discovery and Invention"

2004 Elected Member, National Academy of Sciences

2006 Elected Member, Institute of Medicine

2007 Spencer Award, Columbia University

2008 Dutch Society for Biochemistry and Molecular Biology Speaker of the Year

Other Activities (selected 2005-date)

Chair, Graduate Program, Division of Biological Sciences, 1991-1995 and 2007-date

Dean's Advisory Committee, 1996-date

Member of various campus-wide committees and searches (Academic Salaries, Planning and Budget, Vice-Chancellor for Research, Dean of Biological Sciences, Chair of Neurobiology)

Editorial Board Member for Current Biology (2000-2006), Neuron (1995-date),

Proceedings of the National Academy of Sciences (2007-date)

Scientific Advisor for several foundations, granting agencies and biotech firms

Visiting/Senior fellow Janelia Farm-HHMI

Appendix B
List of Persons that met with Members of the Mission to Chile

- 1- Sally Bendersky – Chief of the Division of Higher Education, Ministry of Education
- 2- Ricardo Reich – Director of the MECESUP Program of the Division of Higher Education, Ministry of Education
- 3- Vivian Heyl – President of the National Commission of Research in Science and Technology – CONICYT
- 4- Carolina Toha – Congress woman – Member of the Education Committee of the House of Representatives
- 5- Hugo Lavados – Minister of Economy and his Science Advisor, Prof. Bernabé Santelices
- 6- Claudio Wernli – Executive Director of the Millenium Initiative, Ministry of Planning
- 7- Members of the National Accreditation Committee and the Higher Council for Education
- 8- Doctoral students (60) from the University of Chile, Pontifical Catholic University of Chile, University of Concepción, University of Santiago, Pontifical Catholic University of Valparaiso.
- 9- Eduardo Bitrán, President of the National Council of Innovation and members of that Council including Servet Martínez, Bernardita Mendez, Virginia Garretón
- 10- Bruno Phillipi, President of SOFOFA (Society for Industrial Development) which is a business consortium. Andrés Concha, Secretary General and Rafael Guilisasti , Vicepresident
- 11- Research Vice Presidents and Directors of Graduate Studies of Universities of the Council of Rectors: Rosa Devés and Jorge E. Allende of the University of Chile, Jaime Baeza of the University of Concepción, Mauricio Escudey of the University of Santiago, Sergio Marshall of the Pontifical University of Valparaiso, María Teresa Marshall, Executive Director of the Council of Rectors
- 12- Presidents of CRUCH Universities Pedro Pablo Rosso of the Pontifical Catholic University of Chile, and Alfonso Muga of the Pontifical Catholic University of Valparaiso; Jorge Las Heras, Prorector of the University of Chile.

- 13- Chilean Academy of Sciences: President Servet Martínez, Vice-President Juan Asenjo, Secretary Francisco Hervé. About 20 Members attended the special session.
- 14- Roberto Kelly, President of the private University Andrés Bello, Andrés Bernasconi, Vicerrector of Research and Graduate Studies of this University, Exequiel González, Academic Vicerrector, and Directors of Academic Departments
- 15- Carlos Alvarez, Vice President of CORFO, Agency for Economic development, and Claudio Maggi, director of CORFO Innovation Program
- 16- Individual visits to different laboratories and faculties.
Dr. Brauman visited Chemistry Department of the University of Santiago.
Dr. Barros visited the Faculty of Physical and Mathematical Sciences of the University of Chile – group on climate.
Dr. Huchra visited a joint Astrophysical Center of Universities of Chile, P. Catholic University and University of Concepción.
Dr. Cook visited the Faculties of Agronomy and Forestry of the University of Chile.
Dr. Zuker visited the Faculty of Medicine, University of Chile.
- 17- Javier Gonzalez, Executive Director of the Bicentennial Fund for Advanced Human Capital
18. Journalist Nicolás Luco from El Mercurio newspaper