

Synberc 2.0

1 Vision and Mission

1.1 *Vision*

Synberc 2.0 [name to be changed to a community-wide acceptable name, hereafter referred to as SB2] will be the leading organization in the US to bring together the synthetic biology community to provide the future vision for synthetic biology, catalyze leading-edge research and education programs, and promote dialogue about synthetic biology among policy-makers and other members of the public.

1.2 *Mission*

The mission of SB2 is to conduct activities and manage programs that strengthen the research and education communities, articulate compelling research visions and goals, align those visions and goals with pressing national and global challenges, and communicate the importance of those ideas to the research and education communities, government and industry stakeholders, and the public.

2 Goals

The goals of SB2 are to:

1. Establish itself as a widely accepted catalyst and voice for the US synthetic biology research and education communities.
2. Bring the synthetic biology research and education communities together to envision and communicate our future research and education aims and needs.
3. Work with federal, state and local government agencies to transform the vision and goals into funded research and education programs.
4. Convene researchers to develop proposals for pre-competitive research programs that will address key research needs identified in the vision- and goal-setting processes and coordinate these efforts with other US-based and international centers.
5. Convene educators to develop new education and training resources that will address key educational and workforce needs.
6. Inculcate values of leadership and service by providing practitioners with the knowledge, training, networks, and venues needed to responsibly advance the field.
7. Convene members of the public, including the policy-makers, to discuss the challenges and contribute to the vision and goals of the synthetic biology community.

SB2 will achieve these goals by:

1. Building an open and inclusive organization that can legitimately serve as a catalyst and voice for the broader synthetic biology research community.
2. Engaging the synthetic biology research and education communities through a variety of approaches.
3. Engaging funding institutions and agencies about critical research needs.

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4. Engaging public and policy stakeholders in order to guide activities toward the common good.
5. Developing written and other materials that will help to guide the development and use of synthetic biology.



Figure 1. Graphical overview of major stakeholders and considerations in the SB2 ecosystem, with SB2 as a central connector.

2.1 SB2 will serve as the catalyst and voice of the broad synthetic biology community

Synberc was established in 2006. It is the largest single program funded by the US government specifically to address the challenges, needs, and potential of synthetic biology. Synberc brought together a small community of faculty from five universities (University of California, Berkeley; University of California, San Francisco; Massachusetts Institute of Technology; Harvard University; Stanford University), researchers from leading companies

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in the synthetic biology sector, and community leaders. Nine years later, Synberc continues to be one of the largest academic-industry collaborations in synthetic biology worldwide. Because the funding for Synberc from the National Science Foundation will end in 2016, we plan to launch SB2 with a larger number of academic, corporate, government, and community participants so that SB2 even better reflects and speaks for the broader synthetic biology community. SB2 will be the “go to” organization for any person, agency or institution seeking input or focused attention from the synthetic biology community. Specifically,

- We will expand the number of academic individuals and institutions involved in SB2 so that it reflects the larger synthetic biology research community.
- We will expand the number and types of companies that participate in SB2 so that it better reflects the larger biotechnology community.
- We will continue to promote a scientific-and-technology dialogue among industry and academic participants.
- We will continue to develop and promote educational activities and programs for the synthetic biology community, for the education community, for the larger biotechnology community, and for the public.
- We will invite federal agencies to appoint representatives, notably program managers, to SB2.
- We will promote and create opportunities for more proactive outreach and engagement with federal agencies so as to be responsive to their interests, requests and needs, including providing proactive science-based policy options and holding events in Washington DC to enable federal-agency program managers and other interested policy-makers to attend and participate in such events.
- SB2 will also coordinate with existing, large-scale, US-based research programs (e.g., DARPA foundries, DOE Bioenergy Research Centers, etc.) to ensure that all research activities are accounted for in planning activities. SB2 also will coordinate with similar organizations in other countries (e.g., Flowers Consortium in the UK) to balance, coordinate and when practicable, integrate national/international research activities.

2.2 SB2 will create and share visions for the future

SB2 will develop a vision- and goal-setting program to assess the current state of synthetic biology, global challenges for which synthetic biology might be deployed to solve them, gaps in technology that will require research and development, gaps in workforce development that will require new or better educational programs, and gaps in communication and policy that will require new or better materials and policies. This process is shown in Figure 2.

- We will hire a Visioning Director to direct the process of vision- and goal-setting. We expect to attract a full-time professional with a strong background in scientific program management and a PhD or equivalent in biology, engineering or related areas of expertise. This person will manage all vision- and goal-setting workshops and reports. Depending on the financial support, the Visioning Director may have a staff.
- We will sponsor workshops that emphasize development of new host organisms, standards, computer-aided design tools, communications, policies, education,

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diversity, career-development, and a variety of other topics. Workshop leaders will invite appropriate scientific leaders from academic institutions, industry and the government, as well as policy-makers and community leaders knowledgeable in the subject of the workshop. Workshop leaders will be responsible for writing a report of the workshop findings that can be integrated into the SB2 vision- and goal-setting process and be a means of continuing education. When appropriate, we will partner with established expert networks and meetings of relevance to the topics. We will strive to post workshop reports within 4-6 months from the time the BOD authorizes a workshop (Figure 2).

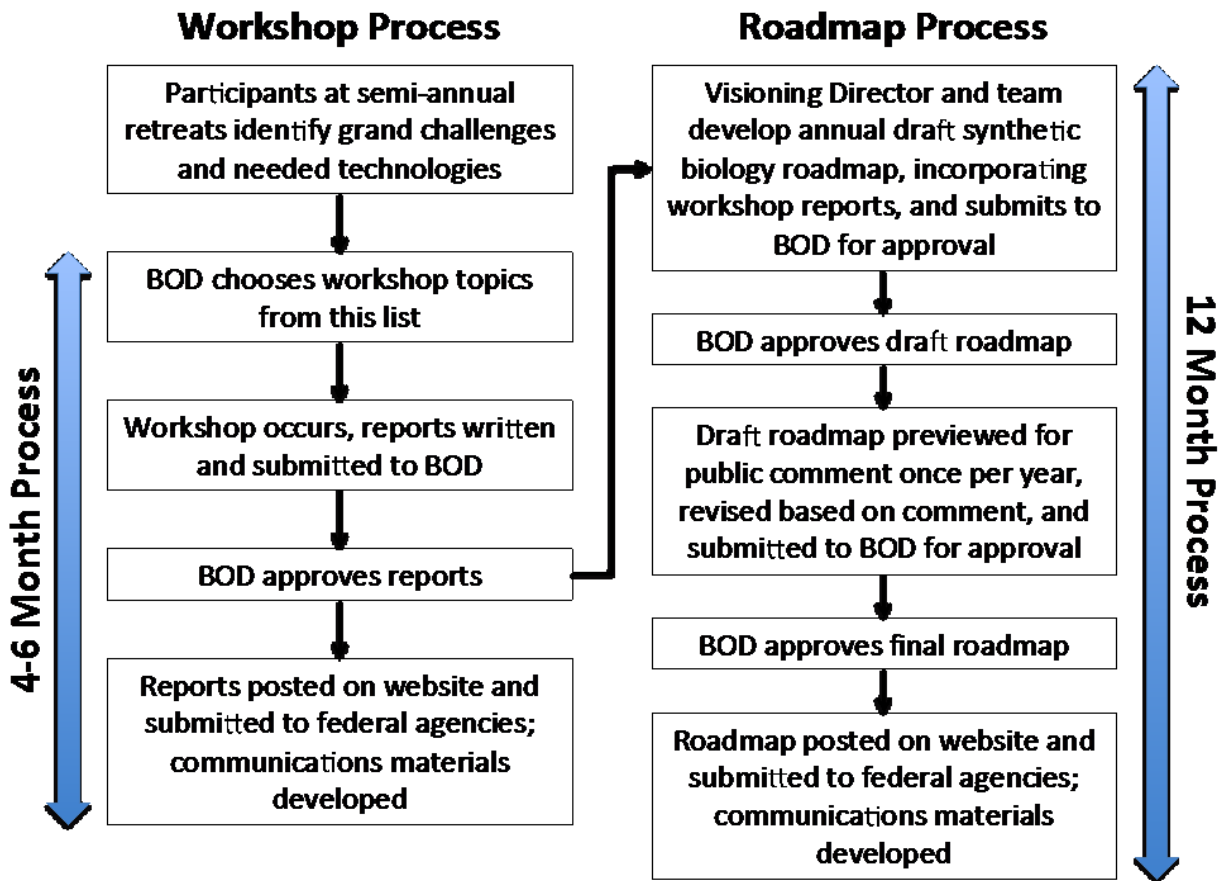


Figure 2. Workshop and roadmap processes in SB2’s visioning program.

- We will hold scientific retreats on a semi-annual basis, alternating between the East Coast and the West Coast. Besides learning the latest research findings of the SB2 members, the participants will hear reports from the workshops and any other communications from SB2 members. In turn, the participants will be expected to provide input. In the absence of a large government or institutional program to sponsor research in SB2 or in conjunction with such a sponsor, retreat participants will be asked to speak about their latest research. Specific topics or speakers also may be invited to give talks on new or controversial topics.

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- We will publish an annual update to the synthetic biology roadmap. This could be introduced in Washington DC as part of an annual Synthetic Biology Day on Capitol Hill event or similar occasion (Figure 3). Participants will get a preview of the annual update to the roadmap and an opportunity to comment.

We will work to proactively position synthetic biology research to have the greatest possible impact on national needs, and we will work to create mechanisms to identify, understand, and communicate national needs to the synthetic biology community.

- We will organize subcommittees of the SB2 Board of Directors (BOD) to focus on specific areas such as agriculture, health, chemicals, energy, and environment, always with concomitant consideration of the social implications. These subcommittees will be charged with identifying and promoting synthetic biology research opportunities, and building solid and durable ties to federal agencies, institutions and the larger community in each area. Their activities will include engaging these communities, institutions and agencies about the role of synthetic- biology research, as well as engaging synthetic biologists about the challenges and opportunities in these fields.
- We will develop a communications strategy to better promote SB2 activities and important synthetic biology research related news items.

The products of SB2's vision- and goal-setting program will be workshop reports that address particular topics, other materials as are appropriate and an annual synthetic biology roadmap.

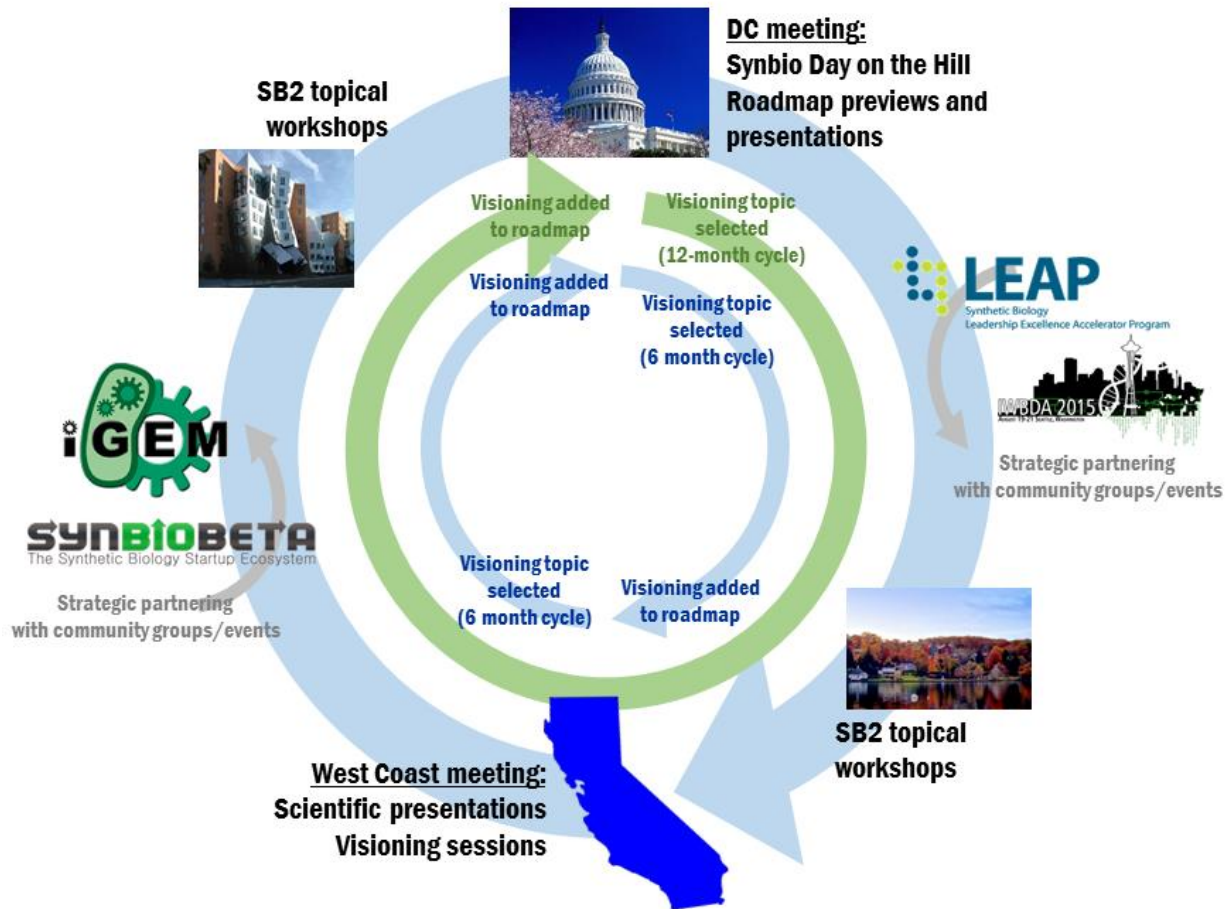


Figure 3. The SB2 annual visioning cycle, showing the proposed timing for selecting and developing topics for inclusion in the synthetic biology roadmap. Topics may be selected at either of the two semi-annual meetings (West Coast or East Coast) or as a result of the Synthetic Biology Day on Capitol Hill. The typical turnaround time for such a document would be 6 months, with an emphasis on quick turnaround with no loss of creativity and analysis. There could be two or three processes being conducted simultaneously.

2.3 SB2 will transform visions into funded programs

It is our intention to move ideas generated in part or whole through SB2 activities into funded programs at Federal and state agencies, foundations, and other such institutions and sources. We will put procedures in place to ensure follow-through on community vision- and goal-setting activities beyond the completion of a workshop reports toward a funded research program.

- We will assign mentors from the SB2 Board of Directors to every workshop report, and we will create a shepherding plan that identifies key stakeholders that need to be

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made aware of the results.

- We will support, with our staff, the creation of materials for promoting workshops, and we will use our presence among the various interested communities to promote the outcomes envisioned by the workshop participants.
- We will cultivate other sources of support for synthetic biology research by taking advantage of workshops and other opportunities to establish connections and trust with Federal and state agencies, national laboratories, foundations and other such institutions and sources, and policy-makers and the public.

2.4 SB2 will develop research projects to address critical needs

As large-scale funding mechanisms become available, SB2 will bring together a diverse group of researchers to apply for that funding. Most if not all of these individuals will be identified through the workshops. With funding, SB2 staff will facilitate collaborations and reporting.¹

2.5 Create resources to fill key educational and workforce needs

As it becomes possible, SB2 will bring together educators to develop new education materials, media of all types, and programs that address key education needs identified in the vision- and goal-setting process. The products of this program will include Research Experience for Undergraduates (REU) programs, K-12 outreach, course materials and media for undergraduate and graduate courses, industry internships for undergraduate and graduate students and post-docs, etc. Some of these materials also will be available and useful to non-student public organizations (e.g., community science fairs, and museums). These activities will be funded through Federal, state, and local grants and from foundations and other such institutions and sources.

2.6 SB2 will inculcate values of leadership and service

The development of next-generation leaders in synthetic biology is crucial. SB2 will work with organizations such as LEAP (the Leadership Excellence Acceleration Program), an initiative designed to foster leadership in advancing responsible practices and to promote the development of the next generation of leaders in the synthetic biology community. Specifically, we will aim to provide practitioners with the following:

- Opportunities for practitioners to exercise leadership and impact the trajectory of the field;
- Practical knowledge about the technical, social, political, and economic landscape that shapes and is shaped by biotechnology;
- Education and training to develop practical skills in areas such as communication, engaging public and policy stakeholders, framing problems, and developing solutions; and

¹ Currently, Synberc manages the Synthetic Biology of Yeast project, which was funded through an NSF grant outside Synberc's core funding. This grant was developed after participants in a Synberc-sponsored workshop about yeast identified gaps in knowledge and tools that would be important to industry. Synberc's Research Director manages interactions among the research laboratories that participate in this grant.

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- A network of peers and mentors to provide guidance, support, and wisdom.

3 Membership, Governance, and Management

3.1 Membership

Academic members shall consist of principal investigators or their equivalents from academic institutions, national laboratories, and non-profit research institutions. Initially, these will consist of Synberc's principal investigators and affiliated investigators. SB2 will expand its academic membership through a nomination process whereby new members are nominated by two or more existing members and voted for inclusion by the Board of Directors. The new membership process will occur on an annual basis. Any company that joins SB2 will be able to designate one or more members depending on the company size.

3.2 Governance

SB2 will be governed by a Board of Directors (BOD) that will establish policy. The initial membership will be fifteen members. A minimum of one-third of the BOD members will be from industry and will be elected by the industry SB2 members. Two will be members-at-large elected by the BOD with the primary responsibility to represent views of the general public. The remainder will be from academic institutions and national laboratories as elected by the academic/national laboratory SB2 members. All BOD members will serve for one or more terms of three years per term as decided by the BOD. The BOD will elect one of its members as the chairperson, one of its members as the vice-chairperson, and one of its members as the secretary. The BOD will hire an Executive Director of SB2, who will execute the policy and be in charge of operating SB2. The Executive Director will, in turn, hire all other staff members as outlined below.

3.3 Management

SB2 will consist of the following staff members working on Visioning, Industry Partnerships, and Communications:

- *Executive Director*: oversees the execution of the BOD policy and all SB2 operations. If SB2 has limited funding, the Executive Director may also serve as the Visioning Director or in other capacities
- *Industrial Liaison Officer*: recruits industry partners
- *Visioning Director*: leads SB2 vision- and goal-setting workshops, and development of workshop reports and annual roadmap
- *Director of Community and Communications*: leads communication between SB2 and all of its stakeholders
- *Administrator*: works with above personnel

SB2 will have the following staff members working on Research, Education, and Policy & Practices:

- *Research Director*: works with scientists to develop multi-investigator research proposals and facilitate research group interactions once the proposals are funded

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- *Education Director*: leads the development and dissemination of education materials
- *Policy & Practices Director*: leads the development and understanding of best policies and practices for the synthetic biology community, including the community's relationships with policy-makers and the public.
- *Administrators*: work with above personnel

The organizational structure for SB2 is shown in Figure 4.

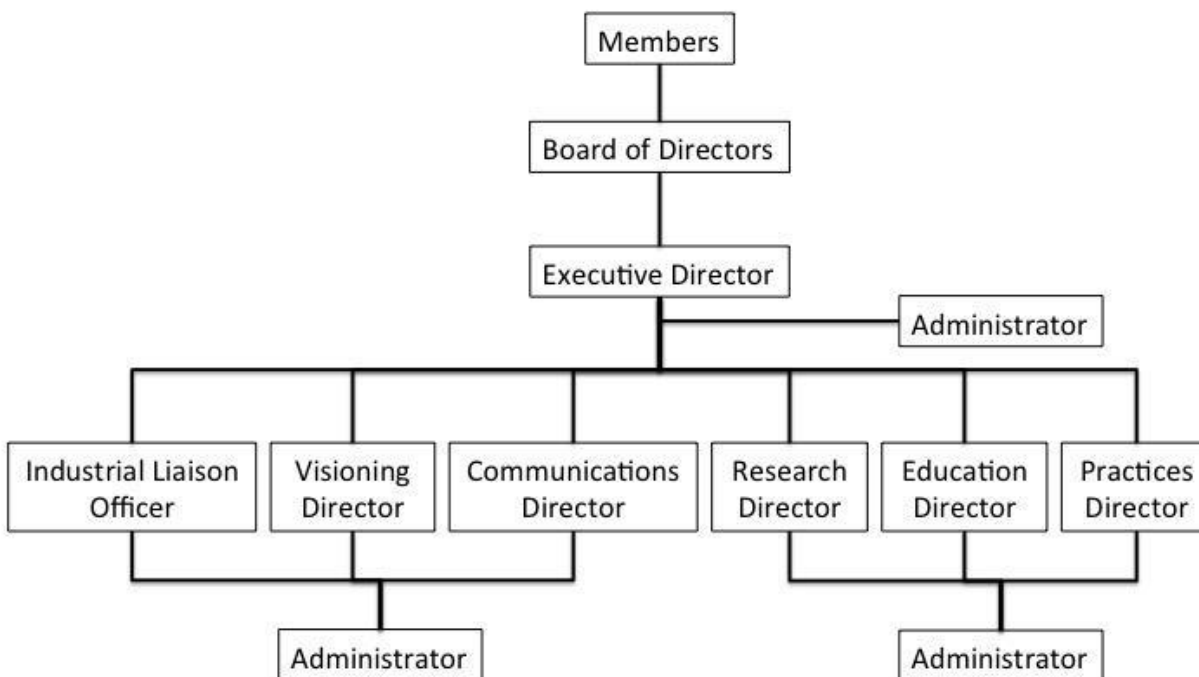


Figure 4. Organizational structure for SB2.

4 Operations

SB2 will initially be located at the University of California, Berkeley. If the BOD determines that it is more appropriate to operate SB2 as an Internal Revenue Code (26 U.S.C.) section 501(c)(3) organization, then SB2 will be transitioned to that status. Operations will include those activities that we hope to fund through a core grant from one or more federal agencies and matched with industry contributions (Visioning, Industry Partnerships, and Communications) and activities that will be funded through grants for specific projects (Research, Education, and Policy & Practices). The operating budget is shown in Table. 1. Operations will include the following:

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Item	Cost/unit	VIPC Activities		REPP Activities	
		No.	Total Cost	No.	Total Cost
Personnel					
Executive Director	\$200,000	1	\$200,000	0	\$0
Industry Liaison Officer	\$150,000	1	\$150,000	0	\$0
Visioning Director	\$150,000	1	\$150,000	0	\$0
Communications Director	\$120,000	1	\$120,000	0	\$0
Research Director	\$120,000	0	\$0	1	\$120,000
Education Director	\$120,000	0	\$0	1	\$120,000
Policy and Practices Director	\$120,000	0	\$0	1	\$120,000
Administrators	\$60,000	1	\$60,000	2	\$120,000
Benefits	45%		\$306,000		\$216,000
Subtotal			\$986,000		\$696,000
Retreats	\$100,000	2	\$200,000	0	\$0
Travel (no. of trips)	\$2,000	12	\$24,000	12	\$24,000
Office expenses	\$6,000	5	\$30,000	5	\$30,000
Total Direct			\$1,240,000		\$750,000
Overhead (assuming 57% rate)			\$706,800		\$427,500
Total Direct + Indirect			\$1,946,800		\$1,177,500

Table 1. Operating budget. VIPC (Visioning, Industry Partnerships, and Communications) will be funded by a core grant from one or more federal agencies and matched with industry funds. REPP (Research, Education, and Policy & Practices) activities will be funded through specific grants from federal and state agencies and foundations and comparable sources for pre-competitive research and education programs. Indirect costs are for locating SB2 at the University of California, Berkeley.

4.1 Vision- and Goal-Setting Process

The vision- and goal-setting process will begin with the identification of global/societal grand challenges that synthetic biology could address and, if not solve, be part of the solution. Included will be the identification of key tools and technologies that do not exist but that would make a fundamental difference if established. This master list of challenges and needed tools will be revisited no fewer than every five years but more frequently as game-changing technologies are developed (e.g., PCR, CRISPR-Cas9).

The Board of Directors will charter these activities to address the one or more items on the list of challenges and needed technologies. Each activity will be composed of a workshop with invited experts, and workshop reports and other means of communicating ideas. Possible outcomes of the process include the identification of ideas for major instrumentation or research initiatives that enjoy widespread community support and that address deep challenges and problems in synthetic biology.

Once the BOD has received a workshop report, the next step will be to identify funding sources. While many activities will primarily require interest and initiation through new, coordinated funding activities, others can be funded through existing funding mechanisms. The BOD will guide the work of the Executive Director as that individual engages with federal agencies and other sources to tailor proposals to existing funding opportunities or to create new funding opportunities.

4.2 Industry partnerships

One of the key functions of SB2 is to ensure that all workshop reports and the annual roadmap are relevant to the biotechnology industry. It therefore is important that SB2 have members companies from many diverse industries, including chemicals, pharmaceuticals and health-care, agriculture, reagent and tool suppliers, etc. The Industrial Liaison Officer will be responsible for recruiting companies to SB2.

4.3 Communications

SB2 will develop various communications pieces targeted at the scientific community, government agencies, interested foundations and institutions, policy-makers and the general public. These pieces will include videos and web communications, position papers, and workshop reports. The Communications Director will be responsible for guiding the development and dissemination of all communications.

4.4 Research

As appropriate, large-scale funding opportunities become available, SB2 will serve as a catalyst to bring together researchers to write proposals in response to those opportunities. If funded, the Research Director will help to coordinate research activities and will coordinate reporting to the funding body.

4.5 Education

As appropriate funding opportunities become available, SB2 will serve as a catalyst to bring together educators to write proposals in response to those opportunities. If funded, the Education Director will help to coordinate education activities and will coordinate reporting to the funding body. The Education Director, in conjunction with the Communications Director, will be responsible for disseminating education materials.

4.6 Policy and Practices

As appropriate funding opportunities become available, SB2 will serve as a catalyst to bring together researchers, educators, and policy-makers to write policies-and-practices proposals in response to those opportunities. If funded, the Policy & Practices Director will lead the development and understanding of best practices for synthetic biology and will coordinate reporting to the funding body.

5 Funding

SB2 will attempt to encourage one or more federal agencies to fund the Visioning, Industry Partnerships, and Communications activities through an infrastructure grant as NSF currently does for the Computing Community Consortium (CCC). Research, Education, and Policy & Practices activities and any Visioning, Industry Partnerships, and Communications activities not funded through an infrastructure grant will be funded through corporate memberships and grants from federal and state governments and from foundations and other comparable institutions and sources. The proposed fee schedule for the corporate members is shown in Table 2, and the potential income generated from the current number of Synberc companies and a potential doubling in the number of companies is shown in Table 3. In return for these fees, companies will have the ability to nominate one or more individuals as members, access to academic investigators, students, and post-docs, access to knowledge generated from any pre-competitive research, potential to sponsor research in academic member laboratories, ability to license intellectual property generated by SB2-managed grants, access to Policy & Practices resources, and communications of best practices, position papers, and talking points. The current annual income for the companies Synberc presently engages as members of its Industry Advisory Board and the expected annual income if the number of companies in each category were to double are given in Table 3.

Table 2. Fees for companies

Company Size	Annual Fee
Large (>500 employees)	\$30,000
Medium (61-500 employees)	\$12,000
Small (11-60 employees)	\$3,000

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Startup (1-10 employees)	\$1,000
Not-for-profit	\$5,000

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Table 3. Expected income based on the current number of companies in Synberc and if we are able to double the number of companies.

<i>Company size</i>	Annual Fee	Current companies		Double companies	
		<i>No of cos</i>	<i>Total</i>	<i>No of cos</i>	<i>Total</i>
Large (>500 employees)	\$30,000	13	\$390,000	26	\$780,000
Medium (61-500 employees)	\$12,000	6	\$72,000	12	\$144,000
Small (11-60 employees)	\$3,000	8	\$24,000	16	\$48,000
Startup (1-10 employees)	\$1,000	10	\$10,000	20	\$20,000
Not-for-profit	\$5,000	2	\$10,000	4	\$20,000
			\$506,000		\$1,012,000

In addition to funds from corporate sponsors, SB2 will bring together researchers from various institutions to write proposals to Federal and state governments, corporate consortia, and foundations and other such institutions to fund pre-competitive research and education initiatives outlined in the vision- and goal-setting process. All of these endeavors will have an SB2 endorsement as a proposal warranting thorough and thoughtful consideration.

6 Assessment

To ensure we are indeed a legitimate catalyst and voice of the community, it will be necessary to seek periodic input and evaluation from the broader community through the following methods, among others:

6.1 Annual industry SWOT analysis

Borrowing from the successful NSF Engineering Research Center model utilized to establish Synberc, the Board of Directors will request that our industry members annually perform a high-level assessment of SB2's **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats (a SWOT analysis). The industry partners will prepare this assessment and share it with the BOD and leadership team at one meeting every year. The BOD will be responsible for deciding which recommendations SB2 should act upon, and ensure that the leadership team does act on those recommendations as is appropriate. This will ensure strong coordination between industry and academia of the technical and broader goals of SB2.

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6.2 *Annual survey of the synthetic biology community*

The annual survey will be used to determine, on a very broad scale, the scientific and technical needs of the research community as well as serve as a means to solicit feedback on SB2's performance. The survey results may measure sentiment within the field for specific initiatives, provide support for various policy recommendations, and otherwise act as a catalyst for further discussion and action. .

6.3 *Partnerships with third-party evaluators*

We will explore partnerships with organizations whose missions are centered on public outcomes as a means to set goals and assess progress toward "science for the public good" in a profound way. Such third-party partnerships would also provide a broad array of expertise in the social sciences, including law and philosophy, that could not easily be replicated internally, to richly assess and inform our activities.

7 Contact information

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