TO: The Executive Committee and Academic Senate
FROM: The Committee on Research
SUBJECT: 18-19 CR 8: Proposal for the creation of The Green Biome Institute (GBI)

PURPOSE: For approval by the Academic Senate

ACTION REQUESTED: That the Academic Senate approve the proposal for the creation of The Green Biome Institute (GBI) and refer the proposal to the Provost and Vice President of Academic Affairs, effective upon signature of the President

BACKGROUND INFORMATION:
At its meeting on March 28, 2019, in accordance with the Centers and Institutes policy, CR reviewed and voted unanimously to refer The Green Biome Institute (GBI) proposal for review and approval by the Academic Senate. The GBI charter and supporting documentation is attached.
Proposal for Creation of
The Green Biome Institute
Dedicated to Endangered Plant Conservation and Genomic Research at CSUEB

This proposal is to consider the approval of a new Cal State East Bay institute: The Green Biome Institute (GBI). This would be an institute associated with and housed within the College of Science. The Association of American Colleges and Universities and other higher education researchers have identified student research and creative activities as key high impact practices that increase student engagement and success in college. In addition, CSUEB has identified Conservation and Sustainability as important parts of the educational experience. The GBI will provide an environment and the biological materials for leading edge research in the plant sciences, and provide a basis for meaningful projects in the departments of Biological Sciences, and potentially within the departments of Chemistry and Biochemistry, Earth and Environmental Sciences, Statistics and Biostatistics, and Computer Science. In the future, other departments within the College of Science and other Colleges across the University might also develop projects associated with the GBI. The central mission of the GBI will be to facilitate student participation in faculty mentored conservation research involving first-of-its-kind genomic profiling of rare and endangered plants from California and eventually across the globe.

The world is experiencing the loss of a variety of species, including plants, at an alarming rate. Global warming, fires and increasing human development are the most prominent factors behind this shift. The California Floristic Province contains over 6,500 native plants with more than 25% being endemic, or restricted to the region. Many of these plants are endangered and/or threatened with extinction. These plants are typically not economically important and are in danger of going extinct with no understanding of their biology, ecological interactions and potential human benefits. The combination of faculty expertise, location, resources, and a campus commitment to sustainability, place CSUEB in a unique position to lead a novel, multi-faceted approach to understanding and conserving these organisms.

At the same time, CSUEB students will benefit from unique research opportunities in the sciences to engage and challenge them to make a difference in the world. The creation of the GBI will provide our students with experience and research opportunities in plant science not currently available at other CSU or UC campuses. The GBI will allow them to conduct outstanding research, publish findings in leading journals, and grow their confidence and technical experience as they enter the workforce or pursue higher degrees. Student projects will also contribute to the preservation of threatened California plants and expand our understanding of their potential benefits for drought tolerance, medicinal value and other potential uses.

There are currently no conservation and genomic profiling centers in the California State University or University of California system. As such, CSUEB is uniquely positioned to create a much-needed institute and become a leader in the field of modern plant conservation genetics. As an institute, the GBI will be better positioned to collaborate and build relationships with state and federal government agencies, non-profit organizations and other entities that share an interest in the institute’s mission. On a global scale it is estimated that 1 in 5 plant species are at
risk of extinction, leaving open the possibility of the GBI continually expanding its scope on both a national and international scale.

1. Documentation showing clear support for the academic units involved.
   Appendix A contains letters of support from faculty.

2. Letter of endorsement from the appropriate official.
   Appendix B contains a letter of support from Dean Jason Singley.

3. Statement of Purpose
   The purpose of the Green Biome Institute is to:
   - Contribute to preserving the genetic diversity of plants in California, and potentially the United States and the world.
   - Provide a secure environment for the long-term storage and maintenance of endangered plants and, for the first time, conduct and make available to the public complete molecular profiles of these plants.
   - Provide unique opportunities for student research and learning in the areas of environmental science, computer science, molecular biology, chemistry and biochemistry, biostatistics and statistics, and plant horticulture.
   - Discover new, useful, biological processes and substances that can improve agriculture and human lives.
   - Distribute all knowledge freely to improve agricultural outcomes and human health.
   - Contribute to the advancement of CSUEB as a leading academic institution with the establishment of a world-class plant conservation and genomics research institute.

4. Description of how the center supports the mission of CSUEB.
   The activities of the GBI will directly support the mission of CSUEB. The GBI will serve as an excellent example of the leading-edge conservation and genomics science being conducted at the University and the outstanding educational opportunities that these projects open to the diverse student body at CSUEB. The scholarly projects they work on as students may have a direct impact on our local, state, national, or global environment and communities. And the hands-on skills and knowledge that students develop while working on these projects will enable them to have a positive impact on society at an early stage in their college careers.

   The work of the GBI will also be aligned to help students meet all of the University’s institutional learning outcomes. In particular, participation in the Center’s activities will encourage and enable students to:
   - Think critically and creatively and apply analytical and quantitative reasoning to address complex challenges;
   - Communicate ideas, perspectives, and values clearly and persuasively while listening to others;
   - Work collaboratively and respectfully as members and leaders of diverse teams.

5. Include identification of similar centers in the region, and how the proposed center differs.
   There are currently no plant conservation and genomic research centers among the 578 existing
centers in the CSU system. CSUEB will be the first genomic research institute dedicated to the preservation and understanding of threatened and/or endangered plants. Like the Center for Sports and Social Justice at CSUEB, the GBI will be affiliated with a particular college and have an external profile. Within the CSU system, another center/institute that might be considered as having similar characteristics with a focus on conservation, and externally facing, is the Estuary and Ocean Science Center at San Francisco State University’s Romberg Tiburon Campus.

6. Description of planned activities.

The primary mission of the GBI is to facilitate student participation in faculty mentored research projects appropriate to the student’s discipline. The GBI will initially be housed in the Molecular Research Lab (MRL) within the College of Science. Student projects will take place in the MRL, faculty research labs and classrooms of the College of Science. Existing space and equipment will be allocated for eight operating sections within the GBI; seed banking, cloning and propagation, molecular analysis, computational analysis, endophyte isolation and living library maintenance, data bank, small greenhouse, and administration.

Five highly threatened plants have been identified as the project’s first priority. The threatened plant samples have been secured and analysis has begun as of January 2019. An initial donation has been pledged to the College of Science to begin the conservation and molecular profiling activities of all five plants and to make public all available data by the end of 2019. The directors of the Center will support this work with the following activities:

- Recruit students to participate in funded research projects on selected endangered plant species. As of this writing, five students are already involved and one received a grant from the California Native Plant Society for his work on one of the plants.

- Secure equipment and resources to perform leading edge research.

- Develop sources of funding for the Institute and student projects. This will include working with the College of Science’s Director of Development to solicit funds from private donors, foundations and corporations. In addition, Grant submissions will be made to support multiple facets of the research and student projects.

- Enter collaborations to preserve samples and share genomic information with UC Botanical Gardens, UC Davis Clonal Germplasm Center, USDA Ft. Collins Seed Bank, US Forest Service Genome Center-Placerville, building on initial meetings that have already taken place. In addition, we plan to meet with Santa Barbara Botanical Garden, San Diego Zoo, other California State University and University of California schools, and other California and International institutions.

- Selection of plant type and species to be conserved and profiled. Candidate plants for profiling will be selected based on their status as rare and endangered as defined by the botanical community. Many of these plants can be found in the California Native Plant Society Inventory of Rare and Endangered Plants and the State of California Department of Fish and Wildlife Natural Diversity Database (CNDDB); State and Federally listed Endangered, Threatened, and Rare Plants of California. Initially candidate plants must show as both critically endangered and be shown to have no known seed bank. These plants typically have no known economic value and so are in the greatest danger of disappearing from the earth with no scientific biological record.
Define and continually update molecular testing plans to best preserve and communicate the biological processes present in each plant. Testing and profiling of the candidate plants will initially include:

1. **DNA Sequence Analysis**: Sequence data will be collected and assembly and annotation will be performed. Epigenetic data will be collected and annotated.
2. **RNA Sequence Analysis**: mRNA transcriptome data collection and transcribed gene analysis will be performed. Complete RNA profiling including small RNAs and non-coding RNA testing will also be performed and the data annotated. Initially a single tissue, most probably leaf, will be analyzed and at a later date additional tissues including flowers, roots and stems may be profiled.
3. **Microbiome Analysis**: Microbiome analysis will be conducted on root, stem, and leaf tissues. At a later date soil and rhizosphere microbiome analysis will also be conducted.
4. **Molecular Marker Analysis**: Profile known molecular markers for drought tolerance and potentially medically relevant substances. Once a draft copy of the genome of each plant is created bioinformatics tools will used to find homologs of genes affecting drought resistance and expressing potential medically relevant substances based on established pathways in model organisms. Molecular evolution studies of these gene families will be carried out in order to predict their function. Further experimental studies on gene function and chemical activity will be carried out in subsequent years. All projects and studies will be spearheaded by students under the guidance of University professors.
5. **Propagation and Storage Studies**: Plant propagation and storage condition studies will be conducted. Cell and tissue culture methods as well as seed storage and regeneration will be explored.
6. **Comprehensive Phenotypic, life cycle, and Environmental Data**: Suitable field sites will be identified and initial observations will be collected. Program data will be collected over a number of years.
7. **Future testing of Plant Chemical Signatures and Proteome Profiles** will be addressed and included in analysis as the Institute expands.

All plant information and genomic profile data will be stored in independent computers, off-line from CSUEB, ensuring the GBI’s complete data integrity. This off-line data will be accessible to the public. Backup copies of all data will not be accessible to the public and will be maintained on CSUEB networked machines.

7. **Identification of advisory board members**.
The Advisory Board will be composed of the 3 Executive Team members from CSUEB, additional internal members composed of CSUEB faculty and administrative staff, and outside members, including alumni, who bring plant access, scientific, business, communications, outreach, or fund-raising expertise and connections to the GBI. The Advisory Board will be an invested and dynamic body. An initial priority of the GBI will be identifying potential members. A listing of potential universities, institutes, botanical gardens, zoos, government research stations, commercial seed companies, and plant societies that may serve as sources for enthusiastic Advisory Board Members outside CSUEB may be found in Appendix C.

The proposed Executive Team of the Green Biome Institute is:

- Chris Baysdorfer, Director
- Ana Almeida, Associate Director
- Brian Perry, Associate Director
8. Organizational structure of the center.
The Directors of the Green Biome Institute will report to the Dean of the College of Science. Input on strategic planning, technical protocols, partnerships, and funding opportunities will be solicited from the Advisory Board members.

The Directors will be responsible for setting the GBI agenda and priorities, program implementation, managing the budget and overseeing any staff that may be hired in the future. All decisions beyond the scope of those listed above will require approval of the Dean of the College of Science. The Directors will solicit input on strategic planning, technical protocols, partnerships, and funding opportunities from the Advisory Board.

10. Name of the starting director.
The starting director will be Chris Baysdorfer, Faculty member, Department of Biological Sciences, CSUEB.

11. Description of faculty and student involvement.
Participation in the GBI will be open to science faculty members that would like to contribute to GBI’s success and who’s proposed research is in keeping with the institute’s mission. The primary way in which faculty will participate in the GBI will be through mentoring students in a scholarly project.

Student participation in the GBI will consist of both mentored research projects and training opportunities. Research projects will be designed in consultation with a faculty mentor, and will relate to the student’s research and training interests, as well as the student’s level of experience and expertise. For certain technical projects, such as DNA or RNA sequencing, or computer analysis, pre-requisite courses and skills beyond those provided by the faculty mentor may be required to safely and successfully complete the proposed work. The Director will work with the Executive Team to set pre-requisites and guidelines for student participation in advanced laboratory projects. Workshops and other training opportunities offered by the GBI will be open to all students, and any guidelines and/or pre-requisites required to participate in both research projects and workshops will be published in advance. All students will be allowed to apply for research and workshop opportunities related to the GBI. Students involved with research projects will be encouraged to present their findings at the Annual Research Symposium hosted by the Dept. of Biological Sciences, the annual University Research Symposium, and at professional meetings and other off-campus conferences where appropriate.
12. **Procedure for how new faculty will be selected to participate.**
New faculty participants will be selected based upon expertise, needs of the GBI and alignment of proposed research with broader goals of the institute. Faculty participation in the GBI will primarily be through the mentoring student research projects.

13. **Procedure for how faculty will be removed.**
Faculty involvement with the GBI will primarily be through the mentorship of student researchers working on specific, approved projects. At the completion of each such project the faculty member will be required to propose an additional research projects or extension of the existing project in order to remain an active member of the GBI.

14. **Description of the method for selection and evaluation of the director.**
The Dean of the College of Science will appoint the Director and Associate Directors. Selection criteria will include past work with students in disciplinary research, a track record of external funding, and appropriate management and program coordination experience. The Advisory Board will evaluate the Director annually during the spring academic term.

15. **Description of the center’s commitment to diversity in its activities and appointments.**
In all of its programming and activities, as well as in the appointment of Executive Team and Advisory Board, the GBI will be committed to supporting the intellectual and professional growth of the diverse student and faculty body of CSUEB.

16. **Business plan that specifies the targeted audience, the marketing strategy, resources required, and how resources are used.**

**Student Focused Business Plan:**
The GBI’s targeted audience is all CSUEB science majors (both graduate and undergraduate) that wish to be part of a meaningful effort to save endangered plant species. Students will learn of the opportunities offered by the GBI through a variety of sources. These include an institute webpage, and websites and social media platforms of College of Science, Department of Biological Sciences and other involved departments, the Center for Student Research, and personal faculty outreach. It is hoped that the GBI will become a high-profile institution that attracts students from a variety of backgrounds to study at CSUEB.

**Marketing Plan to Secure Plant Material and Funding:**
1) Plant Material - The Director, Executive Team, and the Advisory Board will reach out to a wide variety of universities, institutes, botanical gardens, zoos, government research stations, commercial seed companies, and plant societies to secure their support and access to endangered plants. Already, Dr. Baysdorfer and Dr. Almeida have secured plant donations.

2) Funding - The GBI will operate from donations and grants focused on conservation and preservation of our natural resources and support for student education and research. Potential individual donors, foundations and corporations have been identified. This spring alumnus Randy Davis and the Director of Development for the College of Science will begin visiting such prospects.

One of the director’s responsibilities will be to work with the Advisory Board to write government grants for the environmental and educational focus of the GBI and raise awareness of the GBI among alumni and the commercial and philanthropic communities.
The table below shows the GBI’s initial forecasted income and expenditures.

17. Projected budget showing where funds will be raised and how they will be used.
The budget on the following page reflects money that would be raised for the GBI. The level of activity the GBI can sustain will be dictated by the level of external support. Fortunately, an alumni supporter has come forward to support the 2019 budget with a $130,000 donation. We aim to increase the number of supporters in order to gradually expand the budget. Gift funds will be administered by the CSUEB Educational Foundation. In the future, any grant funds awarded will be administered by the CSUEB Foundation through the Office of Research and Sponsored Programs.

<table>
<thead>
<tr>
<th>Institute Operating Income</th>
<th>2019</th>
<th>2020</th>
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<tbody>
<tr>
<td>Opening Balance</td>
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<td>$4500</td>
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<tr>
<td>Individual Donations</td>
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<td>$130,000</td>
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<tr>
<td>Grants</td>
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<td>$25,000</td>
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<tr>
<td><strong>Total Income</strong></td>
<td><strong>$130,000</strong></td>
<td><strong>$159,500</strong></td>
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<table>
<thead>
<tr>
<th>Center Expenses (5-6 plants per year)</th>
<th>2019</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td>Reagents/Consumables</td>
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<td>$95,000</td>
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<tr>
<td>Lab Equipment</td>
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<td>Computers</td>
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<tr>
<td>Software licenses</td>
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<td>$10,000</td>
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<td>Gift fees (5%)</td>
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<tr>
<td><strong>Total Expenses</strong></td>
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<td><strong>$152,750</strong></td>
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<tr>
<td>Closing Balance</td>
<td><strong>$4,500</strong></td>
<td><strong>$6,750</strong></td>
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</table>

18. Explanation of how space will be allocated and where the center will be located.
Space for laboratory work will be provided for in the molecular research lab in the South Science building. It is estimated that the first 3 years of operation and 15-17 plant species can be analyzed in these facilities. It is hoped that a significant amount of fundraising for the new Applied Sciences Building will be secured on behalf of the GBI and that space appropriate for GBI’s work will become available upon the completion of the building in 2021/2022.
Appendix A

1. Letter of support from Dr. Joshua D. Kerr, Chair of the Department of Statistics and Biostatistics

2. Letter of support from Dr. Michael Massey, Chair of the Department of Earth and Environmental Science

3. Letter of support from Dr. Ann McPartland, Chair of the Department of Chemistry and Biochemistry
March 6, 2019

TO:   Proposed Executive Team, Green Biome Institute  
      Dr. Chris Baysdorfer, Director (proposed)  
      Dr. Ana Almeida, Associate Director (proposed)  
      Dr. Brian Perry, Associate Director (proposed)  

To the Proposed Executive Team of the Green Biome Institute:

I write to you today in strong support of the proposed Green Biome Institute. I was informed that the mission of the institute will be to facilitate faculty-mentored student research on the genetics, ecology and conservation of rare and endangered plants in California and eventually the rest of North America and perhaps even internationally. Furthermore, the plan will be using both cutting-edge sequencing technologies and more traditional methods to create a multi-faceted approach to understanding the biology of these plants.

It is my understanding that this venture will create very large amounts of genetic/bioinformatics data that will require statistical analysis. To this end, our Department would be very interested in helping in this capacity.

The Department of Statistics and Biostatistics enthusiastically supports the proposed Green Biome Institute. If you have any questions, please do not hesitate to contact me at (510)885-3626 or via e-mail at joshua.kerr@csueastbay.edu.

Sincerely,

Joshua D. Kerr
Dr. Joshua D. Kerr  
Associate Professor and Department Chair  
Department of Statistics & Biostatistics
February 20, 2019

TO: Proposed Executive Team, Green Biome Institute
   Dr. Chris Baysdorfer, Director (proposed)
   Dr. Ana Almeida, Associate Director (proposed)
   Dr. Brian Perry, Associate Director (proposed)

To the Proposed Executive Team of the Green Biome Institute:

I write to you today in support of the proposed Green Biome Institute. In my understanding, the mission of the Institute will be to facilitate faculty student research on the biology and conservation of rare and endangered plants in California and elsewhere. Faculty and students of the Department of Earth and Environmental Sciences will likely be happy to collaborate and participate in Institute-related activities and research.

In particular, our Department would be interested in studies related to soil, biogeochemical cycling, nutrients, and the interactions between biotic and abiotic factors in the ecology of various species under study.

The Department of Earth and Environmental Sciences enthusiastically supports the proposed Green Biome Institute. If you have any questions, please do not hesitate to contact me at (510)885-3439 or via e-mail at mike.massey@csueastbay.edu.

Regards,

Mike Massey
Associate Professor and Department Chair
Department of Earth and Environmental Sciences
February 25, 2019

To the Proposed Executive Team of the Green Biome Institute:

I am writing in enthusiastic support for the proposed Green Biome Institute. The Department of Chemistry and Biochemistry is interested in collaborating on a number of projects outlined, including an analysis of secondary plant products and the proteomics work. We are pleased that the Institute is student focused and look forward to productive collaborations between the two Departments.

Ann McPartland
Department Chair
Department of Chemistry and Biochemistry
Appendix B

1. Letter of support from Dr. Jason Singley, Dean of the College of Science
Date: March 11, 2019
To: Committee on Research
From: Jason Singley, Dean, College of Science
Subject: Green Biome Institute

I am writing to enthusiastically express my support for the proposed Green Biome Institute (GBI) in the College of Science. The mission of the GBI will be to conduct genomic profiling of rare and endangered plant species from California in order to preserve critical biological information before these plants go extinct. Furthermore, the GBI will have a strong focus on mentoring both undergraduate and graduate students through hand-on research experiences.

The Department of Biological Sciences has several faculty with research interests closely aligned with the proposed work. Faculty in the Department of Chemistry and Biochemistry, Earth and Environmental Sciences and the Department of Statistics and Biostatistics are also working in related fields and are likely to participate. As the Institute develops and expands the scope of its work, I expect that faculty from departments such as Computer Science and others may also contribute to the Institute.

The field of molecular biology has undergone a radical transformation in that past couple decades due to the development of new tools that allow for the efficient reading and now manipulation of a species genome. Already, these advances have lead to breakthroughs in agriculture and medicine and now have a large role in the Bay Area, national, and global economy. In the College of Science we have invested in this field with tenure-track hires, equipment purchases, and the recent remodeling of 3,000 sqft of lab space devoted to molecular research. We are well positioned to leverage these investments to conduct genetic research on California’s endangered plants and to expand the number and depth of research experiences available to Cal State East Bay students.

In addition to the strong connection to existing molecular research and the college’s long tradition of providing faculty-mentored research experiences to our students, the work of the GBI connects to the college’s mission to support sustainability at the regional, national, and global levels. Faculty in the college are working on projects such as monitoring the absorption of greenhouse gases by tidal marshes, creating sustainable concrete, and developing new solar-cell materials. By uncovering and understanding the genetic diversity of California’s native plants, the GBI will help support efforts to conserve our native habitats and promote sustainable land use in our state.
Appendix C

A listing of businesses, institutions and organizations that may serve as sources for enthusiastic Advisory Board Members may be found below.

1) Businesses (including some that employ alumni)
   • Corteva Agriscience (DowDuPont) (US)
   • Syngenta (China)
   • Limagrain (France)
   • Bayer Crop-Science (Germany)
   • KWS (Germany)
   • Sakata Seed (Japan)
   • Rijk Zwann (The Netherlands)
   • Takii Seed (Japan)
   • Barenbrug (The Netherlands)
   • Cargill (US)

2) Environmental Groups
   • World Wide Fund for Nature
   • Sierra Club
   • The Nature Conservatory
   • The Arbor Foundation
   • Environmental Defense Fund
   • Conservation International
   • Friends of the Earth

3) Stone Fruit Support Groups
   • California Fresh Fruit Association
   • Western Growers Association

4) Botanical Gardens and other Plant Organizations
   • UC Berkeley
   • Tilden
   • Santa Barbara
   • San Francisco
   • Rancho Santa Ana
   • Kew Foundation of America
   • California Native Plant Society
   • San Diego Zoo

5) Universities
   • UC Davis Clonal Germplasm Center
   • Other CSU and UC science departments