A HISTORY OF CARBOHYDRATE RESEARCH AT THE USDA LABORATORY IN PEORIA, ILLINOIS*

Gregory L. Côté and Victoria L. Finkenstadt, U.S. Department of Agriculture

Origins

The history of the United States Department of Agriculture (USDA) can be traced back to the Agricultural Division of the US Patent Office (1), so it is perhaps not unexpected that the USDA is still active in the development and patenting of many useful inventions related to agriculture. The Utilization Laboratories of the USDA have been especially involved in this type of activity. This article focuses on the National Center for Agricultural Utilization Research (NCAUR), located in Peoria, Illinois, and its important historical contributions in the field of carbohydrate research.

During the years of the Great Depression, the American farm economy was in dire straits. Prices were low, and farmers were going bankrupt at unprecedented rates. There was a great public outcry for the federal government to do something about the situation, but price supports and other similar programs were not seen as a long-term solution. One obvious solution was to create new markets for farm goods, but this required a long-term investment in research and development. However, there was little infrastructure in place to carry out this type of work. Attention began to turn to those who had been active in this type of research, as exemplified by George Washington Carver, among others. These researchers were at the forefront of a movement that became known as "chemurgy," which focused on the conversion of natural commodities to new and useful materials (2). This techno-political movement resulted in the formation of the National Farm Chemurgic Council (NFCC) in the mid-1930s. Led by such well-known figures as Henry Ford, a proponent of products like corn-derived ethanol fuels and soybean-based plastics, the movement eventually resulted in action by the federal government. Section 202 of the Agricultural Adjustment Act of 1938 states in part:

> The secretary (of Agriculture) is hereby authorized and directed to establish, equip, and maintain four regional research laboratories, one in each major farm producing area, and at such laboratories conduct researches into and to develop new scientific, chemical and technical uses and new and extended markets and outlets for farm commodities and products and byproducts thereof. Such research and development shall be devoted primarily to those farm commodities in which there are regular or seasonal surpluses, and their products and byproducts.

The Regional Research Laboratories, built at the initial cost of approximately one million dollars each, were established in Wyndmoor, PA (Eastern); Peoria, IL (Northern, now NCAUR); New Orleans, LA (Southern); and Albany, CA (Western). A fifth facility was established during the 1960s in Athens, GA (Southeastern). Each of the original four was initially assigned the task of creating new products from crops grown in their respective region, but it eventually proved difficult to delineate scientific research on such a basis. All four of the original laboratories have distinguished themselves by a proud history of research and development, and their accomplishments have been summarized in a number of publications (3). The four original Regional Research Laboratories have been designated National or International Chemical Historic Landmarks (4). In 1953 the USDA formally created the Agricultural Research Service (ARS) to be its chief in-house science agency. In the 54 years since then, ARS has been a significant contributor to agricultural progress and earned a global reputation as a scientific organization whose research has benefited the farmer, the consumer, and the environment.

A contemporary postcard view of the Northern Regional Research Laboratory as it appeared in the 1940s.

Early Research: The 1940s and '50s

The Northern Regional Research Laboratory (NRRL) was assigned the job of finding new uses for corn, wheat, and agricultural waste materials. Soybeans were not included because soy was not considered a major cash crop at that time. NRRL research in oil chemistry would play a role in changing that. Fittingly, an ear of corn encased in a block of the then-new acrylic resin was included in the items placed in the cornerstone of the building, for corn was and is still a cornerstone of the Midwest economy and NRRL research efforts. From the day its doors opened in December of 1940, it was clear that a major portion of the research carried out at NRRL would focus on carbohydrates, since a major constituent of the locally grown wheat and corn is the complex carbohydrate known as starch. Cornstarch was already being converted to corn syrup, used as a sweetener and fermentation medium for alcohol production. In order to investigate ways to improve and better understand the process, a Starch and Dextrose Division was set up at NRRL. A Fermentation Division was also established, for similar reasons. The Fermentation Division would soon become famous for its wartime role in the development of penicillin (5), and the milk sugar lactose played a part in that story (6). It would be the first of many carbohydrate-related contributions by NRRL scientists.

When research first began at NRRL, one of the goals was to improve the conversion of starch to glucose so that it could be converted to fuel alcohol (ethanol) more cheaply and efficiently. At that time, ethanol for fuels and industrial solvents was more efficiently produced from sugar molasses than from grain. However, German U-boat attacks on shipping in the Caribbean seriously threatened the source of molasses. As Peoria was historically a hub for the grain alcohol distilling industry, it is not surprising that researchers would find it a fruitful place to work on alternatives for alcohol production. In the early 1940s, a group of NRRL scientists, no doubt in close contact with their colleagues at the local distilleries, began a search for yeasts or molds that produced higher levels of amylases, the enzymes that break starch down into the simple sugar glucose (dextrose). The Fermentation Division and Engineering Division eventually came up with new strains of mold (*Aspergillus niger* NRRL strains 330 and 337) that produced high levels of amylases in submerged cultures, thus enabling the conversion of cornstarch to glucose much more cheaply on a large industrial scale (7). As a result, the corn processing industry could meet increased demand for corn sugar without costly expansion of facilities. For this accomplishment, the Fungal Amylase team received the USDA Superior Service Unit Award in 1956. The process is still important in the commercial production of fuel ethanol from starch. One remaining drawback

Members of the fungal amylase team at the time of their Superior Service Award in 1956.

was the presence of significant glucosyltransferase activity, resulting in unacceptable levels of unfermentable isomaltose. The problem was solved by Dr. Karl Smiley of the Fermentation Laboratory with the discovery in 1963 of a strain of *Aspergillus awamori* that produced high levels of glucoamylase with little or no transferase activity. The enzyme research also resulted in a technique eventually developed in Japan and later adopted and modified by industry for production of high-fructose corn syrups. This syrup now sweetens hundreds of products, including many fruit drinks and practically every soft drink. The fungal alpha-amylase/glucoamylase process is still important in the commercial production of fuel ethanol from starch.

Drs. Allene Jeanes and Carl Wilham, discussing dextran research, in 1955.

An early leader of the Starch and Dextrose Division was Dr. Roy L. Whistler. Most carbohydrate scientists are familiar with the name, as Professor Whistler is famous to the point of having established the Whistler Center for Carbohydrate Research at Purdue University and the Whistler International Award for Carbohydrate Chemistry administered by the International Carbohydrate Organization, which he helped charter in 1980. The Whistler Hall of Agriculture at Purdue University is named in his honor. While Whistler is usually associated with Purdue, where he spent most of his scientific career on the faculty, it is less well known that one of his first jobs was to assemble and lead a team of carbohydrate scientists in Peoria when the NRRL first opened (8). Near the end of 1940 Whistler accepted a position there as leader of the Starch Structure Group, where he worked until 1946. It was only after his nearly six years at NRRL that he moved to West Lafayette, Indiana to take up a post at Purdue University.

The role Dr. Whistler played in establishing NRRL as a center for excellence in carbohydrate research illustrates an important point. It is impossible to separate contributions in the history of science from the individuals responsible for them. Although most of the major accomplishments at NRRL have been team efforts, those teams often were led, inspired, and sometimes driven by a strong key individual. This is particularly true in the case of Dr. Allene R. Jeanes. From her early days at NRRL working with Whistler until long after her retirement in 1976, Jeanes played a prominent role in making NRRL a world-class center for applied carbohydrate science.

Born in 1906 in Waco, Texas, Allene Rosalind Jeanes earned an A.B. degree in chemistry from Baylor University, graduating *summa cum laude* in 1928 (9). She then went on to study organic chemistry at the University of California at Berkeley, earning her master's degree just one year later. For the next five years she taught science at Athens College in Alabama. Traveling to the Midwest, she eventually continued her graduate work at the University of Illinois under the tutelage of the highly respected organic chemist Roger Adams. In 1938 she received her Ph.D. but subsequently encountered difficulty obtaining a suitable position with a pharmaceutical firm in her chosen field of medicinal organic chemistry. During the Depression era, employers were reluctant to hire women, especially when so many men were out of work, but she eventually found employment in the laboratory of the famous carbohydrate chemist Claude S. Hudson. Working with Hudson at the National Institutes of Health in Washington, DC, Jeanes was funded by one of the first Corn Industries Research Foundation fellowships. She later worked with Horace S. Isbell at the National Bureau of Standards, also in Washington, further establishing her credentials as a carbohydrate chemist. It is likely that she met Whistler at that time.

When the NRRL began recruiting staff, Jeanes accepted a job back in Illinois with Dr. Whistler. It is noteworthy that in an era of open discrimination against women in the workplace, these prominent carbohydrate scientists, all in the employ of the U.S. government, saw fit to mentor a female scientist and provide her the opportunity for what would become a very productive career. (As a side note, it is also of interest to note that Hudson, Wolfrom, Isbell, and Whistler all have prestigious awards in the field of carbohydrate chemistry named after them).

While studying the acid-catalyzed hydrolysis of starch to glucose, Jeanes noted, as had many of her predecessors, that a small but significant proportion of the starch was not converted to glucose, but instead gave rise to a two-glucose unit (disaccharide) "reversion" product known as isomaltose. Because isomaltose is slightly bitter, it is undesirable in corn-based sweeteners. It is also more difficult to ferment to alcohol. The problem of isomaltose formation intrigued Jeanes, but to study it, she needed a good source of isomaltose to use as a standard. It was known at that time that dextran, a bacterial slime, contained glucose chemically linked in the same manner as isomaltose (via α 1-6 linkages). To obtain large amounts of isomaltose, Jeanes began to produce dextran in her laboratory from *Leuconostoc mesenteroides* NRRL B-512, subsequently hydrolyzing it to isomaltose. This strain was originally isolated by Dr. Robert G. Benedict of the Fermentation Laboratory from a locally-produced bottle of "ropy" root beer.

Later, Jeanes and her coworkers discovered a convenient source of an enzyme to break down dextran. This came from the *Penicillium* molds whose spores were probably by then floating about the building. This process led to a convenient source of isomaltose for her group's studies on starch hydrolysis, but more importantly, it introduced Jeanes and her co-workers to the world of dextrans and microbial polysaccharides.

In the mid to late 1940s, Swedish researchers had reported that dextran showed promise as a viscosity-enhancing agent for use in blood plasma substitutes. There were still problems to overcome, however, including the occasional anaphylactic shock reaction, inconsistencies in preparations, and difficulties in obtaining the desirable properties, to name a few. Jeanes was well aware of this work, and when the U.S. entered the Korean War in 1950, she proposed a high-priority project to develop a suitable source of dextran for use as a blood plasma extender. After an extensive survey of dextran-producing bacteria, involving the efforts of nearly 80 scientists and technicians, Jeanes and her colleagues developed the strain and techniques still used today for the commercial production of dextran (9). As it turned out, the best strain was an isolate from the NRRL B-512 culture originally found by Benedict. This work resulted in the saving of countless lives, not only on the battlefields of Korea, but to this day in emergency rooms around the world. For their accomplishments, the Dextran Team received a USDA Distinguished Service Award in 1956, and Dr. Jeanes was awarded the Francis P. Garvan-John M. Olin Medal from the American Chemical Society that same year. [Coincidentally, the Garvan Medal was established in 1936 to recognize distinguished service to chemistry by women chemists by Francis P. Garvan, who was the chief benefactor of the NFCC, eventually leading to the formation of the USDA Regional Research Laboratories (2)].

Building on Success: The 1960s and '70s

Inspired by her own studies on dextran, Jeanes used what she had learned to attack another problem. One part of the NRRL mission is to develop domestically produced replacements for imported commodities. For many years, a small but valuable import from relatively unstable parts of Asia, Africa, and the Middle East had been what are known as plant gums. These complex carbohydrates are used as binders and thickeners in foods and in some industrial applications. Jeanes saw that dextrans and other microbial slimes, or gums, possessed similar properties to these imported plant gums. She reasoned that it would be possible to find a microbial gum with suitable properties that could be used in the same applications as imported plant gums. Again, after extensive surveys and extensive research in the laboratories and pilot plant, her team came up with a winner. Most of the microbiological work and fermentation studies were carried out by Dr. Martin Cadmus of the Fermentation Laboratories. The bacterium *Xanthomonas campestris* was found to generate copious amounts of a gum from glucose that was superior to such imported materials as gum tragacanth. First reported in the early 1960s, xanthan was eventually developed as a commercial product by Kelco Corporation and is now produced by numerous companies around the world. It can be found in many prepared foods as a thickener, stabilizer, and binding agent; it also finds a number of non-food industrial uses such as extending the life of oil and gas wells (10). This work was recognized by the USDA in 1968, when the Biopolymer Research

Drs. Clarence Knutson and Paul Sandford working on xanthan and other microbial polysaccharides in 1971.

Team was given a USDA Superior Service Award. In 1976 the Institute of Food Technologists presented the NRRL and Kelco Co. with the Food Technology Industrial Achievement Award for "Xanthan gum, a microbial polysaccharide with thickening, suspending, emulsifying, and stabilizing properties."

Byproducts of the work on microbial polysaccharides include the first descriptions of the unusual disaccharides leucrose (11) and isomaltulose (12), and development of a novel phosphomannan from the yeast *Hansenula holstii* (13). Isomaltulose, known commercially as palatinose, is currently being marketed as a low-glycemic sweetener (14). Phosphomannan has been used in biomedical research as an affinity ligand for mannose-6-phosphate receptors and for studying insulin-like growth factor II. The easily obtained diester cleavage product, pentamannose monophosphate, is being used as a source of the investigational anticancer drug PI-88 (15).

Jeanes retired from the USDA in 1976, but continued her work as a mentor, collaborator, and source of much knowledge for at least another decade, for despite her physical frailties in later years, her mind remained sharp. She passed away in Champaign-Urbana, Illinois in December, 1995. Jeanes was inducted into the ARS Hall of Fame in 1999.

It may be that the US government was one of the few places women and minorities could readily find gainful and productive employment as scientists at that time, because John Hodge, an African-American chemist, born in 1914 in Kansas City, Kansas, also began his career at NRRL. His father had obtained a master's degree in physics and taught at a prestigious, although segregated, high school in Kansas City. It was his father's influence as an educator with high standards that instilled the ideals of education, hard work, and excellence in young John Hodge. After graduating from the high school where his father taught, Hodge attended the University of Kansas at Lawrence, receiving a bachelor's degree in mathematics in 1936 and distinguishing himself as a Phi Beta Kappa scholar. He taught mathematics and chemistry while continuing his graduate studies and earned an M.S. in organic chemistry at Kansas in 1940. As was the case with Jeanes, he found a job at the newly opened NRRL in 1941, where he was first involved with studies on the conversion of starch to glucose. His work took a somewhat different direction, though, as he became interested in the so-called "browning reactions." When glucose comes in contact with amino compounds, including proteins, under certain conditions, the two combine to form brown-colored products. The reactions, known collectively as the Maillard reaction(s), were poorly understood at that time. Maillard products can be desirable, as in the case of nicely browned bread or dinner rolls, or they can be undesirable, as in the case of off-color corn syrup. The products also impart distinct odor and taste to mixtures, so they are very important in the food industry. John Hodge made it his life work to study and thoroughly understand the complex browning reactions, and he made extremely important contributions to the field (16). Since this type of work did not result in a tangible invention or product, Hodge is not well-known outside his own field of expertise. However, the body of knowledge he contributed through his publications will stand for many years as the definitive word in the field. His influence also extended not only to the scientists he mentored, but to his role in encouraging and mentoring African-American students in Peoria. He was well-known and highly respected for his many community activities, even by local citizens who had no idea of his stature as an internationally known scientist. Hodge passed away in Peoria in 1996, just a month after the death of Allene Jeanes.

If the scientists in Peoria who were contemporaries of Whistler, Jeanes, and Hodge can be considered the first generation, then the second generation would include those who were attracted to NRRL because it had earned a reputation as a center of excellence in carbohydrate research. Many of these second generation scientists have recently retired or are eligible to do so, and it is from them that the authors of this article have learned not only a great deal of carbohydrate chemistry, but also some of the history of NRRL, especially with regard to personalities and reputations. This second generation includes such distinguished scientists as George Inglett, George Fanta, William Doane (a former student of Whistler), Charles Russell, Michael Gould, and Morey Slodki.

Dr. Morey E. Slodki came to NRRL just before the dextran project ended, and one of his first contributions was as part of the team that developed phosphomannans. Actually, Slodki and Jeanes first looked at yeast mannans before shifting to bacterial xanthan. However, unlike xanthan, the sensitivity of the viscosity of phosphomannan to salts precluded its use as an industrial thickener. Slodki, considered the leading figure in the development of yeast phosphomannans, is still sought out for his expertise in that field, despite having been retired since 1989. He also made substantial contributions to a better understanding of the complex structures that make up the family of dextrans and related polysaccharides. As

Jeanes' successor, he supplied samples of various dextrans and mannans to researchers in medicine, academia, and industry for many years. Some three decades after the dextran project, he used the then-new technology of capillary GC-MS, coupled with methylation analysis, to reexamine many of the dextran structures. His work, which is considered the most definitive to date, provided important data for the interpretation of immunochemical properties of dextrans. The dextran and phosphomannan collection kept at NCAUR is still an important resource for scientists around the world.

Continuing the Tradition: 1980s to the Present

"Fluffy cellulose" was developed by J. Michael Gould and co-workers in 1983. It was produced from lignocellulose from corn cobs, oat hulls, and other agricultural residue by way of a patented alkaline peroxide reaction (17, 18). Fluffy cellulose achieved important dietary objectives by providing a noncaloric, high-fiber additive for baked goods. For this work the team received the Federal Laboratory Consortium Award for Excellence in Technology Transfer as well as the R&D 100 Award.

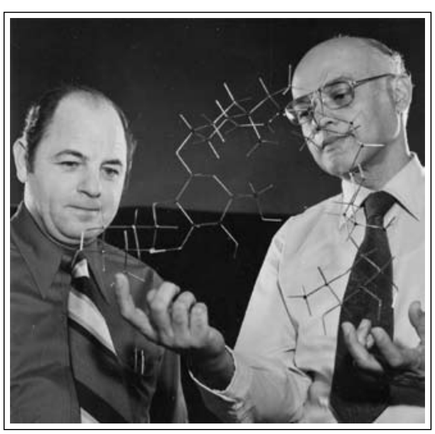
Starch continues to be an important focus of research in Peoria, and the more recent generations of scientists continue to make major advances in its applications. In the early 1970s, Doane, Fanta, Ollidene Weaver, Ed Bagley, and their colleagues developed copolymers of starch that were capable of absorbing up to 1,000 times their weight of water (19-21). The super-absorbent copolymer, having become known as SuperSlurper, has been used in applications ranging from disposable diapers to fuel filters. SuperSlurper was based on the starch grafting technology pioneered by Charles Russell (22). ARS has granted over 40 nonexclusive licenses to make, use, or sell SuperSlurper (23). The team continued to work with industry to transfer the technology and earned the Inventor of the Year Award from the Association for the Advancement of Invention and Innovation and the USDA Distinguished Service Award in 1976. Doane and Bagley were inducted into the ARS Hall of Fame in 1995 and 2003, respectively. These same scientists have contributed many other developments besides SuperSlurper, including starch derivatives that have been used in the paper industry and waste water treatment, as well as a patent filed by Weaver and Russell for novel carbohydrate aliphatic and cyclic acetals in 1966 (24).

SuperSlurper inventors William Doane, George Fanta, and Mary O. Weaver, early 1970s.

More recently, George Fanta and the late oil chemist Ken Eskins were responsible for the invention of a stable oil-water-starch emulsion that is being developed for a myriad of uses in food, medicine, and industry under the name Fantesk (25). Fanta and Doane have also received numerous awards from outside organizations, including the ACS, for their contributions to carbohydrate chemistry.

Another major contributor to the reputation of the Peoria USDA laboratory as a center of excellence has been Dr. George E. Inglett, who had already established himself as a successful scientist before coming to Peoria. When Inglett was honored as Chemist of the Year by the Illinois Heartland local section of the ACS in 2005, he stated that one of the influential factors in his life was the death of his best childhood friend from food poisoning during the Great Depression. During his scientific career Inglett has dedicated himself to the development of a safer and more healthful food supply. He received his B.S. in Chemistry from the University of Illinois in 1949 and his Ph.D. in biochemistry from the University of Iowa just three years later. He worked for many years in the agro-food industry, researching natural sweeteners, among other things. In 1967, when the size of the NRRL was increased 50% by addition of a new wing, he accepted a position as Chief of the Cereal Properties Laboratory. Inglett has continued his career as a food chemist since then and is best known for the development of a family of food ingredients based on cereal glucans, known collectively as the Trim Technologies (26-28). These ingredients are used as fat substitutes, fiber additives, texturizers, and emulsion stabilizers in many foods. OatTrim entered the market a record two years after its discovery and has been licensed by Quaker Oats and Rhodia. These developments have allowed Inglett to realize his lifelong goal of a more healthful food supply by providing consumers with high fiber, low fat, and low glycemic processed foods. For his contributions as a USDA scientist, Inglett was inducted into the ARS Hall of Fame in 2002. The Institute of Food Technologists has honored Inglett with the Industrial Scientist Award and Babcock-Hart Award for contributions to food technology, which have resulted in improved public health through nutrition or more nutritious food in 2000 and the Nicholas Appert Award for preeminence in and contributions to the field of food technology in 2006. In 2005 Inglett was chosen as one of the Laureates of The Lincoln Academy of Illinois, the highest honor the State of Illinois can bestow on persons who were born or have resided in Illinois for outstanding achievement. Inglett has been presented with many awards and honors from several other organizations, far too numerous to list here.

The current generation of carbohydrate scientists in Peoria has inherited a great deal of inspiration from those who have gone before them, building on their successes in the conversion of crop-based carbohydrates to value-added products. A large number of the hundred or so scientists at NCAUR are investigating ways to convert crop-derived carbohydrates such as cellulose and hemicelluloses to fuel ethanol. A somewhat smaller group has been dedicated to preserving the functionalities of the carbohydrate molecules while converting them to new materials. The chemists in the Plant Polymer Research Unit (PPL), for example, focus on derivatizing starch and protein through chemical and physical processes to make new polymers for use in the plastic industry. Chemists and biochemists in the Bioproducts and Biocatalysis Research Unit (BBC) take a somewhat different approach, using enzymes to produce novel compounds from starch, sugar, hemicelluloses, and other starting materials. One recent product arising from BBC research, sucromalt, is currently marketed as a low-glycemic sweetener for diabetics and in sustained-release energy bars and drinks.



Drs. George Inglett and John Hodge in 1973.

Where NCAUR Fits into our Nation's Future

In 1990 the ACS recognized the contributions of all four of the original Regional Research Laboratories and presented them with plaques that read, in part, "In Appreciation of 50 Years of Contributions to Carbohydrate Chemistry and to the Division." The current generation respects the contributions of those who established the reputations of our laboratories and hopes to make the next 50 years equally successful.

To put the contributions of the USDA as a whole and NCAUR in particular in perspective, it is helpful to understand how the Department and Center fit into the national research picture. Since 1953 NCAUR has been administered by the Agricultural Research Service (ARS), the USDA's in-house research agency. ARS research is funded at approximately $1.1 billion for fiscal year 2008, and the money is allocated to research programs according to program areas. The bulk of NCAUR funding, totaling approximately $30 million for FY2008, falls under the two program areas of Bioenergy Research and Agricultural Product Utilization and Quality Research. In the most recent fiscal year, The National Science Foundation (NSF) had a budget of about $6 billion, which was allocated entirely through grants. The National Institutes of Health, which has a history as long and interesting as USDA, funds research both in-house and through extramural grants, with a FY2008 budget of approximately $28 billion. The Department of Energy (DOE), which runs in-house laboratories through contracts, as well as funding extramural grants, has a total annual budget for its Office of Science of approximately $4 billion, with about $200 million of that going to biomass and biorefinery research. As one can see from these figures, in the grand scheme of things, the ARS budget, including NCAUR, is a relatively small slice of federal R&D funding. Despite this fact, the contributions of ARS and NCAUR to the national ecnonomy have been significant. Part of the reason for such a highly successful history is due to the fact that NCAUR scientists have recognized the value of collaborations to succeed in their work. In the past, this was exemplified by cooperation between the War Department and USDA during the penicillin and dextran projects and between NIH and NCAUR in subsequent years, as NIH continued to study dextran-specific antigens. The USDA and DOE currently coordinate many of their efforts in the areas of biofuels research and biomass conversion. NCAUR scientists also have good working relationships with fellow scientists in most of the other 100 or so ARS facilities. However, by far the most significant of NCAUR's collaborations have always been with the private sector. The goal of utilization research is to create new markets, and so the entire process from conceptualization to product development depends strongly on such interactions. NCAUR has established itself as a leader in public-to-private technology transfer, as demonstrated by its long list of awards for these accomplishments. USDA agricultural research, as exemplified by the Regional Research Centers, including the Peoria laboratory, has a long established history of contributing to our nation by developing new technologies which have strengthened our farm economy. In addition, it has provided the world a more healthful food supply, new medicines, new plastics, and a more productive industrial base.

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ABOUT THE AUTHORS

Gregory L. Côte is Lead Scientist, Bioproducts and Biocatalysis Research Unit, and Victoria L. Finkenstadt is Research Chemist, Plant Polymer Research Unit, both at National Center for Agricultural Utilization Research, United States Department of Agriculture, 1815 North University Street, Peoria, IL 61604. http://www.ncaur.usda.gov.

Editor's Note: This feature is being introduced for the first time in this issue. It was suggested by founding editor of the* BULLETIN, *William B. Jensen, Curator of the Oesper Collections at the University of Cincinnati. We hope this will become a continuing item in future issues of the journal.

LOST ARTIFACTS?
The Squibb Museum

Among the books in the Oesper Collections is a small 4.5" x 7" volume of 190 pages by George Urdang and F. W. Nitardy bound in brown leatherette and titled *The Squibb Ancient Pharmacy: A Catalogue of the Collection*. Published in 1940 by E. R. Squibb and Sons of New York, it describes in some detail the artifacts in a two-room museum of pharmacy located on the 28th floor of Squibb Building at the corner of 58th Street and 5th Avenue. Purchased from a private collector in Europe by Squibb and brought to the United States in 1932, one room of the museum was arranged like a Baroque pharmacy and the second as a laboratory or "Faust study" containing a reproduction of a period furnace and hood. Most of the collection appears to have consisted of highly decorated period pharmacy containers, spanning the 15th through the early 19th centuries, and a large collection of mortars and pestles, some dating back to the 7th century. In addition, there were rare books, framed prints (many of which I have never seen elsewhere), paintings, sculpture, and some apparatus common to both pharmacy and chemistry, including 18th-century balances, a microscope, glass alembic heads, and several Florentine distillation receivers. I can find nothing about this museum on the internet, and presumably the Squibb Company has long since been absorbed by some larger pharmaceutical conglomerate. My question is whether any of the readers of the *Bulletin* have any idea what happened to this museum and to its valuable contents.

Readers having information relating to the above artifacts or questions of their own which they would like to see addressed in future columns should send their comments and questions to Dr. William B. Jensen, Department of Chemistry, University of Cincinnati, Cincinnati, OH 45221-0172 or email them to Jensenwb@email.uc.edu.