

# REINVENTING HIGHER EDUCATION

The Promise of Innovation

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*Editors*

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## The Mayo Clinic of Higher Ed

Kevin Carey

ON A COLD FRIDAY AFTERNOON in February, Chelsea Griffin walked through the fading winter light of downtown Rochester, Minnesota, past old-style restaurants and stores filled with balloons and flowers, into the marble-clad halls of the Mayo Clinic.

An elevator and staircase led her to a windowless laboratory, with a stainless steel sink on her left and cabinets filled with medical equipment on her right. In the center of the room, lying prone on a table, was the corpse of a middle-aged man. His chest was split open and his ribs were splayed to either side. Griffin put on a white laboratory coat and pulled a pair of blue latex gloves over her hands. As a group of students watched, she reached into the cavity and pulled out the heart, feeling the weight of it in her wrist and arm. Her index finger traced a path to a spot just above the right ventricle. She knew this part of the internal human anatomy better than any other. Twice, she had undergone surgery to repair a hole there that threatened her life.

The thought of it brought her up short, and her eyes welled with tears. For a moment, her perspective shifted up and out. She saw herself, standing in a lab coat with a stranger's heart in her hands. This, she thought, is where I'm meant to be.

And yet, if it were up to the norms and conventions of American higher education, Griffin wouldn't have been there. She is not a doctor or a nurse, or an intern or a researcher or even an upperclassman studying pre-med.

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She's an eighteen-year-old college freshman. Instead of sitting bored in the back of a cavernous lecture hall or starting another weekend bacchanal, she's been getting the kind of education that most undergraduates only dream about: modern facilities, small classes taught by tenure-track professors, a cutting-edge interdisciplinary curriculum, and access to the best minds of science and industry. Instead of reading about human anatomy, Griffin sees it firsthand.

### A GROUNDBREAKING APPROACH

In a competitive economy, many students need an education like this. Unfortunately, most people like Griffin aren't getting one. The small colleges that specialize in high-quality teaching tend to be exclusive and crippling expensive. Meanwhile, the public universities that educate most students are in crisis. Rocked by steep budget cuts, they're increasing class sizes, cutting faculty salaries, and turning away tens of thousands of qualified students. Many of those universities offered a mediocre, impersonal education to begin with. Now they're getting worse, and nobody seems to know how to stop the bleeding.

But here's the thing about Griffin: she isn't enrolled at an ancient private liberal arts college or an exclusive, wealthy university. Her institution admitted its first undergraduates less than a year ago. And while nearly every other public university in America is retrenching, Griffin's university is expanding, under exactly the same financial conditions. And what will the taxpayer cost of this expansion be? Nothing at all.

Griffin's school has an unremarkable-sounding name but a groundbreaking approach to education. She is a student at the University of Minnesota-Rochester (UMR), a campus based on the idea that most of what we know about how a public university should operate is wrong, and that it can be done better, for modest amounts of money, right away. States across the nation could solve many of their higher education problems by replicating this effort, if they can overcome the entrenched interests of existing colleges and their own failure of imagination.

Understanding what UMR is requires first understanding what it is not: an institution built in the classic mold. That model was established in the late nineteenth century, based on the German research university, and revolves around the individual scholar. In the mind's eye, we still see men like Newton, hunched over a desk in the stone aeries of Trinity College, revealing the universe through sheer force of cognition. That kind of individuality goes hand in hand with autonomy. And autonomy, more than anything else, has defined the way higher education works today.

Ideas like these were on Stephen Lehmkuhle's mind when he first arrived in Rochester in 2007. Tall and balding with a genial affect and a neat moustache, Lehmkuhle was then a senior administrator in the University of Missouri system. He was also, crucially, a trained experimental psychologist. He had thought deeply about the human brain and the vast web of neural links that turn a mass of individual cells into glorious, high-functioning complexity. Yet when he looked around his university, he saw instance after instance of unmade connections between the autonomous components of organizations that were far more atomized than they needed to be.

Lehmkuhle was competing to be the first chancellor of UMR. While the University of Minnesota had offered classes to Rochester's hundred thousand residents since the 1960s, a blue-ribbon commission convened by Governor Tim Pawlenty recommended in 2006 to expand those operations into an official fourth branch of the university, joining branches Duluth, Morris, Crookston, and the flagship campus in the Twin Cities of Minneapolis and St. Paul.

The commission envisioned that UMR would focus exclusively on graduate programs in health, taking advantage of the world-famous Mayo Clinic's expertise. But Lehmkuhle wanted to do more. He proposed adding a new bachelor's degree of health sciences, a novel program that would operate unlike anything else in the system. In September 2007, he got the job.

Lehmkuhle's first challenge was deciding where to put the university. College campuses tend to evolve over time into miniature city-states, with their own churches, police forces, concert halls, and security walls, cut off from surrounding communities. Lehmkuhle wanted his campus to be an

integral part of Rochester. Plus, he didn't have a lot of money to work with. Fortunately, Rochester was eager for a new university to create jobs and liven up a city center whose restaurants and stores mostly served elderly visitors to Mayo. Lehmkuhle set up shop on the third and fourth floors of a shopping center in the heart of downtown, where a food court used to be. The city kicked in \$11 million to help him build offices, classrooms, and laboratories.

Lehmkuhle then struck up a partnership with the city's biggest employer. Under the terms of an unusual agreement between UMR and Mayo, the clinic's doctors and researchers are guest lecturers in UMR health science classes. UMR students have access to research laboratories, a ten-thousand-square-foot medical simulation center complete with robotic surgical mannequins, and other facilities—including Mayo's cadaver lab. That's how Griffin and a small class of fellow students ended up spending time with dead people on a Friday afternoon.

Next, Lehmkuhle had to hire professors and decide how to organize their work. Traditional universities isolate their faculty in academic departments that often view one another as strange denizens of another planet at best, outright enemies at worst. Departments also accumulate administrative structures—chairs, vice chairs, and so on—over time. Lehmkuhle didn't have enough money to pay for vice chairs, and, anyway, he wanted professors from different disciplines to work together. The solution: no departments.

Traditional universities also separate teaching from research. These functions are not just disconnected, but often antagonistic as well. Many professors vying for tenure in the publish-or-perish system are openly encouraged to neglect their students in favor of scholarship. Lehmkuhle resolved this tension by making tenure at UMR contingent on three factors: teaching, research in the academic disciplines, and research *about teaching*. For UMR professors, applying their analytic powers to their own teaching practice would be a standard part of the job.

Having connected the university to the community, disciplines to disciplines, and teaching to research, Lehmkuhle also wanted to connect students to one another. Decades of academic studies have found that stick-

ing freshmen in passive, impersonal lectures is educational malpractice. Most students learn best when they're actively engaged in dialogue and collaboration with faculty and fellow students. UMR classrooms were to be small and intimate, with no "front" from which professors could lecture. Instead of facing a teacher, students would face one another, around tables in teams of four or five.

## UMR AND THE MAYO WAY OF MEDICINE

Rochester turned out to be a particularly hospitable place for Lehmkuhle's vision. The brothers William and Charles Mayo, who founded their clinic in the late nineteenth century, pioneered the concept of group practice, where doctors collaborate with an emphasis on diagnosis and prevention. The clinic also has a thriving medical school with a focus on hands-on education. When Lehmkuhle looks out his office window at the glass skyways that link the university to the Mayo Clinic buildings two blocks away, he sees the physical manifestation of a philosophical connection between the two institutions.

UMR began offering graduate health sciences programs in 2008. But getting final approval for the undergraduate program took time, leaving UMR with only a matter of months to scramble and recruit candidates for the 2009–2010 school year. It tracked down students who had already been accepted to the main Twin Cities campus and offered them the chance to be both subjects and co-designers of a novel higher education experiment. To Lehmkuhle's relief, a healthy crop of students were up for the challenge. Last fall, fifty-seven enrolled in the inaugural class.

To oversee academics, Lehmkuhle brought in Claudia Neuhäuser, an applied mathematician with a PhD from Cornell. The author of papers such as "An Explicitly Spatial Version of the Lotka-Volterra Model with Interspecific Competition," Neuhäuser might have seemed like an unusual choice to guide students only a few months removed from high school. But she is also the author of *Calculus for Biology and Medicine*, a well-known undergraduate textbook designed precisely to help health science majors

learn complex math. She understands the importance of building connections between disciplines.

I met Neuhauser on a Monday morning in early March, after crossing a skyway from my hotel and riding an escalator near a LensCrafters and a knitting supply shop. She explained the parallels between the UMR educational philosophy and the Mayo way of medicine. "They call it personalized health care," she said. "We call it personalized learning." Both processes require diagnosis. Who is this person, exactly? What makes them tick? And diagnosis is only as good as the information to which it's applied.

At traditional universities, nearly all of the information generated about teaching and learning is discarded. Tests, papers, homework, class projects, and the record of day-to-day interaction between students and teachers disappear; only course syllabi and final grades remain. Lehnkuhle calls this the Las Vegas approach to higher education: "What happens in the classroom stays in the classroom."

UMR captures much of that information. It begins by breaking each course into two- to three-week segments called "learning objects," which are electronically tagged in a way that allows them to be matched in a database to student records, course materials, group assignments, draft papers, and exams. (The UMR campus was designed as a paperless environment, and students are issued identical Lenovo ThinkPad laptops, which they seem to keep two feet in front of their faces at all times.) This information will be stored in an electronic database that professors will analyze in conducting the learning research they need to get tenure. That research, in turn, will improve their ability to refine new teaching strategies. By analyzing the relationship between historical student learning patterns and specific educational techniques, UMR may discover that students who struggle with certain concepts benefit from some learning environments but not others. Such insights will allow UMR to personalize the college experience for each student.

There are strong parallels in the health care industry, where Mayo and the Veterans Health Administration have led the way in using electronic medical records to help doctors work together and analyze huge archives of

medical data. Neuhauser also oversees UMR's graduate biomedical informatics and computational biology program, where students apply large-scale statistical analysis to medical data, working in partnership with Mayo and Rochester's second-biggest employer, IBM.

### LEARNING AT UMR

For the next few hours, I hopped from one class to the next: first writing, then organic chemistry, then biology. As the day wore on, something unusual started to become clear. Each professor came from a different academic background and ostensibly taught a different subject. But they were all, in different ways, talking about the same thing.

For instance, during a writing seminar I attended, the term *creatine* came up. Creatine is a naturally occurring organic acid that athletes take in extra doses to build muscle. Later that day, the term showed up a biology class, in which Professor Rob Dunbar noted that there are reasons to believe that ingesting large amounts of creatine can reduce muscle fatigue. But how might experiments testing the proposition be designed, he asked? The class proceeded to work this out as a group.

Everyone at UMR, it turns out, was talking about creatine. Students synthesized it in chemistry, studied its effects on muscle fatigue in biology, learned how to interpret those studies in statistics, pondered the ethics of using artificial performance-enhancing substances in philosophy, and developed papers combining these perspectives in writing. Nobody worked alone, because every student at UMR takes the same structured curriculum for their first two years.

While Griffin wants to be a cardiologist, other UMR students will be able to use their health science degrees to enter a range of jobs: research scientist, hospital administrator, small-town doc with a general practice. People don't need to know much about creatine to succeed in those careers. What they need is to be able to understand things like creatine from the perspective of biology, chemistry, statistics, and philosophy, all at once. They need to be able to develop and improve those ideas within small,

close-knit teams of other people. And they need to be able to communicate that knowledge, in writing, to the rest of the world.

This represents perhaps the most foundational of all the connections that Lehnkuhle and his colleagues have been steadily knitting together in Rochester: that between facts and ideas. Traditional college instruction—the lecture—is largely a process of orally transmitting facts from the brain of a teacher to a student. It's a tremendously inefficient method—even harmful. UMR chemistry professor Rajeev Muthyala points to research finding that undergraduates often finish lecture-based introductory science classes with less expertise than when they started. They get *worse*.

That's because there is a crucial difference between the way novices and experts learn. Experts have a much greater ability to retain information, because they incorporate new facts into complex structures of interconnecting concepts and ideas. For an expert wrestling with large questions of, say, political economy, a data point like the failure of the Smoot-Hawley Tariff Act of 1930 is interesting and significant for suggesting how protectionism can backfire. But a novice often doesn't know what do with new facts, where to put them, or how to connect them to other facts. Something like Smoot-Hawley is nothing more than a name and a date. Simply put, a lot of new information bounces off a novice's brain for want of a place to fit.

This is the reason that so many sophomores at traditional universities fail organic chemistry, says Muthyala, who teaches the class at UMR. Organic chemistry is usually taught “as if it's completely disconnected from other disciplines,” he says, and in many schools it's notoriously used to cull weak students in their sophomore year.<sup>1</sup> But UMR students, who enroll with solid but not earth-shattering ACT scores (typically around 24, or 1100 on the SAT), all take organic chemistry as freshmen and are passing at unusually high (85 percent to 90 percent) rates.

I saw Muthyala's approach to teaching in action when I attended one of his classes. For more than an hour, Muthyala stayed in motion, moving in a 270-degree arc around the room, alternating between short explanations of the material and friendly interrogation. Questions and diagrams popped up on wall-mounted projection screens as students used their laptops to

examine data on spreadsheets and flip back and forth between charts and PowerPoint slides. Some pulled portable whiteboards down from ra and began scribbling out equations with green markers as other members of their team pointed and offered suggestions. “Can we rule out an es unambiguously?” Muthyala asked at one point. “No, we cannot. Make s you read up on proton NMR spectroscopy before you come to the ne class.” This went over my head, but the students seemed to understan completely. And I did understand the term *creative* when it was mentione After all, it had come up in another class already.

### THE UMR MODEL

The UMR experience is highly structured at the beginning, a marked contrast to universities that hand freshmen a huge course catalog and expect them to fend for themselves. UMR faculty from different disciplines carefully map out the sequences of their courses together, coordinating topic areas week by week. But the curriculum is much less structured at the end. The plan is for these undergraduates to have a senior year devoted entirely to a personalized “capstone experience” like getting an allied health certificate at Mayo, taking graduate classes, or working with professors on new research. The groundbreaking UMR model could not have been created at an established college or university. Lehnkuhle was only able to make all the right connections, hire all the right people, and build the right organizational culture by starting a new university from scratch.

Traditional research universities defend their departments, vice chairs, and classically tenured professors on the grounds that autonomy is vital for research. The point is arguable, but also largely irrelevant. According to the Carnegie Foundation, there are only 167 public research universities in America, out of nearly seventeen hundred public colleges and universities nationwide. Only sixty-three qualify as top-tier research institutions. The vast majority of students enroll somewhere else.

State lawmakers don't think much about creating new universities, because they can barely afford the existing ones. But new universities are

expensive only if you build them using the old model. When the Minnesota legislature signed off on the new Rochester campus, it increased the University of Minnesota's annual budget by \$6.3 million. Otherwise, it has provided no additional funding for UMR, and it doesn't intend to. The cost of UMR's planned expansion to fifteen hundred students by 2015 will come entirely from student tuition, which is currently the standard University of Minnesota rate of \$11,200 per year.

Five years from now UMR is scheduled to receive a little over \$5,000 per student from the taxpayer, which is roughly one-third of what the flagship Twin Cities campus receives today. Even after discounting spending on research, the flagship is still two to three times costlier than UMR. And, if UMR eventually grows to a modest size of three thousand to five thousand students, it will be the most cost-effective public university in the state, by far. That's because existing universities have to pay for things and ideas from an earlier time.

Take Winona State University, which is fifty-three miles due east of Rochester on the shores of the Mississippi River. Although it's not a research university, it has dutifully divided its faculty among five colleges and scores of departments, seventeen in the College of Liberal Arts alone. It also takes a traditional approach to buildings. In the late 1990s, Winona decided to erect a handsome new brick and stone library on the corner of the central quad. The facility holds two hundred twenty thousand volumes, employs seventeen people, and sports a terrazzo floor inlaid with images of the Mississippi River and quotes from Bob Dylan. In a nod to information technology, Winona added wi-fi and included a bank of computer terminals and comfortable chairs. The cost to Minnesota taxpayers: \$17.7 million, plus annual expenses for maintenance and the seventeen people.

UMR took more or less the same approach in building its library, except without the brick, stone, floors, tile, books, engravings, people, or \$17.7 million. UMR's library consists of wi-fi, one librarian, a bank of computer terminals, and comfortable chairs. Students who need to borrow physical books get them through the University of Minnesota's interlibrary loan.

UMR's entire print collection fits in a small metal bookcase, the type you can buy at Office Depot for \$129. The bottom two shelves are empty. Instead of living in subsidized dorms, UMR students rent privately owned apartments at a group rate negotiated by the university. Instead of working out at the kind of elaborate fitness center that many universities have built in recent years, students go to the YMCA, which organizes intramural sports. UMR is exclusively in the teaching and learning business. It turns out that if that's the only business you're in, you can do it very well for relatively small amounts of money.

Traditional universities complain that they need expensive amenities to compete for today's entitled, hedonistic student. But the example of UMR suggests that students are quite happy to have something more modest. While UMR students have parties and take part in extracurricular activities—including a competitive ballroom dance team and something called “boot hockey,” which involves boots instead of skates and brooms instead of sticks—the students take their work seriously and stay busy. I asked every student I could find how much they work on academics outside of class. The typical answer: thirty to thirty-five hours a week. According to the nonprofit National Survey of Student Engagement, only 6 percent of freshmen at the biggest, most prestigious research universities work that hard. Nearly a third work ten hours or less. Eighteen-year-olds are highly sensitive to expectations and organizational culture. If you give them a lot of work and commensurate support, they'll do it. If you give them little work, a lot of free time, and an elaborate social infrastructure centered on alcohol consumption, they'll react accordingly.

### A NEED FOR INNOVATIVE LOW-COST PUBLIC UNIVERSITIES

We need more schools like UMR, public universities dedicated to teaching and designed from the ground up with the latest technological developments and research findings in mind. Existing universities cannot and will not provide this. They won't be bulldozing their libraries, disbanding the champion basketball team, radically overhauling tenure, or demoting



she's humming through organic chemistry and is one of only three freshmen who tested out of calculus before starting college. She's wanted to be a doctor ever since she and her father, a dairy equipment salesman, began sitting on the couch together Thursday nights to watch *ER*.

For Gascoigne, the flagship University of Minnesota campus in the Twin Cities seemed monstrously large, and private St. Olaf College was far too expensive. So she commutes twenty-four miles each way to UMR from her three-thousand-citizen hometown of Zumbrota (motto: "The only Zumbrota in the world"). She describes her typical weekend as "studying, and cleaning my apartment," which she shares with her roommate, a hairdresser. This explains the spiky hair.

America's system of old universities has always done a good job of educating a small percentage of talented and well-off students. But the old system is ill-equipped for Gascoigne and Griffin and hundreds of thousands of other students who need universities that are designed to help them in the way that UMR helps its students. For now, the University of Minnesota's new Rochester campus is an interesting outlier. If more people can see the true potential of its newness, it will be much more.

## Conclusion

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MUST UNIVERSITIES CHANGE? How might they change? Can the change in significant ways on a broad scale? The chapters in this volume have offered a range of answers to these questions, not identical by any means. But their consistent thrust is this: change is necessary, at least for many institutions. Change is also inevitable, and plenty of examples show that it's possible. Yet change is difficult and complicated, especially at scale. The real challenge ahead will be how to overcome the ubiquitous disincentives for change outlined in the previous pages. Only then can innovators begin to take hold in American universities—and spread.

In the first chapter, Dominic Brewer and William Tierney succinctly laid out the imperative for innovation in U.S. higher education, a mixture of demographic, economic, and technological forces. Yet Brewer and Tierney set a less-than-encouraging tone about prospects for reform, citing an array of obstacles. Many colleges and universities have failed to learn from innovations that have become routine in other service industries; these range from intelligent use of new information technology and rethinking of rigid labor roles to focusing on a central educational goal, thus avoiding the mission creep that has too often characterized postsecondary institutions. Throughout U.S. higher education, it seems, incentives to innovate vary enormously and—often because of public policy barriers—are