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Generally, papers from the *Bulletin for the History of Chemistry* from the last three years are available only to members of the Division of the History of Chemistry of the American Chemical Society and other subscribers. After three years, the Division makes them available to open access.

These papers are being made available to the general public early as part of the 150<sup>th</sup> Anniversary of the Morrill Act. However, if you would like to read the rest of papers in this issue or others not yet available on open access, consider joining the Division of the History of Chemistry of the American Chemical Society.

## 150 YEARS OF THE MORRILL ACT

### The Promise and Potential of the Land-Grant University

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In 2012, I served as president of the American Chemical Society, the world's largest scientific organization. During that year ACS celebrated the sesquicentennial of the Morrill Land-Grant Act—which gave federal lands to states as a means to raise money to establish colleges that focus on teaching agriculture, science, and engineering in addition to liberal arts—with a retrospective and a prospective look at chemistry.

On the prospective side, the ACS national meetings in San Diego and Philadelphia featured special symposia and events that included high-level federal officials and noted scientists and educators, to help ACS and its members focus efforts in addressing humanity's needs in a world of finite resources. In San Diego in March of 2012, the presidential symposia included Communicating Science to the Public, Production of Fuel Directly from Sunlight: A Grand Challenge for Chemistry of the 21st Century, and Catalysis, as well as a Presidential Keynote Address by then-National Science Foundation Director Dr. Subra Suresh on challenges and opportunities at the NSF.

At the Fall National Meeting held in Philadelphia in August of 2012, the presidential symposia included Communicating Chemistry & Public Engagement: Celebrating the 25th Anniversary of National Chemistry Week; Forensic Chemistry, Science and the Law Presents: Innocence! The Work of the Innocence Project; 150 Years of Chemistry at Land Grant Institutions: The Past as Prelude to the Future; Communicating Controversial Science: Symposium in Honor of Rudy Baum, and Celebrating the Sesquicentennial of the Land Grant College

Act. The meeting's Presidential Plenary Keynote, given by UC-San Diego's Dr. Mario Molina, was on the subject of Chemistry and Climate Change. Videos related to the above are available online, including the Rudy Baum symposium, the Innocence Project symposium panel discussion, the press briefing on the National Chemistry Week anniversary, the press briefing on Dr. Molina's environmental work, and the press briefing on the Land-Grant Act sesquicentennial (1).

The important goal in this prospective look was to articulate the critical role of ACS as a scientific, educational, professional, and learned Society engaged in shaping the future of society as a whole. The Morrill Land-Grant Act sesquicentennial offered ACS and its members an opportunity to showcase what chemistry, chemists, and the ACS have done and are doing, and to use it as a platform to affirm the ACS Mission: "to advance the broader chemistry enterprise and its practitioners for the benefit of Earth and its people."

For the retrospective look at chemistry, I invited all institutions, whether land-grant or not, to publicize their achievements, making them available widely through the Web, as I have done on my website at scifun.org for the University of Wisconsin (2). The retrospective look at chemistry on the 150<sup>th</sup> anniversary of the Morrill Act continues in this issue of the *Bulletin for the History of Chemistry*. It features papers taken mainly from the Presidential Symposium mentioned above, organized by Stephen Weininger and Alan Rocke.

1. “ACS Presidential Symposium: Communicating Science that People May Not Be Ready to Hear,” <http://vimeo.com/49235776>; “The Innocence Project: Science Helping Innocent People Proven Guilty,” <http://www.ustream.tv/recorded/24848172>; “244th ACS National Meeting Press Briefing: Celebrating the Silver Anniversary of National Chemistry Week,” <http://vimeo.com/47890259>; “Nobel Prize-Winning Scientist Cites Evidence of Link Between Extreme Weather, Global Warming,” <http://vimeo.com/48558467>; “New Version of 150-year-old Law Could Ease Student Debt and College Funding Cutback,” <http://vimeo.com/48558428>; all accessed Jan. 9, 2014.
2. “The Promise and Potential of the Land-Grant University: Selected Accomplishments at University of Wisconsin-Madison, 1862–2011,” <http://scifun.org/MorrillLandGrantAct.html> (accessed Jan. 9, 2014).

## Introduction

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On July 2, 1862, in the midst of the Civil War, President Abraham Lincoln signed the Land-Grant Colleges Act, commonly known as the Morrill Act after its principal sponsor. It provided for substantial grants of federal land to each state for the purposes of establishing colleges “whose leading object shall be, without excluding other scientific and classical studies ... to teach such branches of learning as are related to agriculture and the mechanic arts ...” The Act notably prohibited discrimination on the basis of race or sex.

The Act’s mission statement ensured that, because of their perceived centrality to agriculture, chemistry and other natural sciences would have a predominant place in the curriculum. That perception, fostered by Justus von Liebig’s highly influential writings, would require several decades before becoming reality.

Many voices had been advocating scientifically-based agriculture before the Morrill Act. Among the most ardent and effective was Evan Pugh of Pennsylvania. Kristen Yarmey depicts him as pragmatic, patriotic and moral. His persuasive strategy utilized both demonstration and advocacy. A Göttingen Ph.D. with Friedrich Wöhler, Pugh became principal of the Farmer’s High School of Pennsylvania in 1859. Confronted with numerous doubters, skeptics and rivals, Pugh waged tireless publicity campaigns for his institution and his science. The High School became the Agricultural College of Pennsylvania in 1862; in 1863 it shared with Michigan Agricultural College the distinction of being the first institution designated as a land-grant college.

The following five papers, which derive from the ACS Symposium “150 Years of Chemistry at Land Grant Institutions: The Past as Prelude to the Future,” explore various consequences of the Morrill Act. Stephen Weininger makes clear that the land-grant institutions (LGIs) had anything but a smooth start. Student numbers were small, their preparation weak, faculty training was variable, state legislatures were stingy and graduation rates were scant. The Act left much to the discretion of the States; individual colleges fashioned different visions for themselves. Weininger tracks their divergent ambitions by focusing on course curricula and catalog rhetoric relating to qualitative and quantitative analysis, bedrock courses for numerous majors that provided students with marketable skills. By 1900 instruction was more uniform, enrollments and support were rising, and the LGIs were poised to fulfill their potential.

Applying chemistry to agriculture was an ambition initially well ahead of the technical means for realizing it. Alan Marcus reports that some early attempts were disastrous. Chemists then settled on a more modest goal—using their analytical skills to aid farmers by doing water, soil and fertilizer analyses. The idea of having a State Chemist began to spread. Nonetheless, chemists’ reach exceeded their grasp with respect to fertilizer analysis. They responded to trenchant criticism by organizing, upgrading their skills and enforcing standards. By the 20<sup>th</sup> century these analytical chemists had spawned a new, respected profession—the agricultural chemist. The transformation served as a template for the conversion of industrial chemists to chemical engineers.