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*Chair of the Assembly of the Academic Senate
Faculty Representative to the Regents
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1111 Franklin Street, 12th Floor
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July 1, 2020

**THERESA MALDONADO, VICE PRESIDENT
RESEARCH AND INNOVATION**

Re: Five-Year Review of the Bioengineering Institute of California (BIC)

Dear Theresa,

At its June 24, 2020 meeting, the Academic Council approved the attached Five-Year Review of the Bioengineering Institute of California (BIC) Multicampus Research Unit (MRU). Following procedures outlined in the Compendium, the review was performed by a Joint Senate Review Committee, led by the University Committee on Research Policy (UCORP) with input from the University Committee on Planning and Budget (UCPB) and the Coordinating Committee on Graduate Affairs (CCGA).

The Review Committee recommends renewing the BIC as an MRU unit for five years, and also makes recommendations for strengthening the BIC, expanding the breadth of its activities, and attracting sustainable funding. We request that that you forward the report to the BIC director.

The Academic Council appreciates the significant time and effort the Review Committee spent in preparing and writing this report. In particular, I want to recognize the substantial contributions and outstanding leadership of UCORP Chair Andrew Baird.

Please do not hesitate to contact me if you have additional questions.

Sincerely,

A handwritten signature in cursive script that reads "Kum-Kum Bhavnani".

Kum-Kum Bhavnani, Chair
Academic Council

cc: Academic Council
UCORP
Senate Directors

Review of Bioengineering Institute of California (BIC)

University Committee on Research Policy (UCORP)
(Lead Committee)
University Committee on Planning and Budget (UCPB)
Coordinating Committee on Graduate Affairs (CCGA)

May 13, 2020

I. EXECUTIVE SUMMARY

The Bioengineering Institute of California (BIC) is a Multi-campus Research Unit (MRU) involving all ten campuses. It has organized an annual systemwide Bioengineering Symposium (BES) that rotates among the ten UC campuses and involves active participation from students and faculty from all campuses since 2003.

BIC does not receive any systemwide funding for regular MRU operating costs. The operating activities of BIC are funded primarily through inter-campus funding as well as industry support. With the appointment of a new director during the review period, the host campus moved from UC San Diego (UCSD) to UC Davis (UCD). As host campus, UCSD provided in-kind resources to support the director and some staff to coordinate BIC activities. The new director of BIC who was recently appointed for three years has secured a similar level of in-kind resources from UCD. The director-elect is located at UC Los Angeles (UCLA) and has plans to secure a similar level of in-kind resources.

As an MRU, BIC has been successful in terms of fostering intercampus collaborations among faculty and students and exploiting synergies among the unique strengths and profile of each campuses' bioengineering departments. Such synergies have the potential to impact recruitment of faculty and students at UC. Notably, the MRU's activities have exposed participating students to education and training as well as other gainful activities including mentoring through co-advising and industry networking that exceed what is possible at some single campuses. For example, the annual systemwide BES where students and faculty present talks and posters, contributes to interactions among UC bioengineers, beyond other meetings and workshops organized by individual campuses, QB3, Structural Biology, etc. BIC has also been successful in promoting active industry participation including securing modest financial support from industry for the annual systemwide BES. Of note, however, industry involvement in bioengineering is equally or even more active at individual campuses. The MRU shows the potential to expand industry involvement and funding in a more systematic manner. There is also some evidence of intercampus collaboration on research through joint grants although these are more difficult to attribute directly to the MRU. However, the intercampus interactions

during the annual systemwide BES that is the key BIC activity, certainly plays a positive role in fostering collaborative research and joint grants.

This document presents the findings and recommendations resulting from the five-year review of BIC performed on behalf of the Academic Senate by the University Committee on Research Policy (UCORP), the Committee on Planning and Budget (UCPB), and the Coordinating Committee on Graduate Affairs (CCGA), with UCORP acting as the lead committee. Below, we refer to UCORP, together with participating members from UCPB and CCGA, as the Review Committee.

The main questions to be addressed by the review are specified in *The Compendium: Universitywide Review Processes for Academic Programs, Academic Units, and Research Units*¹, which describes establishment and disestablishment procedures, best practices, reporting requirements, and review procedures for MRUs and other University of California research units. According to the Compendium, the report should “provide an objective and balanced critical evaluation of the MRU to be reviewed” and answer two key questions:

1. Does the unit provide a unique service to UC in research, support of graduate education, and public service that would otherwise not be provided in its absence?
2. Should the MRU be continued for another five years?

The outline of this document largely follows the format for five-year MRU reviews specified in the Compendium. The information is presented as follows: Introduction, Evidence of Accomplishment, Budget, Administration and Governance, Advisory Committees, and Conclusions and Recommendations.

II. INTRODUCTION

a) History

The Bioengineering Institute of California (BIC) was established in 2003. Since its establishment (as well as several years prior), the main activity of BIC has been to organize an annual systemwide Bioengineering Symposium (BES) that rotates among the ten UC campuses. The BES costs about \$85,000 per year and has been run with virtually no UCOP funding throughout its history.

b) Mission and scope

The mission of BIC is:

¹ https://www.ucop.edu/institutional-research-academic-planning/_files/compendium_sept2014.pdf

1. To hold annual systemwide Bioengineering Symposium (BES) to bring together students and faculty from all ten campuses to exchange information and foster interactions and collaborations in bioengineering and related fields.
2. To cultivate the next-generation scientists/engineers in fields related to bioengineering by interdisciplinary and inter-campus training and mentoring.
3. To generate extramural funding by preparing outstanding intercampus proposals that synergize the complementary strengths in bioengineering on the UC campuses.
4. To represent the systemwide bioengineering community at national and international bioengineering meetings.

c) Service to university and state

The University of California (UC) provides a service to the State of California in the field of biomedical engineering in two main ways: (1) UC faculty produce world class research, as well as numerous patentable inventions; (2) UC faculty educate and train the next generation of biomedical engineers, who will work for the state's world-renown engineering and high-tech companies, academic institutions and medical centers, thereby enhancing the economic opportunities and quality of life of California citizens. BIC has somewhat contributed to these missions by organizing an annual systemwide BES; but it is not clear that this activity alone significantly enhanced either research collaborations or the training and academic experience of undergraduate, masters and PhD students. BIC clearly has the potential to do more.

d) Regional, national and international visibility

The key activity of BIC is organizing the annual systemwide BES, which has been successful for several years (since 2003) in bringing together faculty and students from different UC campuses, promoting collaborations that might lead to joined grant proposals and expand teaching and research capabilities for graduate students and postdoctoral researchers. There are approximately 100-150 participants at such conferences with an estimated 60 postdocs. This participation should be expanded to account for more than ~20% of UC bioengineering community.

e) Internal interactions between units

In contrast to the organizing of the regular annual systemwide BES, all other documentation of research aspects of BIC are lacking: the mentioned ten campus participation is limited to the annual conference, and while there are multi-campus bioengineering collaborations, joint grants and programs (including the UC Berkeley/UC San Francisco joint graduate group, which was organized and is run without significant BIC involvement), BIC's direct role in these initiatives lacks visibility. In some cases, the list of cross-campus PIs in the self-report were

incomplete and not up to date. The impression is that the grass-roots bioengineering programs and collaborations among UC campuses and PIs originate and proceed without BIC involvement, yet some of these might be listed in the 5-year report.

Diversity, equity and inclusion are not clearly reflected in BIC operations and structure; campus leadership is de-facto the Chairs of bioengineering departments, participation of women and minorities in BIC organization and activities including the Annual conference, does not seem to be carefully considered.

f) External interactions

BIC is not necessarily well known by the broader bioengineering related industry but has had some notable success in engaging with industry. BIC has in the past secured industry involvement in its annual systemwide BES with over 100 industry participants participating in such events since its inception. Ten industry partners participated in the last BES.

The MRU has plans on how to expand the industry liaison components during the annual systemwide BES, including possibilities for enhancing opportunities for internships for students.

III. EVIDENCE FOR ACCOMPLISHMENT

a) Research

The annual systemwide BES which includes all campuses, faculty, and students is attributed with having generated joint-grants amounting to approximately \$10M in 2018; this is reported as an average per year in the self-report. These joint grants do not appear on the BIC budget and it is not clear to what extent faculty would attribute these to BIC or their own initiative in engaging in collaborative science and grant applications (as typical in the bioengineering field), but the current director is confident that many would acknowledge BIC as having played a role in fostering the development of such joint grants. Separately, about \$55,000 per year on average is reported as external support from prestigious foundations and agencies. In comparison, this is an order of magnitude less than industry and philanthropy support of some UC bioengineering departments.

a) Undergraduate education

The MRU's activities have exposed students to education and training as well as other gainful activities including mentoring through co-advising and industry networking, and this adds to what is possible on a single campus. For example, the annual systemwide BES successfully promotes active student engagement with

most presentations and posters being from students and this is an additional avenue to other meetings and workshops on individual campuses. An example of a joint (online) course is mentioned in the self-report and attributed to the MRU.

b) Graduate education

Both undergraduate and graduate students attend the annual systemwide BES. A small number of examples are provided of co-advisorships that involve faculty from more than one campus and these are attributed to the annual systemwide BES. The last BES featured several innovative activities that focus on fostering networking, advising, innovation and entrepreneurship. As an example, one activity involves a 'shark tank' in which ideas are pitched. Other activities included industry networking and 'research speed dating' to introduce students to faculty from other campuses and promote co-advising and mentorship as well as possibly joint projects. These are clearly excellent ideas that should be expanded and, ideally, be in place more frequently than once a year.

c) Recognitions of excellence

While not attributable to BIC, UC engineering is nationally and internationally recognized as leading engineering and bioengineering programs. In addition, the faculty who participate in BIC, as well as those who do not, are very well funded with some very large grants (some are up to \$28M).

d) Public service and outreach

The website is out of date. The new director has moved the website to UCD and there are plans to improve it. There are also plans to establish subcommittees to enhance awareness of BIC through development of a social media platform, a newsletter, and not least industry involvement.

IV. BUDGET

The analysis of the BIC budget focused on whether its expenses are directed toward the MRU's goals of hosting an annual systemwide BES, training students, and fostering intercampus extramural funding, and whether its central, local, external, and projected support are sufficient to meet these goals.

a) Materials provided

The main source of budgetary information is provided by Appendix 1 of the self-report, which consists of four separate sections: a summary of the funds and expenditures, expenditures by campus, expenditures by fund type, and expenditure by MRU sub-grant and contract.

b) Profile of expenses

In its summary of the budget and in the Appendix budget tables, BIC reported two major expenses. First was the annual BES (\$85K in 2018) that cycles among all ten campuses and was supported by contributions from each campus as well as industry donations; the 2019 UC Merced BES received \$2000 in support from UCOP. Second was the fractional salary of several support staff, borne by UC San Diego (UCSD) where BIC has been housed prior to the transition to UCD; these staff have included 15% of an Administrative Assistant, 10% of an Administrative Specialist, and 10% of a Management Services Officer. According to the budget tables, BIC's expenses were quite modest averaging less than \$175,000 from 2014-2018, ranging from a low of \$153,379 (2018) to a high of \$205,388 (2017). The large cost in 2017 was apparently due to higher costs for the annual meeting that year.

c) Central support

BIC does not generally receive central support from UCOP, except for specific research project grant support through competitive mechanisms (e.g. CAL-BRAID, UC Center for Accelerated Innovation (CAI), and UC Discovery). The sole exception was a one-time UCOP conference support for the 2019 BES at UC Merced (\$2000).

d) Local campus support

BIC's host campus was UCSD prior to the appointment of the current director. UCSD provided in-kind space and funding for faculty and staff support including 0.35 FTE administrative support staff. In-kind contributions have averaged about \$43,000 value annually from 2014-2018 (about \$46,000 in 2018). In addition, UCSD has provided about \$18,000 in annual cash support from 2014 to 2018 (only \$14,000 in 2017). With the appointment of a new director, the host campus is now UCD where a similar level of support has been secured.

The other 9 campuses have provided in-kind faculty and staff support valued at about \$19,000 annually (2014-2018) (\$21,000 in 2018). The other campuses provide \$2000 per campus (\$18,000 total) annually for student conference attendance. Campuses contribute an additional average of about \$23,000 total cash annually (about \$15,000 in 2018).

e) External support

BIC has leveraged resources to receive nearly \$275,000 from 2014-2018 (about \$55,000 per year) from prestigious foundations and agencies including the Keck Foundation, National Institutes of Health, National Science Foundation, and Packard Foundation, as well as from industry (located in California).

f) Projected support

BIC has recently relocated its headquarters office from UCSD to UCD. UCD's support remains similar to UCSD. With this support, and if the other 9 campuses also continue to support BIC for student conference participation, BIC is likely to be able to continue its successful annual systemwide symposium.

There are several new activities that are planned, for example, early career lectureships, intercampus electronic and personal networks for graduate and undergraduate education, surveys and inventories, enhanced cross-campus mentoring, but few details were provided in terms of how these will be funded. The director and director-elect discussed with the Review Committee their idea to enhance industry engagement as a potential source of additional funding, for example, by charging membership fees.

V. ADMINISTRATIVE GOVERNANCE

a) Overview/Bylaws

BIC has an executive director, as well as a steering/executive committee and an advisory committee (as detailed below in Section VI). Both provide advice to the executive director. Bylaws have been in place since 2014. Governance is based on the collective decision making between the steering committee and the executive director.

b) Director

During the most recent annual systemwide symposium, a new executive director, Scott Simon of UCD, was chosen by the steering committee. This is a three-year appointment. Song Li of UCLA was chosen by the Steering Committee as director elect. Succession planning and continuity thus appears to be well developed.

c) Personnel

Prior to the transition to UCD, the former director, Shu Chien of UCSD, had support staff for BIC located at UCSD consisting of a part-time MSO (10%), part-time financial analyst (10%), and part-time administrative assistant (15%). UCSD provided the funds for these positions. Now, director Scott Simon has secured a similar level of support and funding that is provided by UCD, and support staff are now located at UCD.

d) Space and resources

Director and support staff were provided space and in-kind resources at UCSD, but this had now transitioned to UCD as mentioned.

e) Contract and grant support

The interactions and collaborations among the bioengineering departments/programs (most without BIC involvement and some seemingly fostered by the BIC annual systemwide BES) have resulted in the successful application of extramural funding. Individual campuses instead of BIC perform grant accounting for the vast majority of these grants with no overhead or budgetary implications for BIC.

VI. ADVISORY COMMITTEE(S)

a) Internal

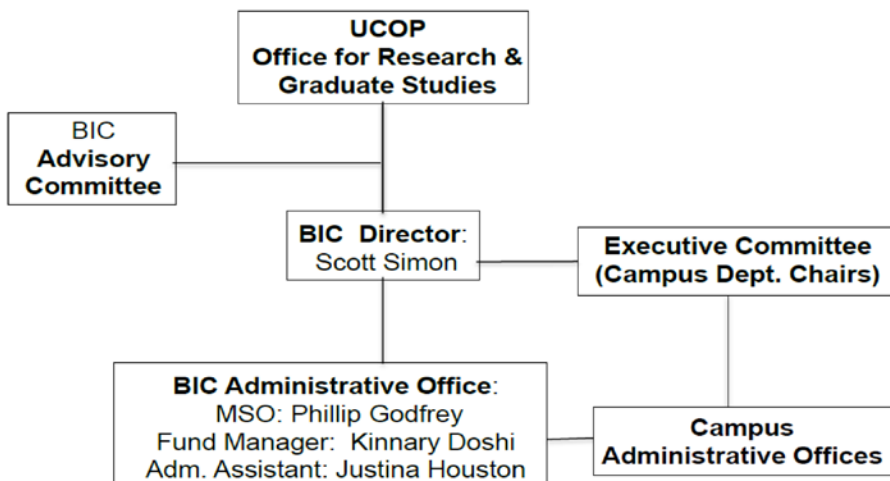
BIC has a steering committee composed of the Chairs of the bioengineering departments/programs of the ten UC campuses, with a second faculty member as an alternate. The Steering Committee elects the BIC director and makes collective decisions on the directions and priorities of BIC, provides support, guidance and oversight of progress, and ensures the delivery and achievement of the goals. The steering committee meets face-to-face at least once a year at the annual systemwide symposium as well as at national bioengineering meetings and periodically by teleconferencing.

b) External

BIC's advisory board is composed of the vice chancellors of research or similar of each of the ten campuses: Paul Alivisatos (UCB), Prasant Mohapatra (UCD), Pramod Khargonekar (UCI), Gene D. Block (UCLA), Samuel Traina (UCM) Michael Pazzani (UCR), Joe Incandella (UCSB), Scott A. Brandt (UCSC), Sandra Brown (UCSD, Chair), and Lindsey Criswell (UCSF) – who was not listed in the report, with Miroslav Krstic (AVC, UCSD) as Executive Secretary.

The advisory board provides strategic advice and knowledgeable counsel, offers valuable advice and perspectives (especially in relation to university administration), and assesses program effectiveness. However, the number of times the board meets per year has not been stipulated.

An organizational chart of BIC is provided below.



VII. CONCLUSIONS AND RECOMMENDATIONS

The Review Committee concludes that BIC has been successful in organizing the annual conference and that it has a great potential to expand its functions as an MRU that could effectively lead the development of a research agenda in the field of bioengineering. This would require among other aspects, more active, open, diverse and equitable organizational structure and expansion of key functions.

To date, the MRU has had success in fostering intercampus collaborations among both faculty and students, but primarily only once per year at a systemwide symposium. In particular, there is evidence of active student engagement at the annual systemwide symposium with most presentations/posters being from students. Moreover, there are several innovative activities at the symposium that seek to foster opportunities for enhanced cross-campus mentorship, industry networking and the development of joint-research projects. Notably, the MRU has had success in engaging industry members at the annual symposium and this is projected to grow, as bioengineering is a naturally attractive field of science for the industry.

The Review Committee believes that there is additional untapped potential associated with BIC. There appears to be considerable opportunity to ramp up industry support including for graduate training and opportunities in terms of internships. Right now, these are not appreciably better than the activities of many individual campuses. There also appears to be much scope for enhancing the dialogue, inclusion and engagement among departments; this is much needed in general and specifically, for accomplishing the self-identified BIC objective: “To

represent the systemwide bioengineering community at national and international bioengineering meetings.”

The Review Committee concludes that there is a need for the MRU to develop a research agenda that is more systematic and visible. *However, with almost no UCOP funding, we recognize that the ability to expand beyond the annual systemwide symposium may be limited.*

The Review Committee recommends that BIC be renewed as an MRU unit for five years. To ensure BIC attains success, we recommend that BIC:

1. Develop a mechanism beyond the annual systemwide symposium to identify strategic priorities for research and education in bioengineering and make annual progress reports on these activities to UCOP. The Review Committee believes this could provide the necessary catalyst for further progress on curricular development, research programs and awards, and expansion of industry engagement and support beyond those available at individual campuses.
2. Enhance interactions with UC bioengineering departments to clarify how BIC is an improvement over their individual Curriculum and Research Programs and whether BIC represents them nationally and/or internationally.
3. Improve industry engagement and support including funding support by developing, for example, membership fees to participate in the peer process; by providing input and feedback surrounding activities related to identifying priorities; by identifying industry needs related to fundamental research and skills and competencies needed (curricular development); as well as reviewing and disseminating research outputs.
4. Improve inclusion, equity, and diversity in participation of faculty and students in BIC leadership, activities and strategic planning. Have student representatives on the steering committee.
5. Going forward, BIC leadership needs to seriously consider whether biomedical engineering at UC is solely confined to bioengineering departments, or whether it is a discipline that transcends departmental structures. The current organization, leadership and vision of BIC seems narrowly confined to bioengineering departments only.

Expanding the activities of BIC as recommended would strengthen the MRU further and in the opinion of the Review Committee would help attract sustainable funding for that greater mission.