

## **“As Nearly Free as Possible”: Liberated by the Liberal Arts**

Address to Phi Beta Kappa

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The National Science Foundation where I work is an agency with a very simple mission: to promote the advancement of scientific knowledge. Our job is to underwrite fundamental scientific research and education. Scientists propose research on topics of their choosing. The successful proposals are chosen through a competitive process of peer merit review. All kinds of amazing discoveries have emerged from NSF-funded research, everything from bar codes and Doppler radar to fiber optics and web browsers<sup>1</sup>. Our system is admired and emulated throughout the world, and I feel very fortunate to be part of it.

By contrast, the mission of a public university like the University of Wyoming is far more multifarious. We see this in the territorial legislature’s session laws that established the university in 1886, and were incorporated into the state’s constitution and statutes<sup>2</sup>. These direct that:

There is established in this state, at the city of Laramie, an institution of learning to be known as "The University of Wyoming".

The objects of the university are to provide an efficient means of imparting to men and women, without regard to color, on equal terms, a liberal education, together with a thorough knowledge of the various branches connected with the scientific, industrial and professional pursuits.

Our state’s founders honored the principle of equality with their emphasis on educating both men and women, and all people without regard to color. They also described a university that provided a balanced education:

The college, or department of science, shall embrace courses of instruction in the mathematical, physical and natural sciences, together with such courses in language, literature and philosophy as shall constitute a liberal education.

But since this was what Henry Adams would call “the age of the Dynamo,” they also stressed the practical: scientific, industrial, and professional training.

The college or department of the arts shall embrace courses of instruction in the practical and fine arts and especially in the applications of science to the arts of mining and metallurgy, mechanics, engineering, architecture, agriculture and commerce, together with instruction in military tactics, and in such branches in the department of letters, as are necessary to a proper fitness of students for their chosen pursuits.

Added to these multiple missions the modern University of Wyoming is subject to other influences: legislative directives, the wishes of donors, federal requirements, and political forces of all kinds. Especially as the sole public university in the state, UW is under pressure to be all things to all people—it is a very complex (if not impossible) business.

This afternoon I would like to focus on just one of UW’s original missions: that of providing “a liberal education.” How do we fulfill our mandate to embrace, in the words of the statute, “the mathematical, physical and natural sciences, together with...language, literature and philosophy”? Today UW addresses this mission by requiring approximately 30 credit hours of general education courses from all students. These classes are intended to develop quantitative and communicative functionality and to expose students to ideas about human culture and the physical and natural world. They represent a *minimum* level of

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<sup>1</sup> National Science Foundation’s Nifty Fifty, <http://nsf.gov/about/history/nifty50/next25.jsp>, accessed April 11, 2015.

<sup>2</sup> 9th Territorial Legislature Session Laws of 1886, Chapter 37, Section 35; Wyoming Constitution Article 7, Section 16; Wyoming State Statutes 21-17-101 to 21-17-103.

competency. The responsibility for encouraging students to attain a *complete* liberal education is embraced by an academic society at UW, by Phi Beta Kappa.

So what is a liberal education? Today the word “liberal” is most often used in a political sense, meaning the opposite of conservative. But the “liberal” in “liberal education” comes from the Latin *liberalis*, which pertains to *freedom*. Think of the words *liberty*, *liberate*, even *libertine*. Liberal, in this sense, contrasts with enslaved, imprisoned, subjugated, or incarcerated. Liberal education enables us to function successfully as free citizens in a free society<sup>3</sup>. As we just heard in our initiation ritual, “it emancipates; it signifies freedom from the tyranny of ignorance, and, from what is worse, the dominion of folly.”

Very often a “liberal education” is referred to as a “liberal arts education.” Our UW College of Arts and Sciences was originally called the College of Liberal Arts. From the ancient world through the Renaissance, the liberal arts, or *artes liberales*, comprised grammar, rhetoric, and logic (referred to as the trivium) along with music, geometry, arithmetic, and astronomy (the quadrivium). These “arts that liberate” are set in contrast to the *artes mechanicae*, the mechanical or servile arts<sup>3</sup>, which might include subjects such as metallurgy, agriculture, masonry, and warfare that appear in our founding state statutes. These are technical skills needed for production, for direct application, for jobs. For the materials of life, not for life itself.

You new initiates into Phi Beta Kappa are here today because you have completed a liberal arts baccalaureate degree here at the University of Wyoming. You’ve done more than complete the *minimum* general education requirements, although those courses constitute some of the core subjects of a liberal education. No, you’ve gone well beyond. You’ve completed more than 90 hours of coursework in the pure liberal arts: in natural sciences, mathematics, social sciences and humanities, and you’ve studied a second language at the intermediate level or beyond. Your mastery of these diverse subjects is indicated by the high grades that all of you have earned.

Why does Phi Beta Kappa expend so much time and effort to recognize and celebrate the liberal arts? Because these studies instill the habits of mind needed to “prepare for complete living,” to use the phrase engraved over the entrance of the College of Arts and Sciences building. In a world where people change jobs several times in their lifetime, and where the jobs of tomorrow don’t even exist today, a liberal arts education prepares you to develop and mature into successful and adaptive members of society. For the past four years or so, you’ve been cultivating your analytical and synthetic intellectual abilities. You can ask difficult questions and formulate apt responses. You’ve learned to evaluate and interpret evidence, you can make clear, well-reasoned arguments, and you have stretched your imagination. You have figured out different ways to solve problems. You can appreciate others and empathize, you can judge fit means to an end, and you know the joy of learning.

A liberal arts education confers substantial personal benefits, despite current national rhetoric that suggests instead that technical training is the better path forward. The *Chronicle of Higher Education*<sup>4</sup> admits that immediately out of college, graduates in liberal arts fields—humanities, social sciences, science and mathematics—earn less than graduates in engineering and professional programs. That’s in the short run. But at their peak earning ages, the humanities and social science graduates make more than professional majors in the same age bracket. And I would propose that they have a life more enriched with timeless ideas and beauty and less circumscribed by practical limitations—a life more worth living. You’ve chosen the path for enduring success and fulfillment.

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<sup>3</sup> Strauss, Valerie, April 2, 2015, What the “liberal” in “liberal arts” really means, Washington Post, <http://www.washingtonpost.com/blogs/answer-sheet/wp/2015/04/02/what-the-liberal-in-liberal-arts-actually-means/>, accessed April 2, 2015.

<sup>4</sup> Supiano, Beckie, January 22, 2014, How liberal-arts majors fare over the long haul. *Chronicle of Higher Education*, <http://chronicle.com/article/How-Liberal-Arts-Majors-Fare/144133/>, accessed April 11, 2015.

Of course, a liberal arts education is about much more than making money. A liberal arts education addresses questions related to our core values: who we are and what kind of persons we choose to become. That education inspires what Rebecca Chopp, Chancellor of the University of Denver, calls “individual flourishing,” that comes from reflection on our purpose in life.<sup>5</sup> Thomas Jefferson’s exhortation to the “pursuit of happiness” encompasses “happiness” in one’s career and personal life but also in one’s community. Now as then the liberal arts prepare us to serve the common good through a variety of practices, styles, and expressions, whether theater or the arts, economic analysis, close reading, scientific discovery, historical interpretation, or judicial inquiry.

The journeys of life-long students of the liberal arts contribute to society in unanticipated ways. I’ll relate an example from my own discipline of geology. Pearl Sheldon, born in 1885, was educated at Cornell University, where she earned her PhD in structural geology in 1911. She measured the orientation of joints in the black shales in the region of Ithaca, New York. Over the course of a fall and two summers she hiked along shorelines and up creek beds taking a total of 3,046 measurements of joints—fractures—in the rocks. She documented that the joints formed two sets that intersected to form a grid of vertical planes. She realized that the joints were old features, since they are displaced by younger faults. She theorized that the joints had been formed during mountain building processes, concluding in one of her few scientific papers, “Some factor like shock may have determined the position of the breaking planes which are classed as joints.”<sup>6</sup> I don’t know very much about Pearl Sheldon. She appears to have become a lecturer at Cornell. Her entry in *Woman’s Who’s Who in America* says she promoted women’s suffrage.<sup>7</sup> The American Seismological Association commemorated her death in their annual meeting minutes in 1967.<sup>8</sup> But as I’ll explain in a moment, a seemingly inconsequential academic study by a little-known female geologist contributed to a new scientific paradigm with consequences that have touched every one of us.

Fast forward 70 years to Terry Engelder, a structural geologist at Penn State. He, like Pearl Sheldon, was interested in black shale. As a Philadelphia news article describes it, “Terry Engelder spent most of his career toiling in obscurity, studying fracture behavior of these rocks. Even among geologists, he says, it was kind of a boring topic, and he was often slotted to present his papers on the last day of professional conferences.

‘Not only was it the last day, but it was in the afternoon of the last day,’ he said.”<sup>9</sup>

But Terry Engelder figured out what caused the shock that broke the rocks. In 1983 he wrote a research proposal to the National Science Foundation entitled, “A test of the hypothesis that some joints formed as natural hydraulic fractures.” His thinking was this: as mud rich in organic matter is buried and heated the organics break down, forming methane gas. The increase in volume associated with the creation of the gas exerts the pressure that breaks the rock and creates the fractures. This is the kind of cool concept that NSF likes to fund. They awarded him almost \$51,000 to follow up on his insight.

Then another 25 years passed. By 2008 horizontal drilling was developed and Engelder and others realized that the gas trapped in the black shales of the Marcellus Formation could be released from the vertically oriented joints by piercing them with a horizontal well. Someone else figured out that hydraulic fracturing techniques that had been developed in vertical wells in the 1940s could be adapted to horizontal wells.

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<sup>5</sup> Chopp, Rebecca, 2012, Against the grain: liberal arts in the 21<sup>st</sup> century. <http://www.swarthmore.edu/aydelotte-foundation/listen-against-grain-liberal-arts-21st-century>, accessed October 15, 2013.

<sup>6</sup> Sheldon, Pearl, 1912, Some observations and experiments on joint planes. *Journal of Geology*, v. 20(1), 53-79.

<sup>7</sup> *Woman’s Who’s Who in America*, 1914, American Commonwealth Company, New York, p. 739.

<sup>8</sup> Tocher, D., 1967, Minutes. *Bulletin of the Seismological Society of America*, v. 57(5), 1123-1124.

<sup>9</sup> Maykuth, Andrew, May 14, 2013, Shale made Penn State professor a star. [www.philly.com](http://www.philly.com), accessed April 16, 2015.

Suddenly oil and gas were being recovered from shales and other previously unproductive hydrocarbon-bearing rocks all across the United States, from Appalachia to Texas and the Rocky Mountains. Almost overnight the United States went from a major energy importer to an important producer. Flow in pipelines changed direction to carry this new energy to the coasts for export. Energy prices dropped. New scientific questions arose—about how to assess aquifer integrity, how to trace injected fluids, how to evaluate the possibility of induced seismicity. Our modern world has changed, quickly, in unexpected and unpredictable ways. And it all goes back to the observations and ideas of two people who didn't set out to discover a new energy source. Far from it. They simply enjoyed studying, puzzling, and developing explanations. In short, this new paradigm came from people who exhibit the fundamental qualities of the liberally educated.

I will summarize it this way: a liberal arts education produces people who can *think*. Think things through for themselves. Liberally educated people can do more than just answer questions or follow directions. They are people who can shape those questions, who can determine whether things are *worth* doing, who can figure out new ways of looking at things, new ways of doing things. As the latest initiates of Phi Beta Kappa, you have embarked on a life-long, purposeful journey that provides personal satisfaction and public benefit. As the Executive Secretary of the Phi Beta Kappa Society, John Churchill, puts it:

“ΦBK stands for freedom of inquiry and expression, disciplinary rigor, breadth of intellectual perspective, the cultivation of skills of deliberation and ethical reflection, the pursuit of wisdom, and the application of the fruits of scholarship and research in practical life. We champion these values in the confidence that a world influenced by them will be a more just and peaceful world.”<sup>10</sup>

Let me close with a well-known phrase from Wyoming's constitution, which proclaims that the instruction UW furnishes should be “as nearly free as possible.” We know that our founders were talking about freeing the pocketbook. But your liberal arts education frees you intellectually, imaginatively, and spiritually. It prepares you to navigate a changing and uncertain world with the confidence that comes from a well-stocked mind, a mind capable of imagining the very future it will create. Because we have confidence in you, we also have confidence that the future is bright.

New members of Phi Beta Kappa, welcome and congratulations.

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<sup>10</sup> John Churchill, A Message from the Secretary, [www.pbk.org](http://www.pbk.org), accessed April 16, 2015.