History of the biomedical studies PhD program: a joint graduate program of the Baylor Health Care System and Baylor University

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On a sweltering summer morning, throngs of people filed into Jones Theatre at Baylor University in Waco for the graduate student orientation. One could look around and notice the diversity of not only the student population, but also the disciplines being represented. Many students had stepped off planes only hours prior, but even those who had been traveling for days could not contain their excitement. As for me, I was nowhere near any of this. I was still 40 miles north of Waco in Waxahachie, having been pulled over for speeding. After 4 days of traveling with my life in my Volkswagon Jetta, all the way from San Francisco, on one of the most important days of my life, I was late. When I finally arrived at the Hooper Schafer Fine Arts Auditorium, out of breath from running all the way from the parking structure, all of the graduate students were quietly listening to the first introductory speech. I snuck into the back and sat down. My mind was racing, as I knew very little about Waco and Baylor University except for the growing accomplishments of the biomedical studies program. What little I did know about Baylor seemed so different from my very liberal upbringing in California. What would this experience be like for me? But, as I listened to the talks, met with other students, and finally met the entire biomedical studies entering class of 2007, I knew that I had made the right decision in coming to Baylor. This would be an experience unlike any other, and I was wholeheartedly open to embracing it. —Christine Morel, PhD candidate, Institute of Biomedical Studies

BEGINNINGS

The seed that has grown to become the joint Baylor University (BU)/Baylor University Medical Center (BUMC) graduate research program in biomedical studies was planted in the fall of 1980, when William Hillis, MD, returned to the Department of Biology of BU, his undergraduate alma mater. Dr. Hillis, who was appointed chair of the biology department in 1981, had been very active in biomedical research at Johns Hopkins University prior to returning to BU as a faculty member (see sidebar). His background and desire to bring research to BU prompted him to approach BU President Herbert Reynolds, PhD, with the idea of establishing a research program in biomedical science. Dr. Reynolds, who had received his graduate education in experimental neuroscience and clinical psychology, had a great appreciation for the value of biomedical research

at an academic institution and enthusiastically supported this initiative. The president of BUMC, Boone Powell Jr., was also eager to establish a relationship between the two facilities.

Accordingly, two committees were formed to establish the terms of a possible BU/BUMC research partnership. The committee in Waco consisted of Dr. Hillis as well as BU professors W. Keith Hartberg, PhD, William H. Scouten, PhD, and Darden Powers, PhD. The research arm of BUMC, the Baylor Research Foundation (which was renamed Baylor Research Institute [BRI] in 1991), was represented by Robert M. Dowben, MD, James Lester Matthews, PhD (see sidebar), and Joseph Newman, PhD. This eclectic group of scientists included a biochemist (Dr. Scouten), a biophysicist (Dr. Matthews), a cell biologist (Dr. Dowben), a geneticist (Dr. Hartberg), a physicist (Dr. Powers), and two virologists (Drs. Newman and Hillis, who was also an immunologist). Finally, Boone Powell Jr., who had received his undergraduate degree from BU in 1955 followed by a master's in public health from the University of California Berkeley, provided a "business" perspective. This diverse and well-qualified group set out to design an exceptional interinstitutional research program.

The initial program concept was to offer undergraduate and graduate students from the university an opportunity to work with BUMC research scientists on medically relevant research projects not feasible on the Waco campus. At the same time, the BUMC researchers were to receive a formal association with BU through adjunct faculty appointments, increasing their eligibility for academic research grants and allowing them to interact formally with university faculty and students. As the research at BUMC was biomedical in nature, initial faculty appointments were made into the BU Department of Biology. Students were encouraged to participate in research projects in BUMC laboratories in Dallas, and it was expected that their compensation would be generated from funding from grants and contracts that the principal investigators at BUMC would be awarded.

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DR. WILLIAM D. HILLIS: "THE LANGUAGE OF GOD"

William D. Hillis, MD (Figure 1), earned an undergraduate degree from BU and a medical degree from Johns Hopkins University. After his residency training in internal medicine as part of the Osler Medical Service, he joined the Air Force. There, his scientific pursuits centered on virology, specifically viral hepatitis. At the time, chimpanzees were being trained to fly space shuttle missions, and the veterinarians and veterinary technicians that were working with these animals were being infected with hepatitis at an alarming rate. Observations by Dr. Hillis and other researchers led them to suspect that these chimps could be transmitting hepatitis to the staff. This prompted Dr. Hillis to travel to Africa, where he spent time gathering chimps that could be used to establish a reliable animal model of hepatitis infection. When revolution broke out in the Congo, he had to be evacuated, and he returned to Johns Hopkins to continue his research in virology. While this exciting work took him all over the world, he felt as if his increasing administrative responsibilities at Hopkins were carrying him further away from one of his real passions—teaching.

While his career at Johns Hopkins was becoming ever more hectic, there was a surge of very conservative individuals in Texas who were loath to accept the scientific validity of evolution. As a Christian and a scientist, he felt that he had found a new calling to return to BU, where his "life had been shaped from the philosophy he learned from Baylor professors." Dr. Hillis hoped to work more closely with students and help them as they studied the science of evolution and attempted to reconcile it with their Christian faith. He therefore returned to BU in 1980 against cries from his associates at Hopkins that he was merely going through a "mid-life crisis." Since his return to BU, Dr. Hillis has conducted research, taught classes, and served as the executive vice president of biology and the vice president of student life.

But his contribution to the university has extended beyond the Waco campus. In the late 1990s he began participating in a study abroad program that allowed premedical students to study biology while traveling in Europe. During these semesters abroad, Dr. Hillis taught the students about medical history while traveling with them to the sites where many of these great discoveries were made. With his wife, Dr. Argye Hillis (herself a Johns Hopkins graduate and a professor of clinical surgery at Texas A&M University College of Medicine), he created a memorable experience for many students over the years, freely sharing his copious knowledge of medicine and biomedical research. Just as important, the Hillises generously shared their personal lives with their students, living with the students and eating every meal with them for the entirety of the trip. Dr. Hillis, who relates his life to Francis Collins' book *The Language of God*, has demonstrated that it is possible to live a life committed as both a scientist and a Christian.

Figure 1. William D. Hillis, MD.

The early days of the new program did not go exactly according to plan. For example, the program initially attracted primarily short-term commitments from undergraduate student researchers who would often join for a summer internship. Graduate students, who would be able to complete significant research projects after years of full-time effort on a topic, were less attracted to the nascent program. Additionally, although the BU Departments of Physics, Chemistry and Biochemistry, and Psychology and Neuroscience were quick to join the Department of Biology in offering adjunct faculty positions to researchers in Dallas, it remained difficult to garner interest from BUMC researchers. Clearly, a change in strategy was necessary. The reorganization of the program as an independent institute at Baylor produced the desired response. With Darden Powers, a BU professor of physics, named as the initial director, the Institute of Biomedical Studies (IBS) was created.

Dr. Powers, with the assistance of a governing committee, set out to assemble a first-class graduate program in biomedical studies from the ground up. In the summer of 1989, he began this task by surveying 24 graduate biomedical studies programs across the country to determine the parameters (curriculum, stipend, research) that would ensure that Baylor would "be in line with other existing programs in biomedical studies" (Darden Powers, letter dated June 30, 1989). As a result of this thorough study, the IBS proposed that doctoral and master's degrees in biomedical studies be offered at BU. These degrees would be offered under three separate curricular tracks: biological science, biochemistry, and biophysics. By April 1990, the necessary approvals were received from the curriculum committee, the graduate council, and the BU board of regents. The IBS could now focus its efforts on promoting significant research efforts involving graduate students.

This design for the IBS graduate program called for the didactic portion of the degree requirements to be completed in the student's first 2 years while in residence at the Waco campus. Afterwards, an extensive research project was to be completed either at the Waco campus or at BUMC research laboratories in Dallas. The primary differentiation between the MS and the PhD degree requirements was the amount of time devoted to coursework and research. To earn an MS degree, students would complete 30 semester hours of coursework and 6 semester hours of research, while PhD students were required to complete a total of 78 semester hours, the majority of which would come from an extensive research project and the preparation of the final dissertation. An additional option was to receive a master's degree without a thesis, which required 36 hours of coursework. The long-term plan was to grow the program to include 25 to 30 graduate students, beginning with an initial class of 10 students and increasing 4 students per year. An initial budget included \$46,000 to fund student tuition reimbursement and stipends, with expenses shared equally between Baylor Research Foundation and BU.

With this structure in place, the IBS could begin to recruit graduate students. Accordingly, in the spring of 1990, the IBS initiated an advertising campaign designed to attract its first

DR. JAMES LESTER MATTHEWS

Dr. James Lester Matthews (*Figure 2*), known affectionately among his friends as “Les,” was born in Denton, Texas. He attended North Texas State College (now the University of North Texas), where he earned both a bachelor’s degree and a master’s degree. After receiving his PhD in

Figure 2. Les Matthews (right) with George Race (chairman of the board, Baylor Research Foundation).

physiology from the University of Illinois, Dr. Matthews began 35 years of dedication to research and education. He returned to Texas to join the faculty of the Baylor College of Dentistry, where he taught anatomy and histology for over 20 years. More than an excellent educator, Dr. Matthews was also a researcher, an entrepreneur, and a patriot, serving in the navy during World War II. An important leader in the push to promote research at BUMC, he served as executive director of the Baylor Research Foundation for a number of years. Through his scientific career, Dr. Matthews wrote 70 articles and two textbooks and held 27 patents. A colleague once remarked, “Les connected the dots better than any scientists that I have had an opportunity to work with. He could look across disciplines, environments, and applications.”

Dr. Matthews served the IBS tirelessly, teaching a large number of courses (usually commuting from Dallas to Waco to spend his Friday afternoons lecturing), serving on countless PhD committees, and personally directing the PhD research of Dr. Lih-Jyh Fuh (the first PhD graduate of the program) and Dr. Yi-Shing Cheng, PhD, DDS, who now serves as an assistant professor of oral pathology at the Texas A&M–Baylor College of Dentistry. One of his former students has said of him, “Dr. Matthews was a special person to me. He took me under his wing as a bumbling East Texas hick, when no one else would, and gave me a chance.”

Dr. Matthews passed away in 2007, leaving behind a great many students and colleagues who cared for and respected him, as well as a distinguished legacy at BU and throughout the scientific community.

class of students. Due to the late nature of the program’s approval, only two students were enrolled that first year: Samantha Burlacu and Xian Shi, both of whom transferred from the BU biology department. The following year, with recruiting efforts in full force, 10 new students enrolled, seven of whom were pursuing a PhD. This class of 1991 included three domestic students and seven international students (who came primarily from Asia; see sidebar). By 1992, there were 20 students in the program (13 PhD, 7 MS), and in 1993 the first students graduated with master’s degrees: Katherine Hyne Budries and Karen Henderson. Finally, in 1996, Lin-Jhy Fuh, a student who pursued research under the guidance of Dr. James Lester Matthews at BRI in Dallas, successfully defended his PhD

STRANGERS IN A STRANGE LAND—THE LIFE OF FOREIGN STUDENTS IN AMERICAN UNIVERSITIES

Han Peng, a current PhD candidate in IBS, had the opportunity to sit down with two students, Haisu Guo and Shengnan Liu, who came to the United States from China to pursue graduate degrees, and discuss the experience they have had.

Han: *Why did you choose the Baylor IBS?*

Guo: I have been interested in biomedical sciences for a long time and I wanted to do something that can have possible applications to improve human health. Baylor has an excellent medical research program in Dallas, so I decided to apply to the Baylor IBS program.

Liu: I have a friend in Houston who introduced me to BU. I was attracted by BRI in Dallas.

Han: *What is your research topic and what do you hope to do after completing your PhD?*

Guo: My current research topic is the mechanisms respiratory syncytial virus utilizes to convert tolerogenic dendritic cells and their possible application in transplantation. After I receive my PhD, I will try to find a postdoctoral research position, and when I have a strong enough publication record, I will try to find a faculty position at a university.

Liu: I am studying microRNAs in breast cancer. I will look for a postdoctoral position upon graduation.

Han: *As a foreigner, what has been the most difficult thing you have encountered at Baylor?*

Guo: Loneliness. I don’t have nearly as many friends here as I did back in China. Although I have gotten to know a lot of people, it is still difficult to find someone who has the same interests, attitudes, etc.

Liu: Language has been very difficult, especially as a teaching assistant. During the first several months here, I could read without difficulty but had trouble understanding the spoken language. If I was in class, I would be okay, but if someone started talking about something not related to biology, I would be completely lost. Now, my listening is better, but I am still new to many daily words and expressions.

Han: *How do you think foreign students help contribute to the diversity of the biomedical studies program?*

Guo: I think they bring not only a different culture, but also a different way of thinking. Foreign students also work very hard at their research studies, which will make the program better and stronger in the future.

Liu: I think the “foreign” factor in a scientific program is not as obvious as that in an art program or other programs more closely related to culture. But I remember once in a virology class, I introduced a concept from Chinese medicine. I realized then that foreign students can sometimes contribute knowledge or methodology that US students do not have access to.

dissertation, “Early gene responses in mechanically loaded bone cells.” The IBS awarded its first PhD degree!

While the early success of the IBS was evidenced by continued interest from students and faculty, increasing rates of publication, and the completion of PhD degrees, it was clear the program had significant hurdles to overcome. As early as

Figure 3. The Lieberman Building housing the Baylor Institute for Immunology Research in Dallas.

1992, a summary report prepared by a select visiting committee commented that “while there are several senior well established investigators, many of the staff are young and untested” and related a concern that the research groups might “suffer from intellectual isolation.” Logistical issues posed a significant challenge. In order to offer the necessary courses, Dallas faculty often volunteered to travel to Waco to teach. Most often these courses were offered as weekly 3-hour lectures on Friday afternoons. With travel, this required a commitment of over 6 hours each Friday by Dallas faculty. Oral examinations also required faculty to travel to Waco. Unfortunately, budgetary limitations significantly limited the growth of the program. But at the same time that the emerging IBS continued to thrive despite these challenges, the parent institutions were undergoing significant changes that would ultimately strengthen the program.

INSTITUTIONAL CHANGES

As the first IBS students were completing their degrees, exciting changes were under way at BRI. Under the leadership of Dr. John S. Fordtran, who became president of BRI in 1991, a thorough review of research in the Baylor Health Care System was undertaken. This review was followed by a decision in 1993 to develop a world-class research program in immunology, and that led to the creation of the Baylor Institute for Immunology Research (BIIR). Dr. Jacques Banchereau, an international leader in immunological research, was recruited from Schering-Plough in 1996 to direct this major research initiative, which is housed in the Zelig H. Lieberman Research Building, a purpose-built building close to the BUMC campus in downtown Dallas (Figure 3). Research at the institute is focused on immunological approaches to the treatment of autoimmune disorders, cancer, and infectious diseases, and the institute is a worldwide leader in dendritic cell-based vaccine therapies. BIIR has become a significant partner to the IBS graduate program: at present 11 heads of BIIR research laboratories have adjunct appointments at BU, and nine students are pursuing PhD degrees under their supervision. The exciting research opportunities and exceptional facilities offered to IBS students who engage in research at BIIR

Figure 4. Dr. Chun-I Yu (PhD, 2008) working at BIIR. Dr. Yu was the first IBS student to complete the requirements for the PhD at BIIR.

have proven to significantly enhance the international visibility and reputation of the IBS graduate program (Figure 4).

Faculty of the Kimberly H. Courtwright and Joseph W. Summers Institute of Metabolic Disease have also increasingly contributed to the IBS. Founded by Charles Roe, MD, the institute is a world-leading research center dedicated to diagnosing and treating metabolic disorders. Numerous researchers from the Institute of Metabolic Disease have been tireless supporters of the IBS over the years, including current faculty Teodoro Bottiglieri, PhD, Jiahuan Ding, PhD, MD, Lawrence Sweetman, PhD, and Bing Zhi Yang, MD. Very recently, Raphael Schiffmann, MD, whose research focuses on glycosphingolipid disorders, has joined the institute as director.

Significant changes were being implemented at BU as well. BU's addition of numerous faculty with biomedical research interests (in the Departments of Biology, Chemistry and Biochemistry, Psychology and Neuroscience, and others) created more of a critical mass in research and in teaching. One result of this growth was the creation of the Center for Drug Discovery, which was established in the spring of 1999 as a means to gather together members of the BU community with research interests in areas loosely related to drug discovery. Center workshops and symposia are offered regularly. Many BU faculty are involved in both the Center for Drug Discovery and the IBS.

More recently, Vision 2012, an ambitious blueprint for the future of BU, was formally adopted in 2001. This vision is focused to a large extent on a 10-year plan to greatly increase the scholarship and reputation of the university while retaining (and enhancing) the undergraduate education and Christian environment that Baylor is known for. The importance of the biomedical sciences is explicitly acknowledged in Vision 2012, and this has had a very tangible impact on the IBS. One of the most visible signs of the university's renewed commitment to excellence in the sciences was the construction of the Baylor Sciences Building, which was officially dedicated on September 24, 2004 (Figure 5). This 500,000+-square-foot

Figure 5. The Baylor Sciences Building in Waco soon after its dedication in 2004.

facility includes classrooms and laboratories and consolidates the disciplines of chemistry, biology, geology, physics, and neurology, as well as most of BU's prehealth programs. This building provides a world-class facility for biomedical research as well as a great stimulus for cross-disciplinary collaboration.

RECENT CHANGES

In 2005, Robert Kane, PhD, became the second director of the IBS. Dr. Kane, an associate professor of chemistry and biochemistry, had long participated in the biomedical studies program—teaching courses, mentoring students, and collaborating with BRI researchers (especially Dr. Les Matthews). He was joined by Christopher Kearney, PhD, who serves as the graduate director of the program. Dr. Kearney, an associate professor of biology, has worked with many IBS graduate students, including three who are now on the BU faculty (see sidebar). Indeed, most students do work in academia after completing their graduate degree (*Figure 6*). Together, Drs. Kane and Kearney have set out to modernize the program, with the goal of continuing to offer a top-tier graduate education in biomedical research while growing the program and retaining the Baylor “character.”

One of their first tasks was to define and strengthen the relationship between BU and BRI. Working closely with BRI President Michael Ramsay, MD, a formal “student intern” agreement was fleshed out. This agreement directly describes the significant commitment from both institutions to support the program and

Figure 6. Breakdown of student job type after graduation.

fortunately resulted in increased financial support. With this important agreement in place, Drs. Kane and Kearney set out to revise the curriculum to take advantage of the present strengths of the faculty and with the goal of getting students into the research labs after just 1 year of coursework. Courses in biotechnology, virology, and bioinformatics were developed specifically for the IBS students, and a two-semester sequence of advanced immunology studies was created. Additionally, a formal program of laboratory rotations was implemented, allowing first-year students ample time to discover the research lab that best fit their interests.

The development of excellent videoconferencing facilities in both Waco and Dallas has helped to minimize many of the logistical challenges inherent in a program with two sites separated by 90 miles. In fact, most courses are now offered simultaneously to students in Dallas and Waco. Student oral presentations also have audiences on both campuses, further strengthening the sense of collaboration. One recent

“EDUCATING THE EDUCATORS OF TOMORROW”

Professor Tamarah Adair received her PhD from the IBS in 1998, studying in Waco under the mentorship of Professor Christopher Kearney. After completing her degree, she was hired by BU as a lecturer in biology. Since joining the faculty at BU, she has focused on research projects that are geared toward giving undergraduates an opportunity to obtain laboratory experience before they graduate. These opportunities are invaluable, especially for students who are planning to attend graduate school or medical school. Looking back on her experiences as a BU graduate student, Dr. Adair said, “The biomedical studies program helped me develop a strong foundation for my career.” Having watched the IBS program since its earlier years, she remarked that it has evolved quite dramatically from when she attended.

In a similar fashion, BU lecturer Dr. Marcie Moehnke received her PhD from the IBS in 2005, also under the mentorship of Dr. Kearney. During her time as a graduate student in the institute, she found that she relished the opportunity to teach classes, and so she was happy to accept an opportunity to stay on at BU as a lecturer in biology. While teaching genetics and related courses to large numbers of undergraduates, Dr. Moehnke continues her research, studying the expression of allergens in plant/yeast-based systems.

Professors Rene Massengale, PhD, and Yi-Shing (Lisa) Cheng, PhD, DDS, both continued their education after earning degrees from the institute. Professor Massengale earned her MS degree in 1995 under the supervision of Dr. Kearney and then moved to the West Virginia University School of Medicine, where she earned a PhD in microbiology and immunology. She returned to BU in 2002, where she teaches and performs research in environmental microbiology. Professor Cheng, who earned her DDS at the Kaohsiung Medical University School of Dentistry prior to joining the IBS PhD program, earned a PhD from the institute in 1999 under the supervision of Dr. James Lester Matthews. She then continued her education, earning a certificate in oral and maxillofacial pathology at the Baylor College of Dentistry, where she continues to do research and to teach as an assistant professor of oral pathology.

Figure 7. Informal “Molecular Waco” presentation at the Kearney home.

Figure 8. Dr. Erica Gomes (PhD, 2006) and Dr. Margret Rodrigues (PhD, 2006) present posters at the fall 2004 Center for Drug Discovery Student Research Symposium.

development has been the enrollment of PhD students in Dallas who do all of the work on their degree—classes as well as research—without ever traveling to Waco. Another strategy to assist students in navigating the gap between Waco and Dallas has been to offer IBS-funded housing in Dallas during the students’ first summer, so that they can explore research groups there before moving and signing a long-term lease.

With each new class of students now spending just their first year together in Waco, Drs. Kane and Kearney have worked hard to foster a sense of community. In 2007, the IBS office was opened to students. This office includes a large boardroom-style table and two computer workstations, where at any given time students are discussing science, reading the most recent copy of *Nature*, studying, or having lunch together. Adding a personal touch, Dr. Chris Kearney and his wife, Virginia, generously host a dinner party the last Thursday of each month at their home. All graduate students, technicians, and faculty involved in biomolecular research at Baylor are invited to this popular event. Dubbed “Molecular Waco,” it provides a forum for scientific discussion along with a home-cooked

meal, fostering a true sense of belonging and catalyzing the development of friendships and collaborations that will last a lifetime (Figure 7). In a more traditional approach, the IBS, in partnership with the Center for Drug Discovery, hosts an annual research symposium in Waco (Figure 8). This past spring over 30 students in numerous disciplines from labs in Waco and Dallas presented posters during a day-long symposium that included poster presentations, a lunch, and two guest lecturers: Dr. Raphael Schiffmann, director of the Baylor Institute of Metabolic Disease, and Dr. Scott Gilbertson, director of the program in chemical biology at the University of Texas Medical Branch. Students and postdoctoral fellows were able to compete in a friendly environment for the best poster prizes, garnering the winners \$100 apiece and ultimate bragging rights.

FUTURE DREAMS

Looking back over the past several years, Dr. Kane observed great success with a great deal of progress: “The trajectory is great. We’ve had an increasingly large pool of very talented applicants for the program, and during the 2007–2008 academic year, we will have seven doctoral and two master’s students complete their education.” IBS students have been all over the world, presenting posters and participating in conferences. Additionally, the students are serving as coauthors on an increasing number of high-profile publications (Table).

The vision for the IBS for the next 5 years begins with defining formal research tracks in areas of strength such as

Table. Highly cited articles coauthored by IBS students

Article	Occasions cited*
Dayal S, Bottiglieri T, Arning E, Maeda N, Malinow MR, Sigmund CD, Heistad DD, Faraci FM, Lentz SR. Endothelial dysfunction and elevation of S-adenosylhomocysteine in cystathionine beta-synthase-deficient mice. <i>Circ Res</i> 2001;88(11):1203–1209	87
Tong AW, Papayoti MH, Netto G, Armstrong DT, Ordonez G, Lawson JM, Stone MJ. Growth-inhibitory effects of CD40 ligand (CD154) and its endogenous expression in human breast cancer. <i>Clin Cancer Res</i> 2001;7(3):691–703	56
Yang BZ, Mallory JM, Roe DS, Brivet M, Strobel GD, Jones KM, Ding JH, Roe CR. Carnitine/acylcarnitine translocase deficiency (neonatal phenotype): successful prenatal and postmortem diagnosis associated with a novel mutation in a single family. <i>Mol Genet Metab</i> 2001;73(1):64–70	53
Hyland K, Fryburg JS, Wilson WG, Bebin EM, Arnold LA, Gunasekera RS, Jacobson RD, Rost-Ruffner E, Trugman JM. Oral phenylalanine loading in dopa-responsive dystonia: a possible diagnostic test. <i>Neurology</i> 1997;48(5):1290–1297	52
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*As of July 2008.

immunology, metabolic disease, applied molecular biology, environmental science, and medicinal chemistry. Faculty in these focus areas will work with an increasingly large pool of PhD students more and more supported by external funds. Dr. Kane commented:

BU and BUMC are special places with a long-standing history of cooperation and collaboration. The IBS graduate program helps to bring the faculty and students of these institutions together, with the significant synergistic effect of partnering an academic research university with medical research institutes focused on translating basic science to the clinic. I believe that the biomedical studies graduate program will put its mark on the world by preparing the biomedical scientists of tomorrow with a unique "Baylor" education and worldview.

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25. Gomes, Erica. *Anti-tumor properties of CD40 ligand when delivered as a transgene by the conditional replicative oncolytic adenovirus AdEH to breast cancer cells*. June 2006. Mentor: Alex Tong.
26. Lyng, Eric. *Gamma hydroxybutyrate (GHB): mechanisms of central nervous system toxicity*. March 2006. Mentor: Teodoro Bottiglieri.
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30. Yu, Chun-I. *Humanized mice to test vaccination against influenza virus via dendritic cells*. March 2008. Mentor: A. Karolina Palucka.
31. Wood, David Rowe. *Design, optimization and evaluation of conditionally active gene therapy vectors*. March 2008. Mentor: Jiahuan Ding.
32. Patel, Pinakeen. *Gene expression profiling to understand the alterations in the monocyte compartment of pediatric systemic lupus erythematosus*. April 2008. Mentor: Virginia Pascual.

PHD DISSERTATIONS

1. Fuh, William Lih-Jyh. *Early gene responses in mechanically loaded bone cells*. May 1996. Mentor: J. Lester Matthews.
2. Bowser, Todd. *Inhibitors of gamma-glutamylamine cyclotransferase*. August 1997. Mentor: Mary Lynn Trawick.
3. Helleck, Adam Michael. *Photosensitization of Eretmapodites quinquevittatus Theobald (Diptera: Culicidae) with Phototrin II*. August 1997. Mentor: W. Keith Hartberg.
4. Hinson, Debra. *Clinical, biochemical, and molecular analysis of mevalonate kinase deficiency*. August 1997. Mentor: K. Michael Gibson.
5. Xiao, Ming. *Rigor cross-bridge conformation in rabbit psoas muscle fluorescence studies*. August 1997. Mentor: Julian Borejdo.
6. Yang, Yuanfeng. *Cross-linking of the G protein of vesicular stomatitis virus during photoinactivation*. August 1997. Mentor: Joseph T. Newman.
7. Gunasekera, Richard Sobana. *Gunasekera pathophysiological mechanisms of dopa-responsive dystonia and a novel regulation of the aromatic amino acid hydroxylases*. December 1997. Mentor: Keith Hyland.
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9. Zhang, Yu An. *Growth inhibition of human non-small cell lung cancer cells by anti-K-ras ribozymes*. December 1997. Mentor: Alex Tong.
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