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Truth for Its Own Sake:
Academic Culture and Technology Transfer
at the Johns Hopkins University

American research universities have long been a source of technical advance for industry, yet few have written on the history of university-industry relationships. This essay examines the evolution of practices and policies at Johns Hopkins University, established in 1876 as the first research university in the United States. Although an academic vision shaped its founding culture, today, the interests of technology transfer increasingly shape that culture. This essay examines how this transformation has come about.

Introduction

Since the end of the Second World War, American research universities have been an engine of technological change. Facilitating technology diffusion and increasing economic growth were the primary justifications for the Bayh-Dole Act of 1980, which established the rights of universities to retain ownership of intellectual property developed as a result of work supported by Federal grants. As a result, American universities have embraced closer interaction with industry in terms of sponsored research, technology licensing, and the formation of start-up companies.1 Henry Etzkowitz coined the phrase entrepreneurial universities to describe the role

being played by universities in promoting technology transfer within national systems of innovation.²

Critics argue that this role may inhibit intellectual freedom, foster public mistrust of science and scientific objectivity, and detract from a university’s fundamental mission.³ Richard Nelson also questions their long-run effect on the US system of innovation⁴. While many scholars have examined these issues,⁵ this paper seeks to add an historical perspective to the discussion. Moreover, while much has been written about the ‘pro-technology transfer culture’

at MIT and Stanford, we have chosen to focus on a research university that from its beginnings emphasized basic research and scholarly publication. Indeed, until recently, university culture has been anathema to commercial activity and technology transfer. Understanding the case of a university that did not embrace relationships with industry provides an appreciation of the diversity of culture and orientations of American research universities and their role in the system of innovation.

Johns Hopkins University -- America’s first research university -- was dedicated to promoting what Robert Merton has described as the norms of open science. This translated into an unwillingness to allow commercial interests to influence research; an abhorrence of patenting and commercialization; and an arms-length relationship with industry. While the university prides itself on scientific breakthroughs that led to useful commercial applications, these discoveries, however significant, brought no direct economic benefit to academic staff or to the university. Instead, they represent a different model of technology transfer, and an alternative role for the university in the national system of innovation.

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8 For example, heparin, a drug used to prevent blood coagulation that is now widely used in the treatment of thrombosis and in cardiac surgery, was discovered in a series of experiment between 1916 and 1918. Merbromin, discovered in 1919 at the School of Medicine was developed and marketed as Mercurochrome by the Baltimore firm of Hynson, Westcott & Dunning. Similarly, research at the School of Hygiene and Public Health led to the discovery of vitamin D in 1922 and set the stage for an effective polio vaccine in the 1930 and 1940s. A list of Hopkins research breakthroughs may be found at www.jhu.edu/news/news_info/research.html; and, hopkins.med.jhu.edu/BasicFacts/discovery.html.
Academic Culture and University-Industry Interaction

Culture is an attribute of organizations that brings underlying values into focus and influences patterns of behaviour and performance.9 Culture, once defined, is also remarkably persistent and resistant to change. Thus, in examining the performance of Italian regional governments, Robert Putnam concludes that, ‘Social patterns plainly traceable from early medieval Italy to today turn out to be decisive in explaining, why on the verge of the twenty-first century, some communities are better able than others to manage collective life and sustain effective institutions.’10 Even after other attributes are accounted for, tradition and social patterns are powerful influences on performance and adaptability.

Johns Hopkins University ranks as the single largest recipient of Federal R&D funds in the US – annually receiving almost twice as much as MIT or Stanford University.11 Despite this prominence, the university lags behind many universities in measures of technology transfer performance -- such as numbers of patents granted, licensing revenues, and university-based spin-offs.12 While academic productivity is difficult to quantify, public statements support the idea that the academic culture has not encouraged direct involvement with industry.


11 See, National Science Board, Science and Engineering Indicators (Washington, DC: National Science Foundation, 2001), Table 6-4. The University includes research expenditures at the Applied Physics Lab when calculating total R&D expenditures.

At Hopkins, the vice-provost for research is responsible for technology transfer. Jared Cohon, who held this post from 1988 to 1992, and who is now President of Carnegie Mellon University said, ‘There’s just been a different kind of culture here. I can’t explain why it happened that way, but I accept it as real. We’ve [Hopkins has] always been a basic research, individual-investigator, Federally-funded institution, the kind of place that emphasizes the creation of knowledge for its own sake.’ Reflecting on more than forty years experience of different divisions of the university, Theodore Poehler, currently vice-provost for research, has said that, ‘Historically, Hopkins has eschewed turning inventions into commercial ventures. Hopkins was a place where you would come to be an academic person and do research, and that’s that. Most people here today are still here for that reason.’

Recent speeches by William Brody, Hopkins’ President, echo this sentiment and highlight the tensions of the university-industry relationship. In a speech entitled ‘From Minds to Minefields: Negotiating the Demilitarized Zone between Industry and Academia,’ Brody cautiously notes that these relationships are likely to be tentative and uneasy, a ‘minefield of potential conflicts, claims and counterclaims.’ He identifies four contentious issues: (1) what can and should be patented; (2) should universities patent at all; (3) whether the university should be licensing any intellectual property; and (4) if the university is to license, should it be on an exclusive basis?’ He concludes as follows:

Our scientists are by nature explorers -- they are off sailing uncharted seas in search of discoveries. Asking them to become managers, marketers and accountants is unrealistic and ultimately inimical to the research enterprise. Time spent in the boardroom is time away from the laboratory, making them less productive and less likely to achieve the things most suited to their abilities...When Hopkins scientists discovered restriction enzymes, one of the basis of the biotechnology industry, we put the discovery in the public domain -- losing millions and millions in potential royalties. Foolish? Perhaps. But I know

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we didn't slow science down or diminish the leading role American industry plays in this field.\textsuperscript{15}

These contemporary statements have historical origins -- in the founding mission of the university, and in the context of early American commercial activity. To understand the institutional culture, this paper begins by examining its founding mission and the views of industry held by early university leaders. The paper turns to the discovery and commercialization of Saccharin to examine how one influential academic -- Ira Remsen, second president of the university -- strengthened the culture of organization. Next, we examine the university’s first spin-off firm. Motivated by Henry Rowland’s personal circumstances, this activity failed, and reinforced the idea that direct commercial activity was inappropriate. The early history of the School of Engineering came to represent an uneasy compromise whose success in the industrial realm lead to its inevitable demise and absorption into the School of Arts and Sciences.

**The Founding Mission**

Johns Hopkins was a Quaker railroad magnate who gave an endowment of $7,000,000 in 1870 for the establishment of a university and hospital to bear his name.\textsuperscript{16} At the time, this was the largest gift made to a college or university in the United States, and was twice the endowment of Harvard University.\textsuperscript{17} Precisely what the word university meant to Hopkins was a

\textsuperscript{15} William Brody, ‘From Minds to Minefields: Negotiating the Demilitarized Zone Between Industry and Academia’, Remarks to the Biomedical Engineering Lectures Series, The Johns Hopkins University, 6 April 1999.

\textsuperscript{16} The value of the endowment would be worth over $130 billion in 2002 real dollars. The amount was equally split between the university and the medical school. This paper focuses on the university and does not explicitly consider the medical school, which provides an additional rich example for further study.

\textsuperscript{17} *Baltimore Sun*. 1873. ‘Death of Johns Hopkins’ December 25, 1973. However, the Hopkins endowment was not as significant as might first be thought, because the university’s annual revenues and property holdings were not comparable to those of older colleges. For example, the property of Harvard was at the time worth more than five million dollars, while that of Yale was thought to equal the university’s endowment. Furthermore, the income-
subject of debate long after his death, owing to an ambiguity in his will. The task of defining the mission and form of the university fell to twelve trustees whom Hopkins named. These were all ‘friends and acquaintances’, ‘resident[s] of Baltimore, in middle life, independent, and acquainted with affairs’ and people Hopkins ‘believed to be free from a desire to promote, in their official action, the special tenets of any denomination or the platform of any political party.’ At a time when institutions were associated with religious denominations, it was decided that the university would be non-sectarian, although the majority of its Board of Trustees belonged to the Society of Friends. As Daniel Coit Gilman, first President of the University, said in his inaugural address: ‘In a land where almost every strong institution of learning is either ‘a child of the church’ or ‘a child of the state,’ and is thus liable to political or ecclesiastical control, [Johns Hopkins] has planted the germ of a university which will doubtless serve both church and state the better because it is free from the guardianship of either.’

The yielding funds of Harvard in 1875 were over three million, a million and a half at Yale, while JHU fund yielded revenue of slightly less than $200,000. By comparison, Harvard received in 1874-75 $168,541.72 in tuition and $218,715.30 from property, the total of which was about twice the income of Hopkins as reported by Daniel Coit Gilman, *The Launching of a University* (New York: Dodd, Mead & Company, 1906), 4-5.

Seven of the twelve trustees were Baltimore businessmen. Four were lawyers, two of these were members of the city’s high court, and the last was Hopkins’ personal physician. At least ten trustees had some college or university training and one had studied abroad. Four were also already involved on the Board of Trustees of another educational institution in Baltimore, the Peabody Institute (a music conservatory) that became part of the University in 1976.


Ibid., 7-8.
decision to be non-sectarian was controversial, but lent a climate of autonomy to scientific
inquiry.\textsuperscript{21}

The trustees wanted an institution that would be markedly different from the four
hundred schools already in existence in the United States. Counsel was sought from President
Eliot of Harvard, President White of Cornell, and President Angell of the University of
Michigan.\textsuperscript{22} They advised the trustees to move slowly in building the academic programme, to
take a local focus, and to orient themselves towards practical applications and relevant industry.
Eliot, for example, argued that the new university should ‘build up and improve the school
system of Maryland. If you could improve the schools through the actions of the university you
could do a good work for a much larger number of children than you would ever bring under
your direct influence’\textsuperscript{23} Angell added, ‘It seems to me in the present state of science and
knowledge you should hold steadfastly in view the practical application to science and arts – the
practical application of chemistry, for instance, to the useful arts, such as working in metals,
dyes, etc.’\textsuperscript{24} President White said, ‘In establishing your course of instruction, permit me to
suggest that you give great weight to the technical side, that is, to science in its application to the
various industries.’\textsuperscript{25} The advice argued for an institution that would follow the prevailing
model. All three were unanimous in nominating Daniel Coit Gilman to the presidency of the
new university.

Gilman greatly influenced the development of the University and its connections with
commerce. Gilman had previously been president of the University of California, but resigned

\textsuperscript{21} J. Vernon Jensen, ‘Thomas Henry Huxley's address at the opening of the Johns Hopkins University in September

\textsuperscript{22}Abraham J. Flexner, Daniel Coit Gilman: Creator of the American type of University. (New York: Harcourt,

\textsuperscript{23} Ibid., 42.

\textsuperscript{24} Ibid., 45.

\textsuperscript{25} Ibid., 46.
over debates with the legislature about his vision for the University.\textsuperscript{26} Now, he articulated a vision for a research institution that the Board of Trustees embraced. This vision differed significantly from the practical orientation of the grant colleges and the liberal arts tradition.

On 18 January 1875, \textit{The Nation} (editor, Edwin L. Godkin)\textsuperscript{27} reported the Mr. Gilman sought to promote high quality scholarship by offering instruction to advanced students. The plan was to hire professors at the forefront of their fields and ‘pay them well enough to leave them at their ease as regards the commoner and courser cares.’\textsuperscript{28} In return, Gilman ‘would find them only students who were far enough advanced to keep them constantly stimulated to the highest point; and he would exact from them yearly proof of diligent and fruitful cultivation of their specialties by compelling them to print somewhere the results of their researches.’\textsuperscript{29}

Against the advice of the three university presidents, the Trustees decided to follow Gilman by creating an institution primarily devoted to advanced study and specialized graduate training, along what has been described as the German model. At the time, German universities were preeminent in the world. An estimated nine thousand Americans studied in Germany during the second half of the nineteenth century. The German university provided two conspicuous features that the American system lacked. The first was the principle of academic freedom, and the second was a commitment to \textit{Wissenchaft}, or pure learning – the idea of

\textsuperscript{26} Ibid., 16-27; John Calvin French, \textit{A History of the University Founded by Johns Hopkins}. (Baltimore: Johns Hopkins Press, 1946), 30-33.

\textsuperscript{27} Reported in Flexner, op. cit. 50-51.

\textsuperscript{28} The importance of adequate pay is justified as ‘we could at this moment name twenty men, employed at small salaries in existing colleges, whose work in certain fields of research would be of inestimable value to science and literature of the world, but who are compelled, in order to earn their livelihood, to pass most of their time teaching the rudiments to boys or preparing schoolbooks and that American graduates are compelled every year either to go abroad or content themselves with the necessarily imperfect aid which they can get in the post-graduate courses from overworked and half-paid professors. Ibid., 50-51.

\textsuperscript{29} Ibid., 50.
knowledge for its own sake.\textsuperscript{30} The trustees decided to build a school dedicated primarily to research and advanced study, beginning the first American university to offer graduate education.\textsuperscript{31}

‘What are we aiming at?’ Gilman asked, in his inaugural address, ‘The encouragement of research ... and the advancement of individual scholars, who by their excellence will advance the sciences they pursue and the society where they dwell.’\textsuperscript{32} Later he added, ‘Remote utility is quite as worthy to be thought of as immediate advantage. Those ventures are not always the most sagacious that expect a return on the morrow. It sometimes pays to send our argosies across the seas, to make investments with an eye to slow but sure returns. So is it always in the promotion of science.’\textsuperscript{33}

During the early decades of the University, some critics charged that its mission was too impractical for an increasingly industrial economy. Seven of the twelve trustees were businessmen of sufficient prominence to give time to public affairs. Specifically notable was John Garrett, President of the Baltimore and Ohio (B&O) Railroad, a close friend and business associate of the founder.\textsuperscript{34} Garrett wanted the university to take a more practical, commercial approach. In 1883, he publicly denounced the Board of Trustees,\textsuperscript{35} and subsequently rarely

\footnotesize{\textsuperscript{30} Louis Menand, \textit{The Metaphysical Club}. (New York: Farrar, Straus and Giroux, 2001), 256.}

\footnotesize{\textsuperscript{31} For context for the adoption and diffusion of the Hopkins model and the effect on American research universities, see Geiger, op. cit. 7-9.}

\footnotesize{\textsuperscript{32} Gilman, op. cit. 35.}

\footnotesize{\textsuperscript{33} Gilman, op. cit. 18.}

\footnotesize{\textsuperscript{34} A large portion of the university’s initial endowment was invested in the Railroad. To this day the President and the Chairman of the finance committee of the Railroad and its predecessors hold seats of the university board of Trustees.}

\footnotesize{\textsuperscript{35} Address of John W. Garrett, delivered on 30 of January, 1883, before the Young Men’s Christian Association of Baltimore, on the occasion of their thirtieth anniversary as noted in Hugh Hawkins, \textit{Pioneer: A History of the Johns Hopkins University, 1874-1889}. (Ithaca: Cornell University Press, 1960), 5.
appeared at the Board of Trustees’ meetings. Trustee Lewis N. Hopkins, nephew of the founder, corresponding with Garrett concurred, “Great discoveries always came from those who were devoting themselves to practical applications.”

In 1887, Robert Garrett, who had succeeded his father as President of the Baltimore and Ohio Railroad, and was also a member of the board of trustees, tried again unsuccessfully to remold the university. One of his assistants, W.T. Barnard prepared a monograph on higher education, entitled *Technical Education in Industrial Pursuit with Special Reference to Railroad Service*, in which he asked,

> Why should not the Johns Hopkins University sustain a department for higher technical training in industrial pursuits?… The present tendency of the Johns Hopkins University management savors too much of the classic and metaphysical scholasticism of the Middle Ages… The Johns Hopkins University should be considered as a part of the Baltimore school system, and its crowning glory. To maintain this position it should afford instruction in applied as well as in pure science.

In a similar spirit, the Garrett family offered the university an endowment to establish an adjunct scientific school like the Sheffield School at Yale, and the Lawrence School at Harvard. However, the administration turned it down. In 1887, one Colonel Thomas J. Scharf also attacked the university for its failure ‘to come down out of the scholastic clouds’ and advocated a more practical orientation. Whether Scharf was part of the attempt by Garrett to remold the

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36 Ibid., 305.

37 Ibid., 318.


university is not known, but in the end, these attempts to remold the university’s orientation were not successful.\textsuperscript{41}

This public debate prompted Gilman to entitle his Commemoration Day speech of 1885 ‘The Benefits Which Society Derives from Universities’, and to take up the disciplines taught at Hopkins one by one to prove their usefulness.\textsuperscript{42} In later years, Gilman would justify his orientation by invoking Faraday’s motto: ‘There is nothing so prolific in utilities as abstractions.’\textsuperscript{43} Gilman would recall that inventions such as the telegraph, the telephone, photography, the steam locomotive, and electric lighting had not been the creation of industrial research, of mercantile corporations or even of private enterprise, but of university researchers, whose motive was not ‘acquisition of wealth, but the ascertainment of fundamental laws.’\textsuperscript{44}

Gilman’s initial hiring decisions stressed scholarly potential. Louis Menand notes that by 1880, four years after it opened, Johns Hopkins had more than one hundred graduate students, compared with forty-one at Harvard. Hopkins staff had published almost as much research as had been published during the previous twenty years by all the staff members of all other American universities combined.\textsuperscript{45} Hugh Hawkins notes, ‘If one had asked among the teachers and students of the early Johns Hopkins University what ideal they served, he would most often have been answered, Truth, or ‘Truth for its own sake’.\textsuperscript{46} Truth was the theme presented as the ideology of the university.’ Beyond this, the early emphasis was on unfettered exploration, pragmatic understanding and academic freedom. The Johns Hopkins Press, which is currently the oldest continuously operated university press in America, was added in 1878 as a way to

\textsuperscript{41} Hawkins, op. cit. 318.

\textsuperscript{42} Gilman, op. cit. 94. Gilman wrote in the preface of the reproduction of this address: ‘When the following address was delivered, the comments which had been made upon the work of the University seemed to call for a new exposition of its principles and aims.’

\textsuperscript{43} Gilman, op. cit. 117.


\textsuperscript{45} Menand, op. cit. 257.

\textsuperscript{46} Hawkins, op. cit. 293-295.
disseminate university research. When Daniel Coit Gilman inaugurated the Press, he stated his conviction that publishing, along with teaching and research, is a primary obligation of a great university.

Assessing institutional culture is not a simple task, and academics never form a unified group. Rosenberg discusses the tension between pure and applied science during this period. At Johns Hopkins, emphasis was on basic scientific inquiry. Many of the staff voiced hostility to direct practical applications of academic work. For instance, the first professor, Basil L. Gildersleeve, a classicist, openly declared in his Commemoration Day address of 1877 ‘that the word useful should be banished from the university vocabulary.’ A number of his colleagues in science expressed similar sentiments. Ira Remsen, the university’s first professor in chemistry, and its second president (from 1901 until 1913), Remsen disparaged what he described as practicalism and refused offers to consult for private industry as long as he occupied his university position. Furthermore, when a student suggested that private industries might help the university by paying for laboratories, and cited German examples, Remsen responded that he ‘could think of no worse fate for the university than such an invasion.’ By contrast, another academic chemist, John W. Mallet, was hired at the University of Virginia with the explicit purpose of expanding practical knowledge, and devoted most of his time and effort to industrial and agricultural subjects.

47 Rosenberg, op. cit. 185-195.

48 Hawkins, op. cit. 304.

49 Hawkins, op. cit. 140.

50 Letter from Judge Morris A. Soper, 13 March 1953 as cited by Hawkins, op. cit. 140. The student was Alfred R.L. Dohme, who later became President of Sharpe and Dohme, a prominent Baltimore pharmaceutical company that subsequently merged with Merck.

51 Hugh Miller Spencer, The Life of John William Mallet, B.A., Ph.D., L.L.D., Hon. M.D. F.R.S.; and the four distinguished sons of Patrick Kerr (1776-1828) and Hannah Blythe (ca. 1775-1820) Rogers. (Charlottesville: Alumni Association of the University of Virginia, 1985). For example, Mallet surveyed the ‘Most Important
The Saccharin Story

That said, the university did not completely avoid commercial connections. Among the first instances of commercialised knowledge was the discovery of saccharin by Constantin Fahlberg, a European postdoctoral fellow who worked with Remsen. The discovery of saccharin is a story of unintended consequences. In 1879, Fahlberg was assisting Remsen in experiments on the oxidation of toluene, a class of coal tar derivatives. During lunch in the laboratory, Fahlberg noticed an unaccountable sweetness in his food, which he proceeded to trace back to a compound that had spattered on his fingers. The researchers jointly published their discovery in two articles in the American Chemical Journal in 1879 and 1880, and in a German journal in 1879. Remsen moved on to other projects, but Fahlberg perceived the commercial potential of low-cost sweetening agents, and moved back to Germany, where he obtained financial backing and eventually perfected a large-scale manufacturing process. Fahlberg marketed his product under the label Saccharin from the Latin for sugar, saccharum. He was granted American and European patents for the Manufacture of Saccharine Compounds and Saccharine Compounds in 1884 and 1885. Remsen was not included as co-inventor, although the patents referenced the jointly authored American article.

Changes in the Industrial Applications of Chemistry within the Last Few Years’ in the first three issues of the American Chemical Journal.

The university's culture probably had no impact on the unpaid Fahlberg, for he had already filed other patents before his serendipitous discovery. Fahlberg became wealthy from the new sweetener, but Remsen and the university never received, nor claimed, a royalty from the commercial venture. Remsen was distressed when Fahlberg claimed full credit for the invention; and insisted that the university’s role be recognised. But Remsen never challenged Fahlberg’s patents, despite an offer from Merck & Company to pursue compensation when the university met financial difficulties during Remsen’s tenure as president. One student recalled: ‘I urged Remsen to accept Merck and Company’s offer to undertake the contest, but he refused, saying that he would not sully his hands with industry.’ What Remsen sought was recognition – not remuneration.

Remsen’s commercial disinterest is consistent with David Hounshell’s description of the contemporary movement in American science that pursued pure, science pursued for its own sake rather than for profit. Proponents of pure research viewed applied science and science -

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53 Fahlberg’s original United States letter patents were for ‘Improvement in processes for utilizing zinc sulphate’ (1878), ‘Method of removing iron from ferroginous saline solutions’ (1882) and ‘Recovery of plumbic dioxide from ferroginous solutions’ (1882). Fahlberg obtained his first German patent in 1886 as noted by Tomas Szmercsanyi, ‘Review of Christopher Maria Merki, Zucker gegen Saccharine: zur Geschichte der Kuslichen Sussstoffe’, World Sugar History Newsletter 24, June (1997), http://www.chass.utoronto.ca/epc/wshn/number24.html).

54 The Ferdinand Hamburg Archives of the Johns Hopkins University, Records of the Office of the President, 02.001 box 116#274, Ira Remsen to Doctor Goodnow, dated 26 February 1918.

55 Field:, op.cit. 1, notes : ‘This has often been attributed to the fact that Fahlberg eventually claimed that the discovery was his alone, leading to Remsen’s comment in a letter to English chemist William Ramsey: ‘Fahlberg is a scoundrel. It nauseates me to hear my name mentioned in the same breath with him.’”

for-profit as a less prestigious activity.\textsuperscript{57} As it was told, the story of Saccharin helped reinforce Johns Hopkins institutional disdain for direct interaction with industry. The Saccharin story became standard fare in introductory chemistry classes, and a method of socializing students into the expectations of an academic career. The sentiment was echoed as recently as 1990 by Professor Robert Massof, who characterized the attitude of his Medical School colleagues as regarding ‘money from business is tainted, [and] dealing with business as a form of prostitution.’\textsuperscript{58}

Of course, the other side of the relationship is the perception held by industry and commerce. Garrett created the impression among the Baltimore community that the university was not practically oriented. A former student of Remsen’s reflects that

Remsen’s attitude toward American chemical industry in that day was unfortunate. The intimate association which existed between the German universities and German industry and the mutual advantages that grew out of the association was a theme not infrequently touched upon in his lectures. Yet there was little attempt made by him to direct any of his students into industry: all his encouragement appeared to steer them into teaching. I suspect he may have had some unfortunate experiences with industrialists. He used to speak ironically of those who were boastful about operations ‘on the large scale’ and I have heard him speak of being refused an entry into some of the Baltimore works. I daresay there may have been as much prejudice on the other side toward the school, but if he had been a more tactful man, prejudices might have been swept away and new opportunities for students might have been opened as well as new avenues of influence for a man so really practical as himself.\textsuperscript{59}

Remsen’s underlying premise appears similar to that which Vannevar Bush later codified as the linear model of innovation, by which university research focuses on the fundamental understanding of nature through unfettered inquiry, producing discoveries which are disseminated by publication and education, and which are subsequently developed and marketed

\textsuperscript{57} Rosenberg, op. cit. 186-187.

\textsuperscript{58} Quoted by Levine, op. cit. 26.

by industry.60 In this model, now largely discredited, knowledge flows in one direction, from the university to industry.61 To the extent to which the university adhered to the model, it severely limited its fortunes. Two cases well illustrate the point.

**The Failure of Early Commercialization**

Far from securing financial benefits, Hopkins’ early forays into commerce demonstrated the difficulties of bringing about a successful technology transfer. In consequence, the university’s academic culture was merely reinforced. The first Hopkins spin-off company, the Rowland Telegraphic Company (RTC), was formed in 1898. Despite the academic culture, special circumstances permitted the university to make an exception to its general rule, and to support commercial activity. Henry A. Rowland, among the first staff hired by Gilman, had a distinguished academic career in physics.62 He founded the Hopkins’ physics department and organized the Physical Laboratory which was regarded as the most complete and extensive facility of its kind in the world. He also created an innovative curriculum in applied electricity and applied mechanics.63 The Department of Physics and Astronomy still bears his name.

Rowland’s views were consistent with Hopkins’ culture. In a speech entitled *A Plea for Pure Science*, delivered as Vice President of the American Association for the Advancement of Science in 1883, he echoed Gilman’s view of the university:


The proper course of one in my position is to consider what must be done to create a science of physics in this country, rather than to call telegraphs, electric lights, and such conveniences, by the name of science…. When the average tone of the [Nation’s scientific] society is low, when the highest honors are given to the mediocre, when third-class men are held up as examples, and when trifling inventions are magnified into scientific discoveries, then the influence of such societies is prejudicial.64

However, as Robert Rosenberg has shown, Rowland was no ‘scientific aristocrat’, and did not think it a disgrace to make money by an invention, or to do commercial work. 65 A change in Rowland’s life circumstances refocused his views. A routine medical examination for an insurance policy revealed that he had diabetes -- at the time, an incurable illness with a limited life expectancy. He wrote in his diary: ‘The certainty of my death in a few years entirely changed my life and I work for money for wife and (3) children as I never expected to’.66 His research turned towards telegraphy and hydroelectric power, which led to consulting with Baltimore business firms. President Gilman, and subsequently President Remsen, supported Rowland’s commercial emphasis personally and materially. The Physical Laboratory was placed at his disposal, and he was given great latitude in the disposition of his time.67

As the president of the Rowland Telegraphic Company (RTC) put it in his annual report for 1907:

The work thus went forward with the combined advantage of laboratory and field experience. It grew upon our hands into an undertaking far greater than we had foreseen. We soon found that it was not enough to demonstrate the working principles of Professor Rowland’s invention, and that only a fully commercial

64 Henry Augustus Rowland, The Physical Papers of Henry Augustus Rowland, Johns Hopkins University, 1876-1901, (Baltimore: Johns Hopkins Press, 1902).


machine would (or could) prove the availability of the invention in commercial use.\textsuperscript{68}

It was necessary to perfect each part of the machine, to standardize all the components, to make special tools and to integrate the machine in existing systems, which meant dealing with the diversity of the telegraph system. As the company president reported: ‘This elaborate work was wholly unexpected. It led to repeated remodeling, but progressive successes always justified the continuance of our work’. Because of these difficulties, after Rowland’s death, the RTC went out of business in 1910, and had little discernable impact on Hopkins’ culture or Baltimore’s economy.

University support for the RTC was seemingly an exception dictated by special circumstances. We may speculate that if this endeavour had proven successful, it might have encouraged others at Hopkins to reconsider their stance on commercial activity. Remsen’s disdain towards the commercial success of Saccharin coupled with the difficulties of commercializing Rowland’s inventions, and the lack of success of the RTC, left their traces on Hopkins. Nevertheless, there was to be another development – the School of Engineering –, which would offer the prospect of a compromise between culture and commerce. The history of the school highlights the continuing tension between pure and applied science, the consequences of close interaction with industry, and the penalties imposed when applied disciplines are forced to abandon applied considerations.

**The Compromise: Engineering Science**

Among academic disciplines, engineering typically has the most extensive interactions with industry. By and large, however, practical engineering education was deemed to lie outside the founding mission of the university and its prevailing academic culture. According to Yoe: ‘A few faculty members felt strongly that formal instruction in an essentially pragmatic field was inconsistent with the University’s role and ideals.’\textsuperscript{69}

In his Inaugural Address in 1876, Gilman stated,


\textsuperscript{69} Mary Ruth Yoe, *Hopkins: Engineering at the University* (Baltimore: The Johns Hopkins University, 1989), 5.
There is a department of engineering, which may also receive special attention here. ...But in forming all these plans we must beware lest we are led away from our foundations; least we make our schools technical instead of liberal; and impart a knowledge of methods than that of principles. If we make that mistake, we may have an excellent Polytechnicum but not a university.\textsuperscript{70}

In 1912, the Maryland state legislature provided $600,000 to launch an engineering program at Johns Hopkins. Because Maryland did not have a prominent engineering school, as many as 300 young men annually left for northern institutes of technology, while others, who could not afford to study away from home, were denied an engineering education.\textsuperscript{71} The Maryland Technical School Bill created 129 scholarships at Hopkins in applied science or advanced technology for state residents. Finance for a new building and laboratory was included. The offer was welcomed at the time when Hopkins faced financial problems owing to reverses in the value of its endowment.\textsuperscript{72}

The university retained full control of the programme. ‘So far as the State was concerned... the work of the school was to be primarily undergraduate with advanced work for adequately prepared college graduates.’\textsuperscript{73} From the outset, however, some insisted that money be used for advanced study and research. To define the curriculum, John Whitehead, professor of applied electricity and a student of Henry Rowland, traveled to fourteen east coast engineering schools and sought practical advice from industry. He concluded that Hopkins needed was a programme rooted in fundamental scientific principles.

Engineering opened as a department in 1912. In addition to Whitehead, the other founding professors were Charles J. Tilden (civil engineering) and Carl C. Thomas (mechanical engineering). Their expectation was that Hopkins would create new standards for engineering

\textsuperscript{70} Ibid., 39.

\textsuperscript{71} Daniel Coit Gilman, Inaugural Address, 22 February 1876, http://milton-real.mse.jhu.edu/text.html.

\textsuperscript{72} French, op. cit. 166.

\textsuperscript{73} French, op. cit. 168.
education, similar to those set in medicine by the Hopkins Medical School.\textsuperscript{74} J. Trueman Thompson was a member of the first four-year class of engineers. He describes himself and his classmates as, ‘guinea pigs in an experiment in engineering education… The teachers in the Faculty of Philosophy looked at us with suspicions and doubt but decided that if we were determined to be plumbers and other varieties of mechanics, we would at least be better educated than the artisans whom they had thus far encountered.’\textsuperscript{75} The term ‘plumbers’, certainly meant to be pejorative, can be traced back to the debates surrounding the establishment of an engineering programme.\textsuperscript{76}

When the US went to war in 1917, Hopkins’ engineering was involved in military work, but after the war, turned to commercial activity. William B. Kouwenhoven, an assistant professor, was also captain in the first Reserve Officers Training Corps (ROTC) unit in the country. His war work focused on methods of quality control in rifle stock manufacturing. After the war, Kouwenhoven became interested in the accidental deaths of utility lineman by electric shock, and began to study the effects of electricity on the body. Ultimately, his work led to the innovation of cardio-pulmonary resuscitation (CPR) in 1960.

Engineering became a school in 1919, with local political and strong corporate support.\textsuperscript{77} The early emphasis on basic scientific courses was progressively abandoned in favor of the practical approach that was common in other technical colleges.\textsuperscript{78} Following this cultural shift, night courses for technical workers were begun, and the school regularly ran short courses at the request of local industries. The School of Engineering also entered into cooperative agreements

\textsuperscript{74} French, op. cit. 169.

\textsuperscript{75} Milton S. Eisenhower Library, special collections, MS 114. J. Trueman Thompson papers, Homewood, 1913-1963: An Autobiographical Sketch.

\textsuperscript{76} John Boswell Whitehead, one of the first faculty in engineering and the first Dean of the School of Engineering, is noted to have remarked, ‘They thought I meant plumbers’ when explaining why some members of the Hopkins faculty opposed the establishment of engineering at the university. Yoe, op. cit. 19.


\textsuperscript{78} Yoe, op. cit. 33-37.
with firms to give students hands-on experience. Many staff consulted with industry and
government on issues ranging from electrical insulation to highway construction and steam
turbines design. John Whitehead, when Dean of the School of Engineering, stated that a
technical school within a university had to be ‘in proper adjustment with, and feeding the needs
of, the surrounding community, but at the same time setting its standards high and providing
opportunity in the field of the applications of science for the most advanced types of study and
education’. Because of this practical orientation, Hopkins engineering graduates were highly
sought after. In 1937, in the depth of the Depression, the Baltimore Sun reported that thirty-five
corporations made campus visits, and every graduate in mechanical engineering had been offered
at least three jobs. Engineering exemplified the University’s rapport with commerce.

However, not all members of the Hopkins community viewed these accomplishments
with unbridled enthusiasm. A 1944 report commissioned by President Bowman recommended
that specialized methods courses be dropped in favour of an increased emphasis on basic science
and engineering principles, and required coursework in social studies, the humanities, and oral
and written expression. The course on Heat Engines was replaced by a course on
Thermodynamics, while Circuit Analysis, to reflect a more scientific orientation, replaced
Electrical Machinery. Graduates were awarded Bachelor of Engineering Science degrees as
coursework became less applied. In 1946, A similar story unfolded with the opening of a new
aeronautics department, when the newly appointed department head, Francis Clauser, made sure


80 Details of the Engineering School’s interactions with industry may be found under the list of ‘professional
services’ in the various Annual Report of the President of the Johns Hopkins University. This can be further
illustrated by the growing financial support that commercial interests gave to the School. Following the First World
War, foundations and associations interested in the applications of scientific discoveries in electricity gave $120,000
for research in Electrical Engineering. In 1924 the member companies of the Southern Gas Association offered
$8,000 a year for five years for both graduate and undergraduate work in their field. The training and research
conducted by the new gas department was so successful that additional grants came from the gas companies of four
large cities and from the American Gas Association. In later years, this work was merged with chemistry to
constitute a department of gas and chemical engineering (French, op. cit. 175).

81 French, op. cit. 24.

82 Yoe, op. cit. 41.
he upheld Hopkins’ research tradition in his inaugural address: ‘I am not here to establish a trade school, but to set up a training course for the type of men who have always pushed back the frontiers of flight knowledge.’ Despite the prominence of the discipline, it had taken seventeen years to create the new department.

After the Second World War, the school pioneered a national trend with a turn towards what would now be called ‘engineering science’. The graduate programme was reoriented

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83 Quoted by Yoe, op. cit. 39.

84 For a description of this phenomena, see Eugene S. Ferguson,., Engineering and the Mind’s Eye  (Cambridge: The MIT Press, 1992). He summarizes his view in the following way: ‘The final report [of the Committee of the American Society for Engineering Education published in the early 1950's]] contained two significant recommendations that were promptly followed by those schools that had received or hoped to receive large research grants. First, ‘those courses having a high vocational and skill content’ should be eliminated, as should ‘those primarily attempting to convey engineering art and practice.’ Thus, shop courses - intended to give students a visual and tactile appreciation of materials and basic processes, such as the welding, casting, and machining of metals - were rapidly dispensed with. Engineering drawing lingered a bit, primarily because many drawing instructors held academic rank and were difficult to fire, but the diminished status of courses in drawing and descriptive geometry was clear to all concerned. The ‘art and practice’ courses - which described the individual components of engineering systems such as steam power plants, electrical networks, and chemical process plants and explained how the components were coordinated in practice, thus providing training in the wy engineering had been and was being done - survived only until the Committee’s second recommendation could be put in place. That second recommendation called for courses in ‘six engineering sciences - mechanics of solids, fluid mechanics, thermodynamics, transfer and rate mechanisms (heat, mass, momentum), electrical theory, and nature and properties of materials.’ By no means were all engineering curricula changed immediately, but the gospel of change was unambiguous for the research-oriented engineering schools and for the schools that aspired to join the prosperous group, Ferguson, op. cit. 160-161.
towards training university professors and researchers. As a result, there were more staff with training in the sciences than in engineering.

In 1961, the School of Engineering changed its name to the School of Engineering Sciences. But the engineering programme had become redundant: its courses were increasingly similar to those offered in the science departments of the university. In 1966, The School of Engineering was merged with the School of Philosophy to create the School of Arts and Sciences. Following the merger, the word ‘engineering’ almost disappeared from the campus.85

In 1975, the university convened a blue-ribbon committee, chaired by L. R. Hafstad, a retired vice president and research director for General Motors, to review the role of the engineering sciences. Their report, issued in the autumn of 1976, came to the following conclusion:

In the industrial world, Hopkins is considered to have lost all interest in practical engineering activities. Individual professors may be known and even acclaimed, but there is no ‘School of Engineering’ to attract students interested in working in industry. There is little incentive for industry to support an institution not sensitive to its needs for broadly trained leaders capable of managing major engineering projects.86

As a result of momentum created by the report and by alumni, the School of Engineering was recreated in 1979. It can be argued, however, that engineering still struggled with culture. In 1990, Jared Cohon, the vice-provost for research, argued that most staff at the engineering school focused on relatively abstract questions and received most of their funding from a handful of Federal agencies, such as the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the various branches of the Department of Defense (DoD).87 To date, there is little industry funding of sponsored research, and there appears to be relatively little consulting for private industry by Hopkins’ engineering staff. In the late 1990’s while Hopkins ranks among the highest American universities in terms of total research expenditure, its percentage of industry-sponsored research as a proportion of total research expenditures ranked second to lowest among the top twenty universities. This was in stark

85 Yoe, op. cit. 52.

86 As reported in Schmidt, op. cit. 132.

87 Levine, op. cit. 26.
contrast to the engineering programs of rival institutions such as MIT, Penn State, and the University of Washington.  

**Conclusion**

With the passage of the Bayh-Dole Act in 1980, many American universities took a more active position towards technology transfer. Johns Hopkins was no exception. In recent years, there have been fresh incentives for direct technology transfer, encouraging staff to patent research and license ideas to industry. Nevertheless, changing an organizational culture is a slow process. As one university officer has put it: ‘Changing a university’s culture takes time, like turning a tanker takes time, there’s a lot of inertia to overcome.’

88 In Fiscal Year 1994, the percentage of industry sponsored research at MIT was 15.25%, at Penn State 14.99% and 9.65% at the University of Washington. In contrast, at Hopkins, industry provided 1.33% of university research funding. H. Norman Abramson, José Encarnaçao, Proctor P. Reid and Ulrich Schmoch (eds). *Technology Transfer Systems in the United States and Germany. Lessons and Perspectives*. (Washington, D.C: National Academy Press, 1997).

89 Hopkins did not have a dedicated technology transfer office until 1986, making it a late entrant into this activity as defined by David Mowery and Arvid Ziedonis, ‘The Effects of the Bayh-Dole Act on U.S. University Research and Technology Transfer: Analyzing Data from Entrants and Incumbents.’ Paper presented at the Science and Technology Group, NBER Summer Institute (Cambridge, MA: National Bureau of Economic Research, 1999). The Association of University Technology Managers (AUTM) reports that Hopkins formed an office of Technology Transfer in 1973 under the criteria that one-half full time equivalent (FTE) was working in technology transfer. We use 1986 as more realistic date due to policy changes that provided more aggressive incentives to encourage faculty to disclose inventions and provided for a commitment of resources to support the activity.

attribute that, while difficult to quantify, is real and persistent. Johns Hopkins University’s founding mission, together with a drive to be a preeminent research university and the hiring decisions that resulted, shaped its academic culture. *Truth for its own Sake* defined a role and mission radically different from the prevailing liberal arts, technical school, and land-grant traditions. By the use of stories and the interpretation of historical episodes, the mission acquired a powerful mystique. The story of Ira Remsen and the discovery and commercialization of Saccharin helped socialize an academic culture that disdained direct interaction with industry. Where such meetings did take place, and benefited from institutional support, as in the case of the Rowland Telegraphic Company, it was only because of individual initiatives and in special circumstances. When such engagements proved unsuccessful, their failure only reinforced the belief that commerce was not an activity in which the university should engage.

The first incarnation of the Engineering School at Hopkins is a tale of uneasy compromise that tested the university’s cultural orientation. The less than thirty-year flirtation with a more applied orientation was always seen as a distraction from the university’s mission. Yet, the Hopkins experience raises a larger question. Richard Nelson argues that the aggressive exercise of intellectual property rights by universities propagated by Bayh-Dole is inconsistent with the norms of open science, and raises questions about long-run effects on the system of innovation.91 The example of Johns Hopkins indicates that there are alternative models of university-industry interaction. Perhaps one of the strengths of the American system of innovation is the diversity of its institutions of higher education. We may well wonder if the current emphasis will, in its zeal for managerial application of new knowledge, destroy that strength and diversity.

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