VANDERBILT INFORMATICS CELEBRATES 30+ YEARS OF EXCELLENCE

"It has been an honor to work closely with a number of very distinguished DBMI chairs over three decades, beginning with Bill Stead. VUMC and all of health care benefit from the many extraordinary contributions DBMI has already made and I know will continue in the future."

JEFF BALSER, MD, PHD
PRESIDENT AND CEO OF VANDERBILT HEALTH
DEAN VANDERBILT UNIVERSITY (VU) SCHOOL OF MEDICINE

VANDERBILT INFORMATICS' IMPACT SPANNING THREE DECADES

A look back at historical milestones

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In the mid 1990s Vanderbilt University Medical Center (VUMC) began to undergo rapid transformation in how clinicians and electronic medical systems interacted.

Randolph "Randy" Miller, MD, had just arrived from the University of Pittsburgh to become VUMC's chair of Biomedical Informatics. He was eager to start using his skills as an early informatician to dive into the technical infrastructure of the highly ranked hospital.

But beneath the surface of a functioning workflow was a clunky system that was more troublesome than helpful. A new pilot, called the Computerized Provider Order Entry, or CPOE, that launched in April 1994, focused on improving the hospital's order entry system flipped responsibilities on its head and led to exasperation from all levels of staff.

Physicians on two units were newly required to input orders themselves — a rarity of the time — and as a result, fell behind on patient visits. Nurses, then, could only take emergency verbal orders from physicians. This spurred some doctors to place emergency orders for non-emergent cases. Some unit clerks, who had previously been responsible for documentation and distributing orders to nurses, were becoming recipients of negative feedback.

In summer 1994, Miller and fellow Antoine Geissbuhler, MD, volunteered to walk in the unit clerks' shoes. They sat in the hospital and worked as unit clerks to see for themselves how the system worked in real life.

Miller began brainstorming home-grown solutions. "If we can create our own system and process orders, that would be ideal," said Miller, Cornelius Vanderbilt Professor Emeritus and professor of Biomedical Informatics, Medicine and Nursing. "Our end users, the doctors, nurses and unit clerks, were the most important people to assist."

Following the volunteer project, Miller and Geissbuhler invited doctors, nurses and medical students for weekly pizza parties and sat with them in front of computers to customize a new ordering system in real-time. Miller talked with the clinicians, gathering their feedback on the system, while Geissbuhler coded on the backend. The order-placing system lasted for nine months.

"It got to the point where people were complaining about the color of things and not the actual system anymore," Miller joked. "Users' orders must be continuously respected, listened to, and addressed."

VUMC leadership greenlit the new pilot, called WizOrder, and implemented it across the adult and pediatric inpatient units over the course of 1995-2001.

Introducing Vanderbilt's Department of Biomedical Informatics

More than 30 years later, the Department of Biomedical Informatics (DBMI) is thriving with faculty and trainees who innovate within the hospital and lead groundbreaking research locally, nationally, and globally.

The Medical Center's clinical and technical infrastructure has dramatically changed since the early 1990s. Paper patient records converted to electronic health records (EHRs); the enterprise later adopted software from Epic Systems Corp. as its primary clinical interface. As each new season emerged in health care, DBMI leadership and faculty stayed at the forefront of change. The department is a powerhouse contributor to the institution's federally funded research.

Randy Miller was recruited to VUMC in 1994 as Professor and Chief of the Division of Biomedical Informatics.

"The Department of Biomedical Informatics has played a pivotal role in VUMC's success for decades," says Jeff Balser, MD, PhD, President and CEO of VUMC and Dean of Vanderbilt University School of Medicine (VUSM). "DBMI creates tools that improve the wellbeing of clinicians, staff and patients across the institution and, in

many cases, nationwide. At the same time, innovations shaping both research and training nationally and worldwide find their roots in DBMI. It has been an honor to work closely with a number of very distinguished DBMI chairs over three decades, beginning with Bill Stead. VUMC and all of health care benefit from the many extraordinary contributions DBMI has already made and I know will continue in the future."

Current and former members of DBMI take pride in belonging to one of the largest informatics departments in the nation. The department includes more than 50 primary faculty, a substantial team of research staff, and dozens of students and trainees across DBMI's educational programs. Interim Department Chair Josh Peterson, MD, MPH, has closely followed this growth, noting:

"As DBMI has expanded, one of its defining strengths is the breadth of faculty expertise," said Peterson. "We have clinical informaticians who shape the flow and presentation of information at the point of care; research informatics leaders who connect clinically derived data resources with investigators across the institution; informatics experts in public health and precision medicine; data scientists developing novel analytic methods; and faculty advancing the 'basic science' of informatics by addressing fundamental challenges in security, privacy, patient engagement, and artificial intelligence."

"We have an incredible wealth of capabilities and subdomains of informatics performed by multiple people on our staff. We also have one of the most incredible groups of students contributing to that work and elsewhere," said Peter Embí, MD, MS, professor of Biomedical Informatics and Medicine and past chair of DBMI. "And while we have matured as an organization, we're still translating code and writing into practice! It's something we do all the time. We have an incredible opportunity to make huge impacts on the future of health and health care. And that's even more important today than it was 30 years ago."

A unique aspect of Vanderbilt's biomedical informatics structure is that it's deeply embedded across the Medical Center and VUSM. Faculty regularly collaborate across both institutions

From left, **Drs. Joel McKinsey**, **David Hansen, Antoine Geissbuhler** and **Gordon Tanner** try out the portable WizOrder unit.
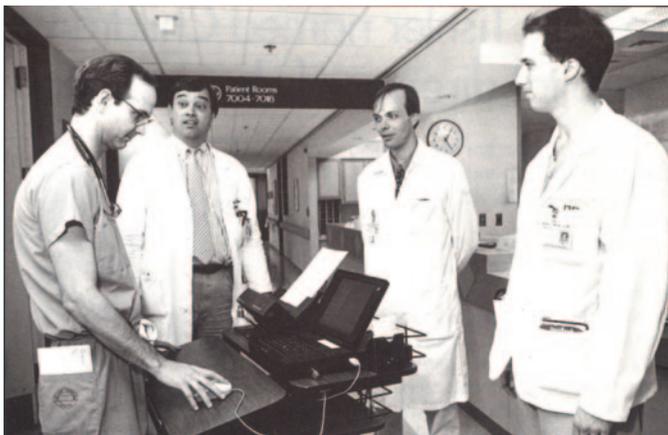
> "DBMI creates tools that improve the well-being of clinicians, staff and patients across the institution and in many cases nationwide. At the same time, innovations shaping both research and training nationally and worldwide find their roots in DBMI."
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> – JEFF BALSER, MD, PHD

with colleagues specializing in computer science, engineering, public health, nursing, biostatistics, oncology, global health, radiology, and nearly every sub-specialty of medicine —or often have secondary appointments across these departments.

The department's offices are at 2525 West End Avenue, located off campus across from The Parthenon, a local Nashville landmark. Faculty are only an elevator-ride away from many of the research groups DBMI works with, including the Vanderbilt Institute for Clinical and Translational Research (VICTR). It's the exact environment in which co-creation and open-innovation flourish.

Every DBMI Chair, with their individual passions and expertise, positively influenced the department's success through education, research, clinical informatics, artificial intelligence (AI) and more. All faculty, whether they joined near the beginning or completed their postdoctoral fellowship in informatics this year, make an impact at the hospital. The tapestry of expertise is woven into many of VUMC's landmark milestones over the last several decades.

And impressively, each chair ascended to leadership positions in many founding informatics organizations, including the American Medical Informatics Association (AMIA) and the American College of Medical Informatics (ACMI), and were elected to nationally ranked organizations, such as the National Academy of Medicine (NAM).

In fact, several primary faculty members have been elected to NAM, including Mark Frisse, Dan Masys, Bill Stead, Randy Miller, Josh Denny, Brad Malin, Peter Embí and Michael Matheny. This underscores the national impact DBMI faculty have.

The early days

DBMI's decorated history begins with William "Bill" Stead, MD, McKesson Foundation Professor in DBMI and professor of Medicine, who began his medical career at Duke University and trained in nephrology under Roscoe "Ike" Robinson, MD, Director of the Division of Nephrology and CEO of Duke Hospital. In the late 1960s, Duke University became an early developer of informatics tools. As an undergrad, Stead joined the team developing the Duke Cardiovascular Disease Databank, and as a medical student, he developed automated patient history-takers.

Stead went on to become co-developer of "The Medical

Bill Stead was recruited from Duke University to Vanderbilt University as Associate Vice Chancellor for Health Affairs in 1991, and began forming the Informatics Center.

Record" (TMR), an early computer-based patient record system, and later the principal investigator (PI) of Duke's medical center-wide effort to test and implement an Integrated Academic Information Management System (IAIMS).

In 1981, Robinson left Duke to become the Vice Chancellor for Health Affairs at VUMC. In 1991, he recruited Stead to Vanderbilt as Associate Vice Chancellor for Health Affairs with responsibility for medical center IT, the biomedical library, and a new academic Center for Biomedical Informatics.

In 1993, the Center for Biomedical Informatics was restructured into a division of the School of Medicine with authority to grant primary academic appointments and Stead at the helm. The division was the third academic unit of its kind in the country following the University of Utah and the University of Illinois Urbana-Champaign.

Meanwhile in Pennsylvania, Miller was leading IAIMS efforts at the University of Pittsburgh from 1986 to 1994. He created that institution's first National Institutes of Health (NIH)'s National Library of Medicine (NLM)-funded Informatics Training Program in 1987.

Nationally, informatics was establishing itself as a field. The merger of ACMI, American Association for Medical Systems and Informatics, and the Symposium on Computer Applications in Medical Care formed AMIA in 1988. And the American Association of Medical Colleges required competency in Medical Informatics in 1999. By 2000, informatics became a formalized specialty in the scientific field.

Miller himself had an unconventional introduction to informatics that started with an asthma attack in medical school.

As a high schooler in the mid 1960s, young Randy Miller began programming computers. He later pursued a medical education at the University of Pittsburgh in hopes of becoming an immunologist—perhaps to discover the roots of the various allergies he had growing up.

One summer when volunteering at an immunology lab, an asthma attack led him to discover his allergy to mice. He went to the emergency room wearing his white lab coat. "Patients were mortified seeing me as a 'doctor', wheezing in the waiting room," Miller said laughing. "My lab leader said later that I should never do a career in a lab."

Miller heard about a new computer assistance diagnostic program at Pittsburgh, led by his soon-to-be mentor Jack Myers, MD, chairperson of the Department of Medicine, and he remembered his childhood passion for technology. "Since I knew I wasn't allergic to computers, I volunteered to work on that project. Here I am, 50 years later," Miller said.

Crossing paths

Miller and Stead frequently encountered each other at medical conferences throughout the 1970s and 1980s. Fate eventually brought the two together in 1988, when they both served on the NLM's Biomedical Library Review Committee, where they evaluated informatics grant applications.

In 1992, the Dean of Columbia University's College of Physicians and Surgeons invited both Miller and Stead to be consultants to help determine whether the Center for Medical Informatics led by Paul Clayton, PhD, should be promoted to departmental status — it subsequently was.

After working together assisting Columbia — discussing philosophies, ideas, and pragmatic approaches — Stead subsequently asked Miller to consider becoming chair of the recently established Division of Biomedical Informatics at Vanderbilt.

The Division, predecessor of today's department, was part of the School of Medicine and the Informatics Center. The Informatics Center also included the Eskind Biomedical Library and personnel responsible for the Medical Center's IT infrastructure. The vision was a partnership, where Miller would grow the education and discovery capacity of DBMI with the rest of the Informatics Center providing an applied laboratory for faculty and trainees.

Miller was enticed by the opportunities, organizational infrastructure, and growing informatics capabilities that Vanderbilt offered. Given the recent retirement of his decades-long mentor at Pitt, Jack Myers, Miller jumped at the opportunity. Yet, he had one critical stipulation. Myers urged Miller to "never go from one academic institution to another unless you bring along enough talented individuals to guarantee success."

"Randy's recruitment created instant scale," Stead recalled. Miller joined Vanderbilt as chair on May 1, 1994. Miller, with Stead's backing, brought with him from Pittsburgh key faculty contributors: Dario and Nunzia Giuse, and informatics fellows Steven Brown, MD, and Geissbuhler.

"The reason why I chose to follow Randy was because Bill Stead implemented a new care provider ordering system, and Vanderbilt was the perfect place to implement decision support systems," said Geissbuhler.

At the time, Geissbuhler had just arrived in Pittsburgh from

Geneva, Switzerland, before heading to Nashville. "I soon realized that implementing tools that change the way people work is not about the technology itself, it's about understanding people and the human factors, and finding the best way to create a new experience and change the way people think about those information systems," he said.

Bringing knowledge base management to Vanderbilt

Before Miller's departure, medical students, clinical fellows, and faculty members at the University of Pittsburgh had, for two decades, spent elective time working under Myers and later under Miller and Nunzia Giuse. They constructed a literature-derived knowledge base to support computer-assisted clinical diagnosis. Volunteers each selected a disease of interest and spent two to four weeks full-time in the library, researching and creating lists of the findings reliably reported to occur in patients with the selected disorder.

Over two decades, the team described in meticulous detail an average of 85 findings apiece for more than 600 diseases. This effort underpinned what Miller called "the best diagnostic knowledge base in medicine" at the time. At Miller's request in 2010, Pittsburgh transferred the intellectual property rights to the INTERNIST-1/QMR knowledge base to Vanderbilt, so that Miller could more easily extend its scope. The renamed VanderbiltDDx Knowledge Base is still being used to this day to publish research at Vanderbilt.

By the mid 1990s, Stead successfully achieved funding from the NLM via an IAIMS grant to support startup packages to recruit primary faculty. Simultaneously, the newly established Annette and Irwin Eskind Biomedical Library at Vanderbilt had become the home of the Informatics Center and was instrumental in the implementation and success of VUMC's IAIMS. Miller initiated Vanderbilt's NIH/NLM sponsored Biomedical Informatics Training grant in the late 1990s.

Nunzia Giuse, MD, current Vice President of Knowledge Management and professor of Biomedical Informatics and Medicine at VUMC, describes what the early changes meant for the institution's growth. "In 1994, all journals were exclusively print, requiring clinicians and researchers to visit the library for access, and 1995 marked a turning point: with the online availability of a single journal, a new era of desktop access to library resources began. Although browsing the print stacks remained a valued experience,

Nunzia Giuse, MD, current Vice President of Knowledge Management and professor of Biomedical Informatics and Medicine at VUMC

Dario Giuse developed StarChart and StarPanel.

by 2013, only one journal remained exclusively in print. This dramatic shift in information accessibility significantly facilitated the adoption of evidence-based practices," she said.

Around the turn of the millennium, the key building blocks of what would become the current DBMI fell into place.

Building blocks of DBMI

From 1994 to 2001, a new era in clinical informatics took place at VUMC under Miller and Stead:

• Stead received a 5-year, $5 million IAIMS implementation grant and began hiring full-time informatics faculty via the VUSM, creating a pipeline of academic informaticians to both advance the science and help transform day-to-day clinical practice.

• Miller and Geissbuhler oversaw the rollout of WizOrder to the hospital to provide relevant "point-of-care" information resources to enhance and support clinicians' decision-making at the time of order entry. Together, WizOrder and StarPanel – supported by the IAIMS grant, faculty recruitment, and strong administrative infrastructure — cemented VUMC's place at the forefront of clinical informatics.

• In 1994, DBMI hired its first full-time administrative staff member, Joyce Green, who now oversees Faculty Affairs with long-time biomedical informatician Trent Rosenbloom, MD, MPH.

• Dario Giuse brought the Medical Archiving System (MARS) from the University of Pittsburgh, giving users easy access to patient data. Then Dario developed from the ground up more efficient and effective successors: StarChart and StarPanel. These applications, along with WizOrder, would be VUMC's core clinical information systems for the next 20 years.

• Stead recruited Nancy Lorenzi, PhD, MLS, MA, (currently professor emerita) to DBMI as vice president of Strategic Change Management at VUMC. She collaborated with Nunzia Giuse to

implement StarPanel and other major initiatives, including My Health at Vanderbilt.

• Miller recruited Kevin B. Johnson, MD, MS, to become vice chair of the new Department of Biomedical Informatics in 2002. Johnson later served as chair of DBMI from 2010 to 2020.

• Nunzia Giuse became director of the Eskind Biomedical Library and developed a new model for librarians and informaticians to work with physicians and use the knowledge base to answer care-related questions.

• Miller gained approval from VUSM for DBMI to gain Departmental status in 2001, and concurrent permission from the Graduate School for the Biomedical Informatics MS and PhD degree programs.

• By 2001, DBMI had 18 faculty members; 13 of them had primary (or dual primary) appointments; two primary DBMI faculty members had earned tenure by that time.

"When DBMI started, informatics was a foreign word at VUMC, and the clinical world simply did not rely on technology," said Dario Giuse, Dr. Ing, MS. "There was no EHR, no decision support, and basically no computers in any clinical areas."

"We implemented technology in a world of medicine at a time when it was really hard," said Nancy Lorenzi. "It's good to come back to people. DBMI does a really great job with pulling people together."

"DBMI's growth and expansion over the past three decades have been phenomenal, but not surprising. After all, the department was built on a solid foundation with Dr. Randolph (Randy) Miller at the helm as Founding Chair, and Dr. William (Bill) Stead

"We have the largest and most diverse department of biomedical informatics in the country, so our trainees get the benefit of a wide range of expertise and research opportunities, as well as a fantastic faculty-student ratio."

– JESSICA ANCKER, PHD, MPH
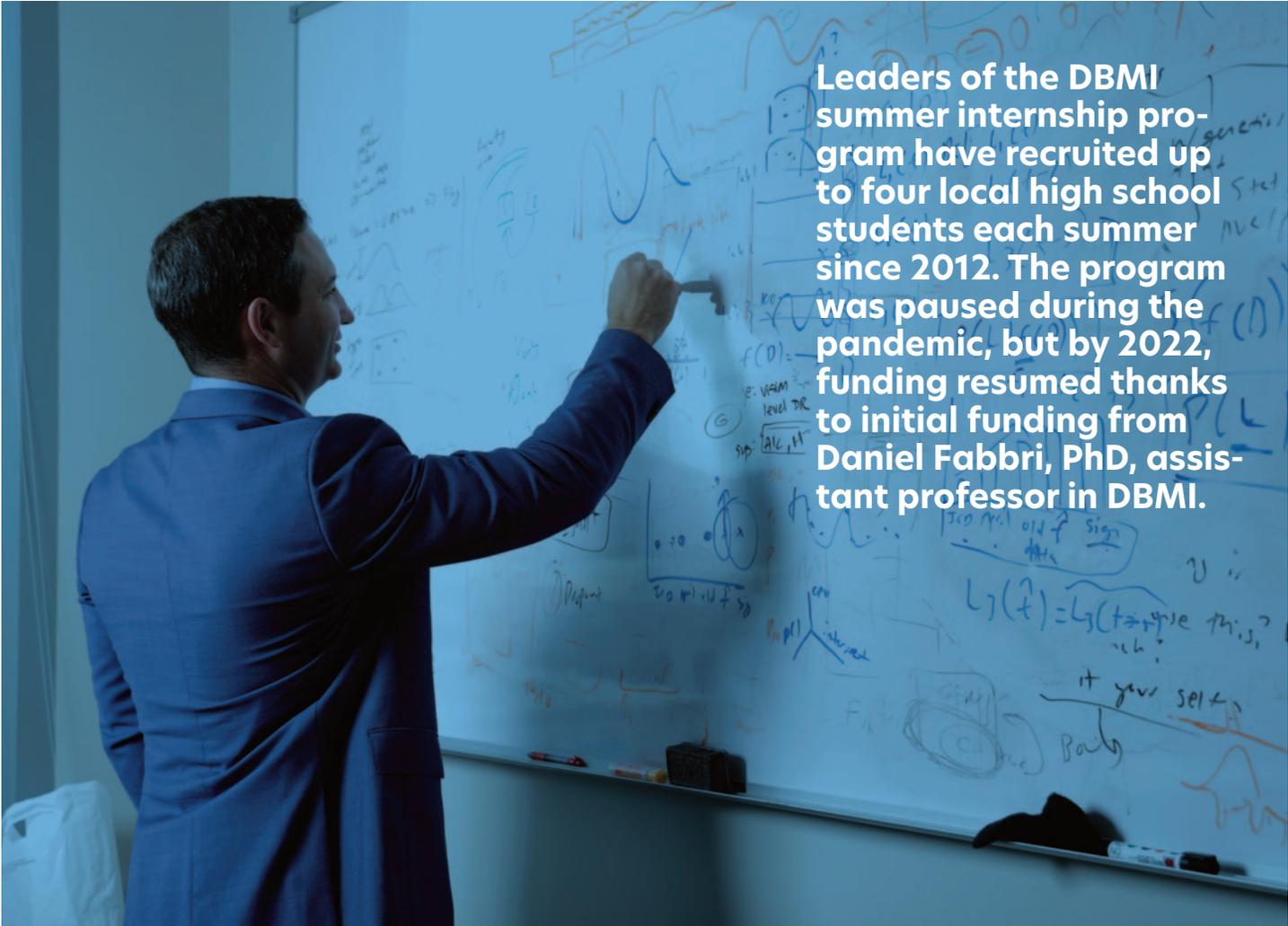
Leaders of the DBMI summer internship program have recruited up to four local high school students each summer since 2012. The program was paused during the pandemic, but by 2022, funding resumed thanks to initial funding from Daniel Fabbri, PhD, assistant professor in DBMI.

as Director of the Informatics Center and Associate Vice Chancellor for Health Affairs. In addition to Miller and Stead, the early core group in 1994 included (among others) Drs. Nunzia and Dario Giuse, Ms. Carol Aronson, myself, and trainees Antoine Geissbuhler and Steven Brown. I thank them for laying the groundwork years ago for DBMI to achieve excellence in innovation while demonstrating unwavering commitment to serve the community, and for building upon it so that others could take up the future charge," said Joyce Green."I am grateful for the privilege and honor of working alongside them during DBMI's amazing 30-year journey. Here's hoping for its continued growth and success!"

In 2001, DBMI was elevated to a Department of the VUSM, and educating future informaticists became the next big step.

Educating future informaticians

Miller, who often advised biomedical engineering students interested in working on informatics projects, formally established a master's and PhD degree program in biomedical infor-

matics. In 2000, he recruited Constantin Aliferis, MD, PhD, from Athens University to become the program's founding director. The first DBMI graduate students joined in fall 2001.

Dominik Aronsky, MD, PhD, joined the faculty in 2000 from the University of Utah and succeeded Aliferis as director of the MS/PhD program. Together with program manager Rischelle Jenkins (who joined in March 2001 and celebrated her 40th work anniversary at Vanderbilt University in 2024), the duo focused heavily on student recruitment and curriculum and program design until Cynthia Gadd, PhD, MBA, MS took over as program director in 2005.

In 2002, Miller obtained the NIH/NILM T15 grant, which provided stipends and tuition for DBMI's MS and PhD students. The T15 program offers graduate education, postdoctoral training and research experiences in a wide range of areas including health care informatics, translational bioinformatics, clinical informatics, public health informatics, and consumer health informatics. Today, VU/VUMC is one of 18 institutions across the U.S. benefiting from the T15 grant.

"We have the largest and most diverse department of biomedical informatics in the country, so our trainees get the benefit of a wide range of expertise and research opportunities, as well as a fantastic faculty-student ratio," said Jessica Ancker, PhD, MPH, professor of Biomedical Informatics and Health Policy and current vice chair for Educational Affairs in DBMI. "We are closely integrated with the hospital, giving trainees an opportunity to work directly with hospital systems and practicing clinicians. Vanderbilt also has a unique decades-long investment in data resources for research, so students can access unusually rich datasets of real medical data."

Along with Cynthia Gadd, Brad Malin, PhD, Accenture Professor of Biomedical Informatics, Biostatistics and Computer Science and current vice chair for Research Affairs in DBMI, and Jeffrey Blume, PhD, Adjoint Professor of Biostatistics, also received a T32 grant called "Big Biomedical Data Science" (or BIDS) that ran for five years from the Big Data to Knowledge (BD2K) program at the NIH. This program also supported students from across the Vanderbilt University School of Arts and Sciences, Engineering, and Medicine.

Reaching Future Generations of Informaticians

In 2008 under the leadership of Cynthia Gadd, PhD, MBA, MS, DBMI started a summer internship program for undergraduate students with funding support from the NLM.

After initial exploration of how the department could engage with younger learners, the program's goals expanded to focus on building new pathways into biomedical informatics. The program began to connect with local high schools to reach talented individuals even earlier in their education. Kim Unertl, PhD, MS, Associate Professor and current Director of Graduate Studies in DBMI, became director of the Vanderbilt Biomedical Informatics Summer Program (VBISP) in 2017. She and co-principal investigator Brad Malin received funding from the National Science Foundation to establish a Research Experience for Undergraduates site in 2018. The funding allowed DBMI to expand the program and to integrate additional training components.

Over the last 17 years, the program has engaged more than 100 high school, undergraduate, and graduate students in meaningful biomedical informatics research projects. These students have gone on to pursue medical degrees, graduate degrees, and career pathways in STEM fields. Many former VBISP interns have also joined DBMI as faculty members and graduate students.

In 2023, Unertl joined with colleagues at neighboring Historically Black Colleges and Universities (HBCUs) Fisk University and Meharry Medical College to obtain funding from the NLM that allowed the department to build a new collaboration around undergraduate and graduate students from Fisk and Meharry.

Entering the research era: Dan Masys

By establishing the MS/PhD program, and follow-on postdoctoral fellowships, DBMI leadership created the foundation needed to foster the future of informaticians. The next stage of advancement was research.

Over the past 17 years, the summer internship program has engaged more than 100 high school, undergraduate, and graduate students in meaningful biomedical informatics research projects. Featured above: The VBISP Class of 2025.

In 2002, Stead received grant funding from the NLM to develop an organizational framework for biomedical information science and technology to maximize multidisciplinary research. Joining the project's external advisory committee was Dan Masys, MD, a colleague of Miller and Stead from his time as director of the NLM's research division under the National Center for Biomedical Communications.

Masys was impressed by what he encountered during a 2004 Advisory Committee meeting.

"This was a medical center where senior leadership valued informatics. The power of knowledge management and technology was like what no other medical center was doing at the time," said Masys. "[Vanderbilt] was putting its money where its mouth was for having informatics create state-of-the-art technology and look to the future of molecular medicine and personalized care based on genomics and molecular variation."

Shortly thereafter, Stead called Masys to share that DBMI had an opening for a new department chair. Soon, Masys took the helm following the tenure of Miller.

Boosting DBMI's research capabilities came naturally to Masys. He had extensive time in the NIH, experience as a director of biomedical informatics programs, and connections in the research world. "I had always been a research critter from the very start," said Masys. "The connections of a research community

"In my annual speech to new DBMI students, I would always say, 'It's not what you know, it's what you do with what you know that counts,'" said Masys.

– DAN MASYS

Dan Masys was named chair in 2002, bringing an extensive background in research.

made it easier for me to recruit a new group of researchers to DBMI. We had a good momentum of people joining who were willing to tackle real-world problems and create solutions in the service of one's career and Vanderbilt as a world-class institution."

Masys embodied high-level expertise as well as humility, which set an example for rising stars, including Joshua Denny, MD, MS, Chief Executive Officer of the All of Us Program, Brad Malin, and Paul Harris, PhD, professor of Biomedical Informatics, Biomedical Engineering and Biostatistics, director of VICTR, and creator of REDCap — which celebrated its 20th anniversary in 2024.

Harris recalls how Masys changed his perspective about the trajectory of his early career. Harris went with Masys to an important meeting with VUMC clinical leadership, and Masys was "singing praises" about Harris's work to the group.

"I felt really good about that! We then walked out of the door and down the corridor before he stopped me and said, 'Never believe your own press,'" Harris said laughing. "It was said at the right time, like, 'Don't get the big head.' He was saying that to me even after everything he accomplished. That shaped who I am today as a human being, not just an informaticist."

"In my annual speech to new DBMI students, I would always say, 'It's not what you know, it's what you do with what you know that counts," said Masys.

The power of translational informatics & personalized medicine

Under the leadership of Masys, who served from January 2005 to May 2011, many critical projects in the fields of genomic and personalized medicine came to life.

BioVU, the world's largest biobank at a single academic institution, was launched at Vanderbilt in 2007. This biorepository houses DNA extracted from discarded blood collected during routine clinical testing and linked to de-identified clinical and demographic data. The goal is to explore the relationships between genetic variation, disease susceptibility, and different drug responses a person may have. In 2022, BioVU reached more than 300,000 biological samples,
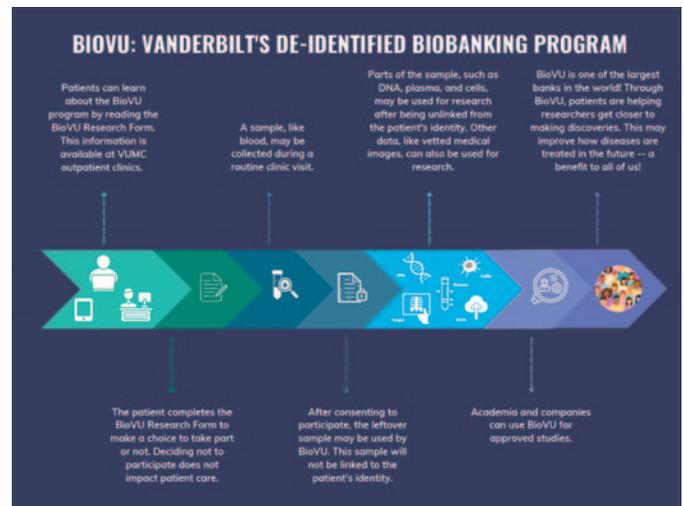
"It has trained a generation of data scientists," Dan Roden, MD, professor of Medicine, Pharmacology and Biomedical Informatics and senior vice president for Personalized Medicine at VUMC, who holds the Sam L. Clark, MD, PhD Chair, said in VUMC News. "It has attracted new faculty and trainees. It has allowed us to develop a national and international leadership position in personalized and precision medicine."

The creation of the Electronic Medical Records and Genomics (eMERGE) network brought together different institutions across the U.S. to collect DNA and share EHR-based data for phenotyping to conduct large-scale genetic research. eMERGE was organized and funded by the National Human Genome Research Institute.

The Pharmacogenomic Resource for Enhanced Decisions in Care and Treatment (PREDICT) program is a clinical decision-support system that tests patients for genetic variations and helps physicians choose prescription drugs and dosages that are best for them. PREDICT was launched in 2010 and overseen by Denny, Peterson, and Roden.

According to Masys, programs like BioVU and PREDICT led to a series of crucial NIH grants and projects, many of which are still active today. They also positioned VUMC as an "active" health care enterprise, rather than "reactive", when it came to diagnoses. DBMI became a leader in interventional informatics and took new knowledge like genomic data back to clinical decision making.

"Vanderbilt was one of the first to gather that information about your personal susceptibilities as evidenced by variations of your genome," said Masys. "You can have that information on-

hand before doctors made a diagnosis years later."

For physician-researchers like Josh Peterson, MD, MPH, director of the Center for Precision Medicine and interim chair of DBMI, there is still much work to be done when it comes to directly impacting patient care using genomic data.

"There is still a large gap between what we see in our research data in terms of unrecognized genomic diagnoses and risks and what is tested in clinical practice," he said. "That gap between evidence and practice is motivating — we start to see how informatics can make hidden biological risks accessible to clinicians and patients."

"We were doing health care in the purest form: understanding ahead of time what health events might happen for you in the future. That objective is still alive and well," said Masys.

Connector in chief: Kevin Johnson

Thanks to Masys, VUMC's research infrastructure became a well-oiled machine, and DBMI, which grew to house more than 60 primary faculty at the time, was ready for someone to bridge all of its educational, research and clinical programs together during a time when EHRs were rapidly changing, and clinician burnout was becoming a critical issue across the country.

Kevin Johnson, MD, MS, pediatrician and informatician, was recruited from Johns Hopkins Hospital in 2002 and appointed vice chair of Biomedical Informatics. Johnson was quickly noticed by DBMI leadership as someone not only passionate about clinical informatics and improving patient safety through innovative technology, but harmonious among faculty, staff, students and patients.

"It was obvious that he could run the department," said Stead, who led the chair search committee following Masys's retirement. "Kevin was an inclusive leader who nurtured all the pieces. He brought everyone and everything together."

Johnson was appointed chair of DBMI and chief informatics officer in Health Information Technology (HealthIT) in 2012, and later senior vice president of HealthIT in 2014. In both roles, Johnson made monumental changes across the institution.

Specifically, Johnson oversaw the implementation of Epic's electronic health system, eStar, from StarPanel, which simultaneously went live across all VUMC sites in November 2017. This multi-year transition was considered the "most significant clinical infrastructure change in the history of the Medical Center," according to The Tennessean.

The endeavor was like "changing the engine mid-flight," Johnson told the news outlet. "Everyone wanted to have an informatics representative after that," he said.

Throughout his tenure, Johnson also created opportunities for DBMI faculty to advance their careers and focus on different aspects of informatics while also contributing to the enterprise:

• Three vice chair roles were created for Faculty Affairs (Trent Rosenbloom), Research (Brad Malin), and Educational Affairs (Cindy Gadd and Jessica Ancker, who succeeded Gadd in 2021;

Kevin Johnson was recruited from Johns Hopkins to Vanderbilt in 2002 and appointed vice chair of Biomedical Informatics.

faculty member and DBMI alumna Kim Unertl, PhD, who was named director of Graduate Studies in 2020). An additional vice chair for Business Affairs role was created for Mark Frisse, MD, MS, MBA, professor emeritus in DBMI.

• Several centers were established to focus on clinical informatics (under Adam Wright, PhD), population health (Michael Matheny, MD, MS, MPH, which then expanded to encompass public health with the recruitment of Melissa McPheeters, PhD, MPH), precision medicine (Josh Peterson), health data science (Brad Malin), and knowledge management (Nunzia Giuse).

• He also oversaw the department's relocation from the fourth floor of the Eskind Biomedical Library to the 8th, 14th and 15th

"It's fair to say that DBMI at Vanderbilt has gone from being the largest department in informatics, which doesn't necessarily convey its impact, to one of the strongest and functionally applicable departments in the world in informatics."

– KEVIN JOHNSON

floors of 2525 West End Avenue to spur more collaboration within DBMI.

"It was an exciting opportunity to build and expand VUMC's research in an area that is inherently multi-disciplinary," said Matheny, director of the Center for Improving the Public's Health through Informatics (CIPHI). "Population and public health informatics itself bridge biomedical informatics, biostatistics, and epidemiology in the conduct of supporting the health and well-being of patients and their families, at a health system and society level. Kevin clearly saw the need for the Department to invest in this area, and his support and mentorship was critical to our success."

On the HealthIT side, Johnson worked closely with Neal Patel, MD, MPH, professor of Pediatrics, Biomedical Informatics and Anesthesiology, to further integrate HealthIT into the research infrastructure of VUMC. Together with DBMI leadership, they worked on numerous projects that empowered clinicians and improved their workflows in an era of great change. VUMC opted to partner with vendors for EHR needs rather than keep building on top of the original homegrown solutions.

"Back in the WizOrder and StarPanel days, our faculty and clinicians knew they could innovate directly in the EHR," explained Adam Wright, PhD, director of the Vanderbilt Clinical Informatics Center (VCLIC) and professor of Biomedical Informatics and Medicine. "If you had an idea, you could walk down the hall and work with DBMI colleagues who had the source code and could make it happen. When we moved to Epic, many worried that kind of innovation was no longer possible. VCLIC emerged as both bridge and catalyst, demonstrating that Vanderbilt could maintain its innovative edge within a commercial platform by creating new pathways for clinician engagement and system customization."

One key initiative out of VCLIC and VUMC's Department of Medicine is the eStar Physician Builder Program, led by Jonathan Wanderer, MD, MPhil. This program provides advanced training to providers with a desire to enhance Epic and its various functions — and gave clinicians the opportunity to tweak the EHR to suit the institution's needs.

"Technology and integrations are getting to the point where platforms like Epic are opening ways that we can make improvements to do better care," said Patel, who succeeded Johnson as chief health information officer in HealthIT following Johnson's departure in 2021. "It's slow work but we're turning a corner and beginning to see the next wave of cycles of improvement how teams interact with each other."

DBMI and HealthIT's capabilities stepped up when the COVID-19 pandemic hit home in March 2020. Johnson and Patel played pivotal roles in helping VUMC navigate the pandemic by helping leadership push out telehealth appointments to patients across Tennessee. "Our ability to move information around to record and capture data, gain insights and quickly make decisions… we were able to deliver care to patients and get vaccines

Peter Embí joined as DBMI's chair in January 2022.

and the right protocols to employees," said Patel.

Johnson predicts a "bigger and brighter" future for the field of informatics. "All the ways it might happen, whether it's through mental health, prediction, home and mobile based technologies… Vanderbilt is positioned to be that."

"It's fair to say that DBMI at Vanderbilt has gone from being the largest department in informatics, which doesn't necessarily convey its impact, to one of the strongest and functionally applicable departments in the world in informatics," said Johnson. "Research, education and the examples of leadership coming out of the department that are key linchpin to the overall success of the field nationally and internationally."

"The collaboration between DBMI and HealthIT sets VUMC apart and makes us unique," said Dara Mize, MD, MS, current chief medical information officer at VUMC. "We have faculty and an operational IT group who work together to ensure we're delivering and leveraging the best technology solutions for patient care. This makes us magic, and I would like to see that continue. To me, that's the reason to work at Vanderbilt."

Innovating the future: Peter Embí

While the country was still reeling from the pandemic in 2021, DBMI leadership began their national search for its newest chair after Johnson announced his departure to join the Univer-

sity of Pennsylvania. Johnson hoped that his successor would be someone who could bridge all aspects of the research enterprise at VUMC, with informatics and HealthIT at the helm, and bring DBMI into nationwide conversations and collaborations.

That's where Peter Embí, President and Chief Executive Officer of the Regenstrief Institute in Indianapolis, came in. Embí joined as DBMI's newest chair and VUMC's inaugural senior vice president for Research and Innovation in January 2022. Fortunately, he was already familiar with DBMI's achievements.

He recalled visiting DBMI and its then-Chair, Masys, early in his career: "I remember sitting in his office and he said, 'One of the amazing things about this place is that we're writing code in the morning and taking care of patients in the afternoon.' That was simultaneously terrifying and exhilarating, but mostly exhilarating because I knew it was being done extremely well and very thoughtfully.

"A lot of my Vanderbilt colleagues were luminaries in the field who had been working for many years to advance what we do in biomedical informatics. So, the opportunity to come here and succeed Kevin, and be able to continue the momentum of growth of what is the best Department of Biomedical Informatics in the country, was a real privilege."

As senior vice president for Research and Innovation, he helped advance VUMC's research capabilities by establishing new research informatics roles for faculty and new centers in collaboration with different academic departments:

Paul Harris was appointed vice president for Research Informatics in June 2023.

Travis Osterman, DO, MS, assistant professor of Biomedical Informatics (DBMI), Hematology and Oncology and director of Cancer Clinical Informatics at Vanderbilt-Ingram Cancer Center, was appointed associate vice president of Research Informatics in March 2023.

Dara Mize, MD, MS, was named chief medical information officer in February 2023, and in August 2023, Osterman and Wanderer were named associate chief medical information officers.

Featured: ADVANCE Center Leadership team

The Department of Biomedical Infographics Through the Years

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1991
Bill Stead recruited from Duke University to Vanderbilt University as Associate Vice Chancellor for Health Affairs, begins forming the Informatics Center

1992
Bill Stead oversees the establishment of the VU Eskind Biomedical Library as the new "hub" for the Informatics Center

1993
The Division of Biomedical Informatics is formally established within the Division of the School of Medicine at VUMC by **Bill Stead**.

1994
Randy Miller is recruited to VUMC as Professor and Chair of the Division of Biomedical Informatics. Nunzia & Dario Giuse, Antoine Geissbuhler and Steven Brown join VU from the University of Pittsburgh.

2001
Division of Biomedical Informatics officially becomes a department at VUMC and hires more primary and secondary faculty in bioinformatics.

2002
DBMI Education program expands to three tracks: MS/PhD, MD-PhD, Postdoctoral Fellowship. **Kevin Johnson** joins as new Vice Chair of Biomedical Informatics

2004
Dan Masys appointed Chair of DBMI. My Health at Vanderbilt and REDCap founded

2007
BioVU is established

2012
Kevin Johnson named Chair of DBMI

2019
Center for Improving the Public's Health through Informatics within DBMI established. **Joshua Denny** selected to lead the *All of Us* Program

2022
Peter Embí joins as new Chair of DBMI

"Together, we have continued to grow the Department of Biomedical Informatics into the leading program of its kind. I am incredibly proud of what we have achieved."

– PETER EMBÍ

In January 2024, VUMC established the Realizing Accelerated Progress, Investigation, Implementation, and Dissemination in Learning Health Systems (RAPID-LHS) Center to "minimize gaps between the generation of clinical evidence, implementation of proven interventions and development of informed public health policy." The center is led by Embí, Christianne Roumie, MD, MPH, and Russell Rothman, MD, MPP, and supported by a $5 million grant from the Agency for Healthcare Research and Quality and the Patient-Centered Outcomes Research Institute.

Embí came to VUMC with a strong passion for ethical care, specifically in AI and clinical trials.

Embí joined a National Academy of Medicine committee to produce a code of conduct for the development and use of artificial intelligence in health, medical care and health research.

In July 2022, Embí was responsible for VUMC's partnership with Yale School of Medicine and the Morehouse School of Medicine via the Equitable Breakthroughs in Medicine Development (EQBMED), which aims to increase diversity in clinical trials and address systemic barriers to participation.

In November 2023, Embí and Laurie Novak, PhD, MHSA, were awarded funding from the Gordon and Betty Moore Foundation for the project "Measuring Artificial Intelligence (AI) Maturity in Healthcare Organizations."

In December 2023, Embí and a group of DBMI faculty received funding from the Augmented Intelligence in Medicine and Healthcare Initiative (AIM-HI) Coordinating Center at Kaiser Permanente for their project "Advancing Novel Approaches and Best Practices for Effective AI-Enabled Diagnosis using Randomized Trials, Algorithmovigilance, and Proactive Risk Assessment".

In March 2024, VUMC joined the new Trustworthy & Responsible AI Network (TRAIN) which is one of the first health AI networks aimed at operationalizing responsible AI principles to improve the quality, safety, and trustworthiness of AI in health.

In March 2024, Embí and Malin established VUMC's first center focused on AI, called the AI Discovery & Vigilance to Accelerate Innovation & Clinical Excellence (ADVANCE) Center, which earned VUMC a title as one of the nation's top health care systems for AI by Becker's Healthcare.

Together, they are working on how to build AI tools and machine learning models that are trustworthy and fair.

"Specifically, we have been working on tools to inject trust into large language models, such as those that serve as the basis of systems like ChatGPT," said Malin, co-director of the AD-VANCE Center.

"To do so, we are building hallucination detection and mitigation mechanisms. Second, we are working on methods to create machine learning models that are fair in their performance for the various populations they are meant to support. One of the ways that we are doing so is through the creation of synthetic data that can be injected into machine learning models to help resolve disparities in the performance of the models."

Looking ahead

In May 2025, Embí stepped down from his role as chair to launch a new company built on innovations developed at VUMC to advance responsible healthcare AI and innovation. He is continuing his role as professor and holder of the endowed Directorship of Biomedical Informatics, as well as co-director of the ADVANCE Center, co-Director of the RAPID-Learning Health System Center, and co-Chair of the AI Technologies governance committee for VUMC.

"Leading this department has been one of the greatest privi-

Josh Peterson became interim chair in May 2025.

leges of my career," he said. "Together, we have continued to grow the Department of Biomedical Informatics into the leading program of its kind. I am incredibly proud of what we have achieved."

"Under Embí's direction, DBMI reached new heights. Peter brought energy and vision to the department's initiatives that will have a lasting impact. His contributions to our programs in artificial intelligence have us well positioned for the future as we seek to harness its full potential," said Jeff Balser, MD, PhD, President and CEO of VUMC and Dean of Vanderbilt University School of Medicine.

Under interim chair Josh Peterson, Embí is "confident that the department will continue to grow and succeed under his capable leadership."

"A well-established leader in DBMI and our organization, Dr. Peterson continues to make substantial contributions to our programs in personalized medicine and is well prepared to serve as the department's interim chair. I want to thank him for his service," said Balser.

DBMI's future

There may be no single solution for improving health care for both patients and clinicians. But informaticians like those working at VUMC will continue to innovate and test tools that impact the field across the globe.

"DBMI takes a holistic approach to informatics," said Malin. "The faculty in the department have backgrounds that are highly diverse, ranging from hardcore computer scientists to anthropologists to clinical specialists that are looking to bring technology into the everyday practice of healthcare."

More importantly, the department is rooted in an ethos of collegiality. Teaming in the department happens regularly and is strongly encouraged, which is something that does not always happen in academia. Also, it's important to recognize that we are encouraged to study the data that the VUMC generates about patients and healthcare operations, as well test our ideas in pragmatic trials. As Bill Stead has repeatedly said, "we treat VUMC as a living laboratory."

"I have a ton of pride. It's been a great place to work over the years. Nationally, Vanderbilt's DBMI has really thrived and is fairly unique, and it's been great to watch DBMI become the leader that we set out to do 30 years ago," said Rosenbloom.

"I'm very proud and delighted with how the department has grown," said Stead. "You see the vibrance at the annual retreat. It's hard to remember a time when all the faculty fit at my dining room table! That's extraordinarily positive."