

Rocky Kolb

504th Convocation Address: "Be Careful What You Rub Out,"

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"Be Careful What You Rub Out" by Rocky Kolb

It is an honor to address the five hundred fourth convocation of the [University of Chicago](#). It is also a little daunting. This is an institution that values originality. But when you do something five hundred and three people have done previously, it is not so easy to be original. So I will take some inspiration from a previous convocation address. The seventy-third convocation address was delivered one hundred years ago, March 15th, 1910 to be exact, during spring graduation. The address was given in Mandel Hall by John M. Coulter, Professor and Chair of the Department of Botany. The title of his address was "Practical Science."

My inspiration is not anything Mr. Coulter said in his address, or anything he did, but something he failed to do. Sometime during the address, Coulter looked up from his notes and surveyed the graduating class. Out there in the graduating class of 1910 was someone Coulter failed to notice. That unnoticed person would one day become one of the greatest astronomers of all time. Someone mentioned in the same breath as Copernicus and Galileo.

This particular member of the graduating class of 1910 had a pretty good college career. He majored in physics with good, but not exceptional grades. He was more of a gym rat than a lab rat. He spent a lot of time boxing at the 53rd St. YMCA. He lettered in track and basketball. He was a proud member of the 1909 University of Chicago National Championship basketball team. He was not so proud of the trouble he got into during his junior year when he was caught throwing eggs at [Divinity](#) students.

That small indiscretion did not prevent Edwin Hubble from winning a prestigious Rhodes Scholarship to Oxford University. In those days, to be a Rhodes Scholar one had to be successful in a "manly" sport. Since basketball was not recognized in England at that time (or even now, for that matter), Hubble chose boxing for his manly sport. He would eventually climb into the ring for an exhibition with the famous French heavyweight champion, George Carpentier. Basketball star and boxer, Hubble was not a typical physics nerd.

Although a physics major, Hubble switched fields at Oxford and read law. Perhaps like many of you today, he didn't quite seem to know what he wanted to do after college. After his Oxford adventure, Hubble lived in

Louisville, Kentucky, where his family had moved. He was admitted to the bar in Kentucky, but he decided that rather than be a lawyer, he would do something useful with his life, and he became a high-school teacher in the nearby town of New Albany, Indiana.

It wasn't until Hubble was twenty five that he finally decided what he wanted to do. So if it takes you a while to figure it out, don't worry. More importantly, Mom and Dad, you shouldn't worry either.

Hubble decided that he wanted to be an astronomer and returned to Chicago for graduate school. After his 1917 PhD and service in France during the First World War, Hubble became an astronomer at Mt. Wilson Observatory outside of Pasadena, California. It was there that he made many discoveries, two of which fundamentally changed our perception of the cosmos. In 1929 Hubble discovered the expansion of the Universe, the basis for my own research on the big bang. But five years earlier, he made perhaps an even more remarkable discovery. Before Hubble, it was thought that our own Milky Way Galaxy comprises the entire Universe. In 1924, Hubble discovered that what appeared as fuzzy patches of the sky are actually distant galaxies, and our Milky Way is but one galaxy in a Universe containing billions. Hubble extended the known size of the universe from 30,000 light years to at least a billion light years. No one has ever extended the size of the known universe by such a great amount.

The key to Hubble's discovery was an image he had taken of the Andromeda Nebula on the evening of 6 October, 1923. The photograph was, frankly, not as good as others. It was taken in poor weather, on a night when Hubble was advised to close the dome and go home. But in this unexceptional photograph Hubble noticed something exceptional. Among the thousands of specs of light was one he had not noticed in previous images. Hubble identified that spec as a Cepheid star, the key to proving that Andromeda was a distant galaxy, far beyond our Milky Way.

So here are two familiar lessons. Luck favors the prepared mind. Hubble was so familiar with the intricate details of Andromeda that he could recognize one unusual speck of light out of a thousand. The second lesson is dogged determination. Hubble didn't let a few raindrops end the night's research program.

We can also learn something from stories of why others did not make the discovery. Let me tell just one, involving two of Hubble's colleagues.

The first person is Harlow Shapley. Shapley, just four years older than Hubble, was a famous astronomer and the most vocal proponent that our Milky Way is the entire Universe. When Shapley first went to college

he didn't have any idea what he wanted to study. So he decided to study the first subject he came across in the course offerings. Rejecting Archeology, which he later explained he didn't know how to pronounce, he chose the next subject, Astronomy.

The other character in this story is Milton Humason. While Hubble and Shapley earned doctorates from elite universities, Humason did not even attend high school. While Hubble was a Rhodes Scholar and Shapley a graduate student, Humason was a mule driver in the mountains of California. Humason's first exposure to astronomy was driving mules bringing astronomical equipment up the steep, winding road to Mt. Wilson Observatory. He became interested in the telescopes and started hanging around the observatories. Eventually, he was hired as a night janitor at the observatory.

Everyone liked Humason, and he seemed to have a gift for making the telescopes and instruments work. Around 1920, Shapley said to the former mule driver, now night janitor, "So you want to be an astronomer, why don't you study my photographs of Andromeda."

In those days, astronomical photographs were taken on glass plates. After the glass plates were developed, astronomers would turn the glass plate over and mark the plate with a grease pencil indicating interesting objects.

After a few weeks studying Shapley's plates of Andromeda, Humason went to him and said, "Dr. Shapley, look at these stars, aren't those some of those 'Cephied stars' people think are so important?" as he circled tiny specs of light with his grease pencil.

Thanks to Humason the mule driver, five years before Hubble's discovery of Cephied stars in Andromeda, Shapley held in his hands the key to one of the greatest astronomical discoveries of all time.

But instead of seizing the opportunity, Shapley told Humason that he was mistaken, those stars couldn't possibly be Cephieds because "everyone knew" Andromeda is inside our own galaxy. Then Shapley took a white linen handkerchief from his pocket, rubbed out Humason's grease pencil marks and said, "Never write on my plates again."

When Shapley rubbed out the marks, he erased the opportunity to make a paradigm-changing discovery. If Shapley had listened to the janitor/mule driver, perhaps today we would be enthralled by images from the "Shapley" Space Telescope.

Now, Shapley was no fool. He was one of the great astronomers of the 20th century and made fundamental discoveries. In 1918 Shapley discovered that our solar system is not at the center of our galaxy, where it was thought to reside, but actually 25,000 light years from the center. Shapley had a long, distinguished career in astronomy and astronomy education.

And Humason was much more than a mule driver and janitor. Eventually he became a staff astronomer and one of Hubble's most valued collaborators. I am fond of a photograph from the 1930s of Humason, the high-school dropout, former mule driver and janitor, explaining his observations to an interested visitor named Albert Einstein.

Why did Hubble make the breakthrough discovery and not Shapley? Was it because Hubble was educated with the Chicago tradition of challenging one's own deeply held beliefs, while Shapley was not? I would like to think so. In any case, Hubble followed where the evidence pointed, rather than rejecting it because "everyone knew" it must be wrong.

I've learned from my own research and reading of the history of science that every great scientific discovery involves abandoning some cherished belief. Every great advance starts out as a crazy idea. Of course, not every crazy idea ends up being a great advance; most end up in the trash where they belong.

Just as John M. Coulter looked out at the graduates in 1910 and didn't recognize the person who would change humanity's perception of the immensity of the cosmos, I look out at the graduates in 2010 and I am unable to recognize those who will make revolutionary discoveries. But I know you are out there. You received a great education at the University of Chicago. But more than that, you have been exposed to the Chicago style of fearlessly challenging "established" truths.

I know that if one day a mule driver without a high-school education shows you something that challenges your view of the universe; you will be careful what you rub out.

Thank you and best of luck in the cosmos.

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