C-DEBI Strategic Implementation Plan 2015-2020

The overall mission of C-DEBI is to explore life beneath the seafloor and make transformative discoveries that advance science, benefit society, and inspire people of all ages and origins. Our plan to achieve this mission is described in this document across the following components of the Center:

I. Research
II. Education
III. Data Management and Knowledge Transfer
IV. External Partnerships
V. Diversity
VI. Management

I. RESEARCH

Overall Research Goal. Our primary research goal is to enable, produce, and communicate transformative, synergistic research through an inclusive and collaborative culture that crosses disciplinary and institutional boundaries and is embedded throughout the Center’s activities.

Detailed Description
In Phase 1, C-DEBI focused primarily on the exploration and discovery of subseafloor ecosystems, with most studies concentrated at four major sites: Juan de Fuca Ridge flank, South Pacific Gyre, North Pond, and the Dorado Outcrop. In Phase 2 (2015-2020), C-DEBI is developing an integrated understanding of microbial subseafloor life covering and connecting the molecular, cellular, and ecosystem scales. Maintaining highly multidisciplinary and interdisciplinary approaches, C-DEBI is emphasizing microbial ecology while ensuring that essential context is provided through studies and advances in geochemistry, hydrology, oceanography, and related disciplines. The three overarching research themes are (1) fluxes, connectivity, and energy; (2) activities, communities, and ecosystems; and (3) metabolism, survival, and adaptation. C-DEBI research projects target two distinct subseafloor biosphere environments—the igneous ocean crust and overlying sediments—that have historically been studied independently; field investigations of these environments are complemented by coordinated laboratory studies and modeling. C-DEBI is led by five Co-PIs and five senior scientists from eight U.S. universities and research labs, but seeks to build and leverage scientific, educational, and technological partnerships with numerous other U.S. and international institutions (educational, research, outreach, engineering, not-for-profit). In addition, C-DEBI seeks to develop a diverse community of multidisciplinary collaborators, to identify promising topics, and to develop new projects that will help to advance the Center's objectives.

Optimal Research Outcomes
1. Transfers of fluid, heat, solutes, carbon, and microbes are quantified within and between subseafloor biomes, and between the subseafloor and the overlying ocean; the nature of energy sources available to microbes in these ecosystems is determined; and the next generation of coupled fluid-energy-biochemical-microbial models is developed.
2. The composition of subseafloor microbial communities and the functional potential of these communities are illuminated, based on the diversity of metabolic activities and interactions with the physicochemical aspects of the system.
3. A ‘portfolio’ of selected model subseafloor organisms is established, and their physiological and genetic traits are characterized; in addition, these microorganisms are used to investigate energy and carbon use for growth and maintenance under kinetically limiting conditions and to determine rates of metabolism under specific conditions.
4. Field investigations at the four ‘major sites’ identified in C-DEBI Phase 1 are largely completed (i.e. at Juan de Fuca, South Pacific Gyre, North Pond, and Dorado Outcrop with the latter two potentially
Environmental data and samples from these sites are compiled and analyzed along with laboratory experiments and modeling to address questions across the three Phase 2 research themes.

5. The new C-DEBI senior scientists are integrated in all aspects of the Center, and cross-disciplinary and cross-institutional research training is thriving through our grants programs, thereby expanding the community of deep biosphere researchers, technologists, and educators.

**Targets and Actions**

1. Transfers of fluid, heat, solutes, carbon, and microbes are quantified within and between subseafloor biomes, and between the subseafloor and the overlying ocean; the nature of energy sources available to microbes in these ecosystems is determined; and the next generation of coupled fluid-energy-biochemical-microbial models is developed.
   a. Quantify transfers of fluid, heat, solutes, carbon, and microbes within and between subseafloor biomes, and between the subseafloor and the overlying ocean
      i. Continue time-series observations and sampling at selected sites and analyze data and samples from earlier studies to resolve the extent of natural variability (within and between biomes), determine environmental controls on crustal microbial community composition, and assess how this variability impacts flows and connections
      ii. Develop studies, including some at new field sites, as needed to test and extend understanding of coupled fluid-rock-geochemical-microbial systems.
   b. Determine the nature of energy sources available to microbes in subseafloor ecosystems
      i. Map the distributions of electron acceptors and electron donors regionally and globally as a function of depth at a range of spatial scales.
      ii. Quantify metabolic reaction energetics as well as fluxes of electron acceptors and donors by combining internally consistent thermodynamic data, available kinetic parameters, and reactive transport modeling
   c. Develop the next generation of coupled fluid-energy-biochemical-microbial models
      i. Combine existing physical and thermal models with rate constants for primary reactions and transport (advection and diffusion) that involve solutes in basement fluids; then attempt to couple these with microbial processes to increase the model complexity
      ii. Test, calibrate, and apply coupled geochemical-microbiological models to a variety of seafloor and subseafloor environments
   d. Publish 25 (in aggregate) papers in this research theme
   e. Publish 5 (in aggregate) method/instrument papers demonstrating new techniques and tools developed and/or applied in this research theme

2. The composition of subseafloor microbial communities and the functional potential of these communities are illuminated, based on the diversity of metabolic activities and interactions with the physicochemical aspects of the system.
   a. Determine community composition, functional potential, and patterns of natural selection in subseafloor ecosystems
      i. Quantify the number, diversity, and relative abundances of microbes at multiple taxonomic levels—from domain to “species-level” operational taxonomic units (OTUs), ecotypes, and oligotypes
      ii. Determine the functional potential embodied in these communities
      iii. Integrate data on community composition and microbial activities to identify how sources of energy and microbial interactions drive natural selection in subseafloor ecosystems
   b. Determine metabolic activity of subseafloor microbial communities
      i. Document actual rates of *in situ* activities using gene expression in sediment and rock samples
ii. Identify potential activities in laboratory experiments using subseafloor samples incubated with isotope-labeled substrates

iii. Closely examine microbe-mineral interactions in conjunction with activity measurements in *in situ* incubations and laboratory microcosms

c. Advance understanding of subseafloor microbe-virus interactions
   i. Integrate correlation network techniques using subseafloor archaeal, bacterial, microeukaryote, and viral diversity datasets combined with microbial activity measurements
   ii. Incorporate the isotopic and diversity datasets collected as part of 2.a. and 2.b. to develop a food web model in combination with statistical diversity-based networks

d. Publish 25 (in aggregate) papers in this research theme

e. Publish 5 (in aggregate) method/instrument papers demonstrating new techniques and tools developed and/or applied in this research theme

3. A ‘portfolio’ of selected model subseafloor organisms is established, and their physiological and genetic traits are characterized; in addition, these microorganisms are used to investigate energy and carbon use for growth and maintenance under kinetically limiting conditions and to determine rates of metabolism under specific conditions.

a. Isolate and characterize novel bacteria and archaea from diverse subseafloor habitats
   i. Enrich subseafloor bacteria and archaea from sediment, crustal fluids, and rock samples, using, among others, plugged flow, chemostat, and hanging sponge reactors
   ii. Fully characterize novel organisms, including their genomes
   iii. Interrogate their abundance and activity in the original sample to help infer their ecological roles

b. Examine fundamental physiology of subseafloor microbes under conditions of low growth rates and low energy flux
   i. Use long-term chemostat-like culturing systems to study the coupling of catabolism and growth in the *Chloroflexi*
   ii. Use down-flow hanging sponge bioreactors to explore the molecular and physiological underpinnings of the hypothesis that archaea may be low-energy specialists and well adapted to the energetic extremes that define many subseafloor environments

c. Perform adaptive evolution and long-term survival experiments with subseafloor microbes to characterize molecular genetic signatures associated with particular phenotypes
   i. Use subseafloor isolates to determine the genotypic, phenotypic, and biochemical and physiological bases for metabolic traits
   ii. Develop genetic markers for model organisms to be used in competition experiments

d. Publish 25 (in aggregate) papers in this research theme

e. Publish 5 (in aggregate) method/instrument papers demonstrating new techniques and tools developed and/or applied in this research theme

4. Field investigations at the four ‘major sites’ identified in C-DEBI Phase 1 are largely completed (i.e. at Juan de Fuca, South Pacific Gyre, North Pond, and Dorado Outcrop with the latter two potentially continuing beyond C-DEBI Phase 2). Environmental data and samples from these sites are compiled and analyzed along with laboratory experiments and modeling to address questions across the three Phase 2 research themes.

a. C-DEBI researchers lead and participate in expeditions to these and other sites of interest
   i. Collect samples for laboratory analyses and experiments
   ii. Collect environmental data for use in experiments and ecosystem modeling

b. Convene workshops and conference sessions
   i. Develop approaches to integrate results from field, lab, and modeling studies
   ii. Synthesize results and methods from multiple sites
5. The new C-DEBI senior scientists are integrated in all aspects of the Center, and cross-disciplinary and cross-institutional research training is thriving through our grants programs, thereby expanding the community of deep biosphere researchers, technologists, and educators.
   a. Provide substantial research funds to the 5 Co-Investigator labs as well as to the 5 new senior scientist labs
   b. Award $1M in research grants/fellowships annually (for the first 3.5 years) to predominantly graduate students, postdoctoral scholars, and other junior researchers through annual RFPs

II. EDUCATION

Overall Education Goal. The main goal of C-DEBI’s education program is to generate distinctive and targeted activities in and around ocean sciences, in general, and the marine subsurface biosphere, specifically. Our vision is to bring C-DEBI research and the role of subseafloor microbes to the forefront by increasing microbiology literacy in the general public, engaging and retaining students in STEM fields, and training the next generation of subseafloor researchers.

Detailed Description
We focus our efforts on three target groups: undergraduate students, graduate students and postdoctoral scholars, and the general public. Central to our mission is the integration of our education programs with our expansive and diverse research effort—we do not see these as independent pursuits. To engage and retain young people in STEM fields and to develop the next generation of specialists, C-DEBI provides training, mentoring, and professional development opportunities, but we also leverage numerous educational partnerships nationally to work with K-12 students and educators to ensure engagement at all levels. At the undergraduate level, we focus heavily on community college students and students from marginalized groups (underrepresented minorities, first generation, low income, etc.), because of the huge potential for educational impact. In addition to providing training in state-of-the-art technologies and instrumentation for graduate students and beyond, we emphasize professional development training targeting skills needed both in and out of academia.

Optimal Education Outcomes
1. The general public is engaged in discovery science through public seminars, outreach activities, and social media.
2. C-DEBI content (e.g., the subseafloor biosphere, extreme microbiology, science and technology) is introduced into K-12 classrooms through professional development activities for educators.
3. Hands-on science opportunities are provided to engage K-12 students in microbiology and oceanography.
4. Cutting-edge university research opportunities are provided to undergraduates, especially for community college students and members of underrepresented minorities, attracting early and potentially undecided undergraduate students into STEM majors and strengthening their interest and passion for science and research.
5. The next generation of subseafloor researchers (graduate students and postdoctorals) are trained in state-of-the-art laboratories across the country and nurtured through professional development opportunities provided to expand their transferable skills.

Targets and Actions
1. The general public is engaged in discovery science through public seminars, outreach activities, and social media.
   a. Present at 5 informal science events or national education conferences per year
   b. Communicate the deep biosphere in 3 general audience, non-scientific publications per year
c. Communicate C-DEBI and related science content to a science-interested public audience through 2-3 weekly social media posts

2. C-DEBI content (e.g., the subseafloor biosphere, extreme microbiology, science and technology) is introduced into K-12 classrooms through professional development activities for educators (for the first 3.5 years)
   a. Create collaborations between C-DEBI science participants and teachers in 3 professional development workshops with K-12 (and some community college) educators per year
   b. Assess workshop effectiveness using formative and summative evaluations with 70% of respondents rating workshops as “very good” or “excellent” (4 or 5 out of 5)
   c. Support 2 K-16 teachers who have attended a C-DEBI teacher training program through 2 K-16 teacher grants per year

3. Hands-on science opportunities are provided to engage K-12 students in microbiology and oceanography.
   a. Conduct 3 activities and programs for K-12 classrooms per year
   b. Assess activity and program effectiveness using formative and summative evaluations with 70% of respondents rating activities and programs as “very good” or “excellent” (4 or 5 out of 5) (for the first 3.5 years)

4. Cutting-edge university research opportunities are provided to undergraduates, especially for community college students and members of underrepresented minorities, attracting early and potentially undecided undergraduate students into STEM majors and strengthening their interest and passion for science and research.
   a. Incorporate deep biosphere content into 5 C-DEBI and partner post-secondary programs per year
   b. Assess program effectiveness using formative and summative evaluations with 70% of respondents rating programs as “very good” or “excellent” (4 or 5 out of 5)
   c. Follow the pathway of former program participants using long-term tracking with 50% of former community college participants successfully transitioning to 4-year institutions in STEM majors, and 25% of all former undergraduate participants earning a degree in a STEM major and continuing on to graduate school and/or STEM careers
   d. Sustain long-term engagement of C-DEBI and STEM opportunities with >75% of former program participants

5. The next generation of subseafloor researchers (graduate students and postdoctorals) are trained in state-of-the-art laboratories across the country and nurtured through professional development opportunities provided to expand their transferable skills.
   a. Support 30-40 individuals from varied institutions through C-DEBI awards (fellowships, exchanges, research and education grants) and in C-DEBI leadership laboratories per year
   b. Develop and conduct 5-8 regular and varied professional development activities for graduate students and postdoctoral researchers
   c. Assess professional development workshop effectiveness using formative and summative evaluations with 70% of respondents rating workshops as “very good” or “excellent” (4 or 5 out of 5)
   d. Follow the pathway of former program participants using long-term tracking with 50% of former graduate student and postdoctoral participants successfully transitioning to postdocs or STEM careers

III. DATA MANAGEMENT AND KNOWLEDGE TRANSFER

Overall Data Management and Knowledge Transfer Goal. Our data management and knowledge transfer goal is to implement effective mechanisms and pathways to facilitate the exchange and application of knowledge, expertise, physical resources, and novel methods and technologies within the STC and between the STC and the broader community. The overall data management plan is in place to
1) assure all data generated from the STC are deposited in publically accessible data repositories (see details in our Data Management Plan), 2) allow STC researchers tools and computational resources that allow them to efficiently perform data analysis, and 3) develop and maintain a data portal for visualization and hypothesis generation from the STC data.

**Detailed Description**

C-DEBI facilitates the exchange of knowledge, expertise, intellectual and physical resources, experimental methods, and application of new technologies within its diverse community and between the STC and the community at large. This commitment is demonstrated through open access of all new discoveries, sensors, samplers, and platforms. This access has many avenues including but not limited to the distribution of information through teleconferences, our website, workshops, meetings, newsletters, presentations, technical documents, peer-reviewed publications, educational activities and outreach events. C-DEBI is also committed to mentoring students and scientists of all ages, including the exchange of personnel among laboratories and professional development.

The overarching objective of Data Management and Integration (DMI) and Knowledge Transfer (KT) to disseminate C-DEBI scientific discoveries and technical advances both to the scientific community and broader population has not changed; however, the emphasis is changing as the STC changes from a growth phase to a nurturing phase with the successful renewal proposal. As such, our DMI and KT goals include (1) implementing effective mechanisms to facilitate intellectual exchanges between institutions of various types, (2) maintaining worldwide access to C-DEBI data and information, (3) nurturing a new generation of C-DEBI researchers, (4) developing and make available targeted education, public outreach, and community interactions, and (5) promoting economic growth through technology development.

**Optimal Data Management and Knowledge Transfer Outcomes**

1. Innovations are imported/exported/shared and partnerships are developed with other fields, research institutions, industry and government.

2. New innovation in the field is communicated through web tools, publications, media, presentations, and educating the next generation of researchers and ocean stewards.

**Targets and Actions**

1. Innovations are imported/exported/shared and partnerships are developed with other fields, research institutions, industry and government.
   a. Publish and promote scholarly activity via 10 publications per year
   b. Continue to develop research collaborations through networking at 2-3 interdisciplinary meetings and talks/posters/exhibition at 2-3 conferences per year
   c. Lead 3 C-DEBI-focused meetings or special sessions at national or international meetings per year
   d. Enhance, develop, or commercialize tools, analytical capabilities, software products, sensors and platforms (2 per year)

2. New innovation in the field is communicated through web tools, publications, media, presentations, and educating the next generation of researchers and ocean stewards.
   a. Continue to ensure all data generated through the STC are in stable public data repositories within 2 years of generation (or for graduate students upon defense of the dissertation or thesis)
   b. Continue transition of C-DEBI data into "Planet Microbe" to preserve continued access to the data and analysis tools for discovery, integration, synthesis, and open sharing
   c. Train researchers in new tools for data analysis by producing 3 webinars on data analysis tools per year and 2 small workshops for data analysis
   d. Engage 20 new undergraduates per year to the fields of microbiology and oceanography and mentor 10 graduate students per year in C-DEBI fields
c. Communicate with the public through non-scientific journals via social and journalistic media (5 significant contributions per year)

IV. EXTERNAL PARTNERSHIPS

Overall External Partnerships Goal. Our external partnership goal is to engage and support cross-disciplinary and cross-institutional partnerships that facilitate, augment, and expand the education, training and research opportunities of Center participants.

Detailed Description
Partnerships among individuals, institutes, organizations, and programs are the core of C-DEBI research and educational efforts. One of the strengths of these partnerships is the quality and broad appeal of publications. C-DEBI has a range of cross-disciplinary and cross-institutional collaborations that have transformed our view of subsurface microbial conditions, activity, and mechanisms within the hydrologic and geochemical context of fluid flow within the oceanic crust. Another strength of C-DEBI partnerships is the web of interaction of C-DEBI community within other organizations and programs and the joint efforts of these organization and programs in collaboration with C-DEBI to promote and facilitate synergetic research objectives. These partners also extend to education and diversity efforts, leading to a community of junior scientists that are engage in cross-disciplinary and cross-institutional training activities and exchanges.

Optimal External Partnerships Outcomes
1. Strong cross-disciplinary research projects and strong cross-institutional programs are demonstrated in all aspects of Center activities, including publications, presentations, proposals, educational exchanges, and educational programs.
2. Partnerships are developed with other fields, research organizations, industry, government, and foundations.

Targets and Actions
1. Strong cross-disciplinary research projects and strong cross-institutional programs are demonstrated in all aspects of Center activities, including publications, presentations, proposals, educational exchanges, and educational programs.
   a. Publish 5 (in aggregate) cross-disciplinary papers per each of the three research themes with support from calls for small research and travel grants to facilitate the interaction of dispersed Center researchers
   b. Submit 2 cross-disciplinary and cross-institutional proposals per year
   c. Support 2 interdisciplinary workshops or meetings in concert with other national programs
   d. Fund 10 graduate students, postdoctoral fellows and C-DEBI community scientists in their pursuit of generating data or developing cross-discipline techniques and tools to further Center objectives
   e. Provide the funds that allow 3 student/researchers per year the opportunity to participate in research expeditions or travel to another institution to expand the scope of their education/research in the use of novel techniques and tools
2. Partnerships are developed with other fields, research organizations, industry, government, and foundations.
   a. Build 10 (total) partnerships by networking at interdisciplinary meetings, developing industrial and governmental partners, and targeting partnerships and interactions for new applications of existing or budding technologies
b. Develop documents and materials that highlight significant results through C-DEBI research, education, and diversity programs suited to specific organizations, foundations, and programs to form the basis of a dialogue between C-DEBI and that organization to further fiscal and research needs.

V. DIVERSITY

Overall Diversity Goal. C-DEBI seeks to train a new, diverse generation of undergraduate, graduate and postdoctoral researchers within an integrated and collaborative multidisciplinary community. We are committed to improving access and support for members of underrepresented and marginalized groups to be able to succeed in STEM fields. It should be noted, however, that the activities intended to enhance diversity do not happen in a vacuum—they are purposefully integrated with C-DEBI’s fundamental research, education, and outreach missions.

Detailed Description
Through its academic programs, C-DEBI promotes inclusion and retention among underrepresented groups, including women and first-generation college students. With a strong base established to increase STEM diversity at all levels, both academically and nationally, we are developing and exporting distinctive, in-depth education and research experiences that encourage historically underserved students. These initiatives will be targeted toward three primary sectors: 1) pre-college; 2) undergraduate and community college populations; and 3) early-career and established scientists.

Optimal Diversity Outcomes
1. The diversity, especially underrepresented minority representation, of participants in all levels of C-DEBI from undergraduate, graduate students, and postdoctoral scholars to participating researchers and staff is increased to reflect our diverse society.
2. Pathways to careers in STEM fields are developed for minority undergraduate students who are interested in STEM majors.
3. Partnerships are initiated with other organizations, institutions, programs, or informal science centers that target underrepresented students and engage them in STEM fields of study.

Targets and Actions
1. The diversity, especially underrepresented minority representation, of participants in all levels of C-DEBI from undergraduate, graduate students, and postdoctoral scholars to participating researchers and staff is increased to reflect our diverse society.
   a. Increase the diversity of C-DEBI participants to reflect the diversity of the United States
   b. Emphasize diversity awareness with the active C-DEBI community through 1 in-person diversity and inclusion training workshop at C-DEBI’s annual meeting, and among individual student cohorts of each C-DEBI summer education program
   c. Promote C-DEBI research opportunities to diverse audiences through 4 different partners that primarily serve underrepresented groups each year
2. Pathways to careers in STEM fields are developed for minority undergraduate students who are interested in STEM majors.
   a. Conduct 3-5 programs each year attracting underrepresented students into STEM fields
   b. Assess program effectiveness using formative and summative evaluations with 70% of respondents rating programs as “very good” or “excellent” (4 or 5 out of 5)
   c. Follow the pathway of former program participants using long-term tracking with 50% of former community college participants successfully transitioning to 4-year institutions in STEM majors, and 25% of all former undergraduate participants earning a degree in a STEM major and continuing on to graduate school and/or STEM careers.
d. Sustain long-term engagement of C-DEBI and STEM opportunities with >75% of former program participants
3. Partnerships are initiated with other organizations, institutions, programs, or informal science centers that target underrepresented students and engage them in STEM fields of study.
   a. Introduce C-DEBI science with appropriate resources and training to 10 institutions and/or educators that primarily serve underrepresented groups

VI. MANAGEMENT

Overall Management Goal. Our leadership and management goal is to envision and enable the Center’s mission through inclusive and transparent decision-making; inspire Center members; and facilitate collaborative effort and guide all participants in the center via a cross-disciplinary and multi-institutional ethics program to instruct them on ethical and responsible conduct of scientific research.

Detailed Description
A fundamental challenge for C-DEBI leadership is to maintain trust and support among a diverse and interdisciplinary community of scientists, educators, and technologists. Maintaining confidence in STC leadership, throughout the existence of the Center, is essential if busy STC participants are to retain a willingness to allocate some of their limited time for advisory, review, and collaborative activities. STC leaders will also need to assure that there are robust opportunities for inter-institutional and cross-disciplinary exchanges and training, and help to secure external resources in support of ongoing and future STC activities. In addition, the Center will maintain a rigorous ethics training system for all C-DEBI participants and an Ethics Panel overseeing policies and procedures. Finally, STC leadership needs to remain focused on the critical goal that motivated formation of C-DEBI in the first place: creating a vibrant, innovative, and focused community, who will work together to achieve what cannot be accomplished by individuals working alone, to transform the nature of deep biosphere research.

Optimal Management Outcomes
1. The decision-making process is defined, transparent and effective leading to a high degree of confidence, ownership, and engagement by STC participants in the Center.
2. Communication is effective in facilitating the exchange of science, education of students, and promotion of other C-DEBI activities and opportunities.
3. STC participants are engaged in cross-Center training and collaboration.
4. Community commitment to an environment promoting high ethical standards in the conduct of research is maintained.
5. Strategies, tools, and resources are developed for sustainability of C-DEBI activities.

Targets and Actions
1. The decision-making process is defined, transparent and effective leading to a high degree of confidence, ownership, and engagement by STC participants in the Center.
   a. Hold biweekly administration meetings as well as biweekly ExCom meetings and an annual ExCom face-to-face retreat to enable clear and effective management of the Center
   b. Invite the evaluation of Center research, education, diversity, and knowledge transfer management annually by the External Advisory Board (typically in conjunction with the C-DEBI annual meeting) for feedback and suggestions to the Director to improve the integration of C-DEBI programs and activities
   c. Update the C-DEBI Operations Manual annually to elucidate the functions of key individuals and groups and main research, education, outreach, and administration activities, programs, operations and procedures and post on the website with the Annual Report and Strategic Implementation Plan

C-DEBI Strategic Implementation Plan 2015-2020 (Revised 12/19/18)
2. Communication is effective in facilitating the exchange of science, education of students, and promotion of other C-DEBI activities and opportunities.
   a. Regularly update the comprehensive website at www.darkenergybiosphere.org with research and education portals and resources
   b. Distribute biweekly newsletters to the C-DEBI community to highlight recent and upcoming C-DEBI research and education programs and events and other relevant/partner activities and opportunities
   c. Continue to improve the private login site for internal documents and community reporting
   d. Solicit 3 nominations for each season of the videoconferenced Networked Speaker seminar series to present early career scientist research to the C-DEBI community
   e. Maintain protocol/procedure for issuance and usage of C-DEBI contributed publication numbers and of logo and branding information

3. STC participants are engaged in cross-Center training and collaboration.
   a. Organize 5-7 C-DEBI-specific opportunities annually for collaboration and training and entrain new membership (e.g., Center-wide Annual Meetings, Research Theme Workshops, and Exchange Grants)
   b. Support 4-6 research and professional development opportunities annually specifically for graduate students and postdoctorals (e.g., workshops at Annual Meetings, professional development webinars, and fellowships and networking activities in Research and Education sections above)

4. Community commitment to an environment promoting high ethical standards in the conduct of research is maintained.
   a. Require 100% of participants complete ethics training within these standards
   b. Ethics Panel composed of Research, Education, ExCom and Early Career representatives resolves complaints regarding C-DEBI administration, funding and scientific conduct in a timely manner (within 6 months of being presented to C-DEBI)

5. Strategies, tools, and resources are developed for sustainability of C-DEBI activities.
   a. Secure $3M annually (beyond initial STC funding) in support of C-DEBI activities