

UNIVERSITY OF CALIFORNIA, ACADEMIC SENATE

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*University of California*  
*1111 Franklin Street, 12th Floor*  
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February 6, 2014

**AIMÉE DORR, PROVOST**  
**STEVEN BECKWITH, VICE PRESIDENT,**  
**RESEARCH & GRADUATE STUDIES**  
**UNIVERSITY OF CALIFORNIA**

**Re: CNSI Review**

Dear Aimée and Steve:

The Academic Council discussed the external review of CNSI in the spring of 2011, but no subsequent action was taken. Because some divisions were not consulted by their administrations and also wanted an opportunity to comment on UCORP's assessment, we extended the comment period to the fall. Council received letters from the Santa Barbara and Los Angeles divisions and asked me to forward them to you, along with UCORP's comments, for the record.

Please do not hesitate to contact me with any questions.

Sincerely,

A handwritten signature in cursive script that reads "Bill Jacob".

Bill Jacob, Chair  
Academic Council

Cc: Academic Council  
Martha Winnacker, Senate Executive Director



UNIVERSITY COMMITTEE ON RESEARCH POLICY (UCORP)  
Mike Kleeman, Chair  
[mjkleeman@ucdavis.edu](mailto:mjkleeman@ucdavis.edu)

Assembly of the Academic Senate  
1111 Franklin Street, 12<sup>th</sup> Floor  
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May 16, 2013

**ROBERT POWELL, CHAIR  
ACADEMIC COUNCIL**

**RE: Academic Review of the California NanoSystems Institute (CNSI), a California Institute for Science and Innovation (Cal ISI)**

Dear Bob,

The University Committee on Research Policy (UCORP) has met and discussed the academic review of the California NanoSystems Institute (CNSI), one of the four California Institutes for Science and Innovation (Cal ISIs). UCORP provides general comments on the external review in the following sections as well as several comments from a system-wide perspective in the final section of the present letter.

CNSI Review Protocol:

UCORP finds the external review protocol to be comprehensive and complete when evaluating CNSI as an individual research unit. The review protocol clearly outlined that programs must do more than excellent research with efficient management in order to be considered successful in the UC system. The external review protocol notes that successful programs need to develop unique research opportunities, seed institutional innovation, realize efficiencies through shared facilities and information, and to achieve state-wide impact on the economy. These criteria are similar to those used by the UC Portfolio Review Group in its assessment of all centrally funded research programs.

CNSI Review Recommendations:

The external review is supportive of CNSI, noting the numerous dimensions where the program has excelled. The two recommendations for change that are clear in the external review report are that (1) the two CNSI campuses should collaborate more fully, and (2) UCOP should investigate barriers to stronger collaboration between the two campuses and between UC and industry (with respect to IP). UCORP finds the first of these recommendations to be particularly relevant given the funding streams environment and the criteria for collaboration between 3 campuses or 2 campuses and 1 national laboratory in order to meet the definition of a centrally-funded Multicampus Research Unit (MRU) in the UC system. The CNSI external report indicates that the current CNSI leadership has dramatically improved collaboration, and UCORP hopes this positive trajectory will be maintained. UCORP notes that the second of these recommendations reflects a persistent tension between UC and industry and is not a unique issue for CNSI. The external review report did not take advantage of the opportunity to comment on how CNSI might adapt

to the current budget climate around the entire UC system and around centrally-funded research programs in specific. More comment on this issue would have been beneficial for CNSI as it contemplates the next stage of its evolution.

As a final note, UCORP feels that the external review report would have been clearer and more effective if it had been organized into sections including "Findings", "Comments" and "Recommendations".

#### CNSI Review Process:

UCORP notes that the CNSI review process did not follow the standard protocol outlined in the Compendium. The standard protocol states that there should be a unified response to the external report from the Chancellors in coordination with the Institute Directors. UCORP questions why this response is absent in the CNSI review. Furthermore, the external review report itself does not indicate how long or how often the review panel interacted with the CNSI directorate or even how many times the panel met. At the very least, an agenda of the panel meetings would have been useful to evaluate the adequacy of the review process.

#### Other Comments:

UCORP notes that CNSI has benefited greatly from an injection of funds from both UCOP and the two (to different extents) campuses. What is not clear is how much this infusion of funding has done to make CNSI unique. UCORP members wonder if UCLA and UCSB have unique features that make them particularly deserving of central funding, or if similar programs could evolve if supported at other UC campuses when funding becomes available. Nano-based research (nanoscience and nanotechnology) is an intense area of research at all of the UCs and even CSUs in many departments and they would all benefit if such research could be supported more widely.

UCORP strongly supports the principle of a competitive grants process (e.g. MRPI and Lab Fees competitions, etc.) for central UCOP funding rather than non-competed support in which success is based on external reviews with no comparison of alternatives. UCORP does acknowledge that the UCOP funding for CNSI arose under unique and necessary circumstances. Looking to the future, UCORP wonders if a case should be made for a competitive grants program around nano-science activities to stimulate research and industrial collaboration at all ten UC campuses. CNSI does not currently fit the definition of a centrally-funded research entity in the UC system since it involves only 2 campuses

The external review report notes that CNSI has existed as two separate campus entities for most of its life and encourages greater future collaboration. UCORP believes this issue merits amplification. The external review report and the CNSI Director report both highlighted inter-departmental collaboration, but not as much collaboration between campuses. The CNSI Directors' report explicitly points out that completely independent (and redundant) accounting and administration was established at UCLA and UCSB because of "differing campus cultures". This replication of administrative functions is not a best practice in the current era of diminished resources. All of the Cal ISIs are challenged to some degree with establishing efficient collaborations between campuses, and UCORP fully supports increased collaboration between CNSI campuses in the future. CNSI should also consider adding more campuses to its program

The CNSI external review report indicates that the "modest" investments made in CNSI are leveraged by external funds to an extent "never seen before". The return on investment certainly appears large based on the information presented to the external review committee. UCORP feels that it would have been useful for the panel to analyze how much of the reported external funding was actually leveraged by CNSI vs. how much funding would have been secured by the UCLA and UCSB faculty independently of CNSI. UCORP notes that some of the other Cal ISIs included approximate calculations to quantify these metrics, and this is considered a best practice moving forward.

Sincerely,

A handwritten signature in black ink that reads "Mike Kleeman". The signature is fluid and cursive, with a long horizontal stroke at the end.

Mike Kleeman, Chair  
UCORP

cc: UCORP  
Steve Beckwith, Vice President, Office of Research and Graduate Studies  
Martha Winnacker, Executive Director, Systemwide Academic Senate



OFFICE OF THE PROVOST AND EXECUTIVE VICE PRESIDENT –  
ACADEMIC AND HEALTH AFFAIRS

OFFICE OF THE PRESIDENT  
1111 Franklin Street, 12<sup>th</sup> Floor  
Oakland, California 94607-5200

February 13, 2013

ACADEMIC SENATE CHAIR POWELL

Dear Academic Senate Chair Powell:

The California Institute for Science and Innovation CNSI, the California Nanotechnology Institute, has undergone an Academic Review. The Review Panel completed their work in November 2011, and the Chancellors and Divisional Senates of the two participating campuses (Irvine and San Diego) were asked for their comments. We have not received the campus response; however, we are enclosing with this letter the Review Panel Report and asking for your comments.

We would appreciate receiving your feedback by May 13, 2013. The enclosures to this letter are in hard copy, and Steve Beckwith's office will also make the electronic files available to you to facilitate Senate review.

Best regards,

A handwritten signature in black ink that reads "Aimée Dorr".

Aimée Dorr  
Provost and Executive Vice President  
Academic Affairs

A handwritten signature in blue ink that reads "Steven V.W. Beckwith".

Steven V.W. Beckwith  
Vice President  
Research and Graduate Studies

cc: UCORP Chair Kleeman

Enclosures





OFFICE OF THE PROVOST AND EXECUTIVE VICE PRESIDENT –  
ACADEMIC AND HEALTH AFFAIRS

OFFICE OF THE PRESIDENT  
1111 Franklin Street, 12<sup>th</sup> Floor  
Oakland, California 94607-5200

January 5, 2012

CHANCELLOR YANG  
CHANCELLOR BLOCK

Re: Chancellors Review of the 2011 CNSI Academic Review Report

Dear Colleagues:

It was our pleasure to meet with you or your representatives at the commencement of the CNSI, California NanoSystems Institute site visit. The Review Panel has now completed their work, and we attach a copy of their report for your consideration and comment.

We ask that you share your thoughts with each other and, along with Directors Paul Weiss and David Awschalom, prepare a consolidated response to the Calit2 Review Panel Report on behalf of the two campuses. We also ask you to share this report with each campus' Divisional Senate for their review. We would appreciate receiving the joint Chancellors' response, plus the two Divisional senate responses by April 2, 2012.

Best regards,

Handwritten signature of Lawrence H. Pitts in cursive.

Lawrence H. Pitts  
Provost and Executive Vice President  
Academic Affairs

Handwritten signature of Steven V.W. Beckwith in cursive.

Steven V.W. Beckwith  
Vice President  
Research and Graduate Studies

cc: Henning Bohn, Divisional Senate Chair, and Professor of Economics, UCSB  
Andrew Leuchter, Divisional Senate Chair and Professor of Psychiatry and Biobehavioral  
Science, UCLA  
Paul Weiss, Director of the California NanoSystems Institute, UCLA  
David Awschalom, Director of the California NanoSystems Institute, UCSB

Enclosures





**CNSI Review Report  
Nov 6-8 2011**

Our committee has reviewed the California Nanosystems Institute, CNSI, one of four multi-campus research institutes established by the University of California. Nanoscience is one of the most exciting fields of science today; Integrating advances in physics, chemistry and materials science with developments in information science, biology and medicine in ways that are intellectually exciting and that have great potential for impact on the citizens of the State of California. This institute was established as a joint partnership between UCLA and UCSB in order to bring the strengths of these two great institutions to bear on the field of nanoscience. In the few years of its existence, CNSI has established itself as a key element of the intellectual life of both campuses and as an exemplar of how universities can organize themselves to address important multi-disciplinary scientific and technical challenges, including the creation of new models for strong and productive interactions with industry.

The committee was struck by the remarkable degree to which both Institutions have succeeded in leveraging the State investments. The core facilities constructed using the initial investment in infrastructure on both campuses provide state-of-the-art measurement and analytical capabilities that are essential enablers for today's nanoscience. These core facilities are widely used by students and postdocs, as well as many others from across the universities and beyond, and establish a foundation and focal point for the CNSI. UCOP continues to make modest (~ \$5M/yr) annual investments in the CNSI, which are then leveraged to an extraordinary degree that we have never seen before. The CNSI catalyzes cross-disciplinary work on both campuses, providing mechanisms for workshops and actively bringing together faculty to explore new research directions. The Institute also provides key assistance in developing research proposals that have provided some \$900M of new funding to the Universities in the last decade. The educational outreach activities of the Institute are also impressive.

The CNSI has very strong and effective leadership. The recruitment of Paul Weiss to the directorship of the UCLA institute has brought energy, vigor, and insight to the position. At UCLA, a major success of CNSI is the development of strong new cooperative projects between medical researchers and physical scientists from across the university. This new culture of cooperation between biomedical researchers and physical scientists is a strong asset that promises increasing differentiation for CNSI in the years to come. Going forward, Professor Weiss has identified imaging science and the nanoscience-neuroscience interface as areas for further development and CNSI leadership. David Awschalom is extremely effective in his role as UCSB CNSI director, widely respected as a leader on the campus. He has leveraged the strong culture of cooperation among disciplines at UCSB to strengthen CNSI by developing excellent programs in nanoelectronics, quantum computing, and bioengineering. The CNSI has benefited from numerous instances of cooperation between UCLA and UCSB, which are steadily growing in both number and substance. Going forward, UCSB can bring more of its expertise in condensed matter physics, materials science and nanoelectronics to an expanded collaboration with the biomedical research at UCLA. In addition, the nanoelectronics focus area will continue to benefit from close cooperation between the advanced materials and future devices efforts at UCSB and the UCLA expertise in imaging, circuits, and electrical engineering.

A key hope when the California Systemwide Institutes were established was that these new institutes would provide focal points for research at the universities that would have direct impacts on California society. CNSI has approached this challenge imaginatively, creating

some interesting new models for industry-university interactions, attracting significant industry partners, and spinning out many new start-ups. Our committee believes that the CNSI has been extremely successful, leveraging relatively modest investments to achieve substantial successes. Furthermore, we believe that CNSI is positioned for even greater success in the relatively near future as some of the longer-term efforts mature and bear fruit. We hope that the University of California as a whole as well as the individual UCLA and UCSB administrations will continue to support this Institute. To date, UCLA has invested its own precious funds into the CNSI each year, so that the UCLA Institute enjoys almost twice the annual budget compared to UCSB. We encourage UCSB to consider matching the magnitude and long-term commitment of UCLA, as this modest investment will be exceptionally well leveraged.

The CNSI has been very successful in all the dimensions that the State of California and the University of California have hoped for. It has led to major positive cultural transformations on and between the UCLA and UCSB campuses in which barriers between traditional academic disciplines have been overcome, the faculty and students have been enabled to pursue exciting new research directions, industry has benefited from the increased and focused level of activity, and the educational outreach efforts have been both highly effective and nationally recognized.

### **Leadership at CNSI**

Unusual research institutes require exceptional leadership and leadership structures. The review committee was impressed with the leadership we found at all levels of the CNSI. Both Chancellor Block at UCLA and Chancellor Yang at UCSB greeted us and expressed both their strong support for CNSI as well as their appreciation for the quality and cross-disciplinary interaction that CNSI has brought to their respective campuses as well as between their two campuses. The leadership of each university has contributed substantial financial and other important resources to the Institute (although the specifics at the two campuses are different). We found it impressive that the co-Directors of the CNSI each report directly to the Chancellor of their respective campus. This reporting structure and consequent access has undoubtedly enabled the decision-making speed and effectiveness of each of the Directors and their respective parts of CNSI.

The CNSI Directors are visionary and charismatic leaders. Paul Weiss joined UCLA as CNSI Director in August 2009. In just over two years, he has developed an impressive knowledge of the multitude of activities of CNSI-UCLA, as well as a working knowledge of the activities in CNSI-UCSB. The committee was impressed by his understanding of the various activities being carried out at UCLA in the diverse fields of CNSI, ranging from the physical and biological sciences, to engineering, and on to medicine. He clearly grasps the strengths of UCLA and CNSI on which the Institute can build and presented a compelling vision for CNSI's future technical directions in imaging science and the nanoscience-neuroscience interface.

Director David Awschalom at UCSB has been associated with CNSI-UCSB from its inception, becoming the Director in the last few years. His low-key and collaborative style fits very well with the culture at UCSB. Many matters are discussed with an Executive Committee of key faculty prior to decision and implementation. He has a comprehensive knowledge of the scientific work being carried out in CNSI-UCSB, a passion for continuing to grow the interdependence of the UCLA and UCSB Institutes, as well as a worldwide reputation in his own research field.

At both UCLA and UCSB, CNSI has been a nucleating agent for new centers and Institutes, a testimony to the interactive, cross-disciplinary culture that it has fostered on each campus, and to the wealth of talent to be found among the large number of faculty who have associated

themselves with CNSI. Bringing together this impressive constellation of faculty, united by common research interests and enabled by outstanding CNSI facilities and other supporting infrastructure, has resulted in increased innovation, cooperation, and enhanced research output. In addition, CNSI has attracted outstanding people to lead in its educational outreach, which is among the best in the country.

Finally, as might be expected, CNSI has attracted outstanding graduate students and post-doctoral students to both campuses. Their research in several pioneering areas furthers the reputation that CNSI is gaining in the worlds of nanoscience, engineering, and medicine. These students are the future leaders in academia and industry that will help keep California at the forefront of this important area for years to come.

### **Scientific Program of the CNSI**

The CNSI focuses on some of the most interesting and important questions in modern science, many of which lie at the traditional boundaries between fields. The CNSI has demonstrated an ability to bring together outstanding scientists, engineers, and clinicians with complementary skills from very different areas of science, engineering, and medicine, and it has fostered an excellent environment for collaborative research at both UCLA and UCSB.

CNSI plays an essential role in bringing complementary research efforts together by creating an open collaborative environment for research and by providing needed tools and services. This enlightened enables attraction of the best graduate students and postdocs, as well as the best new faculty hires. The impressive CNSI buildings are key elements in this design. They provide attractive space for meetings and collaborative research, in addition to well-maintained shared facilities with capable staff, which train and advise the student investigators. We were also impressed that seasoned CNSI staff members help with the preparation of funding proposals, including editing, graphics, and red-teams, to improve the flow of money into their campuses.

Nanoscience research and nanotechnology development at the CNSI may be categorized into three broad areas: Information Technology, Biomedicine and Diagnostics, and Energy and the Environment. In each of these areas, there is particular emphasis on new materials: synthesis, invention of new methodologies for characterization, and development of innovative applications.

Information Technology. The past fifty years have seen tremendous advances in computing and communication. Over the next decade, silicon technology will approach its limits, and new beyond-CMOS approaches are needed. Likewise, new electro-optic devices will be needed for photonic chips and communication. Electronics and photonics joint research efforts by UCLA and UCSB are particularly strong. To explore new devices, one needs to grow new materials, shape them into a device or circuit, image and test their properties, and understand their behavior. These activities combine materials science, nanofabrication, electron and scanning probe microscopy, electronic and optical probes, and theory. CNSI has done an excellent job integrating research activity in these areas across the two campuses. The CNSI buildings play an essential role, providing advanced facilities cared for by skilled staff, as well as space to carry out collaborative research and educational programs.

UCLA and UCSB have complementary strengths to address current electronics and photonics challenges - we consider these below, going from materials to future devices and systems:

- *Materials and Nanofabrication* - UCSB has a well-recognized materials growth and

nanofabrication program including its Molecular Beam Epitaxy (MBE) Lab and the recently constructed and outfitted Nanofabrication Laboratory. Characterization facilities in the CNSI building include an Atom Probe that generates 3D tomographic images with atomic resolution. The UCLA Institute operates excellent facilities for materials synthesis and device fabrication in the Integrated NanoMaterials Lab and the Integrated Systems Nanofabrication Cleanroom.

- *Imaging - Core Facilities* in the CNSI building at UCLA include the Electron Imaging Center for NanoMachines, which provides advanced electron microscopes that can provide 3D images, and the Nano and Pico Characterization facility for scanning probe microscopy, including a cooled scanning tunneling microscope that can image individual atoms and molecules. At UCSB, electron imaging and characterization tools are available in the Materials Research Laboratory Microscopy and Microanalysis Facility.

- *Near-term Electronics and Opto-Electronics* - A focus of electrical engineering at UCLA is to develop relatively near-term electronic and electro-optic devices, led by Kang Wang who heads the STC-funded Western Institute of Nanoelectronics (WIN) as well as the Center on Functional Engineering and Functional Architectonics (FENA).

- *Future Electronics* - Investigations at UCSB are aimed at future devices based on new materials. An example is the ultrafast transistor created from GaN material grown by the UCSB Nitride Group. To probe possible transformations in computational power, the CNSI at UCSB has created Station Q with substantial funding from Microsoft. Station Q focuses on topological quantum computation; it has top investigators, including Michael Freedman, winner of the Fields Medal in Mathematics.

Biomedicine and Diagnostics. One of the unique features of the CNSI is the strong participation of scientists from the UCLA School of Medicine as well as scientists in the biosciences at both UCLA and UCSB. Particularly striking is the success of the CNSI in inspiring and facilitating research collaborations between clinicians, biomedical researchers, basic biological and physical scientists, and engineers. Such efforts are expected to produce new applications for use in personalized medicine, for example, in biomedical imaging, targeted nanodelivery of pharmaceuticals, new high-throughput diagnostic methodologies, and new "theranostic" (therapy + diagnostic) approaches.

This emphasis on translational biomedical research should be enhanced in the future by the participation of the CNSI in the UCLA Clinical and Translational Sciences Institute (CTSI), recently funded by a five-year Clinical and Translational Science Award (CTSA) of \$81.3 million from the NIH, formed through a partnership between Cedars-Sinai Medical Center, Charles Drew University of Medicine and Science, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, and UCLA, and. Although current CNSI activity in translational biomedicine is found primarily at UCLA, active efforts to recruit UCSB CNSI scientists to these collaborations, where it is expected that they will play an important role, are bearing fruit.

*Nanotoxicology.* The CNSI is a global leader in nanoenvironmental health and safety, under the direction of Professor André Nel, developing new strategies to screen nanomaterials and establish guidelines for their safe use. This effort relies heavily on the research infrastructure, core facilities, and industrial relationships of the CNSI.

Energy and the Environment. The CNSI also has an active and highly collaborative program in alternative and bio-energy, which has brought together many top chemists, biochemists, bioengineers, and microbiologists to work on new materials to improve energy efficiency,

production, and storage, biofuel development, CO2 sequestration, and organic photovoltaic solar cells. The close connections of the CNSI with the alternative energy industry are expected to facilitate the development of applications of the new technologies that are being developed in these areas.

### **Impacts of CNSI on UCLA and UCSB**

The CNSI is having significant impact on the research and research environment at both the UCLA and UCSB campuses. The magnitude of impact is particularly impressive in view of the extremely modest funding provided by UCOP and the universities; it speaks to the catalytic effect of these investments. Four CNSI contributions are particularly noteworthy: (1) Opening lines of communication and collaboration among research communities that historically have had weak or nonexistent interactions; (2) The salutary effects of the core CNSI facility on each campus, enabling each to serve as a center for interdisciplinary interactions/ collaborations and providing tools for nanoscale research and education; (3) Significant contributions to the ability of the universities to attract and retain top talent in CNSI focus areas; (4) The provision of infrastructure that provides broad support to a wide swath of the university research community.

Opening lines of communication and collaboration: The facilitation of collaborations between the UCLA medical school and the science and engineering community at both universities is a groundbreaking accomplishment of which the CNSI should be proud. While both universities have long fostered a strong collaborative culture in the sciences and engineering, the UCLA medical school has historically not interacted significantly with these communities. The geography of the UCLA campus, with the medical school adjacent to the engineering and science campus, presents tremendous opportunities that most universities cannot duplicate. From its inception, the CNSI leadership has worked tirelessly to build bridges, with Leonard Rome (previous Acting Director of the UCLA CNSI) as a particularly noteworthy champion. The results have been dramatic. One, but by no means the only, manifestation of the growing medical school-CNSI interdependence is the Center for Environmental Implications of Nanotechnology, which has attracted significant funding from the National Science Foundation and the Environmental Protection Agency, becoming the single largest generator of research funds at UCLA in 2009. The CNSI vision of "owning" the nano-neuroscience interface is audacious but strikes the review panel as being decidedly within the realm of possibility.

Likewise, the Institute for Collaborative Biotechnologies (ICB) headed by CNSI at UCSB has resulted in \$75 million in funding from the Army Research Office (ARO) over the last eight years that we understand has been leveraged by another \$45 million from other government agencies. This grant, housed at UCSB, has participation from Caltech and MIT, as well, and has resulted in significant interaction with industry, including the development for commercialization of several products (discussed in more detail below).

CNSI facilities: The CNSI facilities serve critical and previously underserved functions on both the UCLA and UCSB campuses. Both buildings have been designed to foster collaboration, with highly attractive space devoted to venues for interaction, collaborative laboratories, and scientific tools available to the broad scientific community. The laboratory space has served multiple purposes, including serving as a key component for both campuses in efforts to attract and retain critical faculty. The laboratory space, which is used only for collaborative endeavors, has enabled experimentation with new types of university-industry interaction, including the Abraxis laboratory at UCLA and the Microsoft-funded Station Q at UCSB. Because laboratory occupancy is highly fluid, with collaboration a key prerequisite for attaining (and retaining) it, the laboratories serve a very different purpose from those found in other university buildings.

Seminars and lectures in CNSI space attract attendance from across the campus.

A particularly critical component of the CNSI facilities at both campuses is the state-of-the-art shared user facilities available to CNSI member researchers, other university researchers, industry, and the broader scientific community. Rather than contenting itself with only procuring and operating "off the shelf" equipment, CNSI is investing in developing new tools that will be required as the field of nanotechnology continues to progress. There are several examples of a strong collaboration between instrument manufacturers and scientific staff at the CNSI that have led to advances in instrumentation, advantageous financial terms for CNSI acquisition of instruments, and the ability of CNSI laboratories to remain leading edge. The CNSI core laboratories at both universities provide access, expertise, and training on these tools and methods to diverse users, from students and postdocs to industrial scientists. The CNSI facilities have been intentional in leveraging existing campus capabilities where possible and in providing high value tools that were not previously available on campus. This investment strategy has resulted in, for example, a particularly impressive array of transmission electron microscopy capabilities in the UCLA facility, and siting of many of the UCSB Materials Research Laboratory's high-demand instrumentation in the UCSB facility to facilitate access by the broader scientific community. The value of these facilities to the research community is demonstrated by the fact that the Core Laboratories collectively have trained over 2000 users from academia and industry since opening to the public in 2008.

Attraction and retention of key faculty: The presence of the CNSI at both campuses has significantly increased the ability of both universities to attract and retain faculty in CNSI focus areas. This is particularly apparent at UCLA, which committed at the inception of the Institute to support 15 start-up packages jointly with CNSI. This number has since risen to 21, with the recent addition of 5 FTEs by the medical school (plus the start-up package for Director Weiss). In addition, CNSI resources contributed to the retention of some key faculty members who were being recruited by other institutions. The contribution of the CNSI to attraction and retention at UCSB is less apparent because of the much lower level of monetary support provided to the Institute by the university. Nevertheless, gifts and grants to the UCSB CNSI have enabled the Institute to contribute significantly to the start-up packages for several new faculty, in the form of graduate student support, support for required computational capabilities, etc. The existence of CNSI-centered efforts such as Station Q has also been critical in the recent recruitment of key faculty members. The CNSI at UCSB has established a number of postdoctoral fellowships that have been useful tools for attracting highly accomplished young researchers in key CNSI focus areas.

Infrastructure support: The CNSI has provided significant benefit to researchers broadly across the campuses of both UCLA and UCSB. These include training and networking opportunities for the entire postdoctoral population of the university. The Institute at UCLA provides administrative assistance to faculty members and core lab technical directors in both pre- and post-award management. An administrative team in CNSI helps faculty seek additional external funding. Among other support, CNSI has hired a scientific writer to assist with improving success rates on grant and other funding. Similarly, the Institute at UCSB provides a full range of support of research contracts and grants from inception to completion, including budgetary management, financial reporting, purchasing, employment and visa processing, payroll administration, event coordination, information technology support, etc.

### **Intercampus Interactions of CNSI**

The establishment and nurturing of vibrant cross-campus interactions/collaborations is one

of the main objectives of the California Nanosystems Institute (CNSI), with a primary goal of combining the world-class, well-recognized strengths of the two universities. The review committee agrees that developing cross-campus efforts is important to the future success of CNSI. The relatively recent identification of significant cross-campus thrusts by CNSI that closely couple UCLA's strength in medicine with UCSB's strength in engineering is a major step forward.

In the early years of CNSI, the two campuses were rather independent. The current CNSI leadership has dramatically improved collaboration during its rather brief tenure, so that future prospects for growing the number and strength inter-campus efforts are strong.

There are a number of current innovative and potentially very successful cross-campus collaborations that could be strengthened such as: (1) nanoscience for efficient energy conversion and the environment; (2) the plan to link efforts across campuses in translational medicine by bringing UCSB into CTSI through CNSI; (3) growing and strengthening the focus area of imaging science; and (4) nanoelectronics and spintronics.

CNSI has been very interactive and creative in fostering collaborations within each of its two campuses, but efforts to encourage strong inter-campus entanglement have begun in earnest only rather recently. We believe that CNSI should continue its current efforts develop and implement new ways to further improve communications and collaborations, including providing incentives to promote better cross-campus collaborations. Possibilities include:

- using video technology links for joint seminars and for regular communication between directors, professors, post docs, students, etc.;
- initiating a new funding mechanism for inter-campus research projects;
- sharing best practices in educational outreach between UCLA and UCSB;
- documenting progress on increasing interactions/collaborations through development and monitoring of appropriate metrics;
- encouraging students and post docs to engage in inter-campus research by assisting in temporary housing and other logistical needs;
- establishing additional joint awards emphasizing inter-campus activities for graduate students or post docs such as an extra \$500-1000 incentive;
- establishing offices for the directors at both campuses;
- developing and communicating a strong commitment for inter-campus efforts by the CNSI Directors and university Chancellors;
- increasing the use of joint appointments between campuses such as that of Tom Soh between UCSB and the UCLA medical school.

### **Industry Engagement**

CNSI has been very effective in developing and/or enabling strong industry engagements. An impressive number of startups (> 35) have come out of work associated with CNSI, and major corporate partners have sponsored (and renewed) research programs due to the capabilities of CNSI and the quality of the results delivered. CNSI has been creative in its methods of engagement, including successful use of traditional methods such as licensing, use of core facilities, incubation, and consortia models. But, in addition, the review panel was particularly impressed by innovative collaboration models like that developed with Abraxis Biosciences, in which non-traditional connections grow between faculty and resident partner scientists in a problem-solving environment. In comparing results amongst centers, it is important to keep in mind that many CNSI research areas in physical nanosciences have longer timelines from discovery to commercialization than, for instance, the areas of information technology

or communications. While some of the fields that could benefit from nanoscience advances naturally lead to opportunities for large-scale manufacturing, fully achieving these outcomes require additional investments or incentives from government which do not appear to be considered in California. It is instructive to consider the case of upstate New York, which has developed a comprehensive R&D and manufacturing support program for nanoelectronics, leading to several multi-billion dollar industry investments along with the associated upstream and downstream jobs. It is reasonable to assume that many of these companies would prefer to locate in California, where there is a high density of world-renowned research universities and a highly educated workforce, if the economic considerations were appropriately favorable.

The startups created by CNSI members cross all of the Institute's main disciplines. They include one significant IPO (Gevo for biofuels) and several companies with first tier venture capital (VC) firm backing (e.g., NanoH2O from Khosla Ventures or Transphorm backed by Kleiner Perkins et. al.). The CNSI role in these startups includes more than their incubation within CNSI-facilities (which UCLA has been able to do while UCSB has been inhibited by space-use restrictions) – more fundamental has been the key role played by CNSI and its facilities in the development of the concept. And in many cases, CNSI core facilities continue to support the startups on a pay-for-service basis after they spin out. CNSI has also provided learning experiences for entrepreneurs through VC seminars and interactions with the UCLA Law and Business Schools. Perhaps even more could be done in this regard at both campuses, for instance, more formal and regular engagement with a set of "preferred" VCs. It appears that a number of the non-VC backed startups emerging from CNSI have a very long path to market and look more like vehicles to continue research in a different IP environment. This may not be an ideal outcome, but, rather, a consequence of complex UC policies. Attesting to the increased interaction between the campuses, there is notably at least one startup (Cynvenio Biosystems) that has co-founders from each campus – UCLA (Medical School) and UCSB (Mech. Eng. and Materials Science), demonstrating the unique combinations of institutions and disciplines that CNSI can leverage.

CNSI has played a key role in enabling numerous strong corporate engagements. These include some very forward looking programs with significant financial backing, for instance the Station-Q quantum computing activity supported by Microsoft or the "beyond CMOS" FENA and WIN consortia supported by a number of leading semiconductor companies. FENA and WIN are excellent examples of collaborations across the two campuses, which again leverage complementary strengths within the same field. The core facilities groups within CNSI have implemented valuable "beta site" type arrangements with leading analytical instrument companies where the companies gain an early test bed, feedback on instrumentation just before commercial introduction, and a loyal future customer base of students and post docs who use the equipment, while the universities gain early access to new tools and upgrades under extremely favorable terms. The panel believes there are more opportunities to engage leading biotech corporations, either through a consortium-type model or using the collaboration structure developed with Abraxis. The successes CNSI-affiliates have had with corporations has occurred with only minimal core operational support from the state and with arguably frustrating IP restrictions within the UC system – which has led to some less than desired outcomes such as separate buildings (Microsoft, Solid State Lighting), the aforementioned potentially premature spinoffs, and opportunity costs for much more significant industry investment noted elsewhere in this report. We strongly recommend that UCOP engage leading California-based companies to investigate barriers like these to stronger collaborations across the UC system, as there is evidence the current environment is leading to a migration of investment out of state, despite arguably better institutional capabilities like at CNSI within the state of California.



## **Education/Workforce Development**

CNSI has made significant contributions to community outreach and workforce development at both UCSB and UCLA campuses. Efforts at both campuses seem to have evolved separately, and in some cases target different audiences, as appropriate to their local communities. However, both groups are poised to share best practices within CNSI and also disseminate their materials and best practices to other schools in the UC system and beyond.

Both campuses have high-quality programs that reach diverse audiences, and both have had significant impacts on the individual campuses and local communities. The programs successfully target diverse populations, especially at the K-12 and undergraduate levels – however, this is less evident at the graduate and postdoctoral levels. CNSI highly leverages the seed contributions from the UC system and the individual campuses by providing excellent support and infrastructure for faculty to meet broader impacts criteria for NSF grant proposals.

In terms of collaborative efforts between the campuses, the Institute would benefit from regular meetings between the education leadership of the two campuses so that there is more of a CNSI-wide identity attached to the various efforts. Going forward, it would be valuable for both institutions to articulate and execute a plan for sharing and collaboration. Staff, faculty, students and fellows involved in education and outreach efforts could benefit from regular symposia to share instructional modules, evaluation strategies, and program infrastructure. The methods and infrastructure developed by the Center for Science and Engineering Partnerships (CSEP) could be very useful in program evaluation and participant tracking for UCLA-based efforts. Concomitantly, the teacher kits developed at UCLA could be modified for use in many UCSB outreach activities. Another natural area of collaboration would be sharing of postdoctoral fellow and graduate student professional development activities. This type of exchange has begun on an individual level - of note is the consultation of the UCLA-based Center for the Environmental Impacts of Nanotechnology (CEIN) with the UCSB-based CSEP to develop new educational programs for CEIN. As UCLA works to institutionalize efforts developed through NSF funding such as the Integrated Education and Research Training programs (IGERTs), it would be useful to look at the CSEP model for how that has been accomplished at UCSB.

With its long-term funding, CNSI has a unique opportunity to assess and track long-term impacts that CNSI-led interventions have on career decisions of program participants, from K-12 to graduate/postdoctoral. CSEP has already begun a formalized effort in this challenging area, and we encourage both Institute partners to build on this expertise. In particular, education/outreach groups could ask some very interesting questions that could be informative throughout the UC system – for example, does a summer research experience have a positive impact on community college student transitions to 4-year colleges and on retention in science/engineering? Does the close collaboration with industry help graduate students and postdoctoral fellows make more diverse career choices that contribute to the California economy? Is there an impact that these industrial collaborations have at the undergraduate level?

Overall, the education and outreach programs of the Institute are very strong. Further enhancement of inter-campus sharing and external dissemination of strategies, activities, infrastructure, as well as assessment tools to measure the long-term impacts of the programs, could be very useful to the UC system.

## **Conclusions**

Since its founding about a decade ago, the California Nanosystems Institute, CNSI, has emerged as a world leader in important areas of nanoscience and nanotechnology. The Institute has established itself as a key element of the intellectual life of the UCLA and UCSB campuses and as an exemplar of how universities can organize themselves to address important multi-disciplinary scientific and technical challenges. Recently, CNSI has begun to take advantage of the synergies that can be realized by fully developing and exploiting a partnership in nanoscience between UCLA and UCSB; progress in this area promises to continue and accelerate.

Both institutions have succeeded in leveraging to a phenomenal degree the generous initial and modest ongoing State investments, augmented in important ways by university support. The core facilities provide Institute identity and house critical capabilities for the CNSI. In one way or another, the CNSI has supported the acquisition of an additional \$900M of new funding to the two universities in the last decade.

The CNSI has outstanding leadership, whose effectiveness is enhanced by a direct reporting relationship to the Chancellor at each university. The Institute has achieved world-class standing in numerous areas of nanoscience, for example nanotoxicology and quantum computing. The CNSI Directors communicate a compelling vision for continued development of the Institute's scientific leadership and preeminence in the decade to come.

CNSI has approached the challenge of impacting California society imaginatively. Several interesting new models for industry-university interactions have emerged. The committee expects the economic benefits of CNSI discoveries to become even more apparent in the coming decade, as some of the early start-up companies grow and as more slowly maturing technologies bear fruit. Another significant societal benefit of the CNSI has been the educational outreach programs. These nationally recognized efforts have reached tens of thousands of California students and hundreds of teachers over the past decade and could potentially be replicated at other California universities for even greater impact.

Over the coming decade, the review committee expects that the numerous current instances of cooperation between UCLA and UCSB will grow steadily in both number and substance. The committee looks forward to seeing even higher levels of inter-institution research collaboration, greater numbers of joint appointments, ubiquitous personnel exchanges and virtual connectivity, and sharing of best practices in educational outreach and industry interactions.

The CNSI has been extremely successful with regard to all of the expectations set when it was founded, and it has a bright future indeed. The Institute deserves continued and even increased support from both UCOP and the universities themselves.

December 4, 2013

William Jacob  
Chair UC Academic Council

RE: Review of the California NanoSystems Institute (CNSI)

Dear Bill,

The UCLA Academic Senate's Executive Board appreciates the opportunity to opine on the University Committee on Research Policy (UCORP) review of the MRU review of the California NanoSystems Institute which included UCLA as one of the participating campuses. Although the external review of CNSI was supportive of this collaborative effort and provides directions for future development, concerns remain about the overall MRU evaluation process. As affirmed in the discussions at the Academic Council this past spring, there must be fundamental changes to the MRU review process if it is to be a valid evaluation mechanism. From a divisional Senate perspective, we would like to use this opportunity to make recommendations regarding the review process for MRUs.

1. We note that [The Compendium](#) does not specifically outline a means for divisional Senate input into the review process of MRUs, leaving it by default to the discretion of either the Chair of the Academic Council or the Vice Chancellor for Research to solicit such input late in the process. This is a serious lacuna in the process and does not mirror the process of establishing an MRU, in which the divisional Senate is consulted. As a result, Immediate Past Chair Sarna was concerned about the Academic Council's support for the report from UCORP without any discussion by the Divisional Senate.
2. The Compendium is also silent as to what should be included in an MRU review. By what metrics—academic, research portfolio, fiscal health, etc.—is the MRU being evaluated? Absent some form of standardized metrics, we worry the MRU reviews in general will vary in content and form so much as to make meaningful review of them impossible. We hope that the Academic Council can suggest changes in the review process so that the review criteria area will evaluate the academic aspects of the MRU more clearly.
3. In its current form, the review of the CNSI has no description of its own review process or metrics for success. Such information would have been crucial in interpreting the recommendations. The Executive Board also noted the long lag time from the completion of the review and the evaluation by UCORP.
4. We appreciate that each MRU has its own unique history which should be provided as part of the review materials. For example, if the State Legislature earmarked funding for an MRU, this should be made explicit in the report as this would be important information from the Councils on Planning and Budget, for example.
5. Finally, a number of UCORPs concerns included in review of the CNSI reflected dissatisfaction with the MRU process, in general, rather than the CNSI review. These are important issues but don't appear to be central to evaluation of this collaboration between UCLA and Santa Barbara.

Sincerely,

A handwritten signature in black ink that reads "Jan Reiff". The signature is written in a cursive, flowing style.

Jan Reiff  
Chair, UCLA Academic Senate

CC: Martha Kendall Winnacker, Executive Director, Academic Senate  
Linda Mohr, Interim CAO, UCLA Academic Senate



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Kum-Kum Bhavnani, Chair  
Deborah Karoff, Executive Director

January 13, 2014

RE: Review of UC Committee on Research Policy (UCORP) May 16, 2013 letter regarding the "Academic Review of the California NanoSystems Institute (CNSI), a California Institute for Science and Innovation (Cal ISI)"

Dear Bill,

As you know, UCORP wrote a memo last May in response to the Academic Review of the California NanoSystems Initiative (CNSI) and UCLA and UCSB were provided an opportunity to comment on the UCORP letter. At UCSB the Council on Research and Instructional Resources and the Council on Planning and Budget commented on the UCORP memo. I apologize for the delay in our Divisional response.

*Council on Research and Instructional Resources*

The Council on Research and Instructional Resources (CRIR) has followed the CNSI review process over the last several years, and CRIR also reviewed the Academic Review Report. CRIR met with the current director of the UCSB CNSI, Professor Craig Hawker, and discussed the Academic Review Report, the May 16, 2013 UCORP letter regarding the Academic Review, the CNSI response to the report and the June 3, 2013 letter from the UCLA and UCSB Chancellors regarding the report. CRIR also spoke with Director Craig Hawker regarding the current status of CNSI and its collaborations. Having the benefit of this background, CRIR is concerned that UCORP, in their May 16 2013 letter, seems to underplay many of the significantly positive aspects of the CNSI as identified both by the Academic Review Report and through internal reviews.

CRIR writes that:

"CNSI is an extraordinary resource to both UCSB and the UC system at large. It has further enabled the interdisciplinary collaboration for which our campus is well known, provides access to a broad spectrum of capabilities in support of many different UC campuses, and enables the pursuit of the external funding opportunities of a scale normally outside our ability to address. As an investment, CNSI has paid significant dividends with the Institute for Collaborative Biotechnologies, perhaps one of the most broadly visible and noteworthy of those funding opportunities. CNSI has an extraordinary record of leveraging funds and building collaborations within the UC and with industry partners, with an impact far beyond the UCSB Campus. For example, one of the largest users of the CNSI facilities are the faculty of UC Merced.

We appreciate the independent concerns raised by UCORP but our hope, as a Council, is that the independent Academic Review is given its due weight and that any policy changes being

considered will take into consideration the fact that CNSI at UCSB has been incredibly successful in enabling transformative and collaborative research of significance to both the UC System and the world.”

Council on Planning and Budget

The Council on Planning and Budget (CPB) write that we “recognize the many outstanding achievements of CNSI. However, as noted by the letter of Robert Power (May 16, 2013) a number of administrative features of the UCSB and UCLA collaboration could be strengthened. We endorse the reviewers’ call for a more integrated, cooperative relationship between the two campuses. CNSI is not a traditional MRU, but given its unique initial funding and relatively modest continued state investment, we do not see that opening up competition for research funds in the area of nanotechnology in the UC system would create greater benefits. CPB suggests that CNSI reach out to researchers within the UC System in collaborative efforts consistent with central UCOP funding.”

Thank you for the opportunity to comment.

Sincerely,



Kum-Kum Bhavnani, Chair  
Santa Barbara Division