LEADERSHIP AND ORGANIZATION CHANGE

IN BIOMEDICAL PHD EDUCATION:

AN INSTRUMENTAL CASE STUDY OF THE DEVELOPMENT OF

A CENTRALIZED ORGANIZATION FOR BIOMEDICAL GRADUATE STUDIES

AT THE UNIVERSITY OF PENNSYLVANIA

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ABSTRACT

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Jarle Breivik

Robert Zemsky

Biomedical PhD education is a large and increasingly interdisciplinary segment of higher education. The primarily laboratory-based research training is commonly distributed to a range of administrative units within and outside the research-intensive universities. This organizational fragmentation represents a significant challenge to coordination, oversight, and quality development. The University of Pennsylvania was one of the first institutions to establish a centralized, umbrella-type biomedical graduate program to address these organizational challenges. The thirty-year-old program has been highly successful and is regarded as a model for other institutions. In order to learn from the program's path to success, this research investigated the inner dynamics and leadership actions related to the development of Biomedical Graduate Studies (BGS) at the University of Pennsylvania. The retrospective instrumental case study explored the process from the period prior to the establishment of the program in 1984 until its current configuration in 2014. Data were collected through semi-structured interviews with 18 people representing different time periods and leadership positions in the history of the

program, as well as archival material. The data were analyzed to establish the chronology of events and to identify the main themes and leadership actions of the change process. The presented case was subsequently analyzed in light of established theory on organizational change and leadership orientations in higher education. This analysis demonstrated that the change was a multi-dimensional process and could be explained by several theoretical frameworks. There were elements of planning and decisive management, organizational learning, political bargaining, adaptation to environmental factors, and attention to culture and symbolism. The process involved a transformation that empowered the junior faculty, promoted collegiality, and improved the quality of recruitment, student satisfaction, and scientific outcomes. Centralization of student recruitment and funding, detaching the graduate education from the department structure, and collaborative leadership stood out as primary factors for success. This case study may serve as a guideline for other institutions that aim to develop centralized biomedical graduate programs. It also represents a reference for further research in the field of biomedical education management.

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PREFACE

This fall it will be twenty-five years since I started my career in biomedical research and education at the University of Oslo and the affiliated hospitals, first as an MD and PhD student, then as a post-doctoral fellow, later as a faculty member, and from 2004 as Director of the MD-PhD program and then the overall PhD program in the biomedical and health sciences. Accordingly, I have experienced most sides of biomedical doctoral education and the inner workings of an academic medical center, from the joy of sharing one's first genuine scientific discovery to the hardship of dealing with abusive supervisors and medical school politics.

Like most of my fellow students and colleagues, I have at times been frustrated by organizational inefficiency and dysfunctional leadership, thinking that I could do things better. On becoming a mid-level leader myself and trying to implement change, I discovered that matters were not always that easy. The opposing interests and organizational complexity of an academic medical center made it difficult to find a clear path for change. The interests of the students, the aims of the faculty, and the overall objectives and policies of the institution often pointed in different directions. Trying to achieve one goal often undermined the others. In particular, the faculty generally rejected changes that would limit their autonomy in PhD training, whereas the national implementation of new European standards called for more structured programs, shorter time to degree, curricular reform, and more accountability at all levels in the organization.

This top-down reform was accompanied by rapid growth in the number of students, who were increasingly caught between focusing on their academic research and

preparing for a more probable career outside academia. Moreover, the leadership structure of the medical school was not very helpful. The academic leadership was elected for four-year terms, often directly from research positions, and there was a grave lack of continuity in the organization.

After many years of learning by doing, attempting to lead from below, and an introduction to management theories through an on-the-job training program, I saw a need to professionalize my leadership skills. I was due for a sabbatical, and instead of concentrating on my primary research field of cancer development, I decided to focus on the challenges of organization and leadership of biomedical PhD education. Having participated at several European conferences, I knew that most countries were even further behind than Norway in terms of developing structured PhD programs. Therefore, I decided to look to the United States.

With a medical degree and a research doctorate in cancer development, I had limited training in the social sciences and qualitative methods, and saw the need for a program that could structure my entry into the field of education management research. The Executive Doctorate in Higher Education Management at the University of Pennsylvania Graduate School of Education emerged as an interesting opportunity to combine structured education and independent research with my years of experience in Norwegian higher education.

Concurrently, I realized that the University of Pennsylvania also had a highly recognized program in biomedical graduate education. I researched the information presented online and found that Biomedical Graduate Studies (BGS) was a well-established organization with interdisciplinary graduate groups organized across

departments, schools, and affiliated institutions. I also searched for research regarding organization and leadership at the School of Medicine and identified a paper entitled "Institutional leadership and faculty response: Fostering professionalism at the University of Pennsylvania School of Medicine" (Wasserstein, Brennan, & Rubenstein, 2007).

This paper gave a candid analysis of the challenges of leading a medical school, and indicated that the institution could be receptive to an in-depth and critical analysis. I therefore contacted the first author, former Vice Dean for Faculty Affairs, Alan G. Wasserstein (now a member of my dissertation committee), as well as the Associate Dean of Biomedical Graduate Education and Director of BGS, Susan R. Ross. I presented my interest in studying the program and immediately got a positive response.

In order to get full access to the institution and to facilitate my move to the United States, I received an invitation to become a visiting faculty member at the School of Medicine. On this basis, and with the support of my home institution, I was then granted a scholarship from the Fulbright Foundation and the Unger-Vetlesen Medical Fund. I was subsequently admitted to the Executive Doctorate in Higher Education Management, and in the fall of 2012, I moved to Philadelphia with my wife and our four children to study higher education management and conduct this study.

Jarle Breivik

April 1, 2014

CHAPTER 1 – INTRODUCTION

> *"At the beginning of the last century, the power of nations might have been measured in battleships and coal. In this century it's as likely to be graduates."* (Coughlan, 2011)

We are living in an age when advanced knowledge, accumulated through education, research, and training, is increasingly regarded as the primary asset of society. Developed and developing nations alike are striving to build a knowledge society that can fuel their knowledge economy, and the systems of education and research are under scrutiny as never before (OECD, 2011). At the heart of this development, in the strategic intersection between education, research and innovation, lie the universities and their research-based doctoral education, usually leading to a PhD degree (Nerad & Heggelund, 2008; Walker, Golde, Jones, Bueschel, & Hutchings, 2008). PhD education is where society recruits and educates its future researchers, the university teachers, and the majority of leaders in research and innovation, both within and outside academia. PhD students are also the basic workforce of the research community. They embody the continuous supply of fresh brain power, and in many aspects PhD education represents the vital core of the knowledge society (European University Association, 2005).

Biomedicine, defined as the modern synthesis of medical practice and the natural sciences, is by far the largest field of academic research (National Institutes of Health, 2012). As an illustrative indicator, the U.S. federal government spends about 20 times more on biomedical research than on all the social sciences combined. The private contribution is even higher, and the combined U.S. funding of biomedical research is

estimated to be about $100 billion annually (Dorsey et al., 2010). This massive volume, combined with its strong impact on human development and the global economy, has given the field of biomedicine a defining role in the academic research enterprise (Mallon, 2006).

Most of biomedical research is conducted in the context of comprehensive research universities and used to be confined to the basic science departments of medical schools. However, as the field has expanded and become extensively interdisciplinary, branches and hubs of biomedical research can be found in a broad range of schools and departments within the university, as well as affiliated hospitals and research institutes (Mallon, 2006). Medicine, biology, dentistry, veterinary medicine, agriculture, psychology, bioengineering, and bioinformatics are increasingly united by the fundamental principles of molecular biology and are collectively referred to as the "life sciences." Students who work on similar problems and require the same kind of education and training are therefore distributed over a whole range of organizational units within and outside the university, leaving the system of department-based PhD programs increasingly outdated.

Moreover, biomedical research is generally laboratory-based, which offers a separate set of challenges to PhD education (Boud & Lee, 2009). Unlike the humanities and the social sciences, it is rare for biomedical PhD students to develop their own independent projects. The projects are generally determined by the objectives, methodologies, and collaborators of their designated laboratories and supervisors. Students are therefore strongly dependent on their supervisor in terms of intellectual guidance, research infra-structure and funding, and to a large extent the supervisor

remains the “project owner” even after the student has graduated. At the same time, the supervisor is largely dependent on the student’s labor and intellectual contribution to produce the publications needed to maintain the status and funding of the laboratory. This student-supervisor interdependency is an integral component of biomedical PhD education, which can involve an intimate, efficient, and mutually beneficial context for learning and development (Russo, 2011). Unfortunately, however, graduate education can also be an arena for conflicts, exploitation, misconduct, and lack of transparency and oversight (Johnson & Huwe, 2002).

A related problem concerns the curriculum and learning outcomes of biomedical PhD programs. The PhD has traditionally aimed to develop academic researchers. However, while the number of graduates has increased rapidly over the last decades, the number of university positions has stagnated, and the PhD is no longer an assured route to an academic career. Indeed, the overwhelming majority of today’s students will end up in positions outside academia, which may or may not involve active research (Cyranoski, Gilbert, Ledford, Nayar, & Yahia, 2011). Students and potential employees are therefore calling for PhD programs that are more relevant for the workforce, and the National Institutes of Health (2011) recently emphasized that the biomedical PhD should prepare students for a wider range of careers. This initiative promotes the introduction of structured training plans, which include topics like innovation and leadership, career mentoring, and closer interaction with employees outside the academic institutions. Within the research community, on the other hand, voices argue that this refocusing of the PhD draws resources and attention away from the core mission: to educate leading experts in the fields of biomedical research. Although the National Institutes of Health

and other funding institutions call for PhDs for the workforce, it still demands that the training laboratories maintain a high level of scientific quality and progress, and the graduate programs are faced with the challenge of balancing the different aims of PhD education (Boud & Lee, 2009; Nerad, 2012; Park, 2007).

In combination, these three factors – the organizational complexity, the student-supervisor inter-dependency, and the balancing of the curriculum – call for a new organizational paradigm in biomedical PhD education. This new model should organize and fund the education independent of departmental and institutional barriers, assure oversight, transparency, and accountability down to the individual student-supervisor relationship, and balance the needs and expectations of the faculty with those of the students and society at large.

Many institutions have already moved to address these issues, and major American research universities have been leading the way. The traditional departmental- and discipline-based programs have generally been replaced by "umbrella programs" – interdisciplinary and thematic programs where admission, funding, curricular development and research supervision are coordinated and overseen by a centralized organization (Barnett, 2011). Students are generally admitted after completing a Bachelor's Degree. Then they complete two years of coursework and laboratory rotations leading up to a qualifying exam and assignment of supervisors. The student's research project is overseen by a faculty committee and typically results in at least one peer-reviewed, first-author paper. The average time to graduation is 5.5 years. As such programs, at least traditionally, have been based in medical schools, the Association of American Medical Colleges has taken a coordinating role and has established the

Graduate Research, Education, and Training (GREAT) Group to provide professional development and exchange of best practices (Association of American Medical Colleges, 2014).

In Europe, research-based doctoral education has traditionally had a much looser structure, and there is little tradition of American-style graduate schools. The development of structured PhD programs has therefore lagged behind and is still very much an ongoing process (European University Association, 2005; Mulvany, 2013). An initiative for change has been implemented on an international level as part of the Pan-European collaboration to establish a unified Higher Education Area, the so-called Bologna Process. This standardization of higher education defines the PhD as a three-year degree, following a two-year Master degree, thus comparable to the combined five years of the American system. The general learning outcomes are defined by the European Qualification Framework (European Commission, 2008), which comprises many of the same elements related to generic skills training that the National Institutes of Health (2011) are promoting in the U.S.

ORPHEUS, the Organisation for PhD Education in Biomedicine and Health Sciences in the European System, has actively facilitated institutional collaboration across the different countries and has also proposed a common standard for biomedical PhD education (ORPHEUS/AMSE/WFME Task Force, 2012). This standard includes many of the key elements related to structure, oversight, and learning outcomes characteristic of American graduate programs, and biomedical PhD education is generally experiencing an international convergence driven by the forces of globalization (Yopp, 2008).

Overall, there is broad international agreement concerning best practices in biomedical PhD education, and the centralized programs of leading American universities in many ways represent the gold standard. Therefore, an important question is: What does such a program actually look like, and how was it developed? At least in Europe, there is a need to clarify the concept of umbrella-type graduate programs, and although many of the American programs have detailed online presentations of their organization, procedures, and curriculum, it is hard to grasp their inner workings. Moreover, the development of such programs involves fundamental changes to the academic organization. As outlined above, the new organizational paradigm challenges the traditional department structure; it interferes with the autonomy of the student-supervisor relationship, and it questions the basic objectives of the research degree.

Research that addresses these challenges of biomedical graduate education is limited, and there are apparently no studies on the issue in light of leadership and organizational change theory. From the general perspective of how to implement organizational change in a complex higher education context, as well as from the practical perspective of how to lead and organize biomedical graduate education, it is therefore meaningful to explore the development of a centralized biomedical graduate program at a major American university.

CHAPTER 2 – CASE STUDY APPROACH

As explained in the Preface, the decision to study the biomedical graduate organization at the University of Pennsylvania (Penn) was primarily based on the unique access to this institution. Nevertheless, there are several reasons why BGS stands out as particularly interesting: Penn was one of the first to establish a centralized biomedical graduate organization (Oliver, 1984). It has refined this model for three decades, and BGS has experienced highly positive developments related to student recruitment, national rankings, funding, and scientific outcomes (Appendix: Review of Biomedical Graduate Studies, 2012). The institution is recognized by the Association of American Medical Colleges as a national leader in biomedical graduate education, and the BGS leadership has taken an active role in the above-described GREAT Group (Brass et al., 2010). Moreover, BGS' interdisciplinary program in neuroscience was recently named "Graduate Program of the Year" by the Society for Neuroscience (Kreeger, 2014).

In order to understand the path that led to this success, the problems along the way, and the remaining challenges, this study explored the history of BGS from the period prior to its establishment in 1984 to its current status in 2014. The research designed was that of a retrospective, instrumental case study of a single organization (Creswell, 2013; Saldaña, 2011). It included the collection of archival material and interviews with 18 people representing different leadership roles at different periods in the history of BGS. These were Vice Provosts, Vice Deans for Research, BGS Directors, Department Chairs, Graduate Group Chairs, and Administrative Directors. Several of the participants had concurrently or during different time periods held several of these

positions, and the academic leaders also spoke from their perspective as researchers and faculty members. Three current leaders of the student association (BGSA) were included to represent the student perspective on the organization. Three of the participants were interviewed twice, first for a pre-study to get an overview of the history and structure of the organization, then as part of the main study which primarily focused on the leadership perspective. Semi-structured interviews were conducted based on an interview protocol that was adjusted to the participants' role and history with the organization. The approximately one-hour interviews were recorded and then transcribed by a professional service provider.

The archival material (Appendix) was mainly provided by the BGS administration and included several reviews of the organization and the underlying graduate groups. Documents were also retrieved from the University Archives and Records Center and open online sources, including the BGS Program webpages, academic résumés, and newspaper articles.

Documents and interviews were analyzed in order to establish the chronology of events and to identify the main themes in the history of BGS. The validity of findings was confirmed by triangulation of data from different sources and by member checking: asking five of the most involved participants to review the compiled case (Creswell, 2013; Saldaña, 2011). The objective was not to give a detailed inventory of events and technical matters regarding the organization, but rather to present a coherent story that illustrates the organization's inner dynamics, the decision-making process, the organizational conflicts, the leadership strategies, and the general philosophy that has guided the developments. This story is presented below and subsequently analyzed in

light of established literature on leadership and organizational change in higher education institutions.

The study was approved by the Institutional Review Board (IRB) of the University of Pennsylvania and was conducted in agreement with the leadership of the Perelman School of Medicine. It was agreed that the study would identify the name of the institution, and as clearly stated in the Informed Consent Form, the participants were not granted anonymity.

CHAPTER 3 – PRESENTATION OF CASE

Institutional Context

The University of Pennsylvania is a comprehensive research university, compactly located close to Center City Philadelphia. It proudly traces its roots back to 1740 and its founding father Benjamin Franklin, who later became one of the founding fathers of the United States (Friedman, 1996). The University has been, and still is, one of the most prominent educational institutions in America, and current rankings place it close to the top tenth place for U.S. universities and among the top fifteenth in the world. As a private, not-for-profit institution in the Ivy League, it is also highly affluent, with an endowment of more than $7 billion (University of Pennsylvania, 2014a).

Its School of Medicine also has a proud and rich history. It was established in 1765 and is the oldest medical school in America. In 1847, it was the first medical school to establish its own teaching hospital, The Hospital of the University of Pennsylvania, which was later expanded and developed into a conglomerate of hospitals and clinics, today known as the University of Pennsylvania Health System (University of Pennsylvania, 2014g). This Health System and the School of Medicine are collectively governed under the direction and auspices of Penn Medicine, a division of the University.

In 2011 the School of Medicine received a major private donation from Raymond and Ruth Perelman, and was officially renamed the Perelman School of Medicine (PSOM). In recent years, PSOM has been among the top five research-oriented medical schools in the country as determined by the U.S. News & World Report ranking and the amount of funding it receives from the National Institutes of Health (Perelman School of

Medicine at the University of Pennsylvania, 2014). The school has a particularly strong emphasis on basic biomedical research and has a strategic aim to "translate new knowledge into clinical therapies that positively impact patient care" (University of Pennsylvania, 2014f).

Although primarily located within the context of PSOM, Penn's biomedical research activity is distributed across 30 departments in eight Penn schools and several associated research centers and affiliated institutions. Most significantly, The Children's Hospital of Philadelphia and The Wistar Institute are both closely affiliated with the medical school. This cross-departmental, inter-school, and inter-institutional research activity is intimately connected with biomedical graduate education, which is coordinated by a centralized organization known as Biomedical Graduate Studies (BGS).

Briefly summarized, BGS represents an umbrella organization that divides Penn's biomedical research and graduate education into seven thematically defined graduate groups. It is currently composed of approximately 700 students pursuing a PhD under the guidance of about 600 faculty members, including many world leaders in their field. Today, Penn BGS is regarded among the most prestigious biomedical graduate schools in the U.S. and has received national recognition for its training (University of Pennsylvania, 2014b).

Need for Change

Going back to the early 1980s, the period prior to the establishment of BGS, the situation at the University of Pennsylvania was perceived as quite challenging. The institution was ranked about twentieth in the country (U.S. News rankings through the

years, 2014) and has been described as having an inferiority complex relative to other Ivy League institutions (Zemsky, 2009). Potential students and their parents were discouraged by high crime rates in University City, and the institution had a long history of tension with the impoverished African American population of the surrounding West Philadelphia community (Zweifler, 2013). The fiscal situation was also pressing, and there was a clear sense of urgency. As expressed in his 1983 strategic plan "Choosing Penn's Future," Sheldon Hackney, President at the time, stated (Hackney, 1983):

> A formidable array of difficult problems now faces us […] If the University of Pennsylvania is to continue to fulfill its mission of providing educational, intellectual, and scientific leadership, it must respond creatively to the challenges of the present.

Hackney's strategic plan also emphasized the importance and challenges of PhD education:

> Our Ph.D. programs in the arts and sciences are among the oldest, as they are among the best, in the world […] We cannot afford to diminish our efforts to attract the most promising graduate students whose scholarly pursuits will, under faculty guidance, redound to the University's credit. This effort must include developing financial arrangements to address the increasingly high costs of graduate education.

The School of Medicine was generally recognized as having a first-class MD program that educated physicians, but the research-based PhD education lagged behind its peers at places like Harvard, Yale, and Johns Hopkins. Unlike these institutions, that competed for students at the national level, Penn recruited their biomedical graduate students primarily from the local region, Pennsylvania and the nearby states. The School had been particularly slow to adapt to the rapid developments in the basic biomedical sciences, including molecular biology and genetics, and did not have many distinguished faculty members in these fields.

Beginning in the mid-1960's, biomedical research experienced a great expansion, supported by increases in funding from the National Institutes of Health and other federal and private funding sources (Stemmler, 1989). The major universities, especially their medical schools, absorbed most of this research growth, but other disciplines such as dentistry, veterinary medicine and biology were significantly affected. This interdisciplinary nature of biomedical research and PhD education represented a special organizational challenge to a comprehensive research university like Penn, and was addressed by the Senate Advisory Committee as early as 1975 (University of Pennsylvania, 1975).

Briefly summarized, biomedical graduate education was organized in graduate groups that obtained their faculty members from several different schools, most notably the Schools of Medicine, Dental Medicine and Veterinary Medicine, and the Faculty of Arts and Sciences (later to become the School of Arts and Sciences). Although the majority of active faculty members were affiliated with a given department, the graduate group structure also encouraged faculty to organize themselves by their academic interests across departments and schools. The best example of such early interdisciplinary organization was the Immunology Graduate Group (Appendix: Review of the Immunology Graduate Group, 2005). While it had some administrative and financial support from the department of Pathology and Laboratory Medicine in the School of Medicine, it also had very active members outside that department and outside the School of Medicine, specifically the department of Biology in the School of Arts and Sciences, the School of Veterinary Medicine, and the Wistar Institute. Thus, no single school could be identified as a logical home for the particular groups, and in 1977, it was decided that

the Biomedical Graduate Groups should be assigned to the Faculty of Arts and Sciences for academic matters. The budgetary needs, on the other hand, were to be overseen by a Board of Biomedical Deans, comprising the deans of all the involved schools (Appendix: Brief History of Graduate Education at the University of Pennsylvania 1870-1984, 1992).

This arrangement remained largely unchanged until the mid-1980s. Formally, it implied that the Biomedical Graduate Groups were organized in a centralized school structure under the Provost, but in reality all the control and resources were run through the individual science departments. The quality of the graduate groups was largely dependent on the quality of the departments, and while some departments were leaders in their field and provided excellent training environment for highly selected students, others were academically weak and tended to recruit weak students.

The departments were generally autonomous regarding admission of students and the nature of their training. The registration of students was incomplete; there was no systematic overview of the curricula; and there was a general lack of data regarding the structure and quality of the programs. With regard to leadership and allocation of resources, the position of graduate Group Chair was not well defined and often was just another responsibility of the Department Chair.

The allocation of funds for graduate education was largely based on seniority. Junior faculty or faculty not affiliated with the department that “owned” the particular graduate group were at a disadvantage. There was no standard stipend. The students applied for admission, and if they succeeded in courting the interest of an individual faculty member with access to research funding, they might get some stipend or tuition at the discretion of the faculty sponsor.

The department faculty basically recruited whomever they wanted and independently decided when to graduate them. Accordingly, there was a level of student exploitation. Graduate students were to some degree perceived as cheap labor and could be refused graduation in order for the faculty to maintain a "free pair of hands" in the lab. Summarizing the situation, a Department Chair at the time described the system as "a corrupt gerontocracy." This system could be quite comfortable and protective for faculty who had gained a position in the hierarchy, but was generally dysfunctional from the perspective of promoting quality in research and training.

Founding of the New Organization

During the early 1980s, the low quality of Penn's biomedical research portfolio and graduate education was increasingly recognized as an impediment to institution's status and reputation (Oliver, 1984). The need and opportunity for change were evident, and the primary responsibility lay with the Dean of the School of Medicine. Dean Edward J. Stemmler (1975- 1988) was himself a graduate of the School of Medicine and had both his internship and residency at the Hospital of the University of Pennsylvania. He gained experience as a clinical practitioner, instructor, and researcher, and was appointed Professor of Medicine in 1974, before he was appointed Acting Dean the year after (Chen, 2009).

Stemmler published at least two academic papers on medical education management. The first, which appeared soon after BGS was established, was co-authored by the Associated Deans for academic programs and curriculum and was titled "Managing Medical Education at the University of Pennsylvania" (Burg, McMichael, &

Stemmler, 1986). It described "the tactics used at the school to bring about and maintain changes in managing medical education" and outlined a rather comprehensive leadership strategy for organizational change:

> In meeting the challenge of educating students to be physicians in the 21st century, schools of medicine must develop management systems that promote change and encourage innovation. In this paper, the authors describe the approach used by the University of Pennsylvania School of Medicine over the past five years for managing its programs. The major elements of this management scheme are centralization of administrative functions concerned with medical education; networks for communication about education problems and issues; a system for obtaining consensus among the institution's constituencies on the goals of the school's educational programs; a system for including information on teaching performance as an element in the promotion process; and multiple systems for providing the faculty, students, and administration with information about the quality of the school's educational activities.

The other paper, titled "The medical school – where does it go from here?" was published the year after Stemmler left office and specifically discussed how growth in biomedical research posed an organizational and fiscal challenge to medical schools (Stemmler, 1989):

> The money used for capital investments in research programs has necessarily reduced the funds available for capital investments for other needed programs that may be more closely related to the central educational missions of the schools. One large investment in research technology may use funds that could otherwise have been used to modernize classrooms and libraries or student housing.

As the quote above indicates, Stemmler's primary focus concerned "the central educational missions of the schools," meaning the MD program. He was first and foremost a practitioner and manager of the medical school, and did not have a personal stake in biomedical research and PhD education. Stemmler is described as a "process oriented guy" who was "very well-liked by everybody" and is credited for leading a "remarkable growth in biomedical research as well as in the construction and

modernization of academic, research and clinical facilities" during the 1980s (Chen, 2009).

The other key manager, responsible for all of PhD education at the university, was the Provost, Thomas Ehrlich (1981-87). He had been a professor and Dean of the Law School at Stanford University and had limited experience with biomedical research and PhD education (University of Pennsylvania, 2014e). Thus, both the Provost of the University and the Dean of the School of Medicine were relative outsiders to the problems of biomedical graduate education, and they addressed the issue by appointing a broadly based faculty committee with representatives from several of the involved schools and departments.

Saul Winegrad, a respected professor of physiology who had demonstrated a particular commitment to biomedical graduate education, was asked by Stemmler to chair the committee. Winegrad had been a faculty member of the School of Medicine since 1962 and also had experience as Chair of the Research Committee of the American Heart Association, where he acquired certain skills related to committee work. First, he always made sure to clearly define in his own mind what he aimed to accomplish in a meeting. Second, he always tested an important issue on several committee members prior to the meeting, so that he could be relatively certain about the outcome. Finally, he would not bring an issue up for a vote until the last part of the meeting, when people were tired and eager to end the meeting. Winegrad was strongly devotion to students and is described as soft-spoken, unselfish, and highly determined, but also as somewhat autocratic, and with the support of the Dean and the Provost, he soon got fully engaged in the process of redesigning Penn's biomedical graduate education.

The committee's primary recommendation was to establish a centralized organization that would provide structure and oversight to the biomedical graduate groups. The key question was: What would be the administrative home of this organization? The existing model, where academic matters were assigned to the School of Arts and Sciences and budgetary matters were distributed to individual departments, had proven inefficient. Since most of the funding came through the School of Medicine, the committee therefore proposed that the biomedical graduate groups should be unified within the Dean's office of the School of Medicine and that the Dean should assign administrative responsibility to a Director of Biomedical Graduate Affairs.

This proposal was highly controversial and met with considerable opposition from the other schools, where faculty and leadership were concerned that they would lose power and resources to the medical school. Importantly however, biomedical graduate education would formally remain a university-wide program under the Provost and, as with all PhD education at Penn, the degree would continue to be awarded at the university level. With a combination of force and persuasion, the establishment of the new centralized organization was pushed through the Board of Deans for Biomedical Graduate Education and became effective in July 1984 (Oliver, 1984).

The next step was to find a faculty member to lead and develop the new organization. In the words of the prospectus governing the search (Oliver, 1984), this should be a person who:

> in cooperation with graduate faculty, will be responsible for the development and maintenance of strong curricular programs in graduate education in the biomedical sciences. He or she will be responsible for the enhancement of the quality of accepted applicants and for the establishment of a visible locus to coordinate admissions, recruitment, student records, and student curriculum and career counseling. The Director will seek to promote a sense of common purpose

> and identity among the participating faculty and will have primary responsibility for fund raising efforts directed at improving the level of graduate student support.

The broadly based search committee nominated Winegrad for the shortlist of candidates, and he was asked to present his vision for a new organizational model. This vision involved substantial centralization of the recruitment and funding of students, but was strongly opposed by "an important member of the committee," a department chair of the medical school. Winegrad, who at the time was running his own successful laboratory, was therefore reluctant to take the position and clearly expressed that he did not want it unless he also received the power and support he needed to change the organization. The chair of the search committee emphasized that the opposition was a minority view. Reassured that he had the full support of the Dean and the Provost and that he would receive sufficient funding, Winegrad accepted the position of founding Director of Biomedical Graduate Studies (Doney, 1985). The appointment was announced November 1984 and was publicly endorsed by the Dean (University of Pennsylvania, 1985b):

> The University is committed to achieving the highest standards in biomedical graduate studies. With the School of Medicine assuming responsibility for the program and the appointment of the Director of Biomedical Graduate Studies, we have reached a significant milestone in enhancing the quality of the program. I am particularly pleased that Dr. Saul Winegrad has accepted the position of director of Graduate Studies. He is a distinguished scientist who will lead the program very effectively.

Winegrad had himself suggested that the title of the position should be Director, rather than Associate Dean. He wanted the program to retain the image of being founded in the faculty rather than the administration, and argued that the title of Director would support that image. For the same reason, Winegrad later turned down an offer to be

appointed Deputy Provost. Nevertheless, he worked closely with the administration of the University and the Medical School, as well as the other schools involved.

Building Structure and Identity

In order to acquire information about the biomedical organization and to obtain support from the faculty, Winegrad visited all the thirteen graduate groups. His primary question was "What do you want of the new organization?" and the answer was very clear: "Very good students and money to support them." The faculty wanted qualified students who would contribute to their research groups and a predictable funding scheme. Based on this feedback, Winegrad defined the two basic principles of the BGS model:

First, there had to be a common standard for admission. Potential students would be evaluated by a centralized Admission Committee with members from different graduate groups, based on predefined criteria related to grades, test scores, research experience, letters of recommendation, and interviews. If departments were unable to recruit students who met these standards, they would not get any students that year. For example, it was no longer permissible to let a valued lab assistant enter into the PhD program, no matter how beneficial that arrangement appeared from the perspective of the laboratory. Furthermore, in order to discourage committee members from being biased towards their own candidates, Winegrad reviewed the evaluations. Based on statistical assessments of how the students were scored, he identified which committee members were consistent and who were biased in their evaluation. The results were then presented to the full committee.

Second, the students should have equal and predictable funding. Winegrad

therefore systematically identified all the different funding sources related to biomedical graduate education, including NIH training grants, and insisted that these allocations be controlled by the new centralized organization. This centralization of fiscal resources met with considerable resistance by the Department Chairs, since most of that money would come from their allocations, and the issue became "a bit of a political bombshell." Importantly, however, Winegrad had the support of the involved deans who had established an atmosphere of collaboration regarding the matter.

The Dean of the School of Arts and Sciences, Michael Aiken, who had authority over several of the involved departments outside the medical school, played a particularly central role. Aiken had been Chair of the Department of Sociology, and was an outsider to the biomedical research community. He supported the unification of the biomedical graduate groups under the Dean of the School of Medicine, including a reallocation of $800,000, and "he was willing to have battles with the department chairs" regarding the matter. Aiken was later appointed Provost of the University (1987-93) (Collins, 1987), and together with Dean Stemmler, Aiken was essential in granting Winegrad the resources and authority needed to implement his vision for the new organization.

The BGS office was placed in a suite opposite the Dean's office and was administered by a full-time Assistant Director, Karen Lawrence. Lawrence had been Planning Associate in the Dean's Office and had assisted in the data collection and planning process leading up to the establishment of the new organization. She would lead the administrative side of BGS through its first decade and was "absolutely instrumental in the development of the program."

Three new committees were established to facilitate organizational development

and ground the decision-making process within the biomedical faculty: the chairs from each graduate group comprised an Advisory Committee to the BGS Director for matters concerning the general policies of the program; a centralized Admissions Committee representing all of the graduate groups was instituted to assure a strict and unified admission process based on common criteria; and a Curriculum Committee was established to review and develop the academic programs (Appendix: Resource Document 2000-2010).

During the first months, Lawrence and Winegrad worked intensely to create a catalogue for promoting the new program. At the time, there was no single document that described the large research portfolio of BGS. Therefore, they designed a catalogue that presented the different graduate groups, and they invited all faculty members to write a description of their individual research projects. At first, the faculty showed little interest in the project. Then, "like throwing a switch," according to Winegrad, they realized that this catalogue would influence student selection of laboratories, and both the catalogue and BGS became a focus of attention.

The catalogue also aimed to present a larger vision for BGS and biomedical science at the University of Pennsylvania (1985a). Winegrad believed that Penn had a unique opportunity to promote its image as a national leader in biomedical research and education, and used an innovative piece of the university's architecture to symbolize this position. The main research building at the time was the Richards Medical Research Laboratories (2014), commonly known as the Richards Building, named after former Vice President of the University, Alfred N. Richards. This unique building is regarded as the professional breakthrough of the famous architect and Penn professor Louis Kahn,

and was later designated a National Historic Landmark. With the help of his daughter, a professional designer, Winegrad combined an image of the Richards Building with symbols of recent breakthroughs in molecular biology. This image, entitled "The Richards Building of the School of Medicine at the active site of symbolic protein synthesis on messenger RNA" was used as the cover of the first BGS catalogue, and also became the logo of the program (University of Pennsylvania, 1985a). It symbolized how BGS would transform the individual students into collaborative biomedical scientists.

In addition to the visual symbolism and presentation of the biomedical research portfolio, the catalogue also underscored Penn's historical reputation and was actively used to promote BGS to the outside world. Most importantly, the University's new and comprehensive approach to biomedical graduate education caught the attention of the NIH and other sources of research funding, and assured that essential training grants were renewed. Similarly, the catalogue was used to recruit students. With a centralized organization and designated allocation, BGS was able to develop a more comprehensive recruitment strategy, which included active engagement with selected undergraduate schools, such as Swarthmore College. The effect was almost immediate. The number of applicants doubled, and judging by their standardized GRE test scores, the quality of applicants significant increased (Appendix: Letter from Winegrad to Stemmler, 1968).

Winegrad also pushed hard to establish a core curriculum that would give the students a common theoretical basis, specifically in genetics and cell and molecular biology. Each graduate group had their own courses specific to their sub-disciplines, and there was much overlap and considerable disparity in quality. Still, the faculty was generally comfortable with running their own show, and initially there was some

resistance to contributing to the core curriculum. In the context of the new recruitment and funding model, however, faculty soon realized that teaching these courses put them in a good position to promote their lab and recruit students. The initial resistance therefore transformed into eagerness, and it became somewhat of a competition to contribute to the core curriculum.

Disrupting the Old Structures

In the fall of 1985, after about a year of preparation, BGS was officially inaugurated and welcomed about 70 students to the program (Kirlin, 1985). Before BGS, students were recruited by the different research departments, more or less directly to a particular project and supervisor, and were largely dependent on that supervisor's research funding. With the centralized admission process, however, students enrolled as a cohort, and for the first two years they received funding from the centralized program. This period involved course work and internships in at least three different laboratories. Then, when students were ready to start their dissertation project and contribute to a research group, the designated supervisor would take over the primary funding. Winegrad insisted that students be admitted to the program without necessarily specifying an area for the first two years. This system of so-called "undeclared students" further diminished the departments' authority and met with strong resistance by some Chairs. Not only had the departments lost control over the admission process and the funding, but now they also lost their grip on the admitted students.

As an additional source of tension, BGS introduced procedures for systematic assessment of the graduate groups, which de facto represented assessment of the

academic quality of the affiliated faculty members. The first assessment, conducted in the fall of 1985, evaluated the general graduate group structure, but focused specifically on the newly established graduate group in molecular biology (Appendix: Review of the graduate group in molecular biology, 1985). This group resulted from a merger between three department-based graduate groups in Genetics, Molecular Biology, and Microbiology, and had attracted a broad range of faculty from within the university and affiliated institutes. The internal review team was supplemented with four external consultants, distinguished professors and administrators who came on a two-day site visit. The combined assessment gave a blunt description of the challenges of the organization:

> In summary, the graduate groups represent an interesting organizational feature; but in the absence of clear intellectual foci, and unless new faculty members are added at the growing points and other faculty members disengage as they drift away intellectually, their value can become negative rather than positive. This is what has happened to the graduate group in Molecular Biology. It no longer attracts good graduate students and it should therefore be remodeled.

Several of the graduate groups, the Molecular Biology Group in particular, were composed of a large number of faculty members who had limited research activity and made little contribution to the education and training of students. Moreover, the assessment indicated that the most distinguished and active researchers were in affiliated institutions outside the University, at the Wistar Institute and the Institute for Cancer Research at Fox Chase. There was also promising talent among the junior faculty, but they would need time to develop their research. A primary recommendation was therefore to strengthen the field of molecular biology by recruiting distinguished researchers, and the BGS Director was encouraged to work closely with the Dean and the

Department Chairs to initiate a search for potential candidates.

This assessment gave Winegrad strong support to continue restructuring the biomedical graduate groups and how they operated. The move to combine all the grant money into a centralized and competitive pool was highly commended by the external consultants, as was the concept of undeclared students. Other recommendations included that only faculty who were active contributors to student education and training should be members of a graduate group; that the curriculum should be simplified with emphasis on a few core, compulsory courses; and that the faculty should be actively engaged in the recruitment of students. This initial review laid the path for further development of the organization.

Overall, BGS represented a new organizational paradigm. With delegated authority and resources from the Dean of the School of Medicine and the Provost of the University, it involved a new center of power in the institution, power that previously had resided in the different science departments, specifically with the Department Chairs. The new organization took increasing "ownership" over the graduate groups and students, and introduced a competitive recruitment and funding model that disrupted the status quo: the "gerontocracy" was replaced by a "meritocracy."

This transition did not happen without friction. The primary line of conflict was between BGS and the science departments, especially between the BGS Director and the Department Chairs. As BGS developed, Winegrad's position grew increasingly important. He was accused of "playing politics," and the tension accumulated over time. According to one person who followed the developments closely:

> Winegrad was always soft spoken and tried to be slow moving, he was never a pugnacious kind of person, but he certainly made enemies along the way because

> people did not like giving up control […] when you have been around long enough, and made so many changes, you have conflict with a lot of people, one on one, not in a big public way. You cross this one in this arena and that one in that arena.

The tension between the Chairs and the Director culminated in 1993. Stemmler had stepped down as Dean of the Medical School several years earlier (Chen, 2009), and in February of that year, Aiken left the position as Provost to become Chancellor of the University of Illinois (University of Pennsylvania, 2014e). Consequently, Winegrad found himself in a more challenging position; he had lost both of his primary supporters, the two people who had guaranteed him the authority to implement his radical plan.

The new Dean and Executive Vice President of the University of Pennsylvania Health System, William Kelley (1989-2000) had been recruited from his position as Chair of the Department of Internal Medicine at the University of Michigan and represented a new era in the history of the medical school. Kelley described himself as a "three-crane dean" (Holmes, 2005), referring to the number of active construction sites on campus, and has been both acknowledged and criticized for aggressively expanding the institution. Kelley was eventually forced to resign due to a $300 million financial loss related to the Health System's acquisition of new hospitals and physician practices (Stark, 2000). He was described as brusque and ambitious, but also as a leader who empowered the people around him: "a commanding presence" with a very different leadership style than Stemmler. Assistant Director Lawrence recalled:

> I remember […] the shock of Department Chairs who were used to just going in and saying: "I would like an appointment with the Dean." And they would go in and take however long they wanted. When Kelley came, he would not give anyone more than a 15 minute appointment. They did not like it.

Winegrad, who also was used to having the ear of the Dean, now reported to the Vice Dean for Education, Fredric Burg, and he found that his level of influence was markedly reduced. Dean Kelley was better connected with some of the Department Chairs and heard increasing concerns about how BGS was spending its money. In 1992-93, he therefore requested an administrative review chaired by the Vice Dean for Education. The other members of the committee included the Vice Dean for Research, Arthur Asbury, and four of the top administrative executives at the medical school. There were no faculty members or representatives of BGS on the committee, and "[t]he purpose of the review was to study the current organization, governance, and fiscal status of BGS and to develop recommendations for future directions for the program" (Appendix: BGS Administrative Review, 1993). The review report started by acknowledging BGS and its Director for making positive changes to the organization:

> The creation and implementation of BGS as an entity has resulted in substantial positive changes from the previous structure, which lacked a central locus. The current organizational structure provides a desirable degree of flexibility to the graduate education program, allowing it to change with the times […] Under Dr. Winegrad's leadership, there have been significant improvements in the recruitment process and in the quality of the students.

The report also commended the new model for student funding, the admission of undeclared students, and the consolidation of the graduate groups. Then it turned to the budget and financial management of BGS, and revealed a strong, underlying conflict between the BGS Director and the Department Chairs. The Chairs expressed concerns about lack of transparency and a "perception of secrecy" with respect to the fiscal status of the program, and they requested more access to BGS budget information. Moreover, the report described that:

> There is a striking dichotomy between the view of the Director of BGS and that of the School of Medicine basic science Chairs with respect to who provides the resources to support the administrative functions of the graduate education program.

Winegrad's response to this criticism was outlined in the report in the form of a summary of the costs for central services. It demonstrated that about 50% of these funds went back to the graduate groups as salaries and support for recruitment activities, suggesting that the Chairs' perception was based on a lack of insight into the underlying budget. Next, the review revealed a general concern about lack of oversight:

> While there is an advisory committee, it was noted that BGS does not have an oversight body that participates with the Director in governance of the BGS program. As a result there are times when management decisions appear to be arbitrary. A number of individuals suggested that more direct involvement in governance by faculty would make it easier to effect the necessary organizational changes.

Changes to the governing structure were also a focus of the review committee's recommendations. First, it recommended that the BGS Director should report to the Vice Dean for Research rather than to the Vice Dean for Education, thereby combining responsibility for research and research training under one rubric. Second, based on a proposal by Winegrad, the committee recommended that the Department Chairs form an Advisory Board which should meet twice yearly with the BGS Director to receive information and provide counsel. Third, it recommended that the Dean appoint a task force for developing a long-range plan for biomedical graduate education. Key issues to address should be developing a mission statement, restructuring graduate groups, funding students, and the optimal size of the student body. Finally, the committee recommended that faculty members should be given equal recognition for teaching in PhD courses as in

MD courses.

This administrative review clearly demonstrated the tension that had developed between the Director and the Department Chairs, especially over financial issues, and foreshadowed a change in the BGS leadership. In February 1994, Neal Nathanson, who for the last 15 years had been Chair of the Department of Microbiology, was appointed Vice Dean for Research and Research Training, and a few days later Winegrad stepped down from his position as BGS Director. For six months, Nathanson then doubled as Vice Dean and BGS Director. He closely familiarized himself with the organization, but made no substantial alterations, and besides the change in the line of reporting, none of the recommendations in the administrative review reports were implemented.

Intra- and Inter-School Tensions

At the beginning of 1995, BGS entered a new phase of development with the appointment of a new permanent Director (University of Pennsylvania, 1995). Glen Gaulton had been recruited to Penn in 1985, the same year that BGS was inaugurated. He came from a postdoctoral fellowship at Harvard and an overlapping position as assistant professor at Tuft's Medical School, and was attracted by Penn's strong reputation in immunology. Moreover, Gaulton saw the institution as less hierarchical and more friendly to junior faculty than the institutions he came from, and he experienced an organizational culture that was very different from the pre-BGS era:

> Penn was an environment that was very collaborative, and frankly more friendly to the junior faculty […] if you were strong and productive early, you could grow very quickly in an environment like Penn […] in part because of BGS and the combined degree students, I was also able to get students in my lab very, very quickly.

Gaulton soon got actively involved with graduate education, not only with BGS, but also with the MD-PhD program. This combined degree program had been established in the mid-1960s based on an NIH initiative and funding scheme. It involved a structured path for a few carefully selected medical students aiming to become physician scientists (Brass et al., 2010). Gaulton had been particularly successful in recruiting and training MD-PhD students. He had also talked to students and faculty about making changes to the program, and when a search committee was formed to find a new Director, he became the primary candidate. Gaulton was somewhat surprised to be considered since he was not an MD or MD-PhD himself, only a "straight PhD." Nevertheless, he was appointed Associate Dean and Director of the Combined Degree and Physician Scholar Programs and actively engaged in the process of transforming the MD-PhD from a "sandwich degree" to a truly integrated physician scientist program.

Based on his position as Director of the Combined Degree Program, Gaulton also served on the search committee for a new BGS Director. Because of the complexity of the organization, it was generally agreed only to search among the BGS faculty for an active researcher who knew the research environment and had sufficient institutional knowledge. Such a person proved difficult to find, and the rest of the committee eventually turned to Gaulton and asked if he would consider filling both positions, Director of the Combined Degree Program and BGS. Personally, he regarded that as a workable solution, but again there was some sensitivity to the matter. Somewhat ironically, he was now seen as a representative of the MD side of the organization coming to take over the PhD program, and there were faculty concerns that he was too "medical centric" in his research position. However, after pointing out that he was

himself a PhD, this skepticism soon dissipated, and the two positions were combined.

Although it did not affect the outcome of the appointment, this transition of leadership demonstrated the underlying tension between the MD and the PhD side of the medical school. Going back to the pre-BGS era, the medical school faculty was dominated by MDs. It was a school for physicians by physicians, and the field of medical research also belonged to the physicians. However, as medical research became more molecular, more biological, and more interdisciplinary, the PhDs grew in numbers, and according to a senior professor, "There has always been a tension between the MDs and PhDs."

From the perspective of the PhD faculty, there was an underlying perception, and to some degree acceptance, that the medical school belonged to the MDs: "Particularly as a PhD in a medical school, I never really aspired to leading anything other than my lab." This sense of inferiority was also emphasized by the MD program being referred to as "the medical school" and was clearly expressed by people throughout the BGS organization:

- "I would say that most faculty do feel that graduate education is treated as second class."

- "The centerpiece of pride at a place like this has been solely focused on medical student training. Still, every time the senior administration refers to an astounding breakthrough by a faculty member, there are graduate students who are at the center of that in almost every case. But they don't seem to be able to connect the dots."
- "Everybody acknowledges that you can't have a medical school without medical students. On the other hand, there are now more PhD students than medical students, and yet, the administrative office is way smaller. So everybody understands that medical students pay tuition, but they should also understand that graduate students help bring in research dollars."

Some argued that this tension was typical in a medical school: “It would be nice to be the first born, but get over it.” Others, in particular leaders who answered for both sides of the organization, downplayed the issue and argued that PhDs are represented at all levels of leadership; that the level of dissatisfaction is equally balanced among MDs and PhDs; and that throughout its history, BGS has received strong support and experienced steady growth.

A similar sensitivity existed between the School of Medicine and the other schools within the BGS umbrella. As previously described, BGS was formally defined as a centralized, inter-school and university-level organization with a substantial fraction of the faculty deriving from schools and institutions other than the medical school (currently about one quarter). Going back to the establishment of the program, there were concerns that the medical school was too dominant: “Why should the dental school come down and sit in the medical school and be told what to do?” There were also significant disparities in the way faculty were paid and supported in the School of Medicine as compared to the less affluent schools. In the words of Perry Molinoff, the previous Department Chair and Vice Provost, “The University takes a lot of pride in what they call ‘One University,’ but they also talk about ‘every tub on its own bottom.’ Those two things are inconsistent.”

The term “One University” was coined by President Martin Meyerson (1970-1981) in an attempt to unify the different schools and counter the “balkanization” of the institution (University Development Commission, 1971). The concept of “every tub on its own bottom,” on the other hand, makes reference to the overall management model of

the University. Already in the 1970s, Penn developed and implemented a management model known as Responsibility Center Management (RCM), which held that each school was responsible for managing its own revenues and expenses (McGarvey, 2005). Moreover, each school was expected to incorporate into its budgets a given share of the cost of central administrative services and a subvention fund to be allocated by the Provost and the President for strategic priorities. This model promoted balanced budgets and entrepreneurship within the schools and is widely recognized as an important reason for Penn's growth and success. With regard to the BGS model, however, RCM was regarded by some leaders as an impediment to inter-school collaborations. Vice Provost Binns, on the other hand, described it as the "whipping boy for all problems", arguing that when the schools were unable to negotiate reasonable deals, it was easy for them to blame RCM.

In terms of providing administrative support to several schools, BGS could in theory have been defined within the RCM framework as a central administrative service funded through cost sharing by the participating schools. However, as an academic program it also required an academic home, which for all practical purposes became the School of Medicine. The other schools, therefore, perceived BGS as the responsibility of the wealthy medical school, and with reference to RCM and the principle of "every tub on its own bottom," they were reluctant to contribute to the centralized costs. Issues related to cost sharing, particularly concerning tuition flow and funding of inter-disciplinary courses outside of the medical school, have been a reoccurring cause of friction.

The pragmatic solution to these problems was, and still is, that the School of

Medicine would underwrite all the administrative costs of BGS as well as the first two years of funding for all the students (reduced to 21 months in 2000), whether they conducted their dissertation projects within or outside the medical school. The other schools and the affiliated institutions thereby got highly subsidized PhD students ready to contribute in the laboratories. This decision to subsidize the other schools silenced most of the opposition regarding the medical school's grip on BGS and was described by one administrator as "one of the smarter decisions that BGS made […] because it means we are one institution." Furthermore, the School of Medicine has benefitted from the prestige associated with representing one of the largest biomedical graduate programs in the country, including an impressive portfolio of NIH training grants. Although some people in the School of Medicine argued that the other schools should take on more of the financial burden, the arrangement was generally perceived as a win-win situation.

Releasing the Departmental Grip

Gaulton started his tenure as BGS Director in January 1995 (University of Pennsylvania, 1995). He reported to Nathanson, who continued as the Vice Dean for Research, but he also established a direct line of communication with Dean Kelley. The two of them met several times a year, and Gaulton was given broad authority to develop the organization. Kelley's commitment to expand the biomedical research space and recruit world-class faculty reinforced BGS' mission to attract and train excellent students. Moreover, Kelley's ultimate leadership failure, which almost drove the Health System to bankruptcy, had limited effect on the research side of the organization, and BGS continued to grow into the 2000s.

Gaulton made few changes to the core structure of the BGS organization. He brought with him some new concepts from the MD-PhD program, but in principal, he maintained and strengthened the model and administrative framework that Winegrad and Assistant Director Lawrence had developed. Lawrence left for a position in the Provost's office the same year that Winegrad stepped down, but administrative continuity and institutional knowledge was assured when Judy Jackson was appointed as Administrative Director. She had been recruited to BGS as a Graduate Group Coordinator in 1988 and took over Lawrence's role as the central coordinator and day-to-day manager of the program. Jackson still holds this important position and was described by previous and current leaders as essential for maintaining the structure and stable development of the program.

The principle structure was preserved, but there was still much to be done in terms of organizational development, especially related to the graduate groups. Although the recruitment and funding model had fundamentally changed and much had been accomplished during the first decade, there was a continuous power struggle between BGS and the departments. According to Gaulton, many departments were still "used to doing their own thing, accepting whatever students they wanted, disregarding quality, redesigning their curriculum as how they saw best, without oversight, and particularly in the School of Medicine, they were off on their own." Many of the graduate groups retained remnants of the old department-based structure. Gaulton therefore continued the long-term strategy of detaching the graduate groups from the "hammerlock" of the departments, primarily through the process of periodic reviews of the graduate groups.

This restructuring was an implicit part of the BGS model, but it was not

implemented through top-down directives or a predefined plan. It evolved and developed in an interactive manner throughout the organization's thirty-year history and continues to do so today. Some old departmental-based graduate groups more or less self-imploded at the prospect of being reviewed, whereas others merged in order to gain strength and combine overlapping curricula. New graduate groups were established through the initiative of faculty who were collaborating across schools and departments, and some even laid the groundwork for forming new departments.

By detaching the graduate groups from the departments, BGS established a new and more dynamic structure on top of the old and somewhat dysfunctional departmental structure. Neil Nathanson, former Department Chair, Vice Dean, and interim BGS Director, explained:

> It is very difficult to change the department structure and yet science changes. This is a way of essentially bypassing that. If the graduate group system is really no longer interlocked with the department system, then it can evolve freely without the constraints of having to neither invent new departments nor change departments. So that is an enormous advantage of the system. [It allows for] these institutions to evolve without having to go through a blood bath of trying to change departments, and at Penn, and I guess many places, that would be very difficult.

An important change in the organizational structure was the 1995 merger of the graduate groups in Molecular Biology, Cell Biology, Physiology, and Pathology into the mega-group of Cell and Molecular Biology (CAMB) (University of Pennsylvania, 2014d). CAMB today includes about half of all the BGS students and is further divided into six thematic programs. These programs have evolved over time and today include Cell Biology and Physiology; Cancer Biology; Developmental Stem Cell and Regenerative Biology; Gene Therapy and Vaccines; Genetics and Gene Regulation; and

Microbiology, Virology and Parasitology. In many aspects CAMB became a mini-BGS, an umbrella under the umbrella, with a similar dynamic as the overall BGS organization. The current Chair of the program, Dan Kessler, described the situation like this:

> I'd say the first half of CAMB's history was viewed as significantly problematic. The leadership structure was ineffective, the Chair of the graduate group had no traction on his faculty, the programs were sort of demanding autonomy, and there was almost an implied threat where "We're going to do what we want because we know what's best for our students." So there was a real tug-of-war.

Similar to BGS' overall development, CAMB began with a set of primarily department-based graduate groups, where the faculty and department Chairs were used to running things their own way. The newly appointed CAMB graduate group Chair faced an uphill struggle as the departments also tried to run the thematic programs. The next phase in the development, therefore, was to identify faculty members who could take responsibility for each of the six thematic programs. Under the leadership of the CAMB Chair, these six Program Chairs then formed a much more influential group, an Executive Committee, which would coordinate and implement change independent of the departments.

Each of the thematic programs had its own individual characteristics and evolution. The program in Developmental Biology saw a particularly large influx of new assistant professors who were more amenable and inclined to take ownership of and responsibility for the program. This critical mass of assistant professors then influenced some newly recruited senior faculty, who also adopted the graduate group as their own. The BGS/CAMB model thereby contributed to a spiral of positive reinforcement involving both faculty and students, and the group developed an identity independent of the underlying department structure. Kessler explained:

> One of the things that I find a gratifying consequence of the BGS structure is that most graduate students have no idea what department they're in – because it's irrelevant to them. They're in a graduate group, and they're a member of BGS, and that's totally interschool. So, at that level, there is no barrier. I think the organizational plan has been pretty successful in preventing barriers like those from being actual barriers. They're neither financial nor academic.

The process of detaching the graduate groups from the departments had come a long way, and for most of the groups it was more or less complete. For one group, however, it was still an ongoing process, which may shed additional light on this key aspect of the BGS organization.

Practically all biomedical research projects include some level of statistics, and the School of Medicine's Department of Biostatistics and Epidemiology had a central role in providing courses in quantitative analysis for all the BGS students. It was also the home of the graduate group in Epidemiology and Biostatistics, and the two entities were essentially one and the same. The separation from the department, which had occurred for the other groups, was missing. Moreover, the graduate students in Epidemiology and Biostatistics were not part of the BGS funding model, leading to this graduate group being described as the "misfit" in the organization.

This lack of integration was related to the fact that the field of biostatistics is fundamentally different from the laboratory research, which defines the other BGS groups. These differences include the scientific theory and methods, the academic culture, and the curriculum, as well as students' future career paths. Moreover, when the biomedical faculty teach courses for their respective graduate groups, they are generally presenting aspects of their own research. The epidemiologists and statisticians, on the other hand, provide courses and guidance in biostatistics for all the BGS students. The

curriculum typically corresponds to the undergraduate level from the perspective of an expert in the field, and their own research has limited relevance. To a large extent the Department of Biostatistics and Epidemiology may be described as having a service function in relation to the rest of BGS. This function connected to the department status and identity in the organization:

> That is […] definitely in the area of sensitivity; the feeling that in the Dean's Office we are viewed as a service group. Somebody who is researching immunology is considered part of the core mission of the medical school. [They will say that] "we'll indulge the biostatisticians their pretense of doing research, but really, what they are here for is to help us get grants."

This underlying tension was further intensified by a recent review that placed the Graduate Group in Epidemiology and Biostatistics in the nation's second tier (Appendix: Review of the Biostatistics & Epidemiology Graduate Group, 2013). Although some criticism about academic quality was considered legitimate by the department, there was also a clear sense of miscommunication:

> It is sort of difficult to really process the report because we feel like so much of it was based on just not quite understanding what we do and what the context is for biostatistics training in 2013 in the United States of America. If you do not really understand the basic model; you do not understand the objectives; you do not understand the job market for the graduates. If you do not understand the kind of training that they need, then how can you evaluate the program. That was somewhat worrying.

Despite this tension, there appeared to be general agreement that the Graduate Group in Epidemiology and Biostatistics should be better integrated with the rest of the BGS organization, especially regarding financial matters. According to the general organizational paradigm, such integration would imply that the graduate group is detached from the department through some kind of interdisciplinary and thematic reorganization. Given that Biostatistics and Epidemiology is academically very distinct

from the laboratory research that dominates the rest of BGS, this new thematic arrangement was not obvious.

An indication of how Biostatistics and Epidemiology may be better integrated in the BGS organization was given by the 2001 establishment of the Graduate Group in Genomics and Computational Biology. This graduate group was highlighted as a model for how non-laboratory research can be thematically integrated in the organization, and the discussion suggests that the Epidemiology and Biostatistics Group may over time be broken up and somehow integrated with other research. BGS thus continued to challenge the departmental grip on graduate education, and although it was aiming for a collaborative and inclusive process, the management was expecting a "bumpy ride."

Balancing Aims and Expectations

The Biostatistics and Epidemiology case illustrated also another fundamental and timely issue in PhD education: Should it focus on preparing students for an increasingly limited number of academic positions or should it prepare them for a more probable career outside of academia? According to Graduate Group Chair Daniel Heitjan:

> Some of our faculty says [in response to criticism that the program is too "applied"]: "Nonsense, we are training them for the kind of jobs that they are going to have, when they get out there." I would have to say that I think it is true, but I also acknowledge, if you really wanted to be an academic biostatistician, at the highest level […] I would probably choose Harvard or Hopkins over Penn.

BGS, like other biomedical PhD programs, is torn between two different goals: to educate elite academics who will strengthen the institution's reputation and research portfolio, and to assure that the majority of students, who will not get tenured research positions, also get a relevant education and are rewarded for their hard work (Cyranoski

et al., 2011; Golde & Dore, 2001). This issue is accentuated by NIH's policy to promote PhD education that will prepare the students for "a variety of career options in the dynamic biomedical workforce landscape" (National Institutes of Health, 2012), and BGS has already competed for grants related to this initiative. Still, based on the response of most leaders in the BGS organization, it is quite clear that academic and scientific excellence remained Penn's and BGS' primary priority. In the words of Andrew Binns, the current Vice Provost for Education:

> I am really torn about that, but it is research and scholarship first […] we cannot sacrifice real training into this deep strongly disciplinary focus, because if we are not doing that, nobody else can […] I think that making sure students have the skills sets that can help them succeed in jobs outside of the lab are important. However, I still think that the primary focus on all PhD education has to be in the generation of new research scholars, who are going to do research and teaching. That is goal one.

A similar opinion was stated by the current BGS director, Mike Nusbaum:

> To train somebody to be a first-class scientist requires all the effort we're currently putting into it. So if we were to need to incorporate a substantial fraction of the PhD student's training to acquire a different skill set to achieve a different goal, then it means they're not going to be trained as effectively in the primary goal […] in the short term, that's not the direction we're focusing on.

Instead, Nusbaum argued that the program should focus on research that the funding organizations regard as relevant and particularly on translational-oriented research with relevance for clinical practice. Moreover, Nusbaum emphasized the need to better communicate to students and potential employers that the research-based PhD education imparts a broad set of skills, such as critical thinking, analysis, writing, presentation, and project management, which are indeed transferable to other careers.

The institutional priorities thus seemed clear: research quality first, career preparation second. Yet one of the graduate chairs took a somewhat different approach to

the problem, arguing that stronger attention to other career paths is essential in order to maintain academic quality:

> I think it has to be done, in order to maintain the focus […] I think that helping students see their career destination and allowing them to work on those additional skills as early as possible will help them justify why it is they're in graduate school and why they should be working hard in the lab. Or, alternatively, they may look at this career path and they may decide that they don't need the PhD and they may leave. I hate to say it, but sometimes our job is to help the students see that they shouldn't be in graduate school.

From the student perspective there was also a very clear call for a more career-oriented curriculum. Better preparation for life after the PhD was one of the primary areas where the student leaders asked for changes in the program. They pointed out that BGS has a very strong presence and supporting role in the first two years of the program, but that it is almost absent towards the end. A concluding course or "capstone seminar" that focuses on life after the PhD was therefore suggested.

Recent Leadership and Leadership Perspective

In 1998 Gaulton left the position of BGS Director to be appointed Vice Dean for Research and Research Training, and in 2006 he became Executive Vice Dean and Chief Scientific Officer of the School of Medicine (University of Pennsylvania, 2006). He has continued to oversee the program until the present day, and with consistent support from the Dean's Office, the path of development has been very stable. Gaulton worked closely with the subsequent BGS Directors, who also served as Associate Dean for Graduate Education.

The new Director position was first filled by Michael Selzer, an MD-PhD who after three and a half years left for a leadership position at Temple University. Then in

2002, Susan Ross was appointed Director and would hold the position for a decade. Like Gaulton, she was a "straight PhD" and had some previous BGS experience as Chair of the Admissions Committee for the Immunology Program. She continued the process of implementing unified standards of quality across the graduate groups. She also worked systematically to broaden diversity in the recruitment process, a matter that is still regarded as an area of priority for the program. In 2012, Ross moved on to a position as Department Chair, and after an interim period, Mike Nusbaum was appointed BGS Director (University of Pennsylvania, 2013). Nusbaum, also a PhD, had formerly been Chair of the Neuroscience Graduate Group, which was considered among the best groups in BGS and had received national recognition for its innovative program (Kreeger, 2014).

An interesting observation, although perhaps not very surprising in the context of academia, was that of thirteen past and current academic leaders affiliated with BGS, from Graduate Group Chairs to Vice Provosts, none had received formal training in leadership. One previous Department Chair explained that he reluctantly had attended a leadership course because it was required by the Dean, and had been amazed by how personality type correlated with different decision-making strategies. Otherwise, they had all learned by doing and by watching role models, typically their superiors, but also parents were noted to be important leadership figures. Only one, an MD-PhD, expressed that he had ever had an ambition for leadership. For the rest, leadership was something they had either been drawn into or taken on as a matter of duty. Having ambitions to become an administrator appeared to be somewhat suspect:

- "I did not have a secret plan to move into leadership positions […] The way I like to think about it is I forgot to take two steps back when everybody else did."

- "It was not why I was in research, to get administrative power."

- "I had no plan [for leadership] whatsoever. I just wanted the students to be well looked after, and I cared about the students, and I care about my fellow faculty, and I just wanted to make the place run better and be more supportive, and help galvanize decisions to move forward."

It was also obvious that their primary identity was in research, and to take on administrative duties was commonly described as a sacrifice:

- "I really love doing research and being part of the scientific community, not just the administrative community."

- "I spent most of my time as Director of BGS at that time; my own research program suffered for that period of time."

- "It definitely has had an impact on my research career […] so I think that I am right now tailing towards the end of my formal research career, unless some good fortune comes my way."

An experienced administrator summarized it like this:

> The thing that keeps coming back to me is that the best academic program leaders – Graduate Deans and Program Chairs – seem to be the people who are often very reluctant to take on the job, while the worst ones may actively seek it out […] The good ones are motivated largely by a sense of duty toward the program and a fear that no other competent leader will take it on if they decline it. They know their own research is likely to suffer, but they take the job anyway because they care about their colleagues and the students in the program.

Discussing personal thoughts and experiences as leaders was not very common, and the perspective on leadership can be characterized as somewhat private and implicit, although not necessarily less insightful. The most salient and valued aspect of leadership was the willingness to be inclusive, collaborative, and collegial – combined with a sense of decisiveness:

- "I'm an inclusive person, and I try to work with consensus, but I don't think I'm afraid of making hard decisions."

- "Thoughtfulness and kindness balanced with decisiveness. Somewhere between those two is the perfect administrator."

Another common characteristic was that all the BGS Directors and Graduate Group Chairs saw themselves as student advocates:

- "I became a student defender."
- "Too often, the students are sort of silenced by their own sense of powerlessness. That's what really matters to me."

This devotion to student interests and welfare was strongly confirmed by the student representatives, and BGS appears to attract and empower the altruists in the organization. A former Graduate Group Chair expressed it like this:

> I am very impressed with the leadership of BGS. These are people who really want to teach, and it is interesting how the BGS administration draws these people, who as far as I can tell, from what I have observed, they are very selfless. It is one of the few administrative things that I have been involved in where there is really this sense of mission, commitment, altruism, devotion to the task and team work too.

BGS involves an elaborate leadership structure to which faculty members are recruited, more or less informally, for their desire and aptitude to be part of the collective mission to support student training. To be part of a graduate group is optional, but as a member, one makes a commitment to contribute at a minimum level. Beyond that, the faculty members can to a large extent determine their own level of involvement, and the most devoted are recruited and groomed to advance in the leadership structure. One may start out as a member of one of the many program committees, and then go on to be Program Chair, Graduate Group Chair and BGS Director, which has become a recruitment position for Department Chair or even Vice Dean.

The leadership structure is formally organized as a comprehensive set of committees. The centralized Advisory Committee, Admission Committee, and Curriculum Committee are replicated for each of the graduate groups, and for CAMB, it is also replicated at the level of the individual programs. Each committee is represented at the level above, thereby establishing a comprehensive system for collaborative leadership and shared decision-making. This collaborative leadership structure spans the entire BGS organization, and there was a clear perception that it has had a positive influence on the overall culture of the biomedical research community. There were reportedly fewer "turf wars" than people had experienced at other institutions, and collegiality and an amicable personality was seen as more valued than elitism in searches for new faculty:

- "What one might consider prima donnas or it's-all-about-me people, who you would rather not need to interact with; the percentage of those faculty is surprisingly small, relative to peer institutions."

- "I think that Penn is very special. I am absolutely certain that Penn is a more collegial place than many peer institutions."

This seemingly exceptional level of collegiality does not imply that the current organization is without conflicts. There is still a continuous stream of problems concerning student-supervisor relationship, sometimes due to problematic supervisors, other times due to problematic students, and often due to the sheer complexity and human nature of lab-based PhD education. Some labs are known to be somewhat dysfunctional, and although student surveys are overwhelmingly positive, the student representatives told of several cases where students felt they had been mistreated.

The primary difference from the pre-BGS era is that there is now an organization and a system of devoted faculty and administrators for addressing these problems. With

several people at different levels in the organization working together, it is possible to "triangulate" conflicts and difficult individuals in a way that solves the problems more efficiently. The students have several different faculty members and administrators they can go to with their problems. They are generally content with the current situation, but contend that the program could be improved through more student involvement.

The Biomedical Graduate Student Association (BGSA) represents all students enrolled in BGS and has an expressed mission to "monitor issues of importance to the biomedical graduate student community, represent the concerns of Biomedical Graduate Students to the University administration, and advocate for changes to enhance the quality of biomedical graduate education" (University of Pennsylvania, 2014c). With the exception of some recent academic initiatives, however, it is primarily a social organization. It receives funding from the University and is represented in the Graduate and Professional Student Assembly, but has no formal function related to BGS and no role in the decision-making processes. BGSA is not involved in the process of nominating students for academic boards, and the leaders did not know how students were selected for these positions. The student leaders argued for a somewhat clearer role in the BGS organization and believed that with a little more encouragement and collaboration, the student association could make a significant contribution to the development of the program. Generic skill training and low-threshold mentoring for students were highlighted as key areas where BGSA could take a more active role.

Current Challenges

In 2011, an internal committee chaired by Michael Cancro, former Associate

Dean for Curriculum and Chair of the Immunology Graduate Group, was appointed to conduct the first full academic and administrative review of BGS. The mandate was to do a "comprehensive and independent assessment of how BGS is accomplishing the University's goals for graduate training in the biomedical sciences," and the review process included surveys of current students, recent graduates and faculty. The results were presented in a 2012 report and were "overwhelmingly" positive (Appendix: Review of Biomedical Graduate Studies, 2012):

> BGS faculty are genuinely invested in graduate student training, and BGS is overwhelmingly perceived as a well-conceived and highly effective apparatus […] both past and current students are overwhelmingly positive about the quality of their academic experience at Penn […] Mentoring relationships with faculty are overwhelmingly positive […] Thus, while BGS is an extremely complex entity, it is clearly remarkably effective on multiple levels.

The organizational model, which was basically the same one that Saul Winegrad conceived in 1984, had proven highly successful, and the recommendations of the review committee involved matters of optimization rather than actual changes to the organization. There were four issues of concern, which all related back to the above-described leadership challenges and organizational history of the program.

The first concerned the size and scope of the program. The committee recommended that BGS should consider "encompassing additional schools and programs within the university." This recommendation supported the view expressed by different leaders in the organization that all PhD education at Penn should be organized by the principles of BGS. According to the Vice Provost, however, that scenario was unrealistic and based on a lack of insight into the enormous academic diversity within the University:

> They try to have the entire university run as BGS. [In the context of the whole institution] BGS is equivalent to "a" department, in the intellectual context maybe two. Forget all the clinical stuff; it is BGS I am talking about. Biostatistics and Epidemiology is the closest they got to something that is different, and they cannot deal with it.

The second issue raised in the report concerned the changing needs and interests of the students. The committee emphasized that "Student anxiety about the difficulties of pursuing an academic research career is high" and recommended more career-related seminars, generic skills training, and more teaching opportunities for students. It did not, however, discuss how such initiatives draw time and resources from the "core mission" of producing research papers and training experts in their field.

The third issue concerned disparity and lack of incentives for faculty participation in BGS teaching and service. The committee noted that while some faculty members made very little contribution, others, serving as graduate group chairs or as directors of large core courses, put in a lot of time and effort, but received limited compensation. It therefore recommended clarifying expectations, keeping better records, and stronger incentives for faculty contribution to the program. Looking back in the history of BGS, it is interesting to note that this issue was first raised in the 1985 review of the graduate group structure and then again in the 1993 administrative review (Appendix):

> There is no incentive for faculty to teach these courses and that, in fact, faculty receive the message that any teaching that they do, other than in the M.D. program, is at their own expense.

Thus, little had changed, and it was clear that teaching for BGS continued to have a very different status from teaching in the MD program. Although not explicitly stated, teaching in the PhD program was regarded as part of the research mission and

accordingly, the incentive was the ability to recruit students and acquire research funding rather than financial compensation. This principle also seemed to be generally accepted with regard to teaching specialized courses close to the faculty member's field of research. With regard to taking on larger responsibilities, however, such as serving as graduate group chair or teaching introductory courses in biostatistics for all BGS students, there was a sense of unfairness and frustration. As one graduate group chair stated:

> I don't get supplemental pay; I don't get per cent effort, nothing. I just do it, and I get the appreciation of my department, which, in an academic setting, getting the appreciation of your department is kind of like a slap in the back of the head.

The fourth issue raised by the review committee concerned future funding of the program. As BGS was heavily reliant on NIH funding, there were growing apprehensions about how the economic downturn and the federal sequestration would affect the program's ability to maintain the current number of students and level of ambition. The review report therefore set forth a number of recommendations for fundraising and establishing an endowment to assure the continuous growth and development of BGS. However, while the faculty and many BGS leaders expressed major concerns about the financial future of BGS, Gaulton, the Executive Vice Dean and Chief Scientific Officer, argued that the fear was strongly exaggerated:

> We've gone through major up and down periods in NIH funding before and BGS always continues to prosper and be incredibly well supported […] The best way to ensure that BGS is well positioned for the future is to make sure that our research mission as a whole is strong […] If NIH funding starts to have trouble, and we don't have mechanisms to support the students, then we have to invest more in the student programs than we have traditionally. That's fine.

There thus appeared to be a discrepancy between how the fiscal realities were

perceived by the Dean's Office and by individuals further down in the organization. This misalignment of perspectives could be connected to what appeared as a general deficiency in communication through the organizational hierarchy, a problem that was recognized at both levels: Gaulton talked about the dangers of becoming isolated after many years in administration, and some graduate group chairs expressed difficulties in getting their voice heard beyond their immediate colleagues.

The final recommendations of the review committee concerned the administrative status of the BGS Director. The report noted that the Director had the title of Associate Dean and reported to the Vice Dean, whereas leaders of comparable programs in other schools were Vice Deans and reported directly to the Dean. Accordingly, "the BGS Director has no regularly scheduled contact with the Dean, and thus lacks direct input into the strategic planning processes of the Medical Center […] This can at times obstruct establishing and maintaining collaboration between BGS and the various schools on campus with whom partnerships might be forged." The review report therefore recommended that the administrative stature of the BGS Director should be elevated to Vice Dean with a formal and direct line of communication to the Dean. Noting Gaulton's position as Executive Vice Dean and former BGS Director, the report acknowledged that the current line of communication was unique and that there was no need for an immediate change.

Elevating the Director's formal level of authority was also the primary recommendation proposed by an external review, which supplemented the internal review report. The external committee, which included Directors of similar programs, concluded that:

> This single change would greatly improve the perception of the importance of graduate education in the School of Medicine. In addition, a strengthened BGS leader could more effectively interact with the leaders in the School of Medicine and other Schools to leverage existing strengths and help navigate the School-centered silos that limit training important to 21st century graduate education.

Based on this comprehensive review, one can argue that BGS is to some degree back to where it started almost thirty years ago – with a review report that calls for the empowerment of a leader who can transform the organization in order to meet the challenges of the future. Unlike the situation in 1985, however, there is currently no crisis in biomedical graduate education at the University of Pennsylvanian. As demonstrated by the 2012 review, BGS is regarded as a highly successful program, both within and outside the institution. The student attrition rate is low (12% for students who enrolled in the past 10 years); mean time to degree is 5.7 years, and of the PhD graduates from 2000-2004, 89 % hold some kind of research position.

The program is doing better than ever before, and although NIH funding is decreasing, the institution at large is in good financial shape. Thus, the need for change is limited, and the most probable scenario seems to be that BGS will retain its basic configuration into the foreseeable future. Still, BGS' organization of interdisciplinary graduate groups, which are independent of the department structure, is designed to evolve and adapt to the changing landscape of biomedical research. This development may, as suggested by the review report, involve the assimilation of other schools and departments within the University, but that will likely depend more on the need for change in those organizations than in BGS itself.

CHAPTER 4 – ANALYSIS

Theoretical Perspective

Based on the case study presented, it seems clear that biomedical graduate education at the University of Pennsylvania over the last thirty years has undergone a comprehensive process of change. This process of going from a highly dispersed system of biomedical graduate education to a centralized, umbrella-type organization has relevance for most comprehensive research universities (Barnett, 2011; Mulvany, 2013). It integrates a number of key issues related to institutional structure, culture, and leadership, with general relevance for the field of higher education management. In order to extract new and meaningful knowledge, it is therefore interesting to identify and explore the general problems and concepts of the case and how they relate to the existing literature in the field.

The literature on organizational change in higher education institutions is in many ways as complex, diverse, and contradictory as the organizations it attempts to explain (Kezar, 2001; Kezar, 2014). Sorting under the social sciences, there are at least six schools of thought with overlapping theoretical frameworks and inconsistent terminology. Since this case study concerns the organization of the natural sciences and aims to communicate to an interdisciplinary audience, it will simplify rather than elaborate the theoretical context. In that regard, it should be noted that the different models of organizational change are not necessarily manifestations of conflicting views. Instead they can be viewed as alternative perspectives – frames or lenses – that can be applied to explore different aspects of the organization, its leadership, and the change

process.

The best known and most commonly applied models of organizational change are often referred to in the literature as teleological or scientific. They see change as a rational process conducted by purposeful leaders and focus on the aspects that most people associate with management, such as planning, strategy building, incentives, and assessments (Cameron & Smart, 1998; Ven & Poole, 1995). In this perspective, change occurs because leaders, the change agents, see the necessity for change and act accordingly, and the mode of thinking can be described as linear (Eckel, Hill, Green, & Mallon, 1999).

An alternative perspective is provided by the social cognition models (Kezar, 2014). They focus on people's understanding of the organization and their roles in it. They see change as a learning process and explore the dynamics and interactions in the system. The main obstacle for change is that people see the world differently. They therefore need to explore the organization and find new and common meaning in how they work and collaborate. Organizational learning, learning organizations, and sense-making are key concepts related to these models (Weick, 1995).

Another perspective is the dialectic or political models of change (Kezar, 2014; Ven & Poole, 1995). They view the institution as a playing field where different individuals, interest groups, and coalitions compete for power and influence. Conflict is the norm, and change occurs when a new ideology or regime replaces the old one.

The evolutionary models and the related life-cycle models draw on the principles of biological development (Baum & Singh, 1994; Kezar, 2014). Change is explained as adaptation to the external environment or as a new phase in the growth and maturation of

the organization. The institution and its employees are analogous to components in an eco-system, and the concepts of leadership and purposeful strategies are secondary factors.

Cultural models focus on the influence of institutional history and traditions (Kezar, 2014; Morgan, 1986). They emphasize the importance of identity and symbolism within the change process, and acknowledge the spiritual, irrational, and unconscious aspects of the organization. Change is largely seen as a subjective and unpredictable process.

Finally, there is the miscellaneous group of so-called multiple or mixed models, which aim to provide an integrated understanding of the change process. One popular example is Bolman and Deal's four frames of organizational change (Bolman & Deal, 2008), which more or less overlap with the models described above (Kezar, 2014). The structural frame, which focuses on objectives, resources and decision making, reflects key aspects of the teleological models. The human resource frame focuses on participation, relationships, and open processes, and aligns with the social cognition models. The political frame corresponds to the political models, and finally, the symbolic frame, which focuses on rituals and values, is related to the cultural models.

Based on this framing scheme, Bolman and Deal (2008), like many other scholars in the field, argue that the key to understanding and facilitating organizational change lies in the ability to see the organization, not just through one theoretical framework, but through several. Each frame represents its own advantages and limitations, and it is the combination that gives the full, multi-dimensional picture.

Dimensions of Change

When examining the case of BGS, it is easy to recognize elements of many, if not all of the models described above. The establishment of the new organization was certainly driven by purposeful leaders who made deliberate decisions based on rational and research-based principles. Such teleological or scientific management is evident in Stemmler's published paper on how he promoted change in the School of Medicine. It is seen in how Winegrad, the primary change-maker, collected data and planned the implementation of the new organization, and it pervades the way BGS has systematically assessed the different graduate groups.

Similarly, it is easy to recognize the political or dialectic aspects of the change process. The primary conflict was between the newly established, centralized organization and the individual departments. It concerned authority over biomedical graduate education – the graduate groups and the students. BGS challenged the department's autonomy regarding recruitment, funding, and curriculum and in many ways represented a new regime and ideology. Winegrad was empowered by a coalition of the deans and the provost, and he used deliberate tactics to manipulate the decision process in committee meetings. Moreover, the establishment of BGS implied a system that disrupted the power structure of the old organization. In particular, it took resources and influence away from senior faculty, who dominated the department-based graduate groups, and shifted it towards junior faculty, independent of which department they belonged to.

Another political dimension concerned the power struggle between the School of

Medicine and the other schools. The wealthy medical school somewhat imperially took control of all biomedical graduate education, thereby accentuating an already existing inequality and source of tension in the University. The political process was characterized by negotiations and bargaining, such as how the School of Medicine ended up compensating for its power grab by underwriting most of the expenses related to the new organization.

A third political dimension concerned the tension between the MDs and the PhDs. It presented itself as competition for resources and recognition between the MD and the PhD program, as well as a perceived difference in status between faculty members of the two categories. The MD versus PhD relationship represents one of many professional interfaces in academic medical centers, and although it was not the most important issue in the establishment and development of BGS, it demonstrates how professional identity and status play into organizational dynamics. In light of the growing number of PhD students and faculty in biomedical research, this relationship is relevant for understanding the changing power structures and political dynamics of research-oriented medical schools.

Switching theoretical glasses from a political to a social cognition model presents a completely different picture. Starting with Stemmler's paper, establishing "networks for communication" and "obtaining consensus" were presented as key tactics to bring about and maintain change. Winegrad listened to all the stakeholders and worked hard to explain his plans for the new program. He established three centralized committees, which promoted dialogue and shared decision making, and he communicated closely with the Dean and the Provost about the development of the organization. Similarly, the

development of interdisciplinary graduate groups, which span departments, schools, and institutions, represented a formidable team-building initiative. Today, the organization is characterized by a high level of collegiality and has developed a system and culture that informally grooms faculty members for leadership positions. In the light of social cognition theory, it is clearly justifiable to call BGS a learning organization, where sense-making has been essential to the change process.

The evolutionary and life-cycle aspects of the change process are also evident. Most importantly, BGS has grown and evolved in response to the growth in funding for biomedical research and the accompanying increase in the number of PhD students. The scope of biomedical research expanded beyond the medical school, and the new organization can be seen as an adaptation to rapid advances in biotechnology and the life sciences. Another external factor concerned the competition from other institutions. BGS and its individual research groups compete for students and research funding in a never-ending race that drives innovation and organizational development. There is indeed an aspect of survival of the fittest, and as in biological systems, capacity for collaboration, sharing of functions and coordinated action constitute an evolutionary advantage.

In terms of the life-cycle models, BGS has gone through different phases and is clearly a more mature organization today than it was 10 or 20 years ago. Different challenges and phases in the life of an organization require different leadership skills and styles. As further elaborated below, the life-cycle perspective can be aligned to the tenures of the different BGS Directors, which have been important determining factors in the development of the program. Broadly painted, Winegrad's tenure may be described as the phase of building and positioning the program, whereas Gaulton's tenure was the

phase of expansion and restructuring. Ross' tenure focused on quality control and unified standards and can be described as the phase of institutionalization. The current phase, characterized by stagnation in NIH funding and new expectations to PhD education, may become a phase of reorientation, although the immediate course appears to be quite steady.

Finally, the history of BGS can be seen in light of cultural models of change. The cultural dimension of the change process was vividly displayed in the first BGS catalogue. By combining symbolism from the fundamentals of molecular biology with innovative architectural elements on the Penn campus, Winegrad created an image of a modern and progressive organization. Moreover, he placed this image in the context of the University's historical prominence, thereby adding support and credibility to the vision for a world-class biomedical graduate program.

The cultural aspects were particularly evident in the more challenging and fundamental aspects of the change process. The conflicts between the schools, the departments, and the professions can be explained as differences in cultural identity rather than as manifestations of politics. The lasting tensions may therefore reflect not just competition for resources, but beliefs and prejudices deeply rooted in the academic culture. Such cultural dissonance is illustrated by the Department of Biostatistics and Epidemiology expressing a sense of being misunderstood and unappreciated by the "lab people."

Similarly, the key transition from "gerontocracy" to "meritocracy" can be seen as a paradigm shift, not just in the system for funding and recruiting students, but also in the cultural identity of the institution. The change involved empowerment of the junior

faculty, more interdisciplinary collaboration, and improvements in educational and scientific quality. It also appears to have fostered an exceptional sense of collegiality among the faculty. Overall, development of BGS can be classified as so-called second-order change – a cultural transformation.

Process of Change

Besides the method of applying different frames or theoretical lenses to the organization, analysis of change may also be structured according to the different steps or components of the process. One such process-oriented framework has been specifically designed to address the unique environment of higher education (Lueddeke, 1999), and has also been adapted to facilitate strategic change and innovation in research-intensive universities (Lueddeke, 2007). Known as the adaptive-generative development model (AGD-M), it attempts to combine the cultural, social-cognition, evolutionary, and teleological models, dividing the process of change into six interrelated elements: needs analysis; research and development; strategy formation and development; resource support; implementation and dissemination; and finally, evaluation (Kezar, 2001).

These elements are also quite easy to identify in the transformation of BGS. Going back to the early 1980s, it was generally agreed that something needed to be done about the organization of biomedical graduate education. Elements of the needs analysis can be seen in the President's strategic plan (Hackney, 1983), the Dean's paper on changing the medical school (Burg et al., 1986) and most specifically, in the Provost's announcement of the new organization (Oliver, 1984). The call for change was bottom-up, expressed by faculty and students, and was eventually acted upon by the Dean and the

Provost. Their initial approach was to appoint a broadly based faculty committee that would research the problematic issues and propose the next step – to appoint a Director of Biomedical Graduate Affairs under the Dean of the School of Medicine. Winegrad then developed a comprehensive strategy, which was firmly grounded in the expressed needs of the faculty – good students and funding to support them. He also made sure that he had the necessary resources, both in terms of funding and executive powers. The new organizational paradigm was clearly disseminated through a new catalogue, and then implemented by persistent attention to a set of principles relating to recruitment, funding, and the interdisciplinary organization of graduate groups. Finally, from the beginning and throughout the history of BGS, there have been systematic evaluations of the different components – the graduate groups, the administrative structure, and the curriculum – and in 2012 there was also a complete review of the program (Appendix: Review of Biomedical Graduate Studies, 2012).

Although the development of BGS did not intentionally follow a particular management strategy, such as AGD-M, it is clear that the process included all the principal elements of such models (Lueddeke, 1999; Lueddeke, 2007). This structured approach to the change process – working systematically, not just in the initial phase of establishing the program, but throughout its thirty-year history – can be identified as a key element of the successful transformation.

Tactics for Change

Besides these general elements of the change process, it is also interesting to explore the specific tactics that were used by the leaders. Three tactical approaches stand

out as particularly important. The first was to focus attention on attracting better students and providing predictable funding to support them. These were needs that the faculty articulated; they were something everybody could agree on, and they justified establishing the centralized organization. The new structure followed as a logical consequence of the processes of finding common ground and fulfilling identified needs, and it can be viewed as a combination of the structural and collegial frame (Bolman & Deal, 2008; Kezar, 2014).

Framed in a political perspective (Kezar, 2014; Ven & Poole, 1995), however, this focusing on the faculty's needs can be seen as a clever diversion that moved attention away from the more controversial objectives of the new organization. The naive approach may have been to proclaim that centralization was necessary in order to assess and improve the quality of graduate education and to get better control and accountability of the funding. That tactic would most likely have ignited strong resistance from faculty members and department chairs, and BGS might have never seen the light of day. Instead, most of the oversight and regulatory functions were introduced after the establishment phase and have steadily developed throughout the organization's thirty-year history.

The second tactic was the introduction of a new model for student recruitment and funding. By centralizing recruitment and taking control of the training grants, BGS was able to provide the students with predictable funding for the first two years of the program. Again, the change in structure was presented as a means to meet the needs of the faculty. Winegrad also insisted that the students should be able to enroll without specifying which graduate group they belong to. Thereby the students became

significantly less tied to their supervisors and departments, and the centralized organization gained direct authority and influence over the student body.

The third tactic was the systematic effort to make the graduate groups administratively and academically independent of the science departments. The concept of thematic graduate groups with faculty members from other schools and institutes actually predated BGS, but most of these groups were closely tied to specific departments. In order to get administrative and academic influence, to provide equal opportunities for all faculty members, and to facilitate interdisciplinary collaboration, it was essential to release the graduate groups from the departments. The initial separation was an implicit part of the new recruitment and funding model, but full detachment also implied thematic rearrangement and renaming of the graduate groups.

This restructuring was achieved by a combination of top-down and bottom-up initiatives. On one hand, the BGS leadership introduced systematic evaluations of every graduate group, which revealed weaknesses and opportunities for new forms of integration. On the other hand, faculty members and research groups collaborating across existing graduate groups came up with their own initiatives for new thematic constellations, which were then embraced and developed by the leadership.

Given this central role of the graduate groups and the apparently detrimental and obsolete function of the biomedical science departments, it seems relevant to ask why the departments should be maintained at all. Why not convert the entire organization to a dynamic system of thematically defined groups that can be easily adjusted to meet the scientific developments?

Going back to the pre-BGS era, the function of the medical science departments

was closely tied to the MD curriculum (W. Mallon, Biebuyck, & Jones, 2003). As biomedical research became increasingly more molecular, interdisciplinary, and detached from the clinical perspective of the general physician, this connection was gradually weakened. Still, though, the department remains the administrative home of the faculty. It deals with matters like office and laboratory space, and tenure and promotions, which are closely tied to the work security and the institutional identity of the faculty members. Attempts to change the department structure therefore tend to incite strong resistance – potential "bloodbaths" according to one former Department Chair.

The faculty members' affiliation with the graduate groups, on the other hand, represents a much more dynamic connection and is primarily related to their current research portfolio. Research projects come and go; new projects are defined by discovery, and the same faculty member may have interests in several thematic areas. Accordingly, changing the structure of graduate groups to align with local and global scientific developments is much easier than changing the department structure, especially when there is a centralized administration to facilitate the process and maintain stability and continuity.

The concept of detached graduate groups is somewhat similar to the concept of research centers, which has become increasingly more widespread at research universities over the last decades (Creso, 2008; Stahler & Tash, 1994). Like graduate groups, these centers are an addition to the department structure, intended to promote quality and interdisciplinary collaboration in thematically defined fields of research. Problems with conflicting agendas and competition for resources between departments and research centers are also well documented. However, while the tension between centers and

departments seems highly structural and almost inevitable (Creso, 2008; Stahler & Tash, 1994), a system of graduate groups may be a more complementary addition to the university structure. Having overcome the political tensions of the detachment process, the relationship between BGS' graduate groups and the science departments was generally harmonious. They fulfilled different and complementary functions, and detaching the graduate groups from the department structure was described by several of the BGS' leaders as a primary success factor of the organization.

Role of Leadership in the Establishment Phase

The process of organizational change is closely tied to the concept of leadership. Although the importance of purposeful leadership should not be overestimated, individual change agents are often the most significant facilitators for change (Kezar, 2014). In order to understand a particular change process, it is therefore important to investigate the role and function of the individual as well as the combined leadership of the organization.

As with organizations, leadership can be explored through different theoretical lenses, and the four frames of Bolman and Deal (2008) have become a common tool also for this purpose. The key message is that different leadership challenges require different mindsets and that good leaders have the ability to dynamically switch between and integrate the different perspectives (Kezar, 2014).

Such a combination of different leadership orientations is illustrated by Winegrad's actions during the establishment of BGS. He strongly emphasized the structural aspects of the change process, including data collection, planning, and

centralization. Perhaps even more pronounced, however, were his political skills: how he negotiated funding and authority for his role as Director, how he built an alliance with the Provost and the Deans, how he maneuvered the committee meetings, and how he took control over the graduate groups at the expense of the Department Chairs.

Winegrad also applied the symbolic frame, best illustrated by the first program catalogue, which relied heavily on history and symbolism, and also by his general promotion of BGS as a new and important unit of the University. The human resource frame was arguably less pronounced. Although Winegrad was strongly devoted to student welfare and collaborated closely with both administrators and faculty, he was described as somewhat autocratic. This aspect of his leadership, combined with a lack of budgetary transparency, was emphasized by the 1993 administrative review. It is difficult, however, to decipher how much of this criticism could be attributed to politics.

In summary, Winegrad demonstrated an ability to combine several different leadership perspectives, with the structural and the political orientations as the most dominant. He was clearly the single most important change agent in the transformation of biomedical graduate education, and he laid the foundation for the continued success of the BGS organization.

With regard to the other leaders involved in the establishment of the program, the information provided by the case is more limited. Still, some general observations can be made. Stemmler's paper on "Managing Medical Education at the University of Pennsylvania" (Burg et al., 1986) can be interpreted as a synthesis of two of Bolman and Deal's four frames of leadership. The primary leadership orientation was the structural frame, relating to aspects such as centralization of administrative functions and systems

for information and evaluation. These teleological aspects were closely integrated with key elements of the human resource frame and social cognition models, involving systems to promote shared governance and organizational learning. These two leadership orientations were also reflected in the personal description of Stemmler as being a kind and process-oriented leader.

Aiken's leadership was also important in the first decade of the program: first as the Dean of the School of Arts and Sciences, who was willing to reallocate funds and authority to the School of Medicine, and later as the Provost, who granted Winegrad authority over all the involved schools and departments. Aiken was in many aspects the guarantor of the inter-school collaboration, and together with Winegrad, Stemmler, and the other deans, he represented a leadership team that drove the change process through the university organization. As expressed by Winegrad, the successful establishment of BGS was largely a matter of having the right people in the right places at the right time.

Dean Kelley, who was appointed about five years into the history of BGS, was also a structurally oriented leader. He kept a strict schedule and was renowned for aggressively building the institution to the extent that it almost collapsed. However, whereas his predecessor combined the structural frame with a collegial and social cognition related approach, Kelley appeared to have a more political and authoritarian leadership orientation. It is interesting therefore to consider the impact these differences in leadership styles had on the development of BGS.

Different tasks and phases in the life of an organization can require different skills and styles of leadership. In light of the life cycle model of change described above, one may ask whether Kelley would have been able to unify biomedical graduate education

under the School of Medicine, or if his management style would have undermined the collegial trust necessary to achieve this goal. On the other hand, one may ask if Kelley's ambitious building of the institution, including recruitment of world-class researchers and expansion of research space, was essential for bringing BGS to the next level of development.

Role of Leadership in the Established Organization

As the new organization matured and consolidated, the function of leadership took on a different and arguably less critical role for the stability of the program. Yet, Gaulton's more than twenty years of continuous involvement, first as Director of the Combined Degree Program, then as BGS Director, and finally as the Vice Dean overseeing these programs, obviously had a major influence. Like Stemmler, his primary leadership perspective can be seen as a synthesis of the structural frame and the human resource frame: a combination of a classical managerial perspective with an appreciation for collegiality, shared decision making, and organizational learning.

This combination of the structural and the human resource frame was also the most salient leadership orientation expressed by the other BGS directors and graduate group chairs. The structural aspects included an elaborate hierarchy of committees and academic leadership positions, which tended to attract and empower collaborative members of the organization. This concept of promoting collegiality through structure can be traced back to Stemmler's tactics for changing the School of Medicine, described as "a system for obtaining consensus among the institution's constituencies on the goals of the school's educational programs." This system was implemented in BGS through

Winegrad's political leadership and was further nurtured and developed under Gaulton's leadership.

Overall, the structural frame and the human resource frame appeared as the dominant leadership orientations of the current BGS organization. This finding concurs with the results of previous studies, which have analyzed the prevalence of different leadership orientations in graduate medical education (Lieff & Albert, 2010; Sharpe, 2005; Stephens, 2011). BGS has institutionalized this combination of leadership orientations in the form of a comprehensive system of committees, and the concept of "structured collegiality" appears as a key factor for the successful development of the organization.

The two other leadership orientations were less salient. The political frame was noticeable in relation to persistent inter- and intra-school tensions, but it seemed less important than it was in the earlier history of the program. As the organization matured and developed a stable and collaborative leadership culture, the need for political leadership diminished.

The symbolic frame was also less salient in this later phase; it appeared primarily as a cultural reflection of the more dominant human resource frame. In particular, students and faculty described the BGS' culture as remarkably inclusive and collegial, and this notion appeared as a core identity and value of the organization. As one of the most prestigious biomedical graduate programs in the nation, there was also a strong devotion to scientific excellence and integrity. This combined identity of collegiality and excellence was, however, somewhat hidden.

Aside from several complaints that BGS was unappreciated and poorly recognized

by the School of Medicine, there was little focus on the perceived image of the program. This lack of attention to image was reflected in the program's webpages, by far the most important channel of communication and image building in the modern higher education market. The webpages appeared as visually and technically outdated, lacked a unified structure, and seemed inferior to those of many lesser institutions. The image of an innovative, national leader with a long and proud history, which was presented in the first BGS catalogue, was no longer visible. If the program aims to compete with institutions with stronger international brands, the current leaders may thus want to pay more attention to the symbolic frame.

Leadership Development

Despite the important role of leadership in the history of BGS, there was little tradition for explicit attention to leadership and leadership development in the organization. Leadership was to some degree regarded as a necessary evil, which distracted from the core mission of conducting research. In the words of one of the participants: "Leadership – I just do it." Since the program is currently doing very well, it could be argued that this is a winning strategy, and that structured and research-based leadership development is superfluous.

Alternatively, one could argue that BGS is solidly founded in research-based principles. In particular, the Dean and the leadership team at the School of Medicine who founded the program, demonstrated a highly scientific approach to leadership and organizational change and even published their work in an academic journal (Burg et al., 1986). Although their role should not be overestimated, it is justified to claim that

research-based principles of higher education management played an important role in the development of the program.

Moreover, biomedical research and education remains a highly competitive business. It is increasingly team-based and interdisciplinary, and the optimization of leadership emerges as an important factor to maintaining a competitive edge. In order to make a good organization even better, BGS may therefore consider a more proactive approach to leadership. That does not necessarily imply that the faculty should be sent off campus to attend traditional management courses, which many would likely see as more time diverted from the core mission. Instead, the focus should be on promoting dialogue and awareness about the role and function of leadership as it appears within the BGS organization.

When faculty hear the terms "leadership" and "management," many think in the direction of teleological models – systems of authoritarian decision making that they would rather be without. Articulating the social cognition perspective and the principles of collaborative leadership could promote a more positive perception of leadership within the organization (Kezar, 2014). In particular, it may change the perception that aspiring to academic leadership is a suspect and primarily self-serving trait. Such a change in institutional perception would enable the right-minded people to express their desire for leadership, while discouraging those who seek leadership for the wrong reasons. Furthermore, it would pave the way for a more structured system of preparing faculty members for leadership. A first step would be to make leadership development an explicit aim of the organization, and then implement this aim in the existing committee structure through internal leadership seminars, individual or group mentoring, and long-term

succession plans.

As outlined in the Introduction, leadership training is increasingly regarded as an essential element of the PhD curriculum and is specifically promoted by key policy makers and funding institutions (National Institutes of Health, 2012). Whether students go on to jobs within or outside academic research, most will sooner or later end up in some kind of leadership position. From the grand perspective of building the knowledge economy, to the more immediate goal of educating principle investigators who can develop interdisciplinary research teams, it is therefore pertinent to involve students in the organization's collaborative leadership culture.

The BGS student association requested more student involvement in leadership and development, and there are several reasons why such student participation may be warranted. First, it would support developing a program that is more student-oriented and therefore more attractive and competitive in the higher education market. Second, PhD students have qualities and motivations that go beyond their research projects. Many, and particularly those who volunteer for student associations, are motivated to contribute to the welfare of their fellow students and the development of the curriculum. They represent an untapped resource, which could be utilized by formally including them in the collaborative leadership. Finally, embracing student leadership in a structured manner meets the demand for generic skills training in an experiential manner, which, rather than stealing time and money from the core mission, could contribute to the development of the organization.

CHAPTER 5 – DISCUSSION

Limitations

This case study explored the development of a centralized organization for biomedical graduate education at the University of Pennsylvania. As explained in the Preface, it was conducted by a researcher with considerable experience of biomedical graduate education in the Norwegian and European context. This cultural and professional background has obviously influenced the study, primarily by providing insight to the issues, but it may also be seen as a personal bias. Moreover, the researcher had status as a visiting faculty member at the University, which included unique access and a personal relationship to the institution. Importantly, however, there were no financial or academic obligations related to the research visit.

It should also be noted that the participants were not granted anonymity, and transparency regarding the name of the institution and the people involved may have shaped the interviews. Still, all participants expressed a genuine willingness to contribute to the study, and some non-essential information has been deliberately held back due to its personal character.

Primary information regarding the culture and inner dynamics of the program was provided by current and previous leaders of BGS, several of whom were asked to correct and comment on the presented case. Representing the protagonists of the story, they could arguably have a bias towards a positive representation of the organization. Importantly however, the major trends and overall success of the program was validated by several independent sources. First, the overall positive effects of centralization were

assertively confirmed by the 1993 administrative review committee, which was assigned to conduct a critical assessment of the organization. Even stronger commendations were presented in 2012, by the internal and the external committees that reviewed both the administrative and academic implications of the program. Second, the general characterization of BGS as a collegial organization, responsive to the needs and wellbeing of students, was confirmed by overwhelmingly positive results of anonymous student and faculty surveys, as well as by interviews with representatives of the student association. Finally, the students' incoming test scores, their academic outcomes and subsequent career paths, as well as Penn's high rankings on biomedical research, all strongly indicate a well-functioning graduate program (Appendix: Review of Biomedical Graduate Studies, 2012).

Another key issue where the participant's roles may involve a somewhat biased perspective, is the conflict between the centralized administration and the department chairs, especially during the early history of the organization. One could argue that the power struggle between "the kings" and "the barons," a popular narrative in academic institutions, may have been overemphasized. In this case, however, the conflict indisputably concerned transfer of substantial amounts of money and authority related to the core mission of the science departments and appeared as both real and important. It was documented by the 1993 administrative review and corroborated by administrative and academic leaders, including some who had been Department Chairs at the time. In the later years, this conflict between the departments and the centralized organization was no longer a salient issue, aside from some tension over the ongoing incorporation of the graduate group in Biostatistics and Epidemiology. Overall, the relationship seemed very

harmonious, and it is evident that the organization has experienced a cultural as well as a structural transformation.

Implications

Arguably the most important lesson from this case study is that the development of a centralized biomedical graduate program was a multidimensional and long-term endeavor, which required a broad spectrum of leadership skills. First of all, it required structured and strategic management, including information gathering and analysis, allocation of financial and human resources, a tactical plan for implementation, and continuous evaluation. Equally important was attention to team building, collegiality and shared decision making. As a synthesis of these two perspectives, "structured collegiality," in the form of a comprehensive hierarchy of committees, emerged as a primary characteristic and success factor of the organization.

Particularly in the early phase, there was also an important role for political leadership. The centralization of recruitment and funding addressed the needs of the faculty, but also involved a shift in the institution's power structure. This transition of authority from the individual schools and departments to the centralized organization was orchestrated by a unified coalition of leaders. There were also elements of symbolic leadership, drawing lines between current scientific developments, the modern university campus, and the institutional history.

Three interrelated tactics stood out as particularly important. The first was to focus attention towards the needs of the faculty rather than towards the lack of quality, thereby finding common ground and obtaining support for the change process. The

second was the centralization of student recruitment and the pooling of training grants, which gave the program a direct and much stronger level of authority over the students. The third was to detach the graduate groups from the departments, which promoted interdisciplinary collaboration and gave a stronger influence on curricular development.

Compressed to an "elevator speech," the BGS organizational transformation may be described by the following oversimplified narrative: The establishment of a centralized organization allowed the implementation of a new recruitment and funding structure, which released graduate education from the grip of the science departments. This new organizational paradigm empowered junior faculty members who had an active research portfolio and who were willing to contribute to the program through teaching and committee work. The organization thereby went from a gerontocracy to a meritocracy, that in addition to promote scientific excellence, rewarded collaboration and collegiality. The change in structure facilitated a cultural transformation, which had a positive effect, not only on graduate education, but also on the biomedical research community as a whole.

Although this causal connection between structural change and cultural change seems logical and well-documented, it should be emphasized that the BGS organization developed in a larger context. The transformation of biomedical graduate education coincided with a highly positive and transformational change of the entire Penn organization (The Gazette Editors, 2004), which can be regarded as both a cause and effect of this development. Moreover, the program's thirty-year history coincided with significant developments in higher education in general (Lazerson, 2010), involving increased attention to student rights and faculty accountability, which also influenced

biomedical graduate education. Therefore, it is important to regard the development of BGS as a piece of a bigger picture, and the case stands out as an interesting example of transformational change in a highly complex academic environment.

Conclusion

Representing the very elite of American higher education, Penn BGS is not necessarily representative of biomedical graduate programs in the United States, not to mention similar programs in Europe and elsewhere. Nevertheless, biomedical graduate education is an increasingly global enterprise that is experiencing an international convergence due to the globalization of higher education and the rapidly evolving and highly interdisciplinary context of the biomedical sciences (Yopp, 2008). Such programs share a similar context, due to their common integration with academic medical centers, and they are dealing with many of the same organizational challenges. In particular, the process of going from a dispersed system of biomedical graduate education to a structured and centralized model is highly relevant for many European institutions in their effort to meet the common standard of the PhD degree (Mulvany, 2013).

Mindful of the limitations of a single case study, this analysis can serve as a practical and theoretical reference for other institutions that aim to establish or further develop a centralized biomedical graduate program. Moreover, biomedical graduate education represents a large and increasingly more important segment of higher education, a segment that is generally unexplored in terms of organizational change and management research. This case study therefore represents a reference point for further research into the field of biomedical education management. In particular, it would be

interesting to investigate whether other biomedical graduate programs have followed similar or different paths to success, or equally relevant, to identify why they have been less successful.

APPENDIX

Documents

Year	Tittle	Comment
1985, Oct.	Review of the graduate group in molecular biology	First review regarding the BGS graduate group structure.
1986	Letter from Winegrad to Stemmler	Letter describing progress after the first year of the program.
1992	Brief History of Graduate Education at the University of Pennsylvania 1870-1984	Document prepared by Linda Koons, the Provost's Office
1993	BGS Administrative Review	Internal review of the administrative organization.
2000, Sept.	Report of the Biomedical Graduate School Curriculum Reform Task Force	Recommendation for curricular changes by a committee of faculty and one student representative.
2005, April	Review of the Immunology Graduate Group (IGG) 2004-2005	Review of graduate group by internal and external committee.
2006	Review of the Neurosciences Graduate Group (NGG) 2005-2006	Review of graduate group by internal and external committee.
2008	Review of the Graduate Group in Pharmacological Sciences (GGPS) 2007-2008	Review of graduate group by internal and external committee.
2008	Review of the Graduate Group in Cell and Molecular Biology 2007-2008	Review of graduate group by internal and external committee.
2009	Report of the Committee to Review the Graduate Group in Genomics and Computational Biology	Review of graduate group by internal and external committee.
2009, July	Review of the Biochemistry & Molecular Biology Graduate Group	Review of graduate group by internal and external committee.
2009, Dec.	BGS Course Director Responsibilities	
2010, Dec.	Resource Document 2000-2010, Review of Biomedical Graduate Studies, University of Pennsylvania.	Document prepared by the Director and Administrative Director as underlying material for the 2010 review.

2011	Admissions, 2000-2010	Overview and breakdown of applications and admissions.
2011	Graduate Groups' Recertification Policies	BGS requires student who has not completed after six years to undergo a recertification process.
2011	HHMI Med into Grad Scholars (HMGS) Program	Brochure for translational research certificate program.
2011	BGS Graduate Group Chair Responsibilities	The graduate group chair oversees most aspects of graduate group administration.
2011	BGS Admissions Guidelines	Guidelines for the Admission Committee.
2011	BGS Staff Members' Job Descriptions	
2011	Diversity Recruitment and Retention Plan	
2012, March	Review of Biomedical Graduate Studies	Comprehensive review by internal committee and three external reviewers.
2012	Public Health Certificate Program (PHCP)	Web page the Public Health Certificate Program
2012	About BGS	Web pages presenting overview and history of organization.
2012	BGS Curriculum	Web pages presenting current curriculum.
2013, July	Review of the Biostatistics & Epidemiology Graduate Group	Most recent review of a BGS graduate group.

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