BTI Computational Biology Center

Decoding the Complexity of Life

Strategic Plan
Feb. 2024 – Feb. 2026

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Executive Summary

The BTI Computational Biology Center (BCBC) supports and contributes to BTI's strengths in bioinformatics, plant transformation, and metabolomics to tackle new frontiers. The Center promotes synergistic interactions among groups at BTI and supports integration with the greater community through research collaborations and educational programming. This strategic plan identifies four aspirations to address in the next two years to support our mission.

1) Collaboration: To serve as an integral bioinformatics resource for collaborative research.
2) Education: To make bioinformatics broadly accessible by building capacity with researchers and students with different backgrounds and levels of skill in bioinformatics.
3) Infrastructure: To meet current and future computational infrastructure needs.
4) Funding: To attract new and diverse sources of funding (to stimulate research, education, and infrastructure initiatives).

Introduction

In the spring of 2016, BTI began planning the BCBC – a process set in motion by Lukas Mueller's concept of a bioinformatics-focused center at BTI. The goal was to build on the Institute's strength in genomics and associated bioinformatics and raise our profile. A planning group was convened, including Zhangjun Fei, Fay-Wei Li, Lukas Mueller, Eric Richards, Susan Strickler, and Amy Yanosh, which began with a brainstorming session including members of the Cornell community (Ed Buckler, Michael Gore, Chris Myers and Susan McCouch). Later, additional BTI members were recruited for specialized input (IT, Outreach, and Fundraising). The planning group has become a Steering Committee dubbed 'The Pirates', which provides feedback on how BCBC can best serve the computational needs of the local community as well as engage with scientists, students, and society outside our immediate locale.

The BCBC launched as a center focused on computational approaches to biological diversity, with particular attention to both genomic and biochemical complexity in non-model plants. The planning group also felt strongly that BTI's current efforts in bioinformatics training needed to be continued and additional avenues of training implemented. In the planning process, it was discussed how current and future training programs might mesh with related efforts on campus. There is considerable campus demand for bioinformatics training, and we understood that BTI does not have the capacity to fully satisfy this need. Therefore, the BCBC is principally focused on the BTI community and its circles of collaborators.

Mission, Vision, and Aspirations

Mission

The BCBC enables computational approaches by providing educational resources and developing new methods in a collaborative framework to advance understanding of the complexity of life.

Vision

Computational biology democratized through accessible people and resources

Aspirations (2024-2026):

1) Collaboration: To serve as an integral bioinformatics resource for collaborative research.
2) Education: To make bioinformatics broadly accessible by building capacity with researchers and students with different backgrounds and levels of skill in bioinformatics.
3) Infrastructure: To meet current and future computational infrastructure needs.
4) Funding: To attract new and diverse sources of funding (to stimulate research, education, and infrastructure initiatives).

Strategy and Implementation

Aspiration 1 – COLLABORATION: To serve as an integral bioinformatics resource for collaborative research.

Context

Through the bioinformatics consulting program, workshops, and other BCBC-led activities, the Center has established a number of relationships in the local community and beyond. Research at the BCBC is driven largely by partnerships built on these relationships, which help to guide strategic choice of problems and experimental systems. We will continue to foster these relationships as well as forge new ones.

BCBC collaborations are structured in such a way that there are several tiers of engagement (core, Tier 1, Tier 2). These tiers serve to define the roles of collaborators in relation to the BCBC. Core members include the BCBC Director and the consultants. Tier 1 includes BTI faculty members and members of Cornell University who have a formally established collaboration with the BCBC, typically through a grant or other funding arrangement. Tier 2 includes members of BTI, Cornell and external groups, who do not have formal collaborations established with BCBC. Tier 1 and Tier 2 members will have free access to consulting hours, and BCBC introductory training courses. Free access to server time on BCBC-administered servers is also available to members of Tier 1 and Tier 2, though Tier 2 access will mainly be limited to members with affiliation to a BTI lab group or a BTI-affiliated research project. Tier 3 includes for-fee external collaborations, such as projects with industry or other academic collaborations not covered by an existing grant. Tier 3 collaborators will only be taken on as time and resources allow.

Aspiration 1 – Action & Key Performance Indicators (KPI) Table

Action	KPI	Timeline
1A - Meet with prior, existing and new collaborators to strengthen connections	● Develop a list of current and future opportunities for collaboration	By Dec. 2024
1B - Contribute to collaborative research output	● Serve as co-authors on at least two collaborative papers per year	Two by Jan. 2025; two by Jan. 2026

Aspiration 2 – EDUCATION: To make bioinformatics broadly accessible by building capacity with researchers and students with different backgrounds and levels of skill in bioinformatics.

Context

BCBC engages in educational initiatives by offering bioinformatics consulting services and bioinformatics courses, as well as by contributing to outreach activities based at BTI.

Currently, BCBC offers two annually recurring courses: an introduction to bioinformatics for BTI's summer REU students, and an introduction to bioinformatics for members of the BTI community (Cornell and external participants are also welcome, though priority is given to members of BTI). Course materials are freely available on the course website for future use of attendees, as well as for any others who were unable to attend. In addition to these courses, BCBC has also historically assisted with outreach activities in conjunction with BTI's Education and Outreach Office.

Consulting services primarily occur as question-and-answer sessions during weekly office hour sessions. While attendance and participation in office hours is free, It is requested that there be acknowledgement of the BCBC's assistance in any resulting publications. For consulting requests that involve a greater commitment of time and effort from members of the BCBC beyond that which can be provided during office hours, the Director of the BCBC arranges the structure of the project with the client. Such requests then serve as the basis for research collaborations as covered by Aspiration 1. Such arrangements consider issues such as publications, authorship, server time, consultant time, possible future grant proposals, and fees.

Aspiration 2 – Action & KPI Table

Action	KPI	Timeline
2A - Develop new course offerings that meet emerging needs	● Develop list of emerging needs in the BTI community (incl. faculty, PGS) ● Offer new modules (e.g., machine learning) for summer REU program and for the BTI community (depending on identification of emerging needs) ● Develop and offer two international courses, initially in collaboration with partners in Colombia and Latin America	By Feb. 2025 Offer REU version during summer 2025 Offer first course by Feb. 2025; second by Sept. 2025
2B - Explore outreach activities	● Develop list of outreach opportunities where BCBC can assist BTI's Education and	By Dec. 2024

	Outreach office ● Assist with one outreach activity per year	One by Feb. 2025; one by Feb. 2026
2C - Raise awareness of the consulting service	● Make annual presentation about BCBC at PGS meeting ● Engage with HR's new employee orientations	One/year before Dec. Ongoing; at least once before Dec. 2024

Aspiration 3 – INFRASTRUCTURE: To meet current and future computational infrastructure needs.

Context

To enable its ongoing research and educational activities, the Center must maintain a suitably high level of computational infrastructure and support.

In terms of data storage, while some computational problems can be moved to the cloud, in some cases bandwidth limitations preclude bioinformatics applications from being run in a time-efficient and cost-efficient manner in that environment. The large amounts of data that are produced today, however, need to be vetted, archived and backed up for future reference and analysis. Raw data from projects is submitted to the SRA when applicable and in-house backups are not necessary. Data from genome projects will be submitted to the relevant database. Intermediate data analysis files can be stored in the cloud and on an in-house storage system until submission to the relevant database upon publication, at which point they will typically be removed from the local system. On an ongoing basis, the Center needs to predict storage requirements for future applications, and also provide a backup capacity of commensurate dimensions.

In addition to storage, the Center provides access to servers for analyses. BCBC currently manages four servers (‘william’, ‘boyce’, ‘thompson’, and ‘mcclintock’). As noted hereinabove in the context of collaborative research, these servers are freely accessible to members of BTI, Cornell and external groups, with priority given to either those who have a formally established collaboration with the BCBC or those who are members of a BTI lab group or participate in a BTI-affiliated research project.

To complement the current server infrastructure, the BCBC must plan for future needs, in terms of both analyses and storage space, and will continue working with BTI IT for assistance with system upgrades and maintenance.

Aspiration 3 – Action & KPI Table

Action	KPI	Timeline
3A - Maintain high-level of quality in existing resources	● Complete OS upgrades for all BCBC servers to Ubuntu 24.04 LTS (and corresponding kernel upgrades) ● Implement three new pipelines and workflows for common analyses (incl. HTP analyses)	By Oct. 2024 Aug. 2024 - Feb. 2025
3B - Prepare for emerging bioinformatics needs	● Consult BTI community about demand for bioinformatics capabilities ● Attend at least eight relevant	By Dec. 2024 By Feb. 2026

	seminars or conference sessions for new developments ● Assess cost-benefit of acquiring and maintaining GPU resources for approaches that use ML (e.g., basecalling, HTP)	Aug. 2024 - Jan. 2026

Aspiration 4 – FUNDING: To attract new and diverse sources of funding (to stimulate research, education, and infrastructure initiatives).

Context

The Center will provide an opportunity for attracting new funds to BTI and will work with the development and grants offices at BTI, as well as with research collaborators, to raise funds to support the Center's activities from federal agencies, foundations and private donors. The actions and KPIs listed below are tied, either in specific or general terms, to actions and KPIs in aspirations 1-3 above.

Aspiration 4 – Action & KPI Table

Action	KPI	Timeline
4A - Identify and make BCBC available to participate with and enhance grant applications	● Assist with completion of the BTI-wide compilation of funding opportunities (per BTI strategic plan) ● Compile subset of opportunities where BCBC could enhance applications	Complete by end of 2024 Complete by Feb. 2025
4B - Develop new collaborative research areas with members of BTI and external collaborators	● Contribute to and support at least two grant submissions per year	Two by Feb. 2025 Two by Feb. 2026
4C - Develop international course offerings as source of funds	● Arrange fee-sharing agreement with Latin American partners	By Feb. 2025, or earlier pending implementation of first course
4D - As demand grows, provide support HTP facility's clients	● Develop fee-sharing arrangement with BTI HTP facility	Draft by Feb. 2025