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**PROFESSOR:**

Professor Mindell will be a little late today. He's at a lunch for, I think, department heads or something. But he'll come meandering in at some point. But I'm the one that's designated to give the lecture today. So I'm going to-- what I want to do today is to talk about the general context of the times in which MIT was founded. And one of the questions-- I think several of you raised this question about, why was MIT founded when it was? Why did it happen at that particular moment in history? Because it wasn't the greatest moment in history to be sure. It took them, basically four years from getting a charter to actually opening the Institute, to get started. And even then, they limped along.

It's a wonder MIT survived in some ways because financially, they were always in trouble well through the 1890s. Every year, they're just barely making the budget. And so it's not an easy beginning, even though, in many ways, from an educational standpoint, a revolutionary one. Because it was a different breed of cat that was being founded here in 1861. And I want to sort of give you a background about what the times were like.

How many of you had an American history course, either high school or-- so a lot of you have. OK, that's good.

How many of you have read Charles Dickens *A Tale of Two Cities*? What is the first line, the famous first line? "It was the best of times and it was the worst of times." And that could very well be the same theme for the decade that preceded the founding of MIT. It was the best of times, in some ways, and yet it was the worst of times in others.

And I think the best way to start this is to say, history itself is filled with irony and

contradictions. And surely, the 1850s was one of those times in history that was filled with irony and contradiction. On the one hand, you had a country that was intensely nationalistic, intent on expanding the boundaries to the United States under a theme that you've probably encountered before called Manifest Destiny. It was the idea that America was going to expand across the continent, and perhaps even sweep down through Latin and South America. There were some who really felt that the United States was destined to do that. Intense nationalism.

And on the other hand, you have intense sectional divisions about, what were you going to do with this territory once you got it? Was it going to be slave? Was it going to be free territory? And that was the big question of the 1850s, was the future of slavery in the United States. And people were bitterly divided along sectional lines about the future of slavery in the United States.

Well, when you look at the United States from sort of the best of times perspective-- I'm going to look at the best of times side, and then look at the worst of times. But the best of times side, what really is an economic story and a technology story. And that is, is that between 1839 and 1859, the United States underwent a tremendous spurt of growth. Commodity output, for example, between those two-- or over those two decades, grew by something like 57% per decade. Not just over 20 years, but per decade. That's an amazing number. That's like talking about China today. Even faster than China in a way.

Also, railroad construction begins during the 1830s basically. And by the late 1850s, by 1859, the United States has over 30,000 miles of railroad in the country. That mileage exceeded the total mileage for the entire world at that time-- Britain, France, Germany, wherever. So there was a tremendous growth in railroad construction.

And then, from a more technological perspective, when you look at the manufacturing sector of the United States, there were tremendous technological changes taking place in manufacturing. Not just of agricultural equipment and cotton goods, but also in things like metal products, like firearms with interchangeable

parts, or sewing machine that is a derivative from that new technology. But there seemed to be this big spurt in new technologies that were very innovative during this period. And so much so-- and I'll talk about it in a minute, that Europe began to send observers to the United States to see what was going on here. All of a sudden, this little, nondescript develop-- the United States is a developing country. In 1820, it is really a developing country. Hard to believe that today, but it's true.

By 1850, that had changed. And so during these decades between the '20s and '30s and up through the '50s, you're seeing enormous changes taking place-- railroads, manufacturing.

And then finally, in the area of science. The United States was beginning, after being a backwater-- basically, prior to the 1850s, the United States was a place where European scientists came to collect things, collect specimens of animals, or wood, or plants, things like that. No serious science was done in the United States prior to the 18-- what? 1830s I would say. Some would dispute me on that. Surely there were some first-rate scientists in the country, but not many. By the 1830s and '40s, you begin to see the emergence of a serious science enterprise in the United States led by people like Joseph Henry who is the first secretary-- yeah, I think he is the first Secretary of the Smithsonian Institution, which itself was a scientific organization as much a science enterprise as it was a museum. Today we think of it more as a museum than that, but still has it science projects there.

So there are people like Joseph Henry, a fellow named Alexander Dallas Bache, who was running a survey of the coastline of the United States, a very talented man of science. I think he's the grandson of Benjamin Franklin who is arguably the first famous scientist in the United States because of his experiments with electricity. But they're few and far between. And so this science enterprise is beginning to grow. And I think it's in 1847 that you see the establishment of the American Association for the Advancement of Science, which was one of the key organizations in this count-- still is. *Science* Magazine is published by their organization, and it's considered to be the sort of central source of professional science in the United States.

Finally, there's the educational end of this. And this is where MIT comes in. It's during the decade of the 1850s and '60s that you begin to see this new thinking about trying to shift higher education away from an older, traditional classic oriented curriculum. A classic, by that I mean an educational process that really emphasized the classic languages, like Greek and Latin, history, literature. The world I come from in many ways. But there was this new movement to try to insert the study of science, and even engineering, into this educational process. And it was not easily received. There was a lot of opposition to that. And it's in that context that William Rogers comes along with his vision of what this polytechnic institute, this new polytechnic institute should be. Sort of a revolutionary idea. It was not something that people said, oh, yes, let's do it. We're going to put up millions of dollars to set you up. It didn't happen that way, but he was very persistent in these goals.

He had started thinking about this as early as the 1820s with his brothers. And it doesn't come to fruition until 1861. So it's a long time in the making, even when it does get started it's very shaky. I'll talk about that part of it next week.

But MIT is one of those new institutions that tries to combine science with more practical or useful arts as they were called in that period. And a new way that had not been emphasized much in the United States. If you look at say, for example, engineering schools in the United States-- I mean, there were predecessors to MIT in the area of engineering. Do you know which ones they were? What?

**AUDIENCE:** West Point.

**PROFESSOR:** West Point is the first. Yes, absolutely. West Point is modeled after the French Ecole Polytechnique, and was very much influenced by French ideas. Very mathematically-oriented curriculum. Very oriented towards civil engineering. Not mechanical as much as civil engineering.

And the other school is what?

**AUDIENCE:** RPI.

**PROFESSOR:** RPI founded in 1824. And now, the current president of RPI is an MIT graduate. So we're all over the place now. This is an imperial operation that we're talking about, right? No, not really. But MIT's influence, of course, has become very, very significant in terms of education influences over the world in the last, what? 70 years or so. Especially since World War II. But those are four areas that really are at play during this period that mark an interesting best of times way of thinking about what was going on during this period of time.

And maybe the best way to illustrate this is to talk a bit about an event that took place in 1851 in London when the British held what was called the London Crystal Palace exhibition. This was the first large international exhibition that we are familiar with today. Or maybe not so much your generation. But when I was your age growing up, there were all sorts of these international exhibitions that were taking place, primarily built around science and technology. But this was the first, the first big one was held in London. It was organized or sponsored by the Prince Consort, the husband of Queen Victoria, Albert. And it attracted all the nations of the world pretty much.

And at London, every nation displayed their wares, things they were proud of. And the United States had a lot of space there. And the American delegate to the exhibition got very worried because they had too much space to exhibit fairly few things. And he was writing back to his sponsors in New York saying, you've got to send me more stuff. Our display spaces may be 25% full. The Brits are making fun of us. And so they would send some material over, and they'd put it in display. And the British magazine *Punch*, which is sort of a satirical magazine of the time, was making great fun of this backwater nation and what it was displaying. Plug tobacco from Henrico County, Virginia, or apples from Vermont, or apple peelers from Ohio, really mundane things. When you were comparing this with French exhibitions of [? sieve ?] china, or the Russian-- the famous Russian enamel-- what's the name of it? It's very famous. I never remember the name, but it's a very famous, highly ornate and extremely expensive today.

**AUDIENCE:** [INAUDIBLE].

**PROFESSOR:** Well, they're like those. They can be like that. But it has a name and I cannot remember it. Doesn't matter. High-end stuff was being exhibited there. The British were exhibiting famous steam engines and technologies, famous locomotives. And here's the United States with its apple peelers and stuff.

Well, eventually, the US exhibit got filled up. *Punch* was making a lot of fun of what was there. And then certain competitions begin to be held. And lo and behold, the Americans started winning some prizes.

For example, the harvester guy from Chicago. Cyrus McCormick exhibited his reapers for cutting wheat, grain, crops like that. And he won a prize for beating out in a competition several other reapers that were displayed there.

Charles Goodyear, Goodyear Tire and Rubber Company, was displaying boots, rubber boots, and things that were being made with his vulcanized rubber. And he won some recognition.

Another one, really quite an interesting one, was a locksmith from New York City. A guy named Alfred Hobbs, H-O-B-B-S, displayed his padlocks that he had made in New York. And claimed that they could not be picked.

And they had a competition in London. There was a very famous British lockmaker, named Joseph Bramah, who made all the locks for the big banks in England. And they had put up this prize. I think it was quite a lot of money, maybe as much as 500 pounds, which is still a lot of money today. And that was the prize if you could pick Bramah's lock. Well, damned if Hobbs didn't succeed in picking the British lockmaker's locks. And that got a lot of attention. Because all a sudden, British banks became vulnerable. People started asking questions about, well, how secure are our faults after all?

And immediately, Hobbs, being an enterprising Yankee, moved his business to London to try to pick up on some of that excess business that was coming his way. And then, there was a yacht race that was held off the coast of England. And it was called-- well, I don't know that the race had any name at that time, but the yacht

*America* beat the British yacht, *Titannia*. And that was a serious blow because Great Britain, at that time, had the largest, the most powerful and famous navy in the world. And here, these Yankees come along and beat them in this Yacht race. So that was sort of a slap in the face.

Finally, there were people like Samuel Colt who were in London exhibiting the revolving pistols, for its day a very innovative firearm.

And then finally, there was a little company up in Windsor, Vermont, named Robbins and Lawrence. You've never heard of them before and you probably never will. But they exhibited six rifles, military rifles, that were made for the US Army that were made with interchangeable parts. And they were taking them apart, mixing the parts, and putting them back together. And everyone was very impressed about that. And again, no one in Europe was making guns with interchangeable parts at the time, so that aroused a lot of interest.

And that, in turn, prompted the British government to send a committee to the United States to explore-- and the name of the committee is self-explanatory. It's called the Committee on the Machinery of the United States of America. That covers a lot of territory. Not just gunmaking machinery.

They land the New York in April of 1854. They leave in August. And then the process, they come immediately to New England. Well, why New England? Because at that time, Boston in the New England area was the center point of American industry at that time. And so they immediately head to New England. And where do they go first? They go to the Springfield Armory out in Springfield, Massachusetts, which was not just famous for making guns with interchangeable parts-- and it's a government-owned armory. It also was very famous as being sort of a clearinghouse of technological information. If you got a letter from your congressman or some dignitary, they would give you access to this place to examine all of its machinery, gauging systems, patterns, drawings, and you could make copies of this stuff. And it was free. So the Brits took advantage of that right off the bat.

So they went to Springfield immediately, took a good look see what was going on there. Then they proceeded to make a tour of the whole eastern coast of the United States as far south as Richmond. And then from Richmond, they went west out into the Pittsburgh area-- Wheeling, West Virginia, Pittsburgh. And then they swung further north around the Great Lakes up into Buffalo, New York, and then came across upstate New York. I believe on the New York Central Railroad. It was just build at the time. If not, they would've used the Erie Canal, which parallels pretty much that railroad. And then, they dipped back down in New England and spent a lot of time in New England. Ending up buying \$105,000 worth of machine tools for really, the reconstruction of the British Enfield Armory, which was the main government armory in England.

Now, that's a significant moment because up until this point, pretty much the United States had been a borrower of technology and technological information. This is one of the big moments in which the shift had begun, in which new technologies and information were beginning to make their way from the United States to Europe. It was sort of a wake-up call. In a way, I think parallel to what's happening today with reference to the growth of large economies in China and India. All of a sudden, people are turning their heads and saying, hey, something's happening there.

I heard on the radio this morning that in terms of economic prowess, that China will outgrow the United States by-- well, maybe not in my lifetime, but in yours. By the 2020s, or thereabouts. That's significant moment. Big shift. Whether it happens is another question. Who knows?

But in any case, that moment in 1851 indicates why there was this feeling that these are really interesting times. These are the best of times from an engineering and technology point of view. The economy is moving, and it's moving very fast. There was only one damper on this. It was a panic that took place in 1857 that slowed-- it actually slowed production for a while, but it never stopped it.

And other than that, this was a moment of great change in the United States.

Now, compare that with the theme of the worst of times. What's going on in the



same period. And this is pretty much very similar to what you-- if you read that chapter I wrote on the 1850s in the textbook, you get the drift. I don't need to go into great detail about it, but it's all about the slavery issue in the United States and the sort of sectional divisions that are taking places as a result of this.

And it begins-- if you're to talk about, well, when does the big debate about slavery take place and when does it originate? It was being discussed as early as the 1780s when the US Constitution was being debated. How are slaves going to be counted in terms of voting and things like that?

And then later, in 1820, the first big political issue concerning slavery came up with reference to the admission of Missouri into the Union as a slave state. And the great compromise that was achieved at that time was, OK, you bring in Missouri as a slave state, we'll bring in Maine as a free state. And that sort of tit for tat sort of balance maintained itself up until 1850, when California was brought into a Union as a free state and nothing came in as a slave state.

Why is that significant? Because it gave free states the edge in the US Senate in terms of voting. Each state got two US senators. So that meant the Senate now was under the control of free state politicians. That's a big deal.

But between the Missouri Compromise and 1861, when the war comes, there are a series of cascading crises that I would say create a psychology of crisis by the 1850s that make things worse, and worse, and worse. And more tension and more division, so much so that you have South Carolina seceding from the Union in December of 1860, right after Lincoln's election as president.

Why Lincoln? Why was Lincoln such a feared figure? Well, he represented the Republican Party. This is the same party we have today, Republican Party. It was created in 1854, the origins of it. And the Republican Party started out, one of its chief points was no expansion of slavery into new territories. It wasn't, let's get rid of slavery. It was just, we're against the expansion of slavery into new territories that would come into the United States as states. But Lincoln stood for that. He was not an abolitionist in the sense of immediate abolition of slavery everywhere. He was

not that. He eventually would come to that during the war, but not at the beginning of the war.

And just to talk about Lincoln in this context is extremely interesting. Because he is-- you're bringing me flowers? How thoughtful?

Anyway, he's a masterful politician, who really-- in many ways, sort of skirts around the slavery issue and uses it when he has to, to make policy with reference to pursuit of the Civil War. But prior to the Civil War, you have a series of crises that really bring it on. And I would say if you were to ask me, well, what were they? I'll give you my three top ones.

I'm not going to relay every one of them. You can look them up. But one is definitely the famous Wilmot Proviso of 1846. This was a bill that was put up in Congress by a Free Soil Democratic, congressman from Pennsylvania. Actually, from my hometown. I'm very proud of David Wilmot because he was the initiator of this Wilmot Proviso. And what did that say?

Well, it said-- basically, it was attached to an army appropriations bill for the Mexican war, which said that if the United States is to secure any territory from Mexico as a result of this war, that territory, if organized into states, has to come into the Union as free states. Well, you can understand why Southerners got very upset about that. And that issued a heated debate that continued right up until 1861.

After the Wilmot Proviso, it seemed that every Congress there was something brought to the forefront that was about the extension or non-extension of slavery.

Another moment that was very, I think, had a great deal of influence was the publication of Harriet Beecher Stowe's novel, *Uncle Tom's Cabin*. That appeared in 1851, the same year that I just mentioned with reference to the best of times, the great London Crystal Palace exhibition. That got a huge readership. And as a result of her critique really, in this novel of slavery and how evil it was, turned a lot of people against the idea of slavery and it's being a righteous cause. So that had a lot

of feedback.

There was actually reward put on her head in the South. I think it's in South Carolina, which is one of the more hard line states at that time. But she was not a person who was-- she dared not travel South of the Mason-Dixon line because anyone could shoot her or whatever. She was a woman that was wanted.

And so her book, which started out as newspaper articles, eventually got a huge readership. I think next to the Bible, it was the largest-selling book of the 19th century. That's how big this thing was. Huge.

And then finally, I think the third point I would say that really, probably was the straw that broke the camel's back, was when the abolitionist John Brown raided Harpers Ferry, Virginia.

Now, Harpers Ferry today is located in the panhandle of West Virginia. It's about 60 miles west of Washington, DC, on the Potomac River. But at that time, Harpers Ferry had one of the two large national armories, government-owned armories there. And the reason he raided Harpers Ferry was that he wanted to seize firearms that were being stored there. Some 10,000 guns were in storage there. And arm slaves, and start a slave rebellion against slave masters because they were right on the Virginia border. Literally, you cross the river and you were in Virginia.

And the Brown Raid really sent the fear of the Lord throughout the South. I mean, I've written a book about Harpers Ferry, and I know what the local reaction was. People became totally paranoid. As far as they were concerned after that raid, there was an abolitionist lurking behind every tree. And they organized militias and they did runaway hunts. And it was very much like a vigilante moment in the sense that the whole South became vigilantitized, if that's a word. It's not a word.

What would it be? Vigilant-- vigilized? No, I don't know. Anyway, I will just change the sentence and say, vigilante groups grew by leaps and bounds after that raid.

**AUDIENCE:** Vigilant.

**PROFESSOR:** Vigilant. There you go. Paranoid vigilance. Anyway, following that, of course, that took place in October of 1859. The following year was an election year. And that's when Lincoln gets elected. Well, you can imagine why this became such a heated election. There were, what? There were at least three or four candidates in that election, and Lincoln wins not with the majority vote. But he gets him enough to get himself elected in the electoral college.

And then you have, within a month of Lincoln's election, you have that secession crisis. South Carolina goes out on December 20, and it's followed by around seven other deep Southern states.

Interestingly, the northern tier of Southern states, like Virginia, do not go out until later. Virginia and Tennessee, they don't secede until at least April. I think it's April that Virginia secedes. But by then, within days, war comes. And the irony of all this is that the war-- the Sumter-- the attack on Fort Sumter, which signals the beginning of the American Civil War, is four days after William Barton Rogers got his charter from the state of Massachusetts to establish the Massachusetts Institute of Technology. Not a good time to be getting into the education business because all eyes were shifted on the secession crisis. All budgets were being shifted toward getting ready in preparation for war.

And all of a sudden, there's this big, national crisis in which this new fledgling institution is supposed to be taking root. And it doesn't really take root until the war ends when students are admitted. And I think it's the spring of 1860-- early 1865. So literally, MIT is established in the midst of civil war.

And just to follow that out-- well, no, I won't follow it out anymore. Those are basically-- that's the good and the bad story of the 1850s. It's a very complex time. And it's one of those historical moments that is filled with tension, and change, and reorientation. It's just a critical moment in history. And then, it's capped by the outbreak of the Civil War, right at the moment when this place is being founded.

I really wonder sometimes how in the world Rogers held it all together. He must have worked very hard to try to just keep things together enough so that the

Institution itself could survive through that war, and then open up to a few students. Not a huge number, I forget the number. It's under a hundred when they first open up.

One thing to note, however, is that he's a progressive in many ways. He's very much in favor of women coming to the Institute at a time when most colleges were not in favor of that. It was still an institution that was dominated by males, there's no doubt about that. Women tended to be part-time students, or they were called "special students." That term is still used today, "specials." And it's not until, I would say the 1970s or thereabouts, that women began to grow in proportion to the number of men at MIT. But William Barton Rogers was always in favor of allowing women to come to the Institute, which in itself was sort of innovative. He tended to be on the right side of a lot of issues.

For example, when Darwin announced-- I'm giving away my bias against Darwin. But when Darwin published *The Origins of Species*, of course he got a lot of flack from scientists around the world. One of whom was Louis-- I never pronounce his name right.

**AUDIENCE:** Agassiz.

**PROFESSOR:** Aggasiz. I want to say "Ah-ga-zay." It's Aggasiz. There's a school that used to be called the Agassiz School. You'd think I'd remember it. But he was at Harvard, and he was a big critic of Darwin's. Our friend Rogers, on the other hand, stood up and debated, and really defended the Darwinian idea in the United States. He was one of the primary defenders in this area. So that counts in his favor, I think. A man who pioneered the field of geology in the United States, we'll talk a little bit more about that next week. But he's an important intellectual force. And he had this vision for a new type of institution that he wanted to see established, which eventually became the place that we're sitting in today.

So I must tell you that I didn't know much about William Barton Rogers four years ago. I knew he was the founder of MIT, and I didn't know much else. And then, there was a book that was being published for the 150th anniversary of MIT by one

of my colleagues and he asked me to write an essay about Rogers. And my answer primarily was, crap. Why do I have to do that? Because I didn't know anything about the subject. And I thought, somebody else should do this. But I agreed, primarily because he's a good colleague, and a friend, and it's hard to say no. And at that point, I started reading up on the history of MIT. And the more I read about this place, the more amazed I am about what it is, what it stands for, how it developed. It's an amazing story. So I'm hoping that during the term you'll get bits and pieces of this story, and kind of pull them together.

We don't have a history of MIT. There is no single book that you can pull off the bookshelf and say, this is the history of MIT. That doesn't exist. There are lots of bits and pieces of history of MIT, but no one book that does that. And somebody should do it, I think, because it's really-- it's an important institution. I know I'm proud to be here and I think you are, too. I know you work very hard. And you probably bitch and moan about that a lot. For good reason, but it's worth it when you get the education, get the Brass Rat and leave here. You've got something you can be proud of, too, I think. It's quite a place.

And just, the more I learn about it, the more amazed I am about all that's happened here. And the story even gets more dramatic the further we come to the present. And David Mindell knows a lot about that part of the Institute's history. So that's where we are for today's talk or lecture.

Now, you want to take a break for a few minutes and I will collaborate with my colleague about the discussion. We'll have a little discussion about this and move on from there. OK?

Huge numbers. By my count, roughly 750,000 died. Now, that's not necessarily battlefield deaths, it's including people whose wounds killed them after the war was over, things like that. So it's a really bloody war. And I don't know what percentage of the population that is, but it's a significant number. It would be like losing-- say, if we were to have a similar war today, it would probably be in the order of losing maybe 1, 1.5 million soldiers in the war.

Would we stand for that today? That's pretty bad. It's bad enough when you're losing thousands, but when you're losing over a million, that's getting into a whole different realm. As you say, it's one of these moments that is not apparently the best time. And yet, you see it coming.

What are the earmarks of knowing that it was the right moment? What was Roger's thinking when he was thinking about trying to establish a polytechnic institute? As I said earlier, he starts thinking about this as early as the late 1820s. He's very close to his brother, Henry. Interestingly, Henry's full name was Henry Darwin Rogers. Their father was an immigrant from-- I believe they came from Scotland. Or maybe Northern Ireland, I'm not sure. But he clearly was familiar with the Darwin family, which was not just-- this would have been Charles' father, I suspect, or someone like that. But in any case, here are these two brothers talking about the need for a polytechnic institute. They're not engineers. They're scientists.

William Barton Rogers, I guess if you would have asked him in 1825, what are you? He would have probably called himself-- what would be the word for physicist in those days?

**DAVID MINDELL:** Natural philosopher.

**PROFESSOR:** Natural philosopher, yeah. When he first established the Institute, one of the courses he thought was basically the physics course. That didn't last for long because his obligations were so many that he had to hire somebody to do it. And then he made the shift during the 1820s and '30s into the field of geology. He was one of the early geologists in this country. And really makes his name in that area that we can talk more about next week.

But when you look at the period, there's a lot of stuff going on that would have indicated, yes, we need these places. But we're right in the middle of an Industrial Revolution. We'll see from the essay that I've written-- did you read the essay I wrote yet? That's next week, I think. You'll see in there that he conducts a geological survey of the state of Virginia, which proved to be a political nightmare for him because of the fighting that went on over what should be his primary mission.

That state is divided between Eastern and Western interests, and they were vying with one another about, what should this survey really be about? He got caught in the middle of that.

And in the process of trying to make everyone happy, he doesn't have enough assistance of people who are technically competent to do the surveys, and the note-taking, and things like that. Clearly that's one impetus to him, was starting to think about, boy, do we need people who are trained to be able to do the sort of work that's necessary to explore our industrial resources, or actually go into these industrial areas and actually run them. That's one of the sources of his idea about MIT were-- he wasn't calling it MIT in those days.

The name MIT for him doesn't emerge until the late 1850s. Much later. He's teaching in Virginia this time. He's born and raised in Virginia. His dad taught at William and Mary College. And so he's raised in the slave society. And yet, surely-- well, he marries a woman from Boston, but he's never-- I've never seen anything in his writings that indicated that he was pro-slavery. Quite the opposite. He was opposed to slavery. And so he found Boston a much more acceptable climate to be living in once he moved up here in the 1850s. But this business about why did he do it during-- he gets the idea and starts pushing for it around 1859. Why then?

Clearly, there are needs, no doubt about it. But you got to ask yourself, well, to what extent was he aware of the degree of the political tensions in the crisis? It was two years before the war came. And that slavery issue had been going on for how many years? 20, 30? You can count back as many as 60 years, or more. So I could well imagine that someone like Rogers would be thinking, well, yeah. There's a lot of tension here, but it's not going to happen now. He was probably taken by surprise would be my guess.

**DAVID MINDELL:** Really? There's another way to read it where--

**PROFESSOR:** Did I ask you?

**DAVID MINDELL:** I told you I was going to sit here and listen.



**PROFESSOR:** Yeah, he's going to sit over there like a jaybird.

**DAVID MINDELL:** Where he's married to an abolitionist. Boston, in general in New England society, is - there's a lot of abolitionist fervor. People are extremely political active-- that's one thing he likes about New England. He goes on vacation with Emma Savage's family and they have all these political discussions. So then you could say, maybe he sees the founding of MIT as a political act.

**PROFESSOR:** That's interesting.

**DAVID MINDELL:** And it's interesting then to think about what kind of political act it might be if it was one.

**PROFESSOR:** That's interesting. So a political act in the sense that it would be a place that was doing a new style of education to be sure, coupling it with reform sentiment that is so rampant in Boston-- Boston is the center the abolitionist movement. William Lloyd Garrison's paper was centered here in Boston, so he's pushing at a button here that's very interesting. I hadn't thought about that.

**DAVID MINDELL:** Or Rogers has a vision of a world where technology is important. The people who engineer and deal with it are important, which wasn't really the case then. And that that's a world that he sees as a counter to the world that he left in the South where it's agrarian. It's much more political in different kinds of ways. And he wants to educate a cadre of technical experts who can run the world in a more, maybe dispassionate way than he found in the South.

**PROFESSOR:** Oh, god. That's really interesting. You should be leading this discussion. That's very interesting now, educating a cadre of individuals who would be capable of sort of leading the world in a different way. What does that mean to educate this cadre? What kind of individual would you want to be educating?

We know that MIT was founded to try to combine the useful arts, or what we would describe as engineering today, with science, the pursuit of science, trying to bring them together, have them interact, and produce something-- a student is a special

product in a way.

But what about that ultimate vision of creating a cadre of graduates that are going to go out and shape or reshape the world to a new way of thinking about things?

That's very interesting. Let me push it a little bit further and say this.

Up until the founding of MIT in 1861, there had been this process of industrialization, which was centered around transportation, building railroads, and creating factories for producing everything from boots and shoes, to cotton textiles, to sewing machines. And these things were accompanied not only by the machinery, and the labor forces, and things like that, but they were also accompanied by an attempt to try to learn how to manage them. So many of them were big enterprises. Railroads are employing thousands of people. Pennsylvania Railroad employed 1,200 people by 1859 I would say. And factories, like the Lowell Mills, are employing 200 or 300 in each building, let alone the whole town, which would be well over 1,000.

If you're seeing management emerging alongside of this educational process, it would mean to me that Rogers has got to be interested not just in teaching science and engineering, but also trying to get students to think about, how do you manage these enterprises once you go out to work in them? And what is that all about? What is management really about when you talk about managing things?

Coordination and control. It's trying to control things. That's an important part of this business. That brings a different dimension to the-- now, they're not teaching that in liberal arts colleges or the classical curriculum colleges. They're creating "gentlemen." They're not creating ladies because there were very few ladies in any schools, but they are creating gentleman to go on to law school, or stuff like that. So there's a different breed of cat being made in these schools.

If what David says is true, it's as much about learning how to control things as it is learning about how to do things. Learning and doing also involves learning how to impose some control over that. What are the problems that might arise with that sort of enterprise?

I think it's an interesting question because if you look at it from, say labor. What's the labor management? That's the dichotomy is labor management. MIT ends up on the management side, I would say, more than on the labor side of things. This is right at the moment when you're beginning to see serious labor management divisions. I didn't talk about that in my lecture, but definitely happening during these years. So MIT is sort of adding to the strength of the managerial side of technological change and science then to the so-called labor-oriented rank and file side. That, in itself, is a very interesting statement about what the Institute is about. Openly about. Don't need to apologize for it, but need to be aware of it I think. That in establishing that sort of school, you're going to be more interested in those managerial sides of controlling and coordinating large enterprises.

Where are the early graduates going from MIT? Now, you haven't read about this, so I'll answer the question. Many of them are going to large railroad companies. They're sending a lot of their young graduates off to work as engineers on railroads. Not running locomotives, but to build lines, coordinating control of the operation of the railroad, stuff like that. That's where a lot of these young men are going. So it's an interesting thought about that.

**DAVID MINDELL:** One of the words that caught me in the conversation, and in the responses, was the sense that the founding of MIT was inevitable in any way. And maybe we made it seem that way with some of the material we've been looking at, but if you zoom out one level-- and even, the industrialization of America maybe looks inevitable in some way. But it was not inevitable, and was incredibly fraught with conflict.

There was nothing like the kind of presumption today that technological development equals economic progress equals social progress. And it's not too much of an exaggeration to say the entire American Civil War was fought over different visions of what America might be. One being an agrarian, rural, essentially non-industrialized economy with the kind of social order of slavery and racial divisions. And also, very much a traditional class structure around that. And the other being much more represented by the North, industrialized, very managerial,

very technological, heavily railroads. No small number of the leading Union generals were railroad executives before the war, including McClellan.

And so if you look at the war in that-- and all of the tensions leading up to the war, and it was pretty explicit at the time. Thomas Jefferson very much viewed-- this is 40, 50 years before, but viewed the country in this kind of agrarian way. We weren't going to make the same kind of mistakes that England made and have a dirty industrial economy.

If you look at the war in that way, then the founding of MIT is very much almost like a move in a chess board for one side, which is obviously the one toward, this is what an ordered industrial, Northern-dominated economy could be. And it happens to be the side that won, but it was 3/4 of million people had to die between here and there, much the less another half century of conflict over--

Roe's books about how half the problem was just trying to get people to come to work at the same time every day, and work through the planting season. Because you couldn't have a factory unless you get people to do that. And that was 30 years of conflict just to get people to do that.

**PROFESSOR:** There's a phrase about when you start making machinery and putting them in things that are called factories, which are new. We're familiar with them, but people in the age had never seen these things before. They just knew that there was good money to be made. You could make cash wages by working in one of these places. It was inviting in that sense. But on the other hand, going in there to work and having to work to regimented hours, and be expected to produce so much stuff during the day.

One of the managers of an early textile operation said, this is like trying to put a deer in a harness. Imagine that. Just think about putting a deer in a harness. That just doesn't work. There's going to be a lot of bucking and resistance, and going nowhere sort of. And so it's a tricky business, no doubt about it.

David mentions just getting workers to work according to clocked hours. We're so

used to-- I mean, either we're wearing watches, or you've got it on your cell phones, all of us are very time-oriented in this age. But 200 years ago, very few people, only wealthy people could afford to own a pocket watch. They were really expensive. And only the wealthiest households had these tall clocks in their hallways and stuff like that. Most people didn't have time-keeping devices. That comes in with the coming of industry, with factories and things like that.

In fact, it's factories that start making the early, cheap clocks you can buy for a couple of dollars.

There's a famous traveler who goes in-- it's a British visitor who travels in the Southeastern part of the United States, writing in the late '20s, early '30s thereabouts. And he's writing about-- I'm going to take that back, it's a woman traveler. Sorry. Traveling in these areas. And one of the things she notices is that-- and she comes into Arkansas, which is pretty much in the deep recesses of the United States at that time. Well, Arkansas, West of the Mississippi, 1832 or thereabouts, is really in the deep recesses. That's frontier country. That's what I mean by that. Are you from Arkansas?

**AUDIENCE:** No.

**PROFESSOR:** I didn't mean to insult Arkansas people. But in any case, she makes this comment about, I travel around the countryside and I enter these cabins with dirt floors, hardly a stick of furniture, and there's a Connecticut clock sitting on the fireplace mantle. They'd rather own a clock than owning furniture. That was unheard of 50 years earlier. You couldn't afford something like that. And yet, boy, they were buying them like crazy. Be it these clocks are being made in Connecticut, and then taken literally, in wagons across the country, and sold off by the thousands to people for a couple dollars a piece. Your grandparents or parents may have some of them.

They're old brass works clocks that when they strike the hour, it'd wake the dead. They're very, very available, even today. But that sense of time and time orientation as a new dimension. People are not used to it and they go on strike in many instances. They try to resist this. And that's part of that management, trying to get

that control that didn't exist. No one knew about it.

Jefferson refers to the slavery issue in the 1820s as trying to hold a wolf by the ears. He is very concerned about the future of slavery in America. He never remits his slaves as far as I know. But the other wolf that was being held by the ears at this time has to do with labor management, the problems that were going to emerge.

Lowell, a great industrial city in the 1820s was considered to be a utopia. It was a place that people wanted to work at. But by the 1840s, there are all sorts of strikes going on out there. Protesting time rules and the cost of living in boarding houses, and stuff like that. So it gets very complex. And Rogers is living through all of this, and seeing it, and trying to come to some conclusion about, how do I enter into this educational process? How do I make it better supposedly? So it's a complex, interesting era that is the era that he lives in.

Now, there's another question that was raised today, but how did Rogers get the money to find benefactors? When you graduate from MIT, MIT Alumni Association is going to get your name and address. And several times a year you're going to get mailings from them saying, we need your benefaction. You need to help us keep the Institute going for fellowships, and scholarships, and a new swimming pool, or whatever it may be. It's through that sort of giving that is very important to the operation of any school today. It was important to Rogers then.

When you read my essay next week, the title of the essay is called "Godspeed the Institute." It's in quotations. That's actually a quote from an early benefactor of MIT. He was a doctor here in Boston, Harvard graduate, a surgeon, made a lot of money investing in local industries-- railroads, textile mills. Made a lot of money, and he had money to give. And rather than giving it to Harvard, he gives it to MIT. It's like \$40,000, quite a lot of money for that time.

And I can imagine how people at Harvard felt about that. Because he was turning on a different direction here. But he was interested in sort of the practical hands-on orientation that Rogers was trying to develop in the Institute with reference to bringing science and the useful arts in contact with each other. But that was one

form.

Where else would you be getting money to run a place like this early on?

**AUDIENCE:** From the military?

**PROFESSOR:** Well, military. Who said military? OK. Say a little more. Military in what way? How would you imagine that?

**AUDIENCE:** There's a lot of government contracts maybe back then, I don't know.

**PROFESSOR:** Yeah, absolutely. It's not so much military money, but it's war-related. Legislation that's passed by the Lincoln administration. Interestingly, Lincoln is a Republican, a member of the Republican Party. Early member of the Republican Party.

In those days, Republican Party was all about big government, believe it or not. Today it's just the other way around. What the Democrats were in the 1860s, the Republicans are today, and vice versa. So in Lincoln's day, one of the big proposals that was put up, and you'll read about it next week is, trying to get grants for the establishment of state universities that would emphasize mechanical and agricultural pursuits. Texas A&M. A&M, Agricultural Mechanical colleges.

I went to Penn State. That's a land-grant school. All of these schools come out of a piece of Civil War legislation called the Morrill Land-Grant Act, which literally put up money-- it gave money to each state based on the number of representatives they had in the House of Representatives and the number of US senators they had. I think it's 30,000 acres per representative. They'd give that land to the state legislature, which in turn could keep the land for as long as they want, or they could turn it into script and sell it to investors.

Where was that land located? This is a sore point for those of you who are from the Midwest, especially places like Minnesota, Iowa, places like that. Most of the land was from out on that area and not in the East. There were some plots, but not much. And that land was used by the Massachusetts legislature to parcel out in terms of government grants. Here's government giving out money, in effect, to

places like MIT, University of Massachusetts are the two main beneficiaries of that. MIT is a land-grant college. Did you know that?

MIT emerges right out of this land-grant tradition, and it's arguably one of the first. It may be the first land-grant college in the United States, which we kind of don't recognize because MIT is a private corporation at the same time. You would think, this is not Penn State or it's not Ohio State, which are both land-grant schools. Those are state universities. This is a private corporation. And yet, its initial funding, a big part of it, both the land over in Boston and money from the legislature, came from the state through this piece of national legislation that's sort of filtered down into various states for the establishment of these colleges.

So it's an interesting process that happens. That's important. So there are moments when I can imagine that big government is a bad thing. But there are also moments when big government can be a good thing. In this instance, I think it was not just good, it was extremely important for the future of the United States. Think of the hundreds of thousands of graduates who have come out of these colleges. Not just MIT, but extremely important to the development-- the economic development of the country. And that all started with a federal piece of legislation.

**DAVID MINDELL:** We were just talking during the break, the 21 names that signed the MIT charter. Rogers is one of them. We know a little bit about a couple of them, Roe and I, but we don't know that much about the rest of them. They're not all names that you'd instantly recognize. But it's worth asking, in addition to the government, why would these presumably prominent, moneyed Boston people care about founding this school? What are their interest in it? He wouldn't have been able to do it by himself. He needed this kind of social group to support him.

**PROFESSOR:** Definitely.

**DAVID MINDELL:** It's a good paper topic for someone, but we should talk about it now. Who are those 21 people?

**PROFESSOR:** That would be a good topic, just to look into one. For example, just here's one that I



do know about, a guy named James B Francis. Has anyone ever heard of him before? I doubt it. There's no reason you should, probably. But in his day, James B Francis was probably the most important hydraulic engineer, surely in the United States, if not the world. He was very, very important. He built the canal system in Lowell, which was America's leading industrial-- surely, leading water-powered entity.

You can go up there today and still see those power canals that have been there for what, 200 years I suppose. And he was responsible. He's the guy that engineered this. And he was a close associate of Rogers. Rogers clearly recruited him or told him about his vision for this new polytechnic institute. And Francis immediately signed on to it.

Now, Francis's papers exist up in Lowell at the Lowell Historical Society. But I don't think anyone has looked into, what was going on between him and William Rogers? Were they having a correspondence? Probably they were. I have no idea exactly. What were they saying? Where were they in concert with one another? Did they have disagreements? I don't know, but he's an example of this group of 21 that we don't know much about that would be interesting to know. Where did that support come from because they were critical in supporting the Institute.

So another guy who was involved in that group is a guy named Jacob Bigelow. And he's the fellow who writes-- he's a Harvard faculty member, isn't he, for a while? Interesting how many Harvard people are involved in this place. Almost all the early faculty are Harvard graduates, believe it or not. The early physicists are Harvard graduates. The chemists are Harvard graduates. Where else are they going to get their staff? There are some people that are coming out of industry.

But the architecture department here is founded by a Harvard graduate, a guy named Ware. You'll read about it next week. But it's interesting that that connection, there's this tension and yet, connection at the same time between these two institutions that one tries to take over the other at least, what? Five or six times during the 19th, early 20th centuries. There's this very interesting connection

between those two institutions that still exists in many ways. But it's this ongoing process and the connections of Harvard people joining MIT, being a part of this whole process. Bigelow being a Harvard person who supports the establishment of MIT. Because they see a need.

Harvard has, supposedly, an engineering program. The Lawrence School was funded by a textile magnate here, local merchant who owned a lot of textile mills in the area. He gave Harvard-- I don't know, quite a big bundle of money to try to introduce an engineering curriculum at Harvard. And it never quite took off. It was used for a lot of different purposes, but it never succeeded really, in doing what Rogers was doing down here. And I think that's one of the reasons why a lot of these Harvard folks who had interests in the practical world, if you want to call it that, gravitated toward MIT when it was founded. It's an interesting development there, too.

Well, look, I'm talking. Somebody's asking questions, but I end up talking about them. So that's not a discussion. That's a monologue.

I think from day one, there was a research component introduced into the curriculum at MIT. And that was through laboratories. In the days prior to MIT's existence, laboratories existed. But they were primarily to-- you would hold demonstrations. You would do chemical experiments in front of the students, but the students were watching. They weren't at the Bunsen burner doing things, or anything like that. And with MIT, that changes.

One of Rogers'-- I think it's an innovation, is to get students in the lab doing things, doing research.

There's a fellow, trying to remember his name. He was educated here at MIT as an undergraduate as a physicist, who goes on to found the electrical engineering department at MIT. Becomes a faculty member after he graduates and does graduate work. I'm not sure if he does it here or not. Probably not. Probably went to Germany, or somewhere like that. He founds the electrical engineering department. But it was all about his writing a paper as an undergraduate student in a physics

laboratory that he got published that sent him on his way toward this interesting career as an academic and as a researcher. But the research orientation of MIT has existed-- well, almost from day one. That's interesting.

**DAVID MINDELL:** The idea of MIT as a research institution where the professors are doing primarily research and then the students sort of come along and participate is later, and not really until the 20th century does that get going. I mean, students are always working in the laboratories for their own education. But the fact that the professors are leading these big research programs, that's not so much there at the beginning.

**PROFESSOR:** OK, yeah.

**DAVID MINDELL:** There's a distinction there.

**PROFESSOR:** You need to make a distinction there. Yeah, OK. But the guy's name I'm thinking of is Cross, C-R-O-S-S. And he actually did research in an undergraduate lab and resulted in the publication of a paper. That's research at one level. But you're talking about research, what? Funded by the Air Force?

**DAVID MINDELL:** Or even by foundations and things.

**PROFESSOR:** Yeah. Well, that's true.

**DAVID MINDELL:** If you look today, anybody know how much of MIT's budget is undergraduate tuition? What percentage?

**PROFESSOR:** I have no idea.

**DAVID MINDELL:** Anybody want to guess?

**AUDIENCE:** 20.

**DAVID MINDELL:** 20%?

**AUDIENCE:** 5%.

**DAVID MINDELL:** 5%?

**AUDIENCE:** Are we talking about sources of money or what we spend on it?

**DAVID MINDELL:** How much of MIT's total budget-- if you add up the tuition that each of you pay, forget about financial aid for the moment. Multiply it by the number of undergraduates and put that over the total budget of the place, what's the proportion?

**AUDIENCE:** It's like 5%.

**DAVID MINDELL:** It's like 5% or 10%. It's pretty small. And compare that to, like a Williams College, where it's close to 100%. It's a very different place. So that wasn't so much true early on. And even then, the tuition pays a pretty small amount of what it actually cost to educate an undergraduate. So that gives you some sense of the orientation of the place, where you have hundreds of millions of dollars coming from federal and other kinds of sources to support research. And students pay tuition, too. And they're a big part of it. And MIT does consider itself educational in a big way. But the research is just huge.

The model that's emerged, and it really, in a way, took 100 of the 150 years, is research-based education. Which is a little different from the early model of kind of laboratory-based education. So we'll see that over the course of the next weeks as we read about it that, you don't have MIT professors winning Nobel Prizes during the 19th century. If people want to get a PhD-- we mentioned this I think last time-- in any of the sciences, they're going to Germany. Maybe to England, but particularly to Germany to get it well into the 20th century.

And the whole idea of graduate education really comes in around the turn of the 20th century. So in that sense, it's different from what it is today. It's more like a kind of undergraduate teaching-- maybe like Olin College. Anybody ever heard of Olin College out in the suburbs here? That probably is more like what early MIT was like than MIT today.

**PROFESSOR:** Interesting. And that all, in many ways, was modeled after MIT, wasn't it? There were a number of MIT consultants. It was Woodie Flowers, and people like that.

**DAVID MINDELL:** I think Olin is modeled after a lot of things that are very hard to do at MIT, which is why they were able to do them.

**PROFESSOR:** Maybe that was it, it was the wish list.

Well, that's interesting. So from a corporate, government research sort of orientation, I guess the corporate would be coming first around World War I thereabouts, under Maclaurin. There was a president here named Maclaurin who moved MIT in a direction, I think, toward applied research. Was it called the technology plan or something like that? And we'll see more of that later on.

Yeah, that's different than what I'm talking about. But the idea of getting students in laboratories, and having them literally use the equipment, that's a new ball game there. Even that was novel.

**DAVID MINDELL:** One example there that's worth looking into is Alexander Graham Bell, who's teaching here on campus. Anybody know where he physically actually invented the telephone?

**AUDIENCE:** Wasn't it over on Main Street?

**DAVID MINDELL:** Yeah, it was downtown in Boston over where-- basically where Government Center is now. There's a little teeny plaque right there. You can almost not notice it. It says, this is the place where famous, "Come here, Watson. I need you now," was. But he didn't do that as part of a lab at MIT. Today you would think, of course, if there was an instructor here who was doing research into telephony, he'd be doing it on campus in a lab with graduate students, and so on and so forth. That's not how it worked then. He was doing it in his own laboratory.

**PROFESSOR:** There's another plaque over on Main Street. Who mentioned Main Street? Did you, Eric? Isn't there a plaque on Main Street that--

**AUDIENCE:** [INAUDIBLE].

**PROFESSOR:** Pardon?

**AUDIENCE:** Is that the Polaroid one?

**PROFESSOR:** Yeah, it's a Polaroid building. But I think it's a reference to Alexander Graham Bell.

**DAVID MINDELL:** Maybe the first exchange, which was when he first got it going.

**PROFESSOR:** Yeah, it could be. I've forgotten what it is. But I remember seeing it as I was walking by.

**AUDIENCE:** He was an instructor here. He was teaching. I'm not sure if he was actually teaching at the moment he made that invention. I don't know how they overlap together.

**PROFESSOR:** Interesting.

I have not encountered that sort of thought coming from him. But I have to admit, I have not read-- I have not been in the archives to read everything that he wrote at the time. I suspect there are some references there. What I see, from the literature I've been reading, is primarily a concern about just institution building. I mean, he had a lot on his plate just trying to get this place started. He was very sympathetic to reform groups in Boston, the abolitionist movement being one of them.

There were a bunch of reform movements that were underway during the 1850s, abolitionism being the most famous probably, and the most controversial. But temperance against drinking. Wouldn't that be something if William Barton Rogers was a temperance advocate? That could totally screw up the 150th anniversary.

**DAVID MINDELL:** Or the entire--

**PROFESSOR:** I say that as a house master.

**DAVID MINDELL:** Only a house master would raise that issue.

**PROFESSOR:** Only a house master could resonate to that. I don't know. But he was surely influenced by these reform groups. But his reform was educational, no question about it.

**DAVID MINDELL:** I think if you look at how people like Nathaniel Hawthorne responded to the Civil

War, there was certainly a strain there. He was a slightly earlier-- anybody ever heard of the transcendentalists? Obviously, Thoreau and Emerson. But then there were all these other- Nathaniel Hawthorne, Bronson Alcott, who was the father of Louisa May Alcott, who wrote *Little Women*, was a very big educational reformer. This was sort of more in the 1830s, 1840s. You read what these people were writing. They were basically like '60s counterculture hippies of the day in a certain way. They were pretty radical. There was free love movements among them. They were starting utopian communities, all kinds of wacky things there. I don't think Rogers really fell into that category so much.

So people like Hawthorne and Herman Melville later, responded to the Civil War with the question you asked about, gee, is this just too much industrialization? Just leads to war. Too much machinery, and it's all dehumanizing and destroys the environment. There certainly were some questions raised about that. But I think William Barton Rogers would say, not enough rationality, not enough science leads people to act crazy. We need better, more rational management in the same way that Roe was talking about before.

**PROFESSOR:** That was his focus, as best I can tell.

After he died, his wife edited what she considered to be his most important correspondence. And that resulted in a two-volume book. Basically, of his letters. And I've read a lot of them. Can't say I've read every one of them, but I've read a lot of them. And I don't remember encountering the sort of reform-oriented movements that were very, very much in evidence around here, other than his distaste for slavery. He clearly was not in favor of slavery.

But on the other hand, I don't think he was out there attending anti-slavery rallies and stuff like that. He had his own vision of what he wanted to do from an educational perspective. That took a lot of time, just doing that. Thinking about, how do you form a curriculum? Where do you get the money to start the school? How do you get the land? Those are pretty daunting questions when you're starting from scratch, which he was. He was not a wealthy man.

The first part of your question is easy to answer, and that is that it happened fairly often. If somebody passed away who was a famous engineer, oftentimes the wife, or a cousin, or somebody would edit the correspondence.

I think, for example, there's like a 32-volume set of the correspondence of Eleuthere Irenee du Pont who was the founder of the DuPont company. Even earlier than Rogers in the 19th century that was edited by a woman who was a descendant of his, but wasn't one of his daughters or even his wife. But waited for probably 50 years before she got interested in doing it. So it varies about the time. It may not happen five years after a person's life. It may happen 50 or 60 years afterwards. But that happens. You'll see it fairly often, especially in the 19th century.

There are a few businesspeople that do that. The Appleton family here in Boston are one of the founders of the big textile mills up in Lowell. And there were several volumes edited by their descendants of their correspondence. What were they trying to achieve? And clearly, that correspondence is selective. You got to ask yourself, well, were they including every letter in there? Because most of that correspondence is about the vision they had for the institution. It was very rosy. We have an obligation to be stewards of what we have, and we use our money to promote things. Very civic-spirited.

But on the other hand, there's not a word in that correspondence about the labor management problems that emerged during his lifetime. Didn't he write anything about that? If so, where is it? What happened to it in the correspondence? So those things have to be looked at as something that has been selective. There's a process of interpretation going on there, as there is in all history.

Even I, when I write a book or something, and working in original archives, you select facts to construct your history. And there are things that you may leave out that David would say are very important that Smith ignored. And that's one of the reasons I became a historian, is I'm very interested in how do these differing interpretations of the past emerge? And then, how do you reconcile them once those differences exist? Because they keep getting reconciled, and re-reconciled.



And it keeps going on.

**DAVID MINDELL:** The MIT archives probably doesn't have a collection of people who thought William Barton Rogers was an idiot and it was a terrible idea to make this Institute of Technology. Those people may well have existed. And there may even be scattered around in their archives, around the Massachusetts State Archives of the Massachusetts Historical Society, letters that they wrote to that effect. But it's not something that MIT has gone out of its way to collect. And so the archival record tends to reflect-- well, it reflects the successes and it also helps make the successes.

So Barton Rogers' wife, by compiling his letters, undoubtedly she thought she was doing it because he was a historically important figure. But collecting his letters and publishing them also helps make him into a historically important figure. And that's the kind of stuff that historians and archivists deal with all the time as far as, what are the biases in terms of what gets saved and what gets thrown out? And who's considered important enough? And who's not considered important?

**PROFESSOR:** She wanted to memorialize him for one thing. I mean, that's why those two volumes were published is as a memorial to her husband, to having done what she felt was an important life's work. But in the process, there's all this selectivity that goes on that sort of biases the record. So there's a lot of open ends in all of this study of history. And especially, history of MIT because so little has really been published about it.

You were mentioning, Michelle, collections of the MIT archives. In certain ways, that archive is one of the best in the country for universities, I think, if you look at laboratories, or professors, of people like that. But if you were to ask-- go to the library and try to find out much about Burton-Conner house, or the student housing system. You don't find much there. At least that's what the boss told me one day. That's been an area that wasn't collected that I'm sure is starting to be collected now. But different people have different priorities. And so there are things that get forgotten or left out. You keep adding, trying to add to. So student life is an

important element in all that.

**DAVID MINDELL:** Another question that you all may have, especially as we read next week is, you look at 1865 when classes begin. And suddenly there are people like you in these rooms. And the question is, who were those people? Were they children of immigrants who got a lucky break? Were they children of people in Boston with money who decided that Harvard wasn't for them? Were they people who worked in the Lowell mills who wanted to get a more serious education? We have very, very poor documentation on just, who were those early students? Why did they come to this place that no one had ever heard of?

Because at the time, it wasn't considered important. They were considered faces that were-- they weren't the president and the benefactors. As an historian, one needs to get very creative to think about it.

Now, some of those people ended up becoming famous, and wealthy, and preserved their records, and then gave them back. And over time, you can piece some of it together. But there is no--

**PROFESSOR:** Compared with Harvard, not as expensive? But then, I don't know exactly who paid for, say the use of laboratory equipment. Because I know the Institute had a perennial problem in trying to keep its laboratories sufficiently equipped.

Now, did students have to pay extra fees for that sort of-- if so, that would've raised the tuition. But I'd have to look that up. I don't know.

**DAVID MINDELL:** I think we'll see it in the reading in the next couple weeks. But it was not expensive. It was not the way that undergraduate education is today where for a middle class family it was really like almost as expensive as their house. It was much more of a kind of fee-based thing. And I don't think it was the major barrier. It was not for poor people for sure, but it was not the major barrier to people coming. Probably harder for people to take those years away from the workforce than it was to pay the tuition.

**PROFESSOR:** And for many years, I think through the 1870s and in to the 1880s, most of the

students at MIT were not full-time students. They were special students. And they were paying much smaller fees because they were basically people who were working a 10-hour day, or whatever it would be, and then coming to school at night primarily.

**DAVID MINDELL:** Not living on campus.

**PROFESSOR:** And not living on campus, yeah. I'd have to look. I'm not sure about Boston University. I don't think Boston University was around at that time, but I'd have to look. I don't know. Good question.

**DAVID MINDELL:** You'd have Bowdoin in Maine.

**PROFESSOR:** Yeah, there are--

**DAVID MINDELL:** Williams College I think was--

**PROFESSOR:** Amherst, Williams.

**DAVID MINDELL:** We mentioned RPI.

**PROFESSOR:** Yep.

**DAVID MINDELL:** Most of the early MIT students, there's not great documentation on this. Most of them are from Boston and pretty close by. People didn't travel the way they do today to go to college.

**PROFESSOR:** Yeah. The one piece of information I know exists is there were surveys done of where did students come from, not so much about their socioeconomic backgrounds. And it's interesting to watch that circle. Initially, strictly MIT is a local school. Most of the students that came to it lived within a 20-mile radius of the campus. But then you see that circumference getting larger, and larger, and larger over the first 30 or 40 years.

By the early 1900s, you have students coming here from all parts of the United States.

By the 1890s, for example, the DuPont family were sending some of their sons up here to school. The most important being a guy named Pierre DuPont who became not only the head of the DuPont Company, but the boss of General Motors for many years. Really, made General Motors into the big corporation that it is, with the help of Alfred Sloan. I think DuPont may have hired him, I'm not sure. But Sloan was a graduate of MIT.

**DAVID MINDELL:** Why was a chemical company involved in the auto industry? That's a question you could ask.

**PROFESSOR:** Oh. Why was the chemical company of DuPont involved in the automobile industry? Good question.

**AUDIENCE:** Deals? Deals in oil--

**PROFESSOR:** Not really, no. Think of that. Who's the chemical engineer in the class? Any chemical engineers, chemists? What do you guess?

**AUDIENCE:** I don't know.

**DAVID MINDELL:** What part of a car was made by DuPont? That's another way to ask it.

**AUDIENCE:** Paint.

**PROFESSOR:** Paint, yeah. It's the paint. GM bought all their paint from DuPont. And then, I think got in trouble economically, and DuPont took over the company, or a large chunk of the company in order to resuscitate it and get their investment back out of it. That's when Pierre went in there and basically took things over. Yeah, it's all about paint for DuPont.

**AUDIENCE:** I feel like that's a non-essential part of a car.

**PROFESSOR:** But it's a big part. By the 1910s, it's a big business and a big account that you would have.

**DAVID MINDELL:** It's off-track a little bit, but Henry Ford was famous for saying you can have a Model

T In any color as long as it's black. And one of the ways that General Motors then differentiated itself was both an annual model change where it wasn't so standardized and you could get cars in different colors.

**PROFESSOR:** And Sloan was right in the middle of all that. Absolutely. Any other questions?

People were very tight with their pocketbooks. You'll see next week in the essay that I've written, I make an argument in there that government support was very important because once potential private donors saw that the state of Massachusetts was investing in MIT with land and money, that gave private donors a signal that this institution had a future. That they took more confidence in the possibility of this actually taking root and going forward.

So the guy that wrote that letter was the doctor. I think he gave \$40,000 in 1864. That was a huge amount of money. And that was partly because-- he gave the money because he saw the state of Massachusetts investing in MIT and thought, OK, they got a chance to survive. I will help them out. So that's very important.

**DAVID MINDELL:** There's a case to be made, it came up when we were making that video. That even though the war was so disruptive to Rogers' plans, there's a case to be made that having four years kind of hiatus before really having to get the place going gave him the time and the background to get it a little bit more established financially and institutionally before teaching classes. Where you'd think, as soon as you get the charter signed, you admit students the next fall. Well, then you're both running the place and planning it at the same time, and this way he was able to.

And then, at some point-- and it would be interesting to look at when this point is-- it became clear the war was going to be won at some point by the North. And some people probably believed that from the beginning. And then there was a big reconstruction job to be done. And there was at least some kind of sense of optimism. And that's probably when some of the momentum around 1860-- I'm sure the second half of 1863, 1864 after Gettysburg, it was not a done deal but the tide had turned. And so there was people looking forward and thinking about-- there's a lot of building to be done after a war.

If you're an Iraqi businessman in 2002, you'd be investing in construction equipment, because that's what you got to do.

**PROFESSOR:**

Well, the Morrill Land-Grant Act, which is the background to all of these state universities basically, that wasn't passed until the summer of 1862. So Rogers, really wouldn't have had anything to build on. If that act hadn't been past, he would have been in big trouble. Because no one was ponying up with free land over in Back Bay other than the state of Massachusetts, who he had to do a lot of lobbying with.

One of the things that suited him well-- I should mention this-- was that Rogers was a very effective small "p" politician, in the sense that he knew how to lobby people. And how did he learn that? He learned it through a very bitter experience that he had had in Virginia as the head of the state survey in which he learned how mean-spirited politics could be. And he really became very astute at learning how to approach legislators, people like that, to get their support for voting funds for this new institution that he was trying to establish.

So even though he had a bad experience in Virginia with the geological survey, it served him well in the long run in learning how to negotiate the building of a new educational institute here in Boston. He was a smart man, no doubt about that.

It's hard to get a read on what kind of person was he. I mean, we know about his intellectual qualities. Obviously, very smart, very bright, capable. But did people call him William? Did they call him Billy? They call him Will? Did he have a nickname?

You see his pictures. If you were to judge from his pictures, you always called him William, or Mr. Rogers, or something like that. Yeah, Mr. Rogers. A double entendre there. But he's a hard person to try to get a sense of, what was he like? Clearly, very good with people. But at the same time, he looks as if he's a fairly formal person.

He was raised in a Scots Irish family, so it was probably a fairly strict upbringing that he had. Is he a religious person? I've not seen any references to being a deeply

religious person, though probably he was maybe a Presbyterian coming from that sort of background. I don't know. It's possible to find that out, I just don't know.

**AUDIENCE:** How long was he actually active here once classes started?

**PROFESSOR:** Well, he died in 1883. And he was very active. I'm trying to remember. Around-- was it 1873? I've forgotten. He serves as president twice, basically. He serves a stint getting the thing started. And then he has a health problem. He starts having health problems in the 1870s. And he backs off and he turns over the Institute to one of his most trusted associates. And that goes on until around 18-- I'm trying to remember the dates here. '79, 80 thereabouts, I think.

**AUDIENCE:** It says that he returned in '78 and continued until 1881.

**PROFESSOR:** '81, OK. And that's sort of the interim president. He was not a well person at that time, but he was sort of filling in until they could find a new president and the new president was Francis Amasa Walker?

**AUDIENCE:** I believe so.

**PROFESSOR:** Speaking of the Civil War, Fran-- now, he did have a nickname. His name was Frank. People did call him Frank Walker. But Francis Amasa Walker was a Civil War general. Had earned ribbons and things for service during the war. And then he was-- as I remember, he was educated, I believe, at Amherst and Yale. He went to Yale as a professor. He would have been by our lights today, someone who was in economics. He was not an engineer or scientist. And he became very famous for running the US Census of 1880, which was arguably the best US Census done during the 19th century. Extremely well done. And even today, you can read it and get a lot of good information out of it about all sorts of things, from cotton harvesting to manufacturing processes. But he was in charge of that. And then, he came to MIT from the Census Office in Washington, basically. He'd been on leave at Yale and came up here after that. So he came here in '83 did you say?

**AUDIENCE:** Oops. I had it up here a second ago. It has him '81 to 1897 it seems.

**PROFESSOR:** OK. Well, it's right around in there because the US Census was finished by '82, or thereabouts. And Rogers dies on the platform of Francis Amasa Walker's inaugural day. He's literally giving a speech and keels over and passes away on the platform when he's transferring power, in effect, formally to the new president. So he dies in '83. So that would have meant that Walker arrived somewhere in the previous year.

**DAVID MINDELL:** It's worth talking then a little bit about the postwar years. The classes start here right at the end of the war, but in terms of the US economy, it really takes the better part of a decade to recover from the wounds of the war. And you can think about 1876, which is the centennial year. There's a big exposition in--

**PROFESSOR:** Philadelphia.

**DAVID MINDELL:** --Philadelphia, which features a lot of American technology. The telegraph makes its first sort of public debut there for the first time.

**PROFESSOR:** Telephone. You mean the telephone.

**DAVID MINDELL:** Telephone. Telephone makes public debut there. Edison's electric light is really 1881. And so the kind of industrial, sometimes it's called the second Industrial Revolution after the Civil War, takes a while to get going. And it really takes 10 or 15 years for the country to get out of the tunnel and the kind of malaise of recovering from this national catastrophe. And many of those industrialists that-- Andrew Carnegie's and even Thomas Edison's, these are not people who served in the Civil War. They're just a little younger than that, or they were doing other things during the war.

And the big US Navy sort of turns its attention towards steel only in 1883. And those industries, it's a while. In a sense, Rogers is sort of a product of the generation before the war. It's people like Walker and others who really take up the call after the war. And it takes a while for that era to get going.

**PROFESSOR:** Yeah. I think it's during Walker's administration that MIT really starts to take off as an educational institution. Someone was saying, how many students are living on campus? It's during his administration that you go to full-time students away from



special students. It's during his administration that the majority of students then are full-time students.

I don't know about dormitories. I think they did not have dorms in those days that I'm familiar with. They probably had to find rooms in the city or things like that. I don't think dormitories appear until the new campus is built over here. Senior House is the first dorm, isn't it, on campus?

**DAVID MINDELL:** Is it?

**PROFESSOR:** I think it is.

**DAVID MINDELL:** MIT doesn't become predominantly residential until the '50s really.

**PROFESSOR:** Are you Senior House?

**AUDIENCE:** No, but I [INAUDIBLE].

**PROFESSOR:** I think that's the oldest of the dorms, is Senior House. If that's the case, then we're talking around 1917, 1918. Because I think that's built after the main campus is built. It's built right around the same time that the President's House is built. So that's pretty late. But the shift during Walker's years was important because he gives-- you read it in my essay that he gives an annual report. I think it's in 1894, in which he sort of ends the report by saying the battle of the New Education-- and New Education are capitalized-- has been won. And what he means by that is that MIT's program of education was called the New Education by none other than the president of Harvard.

A guy named Charles Eliot, who started his teaching career here at MIT in the chemistry department. And then he was here for about two years, and then Harvard hired him as president of Harvard University. So there's all of this back and forth between Harvard and MIT. But Eliot coins the phrase-- he writes a two-part essay in *The Atlantic* magazine, which is still being published, called "The New Education." I think part of it, in fact, you have to read for next week. But it's really about MIT. This is this new education that's so different from all the old classical curricula that's

around.

**DAVID MINDELL:** That's 30 years.

**PROFESSOR:** Yeah.

**DAVID MINDELL:** Which is also what about the amount of time it takes graduates from the first classes to rise up through the ranks of whatever field they're in and become senior people. And either start giving money back, or become prominent scientists in their fields, or whatever kinds of career success they have.

**PROFESSOR:** Yeah, that's an interesting point.

**DAVID MINDELL:** It's a generation, basically.

**PROFESSOR:** The person to put up the money to build this campus, do you know who it was? Well, you'll encounter it in the reading. George Eastman from Rochester, New York. Eastman Kodak was the guy who put up most of the money for the building of this campus. But he didn't buy the land over here. Or he didn't give the money for the land. The land had already been purchased. That money came from the du Ponts, who were graduates, former graduates. And they were all products of the 1890s. They would have been here when Walker was president.

By the time of the World War I, they had emerged as business leaders, very wealthy people, and were capable of endowing the Institute with land over here. So it's not just all George Eastman though. Most of it was. He was amazingly generous with President Maclaurin about giving money to the Institute.

And I think I may have mentioned this last time that there were moments when he'd write-- I don't know, huge, huge amount of money for the time. But MIT would discover that it wasn't quite enough and they'd go back to Mr. Eastman for more support. And he would write another check. And he ponied up. I don't know, at least three times, I think, in which President Maclaurin went back and said, we don't quite have enough Mr. Eastman. And he would-- and the reason why according to the records that exist that he did that was that he was not a graduate of MIT. He had no

personal connection with the place, but a lot of his employees were MIT graduates. And he was so impressed by their abilities that he felt that this was a good place to endow. So it's a very interesting--

**DAVID MINDELL:** A company like Kodak is a second Industrial Revolution company in a way where you can't even have a company like that without trained chemists and some PhDs. And the electrical industry is the same way. Even the steel industry to some degree. It was quite different from the early railroads and the Lowell mills where a lot of good tinkerers getting together could really make the thing work. These sort of second wave companies are what you would today call high-tech companies, where it's not something you're going to come up with in your garage is the way to make film. Rubber is that way.

**PROFESSOR:** Yeah, [INAUDIBLE].

**AUDIENCE:** [INAUDIBLE] that started that Harvard tried to buy MIT? [INAUDIBLE].

**PROFESSOR:** Well, it wasn't so much buying, it was amalgamating with it. The first attempt happened during the 1870s, I think. Not long after Charles Eliot became president. See, he was hired here. Eliot was hired here as a professor of chemistry around 1867 if memory serves. He was here for roughly two years, and then he was called to Harvard as president there. And he had written this article called "The New Education," which he was, in effect, sounding the glories of MIT. Saying, this is the way, folks. This is the New Education. So when he went to Harvard, he wanted to try to reconfigure Harvard's system along the lines of MIT. and what better way to do it than to absorb MIT into the Harvard system. So the first attempt was made fairly early in his presidency. I would say as early as 1873 or '74. There will be an essay in the book that we're reading about that subject. It goes through all the different--

**DAVID MINDELL:** Even in 1861, I think as the governor is signing the charter, he looks up and he says to Rogers, why aren't you guys getting together with Harvard and doing this?

**PROFESSOR:** Right, Governor Andrew. There were efforts even-- yeah, even during the charter phase that the governor of Massachusetts who was a Harvard graduate said, wait a

minute. Why do you want to do this separately from Harvard? Why don't you do it in concert with Harvard? And so Rogers was constantly being sort of put upon about trying to nudge up against Harvard. And, of course, his resistance was he was fearful that his vision would not be enacted at Harvard. Plus, he had some intellectual enemies there. Agassiz was one of them. His primary intellectual opponent, and continued to be one well into the 1870s. It's an ongoing process.

As I said earlier, it happens at least five or six times. Harvard did not give up after one attempt. They kept doing it. And Eliot was the most avid of all about trying to absorb MIT into Harvard because he had been here. He had seen what was good about the place, and wanted it moved into Harvard.

**DAVID MINDELL:** How many of you today would vote in favor of a merger with Harvard? That's about how it came out in the 19th century also.

**PROFESSOR:** That was just about right.

Now, how many of you would vote for a merger, say if somebody gave you \$50,000? Wouldn't do it anyway. See, this is true believer territory here. Good.

**AUDIENCE:** The time was it that obvious, too? Or was there more debate?

**PROFESSOR:** As I recollect in the first time around, it was pretty cut and dry. People here were saying, no, we don't need to do that. But later on, it came very close. During the early 1900s, there was a moment when Harvard and MIT became very close. I think it was President Pritchard who actually approved a merger. And then, that kind of got opposition and backed off. And this will be discussed later. But there was a moment when MIT and Harvard were actually granting joint degrees if I'm not mistaken for a very brief time.

**DAVID MINDELL:** Yeah, it only failed because the Massachusetts Supreme Court ruled, however, that they're not allowed to spend the money they were using for it for that purpose.

**PROFESSOR:** It came close to happening in the early 20th century. William Rogers must have rolled over on his grave.

**DAVID MINDELL:** I think there were moments where it came down to MIT might close if it didn't find itself financially more support. And so it was under those kind of stresses. But I think once there's a community of alums, they felt pretty strongly that it should stay as it is. That's in the reading for next week.

**PROFESSOR:** Yeah, it's interesting, too, that that discussion of mergers really fades after Maclaurin has this campus built over here, gets the Eastman money. MIT then is pretty well defining its own life. And that sort of fades off the screen.

**AUDIENCE:** Why is the merger discussion so one-sided? Why does Harvard want to merge with MIT, but MIT not want to merge with Harvard?

**PROFESSOR:** Well, I know the Rogers side of the story is that he was fearful that if that merger were to take place, that the core programs that he wanted to see introduced, like laboratories for students, an emphasis on science interacting with practical applications, would eventually fall by the wayside. Because they were fearful of Harvard's emphasis on the traditional liberal arts. Harvard is, to this day in many ways, controlled by humanities faculty, or social science humanities faculties, rather than science faculty.

**AUDIENCE:** So then why would Harvard so badly want to merge with MIT?

**PROFESSOR:** Why?

**AUDIENCE:** Yeah.

**PROFESSOR:** Because it was MIT It was the cutting edge. It was the New Education. It was the new way of doing science and engineering, which they felt they wanted to incorporate in to the Harvard system.

**DAVID MINDELL:** Well, sort of the opposite problem they had, which was that they couldn't manage to start it on their own. They tried in a number of different ways.

**PROFESSOR:** It never worked.

**DAVID MINDELL:** And their attempts to do technical education were always co-opted by the more old

school scientists who saw it as natural philosophy and not so much-- you also got to remember, MIT's celebrating its 150th anniversary this year. What was the last anniversary Harvard celebrated? Anybody remember? You probably weren't here for it. Because it was already almost 10 years ago, I think. 350. So they have 200 years on MIT. Big difference.

How many MIT graduates have been in the White House? Zero.

How many Harvard graduates have been in the White House? Quite a number of them.

How many Harvard graduates are in Congress? Lots of them. Senators? All over the place. Very, very different sort of social structure to that school.

**PROFESSOR:** It is a different breed of cat.

**DAVID MINDELL:** Harvard played a big role in the American Revolution. Harvard graduates played a big role in the American Revolution, which we can't claim.

**PROFESSOR:** But there were MIT graduates who fought in the Civil War.

**DAVID MINDELL:** There were?

**PROFESSOR:** Yeah. They came back after the war and went to school here. But they fought in the Civil War. They survived. They were survivors. Yes?

**AUDIENCE:** I know this is much later, but when did MIT become a great economic-- [INAUDIBLE], economics--

**PROFESSOR:** I think that probably dates from the arrival of Paul Samuelson as a professor of economics here. And that would have been after World War II.

**DAVID MINDELL:** Yeah, he came during World War II.

**PROFESSOR:** You're familiar with Paul Samuelson? He just died, what? About a year ago. Very famous economist. Arguably the most-- he wrote a textbook in economics that I used as a college student. And it was like in its seventh edition when I used it. And

it's been used over the years in general economics classes. So he became very famous for his textbook. That was the leading textbook in economics for many years.

And then, he won a Nobel Prize. And that department has won a lot of Nobel Prizes. And so under his leadership and others-- he wasn't the only one there-- but Robert Solow is another very famous economist who is now retired, but is very active around here. They really brokered that department into one of the best in the world. And it still is. I think it's still considered to be one of the top departments in the United States.

**DAVID MINDELL:** But that's post-World War II.

**PROFESSOR:** It's post-World War II. Yeah, definitely.

**DAVID MINDELL:** I mean, directly post-World War II. Samuelson came here and he worked in the radiation lab on radar.

**PROFESSOR:** Did he? I didn't know that. Interesting.

Well, good.

Now, we'll stop at this point. We'll continue talking about this era. I want to really focus on Rogers next week. We focused a lot on him today, I don't know there's a whole lot more to say. But there will be. I want you to read the essay about him and read some of those primary documents, just to get a sense of what they're talking about there. That article about the New Education is worthwhile because it's really making a proclamation to the rest of the country about there's something new and different going on here in Boston, and it's MIT. It's that sort of argument that's being made there.

These are not the most scintillating papers to read in the world. So work through them. Read them. You don't have to study them closely. We're just trying to give you a taste of what that formalistic literature looked like in those days. But you got to look at to get a sense of, what was it? You don't need to memorize it, just get a sense

of what it was.