29 Administration

29.1 Organizational Structure and Staff Responsibilities

29.1.1 Organizational Structure

To facilitate the flow of information from researchers (TRD-based research), collaborators (DBPs), and users into Center software development, and to support the DBPs and collaborators in the use of Center software, the Center is organized into functional groups. The six functional groups within the Center are: the four Technical Research and Development (TRD) Cores [specifically, Image Based Modeling (IBM), Visualization (VIS), Simulation (SIM), and Estimation (EST)], the Center Infrastructure Group, and the Executive Committee.

With guidance from the External Advisory Board (EAB), the Center Director and Executive Committee oversee the four TRD cores and DBPs. The co-Directors oversee the Technical Manager in coordinating Center research, development, and collaboration activities at a more detailed, day-to-day level. The Technical Manager coordinates the interactions between TRD cores and the Center’s Infrastructure group, while also advocating Center collaborator and user needs. The Technical Manager and the heads of each TRD or DBP serve as contact points for Center collaborators. The Executive Committee sets new research and development directions for the Center and is comprised of the Center Director and co-Directors, Technical Manager, the heads of each TRD, and the head of the Center administration (see Figure 29.1.1). Finally, the Center Director is responsible for the operation of the entire Center and interacts with the External Advisory Board and NIH-NCRR program managers to obtain advice/feedback and to update them with status information.

Figure 29.1.1 depicts the working interaction between the TRDs, DBPs, external users, and the Center Infrastructure Group. The Center Infrastructure Group, which includes software development, receives research results from the four TRD cores and translates those results into software both for the DBPs and eventually for external distribution via supported Center software. The software is then disseminated, along with user documentation, and supported within the Center Infrastructure Group. The Center’s Infrastructure Group interacts with other users and Center collaborators to field problems, process new development requests, and distribute Center information via the Center’s web site. The Center Infrastructure Group is staffed with trained software development personnel and directed by the Center’s Technical Manager.

The organization and management of the Center has developed over the 10 years we have had funding from NCRR. As such, many of our collaborators have visited and commented on our operations, such as, “...I am fortunate to have had the opportunity to see how you manage the Center, and how the Center team members work together. I can state unequivocally that this is the most well managed, productive Centers that I know of. The scientific and technical team is of extraordinary caliber. Team members work extremely well together. You deserve great credit for creating a highly positive and effective environment for the Center faculty and staff. This is a major reason why your Center has been so successful...”

- Raimond L. Winslow, Director Institute for Computational Medicine & The Center for Cardiovascular Bioinformatics and Modeling, Professor Biomedical Engineering, Computer Science, Electrical & Computer Engineering, Health Care Informatics and Medicine, Johns Hopkins University

29.1.2 Resource Staff Responsibilities

Dr. Chris Johnson, the Center Director, will continue the role of overseeing all aspects of the Center’s research and development efforts, as well as regularly interacting with the External Advisory Board and NIH Program Manager.

Drs. Robert MacLeod and Ross Whitaker, the Center co-Directors, will assume the responsibilities for the day-to-day operation of the Center and direct the Technical Manager in coordinating the Center’s expanding
29.1.3 TRD Leadership:

Each TRD team, led by a senior faculty member, will have a fully funded or partially funded post-doctoral fellow and graduate student as team members (see section 1.2 for details). Each TRD will also have direct support from the Infrastructure Group.

29.1.3.1 Image Based Modeling

Dr. Ross Whitaker will lead the Image Based Modeling Core. He will direct the research activities of a post-doctoral fellow and a graduate student in research and development. The research activities will include all areas involving the manipulation of image-based data, the extraction of structure from these data, and the construction of geometric models from either images or other sources of structural information (e.g. point clouds from a three-dimensional digitizer). This core represents the typical starting point for an analysis, simulation, or visualization of spatially distributed data. The results of this group’s research will feed into the software development group for inclusion into software tools disseminated to users, such as ShapeWorks.

29.1.3.2 Simulation

Dr. Robert MacLeod will lead the Simulation Research effort. Dr. MacLeod will lead a post-doctoral fellow and a graduate student in aspects of biomedical simulation. The goals of this TRD are to perform research and
development leading to a complete set of software tools for modeling and simulating the function of biomedical systems within the scientific scope of the Center and its collaborators. Additionally, Dr. MacLeod will continue the Center’s investigations on forward and inverse problems. The goals of this TRD will be pursued using feedback from collaborators and the collaborative efforts of the other three TRD cores in investigating new simulation techniques. The results of this group’s research will feed into software development for inclusion into the SCIRun problem solving environment.

29.1.3.3 Estimation

Dr. Dana Brooks will lead the Estimation Research effort. Dr. Brooks will lead a partially funded post-doctoral fellow and a fully funded graduate student at Northeastern University in aspects of estimation of biomedically meaningful parameters and values which are either outputs of the other CIBC TRDs or are needed as inputs or parameters for those TRDs. This includes both direct estimation from data and “indirect” estimation via solutions to inverse problems. The work from this TRD will also feed into the SCIRun problem solving environment.

29.1.3.4 Visualization

Dr. Chris Johnson will lead the Visualization TRD. He will direct the research activities of a partially funded post-doctoral fellow on issues relating to the visualization of biomedical data. The goals of this core are to develop and implement advanced, efficient, high-performance algorithms and software for visualizing large, spatially distributed and/or time varying data sets. In pursuit of these goals, Dr. Johnson will rely on feedback from collaborators and users about their data visualization needs. The results of his group’s research will feed into the software development group for inclusion into software tools for dissemination, such as ImageVis3D.
29.1.3.5 Infrastructure Group

The Technical Manager, who we are actively recruiting, will lead the Infrastructure Group. Our past Technical Managers have had bioelectric backgrounds with experience in both software development and biomedical computing, we are recruiting a similarly experienced person for this critical position. He or She will direct the development, testing, deployment, and support of the various software systems offered by the CIBC and oversee two partially funded software developers. This group will perform Center Support as shown in Figure 29.1.1, in addition to developing, testing, documenting and maintaining CIBC software. The Technical Manager’s group will integrate results from the TRDs and DBP work into Center software, relying on feedback from collaborators and the resource co-Directors for workload prioritization. Additionally, the Technical Manager has significant responsibilities in working with DBPs and collaborators in both technical and scientific domains.

29.2 Resource Operating Procedures

The resource operating procedures provide the Center with the optimal organizational infrastructure to achieve its mission:

1. Conduct technical research in advanced image based modeling, simulation, estimation, and visualization methods for biocomputational problems that have wide applicability in experimental, research, and clinical applications in the biomedical sciences.

2. Develop and disseminate state-of-the-art, well-documented software for computational image and geometry processing, mathematical modeling and simulation, mathematical estimation, and visualization for basic and clinical research.

3. Train new and experienced users in the software tools developed at the Center and provide research opportunities for undergraduate and graduate students and post-doctoral fellows.

4. Service our collaborators and general software users using the various support mechanisms available to the Center.

29.2.1 Operating mechanisms

Built on the organization described above, we will continue to use the following mechanisms to ensure efficient operation for the proposed continuation of the Center:

Communication mechanisms: To foster communication among members of the group, we will continue to make extensive use of electronic mail and web-based communications. Specifically, we will continue using established electronic mailing lists, bug reporting systems, and wikis for the project and collaboration groups, and, where necessary, assisting collaborators in establishing additional email links with the Center. As Internet-based technology develops and improves other forms of communication (e.g. teleconferencing and audio/video links), we will investigate their utility.

Weekly Center meetings: Select members of the proposed Center will meet weekly, including the Infrastructure Group and Executive Committee, to discuss progress and planning for all projects.

Project meetings: The TRDs will conduct their own meetings to discuss specific technical details relevant to the project area.

Software development and dissemination meetings: The co-Directors and Technical Manager will continue to meet weekly with the Infrastructure Group, regarding software development and dissemination. This meeting has proven very useful in keeping the development of the Center software linked to the needs of the DBPs and Center collaborators.

Collaborator contacts: Each DBP has an assigned Center member as the primary contact. The co-Directors and Technical Manager will coordinate collaborator communications and projects, but the primary contact is responsible for maintaining responsive communications and coordinating Center personnel working on co-developed projects.
Collaborator seminars: To educate the entire Center about collaborative projects, we will continue to have regular seminars by collaborators or their contact person within the Center (see Section 27.4). The goal of these seminars is to describe the particular DBP project, its current status, and solicit input on any project obstacles, and to suggest new directions for the project.

Annual External Advisory Board meeting: Each year we will host a meeting of the Resource External Advisory Board with the entire Center staff (see Section 29.3). These meetings will include extensive presentations of progress and planning for the Center research and collaborative projects.

29.2.2 Prioritizing and Selecting DBPs, Collaborative Projects, and Service Projects:

DBP selection and prioritization are decided within the Center’s Executive Committee, with advice from our EAB. Several criteria are used for selection including: potential impact in the field of the collaborator and in the fields of the Center, fit with our TRDs, required Center resource, and commitment of the DBP collaborator. Collaborative projects are selected using a similar criteria to that of DBP selection with the added criteria of capability of the collaborator for potential incorporation of the Center methods and software within their research.

DBP and Collaboration Life Cycle During the 2005-2009 timeframe of the Center we implemented a new scheme that places each collaboration and DBP into a management process we call a “collaboration life cycle”. The motivation for such a scheme came from the challenge of providing adequate and appropriate attention and support to each of a number of parallel projects and ensuring that each progresses as it should. This approach to collaborations allows us to effectively manage a large number of high quality collaborations, effectively allowing us to: adjust the level of attention the Center pays to a particular project, add new projects, and occasionally even minimize the ongoing support of a project.

![Collaboration Life Cycle Diagram]

Figure 29.3: Collaboration Life Cycle. To maximize the impact of our Center, we will actively manage new collaborative projects through a maturation process, guiding them from nascent ideas to successful results.

The basic concept of a collaboration life cycle is that each collaboration progresses through a set of stages (as depicted in Figure 29.3), beginning with discussions between the Center and the collaborator about possible projects of mutual interest. From there, a project would pass through evaluation, planning, implementation, testing, and review phases until it reaches a mature phase that requires little more than ongoing maintenance and upgrades. For many collaborations, the goal will be to secure independent funding that is based on the progress that the Center makes possible; such funding allows the Center to support scientific and/or technical staff—or portions thereof—who can dedicate their time to the collaboration. In this way, we hope to continuously grow the impact of the Center and allow the Center to benefit from a diverse set of scientific contacts.

The stages of the collaboration life cycle and their characteristics are briefly stated below, more detailed descriptions are available in Section 14.1:

- Initial discussion
• Evaluation of needs/match
• Preparation of proposal
• Evaluation of the proposal
• Implementation phase
• Evaluation, monitoring, and review
• External funding

By implementing this life cycle management of the collaborations, we hope to maximize the impact that we can achieve from the Center's resources and capabilities. The more effective the management of all phases of collaboration can be, the more likely the Center will be a success.

29.3 External Advisory Board

To ensure the overall success of the research and development goals of the CIBC, we have assembled an External Advisory Board consisting of top scientists, engineers, and clinicians.

Mr. William Lorensen, Chairman: Before retiring, Bill Lorensen directed the Electronic Systems Laboratory as a Coolidge Fellow at GE's Corporate Research and Development Center in Schenectady, New York. Mr. Lorensen has broad expertise in computer graphics and scientific visualization for medical applications from both academic and business perspectives.

Dr. Mark Ellisman: Dr. Ellisman is Professor of Neurosciences and Bioengineering and Director of the National Center for Microscopy and Imaging Research (NCMIR) at the University of California San Diego. Mark's research uses multi-scale imaging of the nervous system to explore how higher order structures such as cellular networks are assembled out of finer building blocks such as dendritic and axonal architectures. His research projects include many aspects of cellular, molecular, and developmental neurobiology: mechanisms of intracellular transport in neurons; interactions between axons and myelinating glia; aging processes in the central nervous system; cellular interactions during nervous system regeneration; molecular differentiation of excitable membranes, ion channels, neurotransmitter receptors and transmembrane ion pumps; structural changes in axons and synapses associated with changes in electrophysiological properties.

Dr. James Gee: Dr. Gee is an Associate Professor of Radiologic Science and Computer and Information Science and a co-Director of the HHMI-NIBIB Integrated Graduate Training Program in Clinical Imaging and Informational Sciences. Jim's major area of interest is biomedical image analysis and computing, with active research in all of the quantitative methods represented, including segmentation, registration, morphometry and shape statistics, as applied to a variety of organ systems and all of the major and emerging modalities in biological/biomaterials imaging and in vivo medical imaging.

Dr. John George: Dr. George heads the Biophysics Division at the Los Alamos National Laboratory, where he has principal responsibility for the development of analytical and computational procedures for functional mapping of the brain. Dr. George's area of expertise is EEG and MEG modeling and simulation. He has devised methods for combined analyses of MEG and MRI data and is Principal Investigator on an NIH funded Human Brain Project grant to develop methods and software tools for such work.

Dr. Peter Hunter: Dr. Hunter is a Professor of Engineering Sciences and Director of the Bioengineering Research Group at the University of Auckland. His research expertise is in Computational Biomechanics and Bioelectricity, with an emphasis on finite element modeling and simulation and the development of integrated software environments for solving large scale engineering problems.

Dr. Ken Joy: Professor Joy is the Director of the UC Davis Institute for Data Analysis and Visualization. His interests include visualization, geometric modeling and computer graphics; multi-resolution methods in scientific visualization, free-form solid models, statistical methods applied to visualization and graphics algorithms, and the applications of computer graphics and visualization to scientific and engineering disciplines.
Dr. Ron Kikinis: Dr. Kikinis is the Director of the Surgical Planning Laboratory of the Department of Radiology, Brigham and Women’s Hospital and Harvard Medical School, Boston, MA, and a Professor of Radiology at Harvard Medical School. His expertise includes the development of clinical applications for image processing, computer vision and interactive rendering methods.

Dr. Eric Voth: Dr. Voth is a senior researcher at Endocardial Solutions Incorporated (ESI). ESI markets a clinical diagnostic system that reconstructs cardiac potential fields from measurements on a 64-electrode balloon catheter.

Dr. Rai Winslow: Dr. Winslow is a Professor of Biomedical Engineering and the Director of the Center for Cardiovascular Bioinformatics and Modeling at Johns Hopkins University, School of Medicine. His expertise includes the computational modeling of signal transduction, mitochondrial energetics, ion channel function, and intracellular calcium dynamics in cardiac myocytes and vascular endothelial cells.

The External Advisory Board will meet annually at the University of Utah to review the Center’s progress and to advise the Center on future research and development directions. For the External Advisory Board’s most recent progress report see Section 8.