CASE WESTERN RESERVE UNIVERSITY EST. 1826

Faculty Senate
Executive Committee
Thursday, September 16, 2010
11 am – 1 pm – Adelbert Hall, M2

AGENDA

11:00am	Approval of Minutes from the April 16, 2010 Executive Committee meeting, *attachment*	A. Levine
	President's Announcements	B. Snyder
11:05am	Provost's Announcements	B. Baeslack
11:10am	Chair's Announcements	A. Levine
	Approval of FSCUE vice-chair	A. Levine
11:15am	Mentee Handbook *attachment*	G. Wnek
11:25am	Internal/External Review of ITS and Updated Charge to FSCIR *attachments*	K. Lyytinen
11:40am	New MS and PhD in Systems Biology and Bioinformatics *attachment*	G. Wnek M. Chance
11:55am	New MS in Medical Physiology *attachment*	G. Wnek T. Nozek
12:05pm	Update from joint Provost/Faculty Senate *ad hoc* Committee on a University Common Undergraduate Core Curriculum	G. Chottiner D. Feke
12:15pm	Discussion: What is the best process to engage the UPF in discussions whether or not CWRU should have a General Education Requirement?	A. Levine

Faculty Senate Executive Committee
Minutes of the September 19, 2010 meeting
Adelbert Hall, Room M2

Committee Members in Attendance

Bud Baeslack	Alan Levine	Jonathan Sadowsky
Jessica Berg	Ken Loparo	Barbara Snyder
Gary Chottiner	Diana Morris	Sorin Teich
Sue Hinze	Carol Musil	Liz Woyczynski

Committee Members Absent

Roy Ritzmann

Others Present

Mark Chance	Kalle Lyytinen	JB Silvers
Don Feke	Jim McGuffin-Cawley	Susan Tullai-McGuiness
Faye Gary	Tom Nosek	Gary Wnek

Call to Order and approval of minutes

Professor Alan Levine, chair, Faculty Senate, called the meeting to order at 11am. A senator requested that the April meeting minutes reflect the extra April meeting required to consider and draft the resolution concerning the Faculty/Senate *ad hoc* Committee on a University Common Core Curriculum. A revised version of the April 13, 2010 minutes of the Executive Committee will be presented for final approval at the November 2010 Executive Committee meeting.

President's announcements

President Barbara Snyder noted the recent pedestrian safety issues at the Euclid Avenue and Adelbert Road crosswalks. The university will widen the sidewalks to accommodate the large pedestrian crowd that gathers at the intersection when students are changing classes. The city did not allow the university to keep two crosswalks across Euclid Avenue at the Adelbert Road intersection. The university will keep an officer stationed at the intersection to direct car and pedestrian traffic to ensure safety.

Provost's announcements

Provost Bud Baeslack commented that 2010-2011 will be a busy year for the Faculty Senate. The Senate will consider a university General Education Requirement (GER) and the final report of the Budget System Review Committee. Provost Baeslack indicated that one of his priorities this academic year is to restructure the Faculty Senate Budget Committee. Prof. Levine, chair, Faculty Senate, mentioned the release of the National Research Council's comparative report on graduate programs across the country. The Provost Baeslack advised that the comparisons will be complex and unfortunately some of the data used in the report will be outdated.

Chair's announcements

Prof. Levine, chair, Faculty Senate announced that Prof. Larry Parker, Accountancy, Weatherhead School of Management, who served in the former University Undergraduate Faculty (UUF), has agreed to serve as vice-chair for the Faculty Senate Committee on Undergraduate Education (FSCUE). Upon motion, duly seconded, the Executive Committee approved Prof. Parker as the FSCUE vice-chair for 2010-2011.

Prof. Levine presented the proposals from the College of Arts and Sciences (CAS) to: 1) split the Department of Theater Arts into a Department of Theater and a Department of Dance, and to 2) merge the Departments of Communication Sciences and Psychology into the Department of Psychological Sciences. There was some discussion whether or not to have the proposals reviewed by any of the standing committees of the Faculty Senate. The Committee on By-laws will make sure the CAS proposals comply with the Faculty Handbook, and the committee will consider the necessary updates to the by-laws of the College of Arts and Sciences. Upon motion, duly seconded, the Executive Committee voted to approve the CAS proposals for final review by the Faculty Senate and final approval by the Board of Trustees.

Prof. Levine announced the formation of the *ad hoc* Task Force for the Joint Provost/Faculty Senate *ad hoc* Committee on a University Common Undergraduate Core Curriculum. The task force is chaired by Vice Provost Don Feke and Prof. Gary Chottiner, chair-elect, Faculty Senate. Currently, the task force is collecting relevant information about general education requirements (GER) at other universities. On October 1 the task force will present its research findings to the entire campus, and the FS will organize discussions about a possible CWRU GER. It was asserted that the current research was necessary before faculty could effectively undertake any discussion about whether or not a CWRU GER was desirable. There was general agreement that establishing a process for faculty to consider future amendments to a possible GER was equally as important as deciding on the content of a possible GER.

Mentee Handbook

Prof. Gary Wnek, chair, Faculty Senate Committee on Graduate Studies presented *A Mentee Guidebook for Students*, drafted by graduate student senators, and reviewed, edited and endorsed by the Graduate Student Senate and the Faculty Senate Committee on Graduate Studies. The Mentee Handbook is a companion to *A Mentoring Guidebook for Faculty*, endorsed by the Faculty Senate in 2009-2010. Prof. Alan Levine, chair, Faculty Senate lauded the tremendous effort by CWRU graduate students to publish these two important handbooks. Upon motion, duly seconded, the Executive Committee approved *A Mentee Guidebook for Students* for final endorsement by the Faculty Senate.

Internal/External Review of ITS and Updated Charge to FSCIR

Prof. Kalle Lyytinen, chair, Faculty Senate Committee on Information Resources presented the internal and external review reports requested by the Faculty Senate Executive Committee in April 2010. As part of its efforts to address the issues presented in these reports, including issues of governance and budgets, the division of Information Technology Services worked with the Committee on Information Resources to update the committee's charge. The scope of the charge and some of the terms used were outdated. The updated charge was approved by the Faculty Senate Committee on By-laws in April 2010. Upon motion, duly seconded, the Executive Committee approved the updated charge to the Faculty Senate Committee on Information Resources, to be called the Faculty Senate Committee on Information and Communication Technology, for final approval by the Faculty Senate.

New MS and PhD in Systems Biology and Bioinformatics

Prof. Gary Wnek, chair, Faculty Senate Committee on Graduate Studies and Prof. Mark Chance, Proteomics, School of Medicine presented the proposed new master's and PhD degrees in Systems Biology and Bioinformatics. The proposed degree programs formalize desired programs of study that have proven difficult

for graduate students to pursue through an informal undertaking of combined studies and research in the affiliated departments. Case Western Reserve University will be among the first universities to offer such degree programs through its School of Medicine. The degree programs will fully immerse students in the study of both scientific concepts and computation. Students will seek funded lab positions, secured by signed contracts, in any of the affiliated departments or centers. Prof. Alan Levine, chair, Faculty Senate requested that an official letter of support be solicited from the department of Electrical Engineering and Computer Science, Case School of Engineering. Upon motion, duly seconded, the Executive Committee approved the proposed degree programs in Systems Biology and Bioinformatics for approval by the Faculty Senate, and final approval by the Board of Trustees.

New MS in Medical Physiology

Prof. Gary Wnek, chair, Faculty Senate Committee on Graduate Studies, and Prof. Tom Nosek, Physiology and Biophysics, School of Medicine presented the proposed new master's degree in Medical Physiology. Pre-med students who need to strengthen their preparation in the sciences before being admitted to an MD program can seek a master's degree in Medical Physiology. The educational program is mostly didactic, and less research oriented. It's a self-pay program; no financial aid is available. Letters of support from the chair of the Physiology and Biophysics Department and the dean of the School of Medicine are required. Upon motion, duly seconded, the Executive Committee approved the proposed degree program in Medical Physiology, if accompanied by the required letters, for final approval by the Faculty Senate and the Board of Trustees.

The meeting of Executive Committee was adjourned at 12:05pm.

APPROVED
by the
FACULTY SENATE EXECUTIVE COMMITTEE

ELIZABETH H. WOYCZYNSKI
SECRETARY OF UNIVERSITY FACULTY

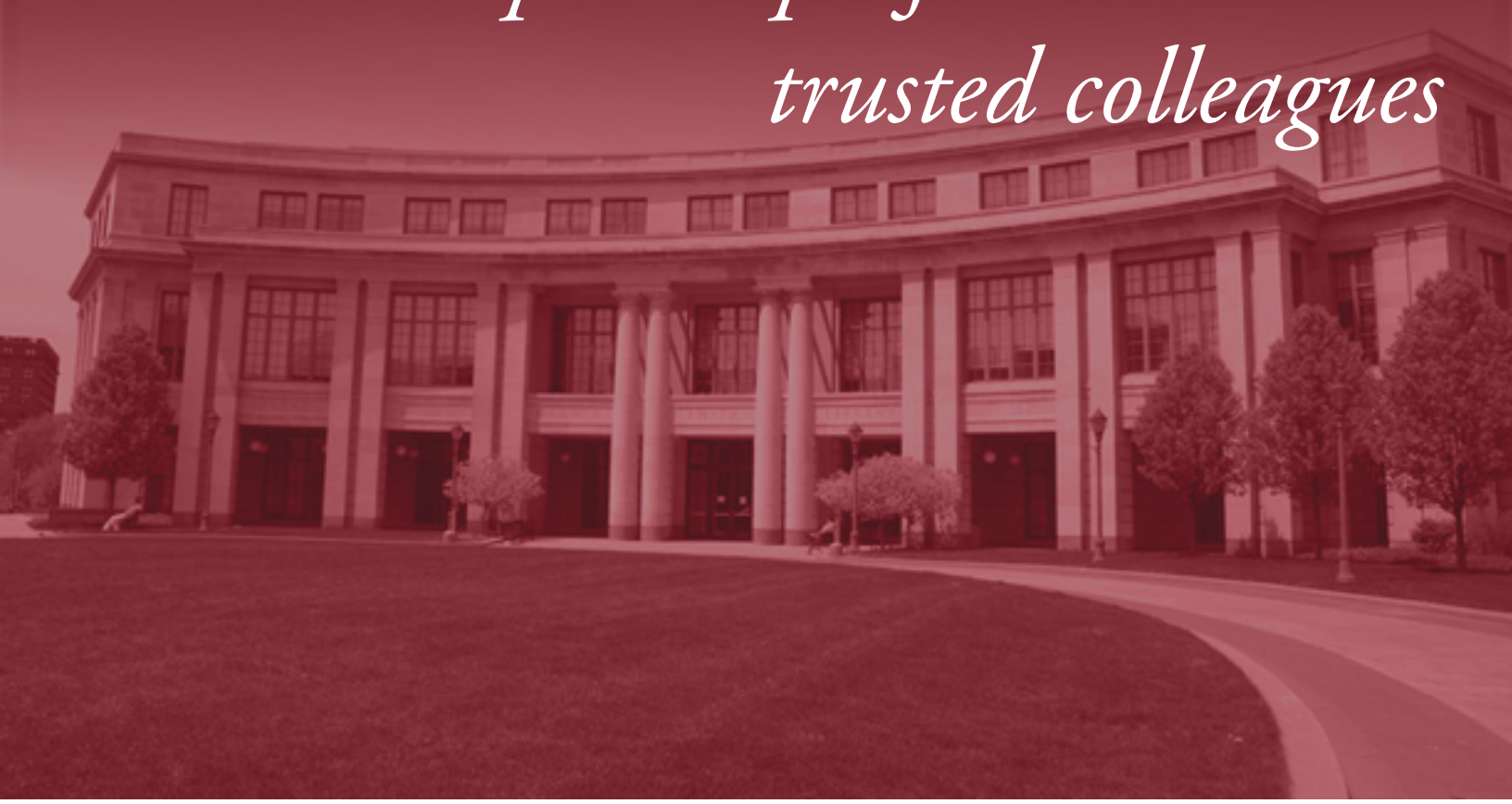
GSS

The Graduate Student Senate of
Case Western Reserve University

A PUBLICATION OF THE GRADUATE STUDENT SENATE | CASE WESTERN RESERVE UNIVERSITY

A Mentee Guidebook for Students:

how graduate students can become respected professionals and trusted colleagues



2008-2009

A Mentee Guidebook for Students:

How Graduate Students Can Become Respected Professionals

and Trusted Colleagues

A Publication of

2008-2009

Subcommittee on Mentoring

This Guidebook is a companion to *A Mentoring Guidebook for Faculty*, a resource produced by the 2007-2008 GSS Committee on Mentoring (GSS-MC). It was created by the following members of the 2008-2009 GSS-MC and finalized by the 2009-2010 GSS-MC:

Sarah Busch, *Neurosciences*

Rachel Bryant***, Sociology

Antje Daub, *Sociology*

Kathleen Courtney***, *Nursing School*

Angela Filous, *Neurosciences*

Timothy Franke***, *Control Engineering*

Cassie Freudenrich, *English*

James Harris*, *Biomedical Engineering*

Cara Henry, *Biomedical Scientists Training Program (BSTP)/Biology*

Brett Hoover**, *Biology/Biomedical Engineering*

Sarah Kyker**, *Biology*

Christina Larson, *Art History*

Elaine Lee, *Biomedical Engineering*

Lucas O'Donnell, *Materials Science & Engineering*

Kristin Sullivant***, *Biomedical Engineering*

Craig Rudick**, *Astronomy*

Kevin Speer**, *Electrical Engineering & Computer Science*

* Committee Chair 2008-2009 and headperson for this Guidebook

** Denotes returning member from 2007-2008

***Committee Members 2010

Faculty Reviewers

To get the faculty perspective, the GSS Subcommittee on Mentoring contacted the following group of exemplary Case Western Reserve University faculty mentors, who volunteered to review and offer suggestions on our draft document. The committee cannot possibly thank you enough for your outstanding service, suggestions, advice, and enthusiasm, all of which vastly improved this Guidebook. Each of you truly epitomizes the word 'mentor'.

Robert Brown, *Physics*

Heath Demaree, *Psychology*

Kimberly Emmons, *English*

Christopher Flint*, *English*

Gary Galbraith, *Theater & Dance*

John Lewandowski, *Materials Science & Engineering*

Christopher Mihos, *Astronomy*

Sandra Russ, *Psychology*

Elizabeth Tracy, *Mandel School of Applied Social Sciences*

Athena Vrettos, *English*

Christian Zorman, *Electrical Engineering & Computer Science*

*Final Faculty Reviewer

Acknowledgments

Throughout the course of drafting this Guidebook, we received suggestions, advice, and encouragement from many members of the Case Western Reserve community. We would like to genuinely thank everyone who took an interest in our project and helped us along the way; without your insight and support, the successful completion of this project would not have been possible. In particular, we would like to thank the following people:

Colleen Barker-Williamson – Director of Thwing Center for Program and Leadership and Executive Administrator Undergraduate Student Government (USG) and Graduate Student Senate (GSS)
Van Bray– Coordinator of E-Learning and Assistive Technology, Educational Services for Students (ESS)
Thalia Dorwick – Chair, Academic Affairs and Student Life Committee, CWRU Board of Trustees
Denise M. Douglas – Senior Associate Dean, School of Graduate Studies and Office of Postdoctoral Affairs
James Eller– Associate Director, Academic Resources, Educational Services for Students
Joseph Gutowski– Associate Director, Student Activities and Leadership
Marilyn Mobley– Vice President, Office of Inclusion, Diversity and Equal Opportunity
Rhonda Moore–Program Coordinator, Educational Services for Students (ESS)
Kim Paik– Assistant Director, Graduate Career Services
Charles Rozek – Vice Provost and Dean, School of Graduate Studies and Postdoctoral Affairs
Jennine Vlach – Training and Operations Manager, The Freedman Center (KSL)
Members of the President's Advisory Council on Women (PACOW) and the President's Advisory Council on Minorities (PACM)

Financial support was provided in its entirety by the Graduate Student Senate.
Finally, we would like to extend special appreciation to the University of Michigan's Rackham School of Graduate Studies for their pioneering and inspirational work upon which this document is largely based. (*"How to Mentor Graduate Students: A Guide for Faculty at a Diverse University,"* 2006)

Remarks from President Barbara R. Snyder

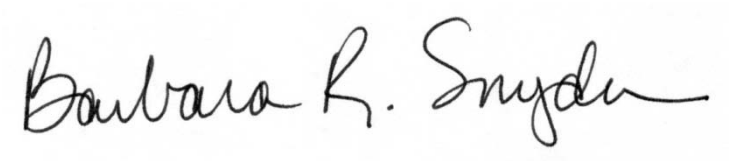
"If I have seen further than others, it is only by standing on the shoulders of giants."

Sir Isaac Newton

Your Graduate Student Senate (GSS) has demonstrated remarkable wisdom in identifying mentoring as a key priority in recent years. In the best of these relationships, faculty are able to provide invaluable advice, insight, and support for students. Each has faced similar questions and uncertainty on their own academic journeys; more, they now have the added perspective allowed by time and experiences as professors themselves.

The GSS began this project by developing an outstanding handbook for mentors. Now they complete it with one for students. As the committee members who developed this document well know, effective mentoring rarely happens by chance. Just identifying appropriate mentors involves careful reflection, wide-ranging conversations, and research regarding faculty members' academic interests. From there the task of establishing and maintaining high-functioning relationships becomes even more complex. Ultimately, though, the effort invested has the potential to reap enormous rewards. I commend the committee for once again producing a most thoughtful piece, and encourage every graduate student to review it with care.

Sincerely,



Barbara R. Snyder
President

Insight from the 2008-2009 President of the GSS

Simply, this is a guide written by graduate students for graduate students. While a trite expression, it sums up the spirit of the guidebook: the best thing you can do for your graduate experience is be proactive and consult others about the lessons they have learned.

Graduate work can often be a solitary experience, but rest assured there are others that have gone before you and can help you. We call these people MENTORS. Your MENTORS, and yes there will be more than one, should be a source for information, not the sole, unquestionable source. Be prepared for meetings and discussions since other people are busy too. Think about questions and anticipate their answers, and soon you will be ready to be a mentor for the next person.

Best Wishes,

James P. Harris

GSS President and Chair Mentoring Committee, 2008-2009

Table of Contents

A Quick Summary

- The process of mentoring includes a variety of ways of assisting and supporting students throughout their graduate education and beyond (p. 1).
    - Not all mentors are advisors and not all advisors are mentors.
- Students who have mentoring relationships have higher productivity levels, more involvement in their departments, and greater overall satisfaction with their program (p. 2).
- It is important for a student to have more than one mentor, and often to have mentors from a variety of fields (p. 3).
- Considerations when forming a mentoring team:
    - Conduct a self-appraisal. (p. 7)
    - Identify potential mentors. (p. 8)
    - Don't limit your options. (p. 9)
    - Have realistic expectations. (p. 10)
    - Clarify roles and responsibilities. (p. 10)
- If problems arise, be sure to address the situation with the mentor immediately. Be proactive in seeking a solution (p. 23).
- Mentees of diverse populations
    - Women graduate students (p. 37)
        - The competitive and critical atmosphere inherent to graduate programs is unsettling for many graduate students. Discuss possible remedies with senior graduate students or mentors.
    - Lesbian, Gay, Bisexual, and Transgender Graduate Students (p. 40)
        - Conversations can be conducted with the unconscious assumption that everyone is heterosexual. Be inclusive with language and actions. Address potential remedies with senior graduate students or mentors.
    - Racial and Ethnic Minority Graduate Students (p. 43)
        - The success of students depends on a good mentor-student relationship. Utilize the Office of Multicultural Affairs and Division of Student Affairs to support mentoring relationships. Discuss potential remedies with mentors or senior graduate students.
    - International Graduate Students (p. 46)

- The Office of International Student Services (ISS) can help to address the cultural differences and language differences common for international students. Decide whether to discuss with other international mentors and national students about potential cultural or social challenges.

o Graduate Students with Family Responsibilities (p. 49)

- Be assertively proactive about dealing with conflicts with studies and research in family matters. Discuss your family responsibilities with your mentors in advance in order to better juggle both.

o Graduate Students Who Have a Disability (p. 53)

- Consult the Office of Disability Resources in Educational Services for Students (ESS) about current resources on campus. Decide whether to inform all mentors who provide you with a grade or a pass and fail about your disability in advance.

o Graduate Students Who Have Different Religious Beliefs (p. 56)

- Communicate with faculty regarding situations related to religious beliefs so that solutions can be created.

PART ONE

Developing Relationships with Mentors

I. What Is Mentoring?

"It seems to me that mentoring is a process that should be continually negotiated by the participants. Good mentors are the people who cross our paths at crucial moments, moments when we are ready to learn from their wisdom and experience. So at any given time, the best mentor may be the senior scholar who inspires you with her insight, the graduate student colleague who shares his classroom strategies, and/or the department assistant who takes the time to explain vital graduation paperwork. A good mentor - someone who possesses knowledge, experience, and the ability to explain both to novices in her field - is really only a small part of good mentoring. As a process, mentoring – perhaps counter-intuitively – implies a good measure of self-reliance: the "expert" can only tell you what has worked for her; you have to decide how that information and experience relates to your own hopes, dreams, and talents."

- CWRU Faculty Member

Mentoring involves an ongoing intellectual engagement between two individuals. In addition to contributing to one's academic and professional growth, the relationship can develop into one of mutual care and respect. Although there is overlap between the role of mentors and that of advisors in graduate education, not all mentors are advisors and not all advisors are mentors. Each department and school employs particular practices for academic and research advisors, and the focus of this guidebook is to address mentoring more generally.

The Council of Graduate Schools defines mentors in the following way:

Advisors, people with career experience willing to share their knowledge; supporters, people who give emotional and moral encouragement; tutors, people who give specific feedback on one's performance; co-operative supervisors, in the sense of moral leadership to whom one is apprenticed; sponsors, sources of

information about, and aid in obtaining opportunities; models of identity, of the kind of person one should be to be an academic (Zelditch, 1990; Jacobi, 1991, Crisp and Cruz, 2009; Rose, 2003; Brown and Trevino, 2006).

As Zelditch (1990) suggests, mentors engage in a constellation of activities that transcend just advising or simply guiding you through a project. Mentors support you throughout all aspects of your graduate careers and beyond. This is not to say that a single mentor can fulfill all of these roles (Rayborn, Denmark, Reuder, & Austria, 2010; Crisp and Cruz, 2009; Rose, 2003). Rather than trying to find one mentor who can support you in every way, it is better to seek out a number of faculty members, each of whom can provide you with one or more of these kinds of support (Jacobi, 1991; Kuh, Kinzie, Schuh, & Whitt, 2010). Indeed, it is to your benefit to have multiple mentors, each influencing you in his or her unique way.

II. Why is Mentoring Important?

"In addition to helping me negotiate the many hoops to be jumped on the way to the degree, my advisor has also given me sound professional advice, assisted me with conference and job preparation, and suggested strategies for balancing work and life issues. Without her guidance and support, I believe my progress would have been much slower and more difficult."

- CWRU Graduate Student

Being a mentee is one of the most important roles you will have as a graduate student at Case Western Reserve University. We encourage you to dedicate yourself to fostering a strong mentoring relationship with faculty members. Doing so will not only enhance your academic experience, but also your professional career. Research shows that students who have good mentoring relationships have higher productivity levels, a higher level of involvement within their departments, and greater satisfaction with their programs (Green & Bauer, 1995). This only underscores the importance of

developing strong mentoring relationships early in your graduate career. If you build a strong foundation through these relationships, it will contribute to your growth from student to colleague.

Mentoring can help facilitate your transition from undergraduate to graduate school. Unlike your undergraduate experience, where classes encouraged you to obtain knowledge, in graduate school your goal should also be to contribute knowledge to your field of study. Your coursework and the professional relationships you foster in graduate school with faculty and fellow students facilitate your entry into the scholarly community.

Mentoring goes beyond issues of professional competence. Many aspects of professional socialization and personal support are central to mentoring as well as to your professional life after graduation. In this latter stage, the mentoring cycle comes full-circle, and you may find yourself in the role of mentor—an opportunity to repay the benefits you received in your own former mentoring relationships.

The Importance of Finding Multiple Mentors

Although graduate work often emphasizes the mentoring role of an advisor, you should not limit yourself to one person as your sole mentor. It is very important to your graduate education that you have access to information from and the methodologies of a wide range of academic professionals, not just your departmental advisor. Having mentors outside of your immediate field of study can be extremely valuable in providing you with a broader perspective on your discipline than you might otherwise have. It can also be a source of fresh ideas, strategies, and methodologies.

Faculty members whom you consider to be part of your mentoring team should complement your academic interests. Such professors could share your methodological philosophy or study topics related to your research pursuits. Additionally, it is to your benefit to have a close relationship with at least three or four faculty members whose work you admire, and who are in turn knowledgeable about your work and can attest to its quality when needed for recommendations. Having multiple

mentors can also be helpful in the unfortunate instance that your advisor leaves the University or if irreconcilable issues develop between you and a faculty member.

Be creative about the people you include on your mentoring team. Although this Guide focuses on faculty mentors, we also encourage you to seek advice from your peers; advanced graduate students; departmental staff; retired faculty; faculty from other departments, colleges or universities; and professionals outside academia. All of these people can serve as part of your professional network. These individuals may not view themselves as a "team" in the traditional sense of the word; if you have selected them from varied fields or professional sectors, your mentors may not know each other closely, but they are still part of a larger professional network.

III. What are the Challenges and Rewards of Being a Mentor?

"The tangible benefits of mentoring, I suppose, involve having students of yours go on to have successful careers in the field, thus spreading the influence of your research and teaching. However, the intangible benefits seem much more compelling to me. It simply feels rewarding—in a deep human sense—to help others in the way you have been helped (or, I suppose in some cases, to try to improve upon the kind of help you yourself received). Many of the intangible rewards of mentoring are the same rewards of good teaching—having exciting intellectual contact with younger minds who bring fresh perspectives to the field. I get a real sense of accomplishment when a graduate student I've worked with writes a wonderful paper, gets it published, gives a great conference talk, or gets a good job at the end of their degree program. While the credit belongs entirely to the student, there is still great pleasure in feeling you were a small part of their success."

- CWRU Faculty Member

Mentors will often be experienced faculty members who have worked through the challenges you currently face and who have achieved what you hope to achieve. However, as a result of their qualifications, they are often very busy individuals who need to balance many demands on their

time. Here are just some of their responsibilities: teaching undergraduate and graduate courses; advising undergraduate and graduate students; serving as the advisor for student organizations; serving on dissertation committees; researching or working on creative projects; writing grants, books and articles; reviewing the work of students and colleagues; serving on departmental and university committees; attending professional meetings; and fulfilling duties for professional organizations in which they are involved.

The pace of these demands does not let up over time. Junior faculty members face the pressure of preparing for their tenure review, which means that they have to be engaged in an especially active research agenda. As faculty members become more senior, and as their national and international prominence increases, there is a concomitant rise in the requests for their time and energy (Tierney & Rhoads, 1994).

Despite all of their other commitments, the vast majority of faculty members find that mentoring graduate students is, in spite of the time it involves, one of the most rewarding of all their professional responsibilities. Faculty members benefit from mentoring graduate students in many ways, including the following.

- Acquiring research assistants whose work is critical to the completion of a research grant.
- Gaining collaborators for current or future projects and creating new support networks with other professionals in the field.
- Providing the personal satisfaction of knowing that the mentor has helped an emerging professional develop his/her potential.
- Creating opportunities for experienced mentors to strengthen their knowledge base and keep abreast of new techniques.
- Enhancing the leadership, teaching, coaching, and communication skills of mentors.

- Demonstrating professionalism and a commitment to their own personal and professional development as well as to that of their colleagues.
- Gaining increased professional stature by shaping future scholars.
- Promoting the professional recognition of mentors for their commitment to developing the talents of new professionals.

Mentoring is not a single task but rather a renewable source of intellectual, professional, and personal fulfillment and a gratifying means by which mentors can pass on the rich lessons they have learned throughout their careers. For these reasons, graduate students and mentors need to ensure that time is reserved for mentoring and that the time is well spent for both parties. Because one individual is rarely able to meet all of your mentoring needs, having just one person as a mentor may put too much pressure on a single relationship. As we have suggested, a mentoring network, in which a series of relationships meets different needs, may be a more realistic way of looking at mentoring.

IV. What Should You Consider When Forming a Mentoring Team?

"I've really benefited from being able to work on multiple projects with different professors. It's allowed me to learn a unique set of diverse skills which gives me a broader perspective and will make me more attractive to future employers."

- CWRU Graduate Student

Consider it *your* responsibility to seek out interactions with faculty members. It is unrealistic to expect a professor to approach you and offer to serve as your mentor. As you get started in your search for faculty mentors, try to look for a balance of both junior and senior faculty members. Each can be of assistance to you, although possibly in different ways. For example, while senior faculty might have more resources to assist you with networking, junior faculty might be more recently

familiar with the stresses and strains associated with being a graduate student. Also, as we have suggested, it is probably advantageous for you to find faculty members outside of your department with interests related to yours to act as additional mentors. This can serve a dual purpose, as your department will most likely require you to have someone outside your department to be on your dissertation committee.

It is not unusual for graduate students to feel hesitant about initiating contact with a faculty member to form a mentoring relationship. Especially in the early stages of graduate school, students often feel that they need guidance about how to choose possible faculty mentors. The following considerations should be helpful to you whether you are just starting to form a mentoring team or whether you already have one.

Conduct a Self-Appraisal

Start the mentor selection process by first conducting a critical self-appraisal. Reflect on what will help you to thrive as a graduate student. Use this information later on to match yourself with faculty or others who can provide you with what you need. The following are types of questions you should ask yourself.

- What are my objectives in doing graduate level studies?
- What type of training do I want and/or need?
- What are my strengths?
- What are my weaknesses?
- What skills do I need to develop?
- What kinds of research or creative projects do I want to explore?
- How much independent versus guided work do I want to do?

- What type of career do I want to pursue?

Identify Potential Mentors

You can identify potential faculty mentors within or outside your department using a variety of formal and informal strategies. Here are some suggestions.

Do your Homework

- Familiarize yourself with professors' work to gain a sense of their past and current interests and methodologies.
- Immerse yourself in departmental academic and social activities. Observe how faculty members interact with colleagues and graduate students.
- Enroll in or audit classes taught by the faculty members who most interest you. Attend their public presentations.
- Ask advanced graduate students about their advisors and mentors. Share your interests with other students and ask them for suggestions about whom you should meet.

Explore Mentors' Reputations with Graduate Students and Departmental Staff

When searching for a potential mentor or advisor, talk to other graduate students and departmental staff. These contacts may be able to provide you with information about a potential mentor from a perspective that the mentor cannot offer.

- Does the professor have a history of giving proper attention to his or her protégés?
- Can the professor provide such things as teaching and research opportunities, access to financial resources, guidance for completing your dissertation, access to professional networks, and assistance in career development?

- Have former graduate students of this professor completed their programs in a timely fashion?

- What other scholars have been mentored by the professor, and where do they stand within the field? Ask yourself if that is where you would like to be in a few years.

- Is the professor comfortable talking about issues that are of a personal nature?

- If you are interested in nonacademic careers, what is the professor's attitude toward such decisions? Is he or she interested in training and funding someone who is not necessarily going to stay in academia?

- Has the professor recently reduced or ended a student's (or multiple students') funding, and if so, was it for a fair reason?

- How active is the professor in managing his or her students' research by setting objectives, milestones and metrics?

Explore Mentors' Academic Work:

- Find out how much the mentors' academic work relates to yours. Additionally, find out about the mentors current workload and whether they are open to working with more students.

- Explore additional mentors who can help you with your academic goals.

Don't Limit Your Options

Research clearly shows that the most important keys to good mentoring are sharing mutual research interests and having good rapport (Atkinson, Neville, & Casas, 1991; Faison, 1996; Ragins and Scandura, 1991; Struthers, 1995). Although factors such as race, gender, nationality and sexual orientation are significant aspects of a person's identity, they are only some of the qualities you

should consider when selecting a mentor. Faculty members who are *different* from you in these ways can often have valuable insights into you as an individual and into your work. You do not necessarily need to limit yourself to finding mentors who are senior faculty members. Junior faculty may not have had as much national exposure and recognition as their senior faculty colleagues, but they can still be very effective mentors.

Have Realistic Expectations

In order for you to develop good mentoring relationships, you must be proactive. It is your responsibility to find and recruit the mentors who can help you achieve your goals. You also need to have a realistic idea about what any single mentor can do for you. Faculty members are more likely to respond to requests for specific types of assistance they know they can provide. Analyze what you need from a specific faculty member and explicitly ask for those things. Finally, remember that part of your task as a graduate student is to develop and demonstrate your abilities to be an independent scholar. If you ask for an *excessive* amount of help, your faculty mentors may feel that they are doing your work. What is felt to be excessive will vary by professor and by discipline. Discuss this with your advisors and your mentors if you have any concerns.

Clarify Roles and Responsibilities

Problems in mentorship most often develop because of misunderstandings about the expectations each side has of the other. Although you do not need to set up a formal contract, some people find it helpful to specify mutual agreements about their respective roles and responsibilities. Some of the expectations you will need to discuss and clarify, especially if your mentor is also your advisor and/or dissertation chair, include the following: availability (in person or in other ways), goals, meetings, feedback, reminders, and publishing. These are discussed in more detail in Section V: How Do You Develop a Relationship with Potential Mentors?

Before your first meeting with your mentor you should take time to clarify your goals. Develop a work plan that includes both short-term and long-term goals, as well as a timeframe for reaching those goals. At least once each semester (but preferably more often), contact your mentors to discuss your progress, as well as any additional training and experiences you need in order to achieve your goals.

What Are Mentors Looking For in a Mentee?

By considering the preceding items, you will have prepared yourself to identify an appropriate mentor. Before you arrange a meeting, take time to think about things from the faculty member's point of view so you can develop a healthy, two-way mentoring relationship.

Mutual Interests

Faculty members will want to know if you have interests similar to theirs. Share how your prior academic, professional, or personal experiences relate to their interests. Ask about their recent work and discuss with them ways in which these intersect with your own interests.

Compatible Working Styles

Your working style should complement that of your mentor in order to promote a good mentoring relationship. This does not mean you need to befriend your mentors—just that you should be aware of your potential mentor's methodology.

Motivation and Direction

Faculty members want motivated students who are eager to move on to the next level of their professional growth. State your goals as you currently see them. Ask about ways you can further explore these goals, what courses you should take, and whether you can assist with existing projects of the professor's or in the department. Remember that your work will be a reflection on your mentor's efforts.

Initiative

Be proactive. For example, seek further conversations with faculty members about issues discussed in class. Ask professors for suggestions about other people and experiences that will help you develop your skills and knowledge.

Professionalism and Collaboration

Work effectively with other graduate students in your department. This not only includes coursework; you should also plan group trips to professional conferences, as time permits. Professional conferences are effective venues for you to network with other students, professionals, and faculty members in your field of study.

Skills and Strengths

Demonstrate to professors why they should invest in you. Let them know what qualities you bring to this relationship—research abilities, language skills, creativity, analytical techniques, computer skills, willingness to learn, enthusiasm and commitment.

V. How Do You Develop a Relationship with Potential Mentors?

"My advisor and I have developed a great relationship over the years. I feel like I can bring any problem—from personal to academic to research—to either my research or academic advisors and get meaningful, helpful advice."

- CWRU Graduate Student

Finding a clear, open, and honest way of communicating with your mentor is key for a successful mentor-mentee relationship. This section addresses often underestimated details that form the foundation of a successful mentoring relationship.

How to Initiate Contact with a Potential Mentor

The first meeting with a potential mentor can be daunting, and some graduate students are reluctant to take this step. Remember, your insights will guide you if have a good understanding of your own academic and professional goals and if you have familiarized yourself with the professor's past and current work. The goals of your initial meeting are to make a positive impression and to establish a working rapport. You also want to assess whether a particular faculty member is a good fit for you. When considering a potential mentor, however, it is important to remember that this relationship is a two-way street, so your potential mentor will also be assessing you. Both you and your mentor have responsibilities that, if met, will ensure a healthy and productive professional relationship.

Faculty members interviewed for this handbook shared numerous insights about what they look for in graduate students. Students interviewed for this handbook gave many suggestions or important characteristics to look for when choosing a mentor or an advisor. The lists in the following section will give you a better understanding of how to present yourself and what topics to discuss with faculty. That said, don't limit yourself to just what is in these lists. Instead, use them to trigger ideas about what topics are most important to you.

Keep in mind that a mentoring relationship is often one that evolves over time and one that often begins because of a particular need. Your initial meeting with potential mentors is to gauge mutual interests and possible interactions. View this initial conversation as simply the first step in a process, an exploration that will help you decide if you really want the person to be your mentor.

What Students Should Clarify with a Mentor

General Availability

Ask your potential mentors how often they will be available to you. Consider the following questions.

- How often does the potential mentor meet with students in general?
- What are the mentor's current projects, and how much time can that person commit to assisting you? Will that amount of time be sufficient for you?
- Is the mentor planning to go on sabbatical or be away for extended periods of time during your time at the university? If so, what arrangements can be made to keep you in communication with this mentor?
- Does the mentor offer additional ways of helping students? Does s/he delegate some of her/his mentoring tasks to other students or staff?

Communication

Meetings and feedback are crucial to establishing good lines of communication between you and your mentor. Take time to clarify and address the following.

General Communication

- Are you able to easily understand the professor?
- Do you feel you are able to effectively communicate your thoughts and ideas when speaking with him/her?
- Do you think you will be able to work closely with this person?
- Do you think you will be able to accommodate to his or her professional and personal style?

Meetings

- How often will you meet face-to-face, making certain to request the amount of time you need in order to accomplish the goals of a given meeting?
- How often does the mentor like to meet one-on-one?

- Will e-mail contact be suitable for certain issues or questions that might arise between meetings? Does the mentor regularly answer his/her e-mails?

- What are the circumstances, if any, in which the mentor feels that it would be appropriate to be called at home? Be sure to let the mentor know if you have any restrictions about phone calls at home as well. If you both have cell phones, establish rules for calling each other on them.

Feedback

- How often will the mentor give you feedback about your general work and your progress? For feedback on specific work, find out how long it typically takes him or her to return papers or other assignments.

- Promise that, in advance of actually handing the mentor a paper or project to review, you will inquire about his or her current workload and whether timely feedback is still possible.

- Ask if the mentor tends to provide a lot of comments or very few, so you will not be taken aback later either by the amount of comments or the lack of them.

Reminders

Explore with the professor the best ways of reminding him or her about getting your work back within an agreed upon timeframe. Ask if it would be helpful to send your mentor a reminder. If yes, please consider the options addressed as follows.

- "When you are very busy, how should I remind you about a paper you have of mine? Should I e-mail you, call you, or come by your office?"

- "How much in advance should I remind you? Is one week enough time or would you prefer two?"

Setting Expectations with a Thesis Advisor

Often one of your mentors will be your thesis advisor. For a thesis advisor it will be important to clarify the following expectations.

Workload and Funding

- What does the thesis advisor consider to be a normal workload?
- How many hours does he or she think you should be spending on your research or creative project per week?
- Does the thesis advisor have funds to support you? Will these remain available until you complete your program? It is very important that the timeline for available funding for a specific project be well understood by both you and your advisor.
- Does the thesis advisor prefer or require her/his students to apply to scholarships/fellowships and will those scholarships/fellowships suit your academic interests?
- Especially for those in the sciences and engineering: Is there potential for developing a dissertation topic that you would find interesting from the thesis advisor's research project? Does the thesis advisor have appropriate space and laboratory equipment for your needs? What is the size of the thesis advisor's research group and is this optimal for you?

Publishing

- Do thesis advisors in your field offer co-authorship? If yes, does your thesis advisor of interest offer co-authorship with graduate students? If so, what are the guidelines for authorship?
- Does your thesis advisor have a specific requirement for number of publications or other scholarly work that exceeds your department requirements for graduation?
- Is your thesis advisor willing to advise you on your own articles for publication?

- What publishing contacts does your thesis advisor have who might be of assistance to you?

Presentations for Performing and Visual Arts

- Does the thesis advisor collaborate with students in public performances or exhibitions?
- Does the thesis advisor have time available to work with you to help you prepare your projects for public presentation?
- Does the thesis advisor use his or her professional contacts to assist students in presenting their own work to the public?

VI. How to Be a Good Mentee

"I expect a successful student mentee to be a person that can communicate openly and listens earnestly. The successful mentee knows when to take criticism and knows when to hold firm. The successful mentee is able to recognize that all people have strengths and weaknesses, including their mentors, and is able to put the mentoring relationship into its proper context"

- CWRU Faculty Member

"A mentee should be absolutely passionate about his/her research interests. This leads to several positive behaviors – devouring related reading, actively partaking in relevant research, etc. A mentee should be considerate. Mentors and mentees don't always have to be friends, but mentors-mentees should always treat one another with mutual respect. A lack of respect in either direction produces a somewhat toxic interaction, which can make the mentoring process very difficult."

- CWRU Faculty Member

Here are some suggestions that will help your interactions with mentors and other faculty members go smoothly while also helping you to become the strongest mentee that you can be.

Things to Remember When Meeting With Mentors

Respect their time. Be sure you know how much time they have available to give you and be aware of how quickly time is passing. If you need additional time, schedule another meeting to discuss the remaining topics. If you want to develop a professional relationship with faculty, contact the professor(s) again once you have something substantive to discuss. For instance, you can send an e-mail to thank them for their time and let them know the progress you are making in pursuing suggestions they gave you.

In order to be treated as a junior colleague, your actions and attitude must demonstrate to your mentor(s) that you are self motivated, responsible, and driven in the pursuit of your career goals.

Be Serious about your Academic Work

There are many ways to demonstrate your commitment to your studies and to your field. Here are just a few.

- Make the transition from thinking of yourself as a student to seeing yourself as a future colleague.
- Attend departmental lectures, seminars, and other departmental activities. Ask intelligent questions and contribute to thoughtful discussion.
- Network at professional meetings in your field and join the sections related to your dissertation.
- Seek out opportunities to present your work (in your department or through outside conferences and publications).
- Attend teaching workshops and courses offered at the University. Suggest speakers for guest lectures.

Be Responsible

Professors often talk about commitment with the term "owning a subject". Take ownership of your work by becoming the best expert possible in the field of your interest. Keep up to date with the latest literature relevant to your work. In fact, try to keep ahead of your mentors in terms of acquiring and reading the most-recently published work in your field.

Be aware that other faculty and graduate students may be relying on your work. Often your work will be needed for publications, performances, funding applications, etc. Meet deadlines and take time to communicate when goals will not be met in a timely fashion.

It is your responsibility to update your mentors about your progress and also about your struggles. Communicating with your mentor and other faculty can be intimidating when adequate progress on your work has not been made for various reasons. Address the issue and be proactive in seeking advice from your mentors.

Papers and Proposals

Before sharing the draft of a paper or proposal with your advisor or mentor, be sure that it matches the standards on which you and your mentor have agreed. Consider utilizing the CWRU Writing Resource Center (http://www.case.edu/writing/writingcenter.html) or friends with strong editing skills to revise your document. The same stands for the content: if you know somebody who is somewhat familiar with the basis of your thesis idea, ask them to proofread your document. Professors may request an early rough draft of your work or ideas, although this is less common. In these cases, you can decide what is more important: timely submission or a perfectly polished version of your idea.

Here are some additional suggestions to help the paper/proposal draft process proceed as efficiently as possible.

- Mark the sections that you have revised. Your mentor should know which sections you have been working on, so that s/he does not re-read the entire document (unless you have completely edited every section.

- Hold regular meetings with other graduate students to review each other's work, share ideas, and give each other feedback.

Respect Your Mentor's Suggestions

Read the books or articles your mentors recommend, and ask questions about the content. Mentors want to see you become a scholar who has learned from their recommendations, guidance, and insight. If you do not follow a mentor's suggestion, be able to discuss your reasoning.

Meetings

- Be punctual for meetings with your mentors.

- Be proactive in the meeting, have an agenda and a set of goals prepared. The best way to be time efficient is to make a list of prioritized questions so that the most important questions are ensured time for discussion.

- Following a meeting, summarize in writing any achievements and agreements that you have made with your mentor. This is particularly important for two reasons. First, it shows your mentor that you are consciously managing your work. Second, it documents what you have agreed upon by creating a list of decisions,, project goals, and actions that can be used if there is a misunderstanding or in case of unusual circumstances.

- Accommodate your mentor's schedule without sacrificing your goals and concerns.

- Try to avoid canceling a meeting. If you must, make sure that the message reaches your professor in a timely manner. Notification by email can be satisfactory, but for last minute cancellations, you may want to call the department assistant or your mentor directly.

Letters of Recommendation

- Set up a specific appointment to discuss a letter of recommendation.
- Provide updated copies of your *curriculum vitae* to everyone from whom you are requesting a letter of recommendation.
- Leave clear written instructions as to when the letters are due and to whom to send them. Attach a stamped and addressed envelope for each letter.
- If you request several letters from each recommender, create a calendar for your mentor that lists application deadlines.
- If the letters are to be completed on-line, provide each recommender with a list of schools and organizations that they should expect emails from so that they are not lost or overlooked. Offer to assist recommenders with the on-line recommendation process, when appropriate.
- Provide a short description of your grant applications.
- Provide details about how you are structuring your application and what points you would like your mentor to emphasize.
- Submit these materials with enough advance time for your mentor to write a letter.
- In case the professor misplaces the application materials, keep extra copies of all forms, emails, and other relevant materials.

- The University and departments have policies to protect student privacy, and you may have to give written permission to allow mentors to discuss academic performance. Ask your departmental assistant about the details of these policies.

Respect Boundaries

Resist the temptation to drop in on professors for casual conversation; allow professors to initiate this type of interaction. Friendships between students and faculty can develop over time but should never be forced. Friendships with faculty and mentors can be beneficial to your professional socialization and in giving you more access to information when needed, but they also present the danger of losing track of the hierarchical order of your relationship. Always keep in mind that, while you are primarily judged for the quality of your work, you are also judged on your level of professionalism in and outside of the workplace.

Receive Criticism in a Professional Way

Accept critiques of your work in a professional manner. If you disagree with a specific criticism, show your appreciation in a respectful manner but assert your reasoning for why you think differently. Rather than responding on the spot, it is often best to take some time to think about the critique in order to provide the best response.

Take Ownership of Your Degree

While your mentors will be helpful and will aid your success, you must remember that you are ultimately responsible for the progress of your degree. Therefore, remember to:

- Investigate and understand your academic and research requirements for graduation.
- Consistently work hard and responsibly throughout your project.

- Demonstrate independent thinking.
- Show your initiative and motivation to succeed.

VII. What to Do if Problems Arise

"I was very stressed out about finishing my research and other requirements on time for May graduation and finding a job, all at the same time. However, I didn't tell my advisor this. At the end of one of our meetings, he told me that he noticed I had been very stressed and wanted to reassure me that I was on track for graduation. This was a very positive experience in my mind, because he was attentive to my behavior and was able to provide the reassurance that I needed to help me get through the stressful time."

- CWRU Graduate Student

Unexpected Circumstances

It is likely that something unexpected will occur in the course of your graduate career that will hamper your efforts to complete your work, such as the birth of a child, a family illness, a medical condition, etc. While it may be difficult to manage the situation, taking proactive steps to contact your mentors will pay dividends. Discuss your situation with your mentor, giving them as much information as you feel comfortable sharing. If you feel uncomfortable discussing the situation with them or feel that they are unhelpful, there are resources on campus to help you. As soon as possible, discuss a new timeline for completing your degree with your mentors. Take care to construct a new plan that is realistic. Additionally, the Graduate Student Handbook describes a temporary leave of absence policy on page 20. You can consult it at:

http://www.case.edu/gradstudies/downloads/GraduateStudentHandbook09-10.pdf

Availability Issues

Like students, mentors can have unexpected circumstances which may impede their availability. Grant your mentors the same courtesy that you would expect from them in a similar situation.

As previously noted, faculty members have many constraints on their time. There may be a time when their unavailability may impede your work and progress. For example, other demands may hinder your mentor's ability to meet with you or provide prompt feedback about your work. Often a mentor's other commitments directly benefit their students, e.g., grant writing, so be understanding. If inaccessibility becomes a problem, address the issue with the mentor.

Minor Issues with a Mentor or Faculty Member

It is important to address and resolve minor issues quickly. It is a good idea to discuss them with the following people in the order listed here.

Mentor/Faculty Member

Your first step is to politely inform the mentor of your concerns. If you are not getting satisfactory results from casual discussions, schedule a meeting with the mentor at the earliest possible time. Face-to-face meetings can lead to more satisfactory results than e-mail, as the situation can be more fully discussed in a collaborative manner. In contrast, one's tone and message can be easily misconstrued in electronic communication.

Peers

Other students who have contact with a particular faculty member can tell you if this behavior is typical, and may be able to suggest some possible resolutions. Your peers can also explain the norms in your department regarding the frequency of meetings, turn-around time for feedback, and the general availability of faculty. Your peers might be able to help you create solutions in which you

take more initiative to solve your issue independently of your mentor. Consider the possibility to become a GSS Peer Mentor or Mentee.

Graduate Student Senate

The Graduate Student Senate is composed of graduate students with whom you can discuss many issues. Explore GSS.CASE.EDU for more information.

Departmental Staff

Staff (e.g., the administrative assistants) can sometimes clarify departmental expectations and standards and possibly offer suggestions about how to resolve problems. Administrative staff are knowledgeable about other people or offices on campus that can assist you. Also, it is possible that the department administration can provide the function you are seeking from your mentor (Planned Program Of Study approval, career counseling, writing resources, etc.).

Other Mentors

Other mentors can often give you advice on how to deal with problematic issues that arise with one of your mentors. If you have been able to form a mentor team, you should be able to consult another mentor about the issue you are having. If you want someone to intercede on your behalf, senior faculty may be in a much better position to do so than junior faculty. If you have formed a dissertation committee, the Chair of your committee (provided that s/he is not your mentor) can act as an advocate and mediator between you and your mentor. This person is generally quite familiar with your mentor as well as with your thesis work, and can be an excellent resource when attempting to resolve issues

Graduate Chair, Director, or Department Chair

If you are not able to resolve issues with your mentor on your own, you may find it advisable to talk to the Graduate Chair in your department or your Department Chair. Be aware that discussing issues with these people means that you are going above your mentor's head, which may put more

strain on the problems you are already having in your relationship. Generally, this should be done only if you are unable to resolve the issue through other means.

School of Graduate Studies

At some point, you may find it helpful to talk things over with staff at the School of Graduate Studies. Please contact Denise Douglas, Associate Dean of Graduate Student Affairs (368-4390) denise.douglas@case.edu for ideas and strategies.

Major Issues with a Mentor or Faculty Member

Major issues, such as a breach of ethical behavior, should be addressed immediately. Even a minor issue that is not addressed can become a major issue, so it is important to address problems that arise as soon as possible. The formal Graduate Student Grievance process can be found at: http://www.case.edu/gradstudies/downloads/SolvingAcademicandOtherConcerns-GraduateStudents.pdf and http://www.case.edu/gradstudies/downloads/GraduateStudentHandbook09-10.pdf (p. 20)

, but here is an overview of the steps suggested to resolve an issue.

First, discuss the grievance with the person against whom the complaint is directed. The goal is for the parties to be sure they understand each other before further steps are taken.

When the student does not feel that the issue has been adequately resolved or feels at risk by addressing the issue with the person against whom the complaint is directed, he or she should then discuss the issue with the department Graduate Director or Department Chair. If the complaint involves the Department Chair, the student may bring the matter to the Faculty Dean (e.g., Engineering, Medicine, etc.) to whom the Chair reports.

In the event that a decision still appears unfair to a student or if the student feels that the department's Graduate Director or Department Chair are not independent mediators, the student

may bring the matter to the attention of the Dean of Graduate Studies. The Dean may ask the student to put the complaint in writing for clarity and fairness to others involved.

VIII. Changing Advisors

"Changing advisors shouldn't always be associated with a negative stigma. In fact, it was a critical step in my educational career that — in addition to broadening my scientific knowledge, enhancing my technical experience, and complementing my skill set — has made me a more complete scholar in my fields of interest, ultimately making me more marketable (and less dispensable) to prospective employers. Different mentors have different priorities and expectations, and exposing oneself to a more diverse spectrum of such goals can be a real virtue."

- CWRU Graduate Student

In the course of your graduate study, it may become appropriate to change advisors. This process may be more common in some fields of graduate work and less common in others. It can be a difficult process in either case, especially where financial support is involved. Some departments encourage students to work with multiple faculty members, thus making it easier for the students to change advisors. In these instances, changing advisors is often a fluid process and can be viewed positively. For example, some students may begin their graduate work with one advisor who specializes in one field and then complement this work by changing to another advisor who specializes in a different area. In other cases, students may be brought to CWRU to work with one specific faculty member, possibly making it more difficult to change advisors. In order to maintain a smooth transition between advisors, you should remain professional with your previous advisor. Your department may have formal policies and procedures for changing advisors, so it is important to follow the appropriate course of action they suggest. That said, here are some general guidelines.

General Guidelines for Changing Advisors

- Reflect on the pros and cons of changing advisors before you start the process.
- Seek advice from your other faculty mentors to assess your needs and determine if changing advisors is the best course of action. This advice may be especially important if you are attempting to change advisors toward the final phase of your graduate work (see Section VII. What to Do if Problems Arise).
- Try to resolve any differences with your advisor before you make a final decision.
- Approach another faculty member who you feel is the best fit to be your new advisor. Your attitude in this conversation should be positive, outlining new interests, goals and possibilities.
- Be professional. Do not make negative comments about your previous advisor, place blame, or discuss specific difficulties or incidents. It is important to avoid saying anything that could have a detrimental impact on your future.
- Express your decision to change advisors by outlining your reasons for wanting the change in the most diplomatic and sensitive manner possible, especially concerning anything you need to say about your previous advisor and others involved in your graduate work. Try to be general; don't bring up small details or petty incidents.
- Discuss a reasonable timeframe for completing any work you owe your previous advisor.
- Complete your department's requirements for changing advisors. Also, be sure to revise your Planned Program of Study (via SIS) and update your Dissertation Committee with the Dean of Graduate Studies and your department.

IX. How to Transition to Being a Mentor

"Before attending graduate school, I had expected to learn from mentors in my field of study. I had not, however, considered how I would be a mentor to undergraduate students and other graduate students. Being a mentor to others has been a rewarding experience, and has enhanced my leadership abilities."

- CWRU Graduate Student

Thus far, this guidebook has defined what mentoring is and has focused on your role as a mentee in the mentoring relationship. However, in the course of your graduate education and eventually in your professional career, it is likely that you will also serve as a mentor. You will then have opportunities to apply what you learned as a mentee in your role as a mentor to others. The following segments include scenarios in which you might be a mentor while in graduate school.

Mentoring Fellow Classmates

An initial step towards mentoring is fostering relationships with your classmates—both undergraduate and graduate students. This might involve sharing information, explaining ideas, or working collaboratively on group projects. Although some students may view graduate school as a competition, it is also important to consider its cooperative aspects in the increasing interdisciplinary nature of research. Professors may weigh your performance against other undergraduate and graduate students in your courses, but will also evaluate your ability to collaboratively work with others. Being open about information will benefit you—when your classmates in turn share their ideas with you about course material or alert you about resources related to your research interests.

Mentoring as a Teaching Assistant or an Instructor

Your graduate education will likely involve mentoring undergraduate students—whether as fellow students, as mentioned previously, or as their Teaching Assistant or Instructor. Mentoring them on a

basic level involves ensuring their comprehension of the material. This may occur by providing them with insightful feedback or meeting with them either after class or during your office hours.

Undergraduate students may, however, ask for direction beyond the classroom. Students might ask for advice about classes or additional information regarding your field of study. Others might become curious about your experience as a graduate student, and how to embark on the graduate school application process. Professors or personnel at offices on campus could also be resources for undergraduate students, but students will likely also appreciate your personal first-hand advice.

Mentoring Other Graduate Students

Incoming graduate students may approach you for guidance. They might ask for your opinion about specific classes or professors. They might also have questions about graduate school in general, university life, your shared field of study, or your experience as a Research Assistant or Teaching Assistant. Because you probably also have been given advice by senior graduate students, it is time to "pay it forward." You should be honest about your experience; while you may have encountered frustrations in the course of your graduate education, consider that incoming graduate students do not need a preconceived negative opinion of your department or the University. For instance, a professor in your department might teach challenging classes. Instead of simply expressing the difficulty of the classes, offer students strategies on how to succeed in such courses. As a senior graduate student, you have a great deal of first-hand knowledge that does not come in any handbook, so communicate what you have learned to junior graduate students: from lab techniques to classes to where to get the best free food to forming a thesis committee to establishing professional relationships with faculty. Senior graduate students can really be the source of a lot of knowledge. You can help familiarize other students with the culture of your department and avoid many common pitfalls of graduate school.

Mentor by Example

Although you might often mentor by offering advice to undergraduate students or other graduate students, it is just as important for your actions to be worthy of emulation, both inside and outside the classroom. Become a leader in the classroom by actively participating in class discussions, contributing to group projects, or giving great presentations. Outside the classroom, participate in departmental activities, attend guest lectures, become involved in campus events, and present at conferences. When you mentor by example, you not only set excellent standards for other students to achieve, but you also develop expertise and leadership experience in your field of study.

PART TWO

Resources in Diverse Communities

I. Common Themes for All Graduate Students

Regardless of their field of study, some or all graduate students often experience the problems and stresses discussed in this section.

Need for Role Models

Mentoring is an important relationship that can help bridge the gap between undergraduate and graduate education; it enables graduate students to grow into professional scholars by fostering an understanding of the practices, knowledge, and expectations of their chosen fields.

Students from groups that are historically underrepresented in academia may have a harder time finding faculty role models who have had experiences similar to their own. As a student you may want to find someone who looks like you, someone who immediately understands your experiences and perspectives. The Office of Multicultural Affairs can provide underrepresented students with additional mentoring that supplements that offered by their thesis advisor.

Questioning the Canons

Students from underrepresented or marginalized groups sometimes find that their perspectives or experiences do not fit into current academic canons; they find that their experiences are missing from current theory and research. Exploring and challenging a discipline's traditional content and boundaries should be an integral part of the study of that discipline. Healthy departments are mindful of the need to create safe environments in which such ideas can be shared freely.

Being Categorized as a "Single-Issue" Scholar

The structure of graduate programs and the need to focus on one topic for the thesis or dissertation can have the effect of producing scholars whose vision and knowledge is quite narrow. This can be advantageous depending on the field. Many graduate students are concerned with being associated with a narrow topic. Initiate an open discussion with your mentors if you have these concerns to explore opportunities to broaden your scope.

Feelings of Isolation

All graduate students probably experience a sense of isolation at times, one that springs from the intense focus of the graduate experience. Students from historically underrepresented groups can feel particularly isolated or alienated from other students in their departments, especially if the composition of a program is highly homogenous. At Case Western Reserve University, students can look for potential mentors outside of their thesis advisors through the Office of Multicultural Affairs. Among other things, this office is dedicated to providing students with positive and professional mentoring. These mentors include University faculty, staff, alumni, and professionals from around the Cleveland area. In addition, they can seek the advice from the Division of Student Affairs.

Seeking Balance

Students observe that professors need to devote large parts of their lives to work to be successful in the academy. Students from all disciplines may feel that faculty members expect them to spend every waking minute of their days on their work. This perception of faculty expectations, accurate or not, is of grave concern to students who wish to have family lives, as well as for those who want to balance their lives with their interests and hobbies. See Part I, Section IV, Clarifying Roles and Responsibilities to address these issues with potential mentors in advance. If your life circumstances

change during your career as a graduate student, take time to discuss these changes with your mentors as soon as possible.

Sexual Harassment

Sexual harassment is a serious issue and can happen to any graduate student. The University's Policy on sexual harassment states that "sexual harassment is unacceptable conduct, which will not be tolerated. All members of the University community share responsibility for avoiding, discouraging, and reporting any form of sexual harassment."

Consult the following website for current policies:

http://studentaffairs.case.edu/handbook/policy/sexual/harassment.html

Suggestions

1. Work with faculty mentors to get names of potential mentors in departments, across the university, or at other universities who may have had similar experiences.

2. Remember that very good mentoring can come from faculty members who are of a different gender, race or culture. After all, past generations of minority scholars did just that. As one professor of color pointed out: "It is important to develop ties and networks irrespective of race and gender but based on what people can offer."

3. If the faculty and students in a department or program are largely homogenous, help identify and recruit new faculty and graduate students who represent diverse backgrounds. When such openings arise, give suggestions for qualified job candidates who may also represent diverse backgrounds. Attend the job talks and meet these potential faculty mentors.

4. The Office of Multicultural Affairs operates a list of organizations at CWRU, and the relevant graduate student organizations recognized by the Graduate Student Senate is listed as well (see the Resources section below).

5. Be open to hearing other people's experiences, particularly those people from backgrounds different than yours. For example, the introduction of women's and minorities' perspectives has brought about the development of whole new disciplines, all of which have greatly enriched the University environment and academia in general.

6. Investigate and join organizations within or outside the University that might provide you with a sense of belonging. Some examples are cultural and religious groups, as well as reading groups and professional associations. Some students may find it particularly difficult to take active roles in academic and/or social settings. Do not be afraid to ask mentors or peers to introduce you to other students and faculty with complementary interests.

7. Seek out mentors you view as role models for advice on how mentors attain balance among life aspects such as career, family, and personal aspirations.

8. It is difficult to balance school work with the demands of personal life, and these demands vary depending on the individual students' experiences. Be honest with yourself in deciding which of these arrangements are suitable for you while still demonstrating that you can be focused and productive in your work.

9. Recognize that your undergraduate time management and study strategies may need revising to better meet the demands of graduate level work. Educational Services for Students (ESS) meets individually with students to develop effective time management and study strategies.

10. Participate in Presentation Workshops. Educational Services for Students (ESS) offers a presentation workshop series to enhance your skills as a presenter. Learn ways to organize your work, understand your audience, use appropriate visual aids, and speak with confidence.

Resources

- The Office of Multicultural Affairs

  http://studentaffairs.case.edu/multicultural/

- A list of student organizations at CWRU in which students from historically underrepresented groups can find a sense of community

  http://studentaffairs.case.edu/multicultural/resources/organizations.html

- A list of student organizations recognized by the Graduate Student Senate

  http://gss.case.edu/committee/orgs.php

- Educational Services for Students (ESS)

  http://studentaffairs.case.edu/education

- Case Western Reserve University Career Center

  http://careercenter.case.edu

- How to Complete and Survive a Doctoral Dissertation by David Sternberg, St. Martin's Griffin, 1981

- A Handbook for Women Mentors: Transcending Stereotype, Race, and Ethnicity, Greenwood by Carol Rayborn et al., 2010

- Good Mentoring: Fostering Excellent Practice in Higher Education by Jeanne Nakamura and David Shernhoff, Jossey-Bass, 2009

II. Female Graduate Students

This section discusses issues that are often experienced by some female students, but other students may experience them as well.

Assertiveness

Success in graduate school can, at times, require you to assert yourself in classroom discussions or in conversations while at meetings with your mentor and other collaborators. This means that you may need to interrupt other students, lab members, or collaborators in order to ensure that your voice is heard. Since some women have been socialized to be polite, such assertive actions may be unnatural. Some women may also see interjecting themselves in this manner as being rude and disrespectful. You may wish to observe how female faculty and senior female graduate students in your department handle this issue or consult resources listed. Try to always state your arguments and do not take everything personally.

Competitiveness

Some graduate students may feel alienated by the competitive and critical atmosphere that is pervasive in many graduate programs (Sandler, Silverberg & Hall, 1996). As a graduate student, you are expected to be critical of others' work when you think it is appropriate, and you may often find that the system does not reward one for praising the contributions of other scholars. One way to minimize this overly competitive atmosphere is to work in small collaborative groups. Collaborative work could help you feel more confident when your work is being constructively criticized or when you are giving constructive criticism to someone else. Such small group settings may also foster positive feedback.

Positive Feedback and Confidence

Academia is wrought with negative feedback regarding all types of scholarly work. While the culture of academia may be shifting to include more constructive criticism, graduate students should be aware that typical comments may sway towards negative feedback instead of constructive criticism depending on the mentor. Both male and female students frequently find that they do not receive positive feedback on their work from their mentors, and the absence of positive feedback can lead graduate students to doubt their capabilities (Nerad, 1992). In a 1991 study by Nerad and Stewart, it was found that women graduate students tend to think that any negative experiences they have in graduate school are due to their own personal deficiencies, while men tend to attribute the reasons for negative experiences to others, i.e. to insufficient guidance or problems within the department. In 2007, the NIH reported that the burden of family responsibility and lower confidence in themselves (relative to men) are factors that impede women from pursuing advanced scientific careers. The study revealed that, although men and women rate themselves equally when asked about professional skill, men were significantly more confident that they could obtain full professor status and become tenured.

Suggestions

If you find that you are having a difficult time participating in class discussions or speaking up in meetings with your mentor, consider meeting with your professor or mentor to discuss the issue. Suggest specific ways in which he or she could make it easier for you to participate in class or meetings. For instance, you may find it helpful if the professor or mentor directs a question to you about what you think about a particular topic.

Take advantage of professors' office hours. You might find it easier to talk with them one-on-one. Let them know that, even if you are quiet in class or in meetings, you are still engaged in the subject matter.

Try to not take constructive criticism personally. The majority of mentors want to see their graduate students excel. Pointing out ways that students' writing, laboratory experiments, etc. could be better is one way of helping students succeed in the future.

If you find that a mentor only engages in brief conversations with you, do not jump to the conclusion that this person does not value you as a mentee. Remember that professors are also very busy and may only have limited time to interact with you at a particular meeting.

Make sure to apply for competitive positions to advance your career once you graduate. There are a variety of resources available for women in academia (see resources below).

Resources

- Flora Stone Mather Center for Women

  http://www.case.edu/provost/centerforwomen/index.html

- WISER (Women in Science and Engineering Roundtable)

  http://www.case.edu/provost/centerforwomen/wiser/index.html

- CWRU Career Center (many women specific resources)

  http://careercenter.case.edu

- Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering

  http://www.nap.edu/catalog.php?record_id=11741

- Center for Innovation and Research in Graduate Education (CIRGE)

  http://depts.washington.edu/cirgeweb/c/about/researchers-and-staff/

- Association for Women in Science

  http://www.awis.org/displaycommon.cfm?an=1&subarticlenbr=209

- Mentoring Gap for Women in Science, Inside Higher Ed News

  http://www.insidehighered.com/news/2008/02/28/mentor

- Minority & Women Doctoral Directory

  http://www.mwdd.com

- Academic Careers in Engineering and Science (ACES)

  http://www.case.edu/admin/aces/

  From here, there is a link to the National Science Foundation's ADVANCE program. The website for the ADVANCE program is: http://www.nsf.gov/funding/advance

III. Lesbian, Gay, Bisexual, and Transgendered (LGBT) Graduate Students

Some students do not talk about their sexual orientation or gender identity openly, and it is generally unacceptable to disclose the sexual orientation of another student (known as "outing" them). Mentors have the responsibility, regardless of their own sexual orientation, to ensure that LGBT students feel comfortable in their classrooms and office, so as to maximize students' learning.

Homophobia

Graduate students who are also LGBT sometimes encounter homophobia in the classroom, in the lab, during meetings, or at other university events. Remarks can range from the blatantly offensive to the less obvious (e.g., "that is so gay"). Such remarks should not be tolerated; it is perfectly

acceptable to politely challenge the person's statement. You can seek to discuss the matter with senior students or faculty. If the incident was more severe or if there were many incidents, report the person to the Vice President for Inclusion, Diversity, and Equal Opportunity, Marilyn Sanders Mobley. or to the Senior Vice President of Student Affairs, Dean Patterson.

Heterosexism

Students who are also LGBT often hear classroom discussions conducted with the unconscious assumption that everyone is heterosexual. Even faculty and students who have a heightened awareness of sexual orientation issues may have an unconscious tendency to think about the world from an exclusively heterosexual perspective. As a result, students who are also LGBT may feel isolated or find that their experiences are not represented in research or in classroom discussions.

Disclosing

Being "out" as a student (or faculty member) who is an LGBT is not a one-time event; rather, it is a decision that the person experiences each time s/he encounters a new social situation. Students who are also LGBT face the burden associated with having to assess the personal, social, and political ramifications of disclosing their sexual orientation each time they do so. Since heterosexual students do not have to disclose their sexuality, only students who are also LGBT may face these physically and emotionally draining experiences. Although faculty members and students should disregard the sexual orientation of all students in any academic environment, students who are also LGBT should only reveal their orientation if they feel safe and comfortable enough to do so.

Suggestions

1. Students who are also LGBT should assess their department's environment and their own level of comfort with being "out." Decide which of your peers and mentors you trust and

enlist their help in creating suggestions for a department environment that is conducive to everyone's learning and professional needs. For example, you may want to encourage the department to review policies on LGBT concerns periodically or may put LGBT concerns on the agenda for graduate student orientations and training programs for faculty and staff.

2. Be aware of anti-gay comments that may be made. If it is appropriate and if you feel comfortable, speak out or discuss how such comments are inappropriate and potentially offensive to other students. If you feel uncomfortable or unsafe in speaking up, you should speak to a trusted faculty member in private about such incidents.

3. For all students, be aware that the examples being discussed may be based on heterosexual experiences. For example, when talking about families, many professors and students will unconsciously adopt a heterosexual point of view, but not every family is composed of a husband, wife, and children. Simply using phrases like "spouse and partner" instead of just "spouse" can go a long way toward making students of many statuses (e.g., unmarried) feel included.

4. Students should treat sexual orientation as a multidimensional phenomenon in their relationships with their peers and mentors. Homosexuality is only one of several expressions of sexual orientation, and gender identity may not be fixed for everyone.

Resources

- CWRU's LGBT resource and information website

  http://www.case.edu/lgbt/index.html

- CWRU's Committee on LGBT Concerns

  http://www.case.edu/lgbt/committee/

- Spectrum (CWRU's LGBTQQIA student group)

  http://spectrum.case.edu/

- CWRU's LGBT Center at Thwing Center

  http://www.case.edu/lgbt/center/

IV. Racial and Ethnic Minority Graduate Students

This section discusses issues that are often experienced by some students from racial and ethnic minorities, but students with other backgrounds may experience them as well.

Lack of Role Models

As a minority graduate student, you may be concerned that the low number of faculty of color suggest that academia is an unwelcoming environment for those who are not white. Regardless of race, assertively seek to acquire mentors who will help you succeed in graduate school and make sure that you do your part to maintain a good relationship with your mentors (see Part I).

Stereotyping and the Impostor Syndrome

When you start graduate school, you may feel isolated. Feelings of isolation may translate to feelings that you do not belong. These feelings are part of what is known as the "Impostor Syndrome". While many students experience these feelings, minority students can be subject to them more because of the dissimilar community around them. As a minority student, others may express opinions that you were accepted because of affirmative action quotas. The biases of others toward students of minority are baseless opinions, and you should remain focused on progress toward the degree. On the other hand, Asian-American students are burdened by the "model minority" myth,

which assumes that they are exemplary students, particularly in math and the sciences. Stereotyping in either direction has negative consequences for all parties involved. If these external biases or isolation are troubling you, seek out the following resources to help you understand why you are a worthy of the graduate student community.

Racism

Racism may be expressed in language, action, and association. Overt instances, such as when a student is denied access to a particular activity because of his/her ethnicity, are perhaps the easiest to recognize. But there are more subtle forms of racism, so called color-blind racism (Bonilla-Silva, 2006), such as when a student is asked to participate in a discussion or serve on a committee simply because of his/her minority status and give, for example, the "Hispanic" or "Native American" perspective. Such requests are based on the generalization that being a member of a given culture makes a person an expert on his/her culture. Although they are not what society thinks of as pre-Civil Rights Jim Crow racism, we understand that situations like these can make you feel quite uncomfortable.

Suggestions

Seek out other mentors on campus (besides your thesis advisors) if you feel that you would like a mentor who is also a racial or ethnic minority. CWRU offers mentors from around the Cleveland area through the Office of Multicultural Affairs (see Resources below).

If you are having feelings of insecurity, it might help to talk to other graduate students. You will likely find that all students, regardless of their ethnicity or race, feel insecure at one time or another in graduate school. It also might help to talk to your mentor or other professionals at the university.

CWRU does not tolerate racism. Make sure that you are aware of the policies in the student handbook in case you ever encounter racism and need to file a formal complaint with the Office of Inclusion, Diversity, and Equal Opportunity or the Division of Student Affairs (see Resources below).

If you are ever asked to give a perspective on behalf of your minority group or otherwise speak for it, it is OK to decline. A respectful reply, such as "I think there is an array of opinions on this subject," could deflect an inappropriate question.

It is always helpful to remember that people of different races and ethnicities face different issues and experiences, and it is important to be respectful of these different experiences. However, don't let race or ethnicity differences become a barrier to communication.

Developing peer networks and peer mentors is an effective strategy that many graduate students of color may find helpful. Students should attend graduate student conferences, workshops, and seminars both to network among themselves and to meet potential mentors in their respective fields.

Resources

- American Psychological Association, Survival Guide for Ethnic Minority Graduate Students

  http://evs.astate.edu/Library/minoritystusurvival.pdf

- University Office of Student Affairs

  http://studentaffairs.case.edu/

- American Indian Graduate Center

  http://www.aigc.com/articles/mentoring-minority-students.asp

- Office of Multicultural Affairs

  http://studentaffairs.case.edu/multicultural/

- Office of Multicultural Programs through the Medical School

  http://casemed.case.edu/omp/

- Minority & Women Doctoral Directory

  http://www.mwdd.com

V. International Graduate Students

International graduate students from many countries enrich the culture of Case Western Reserve University. Here are some topics that may be of concern to them.

Issues of Culture and Language in the Classroom

For most international students, choosing to study in the United States means that they will need to function in a second language and adjust to an entirely new set of cultural and educational norms (Trice, 1999). An important example is the issue of competition. As an international student, you find that American classes are sometimes excessively competitive. In particular, students from Eastern and Southeastern Asia - often trained in educational systems where the student's role is to be passive - are shocked to see American students speaking up without being called upon or challenging the remarks of professors and peers. You may fear that, if you do not exhibit these same behaviors, the faculty will judge you to be less capable and/or less intelligent. Try to use the strategies suggested in Section II, Part Two, of this Handbook.

In addition, as international students, you may be uncertain about academic rules at CWRU. One thing that is clearly unacceptable is plagiarism. Even if you are having difficulty working with the English language, it is not acceptable to copy someone else's words without giving them credit.

Finally, you may find that your classes incorporate few international perspectives and that American faculty and students undervalue or simply do not understand the global experiences you bring to the classroom. Try not to be disappointed by these aspects of your academic experience, and do your best to ameliorate them in appropriate ways.

Social Stresses

While many graduate students experience the stress of having moved away from family and friends, international students may have an even greater sense of displacement. If you have brought your partner and/or children with you, you may also be worried about how well your family is adjusting to American life overall -- and to Cleveland, in particular. In addition, a significant number of international graduate students are plagued by loneliness (because sometimes they are unfamiliar with the ways in which Americans socialize) and find that they are unable to find people patient enough to speak with them (Trice, 1999). For example, in many cultures asking someone "How are you?" signals the start of a conversation, while in American culture, this can be a simple greeting as someone passes you in the hallway. A further complication is that, upon returning home, international graduate students find that because of their different dress, talk, and behavior, they have become "foreigners" in their own countries.

Suggestions

1. If you are having trouble adjusting to American life and culture, consult with a more advanced international student for advice. The Office of International Student Services may be able to help you find other students from your home country. And remember: The first semester is probably the hardest!

2. Talk with your professors about your past educational experiences and point out the new demands you face from the American educational system. Most faculty will be accommodating as you adjust to a new country and culture.

3. If it is hard for you to jump into classroom discussions, ask if professors will help you acclimate by temporarily calling on you for specific responses, or suggest some other strategy.

4. Having someone proofread your assignments can help if you are having difficulty working in the English language. Ask your advisor, other faculty or members of your department, or other graduate students if they wouldn't mind reading over assignments from you. You can also consult CWRU's Writing Resource Center, where consultants will work with you to become a better writer in English.

5. If you are unfamiliar with CWRU's stance on plagiarism, talk to a professor or another graduate student about what plagiarism is and what its consequences are.

6. If you find it difficult to converse over e-mail, let your advisor or other professors know that seeing facial and body expressions helps your understanding. Take advantage of professors' office hours too. Remember that most mentors will be willing to accommodate your needs, but they first must know what those needs are.

7. Although you might feel tempted to spend all of your social time with peers from your home country, seek out as many opportunities as possible to interact with other students as well, for example, at informal lunches. These interactions will help you practice and improve your language skills if you are still learning English.

8. Educational Services for Students hosts a series of lunch time conversation groups to help students practice the English language. Each week a diverse group of students and staff bring their lunch to ESS (Sears 470) to discuss current events and other topics. All students are welcome to participate and should contact the ESS office at 216-368-5230 to find out what day and time the group is being held each semester.

Resources

International Student Services

http://studentaffairs.case.edu/international/

Writing Resource Center

http://www.case.edu/artsci/engl/writing/writingcenter.html

School of Graduate Studies' Academic Integrity Procedures and Rules

http://www.case.edu/gradstudies/downloads/AcadInteg.pdf

Students' Guide to Writing

http://studentaffairs.case.edu/education/resources/sagesguide

VI. Graduate Students with Family Responsibilities

While this section was primarily written about students who have parenting responsibilities, many of the same issues pertain to those who are responsible for the care of their parents or of other family members. Remember that faculty members may themselves face family issues which take time away from their own university commitments. You may find it helpful to talk to your mentor about your specific circumstances – without going into unnecessary detail – so that s/he is aware of your situation. Occasionally family responsibilities may escalate into a situation that requires an extended period of absence; though these instances are rare, extreme accommodations may be necessary. Circumstances such as these are addressed in greater detail in Part I, Section IX.

Dual Commitments

As a student with parenting responsibilities, you are nevertheless as committed to being a successful graduate student as students without these responsibilities. Even though you have other demands on your time, you can be highly successful by being organized and focused during the blocks of time that you carve out for studies, lab work, etc. That said, you may feel that some professors perceive you as having a lack of commitment because of other priorities in your life. This situation is exacerbated when an emergency arises (e.g., an ill child), making it impossible to attend classes or meetings. The intensity of childcare demands does not stop once a child enters school. Like most parents, graduate students who are also parents want the best opportunities for their children. This may involve enrolling your children in a variety of activities inside and outside the classroom that may require parental involvement.

Isolation

Because of family demands, you may not be able to attend some social, academic, and professional functions. This could lead to you feeling isolated from fellow students, colleagues, faculty members, and the department/program as a whole.

Time Constraints

Students with family responsibilities typically need to be home in the evenings to tend to those in their care. If you are participating in group projects, difficulties can emerge since students without such responsibilities often find that evenings are a great time for group meetings. In addition, it is often difficult for students with parenting responsibilities to come back to campus for evening lectures or departmental meetings.

Suggestions

Meet other graduate students who can share the strategies they employ for balancing academic and family demands. They can connect you to a network of other students and point you to helpful resources. Perhaps your mentor might suggest other graduate or professional students who have the same commitments or constraints of family demands. This would be a wonderful way to broaden your social network, find "like-minded" graduate or professional students to socialize with and increase your connection to the university. The feelings of isolation might lessen, overall.

Try to find faculty who have children and are highly involved in their children's lives or faculty who can understand your situation. These faculty members can provide you with advice and support. Often departmental staff will know who these people are.

When working on group projects, suggest that evening meetings take place at your house if that is possible and if that would be easier for you. Or help arrange for the meeting to take place in a location where you can be there via teleconferencing. Also, discuss with your group the possibility of you contributing via e-mail or other internet means. These strategies can also be used for meetings with your advisor or other collaborators.

Talk to your professors about making assignments available in advance, putting class notes on Blackboard, or conducting class opinions with online surveys to help you out if you need to be absent from class.

Consider bringing your children to some departmental social functions and/or into the office. Most likely, you will find that the members of your department will enjoy the opportunity to interact with your children.

Talk to your mentor about your situation so that he or she will understand if you need to be absent from a class or meeting due to your family responsibilities. Take the responsibility for communication regarding the reason for your absence(s) to your mentor. If you do not want

to describe the circumstances completely, at least discuss how your mentor's expectations need to change so that everyone is on the same page.

If you carry a cell phone or beeper in case of family emergencies, discuss this with professors prior to classes, meetings, or seminars so they will be aware of possible interruptions that will force you to step out. And make certain that family members know that they should call you at such times only in the case of a true emergency.

Talk to your mentor or other department members about organizing inclusive functions during regular work hours or organizing events that are family-friendly.

If you have relocated to attend Case Western Reserve University, and do not have local social networks (e.g., extended families) to help relieve the strain children can put on graduate work, peruse the resources below to help you build a social network.

Be realistic about how much work you can do, especially during the transition period. The mentor-mentee need to discuss these expectations, just to make sure everyone is in agreement.

Resources

- The Employee Assistance Service (EASE) program (links with options for both child care and elder care near CWRU are provided)

  https://www.case.edu/finadmin/humres/erelations/ease.html

Other Local resources that may be of interest include:

Local libraries, daycare resources, parent groups, and toy co-ops
http://www.heightsparentcenter.org
http://www.heightslibrary.org

http://www.shakerlibrary.org/Kids/links.aspx?Websites+for+Parents

http://cleveland.craigslist.org/kid/

http://cleveland.craigslist.org/bab/

Local Heath Care Education Resources

http://www.rainbowbabies.org

http://drsenders.com/?q=event

http://www.dailydoseofreading.org

Local & Federal Early-Childhood Education and Healthy-Start Links

http://www.ceogc.org

http://www.clevelandakronfamily.com/Cleveland%20Page.htm

Local Play Areas and Parks

http://gocitykids.parentsconnect.com/?area=177

http://www.dnr.state.oh.us/tabid/11875/default.aspx

http://www.clemetparks.com

http://ohio.hometownlocator.com/features/cultural,class,Park,scfips,39035.cfm

VII. Graduate Students Who Have a Disability

In this section, we address issues confronting students who have physical disabilities, learning disabilities (e.g., ADHD and dyslexia), chronic illnesses (e.g., lupus and cystic fibrosis), and/or psychological illnesses (e.g., bi-polar disorder and clinical depression). Students who have a disability have unique needs and concerns.

Reluctance to Ask for Help

Students who have a disability often fear that they may appear to be too dependent—or become too dependent—if they ask for help. In addition, students who have a disability are sometimes afraid of being treated differently by professors.

Disclosing a Disability

Although students at Case Western Reserve University are not required to disclose a disability to anyone, they are urged to disclose to the Office of Disability Resources in Educational Services for Students (ESS) before they wish to receive reasonable accommodations. The Associate Director of Disability Resources and other Disability Resources staff members keep disability information strictly confidential, and the choice of disclosure is left solely to the student. When students wish to notify professors of accommodations or special considerations, Disability Resources (along with the student) will compose a memo to his/her professors that only identifies the approved accommodations for the student and does not indicate the specific disability. The student is then responsible for giving the memo to the professors of the classes in which he or she needs accommodation. This is an opportunity for the student to speak with the professor about his or her needs and work out the logistics of the accommodation(s).

Effort Exerted Just to Keep Up

For those students who have a physical or learning disability, meeting the basic requirements may demand much more time and energy than it does for students without a disability. Some students find they cannot participate in certain professional activities (such as submitting papers for conferences) as much as they would like because they need to devote all their time and energy to meeting the basic requirements of their programs.

Problems that Arise from Last-Minute Changes

Changes in reading assignments can be very difficult for students who are visually impaired, since students who are blind or visually impaired must have their readings converted into alternative formats. Any readings added on at a later date will require them to make special efforts to have these new materials translated in a short period of time. Changes in room locations can also cause difficulty for students with visual or physical disabilities.

Suggestions

1. If you need an accommodation, you should not hesitate to communicate with your professors. This should be done at the beginning of the semester so that proper accommodations can be made.

2. Strive to complete assignments in as timely fashion as much as possible, but on occasion you may need a longer period of time to complete a task. If strict deadlines can't be relaxed, be sure to request feedback you need from your professors as early as possible. However, sometimes you will simply need to have additional time; these instances should be discussed on a case-by-case basis with the professor giving the assignment, and an agreement should be reached that is acceptable to both parties.

3. Students who have a psychological disability should find a trusted professional practitioner with whom to work. For all students, social support is crucial and should be sought in many forms. Resist any urges to isolate yourself, since many of your peers will be experiencing the same or similar anxieties and worries.

4. Be very realistic about how much work you can do. During the first semester, take the lightest course load possible so that there will be time to adapt to the new environment.

5. Many other suggestions can be found at the following website:

http://studentaffairs.case.edu/education/disability

6. Remember in general, however, that simply keeping the lines of communication open with professors or fellow students--and asking them for help when necessary-- will help students who have a disability find graduate school to be less intimidating.

Resources

- Education Services for Students (ESS)
  470 Sears Building
  216-368-5230
  essinfo@case.edu

A list of disability resources operated by ESS

http://studentaffairs.case.edu/education/disability/

- Information for faculty members operated by ESS

http://studentaffairs.case.edu/education/disability/learning.html

Disability Resources also deals with making accommodations for students with temporary disabilities, such as broken or sprained limbs.

Most libraries on campus have large print text materials and CCTVs as well.

VIII. Graduate Students Who Have Different Religious Beliefs

It is important that everyone respect the religious practices that their professors or fellow graduate students choose to follow. It is impossible to reference every practice in every religion in this

Handbook. That said, this section outlines some items university community members may want to be aware of when interacting with students of diverse religious beliefs.

Religious Garb

Different clothing may be an important part of a religious practice. However, certain disciplines may require clothing restrictions for safety and/or other applicable reasons. It is important to discuss potential clothing issues with your department and/or mentor.

Absences

Students who follow specific religious beliefs may need to take days off from school for religious holidays, even though they may not be official university holidays. Examples include Rosh Hashanah for students who follow Jewish beliefs or Good Friday for students who follow Christian beliefs. Thus, students may be absent from class or be away from their thesis work on these holidays. It is important to understand that observing their religious holidays should not result in a penalty. Faculty members should help inform such students on any important information they have missed. That said, students should not expect faculty to provide them with a complete set of lecture notes; those should be obtained from fellow graduate students.

Dietary Customs

Many religions have dietary customs. Some of these customs are practiced only during religious holidays. An example is the holy month of Ramadan for the Muslim faith, during which practicing Muslims do not consume food or drink during daylight hours. Other nutritional practices are in force all the time. For example, beef is not eaten by practicing Hindus.

Suggestions

1. The Inter-Religious Council (IRC) is composed of the staffs of the four campus ministries serving the institutions of higher education in University Circle. For assistance in understanding religious beliefs contact the IRC through the Office of Student Affairs.

2. When you are absent from class to follow the practices of your specific religious beliefs, notify your professors in advance and be responsible for making up the work. You should not be penalized for following your religious beliefs.

3. Some religious practices may require some adjustments or flexibility from professors. Communicate such requests early. For example, a student who fasts during the holy month of Ramadan would like to bring food and drink to a meeting or class scheduled after sun set, should make the request ahead of time so that accommodations can be made.

4. When planning social gatherings, avoid referring to these as parties for specific religious groups. Having a "Holiday Party" instead of a "Christmas Party" will make all students feel welcome, including Jehovah's Witnesses, who do not celebrate many Christian or any civil holidays.

5. In settings where food will be provided, respect the dietary customs that students may follow. Make sure that Kosher options are available for Jewish students who need them (not all will). Vegetarian options will accommodate Muslims, Hindus, and Roman Catholics on Fridays during Lent (as well as students who are vegetarian, independent of their religious beliefs).

6. Finally, remember that not everyone is religious. Some people are agnostics or atheists. In academia, your belief system is considered your personal preference and religious writings cannot be uncritically utilized as the only reference sources in your graded academic work unless you are a graduate student in Religious Studies. .

Resources

CWRU's student organization list includes a sub-heading of religious groups

http://usg.case.edu/student-organizations

IX. Short-term Obstacles to Progress

Situations occasionally arise in which you may be temporarily unable to perform the material duties of your graduate appointment with reasonable continuity. This may come about as a result of sickness, injury, pregnancy, psychological difficulties, or some other unique situation. It is important that you talk to your mentor about this as soon as possible to convey to him/her that it is a temporary situation and to find mutually agreeable solutions to help you meet your goal of earning an advanced degree. You may need additional resources (e.g., counseling) to help you successfully navigate this difficult time. Remember that mentors, departments, and the university have made an investment of time, resources, and money in you as their student. It is important to communicate necessary information about your challenging situation to your mentor or other appropriate university employees to protect this investment.

Understanding Temporary Limitations and Reassessing Expectations

Set up meetings with your mentor to assess the reality of your short-term condition, and discuss your ability to contribute to the team at any level. After further dialogue, it will likely become apparent that you are still able to contribute, but that you simply need to have the work environment and expectations temporarily redefined. Work with your mentor to redefine expectations and create schedules—consistent with university policy and realistic for all parties involved—that take the extenuating circumstances into account. Students should be aware that the University is not obligated to provide accommodations for students with temporary disabilities, but will attempt to do

so when feasible. Schedule a timeframe for reassessing the situation as it develops. The School of Graduate Studies Graduate Student Handbook (page 20) outlines a policy for graduate student leaves of absence that may provide a solution to the temporary situation. Individual departmental guidelines may vary, so a discussion of the circumstances with the department chair and/or the Dean of Graduate Studies may also be necessary.

Financial Considerations

Be upfront about the possible financial ramifications of the situation. If you find it necessary to temporarily leave the University or if you can only continue in a reduced capacity, it may not be possible to continue to receive a stipend at the same level.

Suggestions

Always be honest (without going into any personal detail that makes you uncomfortable) with your mentor about a situation that requires a temporary leave of absence or inhibits your ability to do your graduate work. Make sure to discuss new expectations or schedules that could help you still make progress in your work while dealing with your difficult situation.

Explore alternative departmental service activities such as grading exams part-time or from home. Sometimes you will still receive a stipend for this type of work.

If the department allows it, consider developing a reading course for credit where you can read articles pertaining to your research and participate in discussions via email. Some departments may offer independent studies where you can do a variety of computer work (analyzing data, creating digital maps of field sites, performing computer simulations, etc.) for credit.

Resources

- School of Graduate Studies

  http://www.case.edu/provost/gradstudies

- Graduate Student Handbook

  http://www.case.edu/gradstudies/downloads/GraduateStudentHandbook09-10.pdf

- Financial Aid

  http://finaid.case.edu

- University Counseling Services

  https://studentaffairs.case.edu/counseling/

Cited Works and Other Resources

"Academic Careers in Engineering & Science (ACES) Home." Retrieved from: http://www.case.edu/admin/aces/

"American Psychological Association of Graduate Students." A Survival Guide for Ethnic Minority Graduate Students." Retrieved from: http://evs.astate.edu/Library/minoritystusurvival.pdf

Association of Colleges and the Further Education National Training Organization, Learning and Skills Council (2001). "Mentoring towards excellence: Section 4: Handbook and guidelines for mentors and mentees." Coventry, England.

"AWIS: Association for Women in Science; Mentoring." Retrieved from: http://www.awis.org/displaycommon.cfm?an=1&subarticlenbr=209

Bonilla-Silva, E. (2006). *Racism without racists: Color-blind racism and persistence of racial inequality in the United States*. Lanham, MD: Rowman and Littlefield Publishers, Inc.

Brown, M. E. and Trevino, L.K. (2006). Ethical leadership: A review and future direction. *The Leadership Quarterly, 17*(6), 595-616.

Brainard, S.G., Harkus, D.A., & George, M.R. (1998). *A curriculum for training mentors and mentees: Guide for administrators.* Seattle, WA: Women in Engineering Initiative, WEPAN Western Regional Center, University of Washington.

"Case Medicine: Office of Multicultural Programs." Retrieved from: http://casemed.case.edu/omp/

"Case School of Graduate Studies." Retrieved from: http://www.case.edu/provost/gradstudies/

"Case Western Reserve University LGBT Resources." Retrieved from: http://www.case.edu/provost/lgbt/

"Cleveland baby & kid stuff classifieds - craigslist." Retrieved from: http://cleveland.craigslist.org/bab/

"Cleveland childcare classifieds - craigslist." Retrieved from: http://cleveland.craigslist.org/kid/

"Cleveland Metroparks." Retrieved from: http://www.clemetparks.com/

"Committee on LGBT Concerns." Retrieved from: http://www.case.edu/provost/lgbt/committee.html

"Council for Economic Opportunities in Greater Cleveland." Retrieved from: http://www.ceogc.org/

"Counseling Services and Collegiate Behavioral Health - Case University Counseling Services." Retrieved from: http://studentaffairs.case.edu/counseling/

"CPST Home Page." Retrieved from: http://cpst.org/index.cfm

Crisp, G. and Cruz, I. (2009). Mentoring college students: A critical review of the literature between 1990 and 2007. *Research in Higher Education, 50*(6), 525-545.

"Cuyahoga County Ohio Parks." Retrieved from: http://ohio.hometownlocator.com/features/cultural,class,Park,scfips,39035.cfm

"Daily Dose of Reading: Home." Retrieved from: http://www.dailydoseofreading.org/

"Disability Resources - Case Educational Services for Students." Retrieved from: http://studentaffairs.case.edu/education/disability/

"Disability Resources One-Pagers - Case Educational Services for Students." Retrieved from: http://studentaffairs.case.edu/education/disability/learning.html

"Events | Dr. Senders and Associates." Retrieved from: http://drsenders.com/?q=event

"Financial Aid - Home." Retrieved from: http://finaid.case.edu/Finaid.aspx?c=1

"Flora Stone Mather Center for Women." Retrieved from: http://www.case.edu/provost/centerforwomen/index.html

"Go City Kids - Cleveland - Kids & Family Activities, Cleveland Entertainment & Events." Retrieved from: http://gocitykids.parentsconnect.com/?area=177

"Graduate Student Handbook." Retrieved from: http://www.case.edu/gradstudies/downloads/GraduateStudentHandbook09-10.pdf

Green, S.G. and Bauer, T.N. (1995). Supervisory mentoring by advisors: Relationships with doctoral student potential, productivity, and commitment. *Personnel Psychology, 48*, 537-561.

"Information for Faculty - Case Educational Services for Students." Retrieved from: http://studentaffairs.case.edu/education/disability/

Jacobi, M. (1991). Mentoring and undergraduate academic success: A literature review. *Review of Educational Research, 61*(A), 505-532.

Kuh, G.D., Kinzie, J., Schuh, J.H., & Whitt, E.J. (2010). *Student success in college: Creating conditions that matter.* San Francisco, CA: Jossey-Bass.

Limbach, P. "AIGC Article: Mentoring Minority Science Students: Can a White Male Really be an Effective Mentor?" *American Indian Graduate Center*. Retrieved from: http://www.aigc.com/articles/mentoring-minority-students.asp

"The Lesbian Gay Bisexual Transgender Center at Case Western Reserve University." Retrieved from: http://www.case.edu/lgbt/center/

Nerad, M. (1992). *Using time, money and human resources efficiently and effectively in the case women graduate students*. Paper prepared for the conference proceedings of Science and Engineering Programs: On Target for Women (March, 1992).

Nerad, M. & Stewart, C.L. (1991). *Assessing Doctoral Student Experience: Gender and department culture*. Paper presented at the 31st Annual Conference of the Association for Institutional Research (San Francisco, CA, May 1991).

"Ohio County/Metro Trails." Retrieved from: http://www.dnr.state.oh.us/tabid/11875/default.aspx

Nyquist, J.D., & Wulff, D.H. (1996). *Working Effectively With Graduate Assistants*. Thousand Oaks, California: Sage.

"Promoting Intercultural Exchange at Case - Case International Student Services." Retrieved from: http://studentaffairs.case.edu/international/

Rose, G.L. (2003). Enhancement of mentor selection using the ideal mentor scale. *Research in Higher Education, 44*(4), 473-494.

Sandler B.R., Silverberg. L.A., & Hall, R.M. (1996). *The chilly Classroom Climate: A guide to improve the Education of Women.* Washington, D.C.: The National Association for Women in Education.

"School of Graduate Studies' Academic Integrity Procedures and Rules" Retrieved from: http://www.case.edu/gradstudies/downloads/AcadInteg.pdf

"Shaker Heights Public Library." Retrieved from: http://www.shakerlibrary.org/Kids/links.aspx?Websites+for+Parents

"Student Organizations - Case Multicultural Affairs." Retrieved from: https://studentaffairs.case.edu/multicultural/resources/organizations.html

"Student Organizations: Case Western Reserve University." Retrieved from: http://www.case.edu/studentorgs/

"The Mentoring Gap for Women in Science: Higher Education's Source for News, and Views and Jobs." Retrieved from: http://www.insidehighered.com/news/2008/02/28/mentor

The Rackham School of Graduate Studies (2006). *How to Mentor Graduate Students: A Guide for Faculty at a Diverse University*. Ann Arbor, MI: University of Michigan.

"Think, Lead, and Act Globally - Case Multicultural Affairs." Retrieved from: http://studentaffairs.case.edu/multicultural/

Trice, A.D.(1999). *Graduate Education at the University of Michigan: A Foreign Experience*. Ann Arbor, MI: University of Michigan, Rackham School of Graduate Studies.

"Welcome to Heights Parent Center." Retrieved from: http://www.heightsparentcenter.org/

Zelditch, M. (1990). "Mentor Roles. Proceedings of the 32nd Annual Meeting of the Western Association of Graduate Schools, Tempe, Arizona, 16-18 March, 1990, p. 11.

Additional Reading

The following resources were used in the writing of this handbook and are quality references in the mentoring of graduate students.

Graduate School Handbooks and Guides

Jackson State University, Division of Graduate Studies. Best practices for mentoring graduate students. Retrieved from: http://www.jsums.edu/gadmappl/Mentoring.pdf

University of Michigan, Rackham School of Graduate Studies. (2006). How to mentor graduate students: a guide for faculty at a diverse university. Retrieved from: http://www.rackham.umich.edu/downloads/publications/Fmentoring.pdf

University of Washington, The Graduate School. (2005). How to mentor graduate students: A faculty guide. Retrieved from: http://www.grad.washington.edu/mentoring/GradFacultyMentor.pdf

Articles and Books

Fowler, J. L. & O'Gorman, J.G. (2005). Mentoring Functions: A Contemporary View of the Perceptions of Mentees and Mentors. *British Journal of Management 16,* 51-57.

Lee, A., Dennis, C., & Campbell, P. (2007). Nature's Guide for Mentors. Nature, 447, 791-797.

Lee, A., Dennis, C., & Campbell, P. (2006). Nature's Guide for Mentors. Nature, 444, 966.

Nakamura, J., Shernoff, J., & Hooker, C.H. (2009). *Good mentoring: Fostering excellent practice in higher education*. San Francisco, CA: Jossey-Bass.

Rayborn, C. A., Denmark, F.L., Reuder, M.E., & Austria, A. M. (2010). *A handbook for women mentors: Transcending barriers of stereotype, race, and ethnicity.* Santa Barbara, CA: Greenwood Publishing Group.

Sternberg, D. (1981). *How to complete and survive a doctoral dissertation.* New York, NY: St. Martin's Griffin.

Trevino, Y. (2010). Mentor vs. Advisor. Indiana University Graduate School. Retrieved from: http://www.indiana.edu/~grdschl/mentoring.php

Organization Websites

American Indian Graduate Center

http://www.aigcs.org/

American Psychological Association, A survival guide for ethnic minority graduate students

http://www.apa.org/pi/oema/resources/brochures/surviving.aspx

Commission on Professional in Science and Technology

http://cpst.org/index.cfm

The Leadership Alliance

http://www.theleadershipalliance.org/AboutUs/Mission/tabid/70/Default.asp

Appendix A – *Phases of a Graduate Student's Professional Development*

As mentee becomes:	Senior Learner	Colleague-in-Training	Junior Colleague/ Colleague
Emphasizes mentor's role as	**Manager**	**Educational/Professional Model**	**Colleague/Mentor**
	"Do the task the way I've laid out and check back with me."	"Think about the problem, generate options, then let's talk about potential outcomes/ decisions."	"You make the decision. Let me know how I can help. I'm interested in the outcome."
Views own teaching role as	**Assistant**	**Associate**	**Collaborator**
	Grading papers Holding office hours Planning quizzes Collecting feedback	Writing assignments Generating test questions Doing some teaching, lecturing, or small group discussions	Designing, developing, or revising advanced courses or curriculum; instructor of record or co-teaching
Views research role as	**Assistant**	**Associate**	**Collaborator**
	Performing specific duties under relatively close supervision	Assuming design and implementation responsibility for part of a grant or for own research project	Conducting research project (or own portion of it) with high degree of independence; sees mentor as a resource
Understands practitioner, applied or service roles as	**Assistant**	**Associate**	**Collaborator**
	Learning the ropes; acquiring discrete technical skills	Providing strategic assistance or expertise; ultimately defers to mentor	Co-leading, co-designing, co-facilitating; sharing responsibility equally
Prefers evaluation to be	**Assistant**	**Associate**	**Collaborator**
	Frequent and focused on immediate performance	Systematic and focused on overall development of skills, aptitudes	Collegial, informal, and focused on style, approach, values
Sees mentoring needs as	**Assistant**	**Associate**	**Collaborator**
	Self-assessment; goal assessment; regular meetings	Observations; job shadowing; meetings; attend/present at conferences together; networking	Reflective practicum; retreat; opportunistic meetings; networking; generate new project together; co-stewardship

Adapted from Nyquist, J.D. and Wulff, D.H. (1996). Working effectively with graduate assistants, p. 27. Thousand Oaks, Ca.: Sage. (See Chao [1997] for a four-phase model of graduate student development.)

Appendix B – *A Worksheet for a Mentor's Expectations*

Use this worksheet to develop an understanding of what you, as a faculty mentor, expect to gain from your mentoring relationship. By clarifying your own expectations, you will be able to communicate and work more effectively with your students. Add items you deem important.

The reasons I want to be a mentor are to:

____ Encourage and support a graduate student in my field

____ Establish close, professional relationships

____ Challenge myself to achieve new goals and explore alternatives

____ Pass on knowledge

____ Create a network of talented people

____ Other_____

I hope that my student and I will:

____ Tour my workplace, classroom, center, or lab

____ Go to formal mentoring events together

____ Meet over coffee or meals

____ Go to educational events such as lectures, conferences, talks, or other University events together

____ Go to local, regional, and national professional meetings together

____ Other_____

The things I feel are off-limits in my mentoring relationship include:

____ Disclosing our conversations to others

____ Using non-public places for meetings

____ Sharing intimate aspects of our lives

____ Meetings behind closed doors

____ Other_____

Appendix B *(continued)*

I will help my student with job opportunities by:

____ Finding job or internship possibilities in my department, center, lab, or company

____ Introducing my student to people who might be interested in hiring him/her

____ Helping my student practice for job interviews

____ Suggesting potential work contacts to pursue

____ Teaching him/her about networking

____ Critiquing his/her resume or curriculum vita

____ Other_____

The amount of time I will spend with my student will be, on average:

1 2 3 4 hours every: week other week per month (circle one)

Worksheet adapted from: Brainard, S.G., Harkus, D.A., and George, M.R. (1998). *A curriculum for training mentors and mentees: Guide for administrators.* Seattle, WA: Women in Engineering Initiative, WEPAN Western Regional Center, University of Washington.

Appendix C – *A Worksheet for a Student's Expectations*

Use this worksheet to develop an understanding of what you, as a student, expect to gain from your mentoring relationships. By clarifying your own expectations, you will be able to communicate them more effectively to your mentors. Add items you deem important.

The reasons I want a mentor are to:

____ Receive encouragement and support

____ Increase my confidence when dealing with professionals

____ Challenge myself to achieve new goals and explore alternatives

____ Gain a realistic perspective of the workplace

____ Get advice on how to balance work and other responsibilities, and to set priorities

____ Gain knowledge of the "do's and don'ts" in my field of study

____ Learn how to operate in a network of talented peers

____ Other_____

I hope that my mentor and I will:

____ Tour my mentor's workplace and explore various teaching or work sites

____ Go to formal mentoring events together

____ Meet over coffee, lunch, or dinner

____ Go to educational events such as lectures, conferences, talks, or other University events together

____ Go to local, regional, and national professional meetings together

____ Other_____

I hope that my mentor and I will discuss:

____ Academic subjects that will benefit my future career

____ Career options and job preparation

____ The realities of the workplace

____ My mentor's work

____ Technical and related field issues

Appendix C *(continued)*

____ How to network

____ How to manage work and family life

____ Personal dreams and life circumstances

____ Other_____

The things I feel are off-limits in my mentoring relationship include:

____ Disclosing our conversations to others

____ Using non-public places for meetings

____ Sharing intimate aspects of our lives

____ Meeting behind closed doors

____ Other_____

I hope that my mentor will help me with job opportunities by:

____ Opening doors for me to job possibilities

____ Introducing me to people who might be interested in hiring me

____ Helping me practice for job interviews

____ Suggesting potential work contacts for me to pursue on my own

____ Teaching me about networking

____ Critiquing my resume or curriculum vita

____ Other_____

The amount of time I will spend with my mentor will be, on average:

1 2 3 4 hours every: week other week per month (circle one)

Adapted from: Brainard, S.G., Harkus, D.A., and George, M.R. (1998). *A curriculum for training mentors and mentees: Guide for administrators.* Seattle, WA: Women in Engineering Initiative, WEPAN Western Regional Center, University of Washington.

Appendix D – *Planning for first meetings: A Mentor's Checklist*

Use this checklist to plan initial meetings with your students in light of what you hope to help them achieve over the long term.

____ Arrange first meetings with potential students.

____ Explain the goals for meetings and discuss how confidentiality should be handled.

____ Discuss what each of you perceives as the boundaries of the mentoring relationship.

____ Review the student's current experience and qualifications.

____ Discuss and record the student's immediate and long-term goals; explore useful professional development experiences in light of these goals. Record these on a professional development plan. Discuss strategies and target dates.

____ Discuss and record any issues that may affect the mentoring relationship such as time and financial constraints, lack of confidence, new to the role, etc.

____ Arrange a meeting schedule (try to meet at least once a quarter). Record topics discussed and feedback given at each meeting. Ensure that all meeting records are kept confidential and in a safe place.

____ Discuss the following activities that can form part of your mentoring relationship:

- Giving advice on strategies for improving teaching.
- Organizing observation(s) of teaching and providing constructive feedback.
- Organizing a session of work shadowing.
- Consulting on issues or concerns the student has with colleagues or study and research groups.
- Providing feedback from other sources (students, faculty, administrators, and other mentors in or outside the University).

____ Create a mentoring action plan that reflects different professional development needs at different stages of the student's graduate program.

____ Encourage your student to reflect regularly on his or her goals, achievements, and areas for improvement. Ask the mentee to compose a brief reflection essay (e.g., 1/2 page) prior to each meeting.

____ Amend the mentoring action plan as needed by focusing on the student's developing needs.

Adapted from: *Mentoring towards excellence*: Section 4: Handbook and guidelines for mentors and mentees. Association of Colleges and the Further Education National Training Organization, Learning and Skills Council: Coventry, England.

Appendix E – *Planning for first meetings: A Student's Checklist*

Use this checklist to plan initial meetings with your mentors in light of what you hope to achieve over the long term.

____ Arrange first meetings with a prospective mentor.

____ Explain your goals for meetings, and ask how confidentiality should be handled.

____ Discuss what each of you perceives as the boundaries of the mentoring relationship.

____ Review the current experience and qualifications.

____ Discuss and record your immediate and long-term goals. Explore useful professional development experiences in light of these goals. Record these on a professional development plan. Discuss options, strategies, and target dates.

____ Discuss and record any issues that may affect the mentoring relationship such as time and financial constraints, lack of confidence, being new to the role, etc.

____ Arrange a meeting schedule with your mentor (try to meet at least once a quarter). Record topics discussed and feedback given at each meeting. Request that all meeting records are kept confidential and in a safe place.

____ Discuss with your mentor the following activities that can form part of your mentoring relationship:

- Getting advice on strategies for improving teaching or research.
- Organizing observation(s) of teaching and providing constructive feedback.
- Organizing a session of work shadowing.
- Getting advice on issues or concerns with colleagues in study and research groups.
- Providing feedback from other sources (students, faculty, administrators, and other mentors in or outside the University).

____ Create a mentoring action plan that reflects different professional development needs at different stages of your graduate program.

____ Encourage your mentor to reflect regularly with you on your goals, achievements, and areas for improvement. Compose a brief reflection essay (e.g., 1/2 page) prior to each meeting.

____ Amend your mentoring action plan as needed by focusing on your developing needs.

Adapted from: *Mentoring towards excellence: Section 4: Handbook and guidelines for mentors and mentees*. Association of Colleges and the Further Education National Training Organization, Learning and Skills Council: Coventry, England.

Appendix F – *Sample Mentor and Student Agreement*

Consider using this agreement, or another one that you and your student(s) create together, if you believe the mentoring relationship will be strengthened by formalizing a mutual agreement of roles, responsibilities, and expectations.

We are voluntarily entering into a mentoring relationship from which we both expect to benefit. We want this to be a rich, rewarding experience with most of our time together spent in professional development activities. To this end, we have mutually agreed upon the terms and conditions of our relationship as outlined in this agreement.

Objectives

We hope to achieve:

1.

2.

3.

4.

To accomplish this we will:

1.

2.

3.

4.

Confidentiality

Any sensitive issues that we discuss will be held in confidence. Issues that are off-limits in this relationship include:

Appendix F *(continued)*

Frequency of Meetings

We will attempt to meet at least _____ time(s) each month. If we cannot attend a scheduled meeting, we agree to notify one another in advance.

Duration

We have determined that our mentoring relationship will continue as long as we both feel comfortable or until:

No-Fault Termination

We are committed to open and honest communication in our relationship. We will discuss and attempt to resolve any conflicts as they arise. If, however, one of us needs to terminate the relationship for any reason, we agree to abide by one another's decision.

_____	_____
Mentor	Student
_____	_____
Date	Date

Agreement adapted from: Brainard, S.G., Harkus, D.A., and George, M.R. (1998). *A curriculum for training mentors and mentees: Guide for administrators.* Seattle, WA: Women in Engineering Initiative, WEPAN Western Regional Center, University of Washington.

Support Unit Internal Review
Division of Information Technology Services
Case Western Reserve University
May 12, 2009

Roger A. Bielefeld
Jeffrey A. Gumpf
Joan M. McFaul

Executive Summary

An Internal Review Committee was charged by the co-sponsors of the organizational review of the Division of Information Technology Services (ITS) at Case Western Reserve University with conducting a reflective self-examination of ITS in the broad areas of environment and culture, working relationships, and mission and effectiveness. Based on objective data, survey data, and interviews, the committee proposes a set of recommendations that it believes will improve the ability of ITS to meet the needs of the university and support its mission and goals over the next five years. Recommendations are made in each of the main areas of focus for the internal review. In the area of Environment and Culture, these recommendations are to resolve the chronic shortage of appropriate physical space for ITS and to revisit the policies and practices related to the CASEworks program. In the area of Working Relationships, these recommendations are to improve cooperation among the functional units within ITS and to improve communications between ITS and its customers and stakeholders. Finally, in the area of Mission and Effectiveness, these recommendations are to ensure ITS's alignment with university strategic priorities, to identify permanent funding for high priority ITS initiatives, secure capital funding for critical IT infrastructure, improve the ability of ITS to provide cost-effective core services for the university community, improve the relationship between ITS and distributed IT units on campus, increase the presence and participation of ITS in university planning and decision making, control the number of major projects that ITS takes on each year, create a Chief Operating Officer position in ITS, decrease the size of the senior leadership team that is involved in discussions relating to ITS strategy and direction, and look for more opportunities for cost-sharing with other units within the university.

Introduction

The Division of Information Technology Services (ITS) at Case Western Reserve University has carried out strategic planning and created annual operating plans for the past eight years. As part of that activity, the division has polled its staff for the past five years on the quality of the workplace. In addition, the most recent strategic plan engaged the entire division (and university) through the use of a Wiki and unit-level meetings. In this past year, a division-wide values statement was developed and endorsed by its staff. As part of the ongoing evaluation of the organization, and in the context of the scope of activity outlined in a parallel external review, the co-sponsors of the ITS organizational review are genuinely interested in soliciting input and feedback from the ITS staff.

The chief information officer and vice president for information technology services, the chair of the Faculty Senate Committee on Information Resources, and the provost, as co-sponsors of the ITS organizational review, outlined a scope of work and charged an Internal Review Committee to carry out a robust and exhaustive internal review and self-examination. The findings of that work, along with recommendations, were to be completed and submitted to the provost as part of the ITS organizational review no later than June 30, 2009.

The Internal Review Committee responsible for this report consists of the following ITS staff: Roger Bielefeld, Director of Advanced Research Computing and lead author of the report, Jeffrey Gumpf, Chief IT Architect, and Joan McFaul, Associate Vice President.

Acknowledgements

The Internal Review Committee acknowledges the participation of the entire staff of ITS, whose participation in an online survey, group meetings, and individual conversations provided valuable input into the process. We acknowledge the participation of the senior leadership of ITS, each of whom agreed to meet with us for an interview for the purpose of discussing the substance of this review. We acknowledge Ly'Nette Cordaro, Deputy CIO, for her assistance in formulating the staff survey and participating in interviews with senior leadership. Finally, we gratefully acknowledge the assistance provided by Elizabeth Quinn and Lora Veselsky, who helped this effort to proceed smoothly and on schedule.

Purpose of the Internal Review

The purpose of the internal review is to conduct an internal, reflective self-study and evaluation of the operation, management, and service role of Information Technology Services, with emphasis on its accomplishments, the opportunities and challenges it faces, the scope and balance of its various functions, and its leadership, administration, and staff professional development. As a part of that self-reflection, the internal review should advise on any changes

ITS should make in its approach to technology direction, governance, staff skills development, staffing, funding and delivery of Case Western Reserve University's centrally provided information technology infrastructure and services, to ensure they meet the needs of the faculty, students, staff and others, and support the mission and goals of the university to the greatest extent possible over the next five years.

Environment and Culture

Charge: To consider and assess the working environment and organizational culture of the ITS division, and to review and self study the division's performance relative to productivity, strategic alignment of activities, management staff relations, employment, equity, and diversity issues.

This part of the report is directed at determining whether the physical working conditions, space planning, CASEworks telecommuting program, and staff morale are conducive to an efficient and effective IT operation. To address this, both objective and subjective data have been gathered. The objective data consist of a summary of the physical space currently available to ITS, how it is being used, and what the process has been for determining what space is available to ITS and how it is used. The subjective data consist of the results of previously administered surveys of ITS staff, the responses from ITS staff to questions devised as a part of the internal review effort, and results of interviews with ITS managers and directors.

Availability and use of physical space by ITS

At the present time ITS has staff in ten different locations on campus: the fourth and fifth floors of Crawford Hall, the second floor of the Kelvin Smith Library, the basement of the Kelvin Smith Library, the ground level of the Wood Building, the second floor of Tomlinson Hall, the second floor of the Sears Building, the fifth floor of the Sears Building, the second floor of the Montessori School, and the first floor of Adelbert Hall. These staff locations were not determined by a need to be in proximity with customers or data center facilities; rather, they were determined by the university administration based on availability of space on campus. This summary is a snapshot of space occupancy at the present time. Until approximately two years ago ITS occupied offices on the sixth floor of Crawford Hall, and there was short-term utilization of space in the Peter B. Lewis Building, home of the School of Management, approximately one year ago. It should be noted that the space currently used in Tomlinson Hall is believed to be temporary and that ITS has not been advised where staff located there might be relocated or when that might occur.

On the fourth floor of Crawford Hall, ITS occupies ten private offices, nine shared offices, one meeting room, and one multi-purpose room. This space is used for the Technical Infrastructure Services, Program Management Office, and Advanced Research Computing units of ITS. The private offices range between 125 and 135 square feet each and are occupied by two directors, one assistant director, six managers, and a department assistant. The six dual-occupancy shared offices range between 155 and 200 square feet each with a total floor space of 1010 square feet for 12 people. There are three large offices that accommodate between three and seven people each, with a total floor space of 1695 square feet for 16 people. There is a 200 square-foot meeting room. Finally, there is one 310 square-foot multi-purpose room that holds

two full-time staff members, one FTE in contractors, and two FTEs in student employees, as well as resources used by the entire floor including a shared printer, a shared copier/scanner/FAX, a paper shredder, a coffee maker, and a refrigerator. This room had also been used as a mail room until approximately a year ago when space constraints required that mail bins be attached to individual office doors so that additional staff could be housed in the room. In summary, 43 ITS staff and student and contractor FTE-equivalents occupy 4360 square feet of office space and 200 square feet of meeting room space at this location. ***There is no room for additional staff, given the current space utilization plan.***

On the fifth floor of Crawford Hall, ITS occupies thirteen private offices, eleven shared offices, one meeting room, and one multi-purpose room. This space is used for the Enterprise Applications Services unit of ITS, by the deputy CIO, by the IT Architect, and by one person from the Advanced Research Computing unit of ITS. The private offices range between 125 and 172 square feet each and are occupied by the deputy CIO, two directors, one assistant director, five managers, and three department assistants). The eight dual-occupancy shared offices range between 126 and 182 square feet each with a total floor space of 1321 square feet for 16 people. There are three offices that accommodate three people each, with a total floor space of 747 square feet for nine people. There is a 201 square-foot meeting room. Finally, there is a 108 square-foot multi-purpose room that holds resources used by the entire floor including a shared printer/copier/scanner/FAX, a paper shredder, and a refrigerator. In summary, 39 ITS staff and student FTEs occupy 3785 square feet of office space, 201 square feet of meeting room space, and 108 square feet of other space at this location. ***There is no room for additional staff, given the current space utilization plan, other than three locations (included in the above accounting) that are to be used by staff currently in the hiring process.***

On the second floor of the Kelvin Smith Library, ITS occupies five private offices, a multi-purpose area, a shared conference room, and a converted closet for student workers. This space is used by the Instructional Technology and Academic Computing unit of ITS. The private offices range between 152 and 236 square feet each and are occupied by a director and four staff members. The 295 square-foot multi-purpose area contains a desk for a department assistant and resources used by the group including a shared printer, a supply cabinet, and a shared copier/scanner/FAX. The 178 square-foot conference room is actually space belonging to the Kelvin Smith Library staff but is usable by the ITAC unit. The 126 square-foot converted closet is used by student workers at the level of approximately two FTE. In summary, eight ITS staff and student FTE-equivalents occupy 1265 square feet of office space and 178 square feet of meeting room space at this location. ***There is no room for additional staff, given the current space utilization plan.*** However, the private offices are sized generously when compared with other areas occupied by ITS and some may have the potential of conversion to dual occupancy.

On the ground floor of the Wood Building in the School of Medicine, ITS occupies a 5500 square-foot space known generically as WG-60. This space is used by the MediaVision group within the Instructional Technology and Academic Computing unit of ITS. This space consists of one 180 square-foot private office occupied by an associate director, 956 square feet for offices

and cubicles occupied by 15 staff members and student workers at the level of 3 FTE, a 378 square-foot conference room, a 660 square-foot space for equipment storage and staging, a 400 square-foot production studio, 252 square feet for production, 325 square feet for post-production, a 294 square-foot area for engineering and repair, and a 396 square-foot area for the technical core. In summary, 19 ITS staff and student FTEs occupy 1136 square feet of office space, 378 square feet of meeting room space, and 2327 square feet of other space at this location. Within this space there are also two shared printers, a copier, two coffee makers, two refrigerators, and a microwave. ***There is no room for additional staff, given the current space utilization plan. The ITAC associate director who is the lead staff person at this location states that the space is much too small and inadequately designed for the size of his staff and the type of work they perform.***

On the second floor of Tomlinson Hall, ITS occupies one private office, one shared office, a multi-occupancy area, and a meeting room. This space is used by the Information Security unit and the Program Management Office of ITS. The private office is 180 square feet in area and is occupied by a director. The shared office is also 180 square feet in area and is currently occupied by one staff member. Two additional private offices are available but are unused due to their unknown near-future status. There is a 600 square-foot library that serves as a meeting room. Finally, there is a 360 square-foot area with cubicles that houses one FTE of student employees. There is room for an additional staff person in the shared office. One PMO staff member is occupying other temporary space on the first floor of Tomlinson Hall where he was assigned previously rather than move to different temporary space on the second floor. ***The long-term plans for this space are uncertain. It is expected that the space will have to be vacated in a matter of months to permit renovation, to include installation of central air conditioning and networking, for a yet to be determined purpose.***

In the Sears Building, ITS occupies a 2500 square-foot space on the second floor and an 80 square-foot office on the fifth floor. The office is occupied by an associate vice president who directs implementation of the student information system. The space on the second floor is currently configured into cubicles for up to fourteen people. It is currently used by nine ITS staff and four to five non-ITS staff working on the same project.

The space in the Montessori School is used by the outsourced help desk provider, with a very small area occupied by the two university telephone operators who are ITS employees.

Finally, on the first floor of Adelbert Hall there is a suite of offices that is shared between the CIO / VPITS and two staff of the Secretary of University Faculty. The ITS personnel include the CIO/VPITS, his executive aide, the director of the Program Management Office, and a department assistant. At this location ITS occupies 630 square feet: there are three staff in private offices totaling 490 square feet, and a department assistant, multi-function printer, refrigerator, and microwave in a 140 square-foot open area. The CIO / VPITS requested use of the other two offices in the suite. However, one of them was assigned to the Secretary of

University Faculty; her department assistant occupies 140 square feet of the open area in the suite. The second office is unoccupied and has not yet been assigned for use by the university.

See Appendix A for a tabular summary of space utilization by ITS staff.

In addition to the aforementioned office space, ITS has space in the form of two data centers. The main data center in the basement of the Kelvin Smith Library consists of a 2400 square-foot space for server and storage that support general production services that ITS provides to the university, and a 1073 square-foot space for high performance research computing. The 1630-square-foot secondary data center on the third floor of Crawford Hall provides redundancy and fail-over capacity for the main data center.

Several members of the senior leadership indicated that the lack of suitable physical space and the history of frequent movement of offices have had a negative impact on morale. Besides office space, senior leadership expressed concern about the lack of space for storage, hardware setup, and audio/video production. Comments from the staff at large echo this theme.

Space planning

The Department of Campus Planning and Operations is responsible for campus planning and design, space management, facilities operations, construction management, and campus services. All allocations of space for ITS are handled by this department. ITS can repurpose space that is assigned to it but cannot increase its space allocation.

Over the past decade there have been several attempts to increase the amount of space allocated to ITS, but the ITS space allocation has actually decreased. For example, ITS has lost the entire sixth floor of Crawford Hall, data center space on the third floor of Crawford Hall, several offices on the second floor of KSL, and two of the offices in Suite 109 in Adelbert Hall.

According to our survey, 70% of staff believe that space planning is not done effectively for ITS. The survey comments reflect the widespread belief among ITS staff that lack of space and space planning hampers productivity and negatively affects morale, and that ITS is not given adequate consideration for its space requirements.

CASEworks telecommuting program

CASEworks is a flexible work plan program that includes a work-from-home option. It is available to staff in Information Technology Services. There are a number of options, but individual plans must be approved by the manager. The CASEworks program was conceived in early 2005 and approved by Department of Human Resources and the Office of the General Counsel in January, 2006.

CASEworks was prompted by space constraints, customer demands, desire for work schedule flexibility, a desire to stay current with modern business practices, and the availability of technology allowing for the desired flexibility.

The CASEworks program is perceived as efficient and effective by 84% of the 64 respondents to this question. Eleven survey participants did not respond to this question.

Comments in the survey highlighted the need for a review of the policies and practices governing CASEworks, that CASEworks is not a solution for the shortage of space in ITS, but that there are benefits of having increased flexibility in work schedules.

Staff morale

In evaluating staff morale, several areas were considered: general morale, relationships between staff and management, how ITS activities align with the strategic plans of both the university and ITS, and diversity issues. We relied on three venues for feedback on staff morale: the Quality of Work Life survey, the Internal Review survey, and in-person interviews.

Based on the Quality of Work Life survey that ITS conducts annually, the overall trend in the last four years for job satisfaction is up and ITS is nearly a complete point above the national norm. After a step backwards in scores for various components of job satisfaction in 2007, the 2008 numbers are consistently higher, often beating historical highs. However, there are suggestions that staff still feel overworked, perhaps due to a lack of prioritization.

Staff was surveyed for the internal review. One question asked how staff morale affects them; 40% said positive, 37% were neutral and 23% were negative. There were 70 respondents to this question and 5 skipped. Comments pointed to the recent sense that there is increased security of employment at CWRU. However, there remains concern about having sufficient resources.

Another question asked about the relationships between staff and management and between management and leadership. Responses were 45% positive, 45% neutral, and 9% negative. Some respondents said the wording of the question made it difficult to answer. Comments suggested that relationships were different in different departments, the senior leadership team is well rounded, and staff and management have good relationships but the senior leadership, along with their relationships, are dysfunctional.

A large percentage (78%) believed that ITS activities aligned well with both the university and ITS strategic plans. Comments included that strides have been made in this area but work remains to be done on prioritization, there is insufficient funding for core services yet new services continue to be added, different levels of management push different goals, resource

allocations do not change based on stated goals, and that there are clear areas of tension that do not get addressed.

Senior leadership interviews revealed the following:

- There is a silo mentality in ITS that keeps its functional units isolated from one another and stifles growth and creativity.
- There are too many new things coming from the CIO, and instructions from the CIO to managers and directors often conflict or overlap. There are too many projects on the table. Timelines from the CIO are overly aggressive leading to poor self-esteem in some individuals when they believe they have failed. The CIO must let people think things through.
- Human resources are so scarce that it is difficult to function.
- ITS is not funded adequately.
- Setting priorities does not work at all and there is no discussion regarding what should and should not be done.
- Improvement is apparent but not to the degree indicated in surveys.
- The surveys themselves are biased and unreliable.
- EAS and TIS do not have good customer service attitudes.
- The senior leadership team does not operate as a "team"; they do not address leadership issues and they are not encouraged to share openly leading to a "disconnect" among directors.
- The lack of space planning for ITS impacts morale.
- It is recommended we do fewer things at greater depth and of higher quality.

Working Relationships

Charge: To consider and self evaluate the working relationships among the key functional units within ITS as well as between ITS and the faculty, departments, institutes, centers, and appropriate university service units.

This part of the report is aimed at determining the nature of the interaction among its functional units, whether ITS is meeting the needs and expectations of the university community, whether ITS believes that it has credibility with its stakeholders, whether ITS staff and services are appropriately integrated with the research and teaching functions of the university faculty, whether ITS is adequately prepared for change to keep up with technological advances and increasing demand from its customers, and whether there are appropriate techniques and methodologies in place to permit ITS to evaluate its service offerings. To address this, primarily subjective data have been gathered. The data consist of the results of previously administered surveys of ITS staff, the responses from ITS staff to questions devised as a part of the internal review effort, and results of interviews with ITS managers and directors.

Interaction among ITS functional units

The functional units in ITS (EAS, ITAC, TIS, PMO, Security, Research Computing, and IT architecture) interact with one another with greater or lesser frequency depending on projects and dependencies. The need to work cooperatively is driven by the integrated nature of our services and the need to interface directly and indirectly to provide services to customers.

According to our survey, 16% see the relationships among the various units as positive, 30% negative and 53% are neutral. Seventy-three respondents answered this question with 2 abstaining.

Comments indicate there is a continuing lack of teamwork, especially between TIS and EAS. EAS and TIS are seen to operate very differently. Lack of teamwork is viewed as more pervasive by some and they believe this starts at the senior levels of the organization. There is very little sense of treating each other as customers.

Senior leadership interviews revealed:

- There is competition for limited resources rather than agreement on common direction and purpose among the senior leadership.
- There should be a smaller group of people at the top who can address issues and work as a team.
- Senior leadership are often not on the same page and work at cross purposes.

Meeting the needs and expectations of the university community

Clearly, as a service provider, ITS must identify and meet the information technology needs of the university in order to be successful. According to the survey, 71% of respondents (9 skipped the question) believe that ITS succeeds in meeting the needs and expectations of the university.

In the comments section, many stated that, given the resource constraints and shaky infrastructure, ITS does an incredible job meeting the university's needs and expectations. Some suggested the expectations of the university are unreasonable. It was also suggested that many ITS projects are driven internally rather than externally.

Senior leadership interviews revealed:

- It is important to have a central IT organization with a high level of expertise and to build trust between central and distributed IT organizations.
- We need to be more consistent with communication and insure our communication is clear and understandable (stay away from tech talk).
- Users may not believe they are getting the best "bang for the buck".
- Customer service orientation is lacking in most areas.
- We have an opportunity to better manage our relationships with the schools. We should reframe how central IT delivers services and begin to "sell" our expertise in the form of consulting services.

ITS credibility with stakeholders

Credibility is an essential element ITS must have if services are to be viewed as adding value. Credibility comes from consistency, reliability, truthfulness, and alignment with goals and objectives.

The survey respondents had a positive outlook on this – 73% believe ITS has credibility with stakeholders. There were 69 respondents and 6 did not answer.

Some believe the data center remediation project has damaged our credibility. Most comments in the survey were neutral but expressed a desire to insure credibility.

Senior leadership interviews revealed:

- ITS needs more interaction with faculty and staff.
- There is a loss of confidence due to the recent number of outages, and the perception of ITS throughout the university is falling below where it should be.
- We should install a work order system that will that will give visibility to work load.

ITS integration into research and teaching

Two units within ITS are far more integrated into research and teaching at CWRU than are the other units. Those units are Instructional Technology and Academic Computing (ITAC) and Advanced Research Computing (ARC).

ITAC's staff of twenty-two provides support for faculty use of Blackboard, operates and supports 175 technology enhanced classrooms throughout the campus, operates and supports a campus-wide video conferencing service based on Adobe Connect, provides digital video recording services for a number of courses offerings and makes the video available for web streaming, and interacts with faculty on a variety of projects involving academic technology. Such projects have included a virtual reality lab and the use of Second Life. The ITAC director and one staff member in ITAC hold Ph.D. degrees in instructional technology. The ITAC director is active in teaching in the undergraduate SAGES (Seminar Approach to General Education and Scholarship) program.

ARC's staff of four (two are half-time) operates an 836-processor high performance computing facility and provides faculty support in the general area of research computing, particularly high performance computing and research database services. The ARC director is in routine contact with faculty to provide pre-award consultation and has been successful in collaborating in research projects and incorporating salary support in several research proposals. ARC has been able to attract over $45 million in external research funding efforts tied to ARC activities over the past three years. Three of the ARC staff hold Ph.D. degrees (in biostatistics, physics, and computational biology) and the fourth holds two master's degrees (in mathematics and applied mathematics). The director holds an adjunct faculty appointment in the Department of Epidemiology and Biostatistics, where he is on three Ph.D. dissertation committees, and he regularly teaches a graduate-level course in operations research and an undergraduate calculus course in a summer program in the School of Medicine.

Integration into teaching is not limited to ITAC and ARC. Other members of ITS teach CWRU classes from time to time including the CIO, both associate vice presidents, and the IT architect.

According to the survey of ITS staff conducted for this review, by a three to one margin the staff believes that ITS staff and services are appropriately integrated with the research and teaching functions of the university faculty. However, nearly 20% of those who took the survey did not respond to the question, suggesting that there is some lack of knowledge in this area. The comments that were submitted in response to the question consistently cited the ITAC and Advanced Research Computing units as making significant efforts and having significant success in this area. Comments also pointed out the reluctance of faculty to permit ITS to have any role in their research.

ITS preparation for change

The environment in which ITS carries out its duties is one of constant change. The IT industry, of which ITS is a part, is one of accelerating change. The very nature of IT makes keeping up with change challenging. Add to that the often changing university environment, particularly with respect to budget and financing of projects. This means that ITS staff must be prepared for change. 59% of the ITS staff survey respondents felt that ITS was prepared for change. Some respondents felt that some ITS staff were not prepared for change because they do not keep their skills current. Some respondents felt they didn't know whether ITS was prepared for change or not.

Evaluating ITS service offerings

This issue has to do with ITS's ability to accurately measure how customers feel about its service offerings. ITS conducts several surveys of customers during the year. There are also other methods for feedback. The majority of respondents to the ITS staff survey, 56%, felt the techniques and methodologies ITS uses for evaluating its service offerings were not adequate. Some respondents said they didn't know what methods were being employed. Other respondents criticized the methods as not detailed enough, not frequent enough, biased, and unreliable.

Mission and Effectiveness

Charge: To identify ITS' strengths, to identify existing opportunities to improve its processes and service lines, to provide a self evaluation of the effectiveness, responsiveness, and accountability of ITS as a university support unit, and to examine and evaluate its interactions with other campus IT operations and organizations.

This portion of the report is targeted at determining whether ITS' present organizational structure is appropriate and whether it supports the fulfillment of its values and mission; whether ITS' resources and facilities, including budget and staff, are optimally deployed to support the university's mission and the newly adopted strategic plan Forward Thinking (http://www.case.edu/stratplan/ForwardThinking0708.pdf); whether ITS is able to ensure the appropriate delivery of systems and services to meet the needs of the university, whether ITS has developed appropriate collaborative relationships with other academic and business organizations across the university, whether ITS has been able to build and maintain a reliable and secure information technology infrastructure, whether ITS provides effective lT vision and leadership for the university, whether ITS and its solution providers afford the campus strong customer service, and what major priorities and future developmental actions should be undertaken by ITS. To address this, both objective and subjective data have been gathered. The objective data consist of a statement of the ITS values and mission, the university strategic goals, the ITS strategic goals and priorities, the current ITS organizational structure, a list of collaborative relationships with other units within the university, current ITS resources and facilities, and information on security and reliability of the ITS infrastructure. The subjective data consist of the results of previously administered surveys of ITS staff, the responses from ITS staff to questions devised as a part of the internal review effort, and results of interviews with ITS managers and directors.

ITS organizational structure

Fewer than half (45%) of survey respondents suggested that the organizational structure should be changed. Those who did suggest a change were not in agreement as to the nature of the change. Generally, the survey comments and interviews reflected a sense that there was room for improvement in role definition and awareness of roles throughout the division.

Senior leadership interviews revealed their belief that Lev is of greatest value to the university in a strategic role within the university and the community, and of lesser value in an operations role. They suggested that a Chief Operating Officer position should be created within ITS.

Please refer to Appendix D for the current organization chart.

ITS resources and facilities

Only 17% of survey respondents believed that ITS is adequately funded to keep technology current at the university. Examples given in the comments included that the versions of human resources and financial modules of ERP lag behind, that the data center remediation project was underfunded, that network infrastructure upgrades are not funded, and that we are not as well funded as our peers in higher education. ITS continues to absorb increases in operational expenses, such as software and hardware maintenance, reducing the ability to allocate dollars for improvements, upgrades, or new equipment. There is no infrastructure refresh (i.e. capital) allocation.

A 59% majority of survey respondents believes that ITS uses its financial and human resources wisely. Comments indicate that there is a general sense that ITS is understaffed and underfunded, but that we do the best we can.

Meeting the needs of the university

This issue is related to how well ITS serves the needs of the university with respect to IT, whether ITS has credibility with its stakeholders, the adequacy of funding of IT by the university, and whether ITS provides effective IT vision and leadership for the university. 70% of the respondents to the ITS staff survey felt ITS was meeting the needs of the university. Some respondents felt that more could be done to meet the university's needs. Nearly 75% felt that ITS had credibility with its stake holders. However, only 17% of the respondents felt the university was adequately funding the mission of ITS, which hinders its ability to meet the needs of the university. 87% of respondents felt that ITS was providing effective vision and leadership with respect to IT for the university.

Senior leadership interviews indicated that ITS has not properly managed the expectations of the university community; for example, there is the perception that we are a "24 by 7 shop" even though we do not have the resources to achieve that level of service. ITS needs to improve its customer management through more effective communications and relationships.

Collaborative relationships

In order to be successful in its mission, it is important that ITS maintain strong relationships with other academic and business organizations within the university. The Internal Review Committee is aware of a large number of such organizations with significant relationships to ITS, including the Office of the Provost, the Office of Campus Planning and Operations, the Office of Student Services, the Office of University Housing and Student Life, the Office of the Registrar, the Office of General Counsel, and IT organizations in all of the schools and colleges and several departments at the university. The survey of ITS staff that was conducted for this review indicated, by a two to one margin, that the ITS staff believe that ITS has developed

appropriate collaborative relationships with other academic and business organizations across the university. However, 25% of those taking the survey did not respond to the main question in this area, suggesting that there is a significant lack of familiarity among ITS staff with these relationships. The comments offered by ITS staff in the survey indicated belief that such efforts are a "work in progress" and that ITS is more successful in some relationships than in others.

Overall, it seems that ITS is somewhat successful in this area but that there is room for improvement. The opinions of senior ITS leadership tend to coincide with those of the staff at large, with the leadership offering the opinion that our relationships with the distributed IT units on campus should be improved. They don't view the Council of Technology Officers as being as functional as it could be, and that it serves primarily as a way for ITS to "report out" to the distributed IT units.

Information Technology infrastructure

This issue is related to the information technology infrastructure supported by ITS, including the network, servers, storage and the various applications which provide services to the university community. Is this infrastructure reliable and secure and is the university adequately funding the technology. Nearly 75% of ITS staff survey respondents felt that ITS services were reliable and secure. But only 17% of respondents felt that ITS is adequately funded by the university to keep its technology current.

IT vision and leadership

The survey of ITS staff provided strong agreement (86%) that ITS provides effective IT vision and leadership for the university. Nearly all comments were supportive and indicated that the CIO and other leadership provide effective vision. It was noted that there is constant thought leadership beyond that of our peer universities. But, at the same time, concern was expressed regarding shifting priorities.

Customer service

The survey results indicated that a significant majority (63%) of ITS staff believe that ITS provides strong customer service to the campus. Most comments indicated that our help desk provider supplies sub-par customer service. Other comments indicate that there is room for improvement and that we should not "rest on our laurels".

The future

This issue relates to the future of ITS and whether ITS staff as well as whether customers and other stakeholders understand the mission of ITS. This also relates to whether ITS is providing effective leadership with respect to IT and whether the university was adequately funding ITS to

keep technology current. About 84% of ITS staff survey respondents felt they knew and understood the mission of ITS and a similar number (86%) felt that ITS was providing effective vision and leadership with respect to IT, but only 17% felt that the university was adequately funding ITS for keeping the technology current.

General

Charge: As part of the self study, the self reflective effort should provide other advice, as appropriate, relative to the general purpose of this review.

ITS Governance

Several governance bodies interact with ITS as a division. These include the Faculty Senate Committee on Information Resources (FSCIR), the Faculty Senate Committee on Research, the provost's Research Council, the ITS Planning and Advisory Committee (ITSPAC), and the Council of Technology Officers (CTO). Thus, all units within ITS also have interactions with these groups.

For individual units within ITS, the governance model is as follows:

Advanced Research Computing For the past four years, faculty oversight of Advanced Research Computing has been provided by the Advisory Committee on Research Computing (ACRC), which also serves as the ITSPAC Subcommittee on Research Computing. This group, composed of 18 faculty from across the university, has set policy, administered a program of matching funds made available by the provost and the CIO / VP ITS, communicated faculty needs in the area of research computing, and has acted in a strong advocacy role with both the deans of the schools and colleges and from the university central administration for support of a central research computing facility. The ACRC endorsed the transition to a "core facility" model for advanced research computing in 2008. Oversight on operations of the High Performance Computing Cluster is provided by the HPC Management Board, another faculty group. Advanced Research Computing also has direct relationships with FSCIR, the Faculty Senate Committee on Research, and the provost's Research Council, but on a less frequent and less formal basis.

Instructional Technology and Academic Computing For five years, ending last year, there was an ITAC Advisory Committee, with membership including faculty from all eight schools and colleges, that met approximately every other month. The purpose of the committee was to communicate current ITAC projects and elicit feedback. Conversation centered around what was successful, what needed to be changed and ideas for other instructional technologies that would support teaching and learning at CWRU. At the present time there is no governance body to replace this committee.

An ePortfolio Advisory Committee was created in 2009 with the purpose of advising and directing the testing and deployment of the university's ePortfolio offering. This group is composed of five beta testers and appropriate associate deans and assessment specialists from all eight schools and colleges of the university.

ITAC also interacts on a regular basis with FSCIR.

Technical Infrastructure Services The TIS director is a member of the university's Emergency Communications Task Force and the director and several TIS managers participate regularly with the CTO.

Enterprise Application Systems The Data Warehouse Oversight Group is composed of the university registrar, the vice president for enrollment management, the vice president for planning and institutional research, the CIO, the director of EAS, and the EAS staff lead for the data warehouse project. As the focus of data warehouse efforts changes over time, the committee composition will change accordingly. A second governance group, a subcommittee of ITSPAC, has been inactive for the past year and is in the process of being assessed as to its relevance and value.

Student Information System There are three governance bodies that interact directly with the Student Information System (SIS) development project. All three meet on a quarterly basis.

The SIS Executive Steering Committee's members include the provost, the vice provost for undergraduate education, the CFO, the CIO, the vice president for planning and institutional research, the university controller, the dean of undergraduate studies, the dean of graduate studies, and faculty from the School of Medicine, the College of Arts and Sciences, and the School of Engineering. It serves to review decision requests presented by the project team and validate decisions in accordance with the decision support policy, to review business process changes recommended by the project team to ascertain if organizational changes are warranted, to provide executive-level support to the project team to remove obstacles to the projects' success, to make policy decisions and approve policy changes, to set priorities which determine timing of the implementation of the student information system modules, to approve the allocation of project resources, to continuously support the high priority status of the project, and to serve as an advocate for the project both internally and externally.

The SIS Faculty Liaison Committee is composed of faculty representatives from throughout the university and provides faculty input regarding the look/feel and function of the system, helps with ideas about training and communicating with faculty, and reviews SIS feedback and helps prioritize from the faculty perspective.

The SIS Student Liaison Committee is composed of representatives from both the undergraduate and graduate student populations and provides student input regarding the look/feel and function of the system, helps with ideas about training and communicating with students, and reviews SIS feedback and helps prioritize from the student perspective.

Program Management Office The PMO has ties to the ITSPAC Subcommittee on Customer Service and Satisfaction, whose charge is to establish relationships between the university staff and the help desk provider and to recommend process improvements based on communications facilitated by these relationships. The PMO also has ties to the ITSPAC

Subcommittee on Student Impact, which serves as an avenue of communication with students, particularly in the context of the new student information system that is in development and other changes in ITS services with a large impact on students. Finally, the PMO director served this year on the committee to manage the RFP process for campus "cost per copy" printing.

Information Security This unit is connected with the ITSPAC Security and Policy Subcommittee, the HIPAA Compliance Committee (where the CISO acts as the university's HIPAA security officer), the University Operations Group, the Emergency Communications Task Force, and the Emerging Infections Committee. Information Security also interacts with FSCIR and the Faculty Senate Committee on Research but on a less formal and less regular basis. Information Security will also interact with the Risk and Compliance Committee when it is reconstituted by the university general counsel.

IT Architecture The chief IT architect is a member of the university's Emergency Communications Task Force and also participates in ITSPAC and the CTO.

Based on the survey of ITS staff, a small majority (57%) of responders believe that there are a sufficient number of formal governance structures in place, with a bare majority (51%) indicating that those structures are effective. However, a significant fraction of survey responders did not respond to these questions (23% and 30%, respectively), suggesting that there is a significant lack of awareness of these governance structures among ITS staff.

ITS perspective on centralized vs. decentralized delivery of IT services

Historically, Case Western Reserve University has had a proliferation of groups providing IT services for various portions of the university community. This can be partly attributed to the highly decentralized nature of the university from the date of the federation of Case Institute of Technology and Western Reserve University in 1967 and to the early focus of the central IT organization on business operations, not support of the teaching and research mission. However, this does not explain the existence of separate IT organizations within administrative divisions of the university administration which support business operations for which ITS is well-equipped to assume responsibility.

The ITS senior leadership recognizes that, given current funding levels for the central IT organization, some aspects of IT support should remain decentralized – in particular, those that are discipline-specific. These are most often in the area of specialized IT for research but also occur less frequently within the scope of teaching and administrative activities. The senior leadership believes that widespread inefficiencies exist due to distributed IT organizations that duplicate services that can be effectively handled centrally. Inefficiencies also result due to under-trained staff and students having responsibility for IT resources required for business operations and due to the missed opportunities to benefit from economies of scale related to hardware operations, especially in the area of servers and storage and their administration.

There is also the view that adequate information security measures are often not observed by under-trained staff and students with responsibility for distributed IT operations.

The view is that any move toward increased centralization of IT services would only come about as a result of either a directive from the president or provost or decisions by individual deans and vice presidents to reduce their spending, either directly or within their academic and administrative offices, for local IT support staff in favor of using central IT services.

Recommendations

The Internal Review Committee offers several recommendations based on the objective data it has collected and examined, and on other information it has gathered. The latter includes results of the ITS staff survey it conducted, the results of previously-conducted surveys of ITS staff, in-person conversations with individual ITS staff members who wanted to share their opinions and insights related to the internal review, and interviews conducted with all members of the senior leadership team. Finally, the recommendations incorporate the insights and observations that each of us has drawn as a member of the senior leadership team and in concentrated reflection while carrying out the review. These recommendations represent the consensus view of all members of the internal review committee.

Our recommendations are organized into the three major areas of the internal review.

Environment and Culture

1. **Resolve the chronic shortage of appropriate physical space for ITS.** While the university at large suffers from a shortage of space, this does not lessen the negative impact of this issue on ITS, its staff, and its services. Morale and productivity have suffered from repeated relocation of staff from office to office and, sometimes, from building to building. Morale also suffers from constant rumors that circulate about future moves. An organization that needs to function as a unit is scattered among six buildings on campus – not in order to locate appropriate parts of the organization in proximity to their customers, but simply because there is no space planning and staff end up where ever there is space available. In addition to office space, the ITS requirements for space to support the increasing use of multimedia in the classroom need to be addressed. We recommend that
    a. **The analysis of ITS space done for this report be enlarged and validated**
    b. **ITS produce a detailed statement of space requirements based on its core activities and expected future activities as determined by the strategic plans of the division and the university**
    c. **A gap analysis be carried out to objectively identify where the current ITS space allocation falls short of what is required to successfully address the needs established in the two strategic plans**
    d. **ITS produce a clear statement of the impact of this space allocation shortfall on the likely success in achieving goals set forth in the strategic plans**

2. **Revisit the policies and practices related to CASEworks.** The CASEworks program provides welcome flexibility to ITS staff and is generally considered positively by those who participate in it. However, concerns were expressed by both staff and management as to how the program is managed, how people are held accountable for

their time, and how it may impact productivity. CASEworks policies and practices should also be examined to determine how CASEworks might be used to ease physical space constraints on ITS. We recommend that

a. **An analysis of past use of the CASEworks program should be undertaken to determine how it impacts on staff morale and productivity**
b. **In light of the results of the analysis, the policies and practices governing the CASEworks program should be examined to determine whether they should be revised**

Working Relationships

1. **Improve cooperation among the functional units within ITS.** The functional units within ITS are considered by staff and management as not cooperating to the extent that they should for the overall benefit of the organization. They are seen as often acting at cross purposes and in competition with one another. These dysfunctional characteristics of the organization are significant in that they negatively impact on staff morale and productivity and on the overall health of the organization. These issues will not be solved by simply creating opportunities for staff to interact socially as the issues to be addressed are tied to roles within the organization. We recommend that
    a. **ITS undertake a program to increase awareness within each unit of what other units do, including their most basic operations and not limited to special projects**
    b. **The senior leadership of ITS improve the definitions of roles, responsibilities, and interrelationships of the ITS units, possibly through the use of formal SLAs**
    c. **ITS continue to search for other ways to reduce tensions between ITS units and their respective staff members**

2. **Improve communications between ITS and its customers and stakeholders.** Despite past efforts, ITS continues to be challenged to effectively communicate with its customers and stakeholders. Effective communication must be instituted at all levels. We recommend that
    a. **The CIO commit to more frequent and comprehensive communications with the senior leadership of the university.** This should include deans and other vice presidents, and should be designed to keep them individually apprised of activities of interest to them and of the strategic direction of ITS
    b. **A consistent ITS "brand" be established.** This should be a consistent message, in place of the disparate branding currently used that often entirely omits mention of ITS
    c. **A full-time position be created to have responsibility for communications and publicity**
    d. **A single communications mechanism be established as the official communications mechanism for ITS.** This mechanism should be publicized as

the authoritative source for ITS information. Expectations should be set to reinforce that this is where the campus community will learn about ITS activities. We should continue to use multiple methods of communication in addition to the officially designated channel

e. **Communications from ITS be used to communicate our vision for the future of IT on campus and to set expectations appropriately based on staffing and funding levels, not just to announce service outages**

Mission and Effectiveness

1. **Work to understand the university strategic plan as it evolves over time and how it impacts on relevant ITS activities, and align and adapt the ITS strategic plan and goals to those of the university.** Therefore, we recommend that
    a. **ITS develop an annual statement of goals and priorities and solicit review by the provost as to alignment with the university goals and priorities.**
    b. **ITS activities beyond the large proportion required for day-to-day operations should be aligned with university goals and priorities.**

2. **Identify permanent funding for high priority ITS initiatives.** For several years ITS has been using one-time funds, primarily from the Office of the Provost, to fund high priority initiatives that are of strategic importance to ITS and to the university. Faculty and student response to both technology enhanced classrooms and MediaVision Courseware has been very positive as demonstrated by surveys and demand for those services. Faculty have embraced the initiative in Advanced Research Computing through direct investment of over $300,000 of their research funds, use of over $145,000 in university-supplied matching funds, and over $45 million in research proposals tied to the initiative. In all three cases, the initiatives and the credibility of ITS are threatened by lack of stable core funding to continue these services. Therefore, we recommend that
    a. **ITS continue its aggressive efforts at the level of the CIO to secure the needed permanent resources for initiatives.** The staffing for Advanced Research Computing and the annual funding needed for all three initiatives must be secured in FY2010 to avoid serious risk of failure.
    b. **ITS improve its approach to funding strategic initiatives.** ITS must secure required annual funding for future initiatives prior to finding itself exposed to failure to live up to expectations and subsequent loss of credibility.

3. **Secure capital funding for critical IT infrastructure.** Without capital funding, critical IT infrastructure is very difficult to sustain and is at risk for falling into an unmaintainable state. Lack of capital funding causes ITS to make requests of the university for large amounts of funding on a periodic but schedule-uncertain basis in order to remediate infrastructure problems when they reach the danger point. This has occurred repeatedly for more than twenty years; nearly every time there has been a delay in

obtaining the required funds, so that the problem reached a critical state by the time the remediation was able to be carried out. Having a capital budget would allow the university to accommodate technology infrastructure in its budget similar to the way it funds other infrastructure, such as buildings, with both improvements and maintenance accommodated. We recommend that

   a. **The university provide capital funding for maintaining critical IT infrastructure such as the wired network, the wireless network, the data centers, and the servers that host mission-critical IT services for the university.**

4. **Improve the ability of ITS to provide cost-effective core services for the university community.** Despite the recognition that individual faculty members, staff members, and students are generally not in a position to house and administer servers and storage at their locations on campus, at the present time ITS is not able to respond appropriately to requests for low-cost bulk storage or server hoteling/administration. ITS has requirements for such services that make it financially unattractive for individual faculty to make use of ITS service offerings in those areas. For example, ITS offers its lowest-cost backed-up bulk storage at $4800 per TB per year while faculty members see the cost of a 1 TB hard drive as $100 with a multi-year lifetime. The surcharge is generally viewed as unacceptable. The solution to this may lie within the movement toward "cloud computing". We recommend that
   a. **Cloud computing be explored as a service offering.** This should include both storage and instances of virtual servers.
   b. **ITS explore other service offerings that may benefit other campus organizations.** This might include, for example, a common admissions module to be used by academic units.

5. **Improve the relationship between ITS and distributed IT units on campus.** The Council of Technology Officers (CTO) has served to improve communications between ITS and the distributed IT units, but is seen primarily as a means for ITS to report out to those units. The level of communication needs to be bi-directional and needs to further strengthen the relationships. ITS needs to remove any sense of threat to job security among the staff in the distributed units. ITS needs to work with the distributed units to define how those units can be used in ways that directly benefit their constituencies, rather than duplicate services that ITS can provide more reliably and more economically. We recommend that
   a. **ITS and the CTO should discuss ways in which the CTO can be more effectively involved in identifying core service offerings that would be of benefit to the university.**

6. **Increase the presence of ITS in university planning and decision making.** Shortly after President Snyder began her tenure at CWRU, she met with ITS in an "all hands" setting in Clapp Hall's Goodyear Auditorium. She said directly that ITS needs to be at the table for university planning and decision making. She acknowledged that IT plays a major

role in nearly everything that the university does, that it is important for ITS to be involved in planning and have input into the decision making process, and that the absence of ITS from these processes poses a risk for the university. Despite these statements, it is not clear that the ITS presence in planning and decision making is as strong as it needs to be. As an example, ITS input into decision making related to the recent data center remediation project, an effort critical to the present and future ability of ITS to deliver necessary IT services to the university, appeared to be of secondary importance to that of other university offices. We recommend that

   a. **The CIO increase efforts to increase awareness among the senior leadership of the university regarding the resource needs of ITS.** This should be tied to the increased communication with that senior leadership that is also recommended. The goal should be to increase involvement of ITS in budget decisions that affect it.

7. **Control the number of major projects that ITS tackles per year.** The senior leadership was consistent in identifying the large number of major projects and the imposition of these projects on them as threats to successful operation of their respective functional units. The Program Management Office was created in ITS, in part, to address the prioritization of projects and the identification of resource requirements of projects in order to prevent the over commitment of human resources and to ensure accurate identification of all resources needed for successful project management and completion. We recommend that
   a. **ITS reduce the number of major projects it takes on each year.** Guidance in this area should come from the PMO.
   b. **ITS identify an effective mechanism for prioritizing and managing projects.** This mechanism must recognize the strategic priorities of the university and of ITS, incorporate resource requirements across the functional units of ITS, and resist the addition of new projects that would cause overload of available resources.

8. **Create a Chief Operating Officer position.** The senior leadership was consistent in the opinion that the CIO is of greatest value to the university in a strategic role within the university and the community. They believe that a Chief Operating Officer would remove the need for the CIO to assume responsibility for day-to-day operations and would free the CIO to focus on a strategic role locally, regionally, nationally, and internationally. We recommend that
   a. **ITS create a Chief Operating Officer position.** Allow the CIO to refocus on strategy.
   b. **ITS use the COO position to strengthen the distinction between operations and development.** The COO and the PMO director should act in concert to protect resources required for operations from being overloaded for development work.

9. **Decrease the size of the senior leadership team that is involved in discussions relating to ITS strategy and direction.** This team should be limited to director-level and above,

thereby reducing the size of the team from 13 to 9, plus the CIO. This team should not include a representative from the outsourced help desk provider. A weekly meeting of this team should replace the current weekly "report out" meeting of a larger group. The purpose of the weekly meeting should change from status reporting to discussion of prioritization of activities and identification and resolution of broad issues. Once a month this meeting should take the form of the current, broader status-reporting meeting. We recommend that

   a. **The weekly senior leadership meeting should focus on prioritization of activities and identification and resolution of issues with strategic impact, and should be limited to director-level and above.**
   b. **One of these meetings per month would also include assistant directors and representation of the outsourced help desk organization and would serve the purpose of status reporting.**

10. **Look for more opportunities for cost-sharing.** Given the lack of ITS budget support for all the initiatives and operational responsibilities that ITS has identified as being essential to its mission and the mission of the university, ITS should increase its efforts to share budget responsibility for efforts that are of great importance and visibility to other units within the university. Some such cost-sharing has been done in the past; examples include the HCM implementation (with staff support provided by the Department of Human Resources and the Payroll Office), the SIS implementation (with staff support provided by the Office of the Registrar, the Bursar's Office, and the Division of Student Affairs), the financial system implementation (with staff support from the Controller's Office), and the high performance computing resource (mainly with research funds support from individual faculty researchers). We recommend that

    a. **ITS continue its efforts to cost-share with appropriate university offices in the areas of high performance computing, and implementation and operation of administrative systems.**
    b. **ITS initiate efforts to cost-share with appropriate deans, department chairs, center directors, etc. in other areas such as technology enhanced classrooms, application hosting, video production and streaming, etc.**

Appendix A

ITS space allocation

The following table provides detailed information on space allocation to ITS and how that space is used. The FTE values include student and contractor employees where 1 FTE = 40 hours worked. "Other space" includes conference rooms, printer/copier rooms, storage areas, video production areas, etc.

Location	FTE*	Office Space	Other Space	Total Space	Office Sq. Ft. per FTE
Crawford Hall (4th floor)	43	4360	200	4560	101
Crawford Hall (5th floor)	39	3785	309	4094	97
Kelvin Smith Library	8	1265	178	1443	158
Wood Building	19	1136	2705	3841	60
Sears Building	13	2580	0	2580	198
Tomlinson Hall	5	720	600	1320	144
Adelbert Hall	4	723	0	723	181
Montessori House	2	147	0	147	74
TOTAL	**133**	**14716**	**3992**	**18708**	**111**

*Includes student and contractor FTE-equivalents

Appendix B

Survey questions for ITS staff

In its effort to obtain input from the ITS staff at large for use in the internal review, a survey was created and administered using SurveyMonkey, a free web-based questionnaire service. The survey was open to the staff from 19 February through 2 March 2009. The SurveyMonkey collection tool was configured to not record the identities of the respondents and all ITS staff were advised of that. To ensure that no one withheld opinions out of fear that their responses would not be completely anonymous, the internal review team also welcomed responses using other means, including hardcopy.

The questions were intentionally worded to correspond closely to the questions to be addressed in the internal review as outlined in the charge given by the sponsors. Only two or three possible responses were permitted in order to encourage the use of open-ended comments via the "Please elaborate" invitation that was attached to each question.

Responses to the following questions were collected:

Environment and Culture

1. Are the working conditions at ITS conducive to an efficient and effective IT operation? (Yes/No) Please elaborate.
2. Is space planning done effectively for ITS? (Yes/No) Please elaborate.
3. Is the CASEworks program conducive to an efficient and effective IT operation? (Yes/No) Please elaborate.
4. How does staff morale affect you in your daily work? (Positive effect / No effect / Negative effect) Please elaborate.
5. How would you characterize relationships between ITS staff and its management and leadership? (Positive / Neutral / Negative) Please elaborate.
6. Are ITS activities properly aligned with the strategic goals of CWRU and ITS? (Yes/No) Please elaborate.
7. Does your opinion matter in decision-making within your unit in ITS? (Yes/No) Please elaborate.
8. Does your opinion matter in decision-making within ITS? (Yes/No) Please elaborate.
9. Does your opinion matter in decision-making within the university? (Yes/No) Please elaborate.
10. Has the university embraced ITS as a part of its mission? (Yes/No) Please explain how or how not.

Working Relationships

1. How would you characterize the relationships among the various functional units (TIS, EAS, ITAC, ARC, CISO, PMO, Architecture, SATO, CIO) within ITS? (Positive / Neutral / Negative) Please elaborate.
2. How would you characterize the relationships between ITS and its solution providers (the Help Desk provider, Dell, Cisco, IBM, etc.)? (Positive / Neutral / Negative) Please elaborate.
3. Is ITS meeting the needs and expectations of the university community? (Yes/No) Please elaborate.
4. Does ITS have credibility with its stakeholders (customers and university leadership)? (Yes/No) Please elaborate.
5. Are ITS' staff and services appropriately integrated with the research and teaching functions of the university faculty? (Yes/No) Please elaborate.
6. Are appropriate techniques and methodologies in place for ITS to evaluate its service offerings? (Yes/No) Please elaborate.
7. Does ITS handle change well? (Yes / No) Please elaborate on how ITS is prepared for change.

Mission and Effectiveness

1. Do you know and understand the mission of ITS? (Yes/No) Please elaborate.
2. Do you think that the organizational structure within ITS should be changed? (Yes/No) Please elaborate on suggested changes, if any.
3. Is ITS adequately funded to keep technology current at the university? (Yes/No) Please elaborate.
4. Does ITS use its financial and human resources wisely? (Yes/No) Please elaborate.
5. Has ITS developed appropriate collaborative relationships with other academic and business organizations across the university? (Yes/No) Please elaborate.
6. Are ITS services reliable and secure? (Yes/No) Please elaborate,
7. Does ITS provide effective IT vision and leadership for the university? (Yes/No) Please elaborate.
8. Do ITS and its solution providers afford the campus strong customer service? (Yes/No) Please elaborate.

General

1. Does ITS have in place a sufficient number of formal structures for receiving input from the university community? (Yes/No) Please elaborate.
2. Are those structures effective? (Yes/No) Please elaborate.
3. If there are any other comments you would like to share, please do so.

Appendix C

Survey responses

Of 108 ITS staff members surveyed, 73 responses were received via the online SurveyMonkey tool and two responses were received via hardcopy, for a total of 75 responses and a response rate of 69%. Not all responders gave responses to all questions.

The following responses were received to the questions listed in Appendix B.

Environment and Culture

1. Are the working conditions at ITS conducive to an efficient and effective IT operation? (Yes/No) Please elaborate.

There were 46 "Yes" responses, 28 "No" responses, and 1 non-responder to this question. Of the responders, 62% responded in the affirmative. There were 31 open-ended comments given to this question.

2. Is space planning done effectively for ITS? (Yes/No) Please elaborate.

There were 21 "Yes" responses, 49 "No" responses, and 5 non-responders to this question. Of the responders, 30% responded in the affirmative. There were 39 open-ended comments given to this question.

3. Is the CASEworks program conducive to an efficient and effective IT operation? (Yes/No) Please elaborate.

There were 54 "Yes" responses, 10 "No" responses, and 11 non-responders to this question. Of the responders, 84% responded in the affirmative. There were 36 open-ended comments given to this question.

4. How does staff morale affect you in your daily work? (Positive effect / No effect / Negative effect) Please elaborate.

There were 28 "Positive" responses, 16 "Negative" responses, 26 "No effect" responses, and 5 non-responders to this question. Of the responders, 40% responded positive, 37% no effect, and 23% negative. There were 31 open-ended comments given to this question.

5. How would you characterize relationships between ITS staff and its management and leadership? (Positive / Neutral / Negative) Please elaborate.

There were 34 (45%) “Positive” responses, 7 (9%) “Negative” responses, and 34 (45%) “Neutral” responses. There were 25 open-ended comments given to this question.

6. Are ITS activities properly aligned with the strategic goals of CWRU and ITS? (Yes/No) Please elaborate.

There were 51 “Yes” responses, 14 “No” responses, and 10 non-responders to this question. Of the responders, 78% responded in the affirmative. There were 25 open-ended comments given to this question.

7. Does your opinion matter in decision-making within your unit in ITS? (Yes/No) Please elaborate.

There were 56 (75%) “Yes” responses and 19 (25%) “No” responses. There were 19 open-ended comments given to this question.

8. Does your opinion matter in decision-making within ITS? (Yes/No) Please elaborate.

There were 37 “Yes” responses and 34 “No” responses, and 4 non-responders to this question. Of the responders, 52% responded in the affirmative. There were 19 open-ended comments given to this question.

9. Does your opinion matter in decision-making within the university? (Yes/No) Please elaborate.

There were 17 “Yes” responses, 54 “No” responses, and 4 non-responders to this question. Of the responders, 24% responded in the affirmative. There were 19 open-ended comments given to this question.

10. Has the university embraced ITS as a part of its mission? (Yes/No) Please explain how or how not?

There were 44 “Yes” responses, 25 “No” responses, and 6 non-responders to this question. Of the responders, 64% responded in the affirmative. There were 34 open-ended comments given to this question.

Please provide any other comments relevant to the general topic of 'environment and culture' you may have that were not addressed above.

There were 8 comments given in response to this question.

Working Relationships

1. How would you characterize the relationships among the various functional units (TIS, EAS, ITAC, ARC, CISO, PMO, Architecture, SATO, CIO) within ITS? (Positive / Neutral / Negative) Please elaborate.

There were 12 "Positive" responses, 22 "Negative" responses, 39 "Neutral" responses, and 2 non-responders to this question. Of the responders, 16% responded positive, 53% neutral, and 30% negative. There were 30 open-ended comments given to this question.

2. How would you characterize the relationships between ITS and its solution providers (the Help Desk provider, Dell, Cisco, IBM, etc.)? (Positive / Neutral / Negative) Please elaborate.

There were 12 "Positive" responses, 16 "Negative" responses, 44 "Neutral" responses, and 3 non-responders to this question. Of the responders, 17% responded positive, 61% neutral, and 22% negative. There were 26 open-ended comments given to this question.

3. Is ITS meeting the needs and expectations of the university community? (Yes/No) Please elaborate.

There were 47 "Yes" responses, 19 "No" responses, and 9 non-responders to this question. Of the responders, 71% responded in the affirmative. There were 27 open-ended comments given to this question.

4. Does ITS have credibility with its stakeholders (customers and university leadership)? (Yes/No) Please elaborate.

There were 51 "Yes" responses, 18 "No" responses, and 6 non-responders to this question. Of the responders, 74% responded in the affirmative. There were 23 open-ended comments given to this question.

5. Are ITS' staff and services appropriately integrated with the research and teaching functions of the university faculty? (Yes/No) Please elaborate.

There were 43 “Yes” responses, 19 “No” responses, and 13 non-responders to this question. Of the responders, 69% responded in the affirmative. There were 22 open-ended comments given to this question.

6. Are appropriate techniques and methodologies in place for ITS to evaluate its service offerings? (Yes/No) Please elaborate.

There were 28 “Yes” responses, 34 “No” responses, and 13 non-responders to this question. Of the responders, 45% responded in the affirmative. There were 24 open-ended comments given to this question.

7. Does ITS handle change well? (Yes / No) Please elaborate on how ITS is prepared for change.

There were 40 “Yes” responses, 28 “No” responses, and 7 non-responders to this question. Of the responders, 59% responded in the affirmative. There were 27 open-ended comments given to this question.

Please provide any other comments relevant to the general topic of ‘working relationships’ you may have that were not addressed above.

There were 3 comments given in response to this question.

Mission and Effectiveness

1. Do you know and understand the mission of ITS? (Yes/No) Please elaborate.

There were 61 “Yes” responses, 12 “No” responses, and 2 non-responders to this question. Of the responders, 84% responded in the affirmative. There were 11 open-ended comments given to this question.

2. Do you think that the organizational structure within ITS should be changed? (Yes/No) Please elaborate on suggested changes, if any.

There were 29 “Yes” responses, 36 “No” responses, and 10 non-responders to this question. Of the responders, 45% responded in the affirmative. There were 29 open-ended comments given to this question.

3. Is ITS adequately funded to keep technology current at the university? (Yes/No) Please elaborate.

There were 12 “Yes” responses, 57 “No” responses, and 6 non-responders to this question. Of the responders, 17% responded in the affirmative. There were 30 open-ended comments given to this question.

4. Does ITS use its financial and human resources wisely? (Yes/No) Please elaborate.

There were 38 “Yes” responses, 26 “No” responses, and 11 non-responders to this question. Of the responders, 59% responded in the affirmative. There were 23 open-ended comments given to this question.

5. Has ITS developed appropriate collaborative relationships with other academic and business organizations across the university? (Yes/No) Please elaborate.

There were 37 “Yes” responses, 20 “No” responses, and 18 non-responders to this question. Of the responders, 65% responded in the affirmative. There were 24 open-ended comments given to this question.

6. Are ITS services reliable and secure? (Yes/No) Please elaborate.

There were 50 “Yes” responses, 18 “No” responses, and 7 non-responders to this question. Of the responders, 73% responded in the affirmative. There were 29 open-ended comments given to this question.

7. Does ITS provide effective IT vision and leadership for the university? (Yes/No) Please elaborate.

There were 54 “Yes” responses, 9 “No” responses, and 12 non-responders to this question. Of the responders, 86% responded in the affirmative. There were 14 open-ended comments given to this question.

8. Do ITS and its solution providers afford the campus strong customer service? (Yes/No) Please elaborate.

There were 40 “Yes” responses, 23 “No” responses, and 12 non-responders to this question. Of the responders, 63% responded in the affirmative. There were 22 open-ended comments given to this question.

Please provide any other comments relevant to the general topic of ‘mission and effectiveness’ you may have that were not addressed above.

There was one comment given in response to this question.

General

1. Does ITS have in place a sufficient number of formal structures for receiving input from the university community? (Yes/No) Please elaborate.

There were 36 “Yes” responses, 25 “No” responses, and 14 non-responders. Of the responders, 59% responded in the affirmative. There were 18 open-ended comments given to this question.

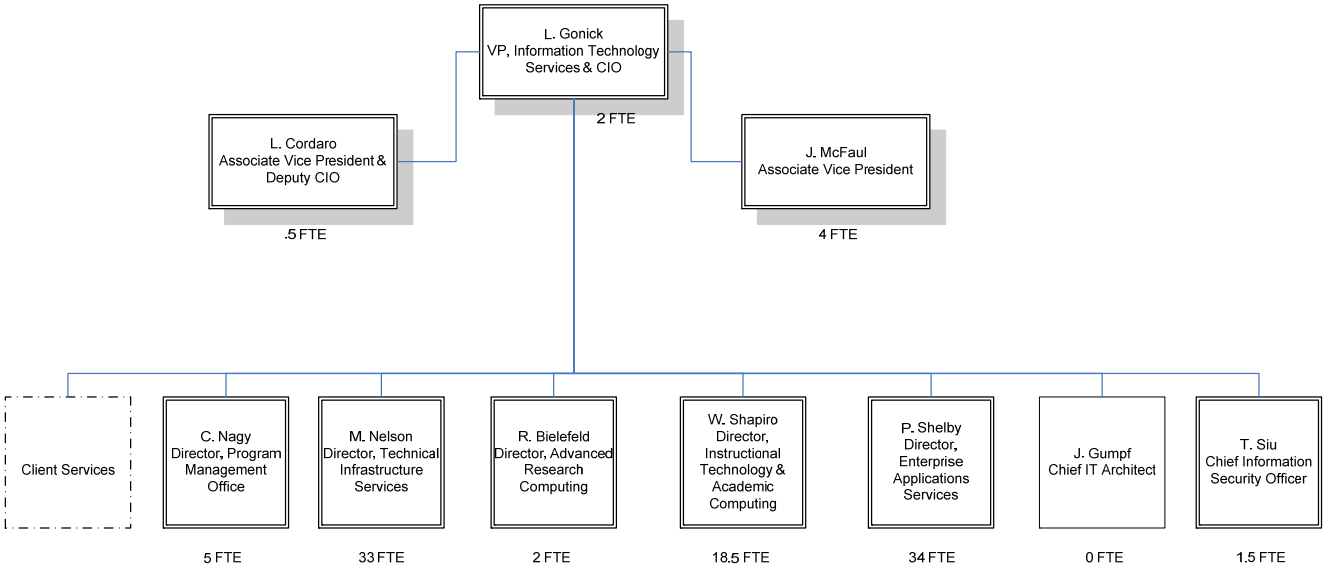
2. Are those structures effective? (Yes/No) Please elaborate.

There were 27 “Yes” responses, 28 “No” responses, and 20 non-responders to the second part. Of the responders, 49% responded in the affirmative to this part. There were 20 open-ended comments given to this question.

3. If there are any other comments you would like to share, please do so.

There were six comments given in response to this question.

Appendix D



Office of the Vice President
Information Technology Services

03/23/2009

External Review Committee Report for Information Technology Services
Case Western Reserve University

May 4, 2009

Stephanie Reel

Vice Provost for Information Technology and CIO, Johns Hopkins University

Joel M. Smith

Vice Provost and CIO, Carnegie Mellon University

Jim Treleaven

President and CEO, Via Strategy Group LLC

Mely Tynan

Former Vice President and CIO, Tufts University

Table of Contents

Contents

I. Executive Summary

The external review committee for Information Technology Services (ITS) visited Case Western Reserve University (CWRU) from March 31 until April 2, 2009. Prior to our visit, we received extensive information on CWRU in general and on ITS in particular from an ITS internal review committee. This, the external review committee's report, is based primarily on information gleaned from the materials provided by the internal review committee and interviews held during our 3 day visit to CWRU.

The committee could only be impressed with the interest and passion of the faculty and staff we interviewed at CWRU. With new leadership, CWRU seems poised for solidification of its world-class research and educational programs as well as moving forward with targeted innovation. The fact that CWRU has positioned itself to realize a new vision while maintaining operational excellence makes this a particularly auspicious time for the university to undertake a thorough review of all of its information technology (IT) resources and services. Some information technologies have become so much a part of our daily work that universities can easily overlook the strategic value of IT. Information technologies of many kinds, ranging from basic infrastructure such as networking and desktop productivity applications to high performance computing are critical tools for a world class research university as it defines its future. Information technology is a strategic and not just a tactical issue for universities. The university's senior leadership must assure that their institution's IT strategies are aligned with the newly developed CWRU Strategic Plan.

In general, the committee was impressed with many aspects of the ITS organization and the state of the IT infrastructure at CWRU. Nevertheless, this report identifies a number of areas where improvements can be made. Key among these recommendations are:

1. **Organization and Governance**. The CIO is universally viewed as strategic, future-oriented and externally focused. Today's IT infrastructure and operations challenges will require more direct attention from the CIO. The CIOs visible leadership and campus presence are important in championing efforts to bolster IT operations. To support this need for internal focus without sacrificing the CIO's valuable strategic and external role, the ITS internal review recommended a new chief operating officer (COO). The current structure already has two senior positions at this level (Deputy CIO and Associate VP). Given budget constraints, it may be prudent to review the occupants' match to the COO requirements and clearly assign or adjust responsibilities, rather than create an additional senior position. The governance processes through which various stakeholders (administration, schools, faculty etc.) influence or participate in decisions regarding IT need to be simplified and clarified. Current confusion (both within and outside of ITS) about roles and responsibilities of committees and individuals in IT decision-making needs to be eliminated. The resulting IT governance structure and processes, including how IT projects are prioritized, will need to be more adequately communicated to the university community. The distribution of labor ITS devotes to various services should be evaluated to determine if the mix of staffing for the most fundamental IT services verses those devoted to "nice to have" services is properly balanced.

2. **Financial**. There are differing views within CWRU regarding the adequacy of funding for IT, relative both to the specific requirements at CWRU and to peer

institutions. There is consensus that ITS has done a good job with the resources available to it. In order to gain agreement on the adequacy of current funding levels, a comprehensive and transparent accounting of all IT expenditures within the university including ITS and the schools should be developed. The balance between central and local IT should be reviewed but appears to be generally appropriate. A traditional capital budget for ITS should be developed along with five-year rolling budgets that adequately support multi-year commitments such as hardware and software maintenance and support. Year-to-year contingencies will inevitably arise but planning will be significantly improved.

3. **Risk Management**. Significant operational security compliance and reputational risks were identified. Application proliferation and complexity is consistently rated as the highest risk factor and it is faced by CWRU. Increased application standardization both within ITS and across the university is encouraged. IT architects should be charged with developing hardware/software integration plans. Research compliance and security issues need to be tracked and mitigated. A disciplined change control and problem management process needs to be developed. An IT security plan must be created, communicated and regularly reviewed. Quality assurance and security standards for application developers, administrative and technical staff should be deployed. Robust disaster recovery and data backup plans, which include routine drills and user testing, must be created.

Detailed observations and recommendations are contained in the body of the report.

NOTE: The committee notes that there is some redundancy in observations and recommendations in the report. Although we have sought to limit these, the interconnected nature of issues of IT operations, governance, finance, and risk management makes some redundancy inevitable. Indeed, in some cases, it points to the need to address particular issues from all of these perspectives. We also note that due to the limited time for engagement, there may be some factual inaccuracies that the committee would be happy to correct.

II. Introduction

Despite operating in what is clearly a resource-constrained environment and having experienced significant budget reductions and resource losses a few years ago, the ITS staff communicate a strong desire to provide the best services they possibly can for CWRU. The ITS staff are clearly committed professionals who are loyal to and passionate about the CWRU's missions and future. The past budget reductions and loss of resources may, however, have created an acceptance of mediocrity in areas where it should not be tolerated.

We observed many significant achievements in IT services at CWRU. The ubiquitous wireless network is a great enabler for all students, faculty, and staff. Despite some challenges with implementation, the outcomes of the Data Center remediation projects will put CWRU in a much better position to meet both administrative and academic IT facilities needs for a number of years into the future. Instructional Technology and Academic Computing (ITAC) is justly proud of their multi-year development and use of Media Vision to support instruction as well as for non-instructional needs. The ERP implementations to date seem to have gone as smoothly as such projects do and the systems are serving the daily needs of the university. There are many other examples of how ITS is "getting it right" in providing IT services. We emphasize this fact early in the report because, inevitably, such reports are written to help the university appreciate its assets, understand the significant risks or weaknesses in the current situation as well identify the opportunities for creating a better future state. In meeting this larger part of our charge, we do not want to obscure the reality that ITS has a creative, dedicated staff who, though facing difficult financial and organizational challenges, have provided many good IT solutions for CWRU.

The overall impression conveyed to the committee, in group meetings and interviews, is that central IT services at CWRU have suffered from constrained resources and a lack of commitment to "the basics." ITS cannot meet all of the expectations of the community at its current level of funding. That alone isn't exceptional – virtually no IT organization can meet the insatiable demand for ever-more-featured, ever-faster, ever-easier-to-use IT solutions to research, teaching, and business problems. What is more troubling is that the level of service that ITS appears to provide in some fundamental areas such as network and e-mail reliability, desktop support, and trouble resolution through the help desk fall below the levels of such services at peer institutions. Certainly, more adequate funding and different budgeting strategies of the kind discussed further on in the report are two ways to address this problem.

It also appears that the processes by which priorities are set for spending the current level of funding are inadequate along several dimensions. Some of the most fundamental infrastructure and support services do not receive the full attention they need. Although there is perhaps more of an effort to be transparent about things like budget allocations at CWRU than there is at peer institutions, the decision processes by which projects are prioritized are not well defined, and they are not effectively communicated to the community. The result is an uneasy uncertainty within the community about whether CWRU is spending enough on central IT services or not and about whether the funds that are being spent are being prioritized properly. If the IT basics are breaking (which appears to be the case in some areas), and more projects than what many in the community *perceive as* "basics" are being funded each year, then questions inevitably arise about whether

strategic priorities are being set properly. We see removing these uncertainties as a fundamental charge to the university (for this is a university and not just an ITS issue) over the next couple of years. The report has concrete suggestions on addressing this problem.

There is also ambiguity related to the responsibilities of the ITS organization, the decentralized IT support teams, and the vendors to whom some support is outsourced. We heard repeatedly that there is confusion related to authority and accountability for information technology support, potentially leading the users to make inaccurate assumptions and costly decisions. Furthermore, this ambiguity perpetuates a perception that the responsibility for customer service is ignored or abdicated by ITS.

The ITS organization and its management skills and strategies are another area that needs attention. For example, as discussed below, despite having two positions on the organizational chart that should be operations officers, the internal report calls for the appointment of a chief operating officer. We agree with the internal report's contention that the VP and CIO may have too many direct reports. Our interviews suggest that the issue may not necessarily be related to the number of direct reports, but to the possible lack of collaboration among them. The ITS organization has struggled to break down silos in the groups run by the various Directors of ITS and that the ITS Directors are not perceived as a highly functional management *team* who speak with a single voice.

Other areas of ITS organizational concern include the help desk operation and a *perceived* lack of clarity both within and beyond ITS about the roles and responsibilities of the Project Management Office. There is clear recognition that leadership in both of these areas is needed, but there is a weak understanding of the value provided by each.

We also cannot ignore the space challenges that were featured in the internal review. Our experience tells us 1) these are real problems for the morale and efficiency of an IT organization and 2) the university currently has no good on-campus options to solve them through a consolidation of office space. It is perhaps the most intractable problem the university and ITS faces over the next few years, if the ITS organization must remain on campus, in its entirety. These challenges and more are addressed in more detail in the Organization and Operation Section below.

The university should revisit the way in which ITS initiatives are identified and prioritized, and how the department is financed and how its budgets are prepared. Like physical facilities, IT systems, both hardware and software, often require multi-year planning, builds, and maintenance plans. Also like physical facilities, the cost of deferring maintenance is often higher than keeping up with the prudent yearly work to stay current. Somewhat more unique to IT, especially at premier research university, is the problem of distributed vs. centralized or shared services. Two almost inseparable issues are:

- Where (and how) does the university draw the line between what is best provided as a centralized, shared service and what is best kept in a single department or school because of its specialized nature, and

- How will the two different kinds of services be coordinated, communicated and funded?

The Financial Management section below puts more flesh on the financial challenges and opportunities we see for making IT services in general better at CWRU.

The governance issues we found were in some ways unexpected. As is documented in the internal report, the VP and CIO has clearly made significant efforts to provide meaningful, transparent governance of IT through advisory committees, metrics, and annual campus-wide updates on the ITS strategic plan. We can only applaud these efforts. Yet, somewhere along the way, the roles and responsibilities of these various governance mechanisms have lost definition. Indeed, they have lost definition to a point that members of some of the committees reported not understanding why their committee even takes votes or what the force of those votes are. The members of governance committees do not feel empowered to speak for their colleagues, nor do they believe they have authority to approve projects that require incremental funding. They suggested that they have no way to understand the inter-relationship of their work, with the work of other committees. There appears to be an absence of clarity as to where the strategic discussions should be occurring, so that a master plan or roadmap could be communicated and understood.

Others felt that the committees were little more than an occasion for ITS to "report out" on decisions that have already been made. This sentiment further complicates the role of the committees, given that most of the members also reported that they do not believe it is their responsibility to inform their colleagues as to IT updates or action plans. The section on Governance below goes into more detail and includes some recommendations about how these problems in what seems a fundamentally well-intentioned effort at governance might be corrected. There is general acknowledgment that an IT governance review is well timed with the university-wide strategic plan implementation underway.

Finally, there is the question of risk. Risk is a tricky category because almost all challenges can be recast as risks. The committee decided to create a matrix, provided in the "Risk Assessment and Associated Recommendations" section below, to identify major operational, security, human resource, and reputational risks that CWRU incurs by virtue of deficiencies in the current IT infrastructure and services.

The external review committee was somewhat surprised by what we perceived as CWRU's level of risk tolerance. The fact that only about 1.5 FTE in ITS are devoted to security is, frankly, shocking. We heard a great deal of faith placed in the fact that CWRU operates a perimeter firewall, a rarity among R1 institutions. But firewalls are, at best, one layer of an adequate "defense in depth" information security strategy. Such a strategy must employ defenses in multiple layers and must also have a robust outreach and educational component. This is an area where a more comprehensive analysis may be desired.

Compliance and internal controls were other areas in which the level of risk tolerance was higher than those of us on the committee are accustomed to. Business continuity and disaster recovery are recognized to be important, yet there does not seem to be a clear framework based on business impact and risks to the institution. In general, the committee had a sense that risk assessment and mitigation should be a major area for concentration by ITS and its business partners.

III. Organization and Operations

Over the years, the strategic focus of ITS is notable in its diligence in publishing an annual strategic plan, engaging campus IT committees, and tracking IT performance metrics to document its progress. In our interviews, many also acknowledged the CIO's external visibility and visionary focus. Many customers expressed satisfaction in core services such as the wireless network and central applications, but that was not the universal opinion.

The ITS staff, many of whom are long time CWRU employees, expressed a strong dedication to their work and eagerness to improve IT services. ITS staff demonstrated technical pride in CWRU's mainstream network, Media Vision and other instructional technology projects. Many also shared their optimism about the new senior University administration's institutional directions, including the anticipation of a clearer process for priority setting and budget planning. More specifically, the first University Strategic Plan is expected to provide a broader and more meaningful institutional context for IT goals and priorities.

Issues

- **Weak alignment and coordination within ITS leadership**

Effective organizations depend on shared interpretations of their goals, realities, and directions. Our interviews revealed an internal and external perception that ITS leadership alignment among directors and the CIO can be improved. Inconsistent directions and communications from senior leadership have inadvertently triggered tensions and competition across the groups. The clarity of roles, decision authority, and responsibilities has consequently been affected. In addition to directors, there are several senior positions (Deputy CIO, Associate VP, PMO director) whose roles and relationships need clarity.

Fragmented leadership weakens opportunities for cross-functional efficiencies, coordination and collaboration – within and outside the central IT organization.

- **Resource constraints and workload**

Many ITS goals and priorities do not have stable funding sources for capital and ongoing operations. Constrained budgets and internal competition for resources reinforce a silo and inwardly focused subcultures within the organization. ITS production and operations groups describe themselves as "one-deep" with virtually nonexistent staffing slack or residual energy for new projects, collaboration or redeployment of talent across the organization. This is a leadership challenge for ITS management. Inertia, talent retention, and deeper silos are management risks.

- **Lacking customer service orientation and advocacy**

As an organization, ITS' customer service identity is shaped by its frontline support. We found customer service to be a serious problem, fueled by repeated, vocal anecdotes of dissatisfaction with the central IT help desk, a third party provider contracted by ITS. In the eyes of CWRU customers, the poor quality, reliability, and consistency of services from this company reflect the central organization. Customers' frustration about the

mediocre frontline support is magnified when they escalate problems to ITS and receive complacent and passive responses about service resolution.

- **Weak attention to operations**

Our interviews revealed consistent observations that not enough attention is given to "nuts and bolts" operations. Experiences of service outages and disruptions (including when we were visiting) were cited as examples of service passivity and lack of attention to basic operations. Some made explicit suggestions that the CIO should spend more time and visible presence on campus to lead a renewed focus on operations excellence. The luxury of having some leading edge efforts does not compensate for ongoing operations support and mediation with customers. Some clients feel that ITS needs to pay less attention to external, glitzy technologies when basic services are failing. This is a leadership prioritization issue.

- **Lack of decision making transparency**

Adequate IT funding was an expected dominant theme in the review. While it was recognized that stable, multi-year funding is needed to support infrastructure maintenance and innovation, there were strong concerns and reservations about transparency, allocation, and decision governance. Moreover, schools strongly expressed the desirability of having their own IT staff and resources to ensure their needs are adequately met. The roles and boundaries of central and departmental IT services and responsibilities need to be clarified.

- **Gaps**

There is a perceived lack of attention to critical needs, including disaster recovery, business continuity, and risk management. Information security and new compliance requirements are not receiving clear attention in the organization.

IV. Financial Management

This section will attempt to cover all issues related to the resources devoted to ITS specifically and IT within the university more broadly; including: the determination of the scale of resources, the allocation of those resources among competing projects, and the budgeting process.

Issues

- **Inadequate resources**

All groups interviewed indicated, to one degree or another, that ITS has inadequate resources-both financial and staffing. The internal review team found that only 17% of respondents believed that ITS is adequately funded to keep technology current at the university. Examples included an underfunded data center remediation project, inadequate network infrastructure upgrades and outdated software versions. The reasons given for this situation included: the common view that IT is always underfunded, concern that IT investments are not seen as strategic, the difficult financial conditions at CWRU over the past few years etc. In addition, "unfunded mandates" as a result of University wide budget decisions create a non-optimal allocation of resources within IT.

The resulting impact on personnel levels was also recognized by most groups both within and outside ITS. The most common comment inside ITS was that the organization is only "one deep." Significant headcount reductions were made during the budget crisis of several years ago, with 25% of staff being eliminated. The most experienced, senior staff was retained, requiring them to focus more on maintenance and less on new developments.

Several senior members of the administration hold a somewhat contrary view. They believe that ITS in particular and IT in general is adequately funded, especially in the context of the overall budget constraints within the university.

In spite of these issues, most parts of the CWRU community felt that ITS does a good job with the resources that it has. The internal review team found that 59% of respondents felt that ITS used its resources wisely.

- **Unknown total IT spend**

A significant issue that contributes to the debate over the adequacy of resources is the lack of consensus on total IT expenditures, either by ITS directly or throughout the university. No two people interviewed agreed on the amount of the ITS budget. Sources of contention included: what to include (e.g. telephone expenses), direct versus indirect resources (e.g. in ITS or in the departments and schools) etc. One result is that accurate comparisons with peer institutions or other organizations become impossible.

- **Transparency**

Another source of debate is the apparent lack of transparency related to budget issues both with ITS and the university in general. Opinions on the adequacy of ITS resources

appeared to be driven as much by rumor and commonly held wisdom as concrete knowledge of the budget.

- **Lack of multi-year funding**

Operating budgets are done annually. Multiyear obligations such as software maintenance and hardware refreshes must all be funded on an annual basis. This creates a misallocation of resources by creating a trade between "keeping the lights on" and any necessary upgrades and improvements.

- **No capital budgets**

Since all capital expenditures are contained in the annual expense budget, it becomes virtually impossible to optimally allocate capital among competing projects. Traditional capital budgeting processes cannot be used. For example, a larger, more strategic investment that would normally be capitalized over a five-year period would lose out to a less strategic but smaller project that would be capitalized over a shorter period. This is true even if the traditional ROI calculation would select the larger project.

- **Legacy loans**

A confounding factor in each year's budget is the need to service the debt that was incurred to fund capital equipment and expansion several years ago. Virtually everything done with this capital has since been replaced or has become obsolete.

- **University budget process unclear**

Particularly within ITS, overall University budget process was not well understood and was felt to contribute to the resource challenge.

- **Allocation formula**

Adding an itemized student fee for IT has created unnecessary visibility and resentment toward IT expenditures. This fee is being bundled into tuition going forward which should eliminate the issue.

V. Governance

For the purposes of this report, "IT Governance" refers to the organizational structures, processes, and policies by which decisions about ITS services for CWRU are made. We choose to include not only the official and formal structures but also the informal relationships between ITS and other business and academic units within the scope of these observations and recommendations. For every IT organization, governance is a mix of official roles, responsibilities, and relationships as well as those that operate at a more informal level with roots in historical practice and personal relationships.

Issues

- **Reporting Structure**

  With the arrival of a new provost, the organizational structure was changed so that the Vice President for Information Technology Services and CIO now reports directly to the Provost. The organizational chart of ITS shows that the CIO has 10 direct reports. In turn, the number of direct reports for these 10 senior leaders ranges from 0 to 34.

  The VP for IT Services and CIO should report to the Provost if not the President and the committee endorses the recent change in reporting relationships. Information technology has become an interesting combination of basic infrastructure and strategic tool for a world-class research university. As such, virtually every decision made by university leadership both influences and is influenced by IT. Modern research in many different fields now depends on IT services for everything from access to scholarly materials to modeling natural phenomena to data mining as new forms of scientific discovery. The deep interaction between IT and the core missions or research and education of every university leads many institutions to choose to have the CIO serve directly on the President's Cabinet.

  Ten direct reports for a CIO is a large number for an organization of this size. The current organizational chart suggests that neither of the Associate Vice President's who report to the CIO have job responsibilities that divide up the load for or with the CIO. The internal report makes a recommendation that ITS create the roll of a "Chief Operating Officer" to "allow the CIO to focus on strategy" (p. 26) While some strategy to reduce the number of direct reports to the CIO is needed, it is not clear why neither of existing roles of "Associate Vice President" have been used to accomplish this goal or why neither of those take on the responsibilities delegated to a COO in some IT organizations. Simply adding another position without understanding what has and has not worked in allowing the CIO room for strategic work while assuring excellence in operations does not seem the right thing to do. Rather than the simple addition of a position, a thoughtful restructuring of the roles and responsibilities of senior leadership of ITS seems a more reasonable course. While the result of such an effort might well be the creation of a COO position with a workable distribution of Directors reporting to that person, other options might emerge which would better suit the needs of the university in light of its constrained resources.

- **Relationship of Offices and Committees**

  The self-study's section on "ITS Governance" (pp. 18-20) *explicitly* identified the following bodies as part of the "governance model":

  - Advanced Research Computing
  - The HPC Management Board
  - Instructional Technology and Academic Computing (no longer operating)
  - ePortfolio Advisory Committee
  - Technical Infrastructure Services
  - Enterprise Application Systems
  - The SIS Executive Steering Committee
  - The SIS Faculty Liaison Committee
  - The SIS Student Liaison Committee
  - The Program Management Office
  - Information Security
  - IT Architecture

  This *section* of the internal report mentioned but did not explicitly call out as governance entities: the Information Technology Services Planning and Advisory Committee (ITSAC), the Council of Technology Officers (CTO), and the Faculty Senate Committee on Informational Resources (FSCIR).

  Given our interview experience while visiting CWRU, we did not find the mingle of what appear to have been intended as advisory committees for IT governance, e.g. FSCIR, with divisions within ITS, e.g. Technical Infrastructure Services, surprising. In fact, interviews with both non-ITS members of committees such as FSCIR and CTO and with ITS staff, suggested a fairly widespread confusion about the charters, roles, and responsibilities of the advisory committees as well as those of the various divisions within ITS. Perhaps most reflective of this confusion was uncertainty on the part of ITSAC, FSCIR, and CTO committees about whether they were impaneled simply to receive information from ITS on what was already decided, to provide advice about and critiques on what was "reported out" to them by ITS, or whether they played a genuine decision-making role of any kind in IT decisions at the University. Members of some of these committees reported being asked to "vote on" certain proposals, e.g. on using GoogleApps, without being clear in their own mind what such a vote signified. Do they actually have the power to "vote down" a proposal and, if not, why were they being asked to vote?

  Members of some of the committees were pessimistic about their ability to serve the role of "information conduit" for the constituencies *if* that was their role. It is notoriously difficult for a few faculty or staff members serving on a central advisory committee to be responsible for informing all their colleagues. If it is a role that expected of the members of the various governance committees, the members are not clear on that expectation.

  From what can be gleaned from the CWRU web site it appears that the main governance committees do have clear charters and/or charges. In fact, they all appear to be advisory to the CIO and without decision-making power. The visiting

committee neither endorses nor descries the purely advisory role. What is clearly problematic is the lack of shared understanding between ITS and the committees on their roles and of the impact of advice they might provide. Several comments suggested the members felt they were being used to provide a *pro forma* rubber stamps for decisions already made by the CIO and/or the ITS division.

- **Partnerships**

  Like any central IT department, ITS has a large number of relationships with various Schools, Departments, and business units. These relationships, which are often most productive when they are well-defined "partnerships," are *de facto* part of the governance of IT at the university. Specifically, decisions made by schools about class schedules or modes of delivery or decisions made by human resources about pay schedules strongly affect what ITS must do to support those decisions. Similarly, decisions that central IT makes, e.g. about outsourcing the "official" mail system, will have consequences for the legal office and the registrar. This interdependence means that ITS and the Schools, Departments, and business units are actually decision makers for one-another. There are a wide range of models (some more and some less effective) for managing this reality of governance of universities. Unfortunately, a "tubs on their own bottom" financial model of the kind used by CWRU, the relationships are based on a less-than-open-market version of a vendor-consumer model.

  The visiting committee met with only a subset of the academic and business partners of ITS. Among this subset, the interviews showed a range of views of the success of relationship as a "partnership." At the extreme, there were reports that ITS failed to meet many of the needs of partners: poor uptime for network connectivity, poor response to help center requests, and no transparency with respect to prioritization of requests for support from IT. Unfortunately, the general sentiment was that ITS is unable to meet the needs of many potential partners. There was both general sympathy about the funding for ITS, there was equally frustration that ITS seems unwilling to listen to partner concerns.

  Clearly, the most successful current "partnerships" for ITS are with faculty who use high performance computing and faculty who depend on MediaVision.

VI. Recommendations

Note: These recommendations are not in any rank order. They reflect our suggestions about how CWRU can deal with risks the visiting committee identified. Prioritization will depend on CWRU's tolerance for different kinds of risks and its assessment of where effort will make the most difference relative to the university's strategic goals.

1. The university's strategic plan provides ITS a new and broader context for the planning and prioritization of IT initiatives. With proactive alignment with the university plan, ITS can better focus its services and projects to support institutional goals. Therefore, an over-arching recommendation is that the university seize this moment to assure solid alignment between its new strategic plan and the strategic planning of ITS.

2. Clarify the structure, roles, and expectations for alignment in the ITS senior leadership. The CIO should acknowledge current challenges with and reinforce the importance of team alignment at the senior level. Invite and engage the directors in an organized, programmatic approach to strengthen alignment with the CIO, foster teamwork, clarify priorities, and identify effective tactics to collaborate and coordinate efforts among directors and ITS groups.

   Clarify roles, responsibilities and boundaries among senior staff and management roles reporting to the CIO. Encourage collaboration and collegiality among the members of the ITS leadership team, to ensure strategic focus and a commitment to service excellence.

3. The ITS senior management team should engage the larger organization in identifying mechanisms for effective internal communication and coordination across groups. Solicit ideas about doable ways to leverage resources, engage in joint projects, etc. Champion and sponsor cross-functional projects with clear customer benefits and improved service delivery.

4. Review the structure, roles, and size of the leadership team. Specifically, clarify assignment and roles of the Associate VP, and/or Deputy CIO. Ensure that the internal team and the customers are aware of these roles and clarified goals.

   The ITS internal review recommended a new Chief Operating Officer (COO) position, yet the current structure appears to already have two senior positions at this level (Deputy CIO and Associate VP). Given the size and scope of the ITS organization, an additional senior position does not appear to be required. However, it may be prudent to review the occupants' match to the COO requirements and clearly assign or adjust responsibilities rather than create an additional senior position. The assignee will need the full support and backing of the CIO. If not managed, the role and effectiveness of the assignee will be undermined.

5. Ensure appropriate balance between an operational and strategic focus for information technologies. The CIO is universally viewed as strategic, future-oriented and externally focused. Today's IT infrastructure and operations challenges will require more direct attention from the CIO. The CIO's visible leadership and campus

presence are important in championing and sponsoring efforts to bolster a greater focus on excellence in day-to-day IT operations.

6. Improve ITS financial management and planning. With anticipated new funding requests, ITS will require more in-depth financial analyses, cost reviews, contract/procurement management, benchmarking, risk analyses, vendor relations, service level agreements, debt management, etc. Address where in ITS these business tasks will get done and who/how/when these will be coordinated across the organization. Identify who can effectively represent ITS in discussions with finance peers in departments as well as central finance/budget offices. The pressure for transparency, reporting and compliance/audit requirements needs to be anticipated. As part of its business process reviews, ITS should also continually review outsourcing arrangements and contracts. Cost studies – containment, avoidance and true savings—should be part of this review.

   Resource management, budget planning information, and fiscal accountability are key management responsibilities in ITS. If not already assigned and effectively performed, we recommend that this role/position be defined and appointed by the CIO.

7. Clarify the role of the PMO. Conduct a review of the Project Management Office (PMO) with an eye toward making a decisive commitment (or not) to the PMO, its missions, intake processes, and measures of effectiveness and value. The tentative or unclear status of the PMO has caused internal and external frustrations. Engage users and project sponsors in the definition or reaffirmation of the roles of the PMO. PMO customers will resist, bypass or undervalue the PMO unless its value is understood, and the authority and expertise of the office is well defined and supported.

8. Review the portfolio of projects and services to ensure that each project is valued by the University and/or the Divisions of the University. If possible, reduce the number of projects ITS is leading at any one time, or at a minimum, prioritize the goals that must be achieved. With or without a PMO, ITS needs focus on projects where there is defined benefit, clarity of goals, and strong user sponsorship. If done well, and in partnership with users and sponsors, it is much more likely that projects will be successfully executed. Unfunded projects are unsustainable and will continue to strain the organization's capacity and impact organizational credibility. Make project commitments public; communicate often and transparently about progress, issues, and results.

9. Assess the adequacy of current information security and compliance efforts. Seek an external review of the information security staffing and practices to determine whether they are sufficient to address the level of risk.

10. Improve customer service focusing first on the services provided by the help desk. The outsourced help desk/call center is a very visible and prominent source of IT customer dissatisfaction across campus. In the eyes of customers, this remains ITS' accountability and not a third party service failure. The CIO or a designate should assume an active and public role to address issues--specific and general ones--including future options related to the help desk.

Engage in active listening about concerns as this provides important insights on customer relations. The transition to a new provider will involve customer adjustments and new complications. Customer service is so central to the success of the organization; the option of discontinuing the outsourcing should also be assessed.

11. Strengthen relationships with departmental IT leaders. It is likely that a hybrid central/decentralized IT culture will continue to grow. Schools recognize the dependence on central IT infrastructure services, yet value having their own IT staff onsite. ITS should explore mechanisms to improve working relationships with peer IT leaders and shift toward a partnership model across schools and departments on campus. Identify shared goals and joint projects, including discussions about technology trends, interoperability, architecture directions, reduced complexity through standards, security improvements etc. Content management and web services are two examples that came up as common requirements across many groups.

    Roles and responsibility boundaries will continue to evolve as IT demand increases across campus. The VP for IT CIO and campus IT leaders will need to engage in ongoing dialogue and collaboration to optimize IT services and outcomes. It may be useful for the VP for IT and CIO to host monthly Technical Council meetings where IT professionals from across the divisions are invited to participate, and contribute ideas and suggestions related to on-going projects, current and future challenges, or emerging technologies.

12. Have the VP for IT and CIO participate in the President's cabinet meetings while retaining the reporting line to the Provost.

13. Clearly define, publicize, and regularly reiterate for both members of IT governance committees and the community at large, the roles, responsibilities, and authority of all committees and individuals (especially the VP for IT and CIO and VPs of other divisions) involved in IT governance at the university.

14. Streamline the current IT governance structure to involve a smaller number of committees, again, with very clearly defined charters and/or charges.

15. Make explicit and document the process by which advice provided by advisory committees is considered in decision-making with respect to IT at the university. Document the advice given, whether it was followed or not, and the reasons for not following the advice of the preponderance of a committee when that situation arises.

16. Create a clear process and criteria for prioritization of the IT projects championed by business offices at the university. Establish guiding principles for the creation and support of new projects.

17. Similar to an "account representative model", partner Directors of ITS with Directors in key business units to establish long-term joint strategic and tactical planning.

18. Establish and maintain one-on-one meetings between the VP for IT and CIO and the Deans and Department Heads. Ensure that these meetings occur at least once each semester.

19. Construct a university wide view on total IT spending both within ITS and in the schools and departments. This is likely to be very difficult to do and could be viewed as an attempt by ITS to "empire build." Communication that this is not the case will be critical.

20. ITS should work with University central purchasing to consolidate vendors and negotiate better volume discounts.

21. If possible, move debt service of the legacy debt to a separate budget.

22. Institute a traditional capital budgeting process distinct from the annual expense budget. With the fixed capital budget each year, ROI can be calculated for competing projects and capital allocated more optimally.

23. Budgets and budget requests should be created on a rolling five-year basis in order to adequately plan for multiyear commitments such as software maintenance and support. Even though each new budget year will be considered independently and will be influenced by current conditions, planning will be significantly improved. Also, insure that policies regarding software upgrades be adhered to.

24. CWRU should make generally available the formulas for budget allocation from the schools to ITS and negotiate service level agreements so that costs and service expectations are clearly defined and transparency is increased. This process will clarify the kinds and levels of services provided to the schools by ITS and provide a basis for discussing: 1) the appropriateness of those costs and 2) whether an alternative means, e.g. straight chargeback for services, would serve CWRU better.

25. As part of any communications program recommended in other sections, ensure that all budget issues are fully and clearly communicated. This would include budget size, comparisons, allocation formulas etc.

26. Explicitly include plans for addressing the space challenges of ITS in the campus space planning process. Even if the plan must be a very long range one for financial reasons, the fact that ITS is so fragmented spatially is a serious problem for an IT organization trying to coordinate and integrate technology solutions and break down organizational silos. Seeing that they are part of long-range facilities planning will at least send a message to ITS that their challenge is recognized.

27. Develop an explicit, actionable, funded, tested disaster recovery capability and business continuity plans.

NOTE: See further recommendations in the table in the next section.

VII. Risk Management and Associated Recommendations

Throughout our report, we have identified the strengths and perceived weaknesses of the current organizational model. We have also provided a series of recommendations that could improve perceptions of the ITS organization. Beyond perception we also believe there are risks that cannot afford to be tolerated by the University. Below we have identified substantial operational, security, compliance, and reputational risks. The entries in the "Mitigation Plan" column of this matrix should be also be considered recommendations from the committee. ITS should follow up with a more thorough business impact analysis to prioritize and formalize a risk mitigation plan based on the issues identified and recommendations made here.

Risk Management Table

Risk Area	Description	Mitigation Plan	Metrics
Priority given to innovative applications deployment over core infrastructure	Although it is motivating to explore emerging technologies, there must also be sufficient resources to ensure stability of the infrastructure. Rather than focusing on core infrastructure and "nuts and bolts", the team is currently engaged in innovative exploration. These projects introduce risks associated with distraction from core mission and the usual concerns of user adoption, basic maintenance, and unanticipated costs.	• Use the IT architect to ensure that solutions are consistent with strategic plans • Ensure that each project has a strong user champion and sponsor, with adequate resources for deployment, integration, management, maintenance and support.	• Project plan schedules • Evaluation of 'priority one problems'
Application Proliferation/Complexity	Consistently rated as the highest risk factor by external reviewers, this is a risk facing CWRU. This risk is compounded by the fact that resources are scarce. The risk includes system failures, troubleshooting challenges, data security and unanticipated maintenance costs.	• Encourage more standardization • Embrace disciplined project management methods and methodologies • Recruit or retrain staff to achieve credentials. • Restructure application groups to meet fundamental requirements • Use architects to plan hardware/software integration • Periodic external review of applications	• Project plan schedules • Evaluation of 'priority one problems'
PeopleSoft Upgrade	Current system requires upgrade to achieve desired levels of functionality (Ex. Grants Administration). Levels of risk to be significant without expertise and resources.	• Partner with other administrative areas to identify best use of shared resources • Consider creation of a shared services center to allow for focus on new release, and further adoption of PeopleSoft functionality • Identify strong IT leader for PeopleSoft Support.	• Project plan schedules • Evaluation of 'priority one problems' • Satisfaction Surveys

PeopleSoft Data Governance	For any ERP to generate business intelligence, data must be owned, classified and policies written around it. In a challenging fiscal climate, strong data governance (perhaps Institutional Research) can improve decision-making. The absence of strong data governance can increase risk of decision support.	• Create ERP/Data governance committee • Identify strong IT leader for PeopleSoft Support.	• Project plan schedules • User reports, user self-service metrics
Project Agenda	Given the arrival of new leadership, and the likely focus on emerging priorities, ITS may have taken on too many un-sponsored projects. Risk includes: technical staffing with inadequate expertise or experience, coordination costs, an absence of valid success measures.	• Rapid intake or partnership with business analysts • Thoughtful and limited outsourcing • Project planning templates and use of collaboration tools	• Cost per application/per user • Number of interfaces
Project Agenda (continued)	Due to ARRA and other government programs, requirements are likely to change over the next few years. There is risk that new wave of demands will require increased network, transaction and data center stability or capacity. The risks are principally cost, scalability and duplicated effort.	• Senior IT and User leadership involvement in planning and budgeting • Work closely with departments and divisions	• User Satisfaction • Project plan review
Research Compliance	Research funding is likely to increase and regulatory requirements are becoming increasingly complex and costly. IT systems are responses to and the subject matter of compliance regimes. Documentation compliance and security are principal risk areas. Neither are addressed without significant effort by researchers, and IT systems must meet multiple needs. It is unlikely that IT solutions can serve granular needs and substantial customization or acquisition of new systems may be needed. (We are uncertain of PeopleSoft's strength in these areas). Research security risk increases with use of distributed and decentralized applications and databases. Researchers rarely use secure development or admin practices. Risks here include compliance costs, downstream loss of revenue, and loss of customer confidence.	• Address some of the IRB and research administrative challenges with dedicated expertise, and a commitment to service • Leverage expertise of the Director of Research IT • Development and deployment of PeopleSoft (or other) research solutions • Perform risk assessment for distributed applications	• Audit findings • Satisfaction surveys • Success on grant yields
Reduced Revenue Streams	The university is in challenging financial position, however the appetite for enabling technologies continues to grow. IT staffing is thin in most areas (reflecting our market as a whole), and resources must be deployed wisely. Risks include loss of key staff, and failure of significant projects.	• Priority re-evaluation based on zero-based methods • Cost containment study • Capital planning	• Comparative cost metrics
Help Desk Support	The help desk has been a significant dis-satisfier for the	• Detailed management attention to problems	• User satisfaction

Failures	user community. . The cause is primarily a lack of a commitment t service excellence on the part of the outsourcer. There may also be a lack of clarity around the expectations of the customer base, and the responsibilities of the vendor. The number of applications, types of users and complexity of the problems are not unique, but the level of dissatisfaction appears to be unusual. Although the risk may not be high, the loss of user confidence will impact other opportunities, and has already resulted in a loss of confidence in ITS.	• Root-cause analysis for frequent problems, or "high use" callers • Call-back protocols • Operator documentation and information sharing • Regular management review of open problems and frequent issues	• Abandonment rates • Ticket closing times
Specialized Staff Hiring and Retention	Highly talented IT workers are at a premium (even in a recession). In some specialties, the shortage is even more pronounced. In network engineering, database administration, scientific computing, ERP support and Web development, retention may become a more significant problem as the UHC organization eliminates its outsourcing contracts. In addition, universities are ideal for teaching valuable skills, causing staff to be recruited away. Retention issues are also challenging, as remaining stars are saddled with unreasonable work and stress.	• Assessment of compensation and hiring practices with HR offices • Workforce education and cross-department exposure • Limited , thoughtful outsourcing • Skills upgrade workshops • Identify single thread skills and make redundant	• Certifications and educational attainment of workforce • Hiring time periods • Turnover rates Staff "engagement" surveys
Change Control	There is a need for a more formalized set of change control and management procedures. There are many customers affected by changes without adequate communication mechanisms. There is a surprising level of acceptance for down-time and risk-intolerance, but this will likely generate greater risks in the long-term. Change-control problems are also discouraging for the most talented and ambitious staff, and a drain on productivity. Although there may not be specific identifiable risks, this level of concern may be corrosive of the ITS departmental stability.	• Embrace a disciplined change control and problem management process, including daily meetings to review problems and changes. • Add executive change control post-mortem and executive review for serious priority-one problems and associated changes. • Encourage additional communications with end-users • Create standardized approaches to problem management and change control. • Ensure that all changes include appropriate technical and end-user testing • Provide technical education for staff to increase comfort of change controls • Create incident reporting, review and management practices • Reduce tolerance for outages	• Evaluation of 'priority one problems' • Audit relationships of problems to changes

Network Security Breaches	Unaware of problems in this area, but I suspect they may exist.	• Create and communicate a Network Security Plan • Review and evaluate 'priority one problems' • Review all security issues at an "incident review meeting" to be held monthly.	
Data Center Costs, Security, Disaster Recovery	The increase in data center costs caught many IT planners by surprise within the past few years. Current cost models reflect increases in energy and other requirements. The principal risk here is in stability, cost and scalability. However, the cost of a major failure is a greater risk. Strong disaster recovery plans, which include routines drills and user testing must be created, tested, and supported. During our visit, we did not discuss this topic in detail.	• Server virtualization • Regular cross-discipline infrastructure meetings • Update and review with facilities staff • Possible outsourcing of data centers; or inclusion of a redundant center • Creation of a comprehensive disaster recovery plan and a detailed user-sponsored business continuity plan.	• Cost of data centers • Predictive cost of outages
Troubleshooting & Incident Response	Incident response communication is difficult as it may affect dozens of User departments. Troubleshooting difficulty is exacerbated by complexity and communication. Risk is related to cost, workforce stress and delays.	• Establish a formal incident response team	
Periodic Network, DNS & Security Outages	Application developers and administrators have difficulty with DNS and Layer 2 and 3 network technologies. Level of specialization makes it more difficult for applications to have clean interfaces between systems, producing component failure, problems for trouble-shooting and system downtime. This involves workforce stress, costs and delays. It also involves focused integration and communication between and among teams.	• Deploy DNS standards for application and administration staff, as well as technical staff. • Provide DNS and network awareness training for all staff • Create a proactive monitoring group and catalogue of trouble-shooting tools • Create and communicate robust, tested downtime procedures for departments	• Priority One Problems
Prioritization of new initiatives	ITS has a five-year plan for capital investment, but there is enough flexibility to pursue other projects. Poor or inconsistent prioritization reinforces interrupt-driven tactical management, sub-optimal resource allocation, increased complexity, and distracts specialized staff.	• Perform TCO evaluation of new initiatives • Conduct risk assessment of new initiatives • Produce quarterly report for Provost on new initiative progress • Ensure every project has a clearly defined sponsor, funding model, milestones, deliverables, and return on the investment.	• Discrepancies between expected outputs and TCO with plan • Benchmarks of new initiatives against peers
Cost of Desktop Customer	In general, the cost of desktop support drops on a per-	• Identify tools for managing in diverse	• Annual cost per device

Support	desktop basis yearly. In homogenized environments this cost can be further cut substantially. The risk involves mis-allocation of resources and unnecessary costs.	environment • Encourage standardized devices where possible.	• Trends in number and types of devices • Satisfaction survey
Potential for Incompatible technologies	Although there was insufficient time to explore this topic, it is relatively predictable that some selected solutions may create incompatibilities with preferred solutions. One example is the use of GoogleApps with Blackberry devices, related to calendar management and synchronization.	• Investigate costs and benefits of outsourcing some additional support or application development	
Cost containment for common software and shared services	Decentralized approach to purchasing substantially increases institutional costs unnecessarily.	• Annual department education of where and how to use available services and solutions	• Software cost per workforce member

Management Response to External Review

Interim report

March 1, 2010

GOVERNANCE SECTION (1-7)

(1) Define IT governance community: All involved in IT governance for the university

(i) Eight subcommittees have been established as part of ITSPAC. Their meetings are documented as:

Security and Policy	**Core Technology**	**Academic Technology** *(Established 2004)*
• July 2, 2009 • Sep 28, 2009 • Oct 27, 2009 • Nov 17, 2009 • Dec 22, 2009 • Jan 19, 2010 • Feb 23, 2010	• July 14, 2009 • Sep 15, 2009 • Nov 10, 2009 • Jan 12, 2010 • Mar 9, 2010 • May 11, 2010 • July 13, 2010	• April 24, 2009 • Oct 30, 2009 • Jan 22, 2010 • Mar 1, 2010

https://sites.google.com/a/case.edu/its-planning-and-advisory-committee/information-technology-services-planning-and-advisory-committee/subcommittees

(1) Define IT governance community: All involved in IT governance for the university

(i) Eight subcommittees have been established as part of ITSPAC. Their meetings are documented as:

FSCIR	RESEARCH COMPUTING *(Established 2004)*	BUDGETING
• Sep 21, 2009 • Oct 25, 2009 • Nov 23, 2009 • Feb 15, 2010 • March 15, 2010 • April 19, 2010	• October 7, 2009 • December 7, 2009 • February 9, 2010 • March, 2010 (tentative)	• Oct 15, 2009 • Nov 23, 2009 • Dec 11, 2009 • Jan11, 2009 • Feb11, 2009

https://sites.google.com/a/case.edu/its-planning-and-advisory-committee/information-technology-services-planning-and-advisory-committee/subcommittees

(1) Define IT governance community: All involved in IT governance for the university

(i) Eight subcommittees have been established as part of ITSPAC. Their meetings are documented as:

CUSTOMER SERVICE AND SUPPORT *(Established 2009)*	EXECUTIVE Committee *(Established 2009)*
• October 7, 2009 • December 7, 2009 • February 9, 2010 • March, 2010 (tentative)	• Oct 15, 2009 • Jan 20, 2010 • Feb 11, 2010 • March 23, 2010 • April 7, 2010

https://sites.google.com/a/case.edu/its-planning-and-advisory-committee/information-technology-services-planning-and-advisory-committee/subcommittees

(1) Define IT governance community: All involved in IT governance for the university

(ii) ITSPAC will meet five times a year. Their meetings are documented as:

ITSPAC Meetings 2009-2010

- Tuesday, September 22, 2009
- Thursday, October 15, 2009
- Friday, December 11, 2009
- Thursday, February 11, 2010
- Wednesday, April 7, 2010

(1) Define IT governance community: All involved in IT governance for the university

(ii) ITSPAC will meet five times a year. Their meetings are documented as:

PROPOSED - ITSPAC Meetings 2010-2011

- Thursday, September 16, 2010
- Thursday, October 28, 2010
- Thursday, December 16, 2010
- Thursday, February 17, 2011
- Thursday, April 7, 2011

(1) Define IT governance community: All involved in IT governance for the university

(iii)The Executive Steering Committee will meet no fewer than five times a year and take recommendations from ITSPAC for policy action, budget prioritization, and project sponsorship.

EXECUTIVE Committee

- Oct 15, 2009
- Jan 20, 2010
- Feb 11, 2010
- March 23, 2010
- April 7, 2010

University-Wide Priority Review Board to meet Spring, 2010.

(2) Recommend CIO to sit on the President's cabinet while reporting to the Provost.

(i) Recommendation to be made to Provost

Recommendation was made to the Provost in August, 2009.

(3) CIO to schedule one–on–one meetings with Deans and Department Chairs

(i) CIO will continue to schedule one-on-one meetings twice a year

Deans Meetings 2009-2010			
MSASS	July 2, 2009	October 13, 2009	January 26, 2010
Medicine	July 23, 2009	Cancelled	March 8, 2010
Arts & Sciences	August 8, 2009	October 12, 2009	February 2, 2010
Nursing	August 18, 2009	October 14, 2009	
Dental Medicine	September 23, 2009	January 21, 2010	
Engineering	August 26, 2009	February 25, 2010	
Law	Cancelled	March 2, 2010	
WSOM	Cancelled	Pending	
Undergraduate Studies	Cancelled	February 15, 2010	
Graduate Studies	Cancelled	Pending	

(4) Document IT governance process using advice provided by Advisory Committees

(i) The process of IT Governance will continue to be documented in ITSPAC charter, through sub-committee activity, and web presence

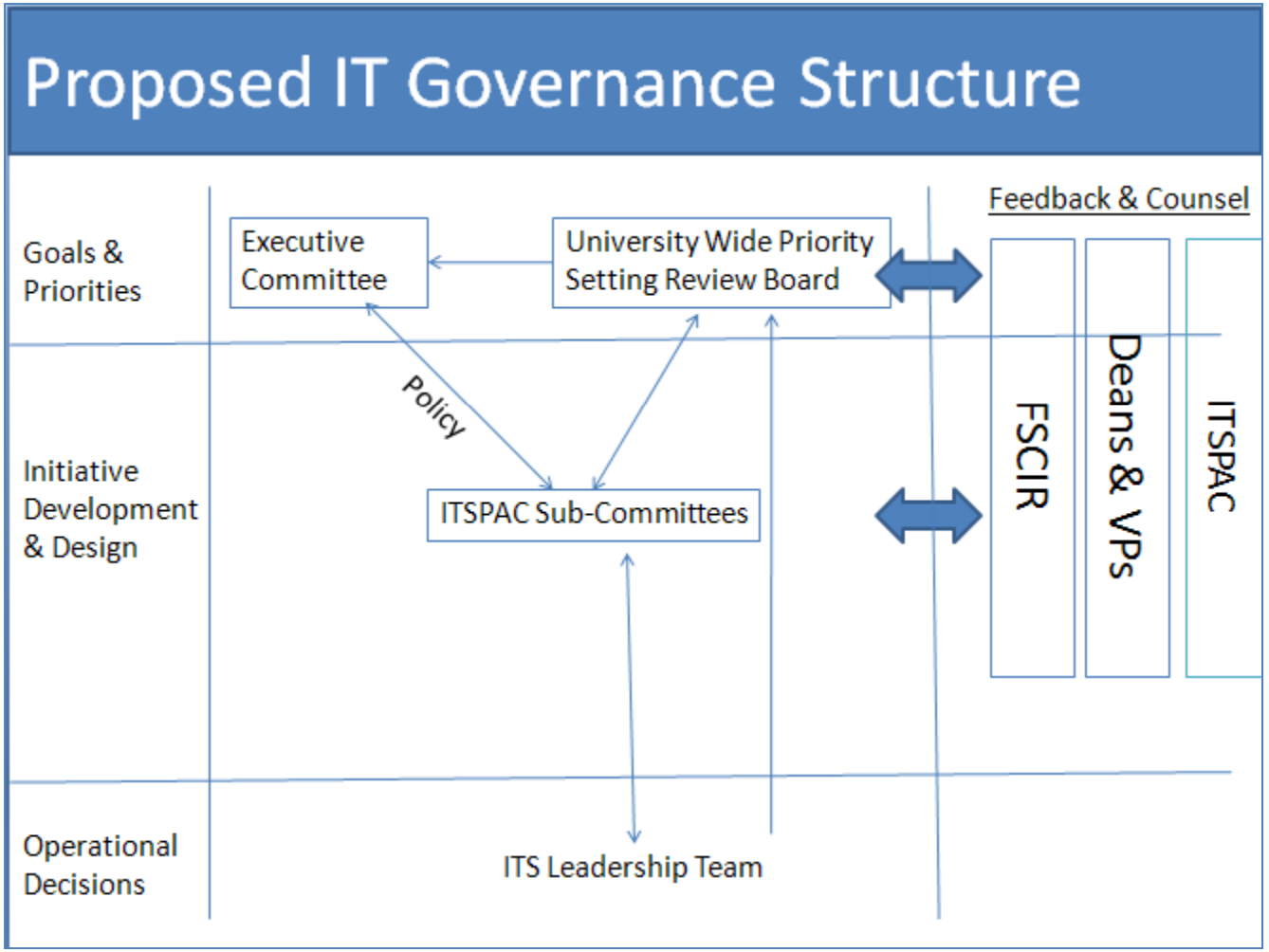
Goldstein & Associates has been engaged to review and provide recommendations on Governance Charter Reviews to each of the governance committees for FY10. Draft charters are online at https://docs.google.com/a/case.edu/View?id=dgtc5c4f_512dtzjmhdp

Goldstein & Associates visits
• Tuesday, September 22, 2009 • Thursday, October 15, 2009 • Friday, December 11, 2009 • Monday, January 11, 2010 • Thursday, February 11, 2010 • Wednesday, April 7, 2010

(5) Streamline IT governance

(i) IT governance work flow is from subcommittees to ITSPAC to Executive Steering Committee

This diagram reflects the revised governance model.



(6) Develop an annual statement of goals and priorities and solicit review by the Provost to align with the university goals and priorities.

(i) ITS will continue to develop a statement of goals and priorities.

(ii) The statement of goals and priorities will be shared with ITSPAC and reviewed and endorsed by the Executive Steering Committee on an annual basis.

An annual statement of priorities is to be vetted with ITSPAC each February and to be shared with the Executive Steering Committee (including the Provost) thereafter.

ITS Priorities as noted in 5; these will be joined with priorities identified by the Council of Technology Officers, the Faculty Senate Committee and the Vice Presidents Council on Administrative Systems through an IT Priority Board in the March timeframe each year.

Those recommendations will be reviewed by the Provost and Executive Steering Committee to ensure alignment with the university's goals and priorities, to be shared with ITSPAC in the first meeting of each fiscal year.

(7) Improve planning and operation and drive towards cost-effective solutions for campus needs.

(i) ITS will improve planning and operations.

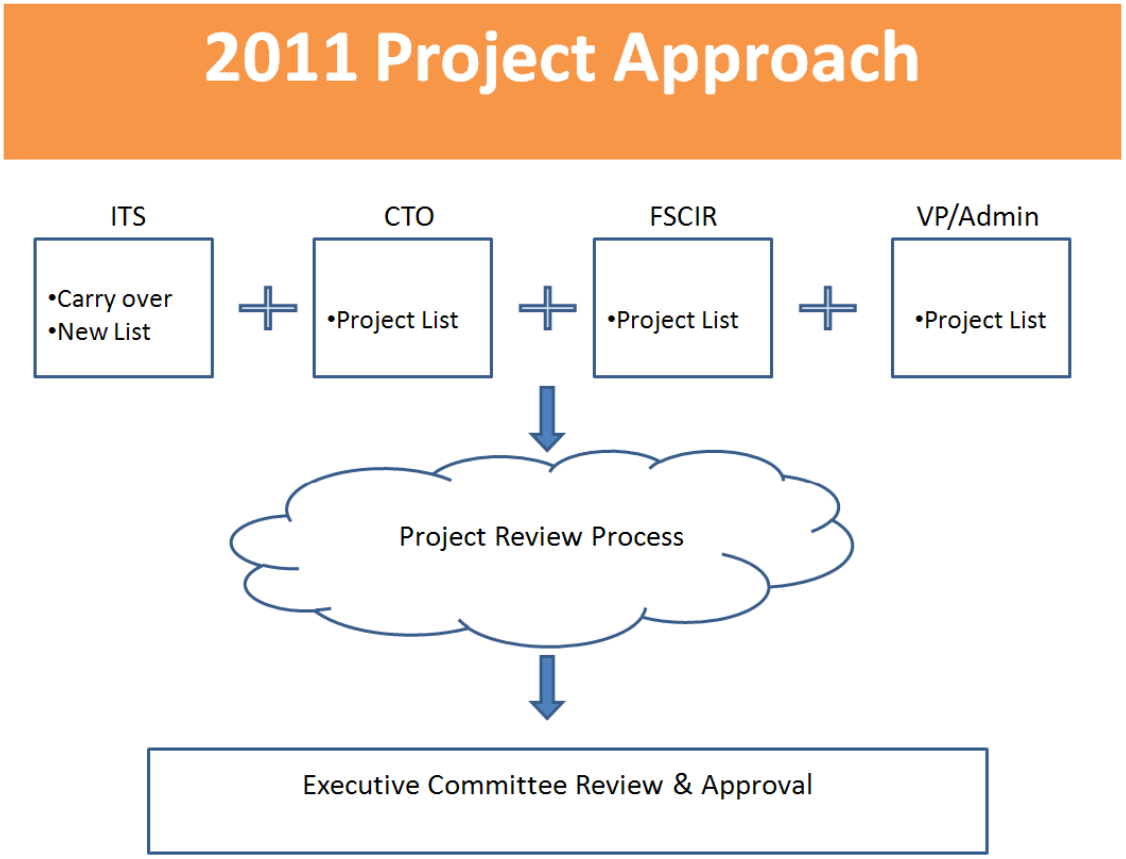
Work is in progress; working with Goldstein and Associates on baseline IT investment throughout the university. An action plan will follow.

ITS will continue to look for opportunities for cost effective solutions regarding the cost of IT operations. (Example: Investment in Help Desk cost-effective solution)

An annual plan and report to the campus on operations and cost effective solutions will be shared in September each year.

(7) Improve planning and operation and drive towards cost-effective solutions for campus needs.

ITS operations and cost effective solutions; these will be joined with those identified by the Council of Technology Officers, the Faculty Senate Committee and the Vice Presidents Council on Administrative Systems through an IT Priority Board in September of each year.



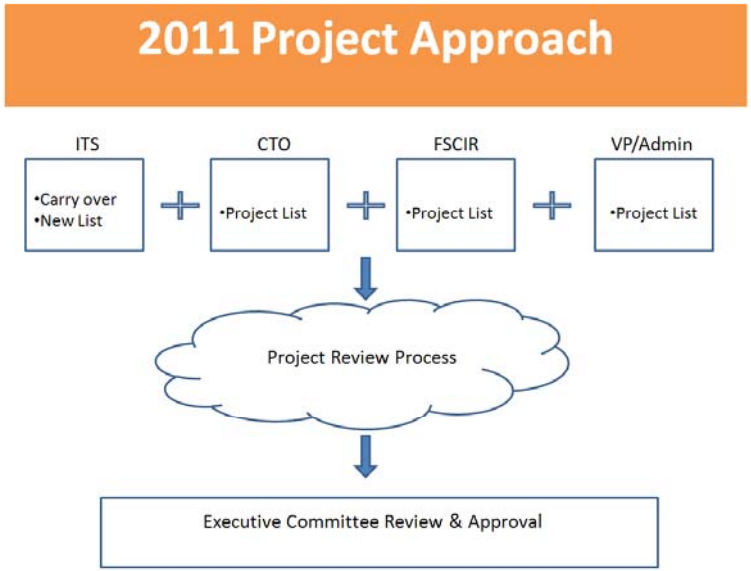
FINANCES (8-16)

(8) Permanent Funding for TECs, Research Computing and MediaVision Courseware

(i) ITS will request permanent funding for FY11 for TECs

(ii) The statement of goals and priorities will be shared with ITSPAC and reviewed and endorsed by the Executive Steering Committee on an annual basis.

ITS has requested permanent capital funding for TEC's and Research Computing. ITS has requested permanent operational funding for MediaVision Courseware.



(9) Capital Funding for Infrastructure

(i) Initial study estimated $40 million as the required ITS capital project funding for the next 10 years in the area of network and server infrastructure

(ii) It is recognized that an average $4 million of capital project funding identified so far by the aforementioned study is not possible to fund from the existing operating budget and new sources of revenue must be aggressively pursued

(iii) Sources for capital funding to include (a) Tech Transfer, (b) Carryover from Operating Budgets (c) Endowment, (d) Carryover from Capital Funds

ITS has requested permanent capital funding for core infrastructure including backbone, network, servers and storage and related investments.

(10) Budget allocations, charge-backs and opportunities for cost sharing

(i) Budget allocations for ITS should be directly related to infrastructure use (and not by FTE)

ITS has made a recommendation to the university budget committee reflecting this recommendation.

(ii) The Division has four limited charge-back provisions (a) telephony pass through, (b) MediaVision AV, (c) Customer Service rate chart, and (d) Server and storage value-added and specialization services rate chart. No other charge-backs are contemplated.

ITS affirms that at present, there are no intentions of additional chargebacks.

(iii) ITS will continue to explore cost sharing opportunities

ITS is actively involved with university management centers to explore opportunities for shared services.

(11) Improve and drive towards cost-effective solutions for campus needs.

(i) ITS management recommends a four step approach to driving cost effective solutions (a) regulatory (b) board directed, (c) tier III security (d) other opportunities.

ITS' planning strategy for FY11 (University-Wide Priority Review Board) reflects this recommendation.

(ii) An evaluation of overall IT operations within UGEN and other appropriate university administrative offices be carried out with a goal of identifying opportunities for consolidation to achieve operational and cost efficiencies.

This will be an ongoing activity for the remainder of the year. Current collaborations driving possible operational cost efficiencies include department file sharing, consolidated desk-side support, centralized fax server, and common enterprise calendaring.

The schools and other university administrative units will deliver their baseline IT investment model for review in April, 2010

(12) Do a 5 year rolling budget request

(i) ITS will work with the new VP for Financial Planning and the CFO to establish the best mid to long-term financial planning model

ITS has met with the CFO and will explore the viability of this option with the new Vice President for Budget and Planning moving forward.

(13) Fully communicate all budget issues

(i) In the interest of transparency, ITS will continue to report a financial spending summary in its annual report.

(ii) The format of this report and the level of detail that is appropriate should be determined by the appropriate ITS governance body.

ITS has met with and proposes an annual meeting with the Faculty Senate Budget Committee, and the continuation of the annual February joint meeting of the Faculty Senate Committee on Information Resources and the Faculty Senate Budget Committee, and an annual briefing to the Provost's meeting with the Deans.

In addition, ITS affirms that it will continue to report spending activity in its annual report to the campus, and will differentiate between maintenance/core technologies and research and development.

(13) Fully communicate all budget issues

(iii) This report should also include, to the extent possible, summarization of university-wide IT spending both within ITS and by units outside of ITS.

Goldstein & Associates has engaged with the Senior Directors of Finance in each of the schools and major business units to carry out a baseline activity as recommended, to be concluded in the April, 2010 timeframe.

(14) Move existing debt service to alternative financial facility

(i) ITS management will investigate this recommendation with CFO

ITS met with the CFO during the Summer, 2009, and has determined that this is not a viable option.

(15) Identify role for resource management including financial and budget planning and fiscal responsibility

(i) Management agrees and will establish a high priority for business process improvements to leverage resource management tools

ITS is embarking on a project level resource management tracking effort, as reflected in this recommendation.

(16) Utilize University central purchasing to extract best pricing

(i) ITS will continue to work with Purchasing to extract best pricing

ITS is collaborating with University Purchasing on a number of initiatives, including printing and document management (e.g. Sci-Quest)

Space Planning and Working Environment (17-21)

(17) Conduct a comprehensive Review of ITS Space Planning and Physical Work Spaces and Working Culture

(i) ITS management supports this recommendation and seeks the support and cooperation of both Facilities Planning and HR to carry out this recommendation

ITS Senior Management is actively engaged with facilities planning and the university architect and exploring three integrated space planning options for ITS.

(18) Produce a detailed statement of space requirements based on core activities and expected future activities as determined by the strategic plans of the division and the University

(i) The comprehensive space plan developed in 2003 by the Office of the Senior Vice President for Administration is to be reviewed and updated to be in alignment with current strategic priorities, staffing levels, and other factors.

As part of an anticipated, university-wide comprehensive space planning RFP to be issued by the university architect, ITS anticipates to be able to respond positively to this recommendation.

(19) Conduct a gap analysis to objectively identify where the current ITS space allocation falls short of what is required to successfully address the needs established in the ITS & University strategic plans

(i) As part of the above mentioned comprehensive space plan update, gap analysis will be conducted

As part of an anticipated, university-wide comprehensive space planning RFP to be issued by the university architect, ITS anticipates to be able to respond positively to this recommendation.

(20) Produce a clear statement of the impact of the space allocation shortfall on the likely success in achieving goals set forth in the strategic plans

(i) Following items 17-19 above, ITS management will produce a statement on the relationship between strategic planning and space allocation

As part of an anticipated, university-wide comprehensive space planning RFP to be issued by the university architect, ITS anticipates to be able to respond positively to this recommendation.

(21) Review CASEWorks

(i) Management will form a new cross-functional committee to review the CASE-Works program and address the following concerns. (a) Effectiveness of program (b) Inconsistency of implementation of this program across all ITS departments (c) Impact to user community when CASE-Works employees are not physically present, if any. (d) Standard expectations of this program (e) Communication of expectations

The committee has been formed and expects to make its recommendations to Senior Management by May 1, 2010.

Disaster Recovery, Risk and Security (22-23)

(22) Information Security and Compliance efforts are understaffed and underdeveloped for a major research university. Management should review both.

(i) ITS Management will request, on a priority basis, funding and approval for 1 additional FTE for the office of the CISO.

A proposed coordination of shared FTE with University Counsel to support eDiscovery and Information Security. This job description is written and ready when funding becomes available.

(22) Information Security and Compliance efforts are understaffed and underdeveloped for a major research university. Management should review both.

(ii) Build a security practice benchmark survey based on either the OCTAVE Catalog of Practices or a security framework such as the ISO 27002.

Under development

(22) Information Security and Compliance efforts are understaffed and underdeveloped for a major research university. Management should review both.

(iii) Assess the current information security program against this benchmark, identifying strengths, weaknesses, opportunities, and threats

(iv) Survey peer institutions on staffing size and baseline security practices. A comparison of practices covered is assumed to drive staffing levels. Compliance driven activities are assumed to drive staffing levels in the IT industry overall, and such factors are expected to drive any recommendations for staffing at Case.

Underway, expect to be completed by end of FY10

(23) Disaster Recovery Planning is largely non-existent at Case. Management should address a foundational approach as a high priority

(i) ITS will take two efforts in parallel to address DRP. (a)Support a nascent business continuity planning process (a function of the University Chief Administrative Officer) where business processes are prioritized. (b) With additional funding, address basic return-to-service operational plans based upon assumed top threats.

ITS has arranged for Deloitte (internal auditor) to present proposal to CFO to complete this activity.

Customer Service and Support (24-27)

(24) Develop customer service design and focus

(i) Re-establish internal customer service and support organization

CSS organization created and operational August 1, 2009. Fully staffed and functional.

Measurement of Customer Satisfaction has become an active process through two means: A seven question survey is sent to all Help Desk customers after issue tickets are closed. In addition, the Help Desk Institute (HDI) has been contracted to provide measurement Customer Satisfaction via an independent source.

A Process Improvement Initiative has been initiated by ITS to document and re-engineer existing processes with the goal of improving customer service.

(24) Develop customer service design and focus

(ii) Renew commitment to customer service through partnerships

Multiple partnerships have already been created between CSS and various university groups. The Director of Customer Service and Support has assembled an advisory committee consisting of faculty, staff and students. Additional partnerships will be pursued in 2010.

(24) Develop customer service design and focus

(iii) Renew commitment to customer service through communication

New Marketing and Communications Specialist hired on October 1, 2009.

A comprehensive Communications Plan is currently under development that will identify opportunities to improve ITS communications to the University community.

(24) Develop customer service design and focus

(iv) Renew commitment through active listening and customer focus efforts

An ITSPAC sub-committee directed at customer service has been meeting since September and several structures initiatives aimed at proactive engagement with various campus constituent groups (faculty, staff and students) is well under way.

(24) Develop customer service design and focus

(v) Renew commitment through new ITS help pages

New help.case.edu page launched February 19, 2010.

A process has been initiated for continual review and renewal of Public Knowledge Base articles located on the newly revised help.case.edu. Additionally, a feedback link has been added to solicit input from the University community in an effort to identify additional support opportunities.

(24) Develop customer service design and focus

(vi) Renew commitment towards customer service through creating SLAs between ITS and other parts of campus

Active work underway, coordinated by the AVP and COO in coordination with CSS director and other Directors as relevant.

Several Service Level Agreements (SLA) related to desktop support have already been implemented

(24) Develop customer service design and focus

(vii) Renew commitment by providing certification and training for ITS staff on customer service and link the completion of this training to specific and measurable performance goals

ITS Management expects a recommendation from the Lead Trainers to the Director of CSS in March, 2010

A major customer service assessment and change management initiative will be pursued in 2010

(25) Improve working relationships with other IT units across campus

(i) Redefine ITS' relationship with distributed IT units

Working examples:

- Current FY 11 budget cycle
- Google Apps transition team
- Identity Finder
- Blackboard

AVP/COO Mark Henderson Meetings with CTO	
Nathan Lambert, KSL	1/10/10
Rimas Biliunas, WSOM	1/20/10
David Pilasky, Medicine	1/20/10
Carmelo Franchina, MSASS	1/29/10
Tron Compton-Engle, Law School	2/4/10
Thomas Knab, A&S	2/18/10
John Smolik, Dental Medicine	Pending
Caron Baldwin, Nursing	Pending

(25) Improve working relationships with other IT units across campus

(ii) Listen and act on the voice of the campus

(iii) Shift to a proactive approach to communication with the campus

Both PMO staff and CSS staff have begun an active listening exercise, across the university beginning with SOM. Work will continue through Spring, 2010. As examples:

Project Manager – Jess Walders	Communications Officer -Kirsten Nagel
CTO meetings	Law School
Medical School Admin Forum	Weatherhead School of Management
MSASS Faculty Meeting	Medical School
Undergrad Admissions Staff meetings	Alumni
Dental School Faculty Retreat	Nursing
Genetics Department	School of Dental Medicine
Google Project Transition Team meetings	Student Affairs
	Graduate and Undergraduate Student Groups

(25) Improve working relationships with other IT units across campus

(iv) Leverage relationships with distributed help desks

Initial conversations held with a number of distributed helpdesks in order to begin dialog.

ITS management expects proposed pilot activity in Spring, 2010.
For example: Datacenter support for servers, afterhours support.

(26) Develop an account representative model

(i)ITS management will take the recommendation under advisement. Such an approach assumes a degree of staffing which may or may not be attainable with any degree of plausibility

ITS management is reviewing such an approach; given current staffing levels, additional resources may be needed.

(27) Develop a strategy of relationship building

(i) ITS management views this recommendation as a multi-tiered and multi-phased effort. A management team will be established to develop a distinct approach to organizational development and leadership that embraces the commitment to relationship building

ITS Directors retreat held January 15-17, 2010, defining broader activities for development, and will convene again on March 26, 2010.

Wendy Shapiro to lead organizational development efforts.

Five detailed initiatives related to this recommendation are underway.

Internal Organizational Development

(28-31)

(28) Clarify structure, roles, and expectations for alignment within the ITS Organization

(i) Management takes details of recommendation to create COO position, clarify other senior management and review with all directors their roles and expectations

Associate Vice President and Chief Operating Officer Mark Henderson assumed role on January 4, 2010.

(28) Clarify structure, roles, and expectations for alignment within the ITS Organization

(ii) As outlined in item 27 above, management will develop a strategy for ITS organizational development and leadership

ITS Directors retreat held January 15-17, 2010, defining broader activities for development, and will convene again on March 26, 2010.

Wendy Shapiro to lead organizational development efforts.

Five detailed initiatives related to this recommendation are underway.

(29) Increase cooperation, coordination and communication across the departments within ITS

(i) Management recommends forming a Service Catalog Committee.

(ii) Each department should create a service catalog from a standard template developed by the Service Catalog Committee that should at least contain the following:

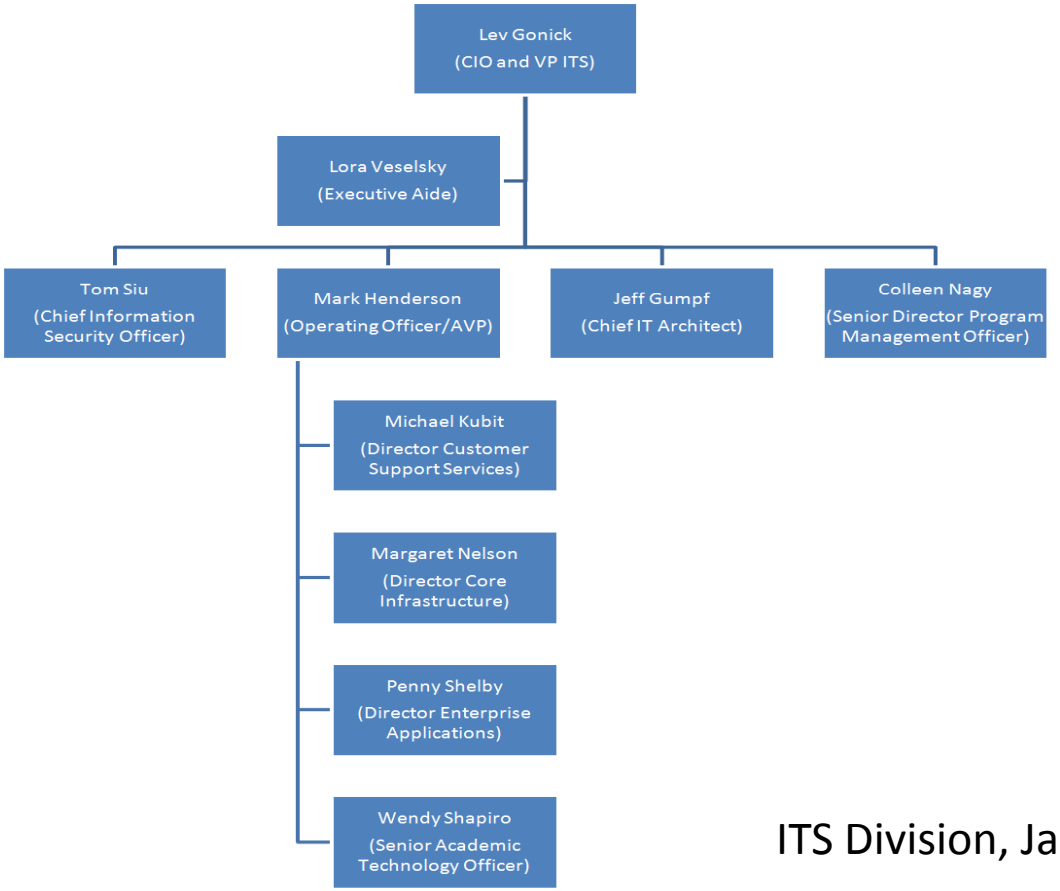
- **(a)Services provided by each ITS department**
- **(b) Outline structure, roles and expectations of each service**
- **(c) Responsibilities in that service**
- **(d) Who to contact for that service**

To be reviewed by the PMO for FY11, in coordination with each of the units within the division.

(30) Decrease the size of the senior leadership team

(i) Management agrees with this recommendation

New organizational chart reflecting this recommendation in place, January, 2010.



ITS Division, January 2010

(31) Clarify the role of the PMO

(i) Management commitments to a regular review of all units within the Division, including the PMO

PMO Services have been defined and communicated to the ITS Directors. PMO Director and the ITS Directors developed a project life cycle process chart. PMO has also hired two project managers who are well versed in project management skills.

Methodology, Project, Prioritization
(32-38)

(32) Create a process for prioritization of the IT projects

(i) Management commits to continuing to refine the process for prioritization of IT projects. The portfolio will include three inputs
(1) customer needs
(2) management direction
(3) directors input.
A formal methodology will be developed

PMO has socialized a formal process for priority setting within the division.

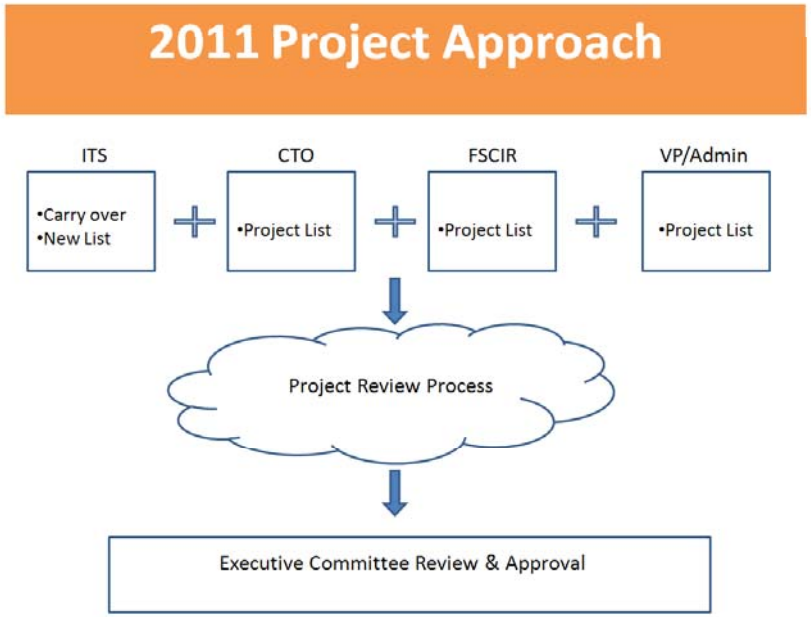
A campus wide priority setting program has been developed and is being piloted in anticipation of the FY11 budget, reflecting this recommendation.

ITS Project Pipeline

(33) Establish criteria for the creation and support of new IT projects

(i)The criterion for creating and supporting new IT projects flows from multiple sources. These include the University's Strategic Plan, the Division's Strategic Plan, regulatory requirements, Board directives, management priority setting, campus input through governance and ITS staff input. Projects in this context are understood to be engagements that require
(a) more than 80 ITS person-hours of effort. (b)requires cross-departmental coordination within ITS and/or is estimated to consume more than $8000 in non-salary cost

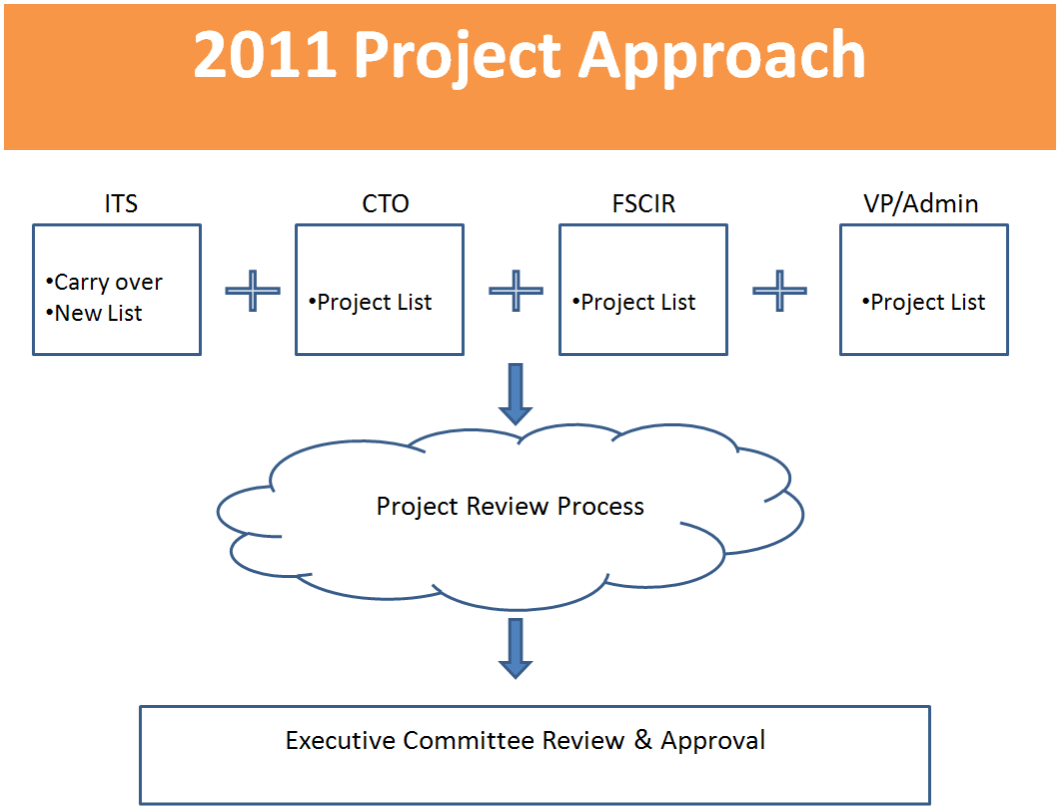
The PMO has socialized a formal process for priority setting within the division.



(34) Identify process for involvement of business offices at the university who are championing projects

(i) Management agrees with the criticality of this recommendation.

A campus wide priority setting program has been developed and is being piloted in anticipation of the FY11 budget, reflecting this recommendation.



(35) Review the current portfolio of projects and services to ensure reasonableness.

(i)The PMO is charged with a regular reporting to management on the status of projects.

The PMO has presented the first 6 month review of the current FY10 portfolio, in response to this recommendation. Quarterly updates will continue to be part of the process moving forward.

FY 10 Completed Projects (28)

First Quarter (16)
Jul – Aug - Sept

- ➢ Data Center Virtualization
- ➢ Upgrade Call Manager
- ➢ Outsource Pinnacle & Billing
- ➢ Upgrade Voice Mail System
- ➢ HCM Upgrade
- • Redundant Internet Connection
- • Shibboleth 1.3
- • Checkpoint Software Upgrade
- • Distribution IOS Upgrade
- • ATM Network Decommissioning
- • Implement Crannog Netflow
- • Sympa Subscriber DB Load
- • Create security question removal tool
- • Account status Tool
- • Design & Implement Network ID Wizard System
- • Office of Faculty Diversity Survey

Second Quarter (7)
Oct – Nov - Dec

- ➢ Google Apps Email for Students
- ➢ Mirapoint end of life replacement
- • Launch New CHSC bldg
- • SER UPS Upgrade
- • Business Mashups (OP)
- • Commencement Registration System
- • AnyConnect VPN Client Rollout

Third Quarter (5)
As of January 26th

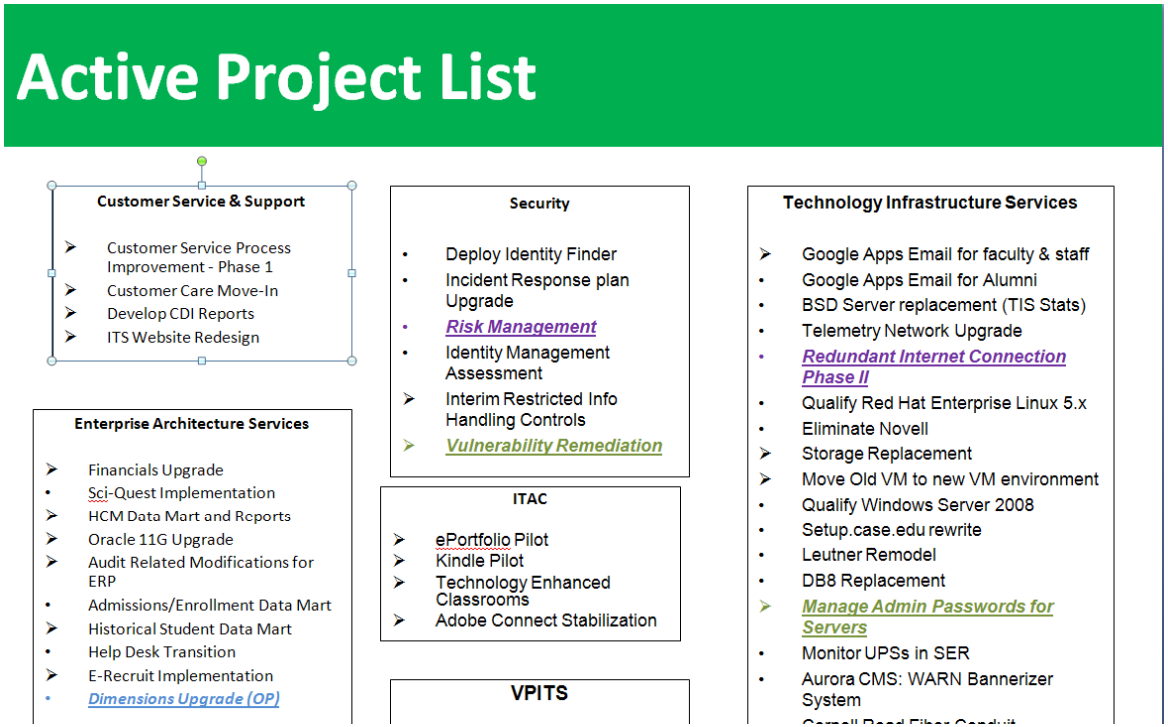
- ➢ Second Life Server
- ➢ Mediavision 3.0
- • Develop Campus Web Launchpad System
- • Develop Mobile Campus Web System Environment
- • Alumni Life Long Learning

➢ ***Denotes High Priority Project***

(36) Identify an effective mechanism for managing projects

(i) The PMO will be an integral part of the Service Catalog noted in item 29 above. The PMO will maintain a portfolio of projects and report out on a monthly basis the status of these projects. As part of their services catalog, the PMO will mentor ITS managers and staff on good project management practices

This is an on-going activity



FSCIR mission charge 4/19/10

The Faculty Senate Committee on Information and Communication Technology (FSCICT) shall advise the Vice President for Information Technology Services and the Executive Technology Steering Committee on policies, strategies and practices that promote the effective use and management of information and communication technologies (ICT) to support the University's academic and administrative missions.

The committee shall:

1) Establish priorities related to ICT policies and strategies on the campus;
2) Review and provide input annually on the operations and budget of Information Technology Services;
3) Advise, consult and help develop guidelines and policies on how to organize and govern information and communication-related services, and how to develop, select and budget for ICT within University Information Technology Services and other technology organizations within the university.

The Committee shall review the information technology and telecommunications infrastructures for teaching, research, and service; collaboration technologies; and administrative systems, especially those related to the academic advising and research administration.

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Pamela B. Davis, M.D., Ph.D.
Dean
Vice President for Medical Affairs

Office of the Dean

10900 Euclid Avenue
Cleveland, Ohio 44106-4915

Visitors and Deliveries
Biomedical Research Bldg. - Rm. 113

Phone 216.368.2825
Fax 216.368.2820

http://casemed.case.edu

Memorandum

To: Carol Musil, Ph.D.
Chair, Faculty Senate
c/o Liz Woyczynski
Secretary of the Faculty Senate

From: Pamela B. Davis, M.D., Ph.D.
Dean, School of Medicine

Date: April 13, 2010

Re: Proposed Ph.D. and M.S. Program in Systems Biology and Bioinformatics

---

Dr. Joseph Carter, Chair of the Faculty Council, has informed me (in the memo attached) on behalf of the Council that it has recommended approval of a proposed new degree program leading to Ph.D. and M.S. degrees in Systems Biology and Bioinformatics.

I strongly support approval of the program as proposed in the attached document.

Please let me know if I can provide additional information. Thank you.

c: Dr. Joseph Carter, Chair, Faculty Council
Dr. Mark Chance
Dan Anker
Preston Pugh

enclosure

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Office of Faculty Affairs and Human Resources
10900 Euclid Avenue
Cleveland, Ohio 44106-4915
Phone 216.368.3870
Fax 216.368.3013
http://mediswww.meds.case.edu

Memorandum

To: Pamela B. Davis, M.D., Ph.D.
Dean, School of Medicine

From: Joseph Carter, M.D.
Chair, Faculty Council 2009-2010

Date: April 13, 2010

Re: Proposed Ph.D. and M.S. Program in Systems Biology and Bioinformatics

At its meeting on April 12, 2010, Faculty Council reviewed the proposed Ph.D. and M.S. program in Systems Biology and Bioinformatics.

The program proposal had been previously reviewed, following the usual School of Medicine process, by an ad hoc committee composed of graduate program directors, members of the Faculty Senate Graduate Studies Committee, and the Faculty Council Steering Committee.

The Faculty Council finds the program satisfactory and voted unanimously to recommend approval of the program. We hope you will agree and forward the proposal to the University Faculty Senate for further review.

Thank you.

CASE WESTERN RESERVE

Pamela B. Davis, M.D., Ph.D.
Dean
Vice President for Medical Affairs
Office of the Dean

February 22, 2010

Mark Chance, Ph.D.
Director, Center for Proteomics and Bioinformatics
Case Western Reserve University
School of Medicine
10900 Euclid Ave.
Cleveland, OH 44106-4988

Dear Mark,

I am most impressed with the work you and your colleagues have done to create the new graduate program proposal for Systems Biology. This is a critical area in biomedicine today and one in which there are too few training programs nationwide. With our strength at CWRU in proteomics, genetics, bioinformatics, and other key disciplines, we have the opportunity to emerge as a leading training site in this area.

The program you have outlined is thoughtful, thorough, and collaborative across the campus. The enthusiasm you and your colleagues bring to this program is also a key ingredient that bodes well for its success.

I strongly endorse this program and hope that it can be approved expeditiously so that you can get started!

Sincerely,

Pamela B. Davis, M.D., Ph.D.

Ph.D. and M.S. Program in Systems Biology and Bioinformatics

Introduction & Summary

Systems Biology represents a new scientific concept of increasing importance to Biology and Medicine. As opposed to the reductionist approach that in the past 50 years has defined the individual pieces of biological systems, this new science attempts to understand the integration of these pieces into networks, complexes and the biological organizations critical to cellular and organism function and development, both normal and in disease. Bioinformatics represents a set of computational approaches to data analysis; the marriage of computational and quantitative thinking in the context of biological integration is a foundational principle of this program.

Case Western Reserve University (CWRU) is uniquely positioned to accomplish the goal of establishing the first **Systems Biology and Bioinformatics Graduate** program in Ohio leading to the Ph.D. CWRU has a long history of excellence in Systems Engineering within the Case School of Engineering, and in the College of Arts and Sciences there are close relationships between the Departments of Biology and Mathematics, all these disciplines are essential components for developing Systems Biology. CWRU also has a remarkable history of education reforms in medical and graduate education that were adopted nationally. **This proposal outlines an integrated plan to form an Systems Biology and Bioinformatics Graduate program, which includes faculty from multiple departments and schools across the university and where the students in the program will combine training in experimental and computational sciences.**

Few institutions have the record of innovative educational programs, an existing faculty with balanced expertise and accomplishments in genetic and quantitative biology and medicine and the right combination of biomedical engineering and biomedical computer sciences to propose this program. CWRU has a well-known culture of collaborative research and a strong commitment from institutional leadership in interdisciplinary programs. Indeed, CWRU hosted one of the first systems biology conferences (1968) and established in 1969 one of the first inter-school departments (Biomedical Engineering, School of Medicine and School of Engineering).

The participating departments and schools have for many years been building research strength in medicine, genetics, genomics, engineering, epidemiology, biostatistics, and quantitative sciences, with a culture and vision that integration will revolutionize the study of biology and understanding health and disease. This includes strengthening core programs in cellular imaging, genomics, and proteomics facilities and faculty.

Over the last several years, the University has expanded its research programs in the diverse areas that provide a foundation for a nationally competitive program in the area of Systems Biology and Bioinformatics.

- The Biomedical Engineering Department and the Radiology Department have invested nearly $15 million in faculty recruitment and advanced imaging facilities that provide enviable research capabilities for exploring molecular, cellular and

organ structure and function at high resolution and in quantitative terms.

- The Genetics department in the School of Medicine (SOM) has invested several million dollars in bioinformatics and quantitative genetics programs.
- The Biology department has established a Systems Biology undergraduate program and targeted recruitment in faculty with strong quantitative interests, while the Electrical Engineering and Computer Science and Mathematics departments have targeted recruitment in faculty with strong biological interests.
- In 2005, the School of Medicine committed $15 million towards a Proteomics and Bioinformatics Center that has focused on quantitative technologies; faculty recruitments to this program have substantially expanded our capabilities in systems-level biology. This program has leveraged existing programs in Metabolomics, where analysis of small molecule metabolites can provide additional important information in defining and modeling biological systems.
- Lastly, investments in Genetic Epidemiology and biostatistics have enhanced our ability to connect Clinical phenotypes with molecular data, provide an additional basis to developing systems analysis of disease.

These programs and their allied department have attracted over $100 million in peer-reviewed funding in terms of both individual grants and large center grants over the lats five years. Many of the involved faculty began meeting on a regular basis to enhance collaboration efforts across the University and to begin the process of organizing a training program in Systems Biology and Bioinformatics to facilitate the research and training of students in this discipline.

This group is proposing a new CWRU Ph.D. and M.S. program in Systems Biology and Bioinformatics, based in the School of Medicine, with the Center for Proteomics and Bioinformatics as its administrative home. The faculty cohort will include faculty from multiple departments and schools, and the fundamental core competencies for this program will include: genes and proteins; bioinformatics; and quantitative analysis and modeling. Scientists trained in the fundamental competencies of this program and guided in an integrative research path will be equipped for challenges ahead in the biological sciences and be the leaders of tomorrow.

This Steering Committee for the proposed program is Chaired by Mark Chance, Professor of Physiology & Biophysics and Director, Center for Proteomics & Bioinformatics and includes as Steering Committee members Joseph Nadeau, Professor and Chair of Genetics, Rob Ewing, Assistant Professor of Proteomics & Bioinformatics (Primary) and Genetics (Secondary), Mehmet Koyuturk, Assistant Professor of Electrical Engineering and Computer Science (Primary) and Proteomics & Bioinformatics (Secondary) and Jill-Barnholtz-Sloan, Assistant Professor, Cancer Center (Primary) and Proteomics & Bioinformatics (Secondary). Many additional faculty, from twelve departments and four schools across the University, have made significant contributions to the proposal and will serve as founding trainers in the program.

1A. Intellectual Rationale

Systems Biology is the science of understanding the resultant behaviors and functions when the individual components of biological systems interact. The past 50 years have seen a triumph of reductionism where the individual components of biological systems have been characterized to a staggering degree of detail. However, progress in understanding normal and disease biology over the next 50 years will require new scientific approaches, where the focus is on understanding the interactions and resultant behaviors of the components.

This new science is key to understanding the function of complex biological systems, to understand their normal development, to understand their transition to abnormal or disease states, and to discover innovative modalities for treating and preventing disease. Progress depends on understanding biological integration in normal organisms and healthy individuals and the ways in these normal organisms develop and age and the ways in which dysfunctions in these complex systems lead to disease. In the future it is likely that treatments will be based on a molecular diagnosis of the individual, leading to a new frontier of personalized medicine. As these challenges in medicine are becoming understood, there has been a parallel explosion in data available from all living organisms, not only sequence but related functional information on phenotypes and protein interactions. Our ability to generate these data far exceeds our ability to organize and understand them. Computational approaches are struggling to deal with the complexity inherent in these data sets, however systems based approaches are well suited to handling these levels of complexity.

To gain an understanding of these –omics data relevant to the normal and abnormal biology of living systems, a transformation based on interdisciplinary research is needed. Systems Biology and Bioinformatics research requires new kinds of scientists who are both familiar with multiple disciplines and adept at forming collaborations with scientists who are uni-disciplinary. Their training requires a specialized and innovative new program. This new scientific approach has spawned new journals like *Molecular Systems Biology* (a joint venture of EMBO and Nature Publishing group) and has induced existing journals to develop specific topic areas, such as the systems biology and emerging technologies topic invited by the journal *Cancer Research* as well as the open access journal *BMC Systems Biology*. Conferences and societies concerning Systems Biology have sprung up, including the International Society of Systems Biology. These journals and professional societies demonstrate the emergence of a new discipline that is attracting students for training.

An important feature of the training in this program is that all students will be required to combine both experimental and computational or mathematical disciplines in their coursework and in the development and execution of their research plan. This distinguishes this program from other graduate programs, where the course of study and research may be wholly experimental, or graduate programs that may be wholly computational. The students who complete this training will be trained to generate and analyze experimental data for biomedical research and will be also trained to develop physical or computational models of the molecular components that drive the behavior of the biological system.

1B. Description of Proposed Ph.D. and M.S. Curriculum

Program Competencies. All Ph.D. students in Systems Biology and Bioinformatics will fulfill the overall academic requirements for Ph.D. study at Case Western Reserve University, including the requirement for a minimum of 24 graded credits of coursework for the PhD, 36 total credits (including 601 research credits), the candidacy examination, and the required numbers of earned 701 credits (at least 18 research credits). Candidates for M.S. will complete 30 total credits, will fulfill the overall academic requirements for M.S. study at Case Western Reserve University, and compete a course of study with thesis (Plan A) or without thesis (Plan B).

The specific academic requirements of the discipline are intended to provide students with a core curriculum in Systems Biology and a set of electives designed both to assure minimum competencies in three major academic areas (genes and proteins, bioinformatics, and quantitative analysis & modeling) and equip them for their particular thesis research area where indicated.

The general framework for fulfilling these competencies, and an example course of study for the Ph.D. is provided in Appendices 1 and 2. Details of the M.S. curriculum are provided in Appendix 3. Competencies in the three major areas are to be demonstrated by satisfactory completion of appropriate CWRU courses or satisfied by equivalent training elsewhere as determined by the program faculty and steering committee after petition by the student of their proposed course of study. This overall study plan approval must be completed by the end of the first semester for M.S. students and by the end of the first year for Ph.D. students. These competencies are intended to drive a novel training program where the student combines experimental and theoretical or mathematical work in their Thesis research (for Ph.D. or M.S. Plan A students) or in their curriculum (M.S., Plan B).

Summary of Curriculum. The Systems Biology program differs from current CWRU programs in the comprehensive requirement for an understanding of biological systems, bioinformatics, and quantitative analysis & modeling. In addition to a set of core courses and electives, a monthly journal club meeting for students and faculty with the designation **SYBB 501 and 502** will be developed; the activities of this session will include, Journal club, Works in progress, team-building activities. Students will be required to participate in this session throughout their graduate career.

Summary of Requirements for Ph.D. program. The Systems Biology and Bioinformatics Ph.D. will include a set of required core courses including Bioinformatics for Systems Biology (EECS 459) and Current Proteomics (PHRM 555), a Systems Biology Journal Club (SYBB 501, 502), at least four additional courses as outlined by the student's advisory committee (for at least 12 additional credits), a course in the Responsible Conduct of research (IBMS 500), a qualifier exam, a Ph.D. Thesis, and oral defense consistent with CWRU requirements.

Entering students will be assigned a mentoring committee (by the steering committee) of two faculty to guide the first year and this mentoring committee will recommend a course of study to be approved by the steering committee. This committee will guide the coursework choices of the student such that they have

completed training in the three major areas required for the thesis research. After admission to candidacy, the student will form a thesis committee that will include faculty that have expertise in experimental work (for example –omics or imaging) and computational or mathematical analysis to guide the Thesis research plan such that it includes a combination of these disciplines.

Two or three, three-month rotations will be typical and will approximately occur from August to April in the student's first year (The rotation expectations for MSTP or BSTP students will conform to the expectations of that program, see below). A student may request to be admitted to a laboratory at any time after matriculation. The student, the mentor, the mentor's Department Chair, and the steering committee must approve the laboratory selection in writing, after review and evaluation of the student's proposed academic record and proposed/completed curriculum by the steering committee. This approval will include the designation of a specific committee to evaluate the qualifying exam and who will function to review student progress every six months until graduation (see below).

Students, by the middle of the second year, will generate and defend an NIH or NSF style proposal based on their proposed thesis research in the qualifier exam; successful oral defense of this proposal and completion of core requirements will result in recommendation for formal Ph.D. candidacy. Candidates not successful at this stage may be asked to leave the program.

1C. Administrative Arrangements for the Program

The Systems Biology and Bioinformatics program will reside in the School of Medicine and be administered by the Center for Proteomics and Bioinformatics. The Center will provide support in terms of a graduate coordinator who will, in collaboration with program faculty, track student performance, schedule program events, and maintain appropriate admission and financial records. The Steering Committee, Program Director, and a list of possible faculty are listed in Appendix 2. Thereafter, affiliated faculty will be reviewed periodically and re-appointed by majority vote of the Steering Committee and will consist of all faculty involved in courses, training, and common research programs who are active participants. The criteria for trainers will be those typically employed by NIH study sections in the review of NIH funded training programs. Important elements typically include previous training track record, funding, and relevance to the discipline in terms of publications and grants. Junior faculty may not have track records in these cases and may be on startup-funds. In these cases relevance to the discipline is the most important factor. All individuals with a primary or adjunct appointment to the faculty of Case Western Reserve University are eligible to be considered for the training faculty. The Program Director will serve at the pleasure of the Dean of the School of Medicine and will recommend, on a yearly basis, the composition of the Steering Committee for the Dean's approval. The Steering Committee will typically include four members plus the Program Director, for voting purposes.

The program will be administered by the Director, the Steering Committee, and a Program Coordinator. This committee is responsible for oversight of all admissions, academic and curricular issues including the addition of new trainers and shall be empowered to form subcommittees to support these functions. Under the auspices of

the Office of Graduate Studies, the affiliated faculty will further develop and regularly review and update program requirements, conduct of qualifying examinations, and administer the final Dissertation Examination as per the rules of the University.

As the program has developed, many individual faculty members and Departments have offered their comments and support. Appendix 4 lists support letters from the Chairs of Genetics, Pharmacology, Epidemiology & Biostatistics, Biomedical Engineering, and the Directors of the Center for Proteomics and Bioinformatics, Center for Imaging Research, and the MSTP program. These Chairs indicate the interest of their participating faculty in contributing to the program's success.

1D. Examples of Student Curricula and Background

The program is intended to be suitable for students with varying backgrounds but with a focus on students who have had strong quantitative training including some computer science background. Minimum requirements for admission include a bachelors or masters degree in the Natural Sciences (Biology, Chemistry, Physics) Computer Science, Engineering, Mathematics, or other fields with strong quantitative skills. Appendix 1 lists the courses that form the core curriculum. The above majors are generally expected to have the relevant background for such courses, have completed such courses, or commit to pursue relevant remedial work prior to enrollment or in selected cases after enrollment. Appendix 1 lists the general credit hours that fulfill a five year Ph.D. program. Appendix 3 lists the M.S. requirements.

2. Evidence of Need

The need for scientists trained in the field of Systems Biology and Bioinformatics is clearly evident upon review of the current National Science Foundation funding opportunities and programs, National Institutes of Health Roadmap initiatives, and a report published by the World Technology Evaluation Center entitled "Assessment of International Research and Development in Systems Biology". This report, which was commissioned by a wide range of funding agencies including NSF, DARPA, NASA, NCI, NIBIB, etc., had a goal to gather information about worldwide status and trends in biological systems - "Network Behavior in Biological Systems" - and to disseminate it among government decision makers and the research community. This report underscored the significant current and future growth expected for this field and the need for specialized training initiatives in this area. Multiple NIH Roadmap initiatives are directly related to systems biology: Interdisciplinary Research Centers, Interdisciplinary Research Training Initiative, Removing Structural Barriers to Interdisciplinary Research and Translational Research. A review of scientific journals also illustrates the need for additional scientists trained in Systems Biology. There are several scientific journals now solely devoted to Systems Biology or systems biology. A graduate program focused on Systems Biology and bioinformatics will likely be in considerable demand. A scan of job advertisements in Science and Nature, reveals many research opportunities for well-trained individuals in this area. Additionally many academic and commercial institutions (particularly pharmaceutical companies) have established research centers focused on Systems Biology.

Relevance to Ohio. In Ohio, Bioinformatics and Systems Biology programs at the undergraduate level are growing rapidly. Statewide standards for Bioinformatics

curricula have been developed by the Ohio Bioinformatics consortium (http://www.ohiobioinformaticsconsortium.org/curriculum.shtml) and both public and private colleges and universities across the state are launching and expanding program offerings. There is an equivalent need to launch and expand graduate offerings to attract out of state students to Ohio as well as provide opportunities for the growing pool of in-state students. Currently there are several programs in Ohio that are similar. Ohio State University has an excellent program in Bioinformatics within its Integrated Biomedical Science Graduate Program. The OSU program (http://www.biomed.osu.edu/ibgp/emphasis/bioinformatics/?ref=flashnavis) is focused on large-scale data management, processing, and visualization of biomedical data. The Department of Biomedical Engineering at the University of Cincinnati has an excellent Bioinformatics curriculum within the Biomedical Engineering Ph.D. (http://www.eng.uc.edu/dept_biomed/pdf/bioinformatics.pdf). These programs fulfill critical needs in Ohio but taken together do not have the capacity to respond to the existing needs and projected growth and have a different emphasis than the program proposed here. The CWRU program has an experimental and computational theme with an emphasis on genomics, proteomics, metabolomics, imaging, and biological mechanisms of disease and is well situated to deliver training in this focused area, as it is located in the leading Medical School in the state of Ohio. Although the OSU program is also based in its School of Medicine, it is has greater expertise in clinical data analysis and management. On the other hand, the UC program is an Engineering Degree, and has 57 course credits required minimum (19 class equivalents) while the program proposed here, as is typical in a Medical School environment, has fewer required coursed and a larger research component Also, neither of these programs will award a specific Ph.D. in the discipline, as the curricula are tracks in an existing Ph.D. program and it is expected that the program proposed here will have a high national visibility for students who have a strong interest in biology and medicine.

Other National and International Programs

In the last few years many Systems Biology, Bioinformatics, and Programs and courses have been established around the world. Notable programs include:

- Computational and Systems Biology graduate program, Massachusetts Institute of Technology. (http://csbi.mit.edu/)
- Systems Biology Ph.D. Program, Harvard University (http://sysbio.med.harvard.edu/)
- Mathematical, Computational and Systems Biology Program, University of California at Irvine (http://mcsb.bio.uci.edu/)
- Computational and Systems Biology Program, Washington University in St. Louis (http://dbbs.wustl.edu/programs/compbio)
- Integrative Program in Complex Biological Systems, University of California San Francisco (http://www.pqb.ucsf.edu/)
- Institute for Theoretical Biology, Humboldt University, Berlin (http://itb.biologie.hu-berlin.de/)
- Systems Biology, Oxford, Great Britain (http://www.ox.ac.uk/admissions/postgraduate_courses/course_guide/systems_biology.html)

The program at Harvard University, which is based in the Department of Systems Biology has 13 faculty and fuses basic biological science questions with mathematics and engineering approaches. The MIT program (CSBI) includes about eighty faculty members from over ten academic units across MIT's Schools of Science, Engineering, and the Whitehead Institute for Biomedical Research. The program at CWRU will be similar in that it will cut across different schools of the University. This will provide a breadth to the program that is competitive compared to the international peer group above. Also, the CWRU program will have a strong biomedical and molecular systems biology focus, providing us with a competitive edge for many students.

Prospective Enrollment and Access and Retention of Underrepresented Groups. The Systems Biology and Bioinformatics Program will be initially be composed of graduate students at CWRU to provide an initial cohort on which to build. Examination of student backgrounds and interests in some of the relevant departments indicate that the current cohort numbers ~5-8 students. These students are in various stages of their graduate careers, such that some may be only suitable for participating in seminar programs and journal clubs, while others are likely to take core courses or electives available in the program.

Students may enter the program through the "umbrella" admissions program of the medical school (the Biomedical Sciences Training Program or BSTP) or through direct admission or through the Medical Sciences Training Program (MSTP). Thus, the program will likely increase overall enrollment in graduate classes across the campus.

For students in the Ph.D. program, we plan for the enrollment of the first direct admit students in the fall of 2011. In the fall of 2011 we expect to have 2 direct admit students plus 2 students from the BSTP path and 1 student from the MSTP path or 5 in the first year. Continued enrollment at this level would provide a total cohort of ~25 students by 2016, and a steady state of ~25 students assuming a time to degree of 5 years and stable matriculation.

Direct admission to the program will be through the CWRU online application. Prospective students will complete Part A and Part B of the existing Graduate Application. Admission to the Graduate School will follow the guidelines denoted in the General Bulletin of CWRU, and the admissions committee will be comprised of the program steering committee or its designate. Candidates will be evaluated based on overall GPA and science GPA, GRE scores and performance on advanced tests (if available). Very important criteria also include the student essay, 3 letters of reference, prior research experience, and on campus interviews. The TOEFL examination will be required for international students. We will follow the General Bulletin guidelines regarding the demonstration of the necessary command of English for foreign students.

Students in this Program will be expected to have an undergraduate or masters degree in one of the component disciplines of the program as detailed above. The following undergraduate courses are strongly encouraged: Introductory Biology (2 semesters), Introductory Chemistry (2 semesters), Biochemistry, Introductory Physics (2 semesters), Calculus through differential equations, Linear Algebra, Introductory Computer Science, and Introductory Statistics. The background of all students who are

offered admission to and are admitted to the program will be evaluated for suitability. Remedial work to cover any deficiencies in background may be recommended as a condition of matriculation.

Recruitment efforts will be collaborative with those already established and ongoing within the MSTP, BSTP, and other programs at CWRU. Special efforts will be made to enroll minority students as part of the CWRU commitment to bringing more minorities and women into advanced fields of study. In the field of Basic and Translational Biomedical Research women are not underrepresented at the student and junior faculty levels, although we recognize that women are underrepresented at the Professor and Department Chair levels. Thus, every effort will be made to foster a supportive environment in order to successfully mentor and retain minority and female Ph.D. candidates and guide these students into leadership roles in this new field.

Financial Issues and Support for the Program. An important issue relates to financial support of students for this program. The Center for Proteomics and Bioinformatics and the School of Medicine will provide the overall support for the program. However, the typical arrangements that exist at the School of Medicine include support for students from individual faculty grants and training grants, when available. The expectation is that for "direct admit" students to the program, the program will make sure the student is provided with tuition, stipend and health insurance and fee support from the point of matriculation into the program up to the point they choose a laboratory mentor. Subsequent to that time, the mentor and the mentor's primary department/management unit will assume financial responsibility for the student consistent with SOM policies.

For students who enroll via the BSTP of the School of Medicine, there is a clear policy of rotations and tuition and stipend "return" subsequent to students selecting a laboratory. For students who enter via the MSTP route, procedures are also in place for financial support up to the time a student selects a mentor. Thus, any financial oversight for these students does not accrue to the program until these students select a laboratory. At this point the program will assure that financial responsibility is appropriately established. The program can easily and seamlessly accommodate these students.

Special Efforts to Recruit Under-Represented Minority Students

Institutional History and Achievements. CWRU has well-established efforts to recruit and retain under-represented minority students to our graduate and medical schools. In 1971, the Office of Multicultural Programs was established to help and encourage minority students enter careers in medicine and biomedical research. Graduate programs across the campus have been successful in matriculating minority students. In 2007, of 823 domestic applicants, 192 matriculated and 46 were minorities (24%). To ensure that matriculated minority students are supported and are part of a community a Minority Graduate Student Organization (MGSO) was formed. Participation is voluntary, but strongly encouraged, to foster a student group identity and shared values. MGSO meeting topics are varied and cover many issues, including the experiences of the students in research.

The success of the medical and graduate minority recruitment efforts at CWRU can also be attributed to our institutional presence at various historically African American colleges and universities and at scientific conferences organized by under-represented minority groups. The Systems Biology Program will be represented at these ongoing recruitment efforts. In addition, we plan to send a representative of the Program to the national meeting of the Society for Advancement of Chicanos/Latinos and Native Americans in Science, the Annual Biomedical Research Conference for Minority Students, and the Natural Sciences Career Fair at the University of Miami.

Summer Programs for Undergraduates and High School Outreach Programs.

Program faculty have been very active in mentoring and providing research opportunities in the summer for college students and high school students. These include the SURP program and other opportunities. In particular, we anticipate providing opportunities to Systems Biology undergraduates at Case; these summer programs are a proven method for generating high quality applicants.

4. Faculty and facilities available for the program and their adequacy. The criteria for trainers will be those typically employed by NIH study sections in the review of NIH funded training programs. Important elements typically include previous training track record, funding, and relevance to the discipline in terms of publications and grants. Junior faculty may not have track records in these cases or may be on startup-funds without their first grant. In these cases relevance to the discipline is the most important factor. This potential training group (Appendix 2) has many years of training experience in biological science, engineering, and medicine. Their funding and facilities are at the forefront of biology and medicine today.

5. Projected financial needs to support program and adequacy of expected financial support

Ph.D. program. The anticipated enrollment for the program is 5 students per year, with two projected students admitted directly to the program and 3 from existing graduate program pipelines (BSTP and MSTP sources). The Center for Proteomics and Bioinformatics will fund 1 student per year in the first year (average 9-10 months of support) for 5 years for a total estimated cost of $100,000-$120,000. The Department of Genetics will fund 1 student per year for the first year (average 9-10 months of support) for 5 years for a total estimated cost of $100,000-$120,000. The other three students per year will be funded through the above indicated admissions routes which have precedented mechanisms of first year support. After the first year, faculty grant support will provide funding for the students. If a student cannot find a mentor willing to take them, they must leave the program. If the student joins a laboratory and support is lost, the mentor's home department will be financially responsible for the student. This support is assured by a required signoff from the mentor's Department Chair. Additional funds to add to these resources are being sought from the strategic plan funding, foundation and philanthropic support. Administrative support for the program will be provided by the Center for Proteomics and Bioinformatics within its existing funds including support for a graduate coordinator (20% time, Department Assistant II, $8-10K per year plus $4-5K per year will be allocated to recruitment, special events, and

advertising for a total of $60-75K over the first 5 years). Additional expenses may include Ph.D. tuition expenses depending on policies in place while revenue may include fundraising, University Alliance funding, tuition from M.S. students, or training grants.

M.S. Program. Masters students will not receive a stipend and will pay tuition according to current CWRU rates. Many may be CWRU employees who wish to expand their knowledge within an approved degree program and who have tuition available as a part of their defined benefit package. We expect 2 such students per year.

6. Support letters from Chairs and Program Directors.

The Chairs of Pharmacology, Biomedical Engineering, and Genetics have written letters of support for the program. Also, the Directors of the Centers for Proteomics and Bioinformatics, the Center for Imaging Research, and the MSTP program have written letters of support (See Appendix 4).

Appendix 1
Major Course Descriptions

PHOL 432 CELL STRUCTURE AND FUNCTION, Instructor: Nosek. This course provides knowledge regarding cell structure and function, chiefly in mammalian cells but also in relevant model systems. The basic structure of the cell is discussed, as are various systems that regulate this structure. Topics to be covered include DNA transcription, translation and protein synthesis, intracellular transport, cell interaction with the external environment, cell cycle regulation, cell death and differentiation, signal transduction, and cell specialization and organization into tissues. The course emphasizes lectures and problem-based discussions with an emphasis on faulty-directed student self-learning. The major goals of this course are to provide students with a working knowledge of the cell to facilitate understanding of the scientific literature, and to familiarize students with current techniques in cell biology. (3 credits - twice weekly - 1.5 hr/session). Fall, capacity 12; no pre-req

PHOL 456 PROTEINS AND NUCLEIC ACIDS; Instructor: Wintrode. The goal of this course is to provide a basic working knowledge of protein structure/function and molecular biology. The course begins with a discussion of protein structure and enzyme catalysis followed by protein purification and characterization. The course then addresses concepts relating to the application of modern molecular biology techniques. Students are taught how to clone genes and use these clones in animals-and cell-based studies. The overall goal is to provide students with an understanding of proteins and genetic approaches that can be used in experimental work and to facilitate comprehension of the scientific literature. (3 credits - twice weekly- 1.5 h/lecture) Fall, capacity 12; department consent

PHOL 475 PROTEIN BIOPHYSICS; Instructor, Buck. This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problems sets, and student presentations. A special emphasis will be placed on discussion of original publications. (3 credits - twice weekly). Spring, no pre-req, limit 10

BIOL 419 APPLIED PROBABILITY AND STOCHASTIC PROCESSES FOR BIOLOGY; Instructor, Thomas. Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of psuedo random samples from specificied probability distributions), Markov processes in discrete and continuous time with discrete and continuous sample spaces, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural

spike trains, baceterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical stimulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of hte course. Offered as BIOL 419, EBME 419, PHOL 419 for graduate credit.

EPBI/MPHP 431 Statistical Methods I; Instructor; O'Brien Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence . Fall Semester. 3 credits. Fall, consent of instructor

EPBI/MPHP 432 Statistical Methods II; Instructor; O'Brien. Methods of analysis of variance, regression and analysis of quantitative data. Emphasis on computer solution of problems drawn from the biomedical sciences. Design of experiments, power of tests, and adequacy of models. Prerequisite: EPBI 431 or Equivalent. Spring Semester. Capacity 25

PHRM 555 /SYBB 555 Current Proteomics, Instructor: Miyagi. This course is designed for graduate students across the university who wish to acquire a better understanding of fundamental concepts of proteomics and hands-on experience with techniques used in current proteomics. Lectures will cover protein/peptide separation techniques, protein mass spectrometry, bioinformatics tools, and biological applications which include quantitative proteomics, protein modification proteomics, interaction proteomics, structural genomics and structural proteomics. Laboratory portion will involve practice two-dimensional gel electrophoresis, molecular weight measurement of proteins by mass spectrometry, peptide structural characterization by tandem mass spectrometry and protein identification using computational tools. Spring Semester 3 credits. Recommended preparation: CBIO 453 and CBIO 455 or equivalent.

EECS 458 Introduction to Bioinformatics; Instructor, Koyuturk. Fundamental algorithmic methods in computational molecular biology and bioinformatics discussed. Sequence analysis, pairwise and multiple alignment, probabilistic models, phylogenetic analysis, folding and structure prediction emphasized. Fall; Recommended preparation EECS 340, EECS 233.

EECS 459/SYBB 549 Bioinformatics for Systems Biology; Instructor, Koyuturk, (new). Modeling of –omics data using computational and mathematics formulations. Pre-requisite: EECS 458 or equivalent.

SYBB 501/502 (new). Once weekly meeting for all program students and faculty. This will include journal club presentations for first and second year students, works in progress presentations for third and fourth year students, team-building exercises and rotations. No credit.

SYBB 601 (new), Research in Systems Biology, includes rotations and thesis research. Variable credit.

SYBB 701 (new), Dissertation PhD research. Prereq: Pre-doctoral research consent or advanced to Ph.D. candidacy milestone. Variable credit.

An example of a year-by-year outline of study; Required Courses in Bold, possible electives also listed.

Semester 1	**Courses**	**Title**	**Credits**	**Graded or P/F**
	PHOL 432	Cell Structure and Function*	3	Graded
	PHOL 456	Proteins and Nucleic Acids*	3	Graded
	EECS 458	Introduction to Bioinformatics*	3	Graded
	SYBB 501	**Systems Biology Journal Club**	0	P/F
	SYBB 601	**Systems Biology Research (Rotation)**	0	P/F
Total			**9**	
	EECS 459	**Bioinformatics for Systems Biology**	3	Graded
	PHRM 555	**Current Proteomics**	3	Graded
	SYBB 502	**Systems Biology Journal Club**	0	P/F
	SYBB 601/651	**Systems Biology Research (Rotation or M.S. Thesis)**	3	P/F
Total			**9**	
Semester 3	EPBI 431	Statistical Methods I*	3	Graded
	BIOL 419	Applied Probability and Stochastic Processes for Biology*	3	Graded
	SYBB 501	**Systems Biology Journal Club**	0	P/F
	SYBB 601/651	**Systems Biology Research (Pre-Ph.D. Dissertation Research or M.S. Thesis)**	3	P/F
Total			**9**	
Semester 4	EPBI 432	Statistical Methods II*	3	Graded
	SYBB 502	**Systems Biology Journal Club**	0	P/F
	SYBB 600/651	**Systems Biology Research (Pre-Ph.D. Dissertation Research or M.S. Thesis)**	3	P/F
Total			**9**	
First two year total			**36**	**24 Graded/ 12 P/F**
Semester 5	SYBB 701	Systems Biology Ph.D. Dissertation Research	**9**	P/F

Semester 6	SYBB 701	Systems Biology Ph.D. Dissertation Research	**9**	P/F
First 3 year total			**54**	
Semester 6	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
Semester 7	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
Semester 8	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
Semester 9	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
5-year total			**58**	

*Notes: Courses required for the Ph.D. program and M.S. Plan A are listed in Bold. Other courses indicate a potential curriculum that fleshes out all core competencies and electives. PHOL 432 and PHOL 456 satisfies the general requirement that the student have appropriate background in cell and molecular biology at the graduate level. The Cellular and Molecular Biology sequence (CBIO 453 and CBIO 455) also is appropriate as is the CWRU M.D., cell and molecular biology curriculum. Also, equivalent preparation at another University can fulfill the requirement. EECS 458, although not specifically required, provides an example that can help fulfill the core competency in Bioinformatics. EPBI 431/431 provides an example that fulfills the core competency in quantitative methods. BIOL 419 provides an example of a class that fulfills the core competency in quantitative modeling; PHOL 475 would also serve this purpose well. A student's specific plan of study must be approved by the program steering committee such that these competencies are fulfilled.

Appendix 2
Systems Biology and Bioinformatics: Potential Faculty Cohort.

Program Director
Mark Chance, Ph.D., Director, Center for Proteomics & Bioinformatics

Steering Committee Members
Joseph Nadeau, Ph.D., Department Chair/Professor, Genetics
Mehmet Koyuturk, Assistant Professor, EECS
Jill Barnholtz-Sloan, Assistant Professor, Cancer Center
Rob Ewing, Assistant Professor, Proteomics and Bioinformatics

Other potential faculty trainers
Jim Basilion, Associate Professor, Biomedical Engineering
Suda Iyengar, Professor, Epidemiology & Biostatistics
Robert Elston, Professor, Epidemiology & Biostatistics
Chris Dealwis, Associate Professor, Pharmacology,
Patrick Wintrode, Assistant Professor, Physiology & Biophysics
Peter Thomas Ph.D., Assistant Professor, Mathematics
Masaru Miyagi, Assistant Professor, Proteomics and Bioinformatics
Mark Adams, Associate Professor, Genetics
Thomas La Framboise, Associate Professor, Genetics
Jing Li, Associate Professor, EECS
GQ Zhang, Professor, EECS
Aaron Weinberg, Professor, Dental Biological Sciences
Tom McCormick, Assistant Professor, Dermatology
Kevin Cooper, Chair and Professor, Dermatology

Appendix 3

Academic Requirements for Masters Degree in Systems Biology and Bioinformatics. These requirements correspond to the requirements of the CWRU General Bulletin in effect in 2010-11. The requirements are typically possible for a full time student to complete in 24 months for Plan A and 18 months for Plan B (see Appendix 2).

Plan A

M.S. with a thesis based on individual research and a final oral examination.

Plan B

M.S. requiring a written comprehensive examination or major project (no thesis).

The Master's Thesis (Plan A)

The minimum requirements for the master's degree under Plan A are 21 semester hours of course work plus a thesis equivalent to at least 9 semester hours of registration for 30 hours total. These must include EECS 459, PHRM 555, and SYBB 501, SYBB 502, and a minimum of 9 hours of SYBB 651. The curriculum plan must be approved by the program steering committee and include appropriate coverage of the core competencies in genes and proteins, bioinformatics, and quantitative modeling and analysis. Sample course schedules are provided in Appendix 2. At least 18 semester hours of course work, in addition to thesis hours, must be at the 400-level or higher. Each student must prepare an individual thesis that must conform to regulations concerning format, quality, and time of submission as established by the dean of graduate studies. For completion of master's degrees under Plan A, an oral examination (defense) of the master's thesis is required, where the examination is conducted by a committee of at least three members of the university faculty.

The Master's Comprehensive (Plan B)

The minimum requirements for the master's degree under Plan B are 30 semester hours of course work (with at least 18 semester hours of course work at the 400 level or higher) and a written comprehensive examination or major project with report to be administered and evaluated by the program steering committee. The coursework must include EECS 459, PHRM 555, SYBB 501 and SYBB 502. The curriculum plan must be approved by the program steering committee and include appropriate coverage of the core competencies in genes and proteins, bioinformatics, and quantitative modeling and analysis.

Appendix 4

Letters of Support:

Director, Center for Proteomics and Bioinformatics
Chair, Department of Genetics
Chair, Department of Pharmacology
Chair, Department of Biomedical Engineering
Chair, Department of Epidemiology & Biostatistics
Director, MSTP Program

Center for Proteomics and Bioinformatics

The Cleveland Foundation
Center for Proteomics

9th Floor, BRB
10900 Euclid Avenue
Cleveland, Ohio 44106-4988

Phone 216.368.1490
Fax 216.368.6846

http://proteomics.case.edu/

Pamela Davis, M.D. Ph.D.
Dean, School of Medicine
Case Western Reserve University

Dear Pam,

Enclosed is a proposed graduate program in Systems Biology and Bioinformatics. I request that the appropriate committees of the School of Medicine provide the appropriate evaluation as rapidly as possible.

The faculty of the Center, both Primary and Secondary, are quite enthusiastic about the proposed program and look forward to productive interactions as the program becomes a reality. Already students from Genetics, Epi/Bio, and Pharmacology are catalyzing interactions across our faculty through new collaborations in this growing field of Systems Biology. We are especially encouraged by the enthusiasm and support of our colleagues in Departments such as Genetics, BME, Pharmacology, Epidemiology & Biostatistics, and within the MSTP program and I include several letters detailing this support.

As outlined in the proposal, the Center for Proteomics and Bioinformatics will be the management center responsible for administering the program and will provide support in terms of a part-time graduate coordinator who will, in collaboration with program faculty, track student performance, schedule program events, and maintain appropriate admission and financial records. We will also support any Direct admits in their first year and will facilitate the flow of MSTP and BSTP students into the program, as appropriate.

As the program grows and matures, we expect that we will be in a position to submit a competitive T32 application to the NIH. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of all our research and training programs.

Sincerely,

Mark Chance, Ph.D.
Director, Center for Proteomics and Bioinformatics
Professor, Department of Physiology and Biophysics
Director, Center for Synchrotron Biosciences

CASE WESTERN RESERVE

Joseph H. Nadeau, Ph.D., Chair
James H. Jewel Professor of Genetics
Department of Genetics

10 February 2010

Dr. Mark Chance
Director, Center for Proteomics and Bioinformatics
Case Western Reserve University School of Medicine
Cleveland

Dear Mark,

Thank you for visiting with our faculty recently to review the proposed PhD program in Systems biology and Bioinformatics. We are enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department. We expect students in our PhD programs to have an interest in courses and journal club activities of the Systems Biology program and we look forward to your students taking relevant classes in our Department. We expect our faculty to have an interest in joining your program as approved trainers as well.

As the Systems Biology program grows and matures, we expect that you will be in a position to submit a competitive T32 application to the NIH and we will support you in this endeavor. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of our research and training programs.

Sincerely,

Joe Nadeau

Chair, Department of Genetics
James H. Jewel Professor Genetics

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Dr. Krzysztof Palczewski, Ph.D.
John H. Hord Professor and Chair

Department of Pharmacology

Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-4965

Visitors and Deliveries
School of Medicine W321A

Phone 216.368-4631
Fax 216-368-1300
E-mail kxp65@case.edu
http://pharmacology.case.ed0

February 15, 2010

Mark R. Chance, Ph.D
Director, Center for Proteomics and Bioinformatics

Dear Mark,

Thank you sharing with me the proposed Ph.D. program in Systems Biology and Bioinformatics. We are quite enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department. We expect students in our Ph.D. programs to have an interest in courses and journal club activities of the Systems Biology program and we look forward to your students taking relevant classes in our Department. We expect our faculty to have an interest in joining your program as approved trainers as well.

As the program grows and matures, we expect that you will be in a position to submit a competitive T32 application to the NIH and we will support you in this endeavor. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of all our research and training programs.

Sincerely,

K. Palczewski

CASE WESTERN RESERVE UNIVERSITY EST. 1826
Department of Biomedical Engineering
A Joint Department of the CWRU School of Medicine and Engineering

February 10, 2010

Jeffrey L. Duerk, Ph.D., Chairman
Department of Biomedical Engineering
Allen H. and Constance T. Ford Professor
Director, Case Center for Imaging Research

Mark Chance
Director, Center for Proteomics and Bioinformatics

RE: Systems Biology and Bioinformatics Ph.D. Program

Dear Mark,

I am writing to you today both as the Director of the Case Center for Imaging Research and also the Chairman of the CWRU Department of Biomedical Engineering. Specifically, I am writing to thank you for sharing with me the proposed PhD program in Systems Biology and Bioinformatics. This program has unique opportunities to positively impact the research programs in both CCIR and BME. Currently, as you and others are aware, imaging is undergoing the transition from morphologic change detection to detecting functional changes in tissues well in advance of any macroscopic structure manifestations. To lead this future vision, we have recruited faculty (e.g., Basilion, Exner, Karathanasis, and a future P30-ARRA funded position) specifically developing imaging compounds that serve as detectable beacons of genetic or functional change in the tissue. Within BME, research over the past decades has moved from devices (e.g., pacemaker, hearing aids), to tissues and tissue interactions (e.g., neural engineering, biomaterials), and now to new horizons in which engineering is considered at the cellular level (e.g., tissue engineering and drug delivery). The pace of our creative thoughts must be matched to educational programs that interact across disciplines. Currently, many of our BME and CCIR faculty struggle in recruiting qualified students as our educational programs have lagged our research pursuits. It is for this reason that I am particularly enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department and Center. We expect students in our PhD programs to have an interest in courses and journal club activities of the Systems Biology program and we look forward to your students taking relevant classes in our Department; this will meet a currently unmet need for a number of our faculty. We expect our faculty to have an interest in joining your program as approved trainers as well. In fact, currently, elements of our Graduate Education Committee are designing a Ph.D. track that greatly intersects with the SYBB program and provides additional training in biomedical engineering and imaging. We hope to be the first engineering department to officially embrace the SYBB vision and have a complementary (not competing, not comparable, but truly complementary) engineering program, to the SOM SYBB offering.

Hence, as these programs grow and mature, we expect that you will be in a position to submit a competitive T32 application to the NIH and we will support you in this endeavor. I cannot adequately express our enthusiasm for your efforts. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of all our research and training programs.

Sincerely,

Jeffrey L. Duerk, Ph.D., Chairman
Department of Biomedical Engineering
Allen H. and Constance T. Ford Professor
Director, Case Center for Imaging Research

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Department of Epidemiology and Biostatistics
Case Western Reserve University

10900 Euclid Avenue
Cleveland, Ohio 44106-4945

Phone 216.368.3197
Fax 216.368.3970

http://epbiwww.case.edu

February 18, 2010

Mark Chance, Ph.D., Director
Center for Proteomics and Bioinformatics
Case Western Reserve University
School of Medicine
Biomedical Research Building, Room 930
Location Code: 4988

Dear Mark,

Thank you for visiting with our faculty recently to review the proposed Ph.D. program in Systems Biology and Bioinformatics. We are quite enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department. We expect students in our Ph.D. programs to have an interest in courses and journal club activities of the Systems Biology program, and we look forward to your students taking relevant classes and attending seminars in our Department. Because of areas of overlapping interest, we expect many of our faculty will have an interest in joining your program as approved trainers as well, leading to enrichment of both our Ph.D. programs. As you know, our own Ph.D. program in Biostatistics and Epidemiology is distinct in its particular focus, but would be greatly enriched if our students could take advantage of training in the complementary areas that will be the focus of your proposed Ph.D. program.

As your program grows and matures, we expect that you will be in a position to submit a competitive T32 application to the NIH, and we will certainly support you in this endeavor, offering all the advantages that come from broad cross-disciplinary training. Novel programs of this kind, bringing to the study of basic biological processes a strong computational element, together with the possibility of adding an epidemiological dimension, will not only strengthen basic research, but will also be helpful in attracting new faculty applicants to join the School of Medicine, and so will raise the visibility of all our research and training programs.

Sincerely,

Robert.

Robert Elston, Ph.D.
Professor and Chair

CASE WESTERN RESERVE
UNIVERSITY

Department of Pathology
10900 Euclid Avenue
Cleveland, Ohio 44106-7288

February 10, 2010

Mark Chance
Director, Center for Proteomics and Bioinformatics

Dear Mark,

Thank you sharing with me the proposed PhD program in Systems Biology and Bioinformatics. I am quite enthusiastic about the proposed program and consider it to be an excellent program for MSTP student training. It also fits with the goals for training indicated in our CTSA education module.

The program appears to have the requisite flexibility for rotations needed for MSTP students and nicely leverages their Year 1 and Year 2 coursework to fulfill many of the required "core competencies" that the students will need to be successful.

Overall, I am enthusiastic about the program in terms of relevance, need and what it will add to our graduate training at Case.

As you know, programmatic changes such as addition of a graduate program to the set of MSTP-affiliated graduate programs require assessment through the MSTP Steering Committee, but I am very confident that this program will be received enthusiastically by the committee and meet with swift approval for participation with the MSTP. It certainly has my full and enthusiastic support in this regard.

Please keep me posted as this program moves through the approval process.

Sincerely,

Clifford V. Harding, MD, PhD
Professor and Interim Chair of Pathology
Director, CWRU Medical Scientist Training Program

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Pamela B. Davis, M.D., Ph.D.
Dean
Vice President for Medical Affairs

Office of the Dean
10900 Euclid Avenue
Cleveland, Ohio 44106-4915

Visitors and Deliveries
Biomedical Research Bldg. - Rm. 113

Phone 216.368.2825
Fax 216.368.2820

http://casemed.case.edu

February 22, 2010

Mark Chance, Ph.D.
Director, Center for Proteomics and Bioinformatics
Case Western Reserve University
School of Medicine
10900 Euclid Ave.
Cleveland, OH 44106-4988

Dear Mark,

I am most impressed with the work you and your colleagues have done to create the new graduate program proposal for Systems Biology. This is a critical area in biomedicine today and one in which there are too few training programs nationwide. With our strength at CWRU in proteomics, genetics, bioinformatics, and other key disciplines, we have the opportunity to emerge as a leading training site in this area.

The program you have outlined is thoughtful, thorough, and collaborative across the campus. The enthusiasm you and your colleagues bring to this program is also a key ingredient that bodes well for its success.

I strongly endorse this program and hope that it can be approved expeditiously so that you can get started!

Sincerely,

Pamela B. Davis, M.D., Ph.D.

Ph.D. and M.S. Program in Systems Biology and Bioinformatics

Introduction & Summary

Systems Biology represents a new scientific concept of increasing importance to Biology and Medicine. As opposed to the reductionist approach that in the past 50 years has defined the individual pieces of biological systems, this new science attempts to understand the integration of these pieces into networks, complexes and the biological organizations critical to cellular and organism function and development, both normal and in disease. Bioinformatics represents a set of computational approaches to data analysis; the marriage of computational and quantitative thinking in the context of biological integration is a foundational principle of this program.

Case Western Reserve University (CWRU) is uniquely positioned to accomplish the goal of establishing the first **Systems Biology and Bioinformatics Graduate** program in Ohio leading to the Ph.D. CWRU has a long history of excellence in Systems Engineering within the Case School of Engineering, and in the College of Arts and Sciences there are close relationships between the Departments of Biology and Mathematics, all these disciplines are essential components for developing Systems Biology. CWRU also has a remarkable history of education reforms in medical and graduate education that were adopted nationally. **This proposal outlines an integrated plan to form an Systems Biology and Bioinformatics Graduate program, which includes faculty from multiple departments and schools across the university and where the students in the program will combine training in experimental and computational sciences.**

Few institutions have the record of innovative educational programs, an existing faculty with balanced expertise and accomplishments in genetic and quantitative biology and medicine and the right combination of biomedical engineering and biomedical computer sciences to propose this program. CWRU has a well-known culture of collaborative research and a strong commitment from institutional leadership in interdisciplinary programs. Indeed, CWRU hosted one of the first systems biology conferences (1968) and established in 1969 one of the first inter-school departments (Biomedical Engineering, School of Medicine and School of Engineering).

The participating departments and schools have for many years been building research strength in medicine, genetics, genomics, engineering, epidemiology, biostatistics, and quantitative sciences, with a culture and vision that integration will revolutionize the study of biology and understanding health and disease. This includes strengthening core programs in cellular imaging, genomics, and proteomics facilities and faculty.

Over the last several years, the University has expanded its research programs in the diverse areas that provide a foundation for a nationally competitive program in the area of Systems Biology and Bioinformatics.

- The Biomedical Engineering Department and the Radiology Department have invested nearly $15 million in faculty recruitment and advanced imaging facilities that provide enviable research capabilities for exploring molecular, cellular and

organ structure and function at high resolution and in quantitative terms.

- The Genetics department in the School of Medicine (SOM) has invested several million dollars in bioinformatics and quantitative genetics programs.
- The Biology department has established a Systems Biology undergraduate program and targeted recruitment in faculty with strong quantitative interests, while the Electrical Engineering and Computer Science and Mathematics departments have targeted recruitment in faculty with strong biological interests.
- In 2005, the School of Medicine committed $15 million towards a Proteomics and Bioinformatics Center that has focused on quantitative technologies; faculty recruitments to this program have substantially expanded our capabilities in systems-level biology. This program has leveraged existing programs in Metabolomics, where analysis of small molecule metabolites can provide additional important information in defining and modeling biological systems.
- Lastly, investments in Genetic Epidemiology and biostatistics have enhanced our ability to connect Clinical phenotypes with molecular data, provide an additional basis to developing systems analysis of disease.

These programs and their allied department have attracted over $100 million in peer-reviewed funding in terms of both individual grants and large center grants over the lats five years. Many of the involved faculty began meeting on a regular basis to enhance collaboration efforts across the University and to begin the process of organizing a training program in Systems Biology and Bioinformatics to facilitate the research and training of students in this discipline.

This group is proposing a new CWRU Ph.D. and M.S. program in Systems Biology and Bioinformatics, based in the School of Medicine, with the Center for Proteomics and Bioinformatics as its administrative home. The faculty cohort will include faculty from multiple departments and schools, and the fundamental core competencies for this program will include: genes and proteins; bioinformatics; and quantitative analysis and modeling. Scientists trained in the fundamental competencies of this program and guided in an integrative research path will be equipped for challenges ahead in the biological sciences and be the leaders of tomorrow.

This Steering Committee for the proposed program is Chaired by Mark Chance, Professor of Physiology & Biophysics and Director, Center for Proteomics & Bioinformatics and includes as Steering Committee members Joseph Nadeau, Professor and Chair of Genetics, Rob Ewing, Assistant Professor of Proteomics & Bioinformatics (Primary) and Genetics (Secondary), Mehmet Koyuturk, Assistant Professor of Electrical Engineering and Computer Science (Primary) and Proteomics & Bioinformatics (Secondary) and Jill-Barnholtz-Sloan, Assistant Professor, Cancer Center (Primary) and Proteomics & Bioinformatics (Secondary). Many additional faculty, from twelve departments and four schools across the University, have made significant contributions to the proposal and will serve as founding trainers in the program.

1A. Intellectual Rationale

Systems Biology is the science of understanding the resultant behaviors and functions when the individual components of biological systems interact. The past 50 years have seen a triumph of reductionism where the individual components of biological systems have been characterized to a staggering degree of detail. However, progress in understanding normal and disease biology over the next 50 years will require new scientific approaches, where the focus is on understanding the interactions and resultant behaviors of the components.

This new science is key to understanding the function of complex biological systems, to understand their normal development, to understand their transition to abnormal or disease states, and to discover innovative modalities for treating and preventing disease. Progress depends on understanding biological integration in normal organisms and healthy individuals and the ways in these normal organisms develop and age and the ways in which dysfunctions in these complex systems lead to disease. In the future it is likely that treatments will be based on a molecular diagnosis of the individual, leading to a new frontier of personalized medicine. As these challenges in medicine are becoming understood, there has been a parallel explosion in data available from all living organisms, not only sequence but related functional information on phenotypes and protein interactions. Our ability to generate these data far exceeds our ability to organize and understand them. Computational approaches are struggling to deal with the complexity inherent in these data sets, however systems based approaches are well suited to handling these levels of complexity.

To gain an understanding of these –omics data relevant to the normal and abnormal biology of living systems, a transformation based on interdisciplinary research is needed. Systems Biology and Bioinformatics research requires new kinds of scientists who are both familiar with multiple disciplines and adept at forming collaborations with scientists who are uni-disciplinary. Their training requires a specialized and innovative new program. This new scientific approach has spawned new journals like *Molecular Systems Biology* (a joint venture of EMBO and Nature Publishing group) and has induced existing journals to develop specific topic areas, such as the systems biology and emerging technologies topic invited by the journal *Cancer Research* as well as the open access journal *BMC Systems Biology*. Conferences and societies concerning Systems Biology have sprung up, including the International Society of Systems Biology. These journals and professional societies demonstrate the emergence of a new discipline that is attracting students for training.

An important feature of the training in this program is that all students will be required to combine both experimental and computational or mathematical disciplines in their coursework and in the development and execution of their research plan. This distinguishes this program from other graduate programs, where the course of study and research may be wholly experimental, or graduate programs that may be wholly computational. The students who complete this training will be trained to generate and analyze experimental data for biomedical research and will be also trained to develop physical or computational models of the molecular components that drive the behavior of the biological system.

1B. Description of Proposed Ph.D. and M.S. Curriculum

Program Competencies. All Ph.D. students in Systems Biology and Bioinformatics will fulfill the overall academic requirements for Ph.D. study at Case Western Reserve University, including the requirement for a minimum of 24 graded credits of coursework for the PhD, 36 total credits (including 601 research credits), the candidacy examination, and the required numbers of earned 701 credits (at least 18 research credits). Candidates for M.S. will complete 30 total credits, will fulfill the overall academic requirements for M.S. study at Case Western Reserve University, and compete a course of study with thesis (Plan A) or without thesis (Plan B).

The specific academic requirements of the discipline are intended to provide students with a core curriculum in Systems Biology and a set of electives designed both to assure minimum competencies in three major academic areas (genes and proteins, bioinformatics, and quantitative analysis & modeling) and equip them for their particular thesis research area where indicated.

The general framework for fulfilling these competencies, and an example course of study for the Ph.D. is provided in Appendices 1 and 2. Details of the M.S. curriculum are provided in Appendix 3. Competencies in the three major areas are to be demonstrated by satisfactory completion of appropriate CWRU courses or satisfied by equivalent training elsewhere as determined by the program faculty and steering committee after petition by the student of their proposed course of study. This overall study plan approval must be completed by the end of the first semester for M.S. students and by the end of the first year for Ph.D. students. These competencies are intended to drive a novel training program where the student combines experimental and theoretical or mathematical work in their Thesis research (for Ph.D. or M.S. Plan A students) or in their curriculum (M.S., Plan B).

Summary of Curriculum. The Systems Biology program differs from current CWRU programs in the comprehensive requirement for an understanding of biological systems, bioinformatics, and quantitative analysis & modeling. In addition to a set of core courses and electives, a monthly journal club meeting for students and faculty with the designation **SYBB 501 and 502** will be developed; the activities of this session will include, Journal club, Works in progress, team-building activities. Students will be required to participate in this session throughout their graduate career.

Summary of Requirements for Ph.D. program. The Systems Biology and Bioinformatics Ph.D. will include a set of required core courses including Bioinformatics for Systems Biology (EECS 459) and Current Proteomics (PHRM 555), a Systems Biology Journal Club (SYBB 501, 502), at least four additional courses as outlined by the student's advisory committee (for at least 12 additional credits), a course in the Responsible Conduct of research (IBMS 500), a qualifier exam, a Ph.D. Thesis, and oral defense consistent with CWRU requirements.

Entering students will be assigned a mentoring committee (by the steering committee) of two faculty to guide the first year and this mentoring committee will recommend a course of study to be approved by the steering committee. This committee will guide the coursework choices of the student such that they have

completed training in the three major areas required for the thesis research. After admission to candidacy, the student will form a thesis committee that will include faculty that have expertise in experimental work (for example –omics or imaging) and computational or mathematical analysis to guide the Thesis research plan such that it includes a combination of these disciplines.

Two or three, three-month rotations will be typical and will approximately occur from August to April in the student's first year (The rotation expectations for MSTP or BSTP students will conform to the expectations of that program, see below). A student may request to be admitted to a laboratory at any time after matriculation. The student, the mentor, the mentor's Department Chair, and the steering committee must approve the laboratory selection in writing, after review and evaluation of the student's proposed academic record and proposed/completed curriculum by the steering committee. This approval will include the designation of a specific committee to evaluate the qualifying exam and who will function to review student progress every six months until graduation (see below).

Students, by the middle of the second year, will generate and defend an NIH or NSF style proposal based on their proposed thesis research in the qualifier exam; successful oral defense of this proposal and completion of core requirements will result in recommendation for formal Ph.D. candidacy. Candidates not successful at this stage may have a second opportunity to defend only at the discretion of the steering committee.

1C. Administrative Arrangements for the Program

The Systems Biology and Bioinformatics program will reside in the School of Medicine and be administered by the Center for Proteomics and Bioinformatics. The Center will provide support in terms of a graduate coordinator who will, in collaboration with program faculty, track student performance, schedule program events, and maintain appropriate admission and financial records. The Steering Committee, Program Director, and a list of possible faculty are listed in Appendix 2. Thereafter, affiliated faculty will be reviewed periodically and re-appointed by majority vote of the Steering Committee and will consist of all faculty involved in courses, training, and common research programs who are active participants. The criteria for trainers will be those typically employed by NIH study sections in the review of NIH funded training programs. Important elements typically include previous training track record, funding, and relevance to the discipline in terms of publications and grants. Junior faculty may not have track records in these cases and may be on startup-funds. In these cases relevance to the discipline is the most important factor. All individuals with a primary or adjunct appointment to the faculty of Case Western Reserve University are eligible to be considered for the training faculty. The Program Director will serve at the pleasure of the Dean of the School of Medicine and will recommend, on a yearly basis, the composition of the Steering Committee for the Dean's approval. The Steering Committee will typically include four members plus the Program Director, for voting purposes.

The program will be administered by the Director, the Steering Committee, and a Program Coordinator. This committee is responsible for oversight of all admissions, academic and curricular issues including the addition of new trainers and shall be empowered to form subcommittees to support these functions. Under the auspices of

the Office of Graduate Studies, the affiliated faculty will further develop and regularly review and update program requirements, conduct of qualifying examinations, and administer the final Dissertation Examination as per the rules of the University.

As the program has developed, many individual faculty members and Departments have offered their comments and support. Appendix 4 lists support letters from the Chairs of Genetics, Pharmacology, Epidemiology & Biostatistics, Biomedical Engineering, and the Directors of the Center for Proteomics and Bioinformatics, Center for Imaging Research, and the MSTP program. These Chairs indicate the interest of their participating faculty in contributing to the program's success.

1D. Examples of Student Curricula and Background

The program is intended to be suitable for students with varying backgrounds but with a focus on students who have had strong quantitative training including some computer science background. Minimum requirements for admission include a bachelors or masters degree in the Natural Sciences (Biology, Chemistry, Physics) Computer Science, Engineering, Mathematics, or other fields with strong quantitative skills. Appendix 1 lists the courses that form the core curriculum. The above majors are generally expected to have the relevant background for such courses, have completed such courses, or commit to pursue relevant remedial work prior to enrollment or in selected cases after enrollment. Appendix 1 lists the general credit hours that fulfill a five year Ph.D. program. Appendix 3 lists the M.S. requirements.

2. Evidence of Need

The need for scientists trained in the field of Systems Biology and Bioinformatics is clearly evident upon review of the current National Science Foundation funding opportunities and programs, National Institutes of Health Roadmap initiatives, and a report published by the World Technology Evaluation Center entitled "Assessment of International Research and Development in Systems Biology". This report, which was commissioned by a wide range of funding agencies including NSF, DARPA, NASA, NCI, NIBIB, etc., had a goal to gather information about worldwide status and trends in biological systems - "Network Behavior in Biological Systems" - and to disseminate it among government decision makers and the research community. This report underscored the significant current and future growth expected for this field and the need for specialized training initiatives in this area. Multiple NIH Roadmap initiatives are directly related to systems biology: Interdisciplinary Research Centers, Interdisciplinary Research Training Initiative, Removing Structural Barriers to Interdisciplinary Research and Translational Research. A review of scientific journals also illustrates the need for additional scientists trained in Systems Biology. There are several scientific journals now solely devoted to Systems Biology or systems biology. A graduate program focused on Systems Biology and bioinformatics will likely be in considerable demand. A scan of job advertisements in Science and Nature, reveals many research opportunities for well-trained individuals in this area. Additionally many academic and commercial institutions (particularly pharmaceutical companies) have established research centers focused on Systems Biology.

Relevance to Ohio. In Ohio, Bioinformatics and Systems Biology programs at the undergraduate level are growing rapidly. Statewide standards for Bioinformatics

curricula have been developed by the Ohio Bioinformatics consortium (http://www.ohiobioinformaticsconsortium.org/curriculum.shtml) and both public and private colleges and universities across the state are launching and expanding program offerings. There is an equivalent need to launch and expand graduate offerings to attract out of state students to Ohio as well as provide opportunities for the growing pool of in-state students. Currently there are several programs in Ohio that are similar. Ohio State University has an excellent program in Bioinformatics within its Integrated Biomedical Science Graduate Program. The OSU program (http://www.biomed.osu.edu/ibgp/emphasis/bioinformatics/?ref=flashnavis) is focused on large-scale data management, processing, and visualization of biomedical data. The Department of Biomedical Engineering at the University of Cincinnati has an excellent Bioinformatics curriculum within the Biomedical Engineering Ph.D. (http://www.eng.uc.edu/dept_biomed/pdf/bioinformatics.pdf). These programs fulfill critical needs in Ohio but taken together do not have the capacity to respond to the existing needs and projected growth and have a different emphasis than the program proposed here. The CWRU program has an experimental and computational theme with an emphasis on genomics, proteomics, metabolomics, imaging, and biological mechanisms of disease and is well situated to deliver training in this focused area, as it is located in the leading Medical School in the state of Ohio. Although the OSU program is also based in its School of Medicine, it is has greater expertise in clinical data analysis and management. On the other hand, the UC program is an Engineering Degree, and has 57 course credits required minimum (19 class equivalents) while the program proposed here, as is typical in a Medical School environment, has fewer required coursed and a larger research component Also, neither of these programs will award a specific Ph.D. in the discipline, as the curricula are tracks in an existing Ph.D. program and it is expected that the program proposed here will have a high national visibility for students who have a strong interest in biology and medicine.

Other National and International Programs

In the last few years many Systems Biology, Bioinformatics, and Programs and courses have been established around the world. Notable programs include:

- Computational and Systems Biology graduate program, Massachusetts Institute of Technology. (http://csbi.mit.edu/)
- Systems Biology Ph.D. Program, Harvard University (http://sysbio.med.harvard.edu/)
- Mathematical, Computational and Systems Biology Program, University of California at Irvine (http://mcsb.bio.uci.edu/)
- Computational and Systems Biology Program, Washington University in St. Louis (http://dbbs.wustl.edu/programs/compbio)
- Integrative Program in Complex Biological Systems, University of California San Francisco (http://www.pqb.ucsf.edu/)
- Institute for Theoretical Biology, Humboldt University, Berlin (http://itb.biologie.hu-berlin.de/)
- Systems Biology, Oxford, Great Britain (http://www.ox.ac.uk/admissions/postgraduate_courses/course_guide/systems_biology.html)

The program at Harvard University, which is based in the Department of Systems Biology has 13 faculty and fuses basic biological science questions with mathematics and engineering approaches. The MIT program (CSBI) includes about eighty faculty members from over ten academic units across MIT's Schools of Science, Engineering, and the Whitehead Institute for Biomedical Research. The program at CWRU will be similar in that it will cut across different schools of the University. This will provide a breadth to the program that is competitive compared to the international peer group above. Also, the CWRU program will have a strong biomedical and molecular systems biology focus, providing us with a competitive edge for many students.

Prospective Enrollment and Access and Retention of Underrepresented Groups. The Systems Biology and Bioinformatics Program will be initially be composed of graduate students at CWRU to provide an initial cohort on which to build. Examination of student backgrounds and interests in some of the relevant departments indicate that the current cohort numbers ~5-8 students. These students are in various stages of their graduate careers, such that some may be only suitable for participating in seminar programs and journal clubs, while others are likely to take core courses or electives available in the program.

Students may enter the program through the “umbrella” admissions program of the medical school (the Biomedical Sciences Training Program or BSTP) or through direct admission or through the Medical Sciences Training Program (MSTP). Thus, the program will likely increase overall enrollment in graduate classes across the campus.

For students in the Ph.D. program, we plan for the enrollment of the first direct admit students in the fall of 2011. In the fall of 2011 we expect to have 2 direct admit students plus 2 students from the BSTP path and 1 student from the MSTP path or 5 in the first year. Continued enrollment at this level would provide a total cohort of ~25 students by 2016, and a steady state of ~25 students assuming a time to degree of 5 years and stable matriculation.

Direct admission to the program will be through the CWRU online application. Prospective students will complete Part A and Part B of the existing Graduate Application. Admission to the Graduate School will follow the guidelines denoted in the General Bulletin of CWRU, and the admissions committee will be comprised of the program steering committee or its designate. Candidates will be evaluated based on overall GPA and science GPA, GRE scores and performance on advanced tests (if available). Very important criteria also include the student essay, 3 letters of reference, prior research experience, and on campus interviews. The TOEFL examination will be required for international students. We will follow the General Bulletin guidelines regarding the demonstration of the necessary command of English for foreign students.

Students in this Program will be expected to have an undergraduate or masters degree in one of the component disciplines of the program as detailed above. The following undergraduate courses are strongly encouraged: Introductory Biology (2 semesters), Introductory Chemistry (2 semesters), Biochemistry, Introductory Physics (2 semesters), Calculus through differential equations, Linear Algebra, Introductory Computer Science, and Introductory Statistics. The background of all students who are

offered admission to and are admitted to the program will be evaluated for suitability. Remedial work to cover any deficiencies in background may be recommended as a condition of matriculation.

Recruitment efforts will be collaborative with those already established and ongoing within the MSTP, BSTP, and other programs at CWRU. Special efforts will be made to enroll minority students as part of the CWRU commitment to bringing more minorities and women into advanced fields of study. In the field of Basic and Translational Biomedical Research women are not underrepresented at the student and junior faculty levels, although we recognize that women are underrepresented at the Professor and Department Chair levels. Thus, every effort will be made to foster a supportive environment in order to successfully mentor and retain minority and female Ph.D. candidates and guide these students into leadership roles in this new field.

Financial Issues and Support for the Program. An important issue relates to financial support of students for this program. The Center for Proteomics and Bioinformatics and the School of Medicine will provide the overall support for the program. However, the typical arrangements that exist at the School of Medicine include support for students from individual faculty grants and training grants, when available. The expectation is that for "direct admit" students to the program, the program will make sure the student is provided with tuition, stipend and health insurance and fee support from the point of matriculation into the program up to the point they choose a laboratory mentor. Subsequent to that time, the mentor and the mentor's primary department/management unit will assume financial responsibility for the student consistent with SOM policies.

For students who enroll via the BSTP of the School of Medicine, there is a clear policy of rotations and tuition and stipend "return" subsequent to students selecting a laboratory. For students who enter via the MSTP route, procedures are also in place for financial support up to the time a student selects a mentor. Thus, any financial oversight for these students does not accrue to the program until these students select a laboratory. At this point the program will assure that financial responsibility is appropriately established. The program can easily and seamlessly accommodate these students.

Special Efforts to Recruit Under-Represented Minority Students

Institutional History and Achievements. CWRU has well-established efforts to recruit and retain under-represented minority students to our graduate and medical schools. In 1971, the Office of Multicultural Programs was established to help and encourage minority students enter careers in medicine and biomedical research. Graduate programs across the campus have been successful in matriculating minority students. In 2007, of 823 domestic applicants, 192 matriculated and 46 were minorities (24%). To ensure that matriculated minority students are supported and are part of a community a Minority Graduate Student Organization (MGSO) was formed. Participation is voluntary, but strongly encouraged, to foster a student group identity and shared values. MGSO meeting topics are varied and cover many issues, including the experiences of the students in research.

The success of the medical and graduate minority recruitment efforts at CWRU can also be attributed to our institutional presence at various historically African American colleges and universities and at scientific conferences organized by under-represented minority groups. The Systems Biology Program will be represented at these ongoing recruitment efforts. In addition, we plan to send a representative of the Program to the national meeting of the Society for Advancement of Chicanos/Latinos and Native Americans in Science, the Annual Biomedical Research Conference for Minority Students, and the Natural Sciences Career Fair at the University of Miami.

Summer Programs for Undergraduates and High School Outreach Programs.

Program faculty have been very active in mentoring and providing research opportunities in the summer for college students and high school students. These include the SURP program and other opportunities. In particular, we anticipate providing opportunities to Systems Biology undergraduates at Case; these summer programs are a proven method for generating high quality applicants.

4. Faculty and facilities available for the program and their adequacy. The criteria for trainers will be those typically employed by NIH study sections in the review of NIH funded training programs. Important elements typically include previous training track record, funding, and relevance to the discipline in terms of publications and grants. Junior faculty may not have track records in these cases or may be on startup-funds without their first grant. In these cases relevance to the discipline is the most important factor. This potential training group (Appendix 2) has many years of training experience in biological science, engineering, and medicine. Their funding and facilities are at the forefront of biology and medicine today.

5. Projected financial needs to support program and adequacy of expected financial support

Ph.D. program. The anticipated enrollment for the program is 5 students per year, with two projected students admitted directly to the program and 3 from existing graduate program pipelines (BSTP and MSTP sources). The Center for Proteomics and Bioinformatics will fund 1 student per year in the first year (average 9-10 months of support) for 5 years for a total estimated cost of $100,000-$120,000. The Department of Genetics will fund 1 student per year for the first year (average 9-10 months of support) for 5 years for a total estimated cost of $100,000-$120,000. The other three students per year will be funded through the above indicated admissions routes which have precedented mechanisms of first year support. After the first year, faculty grant support will provide funding for the students. If a student cannot find a mentor willing to take them, they must leave the program. If the student joins a laboratory and support is lost, the mentor's home department will be financially responsible for the student. This support is assured by a required signoff from the mentor's Department Chair. Additional funds to add to these resources are being sought from the strategic plan funding, foundation and philanthropic support. Administrative support for the program will be provided by the Center for Proteomics and Bioinformatics within its existing funds including support for a graduate coordinator (20% time, Department Assistant II, $8-10K per year plus $4-5K per year will be allocated to recruitment, special events, and

advertising for a total of $60-75K over the first 5 years). Additional expenses may include Ph.D. tuition expenses depending on policies in place while revenue may include fundraising, University Alliance funding, tuition from M.S. students, or training grants.

M.S. Program. Masters students will not receive a stipend and will pay tuition according to current CWRU rates. Many may be CWRU employees who wish to expand their knowledge within an approved degree program and who have tuition available as a part of their defined benefit package. We expect 2 such students per year.

6. Support letters from Chairs and Program Directors.

The Chairs of Pharmacology, Biomedical Engineering, and Genetics have written letters of support for the program. Also, the Directors of the Centers for Proteomics and Bioinformatics, the Center for Imaging Research, and the MSTP program have written letters of support (See Appendix 4).

Appendix 1
Major Course Descriptions

PHOL 432 CELL STRUCTURE AND FUNCTION, Instructor: Nosek. This course provides knowledge regarding cell structure and function, chiefly in mammalian cells but also in relevant model systems. The basic structure of the cell is discussed, as are various systems that regulate this structure. Topics to be covered include DNA transcription, translation and protein synthesis, intracellular transport, cell interaction with the external environment, cell cycle regulation, cell death and differentiation, signal transduction, and cell specialization and organization into tissues. The course emphasizes lectures and problem-based discussions with an emphasis on faulty-directed student self-learning. The major goals of this course are to provide students with a working knowledge of the cell to facilitate understanding of the scientific literature, and to familiarize students with current techniques in cell biology. (3 credits - twice weekly - 1.5 hr/session). Fall, capacity 12; no pre-req

PHOL 456 PROTEINS AND NUCLEIC ACIDS; Instructor: Wintrode. The goal of this course is to provide a basic working knowledge of protein structure/function and molecular biology. The course begins with a discussion of protein structure and enzyme catalysis followed by protein purification and characterization. The course then addresses concepts relating to the application of modern molecular biology techniques. Students are taught how to clone genes and use these clones in animals-and cell-based studies. The overall goal is to provide students with an understanding of proteins and genetic approaches that can be used in experimental work and to facilitate comprehension of the scientific literature. (3 credits - twice weekly- 1.5 h/lecture) Fall, capacity 12; department consent

PHOL 475 PROTEIN BIOPHYSICS; Instructor, Buck. This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problems sets, and student presentations. A special emphasis will be placed on discussion of original publications. (3 credits - twice weekly). Spring, no pre-req, limit 10

BIOL 419 APPLIED PROBABILITY AND STOCHASTIC PROCESSES FOR BIOLOGY; Instructor, Thomas. Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of psuedo random samples from specificied probability distributions), Markov processes in discrete and continuous time with discrete and continuous sample spaces, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural

spike trains, baceterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical stimulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of hte course. Offered as BIOL 419, EBME 419, PHOL 419 for graduate credit.

EPBI/MPHP 431 Statistical Methods I; **Instructor; O'Brien**Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence . Fall Semester. 3 credits. Fall, consent of instructor

EPBI/MPHP 432 Statistical Methods II; Instructor; O'Brien. Methods of analysis of variance, regression and analysis of quantitative data. Emphasis on computer solution of problems drawn from the biomedical sciences. Design of experiments, power of tests, and adequacy of models. Prerequisite: EPBI 431 or Equivalent. Spring Semester. Capacity 25

PHRM 555 /SYBB 555 Current Proteomics, Instructor: Miyagi. This course is designed for graduate students across the university who wish to acquire a better understanding of fundamental concepts of proteomics and hands-on experience with techniques used in current proteomics. Lectures will cover protein/peptide separation techniques, protein mass spectrometry, bioinformatics tools, and biological applications which include quantitative proteomics, protein modification proteomics, interaction proteomics, structural genomics and structural proteomics. Laboratory portion will involve practice two-dimensional gel electrophoresis, molecular weight measurement of proteins by mass spectrometry, peptide structural characterization by tandem mass spectrometry and protein identification using computational tools. Spring Semester 3 credits**.** Recommended preparation: CBIO 453 and CBIO 455 or equivalent.

EECS 458 Introduction to Bioinformatics; Instructor, Koyuturk. Fundamental algorithmic methods in computational molecular biology and bioinformatics discussed. Sequence analysis, pairwise and multiple alignment, probabilistic models, phylogenetic analysis, folding and structure prediction emphasized. Fall; Recommended preparation EECS 340, EECS 233.

EECS 459/SYBB 549 Bioinformatics for Systems Biology; Instructor, Koyuturk, (new). Modeling of –omics data using computational and mathematics formulations. Pre-requisite: EECS 458 or equivalent.

SYBB 501/502 (new). Once weekly meeting for all program students and faculty. This will include journal club presentations for first and second year students, works in progress presentations for third and fourth year students, team-building exercises and rotations. No credit.

SYBB 601 (new), Research in Systems Biology, includes rotations and thesis research. Variable credit.

SYBB 701 (new), Dissertation PhD research. Prereq: Pre-doctoral research consent or advanced to Ph.D. candidacy milestone. Variable credit.

An example of a year-by-year outline of study for the Ph.D.; Required Courses in Bold, possible electives also listed.

Semester 1	**Courses**	**Title**	**Credits**	**Graded or P/F**
	PHOL 432	Cell Structure and Function*	3	Graded
	PHOL 456	Proteins and Nucleic Acids*	3	Graded
	EECS 458	Introduction to Bioinformatics*	3	Graded
	SYBB 501	**Systems Biology Journal Club**	0	P/F
	SYBB 601	**Systems Biology Research (Rotation)**	0	P/F
Total			**9**	
	EECS 459	**Bioinformatics for Systems Biology**	3	Graded
	PHRM 555	**Current Proteomics**	3	Graded
	SYBB 502	**Systems Biology Journal Club**	0	P/F
	SYBB 601/651	**Systems Biology Research (Rotation or M.S. Thesis)**	3	P/F
Total			**9**	
Semester 3	EPBI 431	Statistical Methods I*	3	Graded
	BIOL 419	Applied Probability and Stochastic Processes for Biology*	3	Graded
	SYBB 501	**Systems Biology Journal Club**	0	P/F
	SYBB 601/651	**Systems Biology Research (Pre-Ph.D. Dissertation Research or M.S. Thesis)**	3	P/F
Total			**9**	
Semester 4	EPBI 432	Statistical Methods II*	3	Graded
	SYBB 502	**Systems Biology Journal Club**	0	P/F
	SYBB 600/651	**Systems Biology Research (Pre-Ph.D. Dissertation Research or M.S. Thesis)**	3	P/F
Total			**9**	
First two year total			**36**	**24 Graded/ 12 P/F**
Semester 5	SYBB 701	Systems Biology Ph.D. Dissertation Research	**9**	P/F

Semester 6	SYBB 701	Systems Biology Ph.D. Dissertation Research	**9**	P/F
First 3 year total			**54**	
Semester 6	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
Semester 7	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
Semester 8	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
Semester 9	SYBB 701	Systems Biology Ph.D. Dissertation Research	**1**	P/F
5-year total			**58**	

*Notes: Courses required for the Ph.D. program and M.S. Plan A are listed in Bold. Other courses indicate a potential curriculum that fleshes out all core competencies and electives. PHOL 432 and PHOL 456 satisfies the general requirement that the student have appropriate background in cell and molecular biology at the graduate level. The Cellular and Molecular Biology sequence (CBIO 453 and CBIO 455) also is appropriate as is the CWRU M.D., cell and molecular biology curriculum. Also, equivalent preparation at another University can fulfill the requirement. EECS 458, although not specifically required, provides an example that can help fulfill the core competency in Bioinformatics. EPBI 431/431 provides an example that fulfills the core competency in quantitative methods. BIOL 419 provides an example of a class that fulfills the core competency in quantitative modeling; PHOL 475 would also serve this purpose well. A student's specific plan of study must be approved by the program steering committee such that these competencies are fulfilled.

Appendix 2
Systems Biology and Bioinformatics: Potential Faculty Cohort.

Program Director
Mark Chance, Ph.D., Director, Center for Proteomics & Bioinformatics

Steering Committee Members
Joseph Nadeau, Ph.D., Department Chair/Professor, Genetics
Mehmet Koyuturk, Assistant Professor, EECS
Jill Barnholtz-Sloan, Assistant Professor, Cancer Center
Rob Ewing, Assistant Professor, Proteomics and Bioinformatics

Other potential faculty trainers
Jim Basilion, Associate Professor, Biomedical Engineering
Suda Iyengar, Professor, Epidemiology & Biostatistics
Robert Elston, Professor, Epidemiology & Biostatistics
Chris Dealwis, Associate Professor, Pharmacology,
Patrick Wintrode, Assistant Professor, Physiology & Biophysics
Peter Thomas Ph.D., Assistant Professor, Mathematics
Masaru Miyagi, Assistant Professor, Proteomics and Bioinformatics
Mark Adams, Associate Professor, Genetics
Thomas La Framboise, Associate Professor, Genetics
Jing Li, Associate Professor, EECS
GQ Zhang, Professor, EECS
Aaron Weinberg, Professor, Dental Biological Sciences
Tom McCormick, Assistant Professor, Dermatology
Kevin Cooper, Chair and Professor, Dermatology

Appendix 3

Academic Requirements for Masters Degree in Systems Biology and Bioinformatics. These requirements correspond to the requirements of the CWRU General Bulletin in effect in 2010-11. The requirements are typically possible for a full time student to complete in 24 months for Plan A and 18-24 months for Plan B depending on course work already completed, see Table below).

Plan A
M.S. with a thesis based on individual research and a final oral examination.

Plan B
M.S. requiring a written comprehensive examination or major project (no thesis).

The Master's Thesis (Plan A)
The minimum requirements for the master's degree under Plan A are 21 semester hours of course work plus a thesis equivalent to at least 9 semester hours of registration for 30 hours total. These must include EECS 459, PHRM 555, and SYBB 501, SYBB 502, and a minimum of 9 hours of SYBB 651. The curriculum plan must be approved by the program steering committee and include appropriate coverage of the core competencies in genes and proteins, bioinformatics, and quantitative modeling and analysis. Sample course schedules are provided in Appendix 2. At least 18 semester hours of course work, in addition to thesis hours, must be at the 400-level or higher. Each student must prepare an individual thesis that must conform to regulations concerning format, quality, and time of submission as established by the dean of graduate studies. For completion of master's degrees under Plan A, an oral examination (defense) of the master's thesis is required, where the examination is conducted by a committee of at least three members of the university faculty.

The Master's Comprehensive (Plan B)
The minimum requirements for the master's degree under Plan B are 30 semester hours of course work (with at least 18 semester hours of course work at the 400 level or higher) and a written comprehensive examination or major project with report to be administered and evaluated by the program steering committee. The coursework must include EECS 459, PHRM 555, SYBB 501 and SYBB 502. The curriculum plan must be approved by the program steering committee and include appropriate coverage of the core competencies in genes and proteins, bioinformatics, and quantitative modeling and analysis.

An example of a year-by-year outline of study for the M.S. Plans A and B (30 semester hours); Required Courses in Bold, possible electives also listed.

Semester 1	Courses	Title	Credits	Graded or P/F
	PHOL 432	Cell Structure and Function*	3	Graded
	PHOL 456	Proteins and Nucleic Acids*	3	Graded
	EECS 458	Introduction to Bioinformatics*	3	Graded
	SYBB 501	**Systems Biology Journal Club**	0	P/F
	SYBB 601	**Systems Biology Research (Rotation for Plan A students)**	0	P/F
Total			**9**	
	EECS 459	**Bioinformatics for Systems Biology**	3	Graded
	PHRM 555	**Current Proteomics**	3	Graded
	SYBB 502	**Systems Biology Journal Club**	0	P/F
	SYBB 601/651	**Systems Biology Research (Plan B students, M.S. Thesis research, Plan A students course elective for 3 credits)**	3	P/F
Total			**9**	
Semester 3	EPBI 431	Statistical Methods I*	3	Graded
	BIOL 419	Applied Probability and Stochastic Processes for Biology*	3	Graded
	SYBB 501	**Systems Biology Journal Club**	0	P/F
	SYBB 601/651	**Systems Biology Research (Plan B students, M.S. Thesis research, Plan A students course elective for 3 credits)**	3	P/F
Total			**9**	
Semester 4				
	SYBB 502	**Systems Biology Journal Club**	0	P/F
	SYBB 600/651	**Systems Biology Research (Plan B students, M.S. Thesis research, Plan A students course elective for 3 credits)**	3	P/F
Total			**3**	
Two year total			**30**	

*Notes: Courses required for the M.S. are listed in Bold. Other courses indicate a potential curriculum that fleshes out all core competencies and electives. See also Appendix 1.

Appendix 4

Letters of Support:

Director, Center for Proteomics and Bioinformatics
Chair, Department of Genetics
Chair, Department of Pharmacology
Chair, Department of Biomedical Engineering
Chair, Department of Epidemiology & Biostatistics
Director, MSTP Program

Center for Proteomics and Bioinformatics

The Cleveland Foundation Center for Proteomics

9th Floor, BRB
10900 Euclid Avenue
Cleveland, Ohio 44106-4988

Phone 216.368.1490
Fax 216.368.6846

http://proteomics.case.edu/

Pamela Davis, M.D. Ph.D.
Dean, School of Medicine
Case Western Reserve University

Dear Pam,

Enclosed is a proposed graduate program in Systems Biology and Bioinformatics. I request that the appropriate committees of the School of Medicine provide the appropriate evaluation as rapidly as possible.

The faculty of the Center, both Primary and Secondary, are quite enthusiastic about the proposed program and look forward to productive interactions as the program becomes a reality. Already students from Genetics, Epi/Bio, and Pharmacology are catalyzing interactions across our faculty through new collaborations in this growing field of Systems Biology. We are especially encouraged by the enthusiasm and support of our colleagues in Departments such as Genetics, BME, Pharmacology, Epidemiology & Biostatistics, and within the MSTP program and I include several letters detailing this support.

As outlined in the proposal, the Center for Proteomics and Bioinformatics will be the management center responsible for administering the program and will provide support in terms of a part-time graduate coordinator who will, in collaboration with program faculty, track student performance, schedule program events, and maintain appropriate admission and financial records. We will also support any Direct admits in their first year and will facilitate the flow of MSTP and BSTP students into the program, as appropriate.

As the program grows and matures, we expect that we will be in a position to submit a competitive T32 application to the NIH. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of all our research and training programs.

Sincerely,

Mark Chance, Ph.D.
Director, Center for Proteomics and Bioinformatics
Professor, Department of Physiology and Biophysics
Director, Center for Synchrotron Biosciences

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Joseph H. Nadeau, Ph.D., Chair
James H. Jewel Professor of Genetics

Department of Genetics

10900 Euclid Avenue
Cleveland, Ohio 44106-4955

Phone 216.368.0581
Fax 216.368.3832
E-mail jhn4@case.edu

http://genetics.case.edu

10 February 2010

Dr. Mark Chance
Director, Center for Proteomics and Bioinformatics
Case Western Reserve University School of Medicine
Cleveland

Dear Mark,

Thank you for visiting with our faculty recently to review the proposed PhD program in Systems biology and Bioinformatics. We are enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department. We expect students in our PhD programs to have an interest in courses and journal club activities of the Systems Biology program and we look forward to your students taking relevant classes in our Department. We expect our faculty to have an interest in joining your program as approved trainers as well.

As the Systems Biology program grows and matures, we expect that you will be in a position to submit a competitive T32 application to the NIH and we will support you in this endeavor. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of our research and training programs.

Sincerely,

Joe Nadeau

Chair, Department of Genetics
James H. Jewel Professor Genetics

CASE WESTERN RESERVE UNIVERSITY
SCHOOL OF MEDICINE

Dr. Krzysztof Palczewski, Ph.D.
John H. Hord Professor and Chair

Department of Pharmacology

Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-4965

Visitors and Deliveries
School of Medicine W321A

Phone 216.368-4631
Fax 216-368-1300
E-mail kxp65@case.edu
http//pharmacology.case.ed0

February 15, 2010

Mark R. Chance, Ph.D
Director, Center for Proteomics and Bioinformatics

Dear Mark,

Thank you sharing with me the proposed Ph.D. program in Systems Biology and Bioinformatics. We are quite enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department. We expect students in our Ph.D. programs to have an interest in courses and journal club activities of the Systems Biology program and we look forward to your students taking relevant classes in our Department. We expect our faculty to have an interest in joining your program as approved trainers as well.

As the program grows and matures, we expect that you will be in a position to submit a competitive T32 application to the NIH and we will support you in this endeavor. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of all our research and training programs.

Sincerely,

K. Palczewski

CASE WESTERN RESERVE UNIVERSITY EST. 1826
Department of Biomedical Engineering
A Joint Department of the CWRU School of Medicine and Engineering

February 10, 2010

Jeffrey L. Duerk, Ph.D., Chairman
Department of Biomedical Engineering
Allen H. and Constance T. Ford Professor
Director, Case Center for Imaging Research

Mark Chance
Director, Center for Proteomics and Bioinformatics

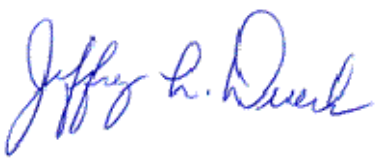
RE: Systems Biology and Bioinformatics Ph.D. Program

Dear Mark,

I am writing to you today both as the Director of the Case Center for Imaging Research and also the Chairman of the CWRU Department of Biomedical Engineering. Specifically, I am writing to thank you for sharing with me the proposed PhD program in Systems Biology and Bioinformatics. This program has unique opportunities to positively impact the research programs in both CCIR and BME. Currently, as you and others are aware, imaging is undergoing the transition from morphologic change detection to detecting functional changes in tissues well in advance of any macroscopic structure manifestations. To lead this future vision, we have recruited faculty (e.g., Basilion, Exner, Karathanasis, and a future P30-ARRA funded position) specifically developing imaging compounds that serve as detectable beacons of genetic or functional change in the tissue. Within BME, research over the past decades has moved from devices (e.g., pacemaker, hearing aids), to tissues and tissue interactions (e.g., neural engineering, biomaterials), and now to new horizons in which engineering is considered at the cellular level (e.g., tissue engineering and drug delivery). The pace of our creative thoughts must be matched to educational programs that interact across disciplines. Currently, many of our BME and CCIR faculty struggle in recruiting qualified students as our educational programs have lagged our research pursuits. It is for this reason that I am particularly enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department and Center. We expect students in our PhD programs to have an interest in courses and journal club activities of the Systems Biology program and we look forward to your students taking relevant classes in our Department; this will meet a currently unmet need for a number of our faculty. We expect our faculty to have an interest in joining your program as approved trainers as well. In fact, currently, elements of our Graduate Education Committee are designing a Ph.D. track that greatly intersects with the SYBB program and provides additional training in biomedical engineering and imaging. We hope to be the first engineering department to officially embrace the SYBB vision and have a complementary (not competing, not comparable, but truly complementary) engineering program, to the SOM SYBB offering.

Hence, as these programs grow and mature, we expect that you will be in a position to submit a competitive T32 application to the NIH and we will support you in this endeavor. I cannot adequately express our enthusiasm for your efforts. In addition, novel programs of this kind will be helpful in attracting faculty applicants to join the School of Medicine and will raise the visibility of all our research and training programs.

Sincerely,



Jeffrey L. Duerk, Ph.D., Chairman
Department of Biomedical Engineering
Allen H. and Constance T. Ford Professor
Director, Case Center for Imaging Research

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Department of Epidemiology and Biostatistics
Case Western Reserve University

10900 Euclid Avenue
Cleveland, Ohio 44106-4945

Phone 216.368.3197
Fax 216.368.3970

http://epbiwww.case.edu

February 18, 2010

Mark Chance, Ph.D., Director
Center for Proteomics and Bioinformatics
Case Western Reserve University
School of Medicine
Biomedical Research Building, Room 930
Location Code: 4988

Dear Mark,

Thank you for visiting with our faculty recently to review the proposed Ph.D. program in Systems Biology and Bioinformatics. We are quite enthusiastic about the proposed program and look forward to productive interactions between your faculty and those in our Department. We expect students in our Ph.D. programs to have an interest in courses and journal club activities of the Systems Biology program, and we look forward to your students taking relevant classes and attending seminars in our Department. Because of areas of overlapping interest, we expect many of our faculty will have an interest in joining your program as approved trainers as well, leading to enrichment of both our Ph.D. programs. As you know, our own Ph.D. program in Biostatistics and Epidemiology is distinct in its particular focus, but would be greatly enriched if our students could take advantage of training in the complementary areas that will be the focus of your proposed Ph.D. program.

As your program grows and matures, we expect that you will be in a position to submit a competitive T32 application to the NIH, and we will certainly support you in this endeavor, offering all the advantages that come from broad cross-disciplinary training. Novel programs of this kind, bringing to the study of basic biological processes a strong computational element, together with the possibility of adding an epidemiological dimension, will not only strengthen basic research, but will also be helpful in attracting new faculty applicants to join the School of Medicine, and so will raise the visibility of all our research and training programs.

Sincerely,

Robert.

Robert Elston, Ph.D.
Professor and Chair

CASE WESTERN RESERVE
UNIVERSITY
SCHOOL OF MEDICINE

Department of Pathology
10900 Euclid Avenue
Cleveland, Ohio 44106-7288

February 10, 2010

Mark Chance
Director, Center for Proteomics and Bioinformatics

Dear Mark,

Thank you sharing with me the proposed PhD program in Systems Biology and Bioinformatics. I am quite enthusiastic about the proposed program and consider it to be an excellent program for MSTP student training. It also fits with the goals for training indicated in our CTSA education module.

The program appears to have the requisite flexibility for rotations needed for MSTP students and nicely leverages their Year 1 and Year 2 coursework to fulfill many of the required "core competencies" that the students will need to be successful.

Overall, I am enthusiastic about the program in terms of relevance, need and what it will add to our graduate training at Case.

As you know, programmatic changes such as addition of a graduate program to the set of MSTP-affiliated graduate programs require assessment through the MSTP Steering Committee, but I am very confident that this program will be received enthusiastically by the committee and meet with swift approval for participation with the MSTP. It certainly has my full and enthusiastic support in this regard.

Please keep me posted as this program moves through the approval process.

Sincerely,

Cliff

Clifford V. Harding, MD, PhD
Professor and Interim Chair of Pathology
Director, CWRU Medical Scientist Training Program

Revised September 7, 2010

Proposed Program: Masters of Science in Medical Physiology
Program Development Plan

1. **Academic Rationale and Purpose:**

The Master's Program in Medical Physiology is designed for students with a bachelor's degree who are seeking advanced training in the physiological sciences, typically in preparation for admission to a professional medical program (e.g. Medical School, Dental School). Medical students in both the University and College programs who are interested in the combined MD/MS degrees, are encouraged to consider making this the basic science component of that program. Students who want a career in industry research or administration of biomedical technology companies also should consider this degree program. Case Western Reserve University undergraduates should consider this as the graduate degree component of the BS/MS program. The program is flexible in duration. It can take as little as 1 year (2 semesters, 9 months) to complete the required 30 credit hours of course work. However, students who wish to decompress the program can take 14 months or more to complete the requirements. Core courses and flexible electives allow students to focus their work in key areas of medical physiology, including Anatomy, Biochemistry, or Pharmacology. Graduates of the Medical Physiology Master's Program also can pursue careers in basic and clinical research, research administration, teaching or management in academia, the pharmaceutical and biotechnology industries, private research institutions, government science or regulatory agencies, or medicine and health care. Thus, in addition, to providing a pathway to medical and dental school, the proposed program would offer an important economic advantage for Northeast Ohio by training a pool of individuals constituting a highly educated work force, which in turn would retain and attract biomedical industry.

Students will earn a plan B type MS from Case Western Reserve University. The core of this degree is 18 hours of course work in the Department of Physiology and Biophysics: 2, 6 hour courses in **Medical Physiology** (PHOL 481 & 482), 2, 2 hour courses in **Translational Physiology** (PHOL 483 & 484), and 2, 1 hour **Physiology Seminar** (PHOL 498) courses. The Medical Physiology courses will be conducted as lecture courses. The Translational Physiology course will be conducted as a combination of both lectures and clinical paper discussions. The Physiology Seminar will require students to attend the weekly physiology seminar followed by a discussion session where a recent paper by the seminar speaker will be discussed. The remaining hours required for graduation are flexible, taking into account each student's unique background and career plans. Laboratory research experience may be included as an elective. To successfully complete the program, students must have a final grade point average of

better than 3.0 and pass a comprehensive examination after all coursework has been successfully completed for a Plan B type master's degree. The comprehensive examination will be in the form of a written paper (at least 10 – 20 pages long) where the student will be given the opportunity to display their understanding of physiology and other biophysical sciences that they have studied during the program. This program will complement the plan A type MS that the department currently offers for students preparing for a career in laboratory research. The MS in Medical Physiology may be a terminal degree or may lead to admission to medical, dental, or Ph.D. programs.

2. **Description of proposed curriculum:**

An Overview of the Program is described here. The template of the proposed degree is constituted by core courses in physiology, elective coursework in various related areas, participation in a seminar series, scientific integrity training, a final comprehensive examination, and completion of a total of 30 graduate credit hours. Several new courses are proposed for this degree, and course action forms and associated syllabi outlines have been submitted for approval.

The core of the curriculum is a total of 18 hours of basic physiology. The sequential Medical Physiology I and II courses begin with the study of the physiology of cells and molecules. The courses then go into a detailed analysis of the various organ systems: the nervous system, the cardiovascular system, the respiratory system, the urinary system, the gastrointestinal system, the endocrine system, followed by the reproductive system. The last part of this course sequence is dedicated to applying the principles learned in the study of the physiological systems to the physiology of everyday life: metabolism, regulation of body temperature, exercise physiology and sports science, environmental physiology, and the physiology of aging. Thomas M. Nosek, Ph.D. will be the initial course director for these two courses.

Concurrent with the two Medical Physiology courses, two Translational Physiology courses will explore examples of how the latest basic research in physiology and biophysics is being applied to the treatment of human disease. For example, while the students are studying the basic principles of cardiovascular physiology, they will also be investigating how these principles are being applied to treat/cure human cardiovascular disorders such as congestive heart failure, coronary artery disease, high blood pressure, etc. These courses are designed to increase the awareness of the students of the importance of understanding the physiology of an organ system in enough detail to be able to correct problems with the functioning of the system when they arise. Walter F. Boron, MD, Ph.D. will be the initial course director for these two courses.

Each Monday afternoon, the department sponsors a seminar series. The Physiology Seminar course that each student takes each term requires that they attend this seminar weekly and a discussion session following each seminar where a recent paper by the seminar speaker will be discussed by the students.

The required and recommended elective courses for this program are detailed here. Appendixes A- D contain sample curricula for students desiring to complete the program in four different time frames.

Summer Semester #1

Select 0 – 3 credits of elective courses:

PHOL 601	-Research	3 Credits
ANAT	-Histology for Physiologists (Dr. H-L. Kaung)	3 Credits

Fall Semester

Required courses for the Fall semesters:

PHOL 481	- Medical Physiology I*	6 Credits
PHOL 483	- Translational Physiology I*	2 Credit
PHOL 498	- Physiology seminar	1 Credit

Select of 0 - 6 hours of courses at the 400 level or above from the School of Medicine Graduate School Bulletin. The following are most highly recommended for the Fall semesters:

ANAT 412	- Histology & Ultrastructure	4 Credits
ANAT 413	- Histology & Ultrastructure Lab	2 Credits
ANAT 431	- Statistical Methods I	3 Credits
BIOC 407	- General Biochemistry	4 Credits
BIOC 434	- Structural Biology	3 Credits
BETH 401	- Foundations of Bioethics I	6 Credits
EPBI 414	- Introduction to Statistical Computing	3 Credits
GENE 451	- Principles of Genetic Epidemiology	3 Credits
MBIO 420	- Molecular Genetics of Cancer	3 Credits

Spring Semester

Required courses for the Spring semesters:

PHOL 482	- Medical Physiology II*	6 Credits
PHOL 484	- Translational Physiology II*	2 Credit
PHOL 498	- Physiology Seminar	1 Credit
IBMS 500	- Ethics and Biomedical Research	0 Credits

Select of 0 - 6 hours of courses at the 400 level or above from the School of Medicine Graduate School Bulletin. The following are most highly recommended for the Spring semesters:

PHOL466	- Cell Signaling	3 Credits
PHOL514	- Cardiovascular Physiology	3 Credits
PHOL519	- Cardio-Respiratory Physiology	3 Credits
PHOL530	- Technology in Physiological Sciences	3 Credits
BIOC408	- Molecular Biology	4 Credits
BIOC 412	- Proteins and Enzymes	3 Credits
BETH 402	- Foundations of Bioethics II	6 Credits
EVHS 429	- Introduction to Environmental Health	3 Credits
INTH 401	- Fundamentals of Global Health	3 Credits
GENE 500	- Advanced Eukaryotic Genetics	3 Credits
PHRM 401	- Principles of Pharmacology I	3 Credits
PHRM 402	- Principles of Pharmacology II	3 Credits

Summer Semester #2

Select 0 – 3 credits of elective courses:

PHOL 601	-Research	3 Credits
ANAT	-Histology for Physiologists (Dr. H-L. Kaung)	3 Credits

Comprehensive Examination (Pass/Fail)

Total 30 Credits

*Textbook for these courses is: ***Medical Physiology: A Cellular and Molecular Approach*** by Walter F. Boron and Emile L. Boulpaep

Appendixes A – D contains sample curricula for 4 different students completing the curriculum in 4 different time frames.

Dr. Boron is Chair of the Department of Physiology and Biophysics. He will teach the Respiratory System section of the Medical Physiology course and direct the Translational Physiology course. His active participation is both these courses is seen as a draw for students seeking programs such as this to improve their academic credentials.

The Medical Physiology courses are scheduled from 10:00 AM – 12:00 noon on Monday, Tuesday, and Thursday of each week in E-501 and will be presented in a lecture format by basic science faculty who are experts in the field. The Translational Physiology courses will be scheduled from 10:00 – 12:00 noon on Friday of each week in E-501 and presented in a lecture format by a clinical faculty member with expertise in the field. Clinical research papers will also be discussed by the students. Grades in these courses (A, B, C, etc.) will be determined by performance on Essay/Multiple Choice

exams administered at the end of each of the blocks of the courses (there are a total of 9 blocks for each pair of courses over the two terms).

The Physiology seminar course is scheduled from 4:00 – 5:00 each Monday throughout the academic year. Students are required to attend this weekly seminar and the post-seminar discussion session. The Physiology seminar is graded pass/fail with a pass score determined by attendance at 75% or more of the weekly seminars and active participation in the post-seminar discussions scheduled during the course of a term.

Admissions to the program will be through the established application process for all graduate programs within the Department of Physiology and Biophysics. Students will be required to submit their scores on either the MCAT or GRE exams. No absolute criteria for performance on these standardized exams or undergraduate grade point average will be established because each student will be evaluated on the merits of their total record; their scores on a standardized exam (MCAT or GRE), undergraduate and graduate grade point average, letters of recommendation (3), application essay describing their interest in the program and career plans, and personal interview (either in person, on our Departmental site on the secure Case Nebraska server of Second Life, or in Skype). The department will cover the costs of a personal interview when that is requested. We expect successful applicants to have MCAT scores totaling at least 30, GRE scores of Verbal >400, Quantitative>500, and Analytical>2.5, and accumulated undergraduate grade point average of at least 3.0. Applications to the program will be accepted throughout the year with qualified applicants being accepted into the program as soon as they are identified. The final application deadline for this program will be June 1st of each year with final admission decisions made by July 1st.

No financial aid will be provided for the program. Tuition is $1,375/credit hour. Because there is a12 credit hour maximum for tuition computation, tuition will be $16,500/term or $33,000 for the program for students who complete the program in 2 semesters (9 months). For those students who decompress the program and take longer to complete the requirements, they will be charged each term for the credit hours they are taking up to a maximum of 12 credit hours.

3. <u>Administrative arrangements for program; academic units involved:</u>

Dr. Thomas M. Nosek, director of Graduate Education for the department, will be the director of the program. Administrative support will be provided by Jean Davis who is currently the Coordinator of all Departmental Educational Programs. All other necessary staff support for the program will be coordinated by Morley Schwebel, Business Manager for the Department. The Admissions subcommittee of the departmental Graduate Education Committee will be responsible for recruiting students and admitting them to the program. This committee is made up of the director of admissions (currently Dr. Andrea Romani), the director of graduate education (currently Dr. Thomas M. Nosek), and the three track directors (currently Dr. William Schilling, Dr. ~~Ulrich~~ Withold Surewicz~~Hopfer~~, and Dr. Corey Smith). A new subcommittee of the

departmental Graduate Education Committee will be constituted (called the MS in Medical Physiology Advisory Committee) to oversee this program. A member of this committee will be assigned to each student to advise them regarding which elective courses to take, to follow their progress in the courses (helping students identify remediation activities should they perform below passing in any of the examinations in the Medical Physiology and Translational Physiology courses), to help them prepare the written paper which constitutes the comprehensive exam for the program, and their application materials for medical/dental school. This committee will grade the comprehensive examination to be given at the end of the student's last term. Students are required to pass the compreshensive examination in order to graduate. If the quality of the first submission of the paper is not satisfactory, students will be given the opportunity to rewrite the paper once. ~~and~~ The committee will also provide an evaluation of each student's academic performance at the end of the program that can be used as part of their medical school admissions materials. Students must successfully pass the comprehensive examination in order to successfully complete the program. One, two hour advisory/Q&A session with the Associate Dean and Director of Admissions to the Case Western Reserve School of Medicine will be held each year to help the students prepare their medical/dental school admissions materials.

4. Evidence of need

For the 2007/2008 entering class, US medicals schools received applications from a total of 42,315 students. Of these, 31,946 were first time applicants and 10,369 were re-applying. The total number of students entering US medical schools was 17,759 for the 2007/2008 medical class. It is assumed that the 10,369 students who reapplied for admission took some remedial action to improve their academic record after being rejected for admission. Also, some first time applicants entered programs such as our MS in Medical Physiology program before applying to medical school for the first time. Therefore, these numbers suggest that approximately 10,000 or more students across the country might be interested in improving their credentials by enrolling in a program like our MS in Medical Physiology Program.

Many schools across the country are providing programs to students who are not yet ready to apply for medical school academically or who have applied and been turned down. The Association of American Medical Colleges (AAMC) lists on their website 119 such programs. Currently there are 4 programs in Ohio:

1. The Master of Science in Physiology program at the University of Cincinnati. This is a special master's degree-granting program that takes 1-2 years to complete. It does not require a thesis. Students take courses alongside medical students in three medical school classes (medical physiology, medical biochemistry, and medical histology and cell biology). Students also take classes in clinical embryology, health professions, molecular physiology, statistical methods in physiology, neurophysiology, and literature review or lab research) within the department of Molecular and Cellular Physiology. This program graduated 20 students in 2009.

Their individual profiles can be found at http://www.med.uc.edu/physiology/MS-2009.htm.

2. The MEDPATH program at The Ohio State University. This is a non-degree, 4 quarter program designed to help students with a bachelor's degree prepare for medical school. The program takes 11-25 students/year.
3. The MSBS in Medical Sciences at the University of Toledo. This is a special master's degree program that takes 1-2 years to complete and requires no thesis. There are 26-50 students enrolled in the program.
4. The Post-Baccalaureate Program at Cleveland State University. This is a non-degree granting program of individualized/unstructured study designed for students who have received their bachelor's degree. It enrolls 11-25 students/year.

There is actually a 5th program currently in the state, the MS in Applied Anatomy at Case Western Reserve University. This is a two year program that focuses on the anatomical sciences; human gross anatomy, histology, neuroanatomy, and embryology. This program currently has approximately 45 students, about 20 of whom are enrolled to prepare for admission to medical school.

Our MS program would be only the second in the state in the discipline of physiology. The existing physiology program is in Cincinnati, which is approximately 200 miles distant.

In the states geographically surrounding Ohio, there are 2 programs in Indiana, 0 in Michigan, 13 in Pennsylvania, 1 in Kentucky, and 0 in West Virginia designed to help students prepare for medical school.

5. Prospective enrollment:

In the first year of the program (2011/2012 academic year), the department expects to matriculate 5 students. In subsequent years, we expect the enrollment to increase by 5 a year up to a maximum of 25-30 per year.

6. Faculty and facilities available for the program and their adequacy

The primary and secondary faculty of the Department of Physiology and Biophysics will be responsible for teaching the new courses (Medical Physiology I and II PHOL 481 & 482 and Translational Physiology I and II PHOL 483 & 484) and for administration of the program. The classrooms in the Department of Physiology and Biophysics will be used for this instruction, primarily E-501. The additional 2 courses (8 hours/semester) will be taught by faculty throughout the School of Medicine. While a limited number of elective courses are highly recommended, students will be able to fulfill these course requirements by selecting as many as 2 courses/semester at the 400 level or above from the medical school graduate courses listed in the graduate school bulletin. All elective courses must be approval of the student's advisor.

7. Need for additional facilities and staff, and plans for meeting these requirements

No additional facilities or staff are required to implement this program.

8. **Projected financial needs to support program and adequacy of expected financial support**

It is estimated that the direct costs of the director of the program (25%) would be $64,250/year, of faculty teaching in the program (35% effort, $67,463/year), and of the administrative costs $30,000/year for a total yearly costs of $161,713. If all students take 9 months to complete the program, each student would bring in tuition dollars of $17,260/semester ($34,320/year) to the university. Therefore, enrolling 5 students (total tuition of $171,600) will approximately cover the cost of administering the program.

9. **Copies of reports from consultants or advisory committees used in the planning process**

This program was proposed to the Departmental Graduate Education Program by Dr. Walter Boron. Dr. Thomas Nosek, as Director of the Departmental Graduate Program, consulted with Dr. Carole Lietdke, chair of the admissions committee for the Case School of Medicine. From her experience interviewing students for medical school, she indicated that there are a number who, because of their background deficiencies, would need to successfully complete a program such as the MS in Medical Physiology to gain admission to medical school. Dr. Nosek also consulted with Dr. Lina Mehta, Associate Dean for Admissions, and Christian Essman, Director of Admissions at the Case Western Reserve University School of Medicine. Both indicated that during the course of counseling approximately 100 students/year, they identify approximately 10/year (because of basic science deficiencies) who they would recommend enroll in and successfully complete a program such as this to compete for a place in the medical class at Case or any other medical school. Drs. Nosek and Boron also talked with Dr. Alison Hall, Director of Graduate Education in the School of Medicine, who indicated that she sees a number of students each year during the course of her interviewing process who would benefit from an MS program in systems physiology as they try to improve their basic science credentials for admission to medical school. At this time, she knows of three students who might be interested in this program. Based on this information and a survey of competing programs, the Graduate Education Committee for the Department of Physiology and Biophysics endorsed development of the details of such a program and implementation of it for the fall of 2011.

10. **Letters of support from the Dean or other directors of appropriate university cost centers.**

Besides the 18 hours of courses in Physiology and Biophysics that the students will take in the program, they will also take 12 credit hours of elective courses. Some of these elective courses could be taken within the Department of Physiology and Biophysics. The two major departments that would be impacted by students taking electives outside the department are Anatomy and Biochemistry. Therefore, Dr. Boron has met with both Drs. Ornt and Weiss and their letters of support of the program are

attached. Letters of support from Dr. Alison Hall, Director of Graduate Education in the School of Medicine and Dr. Davis, Dean of the School of Medicine, are also attached.

There are many combinations of courses/term that a student can make to graduate with 30 credits in as few as 2 terms (9 months). However, the curriculum can be decompressed over a longer time frame. Four examples of specific curricula for 4 sample students are provided in Appendixes A – D.

Appendix A

Student #1
Completing the curriculum in 9 months (2 terms, Fall and Spring)

Fall

PHOL 481	- Medical Physiology I	6 Credits
PHOL 481	- Translational Physiology I	2 Credit
PHOL 498	- Physiology seminar	1 Credit
ANAT 412	- Histology & Ultrastructure	4 Credits
ANAT 413	- Histology & Ultrastructure Lab	2 Credits

Spring

PHOL 482	- Medical Physiology II	6 Credits
PHOL 484	- Translational Physiology II	2 Credit
PHOL 498	- Physiology Seminar	1 Credit
IBMS 500	- Ethics and Biomedical Research	0 Credits
GENE 500	- Advanced Eukaryotic Genetics	3 Credits
PHRM 401	- Principles of Pharmacology I	3 Credits

Comprehensive Examination (Pass/Fail)

Total 30 Credits

Appendix B

Student #2
Completing the curriculum in 14 months (4 terms; Summer #1, Fall, Spring, and Summer #2)

Summer #1

ANAT	-Histology for Physiologists (Dr. H-L. Kaung)	3 Credits

Fall

PHOL 481	- Medical Physiology I	6 Credits
PHOL 483	- Translational Physiology	2 Credit
PHOL 498	- Physiology seminar	1 Credit
BIOC 435	- Structural Biology	3 Credits

Spring

PHOL 482	- Medical Physiology II	6 Credits
PHOL 484	- Translational Physiology II	2 Credit
PHOL 498	- Physiology Seminar	1 Credit
IBMS 500	- Ethics and Biomedical Research	0 Credits
GENE 500	- Advanced Eukaryotic Genetics	3 Credits

Summer #2

PHOL 601	-Research	3 Credits

Comprehensive Examination (Pass/Fail)

Total 30 Credits

Appendix C

Student #3
Completing the curriculum in 2 years (4 terms, 2 Fall and 2 Spring terms)

Fall #1

PHOL 481	- Medical Physiology I	6 Credits
PHOL 483	- Translational Physiology	2 Credit
PHOL 498	- Physiology seminar	1 Credit

Spring #1

PHOL 482	- Medical Physiology II	6 Credits
PHOL 484	- Translational Physiology II	2 Credit
PHOL 498	- Physiology Seminar	1 Credit
IBMS 500	- Ethics and Biomedical Research	0 Credits

Fall #2

ANAT 412	- Histology & Ultrastructure	4 Credits
ANAT 413	- Histology & Ultrastructure Lab	2 Credits

Spring #2

GENE 500	- Advanced Eukaryotic Genetics	3 Credits
PHRM 401	- Principles of Pharmacology I	3 Credits

Comprehensive Examination (Pass/Fail)

Total 30 Credits

Appendix D

Student #4
A CWRU laboratory technician who is limited to taking 6 credit hours during the Fall and Spring terms. This program of study would take a minimum of 5 terms over 2 ½ years.

Fall #1

PHOL 481	- Medical Physiology I	6 Credits

Spring #1

PHOL 482	- Medical Physiology II	6 Credits

Fall #2

PHOL 483	- Translational Physiology I	2 Credit
PHOL 498	- Physiology seminar	1 Credit
BIOC 435	- Structural Biology	3 Credits

Spring #2

PHOL 484	- Translational Physiology II	2 Credit
PHOL 498	- Physiology seminar	1 Credit
GENE 500	- Advanced Eukaryotic Genetics	3 Credits
IBMS 500	- Ethics and Biomedical Research	0 Credits

Fall #3

ANAT 431	- Statistical Methods I	3 Credits
MBIO 420	- Molecular Genetics of Cancer	3 Credits

Comprehensive Examination (Pass/Fail)

Total 30 Credits