

Dewey Brown's 19,000 bu. concrete farm elevator in Pomeroy in 1941



Agricultural and Biological Systems Engineering at Washington State University

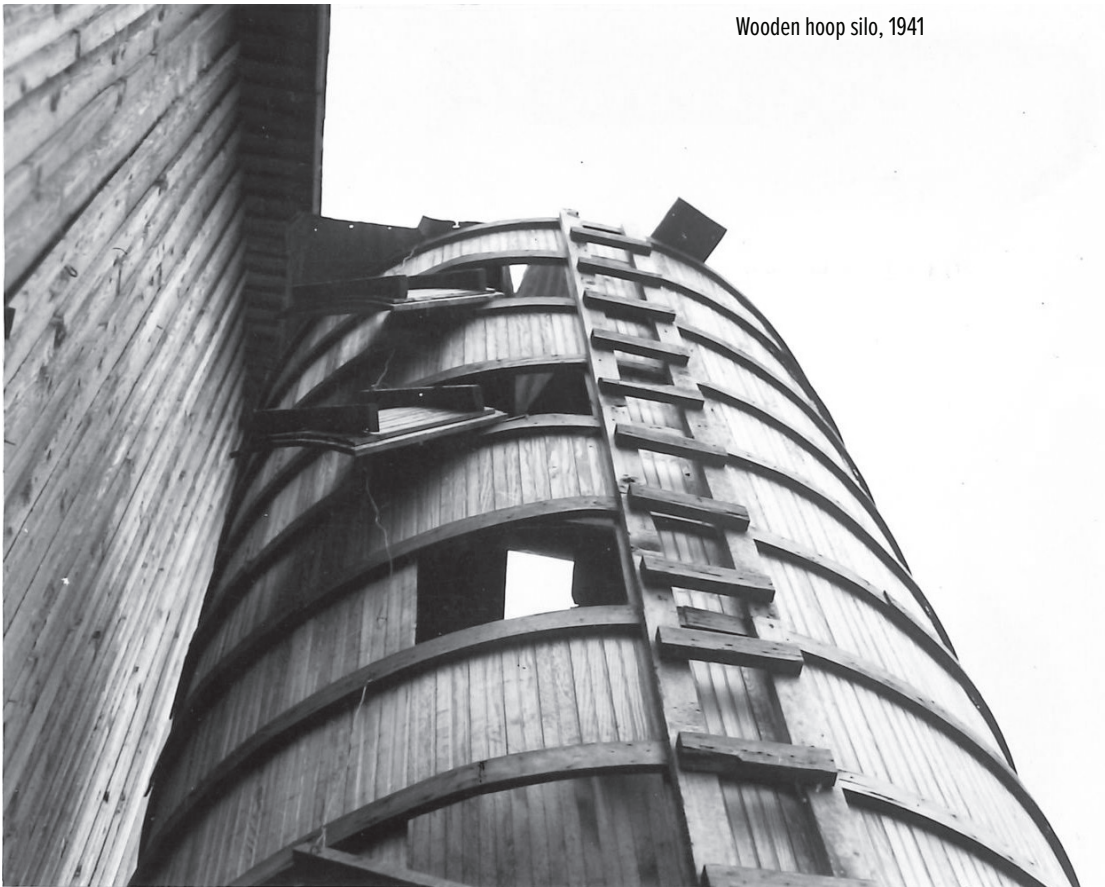
**More than 100 Years Committed to
Building a Better and More Sustainable Agriculture**

**L.G. James, D.C. Davis, R. Cavalieri,
C. Stockle, J. Tang, M. Garcia-Perez, et alia**

A Note to the Reader

Agricultural and Biological Systems Engineering at Washington State University is the first edition of a history of a more than 100-year-old department at Washington State University. The opinions and statements presented here are those of the various authors and are based on their memories and experiences. The information presented here is drawn from various WSU archives. While the authors made very effort to accurately represent the major administrative events shaping the history of the Department, we are aware that we may have inadvertently misrepresented particular situations or neglected to mention important people. We welcome notes of correction and addition to future editions of this history. Please contact department chair Dr. Manuel Garcia-Perez at mgarcia-perez@wsu.edu with your memories, corrections, and additions. You may also contact us through our website, bsyse.wsu.edu.

Larry James thanks Mark O'English of WSU Manuscripts, Archives, and Special Collections (<https://libraries.wsu.edu/masc>) for his patience, prompt help, and invaluable knowledge and expertise in locating documents, photographs, and other sources of information essential to this project.



Wooden hoop silo, 1941

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A Message from the Chair:

More than 100 Years Committed to Our Stakeholders

By Manuel Garcia-Perez, chair

I begin to write these lines feeling certain that I will not be up to the task of introducing the more than 100 years of teaching, research, and extension in Agricultural Engineering at Washington State University. However, I have decided to start my narrative with this statement of inadequacy because overcoming this

existential question and growing in the process of acting have proven many times to be a very important ingredient for the success of our department. The results described in this document are the fruits of the work of hundreds of people who made this department their home. With this effort, I learned that the WSU Department of Agricultural Engineering goes beyond a single life. It is a huge social enterprise in which several generations have invested their lives, their dreams, and their humanity. We are a big family with a long and distinguished history well worth documenting.

Our effort at documenting this history arises from a 2021 conversation in which Professor Juming Tang expressed his concern that the history of the department could be lost with the retirement in the coming years of a significant number of our faculty. Professor Claudio Stockle's retirement highlighted the urgency to act. In conversations with Professor Stockle, he suggested asking former department chairs to write their recollections of important events that happened during their tenure. Professors Larry James, Ralph Cavalieri, and Denny Davis very kindly agreed to participate in this project. Professor James made contact with Professors Larry King and Al Pettibone who very kindly agreed to participate in some of our meetings and to review the content of their sections.

This wonderful document is the result of teamwork of our former chairs and current staff, mutual learn-



ing, and a commitment to the high quality standards for which our department is known.

Thank you very much!

Special thanks go to Professor Larry James. He wrote an important fraction of this document. This document would not be possible without the enormous energy and hours that Professor

James so generously devoted to uncovering archival research through the University.

Working with the department chairs who preceded me allowed me to understand that the collegial culture I value and appreciate so much in our department was created by generations of dedicated professionals with a human-centered vision that privileged collaborative multidisciplinary work. This was the case with Professor L.J. Smith, our first department chair, who in 1920 came to Pullman from the University of Manitoba. Many of our educational and outreach activities were born and grew during his tenure. With the arrival of June Roberts in 1947 the department acquired a formal research mandate and in 1950 our B.S. degree program in Agricultural Engineering was accredited. In 1960 our department appointed Dr. Albert P. Powell as assistant professor. He was the first Agricultural Engineering faculty member with a Ph.D. His expertise was on farm structures and animal environments. With him started a period where research become a central mandate for the department. In the 1960s and '70s, talented young engineers trained by the generation of June Roberts (Simpson, Pettibone, King, Hyde, Davis, James) decided to continue their studies and headed to the leading institutions in the country, and especially Cornell University, to complete their doctoral studies. Upon their return to WSU, this group of Cougars built the foundation for the creation of a highly productive research-in-

tensive department. With the hiring of Drs. Cavaliere, Stockle, Barbosa, Tang, and Chen, in the second half of the 1980s and early '90s, the department continued to grow its graduate program and research output while observing a dramatic decrease in the number of undergraduate students enrolled in our Agricultural Engineering program. In 1992 the name of the department changed from Agricultural Engineering to the Department of Biological Systems Engineering. The B.S. in Biological Systems Engineering was discontinued in 2004.

For nearly 20 years the department has been following a developmental model with four areas of research and outreach excellence: (1) Food Engineering, (2) Agricultural Automation, (3) Land, Air, Water Resources, and Environmental Engineering (LAWREE) and (4) Bioenergy and Bioproducts Engineering. Today, we have very competitive graduate programs with 18 tenure-track and very committed faculty members and two energetic career track assistant professors. Our department has one of the largest graduate programs in our discipline in the nation and our students are finding jobs in leading academic, research, and industrial institutions. We are working to address some of the major challenges facing Washington agriculture, including global warming, food safety, precision agriculture, alternative jet fuels.

For 40 years, the department has hired professionals from all over the world with impressive results. Our department today has very high productivity indicators with 58 Ph.D. students and 9 M.Sc. students and an overall level of expenditure of 5.2 million dollars per year (averaging \$ 304,000 per faculty). In 2021, our department graduated 10 Ph.D. and 3 M.Sc. students. Our faculty publish more than 135 peer reviewed publications every year (an average of 12 per faculty member). According to EduRank, our department ranks number 6 in the United States and eleventh in the world in terms of research productivity among agricultural engineering departments. The average h-factor of our faculty members is 50 (average citation per faculty member is 11,777 (1,429 in 2021)). Nine BSE faculty members are among the 60 most cited researchers from WSU.

Each period in the life of the department is associated with events beyond the control of its members. The capacity of our chairs, faculty and staff members, and students to adapt to a changing environment has

allowed our department to grow. Washington agriculture has changed a lot since the time Washington State College was founded in Pullman late in the 19th century. In the 1880s, farmers began growing wheat in large quantities on the Palouse. In 1901 the highest average wheat yield in U.S. was in Washington. At that time, the average wheat yield in the U.S. was 15 bushels per acre. In 1960, the US average winter yield was close to 29 bushels per acre; today, yields are close to 55 bushels per acre. Washington State is ranked 8th wheat yield with 70 bushels per acre. Equally impressive has been the increase of U.S. corn yields. In 1900, the U.S. average yield was around 25 bushels per acre. This number increased to close to 40 bushels in 1950; today the average yield in US is close to 180 bushels per acre. Washington and Oregon lead the nation with yields close to 235 bushels per acre.

The contribution of engineering to these achievements cannot be overstated. After the construction of the Grand Coulee Dam in 1934, the Columbia Basin Project added 300 miles of canals and provided irrigation to central Washington farmland. In the early 1900s, when WSC offered its first courses in irrigation, the state had 48,000 irrigated acres; by 1950 (the same year the L.J. Smith building was inaugurated), this had increased to 650,000 acres. Today, more than 1.8 million acres are irrigated. In the 1970s, equipment on farms got bigger, reducing the number of people needed to manage more acreage. Center-pivot systems replaced hand lines, requiring less labor, energy, and water to manage crop moisture levels.

The boom period came to an end in the late 1970s when the Federal Reserve Board tightened monetary policy to fight inflation. 1980s land values and farm earnings decreased. In the 1990s, advances from other industries made their way to Washington farms (sensors and other devices, as well as new machine and information technologies) allowing farmers to apply water, fertilizers, and pesticides to targeted locations in their fields. Also in the '90s, sustainability issues became increasingly important for Washington farmers. Most dryland wheat farmers are now using reduced tillage or no-till practices to minimize erosion and soil disturbance. Washington dairies began using anaerobic digesters to manage manure and generate energy. The future growth of Washington agriculture will continue to require the use of engineering tools to improve its economic, social,

and environmental performance.

Today, our 39,500 farms and ranchers generate 164,000 jobs and represent 12 percent of the state's economy. In 2020, agricultural production in Washington State was \$10.6 billion: apples, \$2.1 billion; milk, \$1.2 billion; wheat, \$.95 billion; potatoes, \$.75 billion; cattle, \$ 0.69 billion; cherries, \$.61 billion). Washington State is #1 producer of apples, blueberries, hops, pears and spearmint oil in the United States. Food processing and manufacturing generates \$20.1 billion in revenue and create an additional 40,000 jobs. Washington State is the third-largest exporter of food and agriculture products in the U.S. Close to \$7 billion worth of food and agriculture products are exported, much of that to Asia.

The department moved to our current location in L.J. Smith Hall in 1947. For close to 75 years the history of the department has been linked to this building. A whole section of this document is devoted to describing the history of the building.

Due to the nature of our mandate, our department has contributed to a culture of collaboration among units, not only within the University, but with U.S. Department of Agriculture and the Agricultural Research Service and with researchers from Pacific Northwest National Laboratory as well. Today we work with professors and students from almost all WSU colleges and from many U.S. and foreign institutions.

There's not space enough in this brief introduction to describe all the milestones in the history of the department. The reader is invited to read each of the sections and to contact us if they see ways this history can be expanded or modified. We hope that faculty members and administrators will use it to inform decisions to shape the future of the unit. We know of several areas that could use your help. For example, we've barely been able to document the impact of Cornell University on the training of many of our faculty members in the '70s. Likewise, our relationships with USDA Agricultural Research Service, WSU Department of Food Science, the department's many international projects, our authorial and editorial contributions to the publications of books and important journals are all areas that need to be better documented. The reader should consider this book a work in progress which will be periodically updated.

I end this introduction knowing that while it can be improved, I am satisfied and happy with the time I have dedicated to this project. The teachings of our former department chairs, and the privilege of being able to work with them is something that I will always remember. Despite our every effort, I am aware that it is possible that we have inadvertently left out some names or misrepresented some situations. If this is the case, please contact us and we will correct it in the next edition. It is my sincere hope that the readers enjoy perusing this books as much as I have.

Go Cougs!

Major Events in the Formation and Evolution of the Department

By L. G. James

Table 1 summarizes the main events that shaped the evolution of the Biological Systems Engineering Department at Washington State. For approximately 130 years our institution has been at the service of our state to advance our agriculture and the rational use of our natural resources.

Table 1. Major events in the history of the BSE/Agricultural Engineering Department

Year	Action/ Event
1892	Washington State Agricultural College and School of Science opens Jan 9, 1892. There are 59 students in the inaugural class. Thirteen were admitted as freshman to the college itself; the rest were enrolled in a preparatory department (because the state had few high schools or academies able to prepare students for college). Two courses titled “Shop Work” taught in Horticulture. The first term course was devoted to carpentry. The second term was devoted “to work in iron.”
1893	The newly opened College offers four courses of study: (1) General Science, (2) Agriculture, (3) Civil Engineering, (4) Mechanical Engineering (includes Mill and Hydraulic Engineering, and Steam Engineering)
1894	Irrigation course (5 days/week) added in Civil Engineering; This is intended to follow and supplement the course in hydraulics and will discuss the construction of dams, the location of canals, fluming, weirs, the flow of water in open channels, and the gauging of streams.
1895	Agricultural Physics (full course) offered in Dept. of Agriculture: The principles of Physics as applied to agricultural and dairy machinery, the construction and ventilation of farm buildings, construction and management of silos, and as affecting soil moisture. The latter subject will include drainage, irrigation, evaporation and methods of tillage.
1896	College organized into Departments: (1) Mathematics and Civil Engineering, (2) Chemistry, (3) Botany and Zoology, (4) Agriculture, (5) Horticulture, (6) English Language and Literature, (7) Economic Science and History, (8) Mechanical Engineering—includes Mill Engineering, Electrical Engineering, (9) Steam Engineering, and Hydraulic Engineering, (10) Modern Language and (11) Military Science and Tactics Irrigation Engineering (2/5 course) replaces Irrigation in Dept. of Mathematics and Civil Engineering. (Hydrology; duty of water; distribution; canals; underground sources of supply). This course was taught by OsMarch L. Waller, Prof. and Head of Dept., and Irrigation Engineer in the Agricultural Experiment Station. Professor Waller earned a Ph.M. from Hillsdale College in Michigan, and later became Vice President of WSC. Waller Hall was named in his honor in 1935.
1898	Farm Engineering (3/5 course) replaces Ag Physics in Dept. of Agriculture. This subject includes the principles of drainage, irrigation, road making, construction of buildings fences, etc., and the mechanical principles involved in farm machinery.
1905	College renamed State College of Washington (quickly shortened, colloquially, to Washington State College, or WSC). Rural Engineering (3/5 course) replaces Farm Engineering (course description unchanged). Listed in Agronomy Program. Taught by George Severance, B.S. Michigan Agricultural College, who later was Vice Dean of the College of Agriculture and Head of the Dept. of Farm Management Irrigation Farming (2/5) course added in Agronomy. Taught by Mr. Severance. A course in the theory and practice of irrigation. The principles underlying the practice of applying water from growing crops. The uses of water; crops adapted to irrigation, with particular reference to horticulture.
1907	Dairy Machinery (2 hours) course added in Dairy Manufactures Program in Dept. of Agriculture. Taught by Thomas Whitney, Instructor with B.S. from Iowa State College. A comparative study of the different kinds and makes of dairy machinery, including the principles involved in separation, pasteurization, refrigeration, cream ripening, churning, cheese-making, and testing.
1908	Irrigation Law (3/5 course) added in Mathematics and Civil Engineering. Taught by Professor Waller.

1910	<p>Irrigation and Dry Farming (2 hours) replaces Irrigation Farming in Agronomy Program. Taught by Clark C. Thom, Asst. Professor, BSA Ontario Agricultural College. A study of the relation of soil moisture to crop production; of the principles underlying the application of irrigation water to crops; of the adaptability of crops to irrigation and to dry-farming conditions; and of the economical utilization of soil moisture received from natural rainfall or from artificial irrigation.</p> <p>Irving D Charlton hired as instructor of Farm Mechanics in the Dept. of Agriculture. Mr. Charlton, who earned a B.S. in Mechanical Engineering from the Michigan Agricultural College, is the first faculty with an engineering degree to teach Farm Mechanics.</p>
1912	<p>Farm Machinery and Farm Motors (5 hours) replaces Rural Engineering course. Taught by Mr. Charlton. This course includes a brief study of mechanics and materials; a study of the construction, functions, and methods of operating, adjusting, and repairing farm machinery; of the principles of draft and the production of power; of the operation of gasoline and oil engines on the farm.</p> <p>Irrigation & Drainage Practices (2 hours) course added in Agronomy. Taught by Mr. Thom. A general study of the use of irrigation water in growing crops. The relation of soil moisture to crop production; the preparation of the soil to receive water; methods of distributing water on the land and of draining out surplus water; the principles underlying the application of irrigation water to crops; the moisture requirements of crops and their adaptability to irrigation conditions; the storage and conservation of water in the soil; the economic use of water.</p>
1913	<p>Farm Mechanics Program (within Agronomy Department) begins with courses in: (1) Farm Machinery & Farm Motors (5 hours), (2) Traction Engine Practice (2 hours). Experience in the care and management of traction engines and separators. Mr. Charlton</p> <p>Farm Buildings & Conveniences (5 hours) The farm home; its location, water supply, and sewage disposal. Planning and arranging the farm buildings and constructing miscellaneous devices. Mr. Charlton</p>
1914	Farm Mechanics Program (within Agronomy) renamed Agricultural Engineering
1915	<p>Farm Repairs (3 hours) added to the Agricultural Engineering Program</p> <p>This course includes instruction and practice in the common repair work of the farm. It will include harness repair, rope splicing, belt lacing, soldering, babbitting, pipe fitting, drilling, work with cold metal. Mr. Charlton</p> <p>Leonard J Fletcher hired as Instructor in Agricultural Engineering. Mr. Fletcher, who earned a B.S. from Iowa State College, joins Mr. Charlton in Agricultural Engineering Department.</p>
1916	<p>Nine Agriculture programs, including Agricultural Engineering, move from Science Hall to Wilson Hall, a new building. This will be Agricultural Engineering's home for the next 31 years.</p> <p>James P. Fairbank hired as instructor upon resignation of Mr. Fletcher. Mr. Fairbank has B.S. in Agricultural Engineering from the University of Nebraska.</p>

1917	<p>Regents approved President Ernest Holland's recommendation for reorganizing WSC into the following colleges and schools:</p> <p>College of Agriculture: (1) Agricultural Experiment Station, (2) Dept. of Agriculture, (3) Dept. of Horticulture, (4) Dept. of Forestry</p> <p>College of Mechanic Arts and Engineering: (1) Dept. of Mechanical and Electrical Engineering, (2) Dept. of Mathematics and Civil Engineering, (3) Dept. of Architecture</p> <p>College of Arts and Sciences: (1) Dept. of Botany, (2) Dept. of Zoology, (3) Dept. of Geology, (4) Dept. of Chemistry, (5) Dept. of Economic Science and History, (6) Dept. of English, (7) Dept. of Foreign Languages</p> <p>College of Veterinary Science</p> <p>College of Home Economics</p> <p>School of Mines</p> <p>School of Education</p> <p>School of Pharmacy</p> <p>School of Music and Applied Design</p> <p>Division of Agricultural Engineering established in the new Department of Agriculture. James P. Fairbank appointed Acting Head.</p>
1918	<p>Department begins offering courses in the College of Agriculture Winter School, later called Winter Shortcourse and then Extension Winter Shortcourse when it was assigned to Extension in 1956. Winter School was offered for eight-weeks each year beginning in January to "anyone regardless of previous education." For many years Agricultural Engineering offered two 2-week courses in Winter School: one in gas engines and a second in tractors. These courses began in early January and were repeated each two weeks until spring. The Department's involvement in Winter School continued until at least 1937 and possibly until 1956.</p> <p>Edward J Stirniman joins Ag. E. faculty as an instructor upon resignation of Mr. Charlton on Jan 28, 1918 to take a position at the University of Minnesota. Mr. Stirnman earned a M.S. in Agricultural Engineering at Iowa State College</p>
1919	<p>James P Fairbank promoted to Professor.</p>
1920	<p>Clarence C. Johnson joins faculty as an instructor upon resignation of Edward Stirniman for medical reasons in 1919. Mr. Johnson earned a B.A. in Education from WSC in 1920.</p> <p>Leslie John Smith joined Agricultural Engineering as Professor and Head of the Department. Before coming to WSC, Mr. Smith was a professor of Agricultural Engineering for eleven years at Manitoba University. In the preceding three years, he organized the Farm Mechanics program at the State College of Michigan, where he was an instructor and earned B.S. and M.E. degrees in Mechanical Engineering. Prior to entering college he worked as a machinist and, for a short time, in building construction for his father. Professor Smith replaces Professor Fairbank who resigned June 15, 1920 to pursue commercial interests.</p>

1921	<p>Department of Agricultural Engineering has two faculty members (Smith and Johnson) and offers the following courses: (1) Farm Repairs (2 hours) The use of tools and materials in the farm shop. Soldering, babbiting, pipe fitting, drilling, tap and die work, rope splicing, and belt lacing. Mr. Johnson (2) Farm Machinery (2 hours) Principles of mechanics applied to farm equipment; materials and types of construction, operation, adjustment, and repair of farm implements. Mr. Johnson. (3) Farm Motors (2 hours) The operation, care, and repair of gasoline and oil engines on the farm. Mr. Johnson (4) Steam Tractors (2 hours) The construction, adjustment, repair, care, and operation of steam traction engines, stationary engines, and boilers. Mr. Smith (5) Gas Tractors (2 hours) The construction, adjustment, repair, care, and operation of various types of gas tractors. Special attention will be given to ignition systems and kerosene carbonation. Mr. Johnson (6) Farm Building Design (3 hours) The location, arrangement, and design of farm buildings. Mr. Smith (7) Farm Building and Concrete Construction (2 hours) Practice in farm building construction by the actual erection of small farm structures, models of barn framing, fencing, and other structural details. Mr. Smith (8) Farm Drainage (2 hours) Principles and practice of farm drainage. (9) Advanced Gas Tractors (3 hours) This course will include a study of tractor types, details of component parts, tractor specifications, comparison of designs, tractor ratings, tractor-drawn tools, and tractor hitches. Laboratory work will include testing belt and drawbar horsepower, fuel consumption, efficiency of transmission and tractor members. Field time will be taken to compare tractors under actual working conditions. Mr. Smith and Mr. Johnson (10) Mechanics of the Farmstead (2 hours) A study will be made of heating, ventilation, lighting, power, water supply, and sewage disposal systems as adapted to the farm and home. Laboratory work will consist of making a comparative study of systems in use and in preparing plans, specifications, and cost estimates. Mr. Smith (11) Research (2 to 5 hours) This course affords opportunity for independent study of some chosen problem in agricultural engineering.</p>
1922	WSC Regents authorize the creation of a Graduate School with C. C. Todd as temporary Head.
1923	<p>M.S. in Ag with minor in Agricultural Engineering appears in catalog for the first time.</p> <p>Three new courses added to Agricultural Engineering curriculum:</p> <p>Electricity on the Farm (1 hr) A study of farm lighting outfits and installation of same; care of storage batteries; the farm telephone; and a detailed study of the different types of gas engine ignition. Mr. Johnson</p> <p>Farm Shop (3 hrs) A study of the following subjects for one-half of a high school course in farm shop; use and care of tools and equipment; babbiting; soldering; pipe fitting; belt work; rope work; harness repair; drilling; tapping and threading; and common repairs to machinery. In addition to the above, attention will be given to equipment necessary for teaching a course in high school together with the methods of presenting the subject matter. This course and AE14 (the following course) are intended to make a complete course in Farm Shop. Mr. Johnson.</p> <p>Farm Shop (3 hrs) A study of the principles of farm building and concrete construction as a basis for one-half of a high school course in farm shops. This will include practice in the use of carpenter tools and tools for concrete construction and the care of these tools. Projects for the farm and home will be planned and executed. The course will include the framing of small farm buildings, and a study of the equipment necessary for teaching this subject in high school. Mr. Smith</p>
1924	Electricity on the Farm course increased to 2 hrs credit, and first Farm Shop course reduced from 3 to 2 hrs credit.
1925	<p>Farm Machinery and Repairs (3 hrs) course added. Taught by Mr. Johnson.</p> <p>Harry L Garver hired as Investigator in the uses of Electricity in Agriculture, a new industry funded research/outreach program. Mr. Garver earned a B.S. degree in 1922 from WSC, Dept. of Mechanic Arts and Engineering. This is the Department's first externally funded research/outreach program and its first formal research and outreach program.</p>

1926	<p>Dairy Plant Mechanics (3 hrs) course added in Agricultural Engineering. A study of the mechanical equipment of dairy plants and their accessories. WSC Regents on April 23 grant permission to offer B.S. in Agricultural Engineering. Program jointly administered by the College of Agriculture and College of Mechanical Arts and Engineering. Faculty include: L. J. Smith, Prof and Head C. C. Johnson, Asst Prof H. L. Garver Investigator—Uses of Electricity in Agriculture (research/outreach position)</p> <p>Catalog Description of Agricultural Engineering: The four year course in Agricultural Engineering is intended to equip men (and women) for work along the following lines: (a) the manufacture of farm machinery and equipment; (b) drainage, land clearing, and irrigation; (c) teachers, investigators, and extension specialists in agricultural engineering in colleges, experiment stations, and in the United States Department of Agriculture; (d) agricultural engineering experts for farm papers, technical magazines and in rural electrical work; (e) designers and contractors for farm buildings; (f) salesmen and field experts on farm equipment, superintendents or managers of large farms.</p> <p>A prospective student in Agricultural Engineering should be well versed in farm practice and be sympathetic in attitude towards the agricultural industry. Students taking this course should plan to spend their summer months in practical work related to agricultural engineering.</p> <p>Schedule of Studies for B.S. in Agricultural Engineering in Appendix A. Department continues to offer a specialty in Farm Engineering through the College of Agriculture. Students completing the Farm Engineering specialty earn a B.S. in Agriculture. Schedule of Studies for Farm Engineering specialty in Appendix B.</p>
1930	<p>Land Clearing (2 hrs) course added in Agricultural Engineering. The principles of and practices in the use of powder, fire, and stump pulling devices for the clearing of land. A study of the costs of land clearing. The Department of Mining will give the work in the use of powder. Mr. Smith</p>
1933	<p>Land Clearing retitled Land Clearing and Reclamation (2 hrs). Arthur C. Jacquot replaces C. C. Johnson who begins a 2-year leave as Chief Agricultural Engineer with the US Soil Erosion Service. Mr. Jacquot just finished B.S. in Agricultural Engineering at WSC.</p>
1934	<p>M.S. in Agricultural Engineering appears in Catalog for the first time. Land Drainage and Reclamation (2 hrs) replaces Farm Drainage (2 hrs). Methods and principles of installing drainage systems in the reclamation of agricultural lands. Mr. Smith Advanced Farm Machinery and Building Design Studies (3 hrs) course with 3 prerequisites in Civil Engineering added. A review of recent research in the field of farm machinery and farm building design, with intensive study in some selected phase of either of these fields of agricultural engineering.</p>
1935	<p>Arthur C. Jacquot is first M.S. in Agricultural Engineering graduate C. C. Johnson resigns to accept position as Chief Agricultural Engineer for the U.S. Soil Erosion Service. Mr. Arthur C. Jacquot assumes Mr. Johnson's position.</p>
1936	<p>Two courses added in Agricultural Engineering. Irrigation Practices (2 hrs) The principles of irrigation practices pertaining to equipment and methods of applying water to agricultural lands. A study of water measurements; sources and methods of applying water; farm distribution systems; the selection, cost, and operation of pumping plants. Mr. Jacquot</p> <p>Soil Conservation Engineering (2 hrs) Engineering principles and practices underlying soil erosion control, including dams and obstacles for gullies, terracing, and terracing machinery, mapping, runoff instruments, measurement of runoff, and the study of mechanical aids in soil conservation. Mr. Smith</p> <p>Land Drainage and Reclamation renamed Land Drainage.</p>

1937	<p>Rural Electrification (2 hrs) added in Agricultural Engineering.</p> <p>An intensive course designed to prepare students for work in the field of rural electrification</p> <p>Gas Tractors renamed Gasoline and Diesel Tractors (2 hrs)</p> <p>Advanced Gas Tractors renamed Advanced Gasoline and Diesel Tractors (2 hrs)</p> <p>Farm Shop courses renamed Materials, Techniques, and Methods of Farm Shop (3 hrs)</p> <p>The Engineering Council for Professional Development (ECPD) inspected the B.S. in Agricultural Engineering curriculum and denied accreditation noting that “like agricultural engineering curriculum throughout the United States that the strictly professional work of the last two years did not make proper use of foundational courses. Quiz and final examination questions in these professional courses were as rule very elementary and did not correspond in difficulty or in the use of fundamental subjects to quiz and final examinations given in other divisions of engineering.” Specifically for the State College of Washington program, the ECPD Inspection Committee’s reasons for denial included:</p> <p>Curriculum is weak in the engineering presentation of its own field.</p> <p>The curriculum contains the elements for sound engineering instruction but the sequence of courses could be improved to make better use of foundation courses.</p> <p>Professional agricultural engineering courses are given to mixed classes of agricultural engineering and agricultural students. The latter group, agricultural students, does not have the prerequisites necessary for a thorough understanding of the professional courses.</p> <p>Failure to require engineering prerequisites for courses which should have had them.</p> <p>Too much descriptive and informational teaching and too little problem work.</p> <p>The report also noted that there were only 12 graduates of the program in its first ten years.</p>
1938	<p>W. A. Junnila begins as Investigator—Uses of Electricity in Agriculture upon resignation of Harry L. Garver who accepted research engineer position with USDA.</p>
1939	<p>Orville J. Trenary begins as Asst Professor upon resignation of A. C. Jacquot who accepted a position at Utah State College.</p> <p>Mr. Trenary has B.S. degrees in Agricultural Engineering from the University of Wisconsin and the University of Nebraska.</p> <p>Farm Machinery and Repairs (2 hrs) course added in Agricultural Engineering</p> <p>Principles of mechanics as applied to farm machinery; materials and types of construction; operation, adjustment, and repair of farm implements. Recommended to other than Agricultural Engineering majors. Mr. Jacquot</p> <p>“Primarily for Agricultural students” added to description of Irrigation Practices course.</p> <p>Farm Machinery (3 hrs) revised to increase credit. Phrase “For Agricultural Engineering majors only” included to description.</p> <p>Farm Buildings (2 hrs) course added in Agricultural Engineering.</p> <p>Farm Building Design (3 hrs) revised to increase credit and require 2 CE and 2 ME prerequisites.</p> <p>Motors and Tractors (3 hrs) course added in Agricultural Engineering</p> <p>The principles, operation, care, and repair of motors and tractors on the farm. For Agricultural Engineering majors. Mr. Jacquot</p>
1940	<p>Elementary Perspective (1 hr) course added in Agricultural Engineering</p> <p>Practice in elementary drawing of single and two-point perspectives. A non-technical course for those who wish to make perspectives of interiors, gardens, or of small objects and buildings. Mr. Smith</p> <p>June Roberts begins Oct. 1 as an investigator in Farm Electricity after W. A. Junnila resigns to accept similar position at Ohio State University. Mr. Roberts came from Kansas State College where he was a research assistant from 1933 to 1934, and an instructor from 1935 to 1940. He earned B.S. (1933) and M.S. (1934) degrees in Agricultural Engineering from Kansas State College, one of four U.S. colleges with ECPD accredited B.S. in Agricultural Engineering.</p>

1941	<p>Farm Motors and Conveniences (1 or 3 hrs) course added in Agricultural Engineering</p> <p>The principles, operation, care, and repair of gas engines on the farm. Electric motors, elements of drainage, farm water supply, plumbing systems, sewage disposal, ventilation, and house heating. Mr. Smith and Mr. Trenary</p> <p>Agricultural Engineering chose not to be included in ECPD re-inspection of WSC engineering curricula.</p>
1942	<p>Advanced Farm Shop (3 hrs) course added in Agricultural Engineering For students preparing to teach shop work in high school. The fundamentals of electric and acetylene welding, lathe, and forge work.</p>
1943	<p>Richard N Miller's title changed to Extension Agricultural Engineer. Mr. Miller began as Extension Specialist Land Clearing Economics Oct. 1, 1925.</p> <p>Two temporary "war courses" offered in Agricultural Engineering</p> <p>Elementary Gas Engines and Tractors (3 hrs) Agricultural war course for women. The fundamentals of gas engines and tractors, their care and operation. The elements of carburetors and ignition. The course will also be of value in connection the operation of cars and trucks. Mr. Trenary</p> <p>Home Mechanics and Electrification (2 hrs) Agricultural war course for women. Home water supply, plumbing and sewage disposal, electricity in the home, adequate wiring and lighting, meters, switches, fuses, etc. Laboratory practice in home upkeep of plumbing, lighting, and electrical appliances. How to get the best possible service from the toaster, iron, washer, range, and refrigerator. Mr. Smith</p>

1945	<p>William H Johnson replaces Orville Trenary who resigned Nov 1,1944</p> <p>New courses in Agricultural Engineering- both with required prerequisites in Mechanics of Materials in CE (4 hrs) and Materials in Engineering in ME (4 hrs)</p> <p>Advanced Studies in Rural Building Design (3 hrs)</p> <p>A review of research and developments in the past ten years, in the field of farm buildings, with intensive study in some selected and approved phase of this branch of Agricultural Engineering. Mr. Smith</p> <p>Advanced Farm Machinery Studies (3 hrs)</p> <p>A review of the past ten years' research and publications in the field of farm and power machinery, with intensive study in some selected and approved phase of this branch of Agricultural Engineering. Mr. Johnson</p> <p>Walter W Hinz appointed Instructor and Assistant in Agricultural Engineering. Mr. Hinz has a B.S. in Agricultural Engineering from WSC (1938). Half of this new position is funded by the Agricultural Experiment Station.</p> <p>Regents on Nov 23, 1945 approve President Wilson Compton's reorganization proposal creating:</p> <p>The Institute of Technology, which includes</p> <p>Instruction:</p> <p>College of Mechanic Arts and Engineering</p> <p>Department of Chemical Engineering</p> <p>School of Mineral Industries</p> <p>Department of Agricultural Engineering</p> <p>Experiment Stations</p> <p>Engineering Experiment Station</p> <p>Mining Experiment Station and State Electrometallurgical Laboratories</p> <p>Research and Extension</p> <p>Division of Industrial Research and Extension</p> <p>The Institute of Agricultural Sciences, which includes</p> <p>College of Agriculture</p> <p>Agricultural Experiment Station</p> <p>Agricultural Extension Service</p> <p>College of Veterinary Science</p> <p>College of Home Economics (only activities associated with Agricultural Experiment Station and Agricultural Extension)</p> <p>This reorganization initiated a three-way discussion between the two new Institutes and President Compton regarding the governance of Agricultural Engineering: should it be administered by Engineering or Agriculture? The Institute of Agricultural Sciences sent an eight-page letter dated Oct. 10, 1947 to President Compton (Appendix C) offering its proposal and supporting arguments. It proposed that Agricultural Engineering report to the Dean of Engineering regarding B.S. and graduate programs in Agricultural Engineering, and to the Dean of Agriculture regarding Farm Engineering service courses in Agriculture and the Farm Engineering option of the B.S. in Agriculture degree. The Department's research and extension activities would be under the governance of the Institute of Agricultural Sciences. All State and Federal support for the Department's teaching, research and extension would come from the Institute of Agricultural Sciences. The Institute of Technology would provide no funding to Agricultural Engineering. Both Institutes agreed to this arrangement on Oct. 10, 1947. President Compton approved it Nov. 1, 1947. These letters are included in Appendices D and E.</p>
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1946	<p>The Department's research mission expanded and was enhanced by the allocation of "permanent" funds from the Agricultural Experiment Station (AES). These "permanent" funds majorly expanded the research mission of the Department enabling the employment of additional faculty and providing operating funds to support research in all fields of agricultural engineering—soil and water, farm structures, power and machinery, rural electrification and crop processing. Previously, the Department's only funded research was a program in rural electrification financed by private utility companies through the Washington Farm Electrification Committee.</p> <p>Albert Molenaar appointed Associate Professor and Associate Agricultural Engineer. Mr. Molenaar earned B.S. in Agricultural Engineering from University of Nebraska (1933) and M.S. in Irrigation Science from University of California Davis (1938). He replaces Mr. Hinz.</p> <p>Agricultural Engineering again chose not to be included in ECPD re-inspection of WSC engineering curricula. Future accreditation of Ag E program becomes a WSC priority.</p> <p>Irrigation Practices course revised and new irrigation course entitled Irrigation Principles and Practices added.</p> <p>Irrigation Practices (3 hrs)—increased credit to 3 hrs and new course description</p> <p>Soils 16: Soil Management under Irrigation required. Conveyance of water, methods of measuring water, methods of applying water to land, study of irrigation efficiency, and the design and operation of small pumping plants. Laboratory will include two trips to irrigated areas. Mr. Hinz</p> <p>Irrigation Principles and Practices (3 hrs) added</p> <p>Soils 1: Soils required. The use of water under various methods of irrigation; basic soil and water relations; crop water requirements; farm irrigation structures; water measurement; and irrigation costs. Mr. Hinz</p>
1947	<p>June Roberts appointed Professor and Chair of Agricultural Engineering July 1, 1947. Mr. Smith continues in department as the "State Professor of Agricultural Engineering."</p> <p>Homer D. McGhie appointed Instructor and Junior Agricultural Engineer. Mr. McGhie has B.S. in Agricultural Engineering from University of Minnesota. This is a new position.</p> <p>Department moves from Wilson Hall into new Agricultural Engineering Building in Aug.. The total cost of new building was approximately \$155,000.</p> <p>Walter E. Matson appointed Instructor and Jr Agricultural Engineer Aug. 15, 1947. This is a new position. Mr. Matson has B.S. in Agricultural Engineering from WSC (1947).</p> <p>John E. George appointed Staff Agricultural Engineer. Mr. George has B.S. in Agriculture (Farm Engineering) from the University of Idaho (1947). He would later earn a B.S. in Agricultural Engineering from WSC in 1956 and a M.S. in Agricultural Engineering from the University of Idaho in 1957.</p>
1948	<p>B.S. in Agriculture minor renamed Farm Mechanics (previous name was Farm Engineering).</p> <p>Robert O. Gilden appointed Instructor and Jr Agricultural Engineer. This is a new position. Mr. Gilden has a B.S. in Agricultural Engineering from WSC (1947).</p> <p>David H. Hartzog appointed Instructor of Agricultural Engineering Education. New position, half of which is supported by the State Board for Vocational Education. Mr. Hartzog has B.S. from Oregon State College (1940).</p>
1949	<p>Paul K. Fanning begins as Extension Agricultural Engineer July 18, 1949. He earned B.S. from Kansas State College (1937) and replaces Richard N. Miller who passed away.</p>
1950	<p>William O. Pruitt appointed Junior Agricultural Engineer at IAREC in Prosser. Mr. Pruitt earned B.S. and M.S. degrees in Agricultural Engineering from WSC in 1949 and 1951.</p> <p>New Agricultural Engineering Building named in honor of Leslie J Smith, Head of the Department of Agricultural Engineering from 1920 to 1947. Dedication ceremony held Nov. 18, 1950.</p> <p>B.S. in Agricultural Engineering accredited by the Engineering Council for Professional Development (ECPD, renamed ABET, Accreditation Board for Engineering and Technology in 1980).</p> <p>Began separate listing of Agricultural Engineering courses in College of Engineering section of Catalog. Farm Mechanics courses listed in College of Agriculture section.</p>
1951	<p>Robert A. Aldrich appointed Acting Instructor. Mr. Aldrich has B.S. of Agricultural Engineering from WSC (1950). He replaces Mr. Gilden.</p> <p>John E. George promoted to Instructor. Replaces Mr. McGhie.</p>

1952	Max C. Jensen appointed Assoc Prof and Assoc Ag Engineer Sept. 1, 1952. Mr. Jensen earned B.S. (1939) and M.S. (1940) in Agricultural Engineering from University of Idaho. He replaces Mr. Molenaar. Mr. Jensen's expertise is irrigation engineering, water resource development, and soil and water conservation engineering.
1953	W. H. Johnson resigned Aug. 1953 to accept employment with the Farm Practices Department of International Harvester Company in Chicago, IL. Replaced by Moses J. Morgan Sept. 1953. Mr. Morgan has B.S. from Texas A&M and M.S. from Oklahoma A&M.
1954	In his annual report to President French, Mr. Roberts highlights the following: There is a lack of students majoring in Ag E, but encouraged to have 18 freshman, 4 or 5 of whom are outstanding students. Major problem is finding students with adequate high school preparation. L. J. Smith Building designed for teaching only with no space for storage or for research activities. A building addition needed. Difficult to give students fundamental engineering training, the general college requirements, and in many cases advanced military training, in four years. Five-year B.S. in Agricultural Engineering being considered.
1957	Donald A. Backus appointed Acting Instructor. Mr. Backus earned a B.S. in Agricultural Engineering from WSC (1957). His interest area is farm structures. This is a new position. James A. (Pat) Middleton appointed Assistant Agricultural Engineer at IAREC in Prosser. Mr. Middleton earned a B.S. in Civil Engineering from what is now New Mexico State University in 1950. He replaces William O. Pruitt who resigned in Dec. 1956 to take a position at the University of California Davis where he would pioneer the field of measuring and predicting irrigation water requirements of crops. Mr. Pruitt received a WSU Alumni Achievement Award in 1986.
1959	John B. Simpson appointed instructor. Mr. Simpson has B.S. (1958) and M.S. (1964) degrees in Agricultural Engineering from WSC/WSU. His expertise is farm machinery and engines. He replaces Mr. Aldridge.
1960	B.S. in Agriculture minor renamed Agricultural Mechanization (previous name was Farm Mechanics). C. Alan Pettibone appointed Research Agricultural Engineer with the Agricultural Research Service. Mr. Pettibone has B.S. degrees in Agriculture (1954) and Agricultural Engineering (1960) from WSC/WSU. Dr. Albert E Powell appointed Assistant Professor and Assistant Agricultural Engineer replacing Mr. Backus who resigned July 1, 1960. Dr. Powell, the first Agricultural Engineering faculty member with a Ph.D., brings expertise in farm structures and animal environments.
1961	Melvin A. Hagood appointed Acting Extension Agricultural Engineering Specialist. Mr. Hagood is located at IAREC in Prosser. Mr. Hagood has a B.S. from Oregon State College (1948) and a M.S. from the University of California (1960). Everett H. Davis appointed Extension Agricultural Engineer. Mr. Davis has a B.S. in Agricultural Engineering from Oregon State College (1934) and a M.S. in Agricultural Engineering from the University of Idaho (1955). He replaces Mr. Fanning who resigned to take an international assignment.
1963	Agricultural Extension Service assigns Extension Agricultural Engineers Everett Davis and Mel Hagood to the Department. They now report to the department chair and are housed in the department with teaching and research faculty. Mr. Everett has an office in Spillman Hall, and after the 1968 remodel, in the L. J. Smith building. Mr. Hagood's office remains at the experiment station in Prosser. This is a major change in Extension Administration. Previously, all specialists reported to the State Leader of Extension Programs and were officed together on the second floor of the Administration Building, now Thompson Hall, and since the late 1940s, Troy Hall and two temporary quonset huts. Some specialists had offices at the experiment stations in Prosser and Puyallup. Department chairs are now, for the first time, officially responsible for extension work. They now report to the Director of Extension through the State Leader of Extension Programs regarding all Extension personnel and programming in their department's subject matter area. C. Alan Pettibone appointed Acting Instructor while Walter Matson is on professional leave.

1964	<p>Department joins other College of Engineering programs in offering newly approved Ph.D. in Engineering Science. Eric B. Wilson appointed Extension Agricultural Engineer. He earned a B.S. from Montana State University and a M.S. from Cornell University. His expertise is rural electrification, farm structures and housing, and frost control. After one year in Pullman he moved to IAREC in Prosser.</p>
1965	<p>Institutes of Technology and Agricultural Sciences eliminated and replaced by the colleges of Engineering and Agriculture, respectively. The chief officer of each college is a dean, who is responsible for all teaching, research, and extension/outreach personnel, programs, and facilities in their respective college.</p> <p>C. Alan Pettibone appointed Assistant Professor and Assistant Agricultural Engineer after earning M.S. in Agricultural Engineering from WSU (1965). He replaces Mr. Matson.</p>
1966	<p>Gene T. Thompson hired July 18, 1966 to fill in for Mr. Jensen while he takes leave for an international assignment. Mr. Thompson had many temporary teaching, research and international assignments in the department until 1974 when he earned a Ph.D. in Civil Engineering from WSU and was appointed Associate Professor and Associate Agricultural Engineer replacing Dr. Mueller. He resigned in 1976 and was employed by Harza Engineering in Chicago until 1979 when he returned to WSU. He served as Extension irrigation engineer at IAREC in Prosser until 1981.</p> <p>Long-range plan developed for growing the department and making research and graduate teaching the backbone of the department. Major goals included: (1) Maintain ECPD accreditation for the B.S. in Agricultural Engineering degree*. (2) Participate in the Engineering Science Ph.D. program. (3) Develop a set of advanced agricultural mechanization courses that provide: Advanced service courses for other agricultural disciplines, M.S. training in Agricultural Mechanization, A new route of graduate training for foreign students (4) Focus undergraduate, graduate, and research programs in two areas of specialization: Soil and water—includes irrigation, drainage, conservation, reclamation, water quality, and plant-water relations. Food production and processing systems—includes portions of all four traditional divisions of agricultural engineering in a systems approach to production, harvesting, processing, handling, and storage of fresh and processed food. (5) Strengthen the soil and water graduate program. (6) Establish a strong graduate program in food production and processing systems.</p> <p>Major strategies for achieving these goals included: (1) Upgrading the faculty by: (a) Filling vacant positions with Ph.D. trained personnel, (b) Encouraging younger faculty members to earn Ph.D. degrees, (c) Encouraging exchange of visiting scientists and engineers, (d) Encouraging close cooperation with industry, (e) Integrating research, teaching, and extension programs with joint extension, research, and/or teaching appointments. (f) Adjusting faculty appointments to meet critical extension and research problems as they arise. (g) Pursuing cooperative research and teaching programs with the University of Idaho</p> <p>* The plan noted that Agricultural Engineering Departments at a few universities (Michigan State, Ohio State, and North Carolina State) were incorporating a strong core of biological science in their curriculum. WSU faculty saw both positives and problems with this approach. They agreed to monitor the movement toward bioengineering and to make curriculum changes appropriate to the needs of WSU graduates.</p>
1967	<p>WSU Regents authorize \$222,350 for additions and remodeling of L. J. Smith Agricultural Engineering Building. Charles L. Peterson begins Sept. 20, 1967 in Simpson position while Mr. Simpson is on leave for Ph.D. study at Cornell University. Upon Dr. Simpson's return, Mr. Peterson fills in for Mr. Pettibone while he is on education leave for Ph.D. study at Cornell University.</p>
1968	<p>Addition and remodel of L. J. Smith Agricultural Engineering Building completed fall 1968. Total cost of project \$534,275.</p>
1969	<p>Dr. Charles C. Mueller appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Mueller has expertise in saturated and unsaturated flow of water through soils. This is a new position.</p> <p>Everett Davis retires Oct. 28, 1969</p>

1970	<p>B.S. in Agricultural Mechanization first appears in WSU Catalog.</p> <p>Donald Floyd Johnson first B.S. Agricultural Mechanization graduate Feb 5, 1970.</p> <p>Max Jensen resigns July 1, 1970 to take foreign assignment in Turkey.</p> <p>James H. Milligan appointed Extension Agricultural Engineer. Dr. Milligan's expertise is water resources. He replaces Mr. Davis.</p>
1971	<p>Dr. Keith O. Eggleston appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Eggleston's area of expertise is water resources and hydraulics. He also has experience in simulations and modeling with analog, digital, and hybrid computers. He replaces Mr. Jensen.</p> <p>Hosted 1971 American Society of Agricultural Engineers (ASAE) National Convention</p> <p>Dr. Donald K. McCool, USDA-ARS Agricultural Engineer, given courtesy appointment as Associate Professor. Dr. McCool's expertise is soil erosion, sedimentation, and water quality.</p>
1970-1975	<p>Faculty members Simpson, Pettibone, Bassett, Peterson, and Thompson complete Ph.D. programs. All faculty members with teaching and research appointments except June Roberts and John George now have Ph.D.s.</p>
1973	<p>Dr. Ron Hermanson and Dr. Henry Waelti begin as Extension Specialists replacing Mr. Wilson who retired in 1971 and Dr. Milligan who resigned in 1972 to take a faculty position in Civil Engineering at the University of Idaho. Dr. Milligan was chair of the U. of I. Civil Engineering Department for many years.</p> <p>Dr. Hermanson specializes in agricultural waste management and rural water supply.</p> <p>Dr. Waelti specializes in energy, structures, and mechanization.</p>
1974	<p>Dr. Larry G. King appointed Professor and Agricultural Engineer. Dr. King's areas of interest are irrigation, drainage, porous media flow, soil and water conservation, and water quality. He replaces Dr. Eggleston who took a job with the U.S. Bureau of Reclamation in Denver.</p>
1975	<p>June Roberts retires and C. Alan Pettibone appointed Associate Professor and Chair July 1, 1975. This was the first time that the title became Chair (meaning it is a fixed term appointment, not open ended).</p> <p>Dr. Gary M. Hyde appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Hyde's expertise is machinery, control systems, and materials handling. Replaces Mr. Roberts?</p>
1976	<p>USDA-ARS Agricultural Engineer Dr. Keith E. Saxton appointed courtesy associate professor. Dr. Saxton's areas of expertise are hydrology and water stress modeling.</p> <p>Dr. Denny C. Davis appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Davis' expertise: food quality measurement, processing and storage, solar energy, machinery, and process dynamics.</p> <p>Dr. Glenn A. Kranzler appointed Assistant Professor and Assistant Agricultural Engineer. His expertise is electric power & processing, instrumentation, microcomputers, and solar & biomass energy.</p>
1977	<p>Dr. Larry G. James appointed Assistant Professor and Assistant Agricultural Engineer, replacing Dr. Thompson who resigned to take a position with Harza Engineering in Chicago. Dr. James' expertise areas are hydrology, water infiltration and movement in soils, irrigation engineering, and crop water requirements.</p> <p>B.S. in Agricultural Mechanization (Ag M) recognized by the American Society of Agricultural Engineers (ASAE), the first year that ASAE began recognition of Ag M curricula in the United States.</p>
1979	<p>Larry G. King appointed Professor and Chair upon resignation of Dr. Pettibone to become Associate Dean and Director of Resident Instruction in WSU College of Agriculture and Home Economics. Dr. Pettibone began as Associate Dean July 1, 1979 and continued as Acting Chair until Dr. King became chair Nov. 1, 1979.</p> <p>Dr. William Symons appointed Assistant Professor and Extension Agricultural Engineer, replacing Dick Linhardt who resigned to accept a position at the University of Missouri. Dr. Symons' expertise is vocational agriculture education and farm safety.</p> <p>Dr. Gene Thompson appointed Extension Irrigation Engineer at IAREC Prosser replacing Mel Hagood who retired July 1, 1977</p>

1980	Dr. Robert G. Evans appointed Research Agricultural Engineer at IAREC in Prosser, replacing Pat Middleton who retired April 30, 1980. Dr. Evan's areas of expertise are irrigation and soil-water relationships.
1983	Thomas W. Ley appointed Extension Irrigation Engineer at IAREC in Prosser, replacing Dr. Thompson Dr. Marvin J. Pitts appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Pitts' interests include physical properties of biological materials, computer modeling applications in agriculture control systems, finite element modeling of biological materials, and electronic instrument design.
1985	Dr. Ralph P. Cavalieri appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Cavalieri's primary specialization is process engineering with particular emphasis on process kinetics, biosensors, instrumentation, and controls. Dr. Cavalieri replaces Dr. Glenn Kranzler. Dr. Kranzler took a position at Oklahoma State University, Department of Biosystems and Agricultural Engineering.
1986	Dr. Denny Davis appointed associate dean, undergraduate programs and administration, College of Engineering and Architecture (3/4-time), remaining 1/4-time in department.
1989	Dr. Claudio O. Stockle appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Stockle's focus is the development and application of analytic tools to study, understand, and manage the interaction between soil, weather, and crops.
1990	Dr. Gustavo Barbosa-Canovas appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Barbosa's primary interest is finding effective and less harmful methods of preserving food through the study, development, and application of non-thermal technologies. Dr. Cavalieri appointed interim chair.
1992	B.S. in Agricultural Mechanization renamed B.S. in Agricultural Technology and Management. Approved by Board of Regents June 26, 1992. WSU Regents approve renaming of existing B.S. in Agricultural Engineering to B.S. in Biological Systems Engineering and a corresponding name of the Department of Agricultural Engineering to Department of Biological Systems Engineering. James E. Durfey appointed Instructor in Agricultural Technology and Management Program. Dr. Cavalieri appointed chair.
1993	Administrative responsibility for the WSU Agricultural Education program and three Agricultural Education faculty, Drs. Cvacara, Nelson, and Kleene, assigned to the Department.
1995	Dr. Juming Tang appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Tang brings expertise in microwave pasteurization, microwave sterilization of food, and low moisture food safety. Dr. Shulin Chen appointed Assistant Professor and Assistant Agricultural Engineer. Dr. Chen's interests are industrial biotechnology, developing bioconversion processes and systems for the production of biofuel, bioenergy, and bioproducts.
1997	Dr. Michael Swan appointed Associate Professor. Dr. Swan has expertise and experience in agricultural education and distance education.
1998	Dr. Brian G. Leib appointed Extension Irrigation Engineer at IAREC Prosser. Dr. Leib replaces Dr. Ley.
1999	Dr. Denny Davis appointed Interim Director, Center for Precision Agricultural Systems
2000	Dr. Denny Davis appointed Professor and Chair, Biological Systems Engineering (April 2000) Dr. Francis Pierce appointed Professor and Director of Center for Precision Agricultural Systems at IAREC in Prosser. This is a new position funded by the Washington Legislature.

2001	<p>Dr. Claudio Stockle appointed Chair, Biological Systems Engineering (Oct., 2001), replacing Denny Davis, who is serving as Interim Director of Bioengineering Program (Oct. 2001—July, 2004).</p> <p>Dr. David C. Lin appointed Assistant Professor and Scientist. Dr. Lin brings expertise in the integrated mechanical properties of skeletal muscle and spinal reflexes.</p> <p>Dr. Anita Vasavada appointed Assistant Professor and Assistant Scientist. Dr. Vasavada's interest is biomechanics and neural control of the musculoskeletal system, focusing on the human head and neck system.</p> <p>Dr. Carter D. Clary appointed Assistant Professor and Assistant Scientist. Dr. Clary's expertise is microwave dehydration of fruits and vegetables.</p> <p>Dr. Clyde Fraisse appointed Assistant Water Management Engineer IAREC Prosser. Dr. Fraisse replaces Dr. Evans who re-signed in Dec. 2000 to take a USDA-ARS position in Sidney, MT as Supervisory Agricultural Engineer and Research Leader.</p>
2004	<p>B.S. in Biological Systems Engineering discontinued. Only graduate BSE degrees offered. B.S. in Agricultural Technology and Management and Agriculture degrees continue.</p> <p>Dr. Joan Wu appointed Associate Professor and Associate Scientist. Dr. Wu's interest is the broad area of hydrology, with specific interests in stochastic modeling of vadose-zone flow and solute transport; simulation of ground water flow and contaminant transport; field investigation and computer modeling of water erosion; and application of GIS and remote sensing to hydrologic studies.</p> <p>Dr. Pius M Ndegwa appointed Assistant Professor and Assistant Scientist. Dr. Ndegwa is primarily interested in the development of sustainable livestock manure management systems, air and water quality control engineering, bio-energy and bio-fuels, and livestock odor emission control technologies.</p>
2005	<p>Dr. Denny Davis became Director, Engineering Education Research Center, joint between College of Engineering and Architecture and College of Education.</p>
2006	<p>Agricultural Technology and Management and Agricultural Education programs transferred to Agricultural and Food Systems Program in College of Agricultural, Human, and Natural Resource Sciences.</p> <p>Drs. Lin and Vasavada reassigned to Department of Chemical Engineering and Bioengineering.</p> <p>Dr. R. Troy Peters appointed Extension Irrigation Specialist and Associate Research Scientist at IAREC in Prosser. Replaces Dr. Leib who resigned in 2003 to take a faculty position at the University of Tennessee.</p> <p>Dr. Jeffrey L. Ullman appointed Assistant Professor. Dr. Ullman's focus is environmental chemistry and toxicology of emerging contaminants, metals, and pathogens. Topics of interest include impacts of endocrine disrupting chemicals, sediment remediation, vegetative filter strips, and development of treatment technologies for industry and agriculture.</p>
2007	<p>Dr. Manuel Garcia-Perez appointed Assistant Professor and Assistant Scientist. Dr. Garcia-Perez works in the broad area of bioenergy and bioproducts engineering, with specific interest in converting biowastes, such as forest residues, sugar cane bagasse, triglycerides, sugars, and starch, into transportation fuels and chemicals.</p> <p>Dr. Shyam S. Sablani appointed Assistant professor and Assistant Scientist. Dr. Sabiani's research focus is the application of materials science and transport phenomena to innovative packaging solutions to improve food safety and quality.</p>
2008	<p>Dr. Brigitte K. Ahring appointed Professor and Scientist. Dr. Ahring works in the general area of biomass conversion to biofuels and high-value products.</p>
2009	<p>Dr. Bin Yang appointed Assistant Professor and Assistant Scientist. Dr. Yang's interest is the development of renewable energy technologies with particular emphasis on production of biofuels and chemicals from cellulosic feedstocks and other sustainable resources.</p> <p>Dr. Hanwu Lei appointed Assistant Professor and Assistant Scientist. Dr. Lei's focus is discovering and applying novel approaches for biofuels and bioproducts development, renewable energy technologies, and cost-effective biomass conversion technologies.</p> <p>Dr. Qin Zhang appointed Professor and Director of WSU Center for Precision and Automated Agricultural Systems, Prosser.</p>

2010	Dr. Gerritt Hoogenboom appointed Professor and Director of AgWeatherNet at IAREC in Prosser. Dr. Manoj Karkee appointed Assistant Professor and Assistant Scientist. Dr. Karkee's expertise is automated and autonomous agricultural machinery systems, field robotics, and machine intelligence for production agriculture; and in agricultural systems modeling, simulation, and control.
2011	Added M.S. and Ph.D. degrees in Biological and Agricultural Engineering. Continuing to offer M.S. in Engineering and Ph.D. in Engineering Science.
2012	Dr. Liang Yu appointed Associate in Research. Dr. Yu's interest is clean fuel production, renewable energy technology, organic waste and waste treatment, and bioprocess development, scale-up and intensification. Dr. Denny Davis retires May 15, 2012.
2013	Department offers only M.S. and Ph.D. degrees in Biological and Agricultural Engineering. Dr. Sindhuja Sankaran appointed Assistant Professor and Scientist. Dr. Sankaran's interest is sensor technologies for crop phenotype monitoring to support plant breeding, crop plant research, and precision agriculture applications. Dr. Larry James retires.
2014 2015	Dr. Melba R. Salazar-Gutierrez appointed Assistant Research Professor. Dr. Salazar's interest is the development and integration of opto-electronic, biological, and chemical sensor technologies for noninvasive, rapid, continuous monitoring of plant responses to environment, abiotic and biotic stressors, and other applications. Dr. Lav R. Khot appointed Assistant Research Professor. Dr. Khot's focus is sensing and automation technologies for site specific and precision management of production agriculture.
2020	Dr. Kirti Rajagopalan appointed Assistant Professor and Assistant Scientist. Dr. Rajagopalan's interests include modeling human and regulatory influence on natural systems, food-water nexus and coupled crop-hydrology modeling, data assimilation/integration of satellite imagery inputs to models, weather/climate risk assessment and management in crop production, decision support for regional-scale water and agricultural management, and water markets and decision making.
2021	Dr. Claudio Stockle retires Dec. 30, 2021. Dr. Lav R. Khot appointed interim director of AgWetherNet.

Agricultural Engineering and Biological Systems Engineering

A Departmental History

By Larry G. James

Life on the farm was rugged and strenuous when the Washington State Agricultural College and School of Science, now Washington State University, opened on January 13, 1892. Only a few Washington farms had telephones, running water, or electricity. Draft animals and human sweat were the primary sources of farm power. While there were only 900 farm tractors nationwide, more than 40 percent of the nation's labor force was farmers.

Washington agriculture has changed dramatically since then. Today, machines do most of the farm work once done by humans and animals. New automated food production and processing systems utilizing artificial intelligence technologies, including machine vision and robotics, are being developed and deployed. Electricity and wireless broadband are readily accessible throughout most Washington rural areas. Nationally, farm and ranch families now comprise less than two percent of the US population and each US farm feeds 166 people.

The WSU Department of Biological Systems Engineering, (originally Agricultural Engineering) has played an important role in this transformation. The Department's teaching programs produced engineers, educators, farmers, agriculturalists, and leaders who helped fuel the transformation. Research conducted by department faculty and students has contributed to many environmentally friendly technologies that increase productivity and sustainability, while reducing costs and improving rural life. The Department's outreach programs have facilitated the application and adoption of many of these technologies.

The following pages trace the Department's long and rich heritage from the beginning of WSU to the present. Some of the people, major events, and societal trends influencing the department's formation and evolution are highlighted.

Birth of the Department

The importance of agricultural engineering was recognized from the beginning of Washington's new land grant college. Two "shop work" courses—one covering carpentry and another devoted to "work in iron"—were listed in the Horticulture section of the College's first Catalog in 1892. In 1894, Civil Engineering offered an irrigation course covering "the construction of dams, the location of canals, fluming, weirs, the flow of water in open channels, and the gauging of streams." A year later, in 1895, the Department of Agriculture added a course called Agricultural Physics, which addressed "the principles of physics as applied to agricultural and dairy machinery, the construction and ventilation of farm buildings, the construction of silos, and as affecting soil moisture." The latter subject included drainage, irrigation, evaporation, and methods of tillage.

A course titled Farm Engineering replaced Agricultural Physics in the 1898 Catalog. This course provided instruction in "the principles of drainage, irrigation, road making, construction of buildings, fences, etc., and the mechanical principles involved in farm machinery." Later in 1905, the same year that the State Agricultural College and School of Science was renamed Washington State College (WSC), Farm Engineering was renamed Rural Engineering. In 1907, a dairy machinery course that included "a comprehensive study of the different kinds and makes of dairy machinery, including principles involved in separation, pasteurization, refrigeration, cream ripening, churning, cheese-making, and testing" was first offered in the Dairy Manufactures Program.

Hiring Irving D. Charlton—the first faculty member in the Department of Agriculture with an engineering degree—to teach rural engineering was a major step in, and commitment to the development of agricultural engineering. Mr. Charlton, who earned a B.S. in mechanical engineering from the Michigan Agricultural College, was appointed Instructor in

Farm Mechanics in 1910. By 1913 he had grown the Farm Mechanics program to include three courses: Farm Machinery and Farm Motors, Traction Engine Practice, and Farm Buildings and Conveniences. In 1914, the Farm Mechanics program was renamed Agricultural Engineering, and in 1915, a second agricultural engineering faculty member, Leonard B. Fletcher, was hired. Mr. Fletcher had a B.S. from Iowa State College.

The Division of Agricultural Engineering was established during President Ernest Holland's WSC reorganization in 1917. James P. Fairbank, who had replaced Mr. Fletcher in 1916, was named Acting Head of Agricultural Engineering. A year later in 1918, Mr. Fairbank was promoted to Assistant Professor and Head. In 1919, he became Professor and Head.



L. J. Smith in 1936

L. J. Smith 1920-1947

Program Development and Public Service

Leslie John Smith became Professor and Head of Agricultural Engineering in 1920. He came to WSC with 14 years of college teaching and outreach experience: eleven years as Professor of Agricultural Engineering at Manitoba University in Winnipeg, Canada and three years as the instructor in charge of Farm Mechanics at the State College of Michigan where he previously earned B.S. and M.E. degrees in mechanical

engineering. Prior to college, he worked as a machinist and, for a short time, in building construction for his father. Professor Smith replaced Professor Fairbank who resigned June 15, 1920 "to pursue commercial interests."

Professor Smith led Agricultural Engineering as Department Head until 1947. During those 27 years, Professor Smith ably shepherded the Department through the Roaring 1920s, the budget and enrollment woes of the Great Depression, and the scarcity of male students during World War II. His tenure also included a period of unprecedented growth in WSC enrollment following World War II. Free tuition and weekly living expense stipends provided to World War II veterans by the GI Bill along with President Wilson Compton's well-publicized policy of admitting all academically qualified veterans encouraged wave after wave of student-veterans to enroll at WSC. Agricultural engineering enrollment grew during this time, especially in shop courses.

There was only one degree option—a B.S. in Agriculture with a minor in agricultural engineering—for students interested in Agricultural Engineering in 1920 when Professor Smith arrived. The B.S. in agricultural engineering was added in 1926. Its schedule of studies, which mirrored other WSC professional engineering degrees, was listed in the College of Mechanic Arts and Engineering section of the WSC Catalog to differentiate it from the minor for agriculture students. Further differentiation was achieved by changing the name of the minor to farm engineering. All agricultural engineering courses and the requirements for the farm engineering minor were listed in the College of Agriculture section of the Catalog.

There were twelve agricultural engineering courses listed in the WSC Catalog when Professor Smith came in 1920, and 25 at the end of his tenure in 1947. Initially, agriculture and engineering students were taught together in the same course. Later, spurred by engineering accreditation concerns, offerings were expanded to provide two sets of courses: one set of service courses for non-engineers and second set for engineering majors. All areas of agricultural engineering were included in both sets of courses.

Professor Smith and a junior faculty member taught all these courses until 1945 when a third faculty member, Walter Hinz, joined the faculty. Two more faculty positions were added, one in 1946 and the second

in 1947, after Agricultural Experiment Station funds were first allocated to the department in 1946. Faculty during Professor's Smith's tenure are listed in Table 1.

courses in Winter School: one in gas engines, and a second in tractors. These courses began early in January and were repeated each two weeks until spring. The department's involvement in Winter School continued until at least 1937 and possibly into the early 1960s.

The department's first formal research/outreach program began in 1925 when public utilities through

Table 1: Agricultural Engineering Faculty while L. J. Smith was Chair 1920-1947.

Faculty Member	Period of Service	Comments
Leslie J. Smith***	1920-1949	Professor and Department Head 1920-1947 (27 yrs), replaced Mr. Fairbank
Clarence Johnson*	1920-1933	Replaced Mr. Stirniman
Harry L. Garver	1925-1938	New externally funded research/outreach position
Arthur C. Jacquot	1933-1939	Replaced Mr. Johnson
W. A. Junnila	1938-1940	Replaced Mr. Garver
Orville J. Trenary	1939-1944	Replaced Mr. Jacquot
June Roberts**	1940-1975	Replaced Mr. Junnila
William H. Johnson**	1945-1953	Instructor, replaced Mr. Trenary
Walter W. Hinz	1945-1947	New position
Aldert Molenaar**	1946-1950	Replaced Mr. Hinz
Homer D. McGhie**	1947-1951	New position

*Faculty member at beginning of Professor Smith's time as chair

**Faculty member at end of Professor Smith's time as chair

***Faculty member at beginning and end of Professor Smith's time as chair

Agricultural engineering had a key role in WSC outreach efforts to improve life on the farm and the efficiency of farmers during this period. Professor Smith wrote over 350 articles for farm papers and magazines plus giving numerous radio talks during his WSC career. He covered a wide range of agricultural engineering topics including rural electrification, farm structures, farm irrigation, how to build a silo, improved milking parlors, and the farm shop. He also authored over 30 extension bulletins on similar topics and developed numerous plans for farm buildings and houses published and disseminated by USDA.

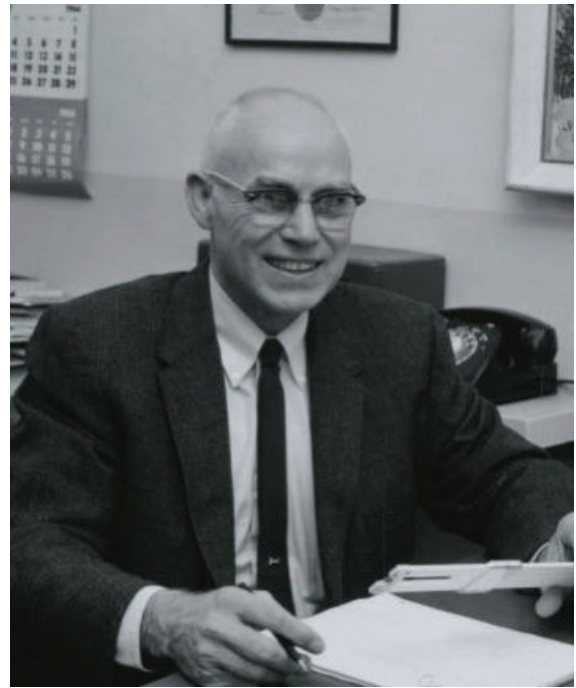
In addition to Professor Smith's outreach efforts, the department began offering courses in the College of Agriculture Winter School, later called Winter Shortcourse, and in 1956, Extension Winter Shortcourse. Winter school was offered annually for eight weeks beginning in January to any member of the public "regardless of previous education." For many years, agricultural engineering offered two 2-week

the Washington Farm Electrification Committee provided funding "to identify, develop, and encourage uses of electricity in agriculture." Harry L Garver was hired with these funds and was appointed investigator, the first full-time research/outreach position in agricultural engineering. Mr. Garver, a 1922 WSC B.S. in engineering graduate, accepted a research position with USDA in 1938 and was replaced by W. A. Junnila. In 1940, June Roberts was hired to replace Mr. Junnila. This program continued into the 1960s.

The department's research mission was significantly expanded in 1946 when it began receiving "permanent" funding from the Agricultural Experiment Station. This investment in Agricultural Engineering was driven by the State's post-war economic development goals and President Wilson Compton's vision of WSC being "a great center of industrial and agricultural technologies ..." The investment was also driven by rapid agricultural development and mechanization that was occurring throughout the State, especially in

the Columbia Basin where more and more land was being irrigated following the completion of Grand Coulee Dam in 1942. These trends caused many Institute of Agricultural Sciences citizen advisory boards to call for increased research in farm machinery and mechanization, irrigation and drainage, farm structures, food processing, and rural electrification. The Institute of Agricultural Sciences responded by allocating Agricultural Experiment Station funds to Agricultural Engineering in 1946.

Additionally, the Institute of Agricultural Sciences recommended the construction of a new 15,660 square foot building for Agricultural Engineering. The project was strongly endorsed by Washington Vocational Agricultural Education who recognized that larger and better equipped laboratories were essential to strengthening farm machinery and shop instruction provided in Agricultural Engineering. The WSC Board of Regents approved what would become a \$155,000 Agricultural Engineering Building on Aug. 22, 1945. The Department moved into the new building two years later in Sept. of 1947. It was dedicated and named the L. J. Smith Agricultural Engineering Building on Nov. 18, 1950, honoring Professor Smith's many years of tireless leadership and service.



June Roberts in 1966

June Roberts 1947-1975 Department Expansion with a Research Mandate

June "Butch" Roberts was appointed Head of Agricultural Engineering effective July 1, 1947. Professor Roberts had worked as an investigator in the department's externally funded farm electricity research/outreach program since 1940. He came to WSC from Kansas State College where he was a research assistant from 1933 to 1934, an instructor from 1935 to 1940, and a champion collegiate wrestler. He earned B.S. (1933) and M.S. (1934) degrees in agricultural engineering while at Kansas State College, one of four US colleges at the time with an ECPD accredited B.S. in agricultural engineering. A year before becoming head, and just after he returned from a three and a half year leave of absence to serve as a World War II naval officer, Mr. Roberts was promoted to associate professor and associate agricultural engineer.

Professor Roberts' tenure as head began as WSC was initiating a transformation "from a small college to a true university" (George Fryman, 1990, *Creating the People's University*). In his 1946 inauguration, President Compton said that by 1960 "I see a great center of industrial and agricultural technologies with modern laboratories, housing great scientists; a library which has it and can find it when you want it; a

Student Union, a congenial campus meeting place of 10,000 young men and women...” He quickly created the Institutes of Technology and Agricultural Sciences in 1946 to implement his vision. Thirteen years later, in 1959, the Washington Legislature approved changing the College’s name to Washington State University. And in 1952, the Compton Union Building, honoring President Compton opened. WSU enrollment reached 10,000 students in 1965.

When Professor Roberts began as head, the Department was moving into a new building, and had just acquired a formal research mission (when the department first received “permanent” Agriculture Experiment Station funds in 1946). Additionally, a question about the department’s administrative home—whether it would be in Engineering or in Agriculture—was being resolved. The question arose as President Compton was forming the Institutes of Technology and Agricultural Sciences. The desire for an accredited B.S. in Agricultural Engineering, a high priority for WSC, favored the Department being in Engineering. On the other hand, the strong dependence of agricultural curricula on the department’s service courses and the growing need for collaborative research and outreach to address increasingly complex agricultural problems were best served by having the department in Agriculture.

In an eight-page letter to President Compton dated April 4, 1947 (see Appendix A), the Institute of Agricultural Sciences offered its proposal and supporting arguments for having the chair of Agricultural Engineering report to the Dean of Engineering regarding B.S. and graduate programs in agricultural engineering, and to the Dean of Agriculture regarding the department’s service courses and farm engineering minor. It was also proposed that the department’s research and extension activities be the responsibility of the Institute of Agricultural Sciences, and that all state and federal support for the department’s teaching and research come from the Institute of Agricultural Sciences (departments were not responsible for extension programming until 1963). Additionally, the Institute of Technology would provide no funding to Agricultural Engineering. Both Institutes agreed to this arrangement October 10, 1947. President Compton approved it Nov. 1, 1947. These letters are included in Appendices B and C, respectively.

More faculty were added utilizing Agricultural Experiment Station funds. By 1950 the Department included eight faculty in Pullman, one in Prosser (Bill Pruitt), and an extension agricultural engineer (Paul Fanning). Most Pullman faculty had split research-teaching appointments. Faculty expertise spanned all fields of agricultural engineering. Professor Roberts explained in 1950:

During the last five years, the staff of the Department has been increased from two to eight (not including Extension and Prosser faculty). All staff members are employed and are expected to do both teaching and research. Most are employed on a half-time teaching and half-time research basis. Since most of the research is carried out during the summer months, it leaves more than half of their time available for teaching during the school year.

The B.S. in Agricultural Engineering degree was accredited in 1950 by ECPD, the Engineering Council for Professional Development, which became the Accreditation Board for Engineering and Technology, in 1980 and has used the acronym ABET since 2005. Having a new building, more faculty, a larger breadth of faculty expertise, and strong administrative support and coordination between the Institutes of Technology and Agricultural Sciences were key factors in securing accreditation. ECPD inspectors praised the quality of the faculty but were concerned about faculty “inbreeding,” that is, inspectors felt the department had hired too many of its graduates as faculty members.

The development of the department was also influenced by regular research program reviews conducted by the Cooperative State Research Service (CSRS). Reviews during the 1950s and early 1960s consistently found that departmental research would benefit from more dedicated laboratory space for research and the addition of Ph.D. trained faculty.

Professor Roberts first articulated research laboratory space concerns in the early 1950s:

The L. J. Smith Agricultural Engineering Building was designed before this Department was made part of the Agricultural Research Station, with a result of no room provided for research

facilities. This lack of space hampers our work and requires that the research be carried on in our teaching laboratories. Considerable equipment must be moved in and out of the laboratories to conduct the laboratory classes and to get the research done. This results in conflicts, some confusion, and cluttered laboratories. Teaching and research activities cannot be carried out at the same time in the same laboratories. There is not adequate space for both teaching and research in the current building.

Plans for the expansion and remodel of the L. J. Smith Agricultural Engineering Building were developed for inclusion in WSC's ten-year building plan developed in 1955. These initial plans proposed covering the courtyard between the machinery and engines laboratories (rooms 111 and 114) to create two new research laboratories. By 1962, this plan had evolved into a 13,800-square-foot addition and remodel that included covering the courtyard, adding a second story above the courtyard, and building a new south wing for the welding and metal shop areas. This plan doubled the number of offices, added two classrooms and a library/seminar room, doubled the size of the irrigation and electric power and processing laboratories, and added two large general purpose research laboratories.

The WSU Regents authorized architectural planning for the expansion and remodel project on Sept. 30, 1966, and entered into the construction contract on June 12, 1967. The project was completed in Sept. 1968 at a total cost of \$535,275.

The department developed a comprehensive long-range plan in 1966 as part of a university-wide planning effort led by Academic Vice President Wallis Beasley. The department's plan called for "growing the department and making research and graduate teaching the backbone of the department." Major goals included:

1. Maintaining ECPD accreditation for the B.S. in Agricultural Engineering¹.
2. Participating in the Engineering Science Ph.D. program.
3. Developing an advanced set of agricultural mechanization courses to provide
 - » Advanced service courses for other agricultural disciplines;
 - » M.S. training in agricultural mechanization;
 - » A new route of graduate training for foreign students.
4. Focusing undergraduate, graduate, and research programs in two areas of specialization:
 - » Soil and water—includes irrigation, drainage, conservation, reclamation, water quality, and plant-water relations.
 - » Food production and processing systems engineering—includes all portions of the four traditional agricultural engineering divisions in a systems approach to producing, harvesting, processing, handling, and storing fresh and processed food.

Major strategies for achieving these goals included:

1. Upgrading the faculty by
 - » Encouraging younger faculty members to earn Ph.D. degrees;
 - » Encouraging exchange of visiting scientists and engineers;
 - » Filling vacant positions with Ph.D. trained personnel;
 - » Encouraging and promoting close cooperation with industry.
2. Integrating research, teaching, and extension programs with joint extension and research appointments.
3. Adjusting faculty appointments to meet critical extension and research problems as they arise
4. Developing cooperative research and teaching programs with the University of Idaho.

1. The plan noted that agricultural engineering departments at a few universities (Michigan State, Ohio State, and North Carolina State) were incorporating a strong core of biological sciences in their curriculum. WSU faculty saw both positives and problems with this approach. They agreed to monitor the movement toward bioengineering and to make curriculum changes appropriate to the needs of WSU graduates.

The department immediately began implementing this plan. Specific actions included:

- » Five younger faculty members began Ph.D. programs. Professor Simpson, and later Professor Pettibone, took leaves of absence to pursue Ph.D.s at Cornell University and Professor Bassett took a leave to complete Ph.D. studies at the University of Idaho. Professors Thompson and Peterson pursued Ph.D.s in Engineering Science at WSU.
- » Ph.D. trained personnel were hired to fill open faculty positions. Drs Powell, Mueller, Milligan, Eggleston, and Waelti filled positions previously held by personnel without a Ph.D.. By the time Professor Roberts retired in 1975, all teaching and research faculty had a Ph.D. except Professors Roberts and George in Pullman and Mr. Middleton in Prosser.

» A talented and established research engineer, Dr. Larry King, was hired to replace Dr. Eggleston in 1974. Dr. King had a record of research and teaching excellence as well as proven success in acquiring outside funding when he joined the Department. His stature and experience in a research culture significantly improved the department's research program and profile.

Changes in the faculty during Professor Roberts' tenure as chair are detailed in Table 2.

Table 2. Faculty changes while June Roberts was head 1947-1975.

Faculty Member	Period of Service	Comments
Leslie J Smith*	1920-1949	Retired Sept. 16, 1949
June Roberts***	1940-1975	Head 1947-1975 (28 yrs)
William H Johnson*	1945-1953	Replaced Mr. Trenary
Aldert Molenaar*	1946-1952	Replaced Mr. Hinz
Homer D McGhie*	1947-1951	New position
Walter E Matson	1947-1965	New position
Robert O Gilden	1948-1951	New position
David A Hartzog	1948-1958	New position to oversee Farm Mechanics portion of Agricultural Education program
Paul K Fanning	1949-1961	Extension Specialist, replaced Mr. Miller
William O Pruitt	1950-1956	New position at IAREC
Robert A Aldrich	1951-1959	Replaced Mr. Gildin
John E George**	1951-1987	Replaced Mr. McGhie
Max C Jensen	1952-1970	Replaced Mr. Molenaar
Moses Morgan	1953-1959	Replaced Mr. Johnson
Day L Bassett**	1954-1989	Replaced Mr. Smith??
James E (Pat) Middleton**	1957-1980	Replaced Mr. Pruitt at IAREC
Donald A Backus	1957-1959	Replaced Mr. Hartzog
Patrick F Alleyn	1957-1959	Temporary position
John B Simpson**	1959-1999	Replaced Mr. Aldridge
Albert E Powell**	1960-1986	Replaced Mr. Backus

Faculty Member	Period of Service	Comments
Melvin A. Hagood**	1960-1977	Extension Specialist at IAREC
Everett H. Davis	1961-1969	Extension Specialist, replaced Mr. Fanning
Walter R. Friberg	1962-1969	Professor and Agricultural Engineering Advisor at West Pakistan Agricultural University
Eric B. Wilson	1964-1971	Extension Specialist at IAREC, new position
C. Alan Pettibone**	1965-1996	Replaced Mr. Matson. Became faculty member in both Agricultural Engineering and Food Science and Technology beginning in 1970 (FTE remained in Ag E).
W. Kenneth Bach	1965-1968	Professor and Agricultural Engineering Advisor at University of Peshawar, Pakistan
Charles L. Peterson	1967-1973	Replaced Mr. Simpson and Mr. Pettibone while they took Ph.D. study leaves at Cornell University. Later supported by Washington State Potato Commission.
Charles C. Mueller	1968-1973	New position (offsets Morgan resignation)
James H. Milligan	1970-1972	Replaced Mr. Davis as Extension Specialist
Gene T. Thompson**	1966-1976	Mix of temporary teaching, research, and international assignments until 1973 when he replaced Dr. Mueller who resigned to take civil engineering position at California State University Chico.
Donald K. McCool**	1971-2020	USDA-ARS courtesy appointment
Keith O. Eggleston	1971-1973	Replaced Mr. Jensen
Henry Waelti**	1973-1995	Extension Specialist, replaced Mr. Wilson
Ronald E. Hermanson**	1973-1996	Extension Specialist, replaced Dr. Milligan who resigned to take a civil engineering position at the University of Idaho
Larry G. King**	1974-1998	Replaced Dr. Eggleston

*Faculty member at beginning of Mr. Roberts' time as head.

**Faculty member when Mr. Roberts retired in 1975.

***Faculty member at beginning and end of Mr. Roberts' time as head.

Other Major Changes During Professor Roberts' Tenure as Head

Irrigated Agriculture Research and Extension Center

The Department's relationship with the Irrigated Agriculture Research and Extension Center (IAREC) began in 1950 when the Institute of Agricultural Sciences created an irrigation engineering position in response to post-war, public pressure for irrigation research. William O. Pruitt, with a B.S. (1949) and M.S. (1951) in Agricultural Engineering from WSC, was IAREC's first irrigation engineer. During his six years in Prosser, Mr. Pruitt innovated the use of evaporation pans and weighing lysimeters to quantify crop

irrigation requirements. He worked very closely with Professor Jensen before leaving IAREC in December 1956 to continue his work at the University of California, Davis. In 1986, Mr. Pruitt received a WSU Alumni Achievement Award recognizing him as a world renown pioneer in the field of crop irrigation requirement measurement and prediction.

James A. (Pat) Middleton, who received a B.S. in Agricultural Engineering in 1950 from what is now New Mexico State University, replaced Mr. Pruitt Aug. 1, 1957. Mr. Middleton collaborated with Professors Jensen and Bassett to develop and refine a method of scheduling irrigations and estimating crop irrigation requirements based on pan evaporation measurements. He also had a major role in the development and adoption of trickle irrigation in Washington.

Melvin A Hagood was the first extension irrigation engineering specialist at IAREC. He began in 1961, after being an extension agent in Grant County for 10 years and leading the Settlers Assistance Program. This US Bureau of Reclamation funded program helped new settlers in the Columbia Basin clear, level, and develop farms for irrigation. Mr. Hagood was responsible for training and providing technical assistance to as many as 28 Settlers Assistance Agents involved in surveying for farm unit boundaries, land leveling, and water distribution systems as well as overall advising on farm development. (Professor Bassett was a Settler Assistance Agent prior to joining the Department in 1954.)

Food Science Partnership

Formal ties between agricultural engineering and food scientists at WSU began in the 1960s when Professor Roberts was asked to serve on a committee considering whether WSU should consolidate existing food technology and processing programs in Animal Science, Horticulture, and Agricultural Engineering into a single department. He helped draft a successful proposal to WSU administration to create a new Food Science and Technology Department, and later, with the assistance of Professor Pettibone, helped organize it.

Professor Pettibone was one of ten charter faculty in the new department when it was established in 1970. He provided food engineering expertise and was eventually tenured in both departments: Agricultural Engineering in 1969 and Food Science and Technology in 1973. He was promoted to associate professor of agricultural engineering and food science and technology in 1974.

The new department also included faculty from the dairy manufacturing and meat processing programs in Animal Science, and the fruit and vegetable processing program in the Department of Horticulture. Food Science and Technology was later combined with the Department of Human Nutrition and Foods from the College of Home Economics in 1982 when the Colleges of Agriculture and Home Economics merged. The resulting department was named Food Science and Human Nutrition.

Outdoor Irrigation Laboratory in Pullman

In 1954, the Department began a two-year effort to secure an outdoor irrigation laboratory so undergraduate and graduate students could observe and study sprinkler, furrow, and border irrigation systems in operation in Pullman without traveling hundreds of miles to irrigated farms. The laboratory was located on 2-acres of land owned by the U.S. Soil Conservation Service (SCS) south of Paradise Creek and immediately east of the intersection of the Moscow-Pullman Highway and Terre View Drive. The project required negotiating an agreement with SCS to access and use the land; securing a permit from the State of Washington to construct a dam and to pump water from Paradise Creek; and obtaining \$5,000 from the College of Agriculture to fund the project. It also required the Board of Regents to grant an exception to policy allowing the expenditure of university funds to construct permanent structures (dam, water conveyance and control structures, and a classroom) and install University owned pumps on property not owned by the University.

The laboratory was used for the first time in the fall of 1956 and remained in use until the late 1980s when US-SCS opted out of the 1955 agreement.

Teaching

Once accredited in 1950, the B.S. in Agricultural Engineering was reviewed and re-accredited approximately every five years by ECPD, and after 1980, ABET. Several curricular adjustments were made in response to reviewer suggestions and concerns. Notable changes included the addition of computer science (1964) and biological science (1968) requirements in the sophomore year. The B.S. Agricultural Engineering degree was offered until 1997, when it was replaced by the B.S. Biological Systems Engineering degree. The B.S. Biological Systems Engineering degree was discontinued in 2004.

The demise of slide rule use by students began in 1972 when Hewlett Packard introduced the first handheld calculator, the HP-35, in February followed by Texas Instruments' introduction of the TI-2500 in Nov.. The HP-35, which sold for \$395, added, subtracted, multiplied, and divided, and, also, computed trigonometric functions, logarithms, and exponents.

The TI-2500 cost \$150 but could only add, subtract, multiply and divide. The TI-50 (introduced in 1974 for \$170) and the HP-21 (introduced in 1975 for \$125) both performed all slide rule functions at a more affordable cost. Most students had abandoned their slide rules and were using calculators for homework and exams by 1975.

The department's minor in the B.S. in Agriculture program was changed in 1948 from Farm Engineering to Farm Mechanics, and from Farm Mechanics to Agricultural Mechanization in 1960. The department began offering the B.S. in Agricultural Mechanization in 1970. The program's first graduate was Donald Floyd Johnson in February 1970.

The department began to cooperatively list graduate soil and water courses with the University of Idaho in 1972. This ingenuous program, developed by the WSU and U of I deans of graduate study in 1963, involved each institution identifying courses at the other institution it wished to list in its course catalog. If the offering institution agreed, the other institution cooperatively listed them in their Catalog. This enabled students to earn graduate credit at their home institution for cooperatively listed courses taken at the other institution for no additional cost. The institutions benefited by expanding course offerings and increasing enrollment—especially important in small courses—without adding faculty and equipment. Additionally, students enjoyed access to expanded course offerings and a wider variety of faculty with no extra fees.

WSU and the University of Idaho extended the cooperative listing program to include undergraduate courses in 1972. Selected undergraduate agricultural engineering and agricultural mechanization courses were cooperatively listed with the University of Idaho beginning in 1987.

The M.S. in Agricultural Engineering was replaced with the M.S. in Engineering in 1974 in response to concerns raised by the Washington Council on Higher Education, who in April 1972, recommended terminating M.S. programs in Agricultural, Chemical, and Nuclear Engineering due to low enrollment. The Graduate School and the Graduate Studies Committee of the Faculty Senate suggested the involved departments develop a joint proposal for terminating their respective M.S. programs and replacing them with a M.S. in Engineering. The resulting proposal

was approved by the Faculty Senate and accepted by the Council on Higher Education in the Fall 1973. The addition of the M.S. in Engineering and termination of the M.S. in Agricultural Engineering were effective Sept. 16, 1974.

The department joined other College of Engineering departments to offer the newly approved Ph.D. in Engineering Science in 1964.

Research

In addition to upgrading faculty and facilities as previously described, external reviewers in the early 1970s urged the department to create more faculty time for research by curtailing the amount of engineering services provided to the College of Agriculture. From the earliest days of WSC, Agricultural Engineering faculty had assisted in the design and operation of the College's irrigation systems, buildings, and machines throughout the state. Reviewers specifically recommended the department no longer be responsible for the day-to-day operation and management of the College feed plant.

Concerns about the adverse effects of farm mechanization on farm laborers, family farmers, independent rural businesses, and rural communities raised by Jim Hightower's 1972 book *Hard Tomatoes, Hard Times: The Failure of the Land Grant College Complex* adversely impacted power and machinery research programs at WSU and nationwide. Federal funding for mechanization research remained depressed for approximately twenty years until the emergence of precision agriculture in the 1990s.

Extension

Everett Davis and Mel Hagood, extension agricultural engineers, were assigned to the Department as part of the 1963 administrative reorganization of Agricultural Extension. They now reported to the chair rather than the state leader of extension programs. This was the first formal role for department chairs in extension: they were now responsible for all extension personnel and programs in their subject matter area and reported to the Extension Director through the State Leader of Extension Programs.

Relocating extension specialist offices to their respective departments was another major element

of the reorganization. Mr. Davis moved into an office in Spillman Hall, and following the 1968 remodel, into the L. J. Smith building. Mr. Hagood's office remained at the Irrigated Agriculture Research and Extension Center in Prosser.

International

During the 1960s the Department helped establish two new agricultural engineering departments in West Pakistan: one at the West Pakistan Agricultural University, and a second at the University of Peshawar. The Department recruited an agricultural engineer for each university to advise and assist with the development of teaching, research, and extension programs in "farm irrigation and agricultural machinery." These in-country agricultural engineering advisors assisted with faculty, curriculum, and facilities development, and in establishing and building a B.S. in Agricultural Engineering program at each university. They also had a major role in selecting and placing Pakistani students and faculty at WSU and other US universities for graduate study. Each was a visiting professor at their Pakistani university and a faculty member in agricultural engineering at WSU. Walter R. Friberg served as the agricultural engineering advisor at West Pakistan Agricultural University from 1962 to 1969. W. Kenneth Bach served in a similar capacity at the University of Peshawar from 1965 to 1968.



C Alan Pettibone (1975)

C. Alan Pettibone 1975-1979

Building a Research Culture

Dr. C. Alan Pettibone became chair July 1, 1975, upon Professor Roberts' retirement. Dr. Pettibone was born in Redmond, OR, and raised on a farm near Steptoe, WA. He completed a B.S. in agriculture with a minor in agricultural mechanization in 1954, and B.S. and M.S. degrees in agricultural engineering in 1960 and 1965, all from WSC/WSU. In 1975 he received a Ph.D. in agricultural engineering from Cornell University.

Prior to joining the WSU faculty in 1965, Dr. Pettibone spent two years as an Officer in the Army Corps of Engineers (1955-57), three years as an experimental aide in the WSU Agricultural Engineering Department (1957-60), and five years with the US Department of Agriculture as a Research Agricultural Engineer (1960-65). His first day as a WSU assistant professor of agricultural engineering was Sept. 1, 1965.

Dr. Pettibone's experience at Cornell University (studying for his Ph.D.) and previous visits to agricultural engineering departments at Michigan State

University and the University of California at Davis alerted him to shortcomings in the department's research and graduate programs. They lacked depth and quality relative to those of the other three universities. The department also fared poorly in attracting outside funding for research. Additionally, Dr. Pettibone felt that, with one or two exceptions, faculty were not well prepared to make the necessary improvements, and that a new departmental research culture was needed.

His first step in making these changes was getting the support of College Administration. During his interview for the chair position, Dr. Pettibone shared his view that research and graduate programs must be improved; that additional State and Federal research funds as well as outside funding for research were needed; and that new appropriately trained young faculty were needed make the necessary changes in departmental culture. They agreed: Dr. Pettibone was appointed chair and allocations for new faculty and support positions followed.

The next step in implementing the necessary change was holding a 2½ day departmental planning meeting at Camp Larson on Lake Coeur d'Alene Sept. 8-10, 1975, which all faculty attended. They reviewed and evaluated all teaching, research, and extension programs, and, in work sessions, discussed what these programs might look like in the future and how to meet the future needs of each program. The work sessions produced consensus that departmental programs in teaching, research, and extension must be strengthened to achieve the following departmental vision:

- » The Agricultural Engineering Department at Washington State University is recognized by the profession, universities, and the public as a leader in meeting state and national needs.

A set of actions and a plan for advancing the Department toward this vision were developed. Faculty agreed that research productivity "must be put in the limelight of departmental priorities"—without degrading teaching. All concurred that quality teaching must be maintained but "put in the proper perspective in relation to the function of the department."

The principle of raising research productivity while maintaining quality teaching guided resource allocation and faculty evaluation. Dr. Pettibone utilized

measures of research productivity to allocate Agricultural Experiment Station resources for research and instituted annual performance review of faculty. The primary measure of individual and departmental research productivity was publications per research FTE or "full time equivalent." Faculty teaching was assessed with the aid of course questionnaires completed by students.

These new policies significantly increased the number of grant proposals, the number of grants funded, and the amount of outside funding to support research. The number of research papers presented at professional meetings and the number published in refereed journals also increased significantly.

The principle of raising research productivity while maintaining quality teaching also guided faculty hiring. Well trained individuals with Ph.D.s and demonstrated ability and commitment to both research and teaching were hired to fill five vacant research and teaching positions during Dr. Pettibone's time as chair. Drs. Gary Hyde and Richard Linhardt, who both began Sept. 1, 1975, were recruited from the University of Illinois and Clemson University, respectively. Dr. Denny Davis, who earned his Ph.D. at Cornell University and had three years of faculty experience at the University of Georgia, and Dr. Glenn Kranzler, a native of North Dakota who had just completed a Ph.D. at Iowa State University, joined the faculty in 1976. Dr. Larry James, with a Ph.D. from the University of Minnesota and two years as an assistant professor at Cornell University, began Aug. 1, 1977. Also beginning in 1977 was Mr. Paul Fanning who rejoined the faculty to fill a new, federally funded extension position in farm safety. Dr. Keith Saxton, USDA-ARS research hydrologist, was appointed as courtesy associate professor in 1976. Faculty changes during Dr. Pettibone's time as chair are summarized in Table 3.

Table 3. Faculty changes while Dr. C. Alan Pettibone was chair 1975-1979

Faculty Member	Period of Service	Comment
John E. George***	1947-1987	
Day L. Bassett***	1954-1989	
James E. (Pat) Middleton***	1957-1980	
John B. Simpson***	1959-1999	
Albert E. Powell***	1960-1986	
Melvin A Hagood*	1960-1977	Retired July 15, 1977, from IAREC, replaced by Dr. Thompson in 1979
C Alan Pettibone***	1965-1996	Department Chair
Gene T Thompson***	1966-1976 1979-1981	Went to Harza Engineering in Chicago in 1976 Replaced Mel Hagood at IAREC in 1979
Donald K. McCool***	1971-2020	USDA-ARS courtesy appointment
Henry Waelti**	1973-1995	Extension Agricultural Engineer
Ronald E. Hermanson***	1973-1996	Extension Agricultural Engineer
Larry G. King***	1974-1998	
Gary M. Hyde**	1975-2003	Replaced Professor Roberts
Richard E. Linhardt**	1975-1979	New joint position with Agricultural Education
Keith E Saxton**	1976-2000	USDA-ARS courtesy appointment
Denny C. Davis**	1976-2012	New position
Glenn A. Kranzler**	1976-1982	New position
Larry G. James**	1977-2013	Replaced Dr. Thompson
Paul K. Fanning**	1977-1981	New federally funded extension position in Farm Safety

*Faculty member at beginning of Dr. Pettibone's time as chair

**Faculty member at end of Dr. Pettibone's time as chair

***Faculty member at beginning and end of Dr. Pettibone's time as chair

Another major strategy for increasing research productivity was adding staff and graduate students to assist faculty with teaching and research. Faculty were encouraged to aggressively pursue external grants to fund such positions. Additionally, the College provided additional secretarial and technician positions to support the department's teaching and research programs.

Recruitment of both undergraduate and graduate students was a high department priority. As shown in Figures 1 and 2, the number of agricultural engineering and agricultural mechanization graduates surged during the late 1970s. These surges were concurrent with rises in engineering and agricultural graduates at WSU and nationally. Departmental surges, however, significantly exceeded corresponding WSU and national surges.

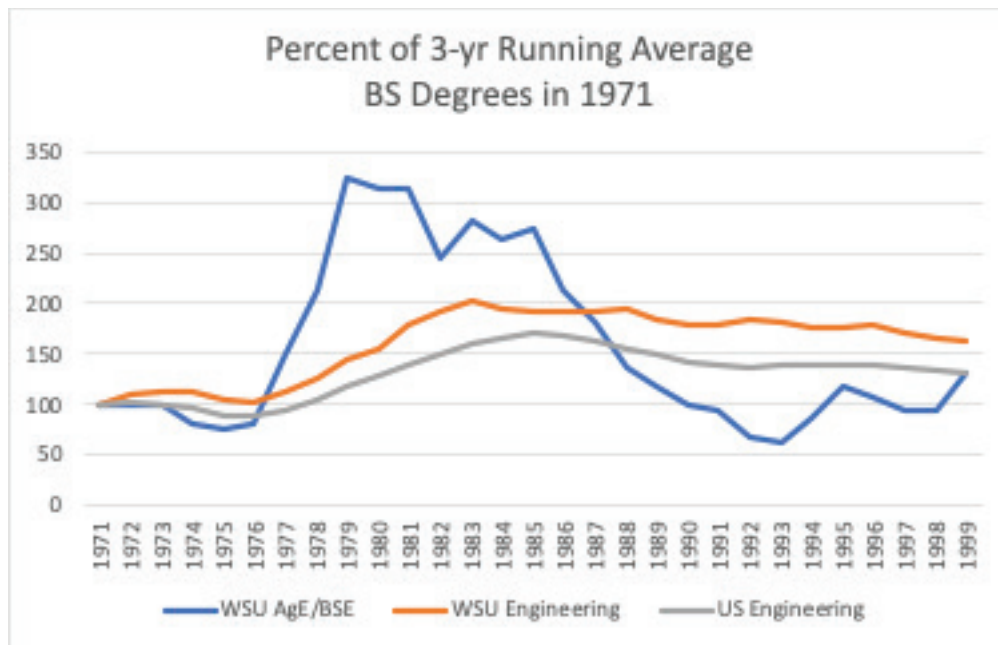


Figure 1. Comparison of B.S. degrees in Agricultural Engineering plus Biological Systems Engineering to B.S. degrees awarded by WSU College of Engineering and total B.S. In Engineering degrees awarded in US. The vertical axis is percent of 3-yr running average B.S. degrees in 1971.

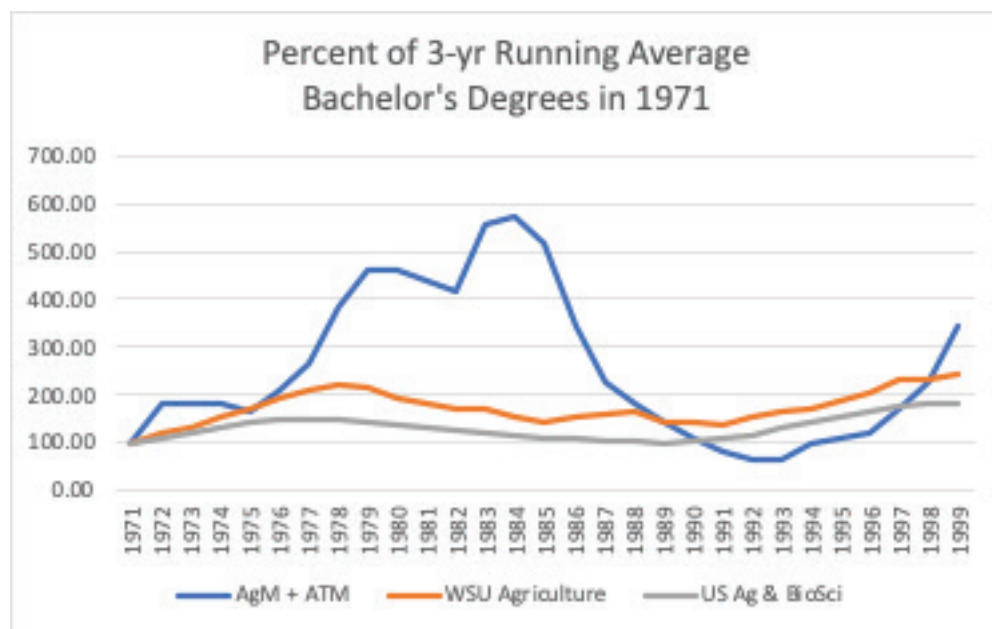


Figure 2. Comparison of B.S. degrees in Agricultural Mechanization plus Agricultural Technology and Management to bachelor's degrees awarded by WSU College of Agriculture and total bachelor's degrees in Agriculture and Biological Sciences awarded in US. The vertical axis is percent of 3-yr running average bachelor's degrees in 1971.

Increased enrollment created heavier faculty teaching loads that jeopardized research productivity. Additional secretarial and technician positions helped but college funding for department teaching and research in 1978 was 56% and 84%, respectively, of the average funding per FTE of agricultural engineering departments nationally.

Emerging problems in State funding of higher education dashed hopes for improving the department's budget. In 1977, Washington voters removed sales tax from food and medicine—an action that reduced net state revenue by \$127 million and forced Governor Dixie Lee Ray to declare a “hiring freeze” for all state agencies. In early January 1978, the Office of Fiscal Management in Olympia ordered WSU to cut spending by \$5.5 million, an 8.5 percent reduction.

International

Professor Emeritus Roberts and Dr. Waeti, along with four other WSU scientists, spent several weeks on a WSU led USAID project in Syria during 1975 advising the Government on increasing agricultural production, especially livestock.

In 1976, Professor Roberts traveled to Jordan as a member of a team to assist with training agricultural faculty at the University of Jordan. This was another WSU led USAID project.

Dr. Bassett spent the 1978-79 academic year as a professor in the Department of Soils and Irrigation at the University of Jordan, Amman. He helped develop the graduate program in irrigation and drainage in the College of Agriculture; establish and teach graduate courses; start research projects; and develop the University Research Center in the Jordan Valley.

Larry King 1979-1987

Biological Engineering Debate Begins

Dr. Pettibone was promoted to associate dean and director of resident instruction in the WSU College of Agriculture effective July 1, 1979. He continued as acting chair while a national search was conducted. Dr. Larry G King emerged from the search as the department's clear choice and began as chair Nov. 1, 1979.



Larry G. King in 1979

Dr. King, a native of Prosser, Wash., received a B.S. in agricultural engineering from WSU in 1958 and a M.S. in mathematics from Colorado State University in 1961. He earned his doctorate in civil engineering from Colorado State in 1965.

Before joining the WSU faculty in agricultural engineering as a professor in 1974, he was an associate professor in the department of agricultural and irrigation engineering at Utah State University from 1969 to 1974. Previously he worked as a research engineer at the Hanford Laboratories of the General Electric Company (1962-1965) and as a research associate at the Battelle Memorial Institute (1965-1969) both in Richland, Wash.

The primary challenge facing Dr. King when he became chair was continuing to advance the research program while dealing with faculty overloads in teaching and budget cuts due to declining State support for higher education. Later in his term, agricultural engineering and agricultural mechanization enrollment fell as it did across the country. Some departments responded by dropping agricultural engineering in favor of some form of biological engi-

neering. This prompted a national dialogue about the future of agricultural engineering education.

Teaching Overloads: Using academic year 1985-86 enrollments and teaching workload formulas (developed by Purdue University and adopted by WSU), Dr. King estimated the Department needed an additional teaching FTE. The overload problem was compounded by not being able to fill faculty vacancies and having to return funds from these open positions to meet reductions in State funding.

In 1985, the Department began exploring ways of reducing faculty teaching loads by cooperating more fully with the Agricultural Engineering Department at the University of Idaho and with other WSU departments. In 1987, cooperative listing of courses with the University of Idaho was extended to include several undergraduate courses (many graduate courses had been cooperatively listed since 1972). Dr. King estimated that fuller cooperation would reduce teaching loads about 0.5 to 0.75 FTE.

Declining State Support for Higher Education

In the first week of Dr. King's chairmanship, the passage of Initiative 62—a measure designed to slow state government growth by restricting tax increases—magnified the likelihood of additional cuts in WSU's state funding. Basic education (kindergarten through twelfth grade) was singled out by the state legislature as an "essential service" to be protected from budget reductions while higher education was left "unprotected." Additionally, state government took control of community colleges in 1979 intensifying competition for state resources. As a result, WSU's 1981-83 appropriation from the State was 15.6% less than that of the previous biennium. Fortunately for the Department, research funding from the federal government and other external sources was not affected and continued to grow.

WSU experienced a series of reductions in state appropriations ranging from 2-5% over the next several biennia. The University employed a variety of strategies to make the required reductions including delaying salary increases for faculty and staff, encouraging early retirement, eliminating vacant positions, and reducing all budgets an equal percentage "across-the-board." WSU Regents even declared a "financial

exigency" on Sept. 15, 1981, to enable the termination of tenured faculty "if fiscal shortcomings forced the administration to eliminate functions, positions, or even whole units." President Terrell ended the exigency on June 4, 1982, noting that the policy had damaged faculty morale and the University's ability to recruit future faculty (George Fryman, 1990, *Creating the People's University*).

A more strategic approach to budget reductions was developed and implemented in the mid-1980s. University programs and functions were prioritized according to their centrality (to WSU's mission), cost, quality, and need (essentialness to other units). Reductions were distributed according to the relative priority of the program or function: the very highest priority programs and functions received the smallest cuts and, in some cases, no cut or an increase while lower priority programs and functions experienced deeper cuts. Those with the lowest priority received the biggest reductions, and, in some cases, were phased out.

Agricultural Engineering responded by adopting the following "prioritized goals for departmental programs" during a planning meeting in Feb. 1986:

1. Maintain strong research programs which meet needs of the state and nation, are consistent with college and university goals and the unique qualifications of agricultural engineers and provide a base for a strong graduate program.
2. Maintain strong graduate programs in agricultural engineering which attract highly qualified students into graduate study and support departmental research programs.
3. Maintain the strengths of the extension programs of the department to meet needs of the state.
4. Maintain an ABET accredited undergraduate degree program in agricultural engineering with strengths oriented to needs of the state and region.
5. Teach courses that rely on the body of knowledge unique to agricultural engineering as needed by other units of the university.
6. Maintain an ASAE recognized undergraduate degree program in agricultural mechanization.

There were several faculty changes during Dr. King's time as chair (see Table 4). Mr. Middleton retired; Drs Kranzler and Linhardt resigned to take

faculty positions at other universities; Dr. Pettibone became Director of the Washington Department of Agriculture; and Dr. Davis began a $\frac{3}{4}$ time position in the College of Engineering as associate dean for instruction and administration. In 1980, Robert Evans, who was finishing up a Ph.D. program at Colorado State University, replaced Mr. Middleton at IAREC and Dr. William Symons from Southern Illinois University replaced Dr. Linhardt. Dr. Marvin Pitts, a new Ph.D. from the University of Illinois, replaced Dr. Kranzler in 1983. And in 1986, Dr. Ralph Cavalieri,

upon completing a Ph.D. in chemical engineering at WSU, was hired to fill Dr. Glen Kranzler's position.

Dr. Powell and Mr. George continued to teach part-time in the department in the first years of their retirement. They took advantage of the University's "40 percent rehire" program that enabled them to "transition into retirement" while earning 40 percent of their former salary plus retirement income. The department benefited by retaining their services part-time and the University saved 60% of their former salaries plus benefits.

Table 4. Faculty Changes while Dr. Larry G. King was chair 1979-1987

Faculty Member	Period of Service	Comments
John E George***	1947-1987	
Day L Bassett***	1954-1989	International assignment in Pakistan 1986-1988
James E Middleton*	1957-1980	Retired April 30, 1980, replaced by Dr. Evans
John B Simpson***	1959-1999	
Albert E Powell*	1960-1986	Retired Aug. 16, 1986, continued to teach part-time (40% rehire program) through Spring 1988
C Alan Pettibone***	1965-1996	CAHE Administration until appointed Director the Washington State Department of Agriculture in 1985
Donald K McCool***	1971-2010	USDA-ARS Courtesy Appointment
Ronald E Hermanson***	1973-1996	
Henry Waelti***	1973-1995	
Larry G King***	1974-1999	Department Chair
Gary M Hyde***	1975-2003	
Richard E Linhardt*	1975-1979	Resigned in 1979 for faculty position at University of Missouri, replaced by Dr. Symons
Keith E Saxton***	1976-2000	USDA-ARS Courtesy Appointment
Denny C Davis***	1976-2012	Began $\frac{3}{4}$ time as Associate Dean for Instruction and Administration in the WSU College of Engineering Jan 1, 1986, continued $\frac{1}{4}$ time research in department
Glenn A Kranzler*	1976-1982	Resigned in 1982 for faculty position at Oklahoma State University, replaced by Dr. Pitts
Larry G James***	1977-2013	
Gene T Thompson*	1979-1981	Replaced Mr. Hagood, resigned 1981
William B Symons**	1980-2006	Replaced Dr. Linhardt
Robert G Evans**	1980-2001	Replaced Mr. Middleton
Thomas W Ley**	1983-1997	Replaced Dr. Thompson
Marvin J Pitts**	1983-2010	Replaced Dr. Kranzler
Dale E Wilkens**	1984-1994	USDA-ARS Courtesy Appointment
Ralph P Cavalieri**	1985-2016	Replaced Dr. Kranzler

*Faculty member at beginning of Dr. King's time as chair.

**Faculty member at end of Dr. King's time as chair.

***Faculty member at beginning and end of Dr. King's time as chair.

Agricultural engineering enrollment at WSU and nationally declined during the 1980s (see Figure 4). As was the case nationally, shrinking farm population in Washington was drying up the department's traditional source of students. Aggressive marketing and recruitment programs were not significantly improving enrollment. Additionally, student recruitment efforts required considerable faculty time and conflicted with the department's focus on research productivity.

Most, if not all, US agricultural engineering departments were grappling with these same challenges. Solutions ranging from "cosmetic" departmental and program name changes to fundamental curricular and course revision were under consideration. A few universities were moving toward discontinuing their agricultural engineering program in favor of some form of biological engineering. The Department monitored these developments as it considered the potential impact and merit of moving to a more biological science-based curricula at WSU.

Research program growth that began in the late 1970s continued and diversified during the 1980s (see Table 5 and Appendix D). Research growth in the late 1970s and early 1980s was primarily in soil and water because of Dr. King's major externally funded irrigation return flow program, the addition of new faculty (Drs James and Evans), and the inclusion of USDA research led by Drs McCool and Saxton. Food process engineering growth began with the addition of Drs Davis and Kranzler in 1976 and continued through the 1980s as their programs matured and Dr. Pitts, who replaced Dr. Kranzler in 1983, and Dr. Cavalieri, who joined the faculty in 1986, developed their programs. Graduate student numbers and outside funding continued to rise during this period as new faculty established their programs.

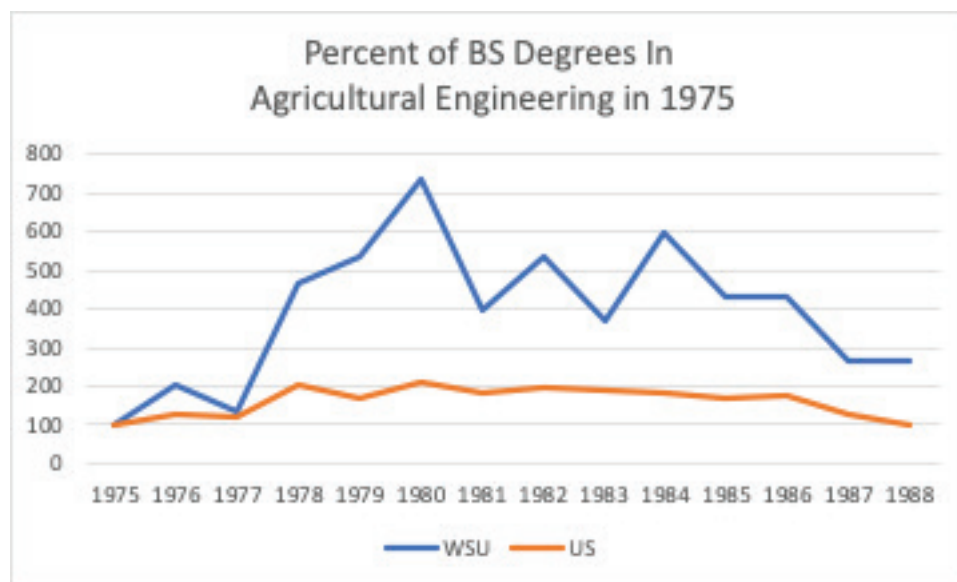


Figure 3. Comparison of B.S. in Agricultural Engineering Degrees awarded at WSU to total number of B.S. in Agricultural Engineering degrees awarded in US.

Table 5. Number of Agricultural Engineering research projects (compiled from various Department reports and self-studies) between 1956 and 1987. Project titles and principal investigators are listed in Appendix D.

Year	Farm Structures	Electric Power & Processing*	Power & Machinery	Soil & Water	Total
1956	5	2	2	4	13
1960	2	4	3	3	12
1971	1	1	2	7	11
1975	1	2	1	10	14
1981	0	6	4	15	25
1987	0	10	9	20**	39

*After 1975 Post Harvest Processing

**Does not include Dr. King's programs

International

During the 1980s, the Department had a major role in designing and implementing a research program to improve irrigation system water management in Pakistan. Dr. King spent a total of two months during 1984 in Pakistan (two separate trips) assisting with research program design. In 1986, he returned to Lahore, Pakistan for five weeks to help specify equipment and develop research implementation and personnel training plans. From 1986 to 1991, Dr. King was WSU's campus coordinator for this project directed by the Agricultural Engineering Department at the University of Idaho. Additionally, Dr. Bassett spent two years, beginning October 1986, in Pakistan teaching and providing technical assistance to this project.

Other international activities involving Department faculty during the 1980s included:

- » Dr. Bassett spent Aug. of 1981 in Amman, Jordan helping design the Jordan Valley Agricultural Services Project for USAID. WSU was chosen to lead this five-year, \$5 million-project which began in 1982.
- » Dr. Bassett traveled to Portugal during July and Aug. of 1983 to be a consultant for Purdue University on its USAID Portugal University Institutes Development Project. He advised faculty and administration of the Institution Universitario De Tras-Os-Montes Alto Douro on the development of new teaching and research programs to serve northeast Portugal. While there he also trained faculty in elementary field research techniques for furrow and sprinkler irrigation, and prepared

general plans for the development of laboratories and further training of faculty.

- » Dr. Symons spent one year in India during 1987-1988 academic year at the invitation of the Director of International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad. His work focused on institutional infrastructures (including a new facility in Africa), labor, and equipment issues.

Larry G. James 1987-1991 Biological Systems Engineering Transition Begins

Dr. Larry G. James began as chair July 1, 1987. He grew up on a dairy farm near Custer, Wash. and graduated from WSU, earning a B.S. in agricultural engineering in 1970. He entered graduate school in agricultural engineering and served as a graduate research assistant at WSU for one year before accepting a US Department of Defense graduate fellowship at the University of Minnesota. After receiving a doctorate in agricultural engineering from the University of Minnesota, he began as an assistant professor of agricultural engineering at Cornell University in March 1975. He joined the WSU agricultural engineering faculty as an assistant professor Aug. 1, 1977.

There were several challenges facing the Department when Dr. James became chair. Enrollment in both agricultural engineering and agricultural mechanization was dropping as the part-time teaching of Dr. Powell and Mr. George was about to end, and Dr. Bassett was expected to retire upon his return from a two-year international assignment in Pakistan. The



Dr. Larry G. James in 1984

loss of these long-time faculty threatened agricultural mechanization and jeopardized the department's progress in research and graduate education. And biennial reductions in WSU's State funding were continuing one after the other.

Shortly after Dr. James became chair, task forces of faculty, staff, and students were formed to develop recommendations for implementing the department's 1986 prioritized list of goals. These task forces worked through the Fall 1987 semester and presented their recommendations at an all-department meeting in March 1988. Task force chairs and Dr. James synthesized the recommendations and input from the all-department meeting into a departmental strategic plan. The elements of the plan requiring immediate attention were:

1. Strengthening research and graduate programs, the Department's two highest priorities, by:
 - » Focusing departmental research and graduate education in the areas of soil and water resource engineering, and food engineering (including post-harvest engineering).
 - » Reducing faculty teaching loads.

- » Filling faculty vacancies with outstanding new faculty with strong research capabilities.
2. Increasing student numbers, the highest priority within the Department's teaching program, by:
 - » Aggressively recruiting more high school students.
 - » Identifying and implementing major curricular revision.

The strategic plan was essential to retaining and filling restructured faculty vacancies created by the full retirement of Dr. Powell and Mr. George. Consistent with the strategic plan, new faculty members with strong research credentials and expertise in soil and water resource engineering (Dr. Stockle) and food engineering (Dr. Barbosa-Canovas) were recruited for these positions. Both Drs Stockle and Barbosa-Canovas had 60 percent research appointments and training congruent with biological engineering. They replaced retired faculty with 100 percent teaching appointments who taught primarily in the agricultural mechanization program, the focus of the two lowest priority 1986 goals. The Department anticipated filling a third position when Dr. Bassett returned from international assignment and fully retired. Faculty changes during Dr. James' chairmanship are listed in Table 6.

Table 6. Faculty changes while Dr. Larry G James was chair 1987-1991

Faculty Member	Period of Service	Comments
John E. George*	1947-1987	Retired Oct. 31, 1987, continued to teach part-time (40% rehire program) through Spring 1990
Day L. Bassett*	1954-1989	Retired Jan 31, 1989, continued to teach part-time (40% rehire program) through Spring 1991
John B. Simpson***	1959-1999	
Albert E. Powell*	1960-1986	Continued to teach part-time (40 percent rehire program) through Spring 1988
C. Alan Pettibone***	1965-1996	Director Washington State Department of Agriculture 1985-1993
Donald K. McCool***	1971-2010	USDA-ARS courtesy appointment
Ronald E. Hermanson***	1973-1996	
Henry Waelti***	1973-1995	
Larry G. King***	1974-1999	
Gary M. Hyde***	1975-2003	
Keith E. Saxton***	1976-2000	USDA-ARS Courtesy appointment
Denny C. Davis***	1976-2012	.25% departmental research, .75% associate dean in College of Engineering
Larry G. James***	1977-2013	Department Chair (1987-1991)
William B. Symons***	1980-2006	
Robert G. Evans***	1980-2001	
Thomas W. Ley***	1983-1997	
Marvin J. Pitts***	1983-2010	
Dale E. Wilkens***	1984-1994	USDA-ARS courtesy appointment
Ralph P. Cavalieri***	1985-2016	
Claudio O. Stockle**	1989-	Powell position
Gustavo Barbosa-Canovas**	1990-	George position

*Faculty member at beginning of Dr. James' time as chair.

**Faculty member at end of Dr. James' time as chair.

***Faculty member at beginning and end of Dr. James' time as chair.

Smaller teaching loads were essential to continued improvement of research productivity. Teaching loads were reduced by coordinating teaching schedules and expanding the number of cooperatively listed courses with the Agricultural Engineering Department at the University of Idaho. Rather than offering selected courses with similar content every year at both universities, the departments agreed to teach these courses in alternate years, that is, one university would teach the course in even years and the other university would teach it in odd years. Approximately 30 courses were jointly scheduled or cooperatively listed with the University of Idaho, which reduced

the number of courses taught per semester by about one-third.

Low enrollment in agricultural engineering and agricultural mechanization made the Department an attractive target for University imposed budget reductions or even program elimination. Immediately increasing student numbers was therefore imperative. Efforts to increase student numbers included updating student recruitment materials and participating in all University and College (both Agriculture and Home Economics, and Engineering and Architecture) high school student recruiting activities. Faculty routinely spoke with and/or wrote every WSU

applicant from a rural area who expressed interest in engineering or agriculture. Prospective engineering students from urban areas with FFA backgrounds were also contacted and scholarships and/or part-time employment were offered to the best students. These time-consuming efforts were, however, only marginally successful.

This experience coupled with advances in the application of biotechnology and automation technologies to food production and processing systems convinced many in the department that fundamental curriculum reform was key to increasing student numbers over the long term. Many concluded that a traditional agricultural engineering education was no longer attractive to enough students and may not provide adequate preparation for addressing contemporary engineering challenges and societal issues facing agriculture. Efforts to develop biological science-based curricula intensified: biological systems engineering, and agricultural technology and management as well as a new name for the Department took shape.

The Department's move toward biological systems engineering occurred as Agricultural Engineering Departments throughout North America were responding to similar enrollment and professional identity issues.² By 1989,

- » Fourteen agricultural engineering departments had been renamed to reflect an increased emphasis on biology. The new names of these departments included either the words "biological", "biosystems", or "food" before or after "agricultural."
- » Thirty departments continued to be named Agricultural Engineering. Like WSU, many of these departments were considering curricular and course revisions and corresponding department name changes.
- » Four agricultural engineering programs jointly administered with civil, chemical, or irrigation engineering remained intact.

» Three engineering departments traditionally affiliated with agricultural engineering remained intact (e.g., food engineering at the University of Massachusetts, bio-resource engineering at the University of British Columbia, and natural resources management and engineering at the University of Connecticut).

Between 1990 and 1993, Dr. Davis was on a steering committee for a USDA-HEP grant at the University of California-Davis developing core curricula for a Biological Engineering program. This group developed curricula for an Engineering Properties of Biological Materials courses and a Biology for Engineers course.

Facilities

Facilities changes included a summer-long building cleanup and a second-floor remodel of the L. J. Smith Building. Research space was reclaimed in 1988 by discarding abandoned research apparatus and obsolete and non-operational equipment that had accumulated over the years. The clean-up greatly improved the appearance and safety throughout the building as well as faculty and staff morale. It was also essential to acquiring minor capital improvement money for remodeling the second floor in 1990 to create a computer laboratory and additional office space. Additionally, a new phone system and a computer network linking the entire department were installed.

The Department began using the pilot plant in the new Food Science and Human Nutrition Building for non-thermal food processing research soon after the building opened in 1989 and Dr. Barbosa-Canova's arrival in 1990. Initial work was supported by a \$800,000 US Department of Defense grant to assess the feasibility of cold pasteurization for preparing MREs (meals ready to eat) for the US military. This grant was obtained with the assistance of Nalley's Fine Foods in Tacoma and Speaker of the U.S. House of Representatives Thomas Foley of Spokane.

² Dr. James summarized the state of agricultural engineering education regionally and nationally in a paper presented at the Sept. 1989 joint meeting of the Pacific Northwest Region of American Society of Agricultural Engineers and the Canadian Society of Agricultural Engineers. This paper, included in Appendix E, provides additional context for the Department's new direction and is the source of agricultural engineering department status information presented herein.

Ralph P. Cavalieri 1991 – 2000

Department of Biological Systems Engineering Becomes a Reality

by Ralph P. Cavalieri



Dr. Ralph P. Cavalieri in 1994

Dr. Ralph P. Cavalieri began as interim chair in August of 1991, serving while Dr. James filled a temporary vacancy in the administration of the College of Agriculture and Home Economics. After Dr. James was appointed as the college's Director of Academic Programs, Dr. Cavalieri was appointed chair of the department on July 1, 1993 and continued in that position until April, 2000 when he left to become the Associate Dean for Research and Director of the Agricultural Research Center for the College of Agricultural, Food, and Natural Resource Sciences.

Dr. Cavalieri, a native of Sacramento, California, was raised in a family that was associated with the vegetable processing industry in that area. He received a B.S. in Chemical Engineering at the University of Idaho.

After completing a period of required service flying for the Navy, Dr. Cavalieri returned to the Palouse and earned a Ph.D. in Chemical Engineering from Washington State University and in 1985 joined the faculty of the Agricultural Engineering Department.

Turbulent Times and Opportunities for Change

The period beginning in Aug. 1991 was another one of a series of budgetary challenges for Washington State University. During the first few weeks of the 1991-92 academic year, having experienced the retirement of a number of faculty members, a relatively small undergraduate student population, and only an interim department chair, the department faculty was presented with a proposal to break it up and send a portion of its faculty and staff to work with the Food Science and Human Nutrition Department and the rest to the Crop and Soils Sciences Department. On learning of this plan, the faculty developed a counter-proposal for the college leadership to consider. The counter proposal was an outgrowth of multiple years of local and national discussion about the emerging discipline of biological (systems) engineering and a departmental transition from agricultural mechanization to agricultural technology and management, some of which has been previously discussed. Being convinced that the proposed changes in undergraduate curricula would lead to a significant growth in the undergraduate student population, the college agreed to allow the department to remain intact for the foreseeable future.

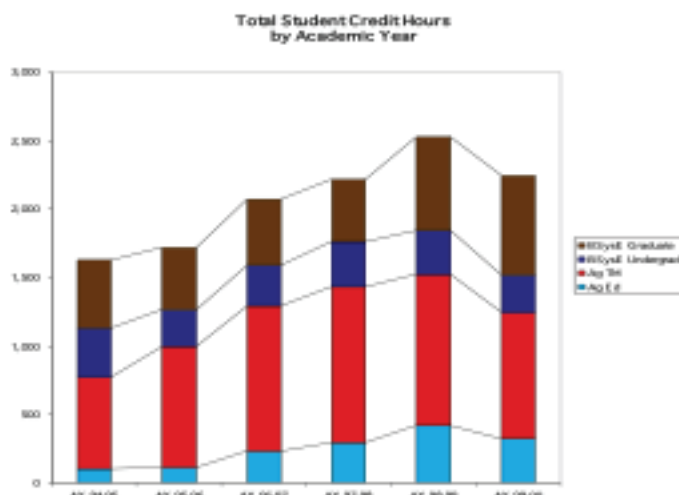
In a whirlwind of activity during the 1991-92 academic year, formal proposals to create the BS in Biological Systems Engineering and the BS in Agricultural Technology and Management were written and submitted through the college to the Faculty Senate. After months of hearings, the department received approval to establish the B.S. in Biological Systems Engineering (BSYSE), the B.S. in Agricultural Technology and Management (AgTM), and to change the name of the department to Biological Systems Engineering.

The faculty and staff put substantial effort in developing and printing recruitment materials and traveling to various locations around Washington to tell the story of its new degrees. The net result was that for

the rest of the decade of the 1990s, the department's student population and associated teaching credit hours continued to grow.

During this time period, the faculty was asked to allow the department to serve as the temporary home for three faculty members and the associated B.S. in Agriculture degrees (Agricultural Education, Agricultural Communications, and General Agriculture). The logic was that many of the students in these majors took a number of AgTM courses. This temporary arrangement lasted until a permanent home was found in the Department of Crop and Soil Sciences a decade later.

The graphic below shows student credit hours taught by the department during academic years 1994-95 through 1999-2000 – every year being a



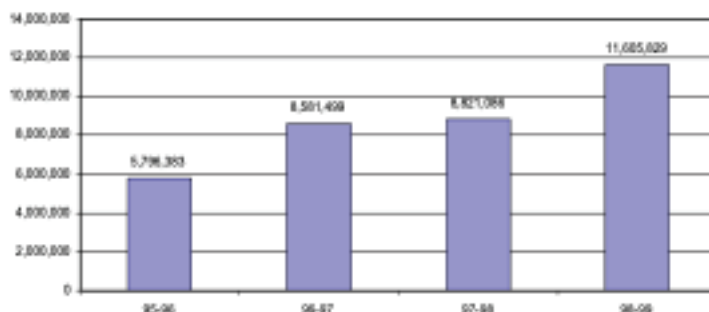
marked improvement over the comparable data from prior to the changes.

It is appropriate to highlight the improvement in the numbers associated with the Agricultural Technology and Management courses. Following the retirements of Prof. John George (1987), Dr. Day Bassett (1989), and Dr. Albert Powell (1990), in 1992, Mr. James Durfey was hired as an instructor to support the Agricultural Technology and Management program. His practical background in farming and education led to a notable increase in students in AgTM and its courses.

Research and A Period of Growth

With the hiring of Dr. Gustavo Barbosa-Canovas (1990), Dr. Juming Tang (1995), and Dr. Shulin Chen (1995), along with efforts of the existing members of

**Department of Biological Systems Engineering
Grant Proposals Submitted
1995-1999**



the faculty, the availability of the new joint facilities with the Food Science and Human Nutrition Department and the improved facilities in Smith Agricultural Engineering Building, the department was poised for a period of growth in extramurally funded research and graduate education. The creation of the Center for Nonthermal Processing of Food, the Center for Precision Agriculture, and other focused research efforts helped to make the department an increasingly important contributor to the research mission of the college's tri-partite portfolio of teaching, research, and extension. By the end of the 1990s, the department was on a trajectory to become one of the college's leaders in research output.

Extension: A Highly Valued Service to the State of Washington

During the 1990s, the department's highly regarded extension faculty members continued to provide strong, extramurally funded programs that were very impactful to the State of Washington. Dr. Hermanson was selected to assemble and publish a comprehensive water quality management document and to assist the State Department of Ecology in numerous water quality issues. Dr. Henry Waelti led a decade-long effort to research and educate the tree fruit industry on several rapidly emerging technologies that addressed challenges such as the creation and maintenance of controlled atmosphere for fruit storage and the exploration of ways to improve the energy efficiency of the vast number of refrigerated fruit warehouses. Dr. Tom Ley, irrigation specialist, created an extramurally funded irrigation weather monitoring network and published many important documents on irrigation water use efficiency. Dr. William Symons, in addition to teaching in the AgTM

program, also served as the state's Extension Safety Specialist and was frequently called upon to examine and discuss safety practices in agriculture.

Facilities

Smith Agricultural Engineering Building (SMAG) had been known by that name for decades. With the change in the department's name and as the building's sole resident, the department requested and finally obtained approval to change the name to honor Prof. L.J. Smith, who led the department for nearly 30 years. L.J. Smith Hall was approved as the new name.

Changing the name was not the end of the needed changes. With the rapidly growing research program and need for new and different teaching and

research laboratories, the search began for a new building, new spaces, shared spaces, and whatever we could find to support our efforts. Getting a new building was not going to happen, so the faculty looked around campus, located unused or underused locations, and worked to gain temporary use of them. While not enumerating them, at one point late in the 1990s, the department had research activities in about 20 different locations around campus. In ensuing years, L.J. Smith was improved, partnerships continued in other spaces, and more facilities were added at Prosser—but those are stories for a later chapter. The need for a modern facility that meets the instructional and research needs of the department is a continuing challenge.



Liquid manure spreader owned by Carl Schraeder, 1941

Denny C. Davis 2000-2001

by D. C. Davis



Realignments for Excellence and Efficiencies

Dr. Denny C Davis became chair April 1, 2000, when Dr. Cavaliere moved into the position of Associate Dean and Director of the Agricultural Research Center at WSU. Dr. Davis was born in Toppenish, WA, and was raised on a diverse irrigated agriculture farm near Wapato, Wash. He was active in FFA, achieving the American Farmer degree. He completed a B.S. in Agricultural Engineering at WSU in 1967. He attended Cornell University (fellow student with Mr. Simpson and Mr. Pettibone, who were earning their doctoral degrees), completing his M.S. and Ph.D. degrees in agricultural engineering in 1969 and 1973, respectively, with emphases on farm machinery for reducing fruit damage during harvest and protecting operators in tractor overturns.

The start of a new millennium found the Department of Biological Systems Engineering boasting of successes and contending with challenges. But they

continued a heritage of innovation and a willingness to lead change. As noted in a Departmental Newsletter written by their new Chair, Denny Davis, in summer of 2000, "The Biological Systems Engineering Department is a group of innovators, known for their collective creativity, energy, and excellence in times of fiscal and programmatic change." He stated that "We must maintain a foundation of unchanging principles and values, but we also must adapt as necessary to be effective under rapidly-changing conditions."

Faculty in the department had increased their research activity and productivity dramatically over the past few years. Research projects included collaboration with faculty in food science, soils, animal sciences, environmental engineering, microbiology, veterinary medicine, education, crop sciences, and agricultural economics, as well as with government agencies, government laboratories, state agencies, and private companies. The department housed the office of the Center for Non-thermal Food Processing and a state certified water quality laboratory. In 1999, engineering faculty in the department received new grants totaling over \$4 million, averaging \$180,000 per person per year. Research funding per person was among the highest in the college and the university.

Personnel changes in the Department occurred during the period of 1999-2001 due to retirements, position changes, and hiring.

General topics of ongoing research projects directed by engineering faculty in the department were: (a) microwave and radio frequency processing of food; (b) high pressure and pulsed electric field processing of foods; (c) natural systems for treatment of wastewater; (d) closed systems for production of fish; (e) plant system modeling for efficiency and productivity; (f) irrigation and chemical application for site-specific conditions; (g) curriculum and assessment for improving engineering design.

Strategic Planning

During 2001, Dr. Davis led the development of a Biological Systems Engineering Department strategic plan to guide the department over the next five years.

Strengths

This plan summarized the Department's historical strengths as stated below.

The department's educational programs are flagships for regional collaboration, distance delivery, cross-disciplinary integration, and international partnering. Our research and scholarship have national and international stature. Examples of innovation and success include:

- » B.S. Agricultural Engineering degree replaced by B.S. Biological Systems Engineering degree, with food engineering, water-soil-environmental engineering, and bioengineering emphases.
- » B.S. Agricultural Mechanization degree replaced by B.S. Agricultural Technology and Management degree, integrating systems management with technology applied to agriculture.
- » Tri-state Agriculture Distance Delivery Alliance (TADDA) developed to enhance collaboration and to extend agriculture degree to students distant from WSU.
- » B.S. and M.S. Agriculture degrees approved for distance delivery, with off-campus enrollments exceeding 30 students in the first year.
- » Food engineering and water-soil-environmental engineering research and graduate programs reached all-time highs in student numbers and research productivity.
- » Public Agriculture Weather System (PAWS) statewide weather station network established to support decisions on agricultural water use and crop management.
- » Center for Precision Agricultural Systems established to support multi-disciplinary development of practical systems for precise management in food production.
- » Creation of the Center for Non-Thermal Processing of Food within the department.

Constraints

During this period, the Department faced significant constraints to program excellence that are summarized below.

Facilities. Departmental facilities are outdated, inadequate, and inaccessible to handicapped. Most laboratory equipment predates 1950. Research spaces and graduate offices are spread over nine buildings in Pullman, in addition to Prosser locations. Faculty, students, and staff on the same project are scattered in multiple buildings. Embarrassing facilities discred-

it programs otherwise bordering on world-class in content.

Faculty. The number of faculty is inadequate to support excellence in the many programs of the Department. Three B.S. (with 5 majors), 2 MS, and 1 Ph.D. degree programs, 3 research areas, and 2 extension programs are supported by approximately 16 faculty FTE at 2 locations. Faculty under incredible workloads are unable to support all program areas adequately.

Identity. Programs in the Department span general agriculture, agricultural technology and management, and biological systems engineering. No engineering graduate degrees reside in the Biological Systems Engineering Department or the College of Agriculture & Home Economics. The department name and catalog format mask the department's agriculture programs.

Strategic Directions

By the end of 2001, the Department defined strategic directions that would enable them to achieve greater excellence in their programs. The directions identified included the following:

Proposed Department Name. Change the name to Department of Agricultural and Biological Engineering, Technology and Education

Proposed Department Structure. The Department would be organized into two major areas: (a) Agricultural and Biological Engineering and (b) Agricultural Systems, Technology and Education. Education, research, and extension programs will be aligned under this dual umbrella. Educational, research, and extension programs of the Department were envisioned to change over the next five years to become as shown.

Proposed Actions. The Department defined strategic directions and actions that would enable them to reach desired excellence in the next five years. These are stated below.

1. **Mission Centrality.** Better articulation (internally and externally) of how engineering and agricultural systems, technology and education programs in the department are central to the mission of CAHE and serve the needs of the college constituencies. This would be accomplished by (a) changing the name of

the department, (b) connecting better with commodity commissions, (c) increasing interactions with research and extension centers, (d) helping to create a CAHE Postharvest Processing and Engineering Institute, (e) supporting environmental stewardship of agricultural and natural resources, (f) establishing an agricultural and aquacultural design program, and (g) developing close cooperation with Cooperative Extension.

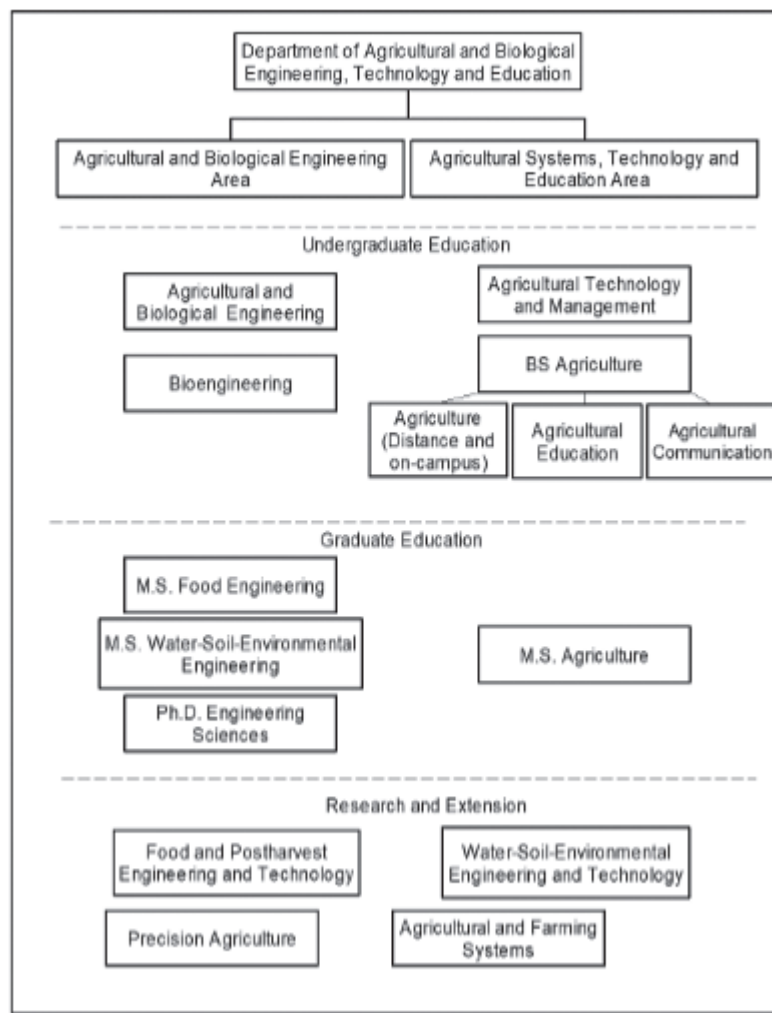
2. **Program Identity.** Foster and market a stronger identity for both engineering and agricultural systems programs. This would be accomplished by (a) giving the Agricultural Systems, Technology and Education area greater autonomy and visibility in website and

promotional materials, (b) establishing a clear identity of the Department's engineering programs with agriculture and food and natural resources and a clear distinction from the future Bioengineering Program, and (c) using Cooperative Extension and vocational agriculture teachers to promote the Department's educational programs.

3. **Educational Delivery.** Diversify the opportunities to deliver quality undergraduate and graduate education programs. This would be accomplished by (a) developing a certificate program in Watershed Science and Engineering at Puyallup, (b) participating in a multidisciplinary Bioengineering program with proper credit to the Department, (c) dropping human and animal systems focus in the BSE degree with a possible name change and determining if

the degree should be discontinued, (d) establishing minors in Food Engineering and Bioresource Engineering, (e) creating an Agricultural Systems, Technology and Education program to address production, management, technology, communica-

tion, and continuing education, (f) establishing a center for distance delivery in CAHE, (g) strengthening math and science and postharvest content in AgTM program, (h) providing specialized service courses to outside and place-bound students, (i) replacing M.S. Engineering degree by M.S. in Food Engineering and M.S. in Bioresource Engineering degrees, (j) establishing cooperative graduate programs with selected international universities, and (k) seeking extramural support to fund new educa-



tional initiatives.

4. **Research.** Sustain the strength and expand opportunities for engineering and agricultural systems and technology research. This can be accomplished by (a) continuing to attract external funding at the level of \$2.5 million per year and exploring Bioengineering research funds, (b) adding a substantial research component in the Agricultural Systems, Technology, and Education area, and (c) incorporating externally-funded non-tenure, temporary faculty into departmental research programs.

Engineering Program Accreditation: One of the challenges faced by the B.S. Biological Systems Engineering degree was a fall 2001 ABET (Accreditation Board for Engineering and Technology) accreditation

review that required assessment of student learning. To aid this assessment, the Department appointed a BSE Advisory Council for feedback on BSE graduates' performance. This group met in April 1999 and March 2000 to provide input on the objectives for the BSysE program, educational outcomes desired, and methods for measuring program success. In April 1999, they reviewed student design project presentations.

The department was active in efforts to improve the preparation of engineering graduates to practice engineering design. Dr. Davis had been working with faculty in engineering and education at WSU, along with others at University of Washington, Seattle University, Tacoma Community College, and Green River Community College to improve engineering design education for the Pacific Northwest and beyond. His project, "Transferable Integrated Design Engineering Education" or TIDEE, funded by the National Science Foundation, focused on (a) defining design capabilities needed for engineering practice, (b) creating curricular materials and teaching methods to help students learn design capabilities, and (c) assessing how well these capabilities are demonstrated by graduates. This project had been influencing design education in the Department. It also provided a foundation for performing assessments of student learning needed for the ABET visit.

In October 2001, Dr. Davis was appointed Interim Director of the Bioengineering program to provide

leadership to make the program attractive for external funding and student enrollments. Prior to this, the program had been funded jointly by the College of Agriculture and Human Ecology, College of Engineering and Architecture, and College of Veterinary Medicine. It was housed in Biological Systems Engineering and its educational offerings were treated as a specialization within the B.S. Biological Systems Engineering degree. The decision to make Bioengineering a stand-alone program in the College of Engineering and Architecture led to Dr. Davis being appointed as Interim Director of the program. Upon this appointment, Dr. Davis submitted his resignation as Chair of the Biological Systems Engineering Department so he could focus his efforts on Bioengineering and his extensive research activity in Engineering Education.

Dr. Davis led efforts to develop curriculum for the B.S. Bioengineering degree and obtain approval of the degree from the Faculty Senate (April, 2002), Washington's Higher Education Coordinating Board (HECB) in July 2002, and WSU Regents in Sept., 2002. He also developed a proposal and obtained high-demand funding from the HECB in 2004 to support hiring of extra faculty and staff, and for improvement of facilities for the program. He led preparation for ABET accreditation for B.S. Bioengineering, received in 2002. The first three B.S. Bioengineering graduates at WSU were celebrated in 2004.

Advisory Council Members

Name	Position and Organization
Mr. Brad Phelps, P.E.	Water and Wastewater Utilities Manager, CH2M-Hill
Mr. Ronald L. Luedeman, P.E.	Product Development Manager, Basic American Foods
Dr. James H. Dooley, P.E.	President / CEO, Silverbrook Limited
Mr. Douglas Swanson	Chief Engineer, Crew Systems and Subsystems, Boeing
Dr. Alan E. Drysdale	Life Sciences Project Manager, Boeing Kennedy Space Center
Ms. Teri Johnson	VP-General Manager of Automated Inspection Systems, Key Technology, Inc.
Dr. Pedro Verdugo	Professor of Bioengineering & Biostructure, University of Washington
Dr. Tom Hess, P.E.	Associate Professor, Biological and Agricultural Engineering Department, University of Idaho
Dr. Stuart Crane	Water Resource Engineer, Yakama Indian Nation
Dr. James DeShazer, P.E.	Professor and Head, Biological and Agricultural Engineering Department, University of Idaho
Mr. Dennis Stiles, P.E.	Program Manager, Agriculture and Food Processing Technology, Battelle Pacific Northwest National Laboratory
Dr. Mark McMulkin	Director, Motion Analysis Lab, Shriners Hospital

Faculty changes during Dr. Davis' period as chair

Faculty Member	Period of Service	Comments
Donald K. McCool***	1971-2010	USDA-ARS courtesy appointment
Gary M. Hyde***	1975-2003	
Keith E. Saxton*	1976-2000	USDA-ARS Courtesy appointment, retired December 2000
Denny C. Davis***	1976-2012	Appointed chair April 2000, resigned as chair October 2001 to serve as Interim Director, Bioengineering Program
Larry G. James***	1977-2013	
William B. Symons***	1980-2006	
Robert G. Evans*	1980-2000	Resigned December 2000 to accept USDA-ARS position, Sydney, MT
Marvin J. Pitts***	1983-2010	
Ralph P. Cavalieri***	1985-2016	
Claudio O. Stockle***	1989-	
Gustavo Barbosa-Canovas***	1990-	
Juming Tang***	1995-	
Shulin Chen***	1995-	
Michael Swan	1997-	
Brian Leib	1998-	
David Lin**	2001-	Hired cooperatively funded by CAHE, CVM, CEA for new Bioengineering position (January) with expertise in integrated mechanical properties of skeletal muscle and spinal reflexes
Anita Vasavada**	2001-	Hired cooperatively funded by CAHE, CVM, CEA for new Bioengineering position (January) with expertise in biomechanics and neural control of the musculoskeletal system
Francis Pierce**	2001-	Hired as Director, Center for Precision Agricultural Systems (Sept.) at IAREC with advanced technology funding from Washington Legislature
Carter Clary**	2001-	Hired with expertise in microwave dehydration of fruits and vegetables
Clyde Fraisse**	2001-	Hired with expertise in water management, replacing Dr. Evans

*Faculty member at beginning of Dr. Davis' time as chair

**Faculty member at end of Dr. Davis' time as chair

***Faculty member at beginning and end of Dr. Davis' time as chair

Claudio Stöckle
Department Chair, 2001 – 2016

by Claudio Stöckle



**Transition to a Research and
Graduate Education Focus**

By the time Dr. Claudio Stöckle started his tenure as Chair, it was becoming clear that a decade of efforts to increase enrollment in the Biological Systems Engineering undergraduate degree was not producing meaningful results. Despite the 1992 changing of name of the department to reflect a new vision merging biology and engineering toward more sustainable food production systems, the addition of a bio-engineering track to expand the appeal of the program, and countless recruitment efforts by faculty detracting from teaching and research work, enrollment continued to fall once reaching a first-year class size of one. This path was no longer sustainable and made the department extremely vulnerable to elimination or merging with other programs. On the other hand, increasing interest in Agricultural Technology and Management and Agricultural Education degrees provided a relative shield but did little to advance the

prospects of the engineering core of the department.

Ultimately, the B.S. in Biological Systems Engineering was discontinued in 2004. This was a risky decision that would make the department even more vulnerable unless we could change the engineering graduate education and research programs, at the time with a handful of graduate students and modest external funding, into a more robust program. Moving this agenda forward required the department to operate as a research institute and intensively seek internal and external funding to grow the number of graduate students and postdoctoral research associates, hire a younger faculty better fitting this new reality, and have better access to adequate research facilities and equipment. This new mission and goals created a significant lack of alignment, and therefore friction, with the non-engineering faculty and the degrees they supported. This was not a good situation for this group and their aspirations. This was not a good situation, and the solution was to transfer these faculty members and programs to the Crop and Soil Science department.

In addition to the faculty transfer, incentives were provided to the more senior faculty to retire. It should also be noted that previously (2006), the newly created bioengineering undergraduate program, with a biomedical flavor, did not fit well with the core engineering programs in the department and was transferred to Chemical Engineering to form the Chemical Engineering and Bioengineering department. Because of these changes, the faculty was reduced to a size insufficient in number and disciplinary interest to fulfill the new vision. This faculty supported work in two areas: a) Soil and Water, which later expanded to Land, Air, Water Resources and Environmental Engineering, and b) Food Engineering.

Given the importance of reducing the use of fossil fuels with renewable fuel sources, serious discussions on the possibility of creating a new emphasis area of Bioenergy and Bioproducts Engineering were considered suitable and necessary for the department's growth. This area was established in 2007,

and eventually, four new faculty members were hired along with remodeling at L.J Smith to accommodate laboratories, analytical instrumentation, and other equipment. This development was later enhanced with the creation of the Laboratory of Biofuels and Bioproducts, established in 2008 at the WSU Tri-cities campus in partnership with PNNL and with participant faculty from BSE and Chemical Engineering and Bioengineering.

Shortage of labor and the need to improve field management in production agriculture to increase yields while decreasing environmental impacts are promoting the emergence of a new paradigm in food production. Advances in sensors, robotics, the Internet of Things, and artificial intelligence promise to make this possible, bringing a renewed interest in precision/smart agriculture. Working with the CAHNRS Office of Research, a plan to meet these challenges was elaborated. As part of this plan, a new area of emphasis on Agricultural Automation Engineering was created as the fourth area of emphasis in the department. The Center for Precision Agriculture and Automated Systems was founded at the IAREC to catalyze research and education in this area, Prosser, inviting the participation of other relevant units at WSU.

Thanks to the efforts of faculty, associate researchers, graduate students, and staff, the department significantly raised its stand within CAHNRS and

WSU. There was a brief period of discussion on the merging of Chemical Engineering and BSE to form a Department of Chemical and Biological Engineering. At the time, the teaching appointments of BSE faculty were funded through the College of Engineering and Architecture. The merge, proposed by CEA, did not gather enough support from faculties in both departments, and eventually, the BSE teaching funding was transferred to CAHNRS. By some metrics, BSE research and graduate program was the top performer in CAHNRS, and the program was among the top performers at WSU in terms of the number of doctoral degrees awarded and the number of citations of published research.

The department experienced significant growth in graduate students, post-doctoral research associates, peer-reviewed publications, and external grant funding.

Semester	Ph.D. students	M.Sc. Students	Total Number of Graduate Students
Spring 2011	56	10	66
Fall 2011	65	10	75
Spring 2012	62	10	72
Fall 2012	68	11	79
Spring 2013	73	10	83
Fall 2013	70	12	82
Spring 2014	70	12	82
Fall 2014	67	12	79
Spring 2015	66	24	90
Fall 2015	75	13	88
Spring 2016	72	16	88
Fall 2016	79	14	93

Faculty changes 2001-2016

Anita Vasavada	Hired in 2001
David Lin	Hired in 2001
Clyde Fraisse	Hired in 2001
Carter Clary	Hired in 2001
Gary Hyde	Retired in 2002
William Symons	Retired in 2002
Pius Ndegwa	Hired in 2004
Clyde Fraisse	Left WSU in 2004
Carter Clary	Left WSU in 2006
Troy Peters	Hired in 2006
Jeff Ullman	Hired in 2006
James Durfey	Transferred to Crop and Soil Science in 2006
Michael Swan	Transferred to Crop and Soil Science in 2006
Marvin Kleene	Transferred to Crop and Soil Science in 2006
Anita Vasavada	Transferred to Chemical Engineering in 2006
David Lin	Transferred to Chemical Engineering in 2006
Manuel Garcia-Perez	Hired in 2007
Shyam Sablani	Hired in 2007
Brigitte Ahring	Hired in 2008
Bin Yang	Hired in 2009
Hanwu Lei	Hired in 2009
Qin Zhang	Hired in 2009
Gerritt Hoogenboom	Hired in 2010
Marvin Pitts	Transferred to WSU/OC-Bremerton in 2010
Jeff Ullman	Left WSU in 2011
Manoj Karkee	Hired in 2010
Sindhuja Sankaran	Hired in 2013
Lav Khot	Hired in 2015
Gerrit Hoogenboom	Left WSU in 2016

A Note on Facilities

The Bioproducts, Science, and Engineering Laboratory (BSEL) opened in May 2008 at the WSU Tri-cities campus in partnership with the Pacific Northwest National Laboratory. BSEL's goal is to move science to industrial processes that improve energy security, reduce petroleum imports, and decrease the impact of fuels on the environment. The facility is shared by BSE, Chemical Engineering and Bioengineering, and PNNL personnel. Three to four BSE faculty members have been housed and conducted research and graduate education at BSEL. Two of them (Birgitte Ahring and Manuel García-Perez) have been laboratory directors.

The Center for Precision and Automated Agricultural Systems (CPAAS) was established in 2000 to develop a world preeminent and Washington relevant research and educational program in the areas of agricultural automation and precision farming. New facilities for the center were built in 2015, housing three BSE faculty members. Dr. Qin Zhang has served as Director since 2010.

BSE has faculty housed in 5 locations: The L.J. Smith Hall in Pullman, the Bioproducts, Science, and Engineering Laboratory (BSEL) at Tri-cities; the Irrigated Agriculture Research and Extension Center (IAREC), and the Center for Precision Agriculture and Automated Systems (CPAAS) at Prosser; and the Puyallup Research and Extension Center. In addition, the Food Engineering faculty has laboratories and a pilot plant in the Food Science and Human Nutrition Building, and the Agricultural Automation Engineering faculty has access to a laboratory in Johnson Hall at the Pullman campus. The L.J. Smith Hall serves as the headquarters of the BSE department. This building was inaugurated in 1950, and many efforts were made to improve the utility of a facility built to meet the interest of the Agricultural Engineering and the Agricultural Mechanization at that time. Remodeling activities took place after the undergraduate programs in the department were discontinued or transferred to provide better space for research laboratories and graduate student offices.

Juming Tang 2016-2020

Driving for Top Department Ranking in Agricultural Engineering

by Juming Tang



Dr. Juming Tang was appointed Chair of the Department of Biological Systems Engineering on July 1, 2016 and completed the appointment on Nov. 1, 2020. Before 2016, Dr. Tang served as Associate Department Chair for several years, taking responsibility for graduate studies.

Dr. Tang was born in Changsha, China. He completed a B.S. in the Department of Engineering Mechanics at the Central South University in China, worked three years as a junior faculty member in the Department of Agriculture Engineering at Hunan Agricultural University before going to Canada in 1985 for advanced degrees. He completed an M.S. degree in the School of Engineering at the University of Guelph in 1987 and a Ph.D. degree in 1990 in the Department of Agricultural Engineering at the University of Saskatchewan. After a brief post-doctorate experience in

the Cereal Chemistry and Processing Laboratory at the University of Saskatchewan, he joined the School of Food Science at Acadia University in Canada as an assistant professor where he taught undergraduate courses on introductory food engineering, food processing technologies, and food commodities. He moved to the United States in 1994, where he taught at South Dakota State University for one year before coming to WSU as an assistant professor in food engineering. At WSU, he expanded his earlier research on food drying technologies and food rheology to advanced food processing technologies for ready-to-eat meals and low-moisture food safety. He was promoted to Associate Professor in 2000, to full Professor in 2003, and to Regents' Professor in 2014. Dr. Tang became a fellow of ASABE and IFT in 2014. He was elected to the Washington State Academy of Sciences in 2019, to the U.S. National Academy of Engineering, and elected as a Fellow of the National Academy of Inventors in 2021.

Department Priorities

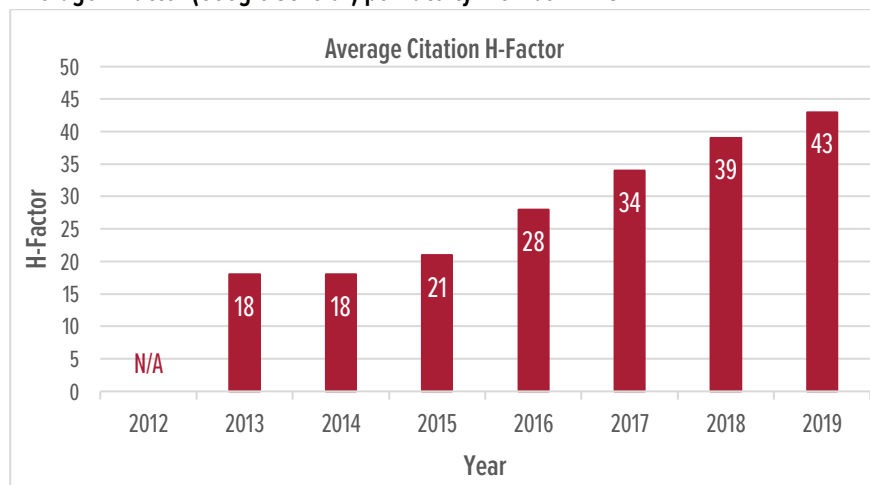
When Dr. Tang took over as Chair of the Department, BSE had enjoyed a lengthy period of expansion, adding faculty members and improving research laboratories and infrastructure, increasing the number and value of external grants, and steadily increasing the number of graduate students, especially Ph.D. students. Yet faculty members recognized that the strength of our department was undervalued by our

peers, as reflected by the consistently low ranking of our graduate programs in various ranking systems, including by *U.S. News & World Report*. This adversely influenced our ability to attract and recruit high-quality graduate students. At the departmental retreat in 2016, the faculty set three priorities for future activities:



BSE students, staff, and faculty at the 2017 ASABE annual conference in Spokane

Average H-factor (Google Scholar) per faculty member in BSE



1. Increasing visibility and ranking of our department;
2. Improving quality of recruitment of graduate students;
3. Strengthening collaborations within and between focus areas.

In 2016, BSE had 16 full time permanent faculty FTE members, four in Agricultural Automation Engineering, five in Bioenergy and Bioproducts Engineering, three in Food Engineering, and four in Land, Air, Water Resources, and Environmental Engineering (LAWREE). The department identified a need to strengthen the focus area of Food Engineering and prepare for retirement of Dr. Claudio Stockle in LAWREE. In support of Dr. Tang's appointment as Chair of the Department and the priorities of the department, the college promised two new positions for BSE, one in Food Engineering and one in LAWREE. The college also allocated \$30,000 per year to strengthen BSE graduate education. Most of the funds were used to support graduate students' participation at ASABE conferences that significantly enhanced the professional experiences of the student and elevated the visibility of the department among our peers. In addition, the college appointed Dr. Sablani as Associate Chair responsible for the department graduate programs, so that Dr. Tang could maintain his research activities and continue teaching graduate courses.

Elevating the Department's Visibility and Ranking

The first effort to elevate our visibility was a one-day workshop on graduate education organized by the department before the ASABE Annual Conference in Spokane on July 16-19, 2017. We invited the department chairs and associate chairs responsible for graduate education from five top ranked departments, i.e., Cornell University, Purdue University, Iowa State University, Illinois

University at Urbana-Champaign, and Texas A&M University). The workshop took place on July 15, chaired by Dr. James H. Dooley, a past President of ASABE, and Dr. Norman Scott, an alumnus of BSE and former vice president at Cornell University. ASABE Executive Director Darrin Drollinger and USDA NIFA National Program Leader Dr. Hongda Chen were also invited to participate. As a hosting department of ASABE's Annual Conference in 2017, over 30 graduate students from BSE provided service as volunteers coordinated by Jonathan Lomber. The department hosted over 50 visitors from the U.S. and several other countries on the Pullman campus and organized a half-day workshop on research and graduate education in Agricultural Engineering the day after the conference.

In 2017, the university began multiple years of budget reductions. A few years later, COVID-19 put additional financial pressure on the university. The resulting cuts damped our ambition for expansion. One of the most important responsibilities for the Department Chair became planning and navigating budget cuts and managing crises to minimize damages to the core functions of the Department and the morale of the faculty, staff, and students.

Although BSE was able to weather the unprecedented financial storm via the phased retirement of Dr. Claudio Stockle between 2019 and 2021, the continuous cuts significantly eroded the operation funds for the Department. We managed to protect all the faculty and staff positions; the resilient faculty members continued to be extremely productive in scholarly activities and graduate education. From 2016 to

2019, the annual departmental research expenditures from external grants increased from \$3.4M to \$4.5M, new grant awards increased from \$4.9M to \$9.0M, the total Google Scholar citations of papers published by BSE faculty members increased from 95,000 to 153,000, and the average H-factor per faculty member increased from 34 to 43. The research of BSE faculty members also led to nine patents being granted during this period.

The department faculty received several multi-million dollar grants from the DoE and USDA NIFA, with participation of multiple faculty members from the department as co-PIs of grants. The large projects enhanced collaboration among faculty members within and across the four focus areas. The visibility of the department was greatly enhanced by the numerous professional awards and recognitions given to our faculty members: Dr. Gustavo V. Barbosa-Cánovas received IFT R&D Award (2017) and EFFoST/IFT Nonthermal Processing Division Lifetime Achievement Award (2019), Dr. Manoj Karkee was featured as a pioneer in AI and IoT in Connected World Magazine (2019) and Western Innovator in Capital Press (2019), Dr. Lav Khot was named as New Innovator in Food and Agriculture Research by the Foundation for Food and Agriculture Research, Washington DC (2018), Dr. Shyam Sablani received the Marcel Loncin Research Prize from IFT (2016), Dr. Tang received a Life-Time Achievement Award from the International Association for Engineering and Food (2018) and was elected to the Washington State Academy of Sciences (2019), Dr. Bin Yang was awarded a Fulbright-Aalto University Distinguished Chair (2019-2020), and Dr. Qin Zhang received the John Deere Gold Metal in ASABE (2017) and was elected to the Washington State Academy of Sciences (2020). An outcome of our faculty's efforts is a steady rising of the department in US News Best Graduate School rankings: from 18th in 2017 to 14th in 2018 and 12th in 2021. The department was also ranked 5th in the US and 8th in the worldwide ranking (EduRank) of the World's Best Agricultural Engineering Departments.

Graduate Program

Throughout this period, BSE's graduate programs remained strong. In total, 73 Ph.D. students and 27 M.S. students graduated from BSE between 2016 and 2020. BSE faculty members hosted between 12 and 31 international visitors per year from 17 different countries. But our recruitment efforts were hampered by the COVID-19 pandemic between 2019 and 2021. BSE's graduate education had benefited greatly from WSU's agreement with the Chinese Scholarship Council (CSC); our programs had attracted more than 50 CSC supported Ph.D. students over the past ten years. The agreement was terminated in 2021, and the department saw a historically low number of applicants, the lowest from China since 1995. It will be a major challenge for BSE to maintain a strong graduate program with high quality new applicants.

Promotion of Faculty Members

This period witnessed the most faculty applications for tenure and promotions: Drs. Sindhuja Sankaran (2018) and Lav R. Khot (2019) were tenured and promoted to Associate professor; Drs. Troy Peters (2017), Shaym Sablani (2018), Pius Ndegwa (2018), Manuel Garcia-Perez (2018), Bin Yang (2020) and Hanwu Lei (2020) were promoted to full Professor. These promotions significantly changed the composition of the department.

In 2020, 12 faculty members were full Professors, and three were Associate Professors. The department saw a need to bring in young faculty members. In 2020, Dr. Kirti Rajagopalan joined BSE as an assistant professor in LAWREE, filling the void left by Dr. Stockle's retirement. In May, 2022, the university reopened the food engineering position that was originally committed to BSE in 2016. The search in 2017-18 failed to find the right individual and the position had been closed during COVID-19. We hope to bring more young faculty members with fresh energy and ideas to elevate the department to a level that matches the sharp increase in economic strength and status of Washington State.

Chronological Listing of Faculty, Staff Members, Graduate and Undergraduate Students, and Visiting Scholars

1. Chronological Listing of Faculty

Compiled by Larry G. James
from WSU Catalog, Regent's Meeting Minutes, and Departmental and University Records

Faculty	Education	Position	Date of first - End Date Appointment
Irving D. Charlton	B.S. Mechanical Engineering Michigan Agricultural College	Instructor 1910-1912; Asst Professor 1912-1914; Professor 1914-1918	1910- Feb. 11, 1918
Leonard J. Fletcher	B.S. Iowa State College	Instructor 1915-1916	Sept. 15, 1915-Aug. 1, 1916
James P. Fairbank	B.Sc. Agricultural Engineering University of Nebraska.	Instructor 1916-1918; Acting Head 1917; Asst Professor & Head 1918-1919; Professor & Head 1919-1920	Sept. 15, 1916—June 15, 1920
Edward J. Stirniman	M.S. Agricultural Engineering Iowa State College	Instructor 1918-1919	June 1, 1918 Oct. 1, 1919
Clarence C. Johnson	B.A. State College of Washington	Student Instructor 1919-1920; Asst in Ag E 1920-22; Instructor 1922-1928; Asst Prof 1928-1935	Oct. 10, 1919 June 30, 1935
Leslie John Smith	B.S. Engineering (emphasis Mechanical Engineering) State College of Michigan (1906) M.E. Mechanical Engineering State College of Michigan (1908)	Prof and Head 1920-1947; State Professor of Agricultural Engineering 1947-1949; Born: May 25, 1881; Died: May 11, 1968 (age 86)	Aug. 16, 1920- Sept. 16, 1949
Austin B. Crane	B.S. and M.S. Engineering South Dakota State College	Extension Assistant Professor of Agricultural Engineer 1922-1929	Sept. 1922 -July 1929
Harry L. Garver	B.S. from Dept. of Mechanic Arts and Engineering WSC (1922)	Investigator—Uses of Electricity in Agriculture	April 21, 1925- Nov 6, 1938
Arthur Jacquot	B.S. (1932) and M.S. (1935) Agricultural Engineering WSC	Instructor 1933-39	Dec. 1, 1933- Sept. 1, 1939
W. A. Junnila	Unknown	Investigator—Uses of Electricity in Agriculture	Nov. 15, 1938-Sept. 30, 1940
Orville J. Trenary	B.S. Agricultural Engineering University of Wisconsin B.S. Agricultural Engineering University of Nebraska	Asst Professor 1939-1944	Sept. 16, 1939-Nov 1, 1944
June Roberts	B.S. & M.S. Agricultural Engineering Kansas State College	Investigator in Farm Electricity 1940-1946; Leave of absence to serve in US Navy 1942-1946; Assoc Prof & Assoc Ag E 1946-1947; Prof and Chair 1947-1975 Died Jan 23, 2004 (age 93)	Oct. 1, 1940-June 30, 1975

Richard N. Miller	unknown	Extension Specialist Land Clearing Economics 1925-1943 Extension Agricultural Engineer 1943-1949	July 1, 1943-1949
William H. Johnson	B.S. University of Minnesota (1941)	Instructor 1945-194; Asst Prof and Asst Ag Engr 1947-1953	Jan 1, 1945-Aug. 1953
Walter W. Hinz	B.S. Agricultural Engineering WSC (1938)	Instructor & Asst in Agricultural Engineering in the Ag Experiment Station 1945-1947	Oct. 1, 1945-1947
Aldert Molenaar	B.S. Agricultural Engineering University of Nebraska (1933) M.S. Irrigation Science University of California, Davis (1938)	Extension Agricultural Engineer 1946-1946; Assoc Prof & Assoc Ag Engr 1946-1950; Prof & Ag Engr 1950-1952	March 25, 1946-1952
Homer D. McGhie	B.S. Agricultural Engineering University of Minnesota (1940)	Instructor & Assistant Agricultural Engineer 1947-1951	Feb 1, 1947-1951
Walter E. Matson	B.S. (1947) and M.S. (1953) Agricultural Engineering WSC B.S. Electrical Engineering WSC (1957)	Instructor and Junior Agricultural Engineer 1947-1950; Asst Prof & Asst Ag Engr 1953-1958; Assoc Prof & Assoc Ag Engr 1958-1965	Aug. 15, 1947-1965
John E. George	B.S. Agriculture (Farm Engineering) 1947 and B.S. Agricultural Engineering (1956) WSC M.S. Agricultural Engineering University of Idaho (1957)	Staff Agricultural Engineer 1947-1948; Junior Agricultural Engineer 1948-1951; Instructor 1951-1953; Assistant Agricultural Engineer 1953-1954; Asst Prof & Asst Ag Engr 1954-1964; Assoc Prof & Assoc Ag Engr 1964-1973 Prof & Ag Engr 1973-1987	Sept. 1, 1947-Oct. 31, 1987
Robert O. Gilden	B.S. Agricultural Engineering Washington State College (1947)	Instructor & Junior Agricultural Engineer 1948-1951	May 29, 1948-Feb 1, 1951
David A. Hartzog	B.S. Oregon State College (1940)	Instructor; Asst Prof & Asst Ag Engr; Assoc Prof & Assoc Ag Engr 1957	July 1, 1948-1958
Paul K. Fanning	B.S. Kansas State College (1937)	Extension Agricultural Engineer 1949-1955; Ext Ag E-3 1955-1961; Returned as Extension Ag Engr specializing in Farm Safety E-4 1977; Retired April 15, 1981	July 18, 1949-April 15, 1981
William O. Pruitt	B.S. (1949) and M.S. (1951) Agricultural Engineering WSC	Jr Ag Engr (IAREC, Prosser) 1950-1956; WSU Alumni Achievement Award 1986; Died: Jan 26, 2009	June 1, 1950-1956
Robert A. Aldrich	B.S. Agricultural Engineering WSC (1951)	Acting Instructor & Jr Ag Engr 1951-1952; Instr & Jr Ag Engr 1952-1954; Asst Prof & Asst Ag Engr 1954-1959	Feb 1, 1951-1959
Max C. Jensen	B.S. (1939) and M.S. (1940) Agricultural Engineering University of Idaho	Assoc Prof & Assoc Ag Engr 1952-1953; Prof & Ag Engr 1953-1970	Sept. 1, 1952-July 1, 1970
Moses Morgan	B.S. Texas A&M M.S. Oklahoma A&M	Asst Prof & Asst Ag Engr 1953	Sept. 1, 1953-1959
Day L. Bassett	B.S. Agricultural Engineering (1948), Civil Engineering (1950), and M.S. Irrigation Engineering (1952) Utah State College Ph.D. Agricultural Engineering University of Idaho (1973)	Asst Prof & Asst Ag Engr 1954-1961; Assoc Prof & Assoc Ag Engr 1961-1989; Retired Jan 31, 1989	1954-Jan 31, 1989

James E. (Pat) Middleton	Not applicable	Asst Ag Engr (IAREC, Prosser) 1957-1963, Associate Ag Engr 1963-1980	1957-April 30, 1980
William H. Knight	B.S. Agricultural Engineering?	Assistant Dean and Director of Engineering Extension WSU 1956-1981; Died Aug. 7, 1984 (age 68)	Never an active member of department
Donald A. Backus	B.S. Agricultural Engineering WSC (1957)	Acting Instructor 1957-1958; Instr & Jr Ag Engr 1958-1960	1957-July 1, 1960
Patrick F. Alleyn	Not applicable	Acting Instr & Acting Jr Ag Engr 1957-1959	Sept. 15, 1957-1959
John B. Simpson	B.S. (1958) and M.S. (1964) Agricultural Engineering WSU Ph.D. Agricultural Engineering Cornell University (1971)	Instructor 1959-1967; Asst Prof & Asst Ag Engr 1970-1975; Assoc Prof and Assoc Ag Engr 1975; Prof and Ag Engr??	1959-1994
Albert E. Powell	B.S. Agricultural Engineering Pennsylvania State University (1941) M.S. Agricultural Engineering Purdue University (1943) Ph.D. Agricultural and Mechanical Engineering Iowa State University (1960)	Asst Prof and Asst Ag Engr 1960-1965; Assoc Prof and Assoc Ag Engr 1965- ; Prof and Ag Engr??	July 1, 1960-1990
Melvin A. Hagood	B.S. Oregon State College (1948)	Country Extension Agent (Grant Co) E-2 1951-1961; Extension Agricultural Engineer (E-3) 1961; Ext Agricultural Engineer IAREC Prosser E-4?; Retired July 15, 1977	July 1, 1961—July 15, 1977
Everett H. Davis	B.S. ? M.S. University of Idaho	Extension Agricultural Engineer	1962?-Oct. 28, 1969
C. Alan Pettibone	B.S. Agriculture, (1954) WSC; B.S. (1960) and M.S. (1965) in Agricultural Engineering WSU; Ph.D. Agricultural Engineering Cornell University (1973?)	Acting Instructor 1963-64; Asst Prof and Asst Ag Engr 1965-1974; Assoc Prof and Assoc Ag Engr 1974-1978; Assoc Prof and Chair 1975-1978; Prof & Chair 1978-1979; Assoc Dean of Ag & Home Econ & Dir Resident Instruction 1979-1982, 1983-1985; Interim Dean Ag & Home Econ 1982-1983; Director of Washington Dept. of Agriculture 1985-1993; Superintendent of WSU Puyallup 1993-???	1963-Sept. 1, 1965 1985
Charles L. Peterson	B.S. (1961) and M.S. (1966) Agricultural Engineering University of Idaho Ph.D. Engr Sci (Ag Engr) WSU (1973)	Instructor 1967-1968?; Asst Prof and Asst Ag Engr 1968-1973	1967-1973
Charles C. Mueller	B.S. Agricultural Engineering California Polytechnic State University (1963) M.S. (1964) and Ph.D. (1969) Michigan State University	Asst Prof & Asst Ag Engr 1968-1973	1968-1973
James H. Milligan	B.S. (1963) and Ph.D. (1969) Civil Engineering Utah State University	Extension Agricultural Engineer 1970?-1972?	1970-1972

Gene T. Thompson	B.S. (1951) and M.S. (1961) Agricultural Engineering WSU Ph.D. Civil Engineering WSU (1974)	Asst Prof and Asst Ag Engr 1970-1978 Extension Irrigation Engineer IAREC Prosser 1979-1982 Died March 28, 2015 (age 86)	1970-1982?
Donald McCool	B.S. (1960) & M.S. (1961) Agricultural Engineering University of Missouri Ph.D. Agricultural Engineering Oklahoma State University (1965)	USDA-ARS, Assoc Prof (courtesy appointment)	1971-?
Keith O. Eggleston	B.S. (1966) and M.S. (1967) Agricultural Engineering Utah State University Ph.D. Irrigation Engineering Utah State University (1970)	Asst Prof & Asst Ag Engr 1971-1973	1971-1973?
Ronald E. Hermanson	B.S. (1958), & M.S. (1964) Agricultural Engineering Iowa State University Ph.D. Water Resource Engineering Iowa State University (1967)	Ext Ag Engineer E-2 1973-1975, Ext Ag Engineer E-3 1975-1979, Ext Ag Engineer E-4 1979-1996, Died Aug. 21, 2015 (age 82)	Jan 1, 1973-1996
Henry Waelti	B.S. Agricultural Engineering Oregon State university (1957) M.S. Purdue (1960) Ph.D. Iowa State University (1967)	Ext Ag Engineer E-2 1973-1974, Ext Ag Engineer E-3 1974-1976 Ext Ag Engineer E-4 1976-1995 Died May 21, 2004 (age 75)	Jan 1, 1973-1996?
Larry G. King	B.S. Agricultural Engineering WSU (1958) M.S. Mathematics Colorado State University (1961) Ph.D. Water Resources Colorado State University (1965)	Professor 1974-1979, Professor and Chair 1979-1987, Professor (1987-1998), Retired June 1998	June 1, 1974-June 1998
Gary M. Hyde	B.S. (1964) and M.S. (1969) Agricultural Engineering WSU Ph.D. Engineering University of Illinois (1975)	Assoc Prof & Assoc Ag Engr 1975-1988, Prof & Ag Engr 1988-2003	Sept. 1, 1975-2003
Richard E. Linhardt	Ph.D. University of Missouri	Assoc Prof 1975-1979	Sept. 1, 1975-1979
Keith E. Saxton	B.S. Agricultural Engineering University of Nebraska (1961) M.S. Civil Engineering University of Wisconsin (1965) Ph.D. Agricultural Engineering Iowa State University (1972)	USDA-ARS (Research Hydrologist; Assoc Prof (courtesy appointment)	1976-?
Denny C. Davis	B.S. Agricultural Engineering WSU (1967) M.S. (1969) and Ph.D. (1973) Agricultural Engineering Cornell University	Asst Prof & Asst Ag Engr 1976-1980, Assoc Prof & Ag Engr 1980-1987, Prof & Ag Engr 1987-2012, Associate Dean of Undergraduate Programs College of Engineering & Architecture WSU 1986-1998, Interim Director Center for Precision Agriculture 1999-2000, Prof & Chair Dept. of Biological Systems Engineering 2000-2001, Interim Director Program in Bioengineering 2001-2003	June 1976-May 2012

Glenn A. Kranzler	B.S. (1963) and M.S. (1965) Agricultural Engineering North Dakota State University Ph.D. Agricultural Engineering Iowa State University (1977)	Asst Prof & Asst Ag Engr 1976-1980, Assoc Prof & Assoc Ag Engr 1980-1982	1976-1982
Larry G. James	B.S. Agricultural Engineering Washington State University (1970) Ph.D. Agricultural Engineering University of Minnesota (1975)	Asst Prof & Asst Ag Engr, Assoc Prof & Assoc Ag Engr 1977-1982, Assoc Prof & Chair 1987-1988, Prof & Chair 1988-1991, Interim Assoc Dean of Ag & Home Econ & Dir of Cooperative Extension 1991-1992, Assoc Dean of Ag & Home Econ & dir of Resident Instruction 1992-1994, 1995-1998, Interim Dean of Ag & Home Econ 1994-95, Chancellor WSU Tri-Cities 1998-2005, Associate Executive VP 2005-2009, Vice Provost for Academic Affairs 2009-2013, Retired April 30, 2013	Aug. 1, 1977-Aug. 1991
Landis L. Boyd	B.S. (1947), M.S. (1948) & Ph.D. (1959) Agricultural Engineering Iowa State University	Assoc Dean and Director Ag Research Station 1978-1985, Died April 28, 2019 in Minnetonka, MN	1978-1985
William B. Symons	B.S. Agricultural Mechanization Merced College (1969) M.S. Agricultural Mechanization (1973) Ph.D. Agricultural Education Ohio State University (1975)	Asst Prof & Ext Spec E-2 1980-?, Assoc Prof & Ext Spec E-3	1980-2006?
Robert G. Evans	B.S. Agricultural Engineering Colorado State University (1970) M.S. Civil engineering Colorado State University (1972) Ph.D. Engineering Science Colorado State University (1981)	Asst Ag Engr (IAREC, Prosser) 1980-1986, Assoc Ag Engr 1986-1993, Ag Engr 1993-2001	Oct. 27, 1980-Jan 2001
Thomas W. Ley	B.S. (1977) and M.S. (1978) Agricultural Engineering Colorado State University Ph.D. Irrigation Engineering Utah State University (1995)	Extension Irrigation Engr (IAREC, Prosser) E-2 1983-1988, Ext Irrigation Engineer E-3 1988-?, Ext Irrigation Engineer E-4?	July 1983- April 1997
Marvin J. Pitts	B.S. (1978), M.S. (1980), and Ph.D. (1983) Agricultural Engineering University of Illinois	Asst Prof and Asst Ag Engr 1983-1989, Assoc Prof and Assoc Ag Engr 1989-2010, Professor and Program Coordinator WSU Mechanical Engineering Program at Olympic College 2010-	1983-2010
Dale E. Wilkens	B.S. Agricultural Engineering Purdue University ? M.S. Agricultural Engineering University of Maryland ? Ph.D. Agricultural Engineering Iowa State University ?	USDA- ARS Agricultural Engineer (Power and Machinery), Assoc Prof (courtesy appointment)	1984-1994?

Ralph P. Cavalieri	B.S. Chemical Engineering University of Idaho (1975) Ph.D. Chemical Engineering WSU (1985)	Asst Prof & Asst Ag Engr 1985-, Assoc Prof & Assoc Ag Engr?, Prof & Chair Dept. of Biological Systems Engineering 1990-2000, Assoc Dean and Director Ag Research Center 2000-2012, Assoc Vice President for Alternative Energy WSU 2012-2016	Jan 1985-Dec. 2016
Claudio O. Stockle	B.S. Agricultural Engineering University of Chile (1972) M.S. Agricultural Engineering,(1986), and M.S. (1983) and Ph.D. (1985) Soil Physics Washington State University	Asst Prof & Asst Scientist 1989-1994, Assoc Prof & Assoc Scientist 1994-1998, Prof & Scientist 1998-2022, Interim Director Water Research Center State of Washington 1999-2001, Prof & Chair 2001-2016	Sept. 1989-Dec. 2022
Gustavo Barbosa-Canovas	B.S. Mechanical Engineering University of Uruguay (1977) M.S. (1982) and Ph.D. (1985) Food Engineering University of Massachusetts-Amherst	Asst Prof & Scientist 1990-1994, Assoc Prof & Assoc Scientist 1994-1998, Prof & Scientist 1998-	1990
James E. Durfey	B.S. Forestry Management (1973), B.S. Agricultural Education (1987), and MA Adult & Continuing Education (1989) WSU	Instructor 1992-2006	1992-2006
Joseph Cvancara	Ph.D. Ag Education University of Minnesota	Professor of Agricultural Education	1993-1997
Clifford Nelson	Ph.D. Ag Education University of Minnesota	Professor of Agricultural Education	1993-1997
Marvin Kleene	Ph.D. Ag Education University of Minnesota	Assoc Professor of Agricultural Education	1993-2006
Juming Tang	B.S. Mechanical Engineering Central-South University of Technology Changsha, Hunan, China (1982) M.S. Agricultural Engineering University of Guelph (1987) Ph.D. Agricultural Engineering University of Saskatchewan (1991)	Asst Prof and Asst Scientist 1995-2000, Assoc Prof and Assoc Scientists 2000-2003, Prof and Scientist 2003-2014, Distinguished Chair of Food Engineering 2012, Regents Prof 2014-	1995
Shulin Chen	B.S. Agricultural Engineering The Agricultural University of Hebei (1981) M.S. Agricultural Engineering Beijing Agricultural Engineering University (1984) Ph.D. Biological and Agricultural Engineering Cornell University (1991)	Asst Prof & Scientist 1995-2000, Assoc Prof & Scientist 2000-2003, Prof & Scientist 2003-, Interim Director of WSU Center for Bioproducts and Bioenergy 2006-2007	Oct. 1995
Michael K. Swan	B.S. Agriculture (1974) WSU M Ed Agricultural Education (1984) and Ph.D. (1990) Vocational Education Oregon State University	Professor 1997-2006	1997-2006
Kenneth B. Campbell	Ph.D. & DVM University of California, Davis	Professor, Veterinary Comparative Anatomy, Pharmacology, Physiology, and Bioengineering	1997-2004

Brian G. Leib	B.S. Agricultural Engineering Pennsylvania State University (1982) M.S. Agricultural Engineering Colorado State University (1989) Ph.D. Agricultural Engineering Pennsylvania State University (1998)	Assistant Professor and Extension Irrigation Specialist E-2 IAREC Prosser 1998-2003	2000-2003
Francis Pierce	B.S. Geology SUNY Brockport ? M.S. (1980) and Ph.D. (1984) Soil Science University of Minnesota	Professor and Director of Center for Precision Agricultural Systems Professor and Ag Engr 2000-2010, retired March 2011	Sept. 2000-2010
Anita Vasavada	BA Mathematics/Physics Whitman College and B.S. Mechanical Engineering Columbia University (1990) M.S. Mechanical Engineering Stanford University (1991) Ph.D. Biomedical Engineering Northwestern University (1999)	Assistant Professor 2001, Associate Professor?, reassigned to Dept. of Chemical and Bioengineering in 2006	Jan 2001-2006
David C. Lin	B.S. Mechanical Engineering Massachusetts Institute of Technology (1987) M.S. (1989) and Ph.D. (1997) Biomedical Engineering Northwestern University	Assistant Professor 2001-2006, Assistant Professor Chemical and Bioengineering 2006-2008, Associate Professor Chemical and Bioengineering 2008-	2001-2006
Clyde Fraisse	B.S. Civil Engineering Universidade Federal do Parana (1982) M.S. Irrigation Engineering Katholieke Universiteit Leuven (1988) Ph.D. Agricultural Engineering Colorado State University (1994)	Assistant Water Management Engineer IAREC Prosser 2001-2003	2001?-2003
Jane Q. Wu	B.S. Geology (1986) and M.S. Hydrology (1989) Tongji University M.S. Mathematics WSU (2009) Ph.D. Agricultural Engineering Ohio State University (1994)	Associate Professor, BSE Pullman, Professor BSE Puyallup 2010	2004-
Pius M. Ndegwa	B.S. Agricultural Engineering University of Nairobi, Nairobi, Kenya (1986) M.S. Agricultural Engineering (1990) and Ph.D. (1999) Biological and Agricultural Engineering University of Georgia	Assistant Professor 2004-2010, Associate Professor 2010-2019, Professor 2019	Aug. 2004-
R. Troy Peters	B.S. Manufacturing Engineering Brigham Young University (1997) Ph.D. Irrigation Engineering Utah State University (2003)	Extension Irrigation Specialist/Assoc Research Scientist E-3 2006-, E-4?	March 2006-
Jeffrey L. Ullman	Ph.D. Environmental Engineering	Assistant Professor	2006-2011

Manuel Garcia-Perez	BE Chemical Engineering (1995) and M Engr Process Engineering (1998) University of Orient, Santiago de Cuba M.S. (2001) and Ph.D. (2005) Chemical Engineering University Laval	Assistant Professor 2007-2013, Associate Professor 2013-2020 Professor and Chair 2020	2007-
Shyam S. Sablani	BE Mechanical Engineering National Institute of Technology, Raipur, India (1986) M.S. Mechanical Engineering India Institute of Technology (1990) Ph.D. Food/Process Engineering McGill University (1996)	Assistant Professor 2007-2013, Associate Professor 2013-2020, Professor 2020	2007-
Birgitte K. Ahring	B.S. Biology Copenhagen University (1982) Ph.D. Microbiology Copenhagen University (1986)	Professor 2008-	2008
Hanwu Lei	B.S. Grain Science and Engineering Wuxi University of Light Industry, China (1992) M.S. (2003) and Ph.D. (2006) Biosystems and Agricultural Engineering University of Minnesota	Assistant Professor and Assistant Scientist 2009-2015, Associate Professor and Associate Scientist 2015-	Aug. 2009-
Bin Yang	B.S. Microbiology (1986) and M of Engr Chemical Engineering (1993) Northwest University, Xi'an, China (1986) Ph.D. Food Engineering South China University of Technology, Guangzhou, China (1996)	Assistant Professor 2009-2015, Associate Professor 2015-, Professor	2009-
Qin Zhang	B.S. Mechanical Engineering Zhejiang Agricultural University, China (1982) M.S. Agricultural Engineering University of Idaho (1987) Ph.D. Agricultural Engineering University of Illinois (1991)	Professor & Director of WSU Center for Precision and Automated Agricultural Systems, Prosser 2010-	2009-
Manoj Karkee	Assoc degree Civil Engineering(1997) and BE Computer Engineering Tribhuvan University, Nepal (2002) ME Remote Sensing and GIS Asian Institute of Technology, Thailand (2005) Ph.D. Agricultural Engineering and Human Computer Interaction Iowa State University (2009)	Assistant Professor 2010-2016, Associate Professor 2016-	2010-

Gerrit Hoogenboom	B.S. Horticulture: Plant Physiology, M.S. Horticulture: Theoretical Production Ecology, and Wageningen University, the Netherlands (1981) Ph.D. Agronomy and Soils (Crop Science) Auburn University (1985)	Professor and Director of AgWeatherNet 2010-2015	Aug. 2010-Dec. 2015
Liang Yu	BSE Chemical Engineering Zhejiang University (1992) M.S. Chemical Engineering-Petroleum Technology China University of Petroleum (2004) Ph.D. Chemical Engineering Institute of Process Engineering, Chinese Academy of Science (2008)	Associate in Research 2012-2019, Research Assistant Professor 2019-2021, Assistant Professor 2021-	2012
Lav R. Khot	B Tech Agricultural Engineering MPKV Agricultural University, India (2001) PG Diploma Advance Computing C-DAC, Govt of India (2002) M Engr Agricultural Systems and Engineering Asian Institute of Technology Thailand (2004) M.S. Agricultural and Biological Engineering Iowa State University (2006) Ph.D. Agricultural and Biological Systems Engineering North Dakota State University (2009)	Asst Research Professor (Pullman) 2013-2014, Asst Research Prof & Ext Specialist E-2 2015- Center for Precision and Automated Agricultural Systems (CPAAS) Prosser, Interim Director of CPAAS 2021	June 2013
Sindhuja Sankaran	B.S. Zoology University of Madras, India (2000) M.S. Environmental Science Anna University, India (2002) M.S. Environmental Engineering Iowa State University (2006) Ph.D. Agricultural and Biological Engineering North Dakota State University (2009)	Assistant Professor 2013-	June 2013
Melba R. Salazar-Gutierrez	B.S. Education—Biology Universidad del Cauca (1993) Specialization in Statistics Universidad Nacional de Colombia (1996) Ph.D. Agronomy Sciences Universidad Nacional de Columbia (2006)	Assistant Research Professor 2013-2021	2013-Jan 2021
Kirti Rajagopalan	BE Civil Engineering National Institute of Technology, Nagpur, India (2000) MBA Iowa State University (2005) Ph.D. Civil Engineering WSU (2016)	Assistant Professor 2020-	2020-



Back row, L-R: Lav Khot, Melba Salazar Gutierrez, Bin Yang, Jonathan Lomber, Joanna Dreger, Troy Peters, Hanwu Lei, Qin Zhang, Shulin Chen, Joan Wu, Sindhuja Sankaran. Front row, L-R: Shyam Sablani, Claudio Stockle, Juming Tang, Ralph Cavalieri, Birgitte Ahring.

2. Chronological List of Staff Members

Compiled by Jonathan Lomber
from WSU phone directories

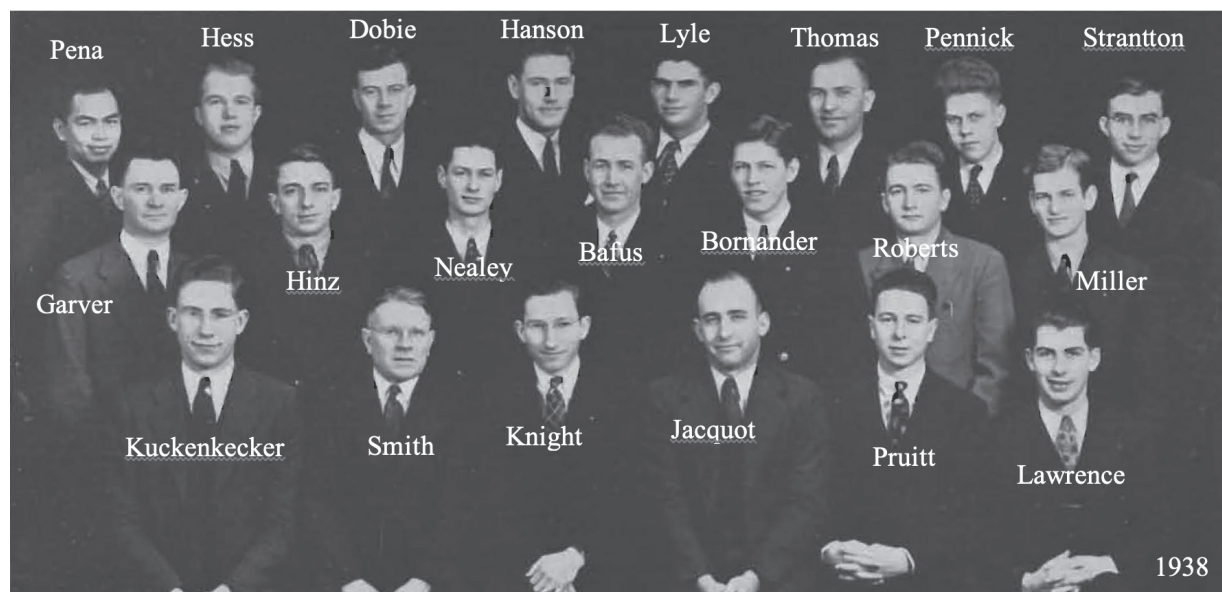
Staff	Position/degree	Date of first AgE/BSE Appointment	End Date of AgE/BSE Appointment
No Secretary or Chair listed pre-1958			
Haynes, Robert E.	Feed Plant Operator Tractor Operator @ College Farm 1949-1952	54/55	Not Listed after 1970
Harrison, Gladys V.	Secretary	Pre-1958	67/68
Robinson, R.M.	Asst. Feed Plant Operator	65/66	Not Listed after 1970
Osgard, Genevieve	Secretary	67/68	68/69
Sprute, Mona	Secretary	68/69	69/70
Ochs, Charlotte S.	Secretary	70/71	71/72
Johnson, Mary	Secretary	71/72	73/74
Hancock, Martha	Secretary	73/74	74/75
Woodslide, Leslie	Secretary	73/74	75/76
Ewell, Virgil N.	Engr Tech II	Pre 1976*	90/91
Holland, Fran	Secretary	75/76	78/79
Dossett, Myron	Staff Member (nos***)	Pre-1976*	79/80
Janke, Albert	Staff Member (nos)	Pre-1976*	79/80
Smythe, Mary	Secretary	76/77	77/78
Lynch, Ellen	Secretary	76/77	78/79
DeWitt Wayne L	Engr Tech II/BS, AgSci, Uof Idaho	76/77	2010
Bowe, William (Bill) E	Engr Tech II/B.S. Agrom, WSU	77/78	2009
Himsl, Vince S.	Opt Mantn. Engr./ AA Centralia > Cmptr. Maint. Tech III> Cmptr. Maint. Tech. Supr.	78/79	2014
Plymire, Sylvia	Secretary	78/79	79/80
Vilett, Linda	Secretary	78/79	79/80
Martel, Soleil	Staff Member (nos)	78/79	79/80
Mutch, Paul	Staff Member (nos)	Pre-1976* (not listed 1977)	79/80
Martel, Soleil	Staff Member (nos)	78/79	79/80
Mutch, Paul	Staff Member (nos)	Pre-1976* (not listed 1977)	79/80
Richmand, Raymond	Technical Staff (nos)	78/79	82/83
Harrell, Roy C.	Research Associate (RA not listed Pre-1980)	Pre-1980	82/83
Stone, Marvin L.	Research Associate (RA not listed Pre-1980)	Pre-1980	81/82
Boyle, Jeffrey	Technical Staff(nos)	79/80	82/83
Brooks, Peter C	Research Associate	80/81	81/82
Ziari, Farahmand	Research Associate	80/81	81/82
Maddox, Barbra	Secretary-Supervisor	79/80	83/84

Burnham, Katherine	Accounting Tech	79/80	80/81
Smith, Crandolyn	Ext. Prog. Asst.	79/80	84/85
Mack, Sandy L.	Secretary-Student Records>Secretary IV>Secy. Supr	79/80	94/95
Harris, Laneva	Accounting Tech	80/81	84/85
Andrew, James L	Ag Res. Tech II/BS	82/83	86/87
Mitchel, Kenneth	Research Associate	82/83	86/87
Gaff, Sharon	Accounting Tech.	84/85	86/87
Hagedorn, K. Joan	Secretary>Ext. Prog. Asst. (1987)>Word Proc.	84/85	92/93
Million, K. Joan	Opr II > Prog. Cord>Adm. Ast.	92/93	2013
Oliver, Terry	Word Proc. Op. II>Technical Secy.	86/87	Post-1990 no info
Kiernan, Kathy/Kathleen	Fiscl Tech.III<Fiscl Spec. 50% 1988-1992	87/88	2000
Nelson, Roger	Tech Asst II/Postdoc. Fellow>Research Associate	1990	Present
Cole, Kerby	Technical Staff(nos)	92/93	92/93
Paynter, Amy	Ofc. Asst II	92/93	94/95
Jamison, Sandra	Program Assistant>Prog.Support Supr.II	92/93	96/97
Gilchrist, Diane	Ofc. Asst III	92/93	96/97
Younce, Frank	Engineering Tech Supr> Sr. Sci. Asst.	93/94	12/2021
Anderson, John	Adm. Mgr.	94/95	2012
Huggins, Pat	Ofc. Asst>Adm. Asst.	96/97	2012
Posey, Gail	Title unknown	Dates unknown	Post 2010
Mason, Shauna	Lab Tech. (Chen or Dept.?)	98/99	3/2002
Himsl, Sharon	Prof. Wrk, Editor (Barbosa)	2000	2015
Mikhaylenko, Galina	Postdoc. Fellow>Research Staff	2002	2011
Lomber, Jonathan	Res.Tech II 2002 (Chen) > Sci Lab Mgr 2007 (Dept.) / MS	3/2002	Present
Frear, Craig	Postdoc. Fellow>Research Staff	2003	2015
King, Pat	Fiscal Spec.	2007	2012
Dorgan, Kathy	Sci. Asst. (Chen)	2008	2011
Wilk, Dorota	Adm. Mgr.	2012	Present
Dreger, Joanna	Academic Coordinator	2013	Present
Kroeger, M.W.	Engr. Tech II/BS, AgE, WSU	Listed under T-C	
Mahan M.O.	Ag. Tech III, BS, Agrom, CPSLD	Prosser IRAC	
* Staff not listed in directory before 1976, only secretary is listed.			
** No Secretary or Chair listed pre-1958			
*** (nos) Not otherwise specified			

Chronological Listing of B.S. Students

Compiled by Manuel Garcia-Perez and Nina M. Willis
from WSU Commencement records

Year	Name	Degree
1924	Winston C. Countryman Frederick H. Linke	Ag with specialization in Farm Engineering Ag with specialization in Farm Engineering
1926	Merle H. Young	Ag with specialization in Farm Engineering
1928	Lawrence C. Moore	Ag with specialization in Farm Engineering
1929	George W. Singlair	Ag with specialization in Farm Engineering
1930	Cyril Vicent Burn	B.Sc. in Agricultural Engineering
1931	Silvestre Ilao Sulit	B.Sc. in Agricultural Engineering
1932	Arthur Charles Jacquot Neal George Presten	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1933	Fabian Vendadero Gongonio	B.Sc. in Agricultural Engineering
1934	Apolonario O.H. Salvador (Philippines)	Ag with specialization in Farm Engineering
1935	Lyle Wisely Neff	B.Sc. in Agricultural Engineering
1936	Frank LeRoy Norton Wendell Weaver Prater Dale A. Shelton	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1936	Ronald H. Wills	Ag with specialization in Farm Engineering
1937	Lyle Wisely Neff	B.Sc. in Agricultural Engineering
1938	John Birge Dobie Walter W. Hinz Frederick Noel Johnson Celestino A Pena James W. Strantton Everett H. Thomas	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1938	Robt. J. Fulfs Romain S. Carrasca (Philippines)	Ag with specialization in Farm Engineering Ag with specialization in Farm Engineering



1939	Robert W. Day Francis M. Roberts	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1939	Robert E. Daily	Ag with specialization in Farm Engineering



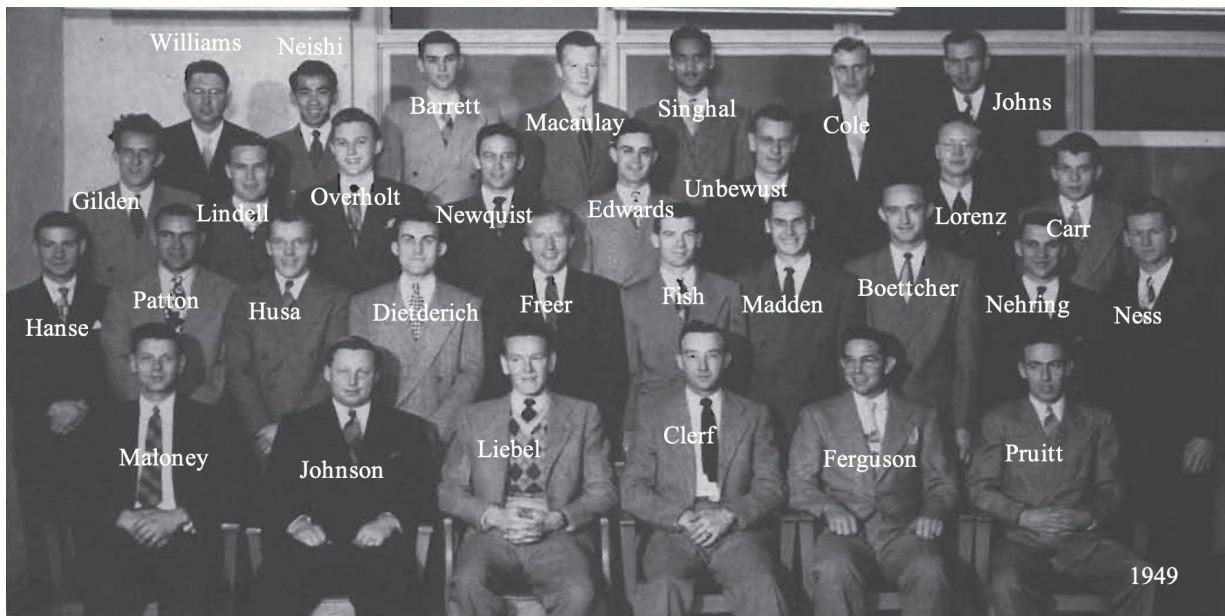
Officers of the American Society of Agricultural Engineers: First Semester: Frank Roberts, Vice-President: Ron Hanson, Secretary: John Kuckenbecker, Treasurer: Darwin Nealy, Reporter: Howard Knight, Second Semester: President: Darwin Nealy, Vice-President: Chris Bafus, Secretary: Max Smith, Treasurer: Frank Roberts, Reporter: George Miller Members: Fred Actor, Joe Beckman, Theodore Birchill, Chris Bafus, Jack Bowen, Bob Breckenridge, Herman Curtis, Bob Dailey, George Fisher, Clifford Forslund, Albert Franz, Francis Garmann, Melvin George, Ron Hanson, Raymond Heglar, Oswald Heid, Walter Hoefel, Howard Knight, John Kuckenbecker, Lester Lyle, George Miller, Darwin Nealey, Eldred Pennick, Paul Reiffe, John Reynolds, Howard Rice, Frank Roberts, Max Smith, Blaine Warner, Elmer Jurgensen

1940	Clark L. Rambo	BSc. in Agricultural Engineering
1940	George R. Kerstaffer	Ag with specialization in Farm Engineering
1941	Andrew S. Kupka Percy E. Pennick	Ag with specialization in Farm Engineering Ag with specialization in Farm Engineering
1942	George Edward Haymond Lester D. Lyle George Edmonds Miller, Jr. Elmer Edmund Neustel	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1945	Howard Donovan Skelton	B.Sc. in Agricultural Engineering
1947	M. Conner Ahrens Charles Melvin Breckenridge Alfred Dominic Gallucci Robert Gilden Walter Edward Matsen Vernon Selde	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering

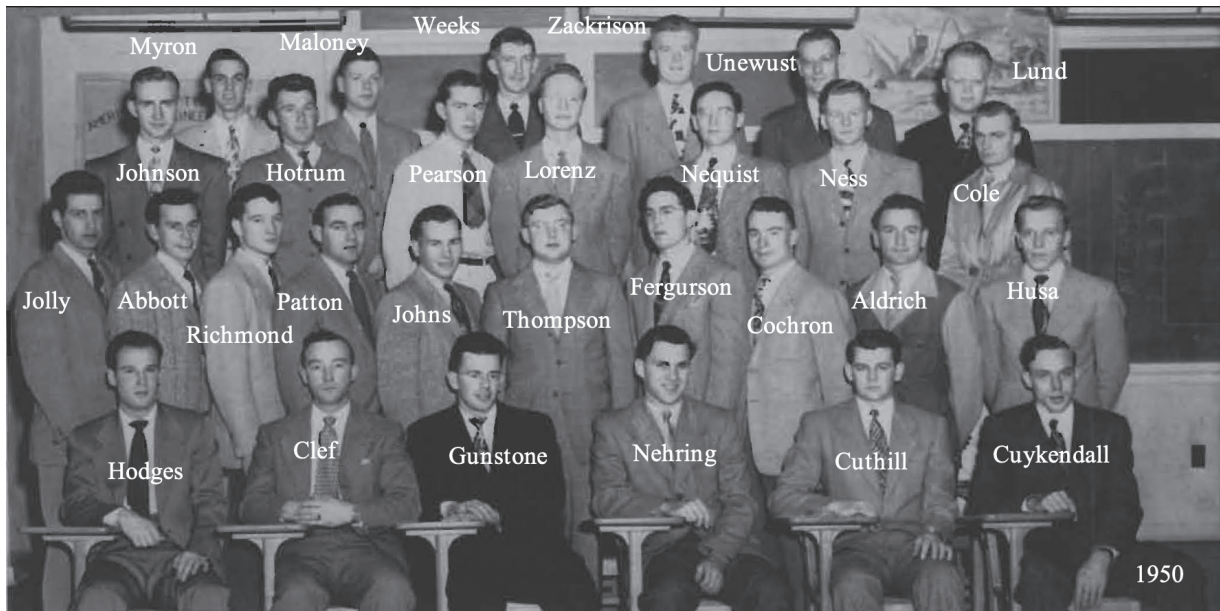


First row: L.J.Smith, O.D. Jeffords, T. Chin, D.O. Turner, G.M. Hastings, J.M. Cole, M. Sickles, Second row: M.C Ahrens, Mr. Johnson, C.M. Breckenridge, C.E. Bracht, W.E. Matson, E. Kettle, P.C. Corbit, L. Husa, Third row: R.O. Gilden, V. Selde, C.A. Lund, J.E. George, Mr. Roberts, P.M. Freer, Fourth Row: Mr. Foster, A.D. Gallucci, R.R. Bailey, W.H. Bennington, E.L. Towne, Guy Kendall, Mr. Hinz, B.R. Warner.

1948	Marion Gregory Hastings Oliver Drawing Jeffords Elbert Louis Towne Jr. Blaine Rush Warner	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1949	Robert Edward Carson Calvin Robert Liebel Arlie M. Updegrave Ting H. Ching Blaine Martin Madden	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering



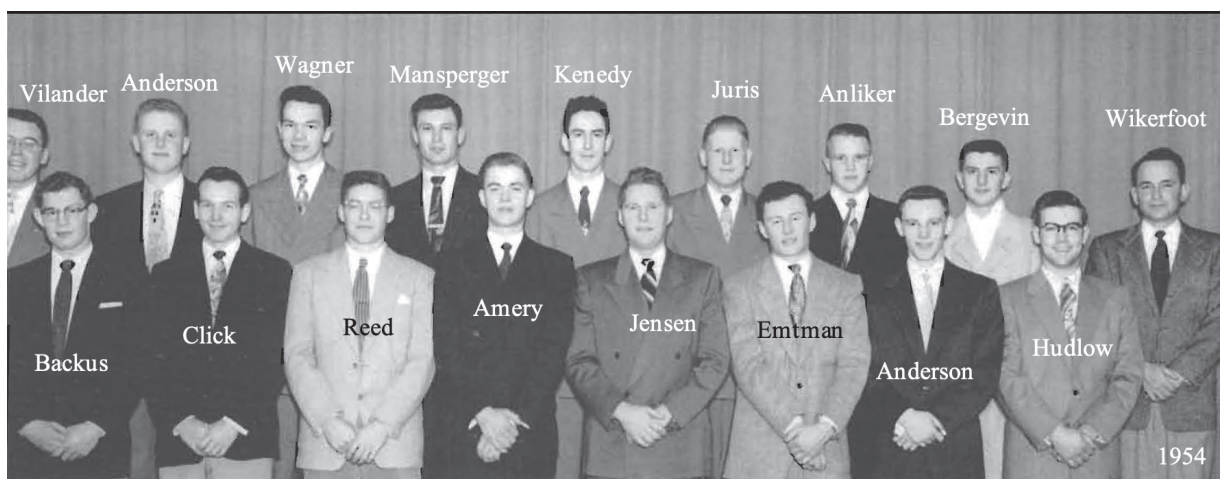
1950	Robert A. Aldrich Robert A. Cochran John Melvin Cole James Theodore Cuykendall Veikko Lennie Husa Danver W. Johns Charles Adams Lund Frederick George Maloney Milo O. Nehring Donald Miles Newquist John Stallard Unbewust Lowell Roy Williams	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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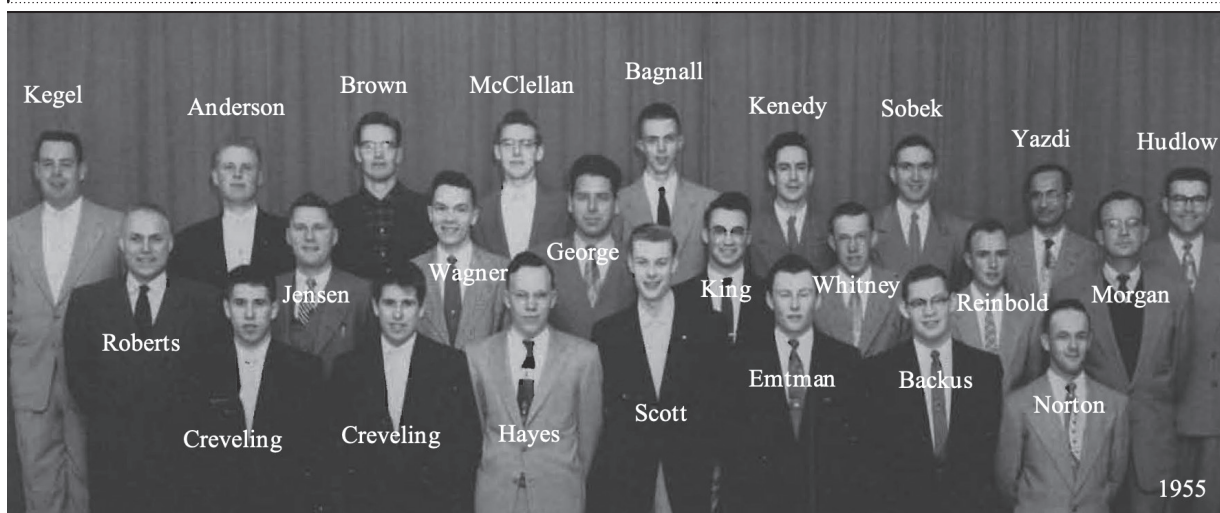
1951	David A. Jolly Hugh Wellyn Myron Charles R. Ness Richard Earl Patton Gene Thomas Thompson	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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1952	William Garlen Gray Ronald Lynn Kercheval Andrew Linn William Rufus Meyer Neil Clayton Montgomery James Leander Pearson Edward Joseph Votava D. Elton Wheeler	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1953	James Oscar Kildow Reginald D. Tripp	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1954	Robert Charles Henneman Richard W. Kerfoot Dean Reid Vilander	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering

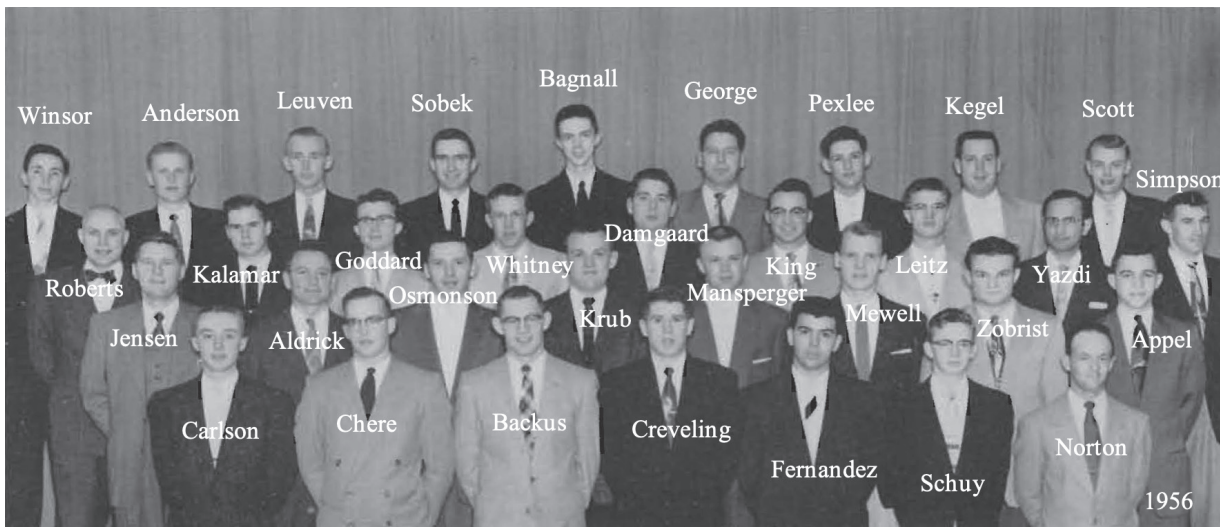


1955	David Eugene Click Lowell W. Kenedy Carl Andrew Mansperger	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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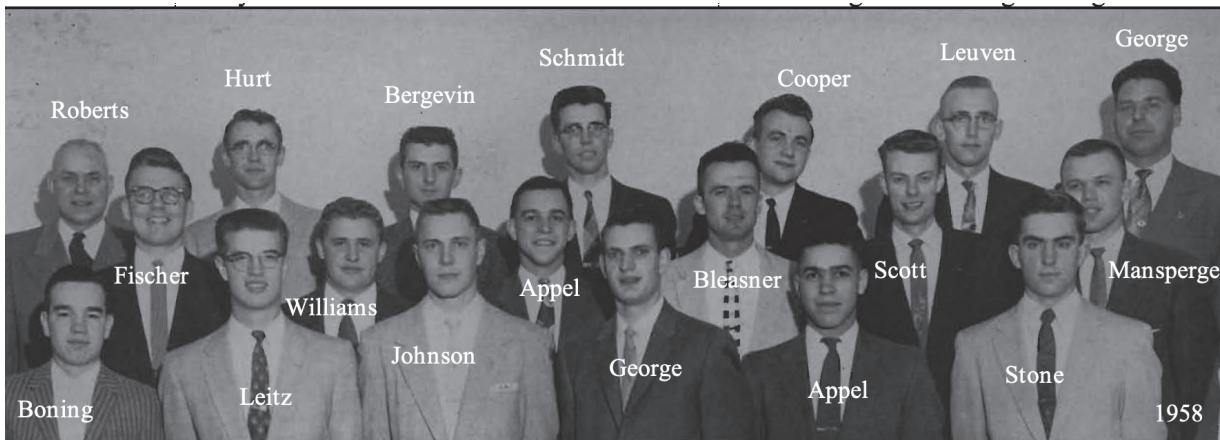


1956	David Eugene Edwards John E. George Jr. Marvin C. Hix Mehdi Yazdi (Iran)	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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1957	Vernoon Laroy Anderson Donald A. Backus Larry Owen Bagnall David Peter Ghere William Oliver Haxton Charles Augst Neumann Donald Marvin Tucker	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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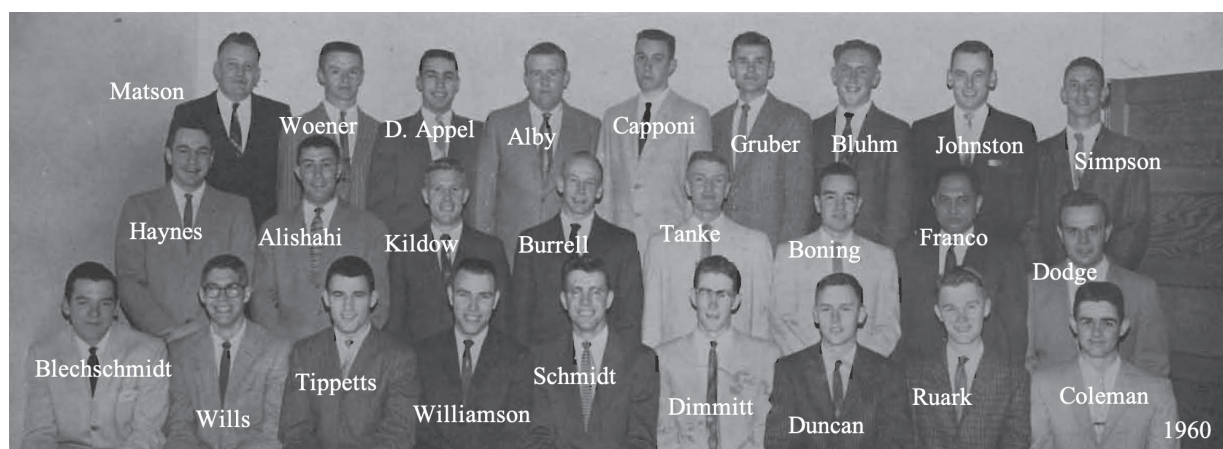
1958	Duane Barton Bergevin Eugene T. Budiselich Guy Duane Fischer Larry Gene King Melvin Lee Mathis John Gordon Odell Norman R. Scott John B. Simpson Terry Allen Tucker	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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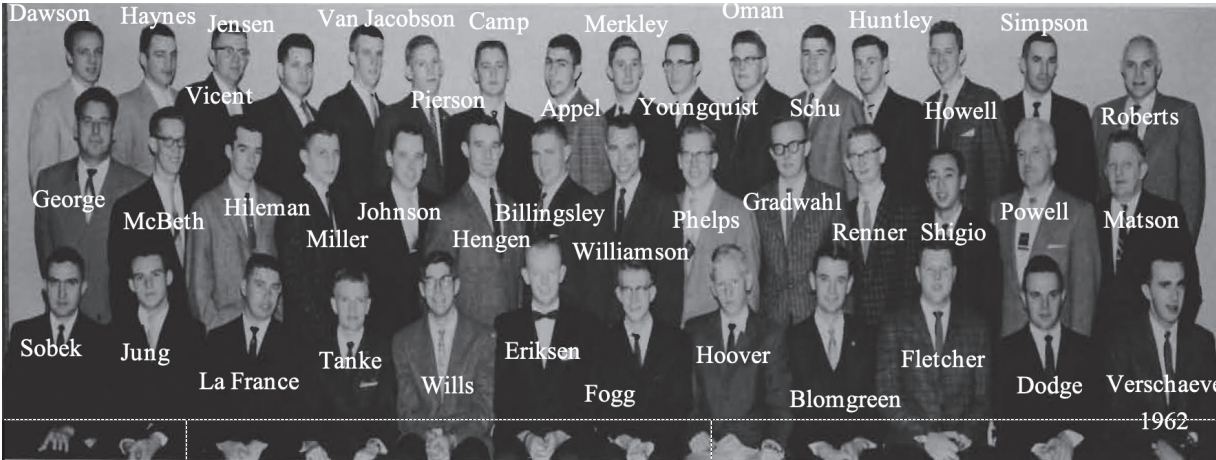


1959	Richard Donald Appel James C. Hansen Arnold Rupert Kegel Frankling William Leiz John W. Morgan Dale R. Petersen William Frank Pixlee Ernest Leo Preedy Leslie Earl Stone Jr. Harvey R. Williams Herbert John Zackrison Frederick Andrew Zobrist	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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1960	Charles William Boning Donald A. Bratsch Arnold Kirk Dimmitt Gary Don Haynes Stanley George Kildow James Edward Krussel John H. Mansperger Kenneth Kenichi Ono Robert O. Pearce Clifford Alan Pettibone Don R. Van Leuven	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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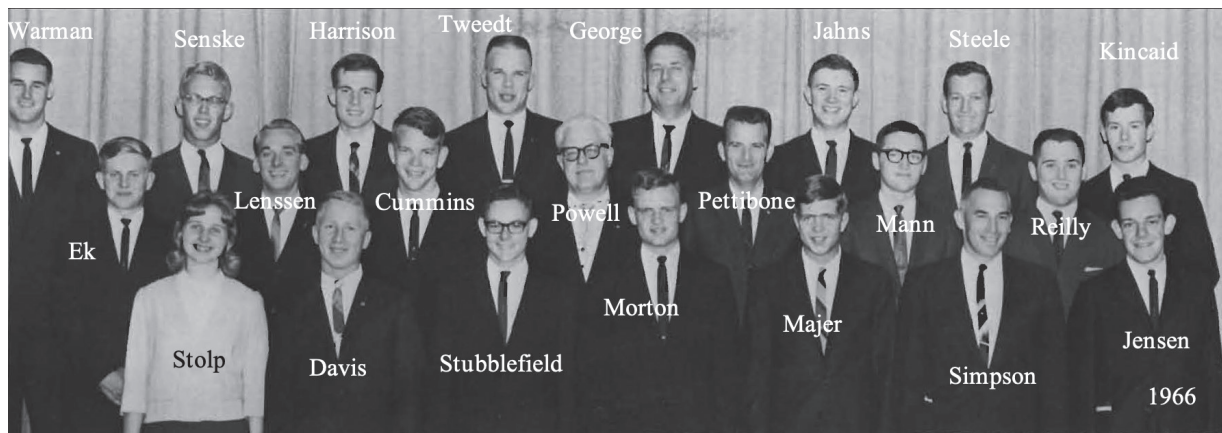
1961	Eugene David Alby Mohammad R. Alishahi (Iran) David Harold Appel Marion M. Breshears James Leonard Gruber Dirk Mar Van Worden Jack Lynn Woerner George Olof Ziegwied	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1962	Wayne Andrew Engstrom Richard L. Heller Edward J. Hengen Rodney Dean Lindstrom Alvin R. Schmidt Irvin G. Sobek	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
		
1962	Wayne Andrew Engstrom Richard L. Heller Edward J. Hengen Rodney Dean Lindstrom Alvin R. Schmidt Irvin G. Sobek	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1963	Stephen Blomgren George Charles Bluhm Larry James Dawson Paul Donald Dodge Tracy L. Eriksen Francis Eugene Jensen William Lawrence Johnston David E. LaFrance	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering



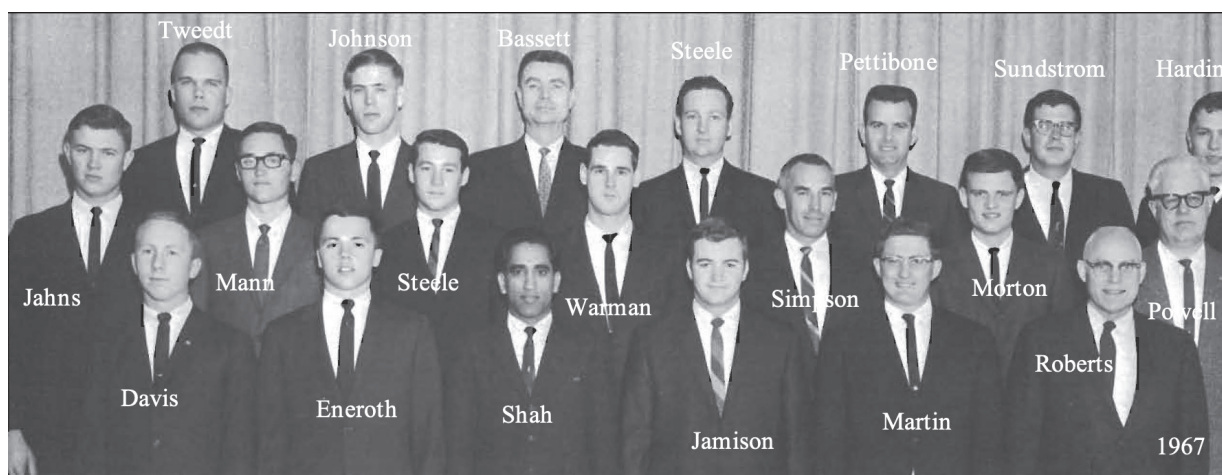
1964	Gary Maurice Hyde Richard Dexter Krause Louis Glenn Krub Jr. King Almon Phelps Albert W. Verschaeve Will John Vincent Gerald E. Williamson	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1965	David K. Billingsley Michael Eugene Howell Fran Ros (Yugoslavia)	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering



1966	Alfred R. Cummins Dennis Campbell Kincaid Dean Michael Renner Dwane LeRoy Saboe Gary O. Weythman	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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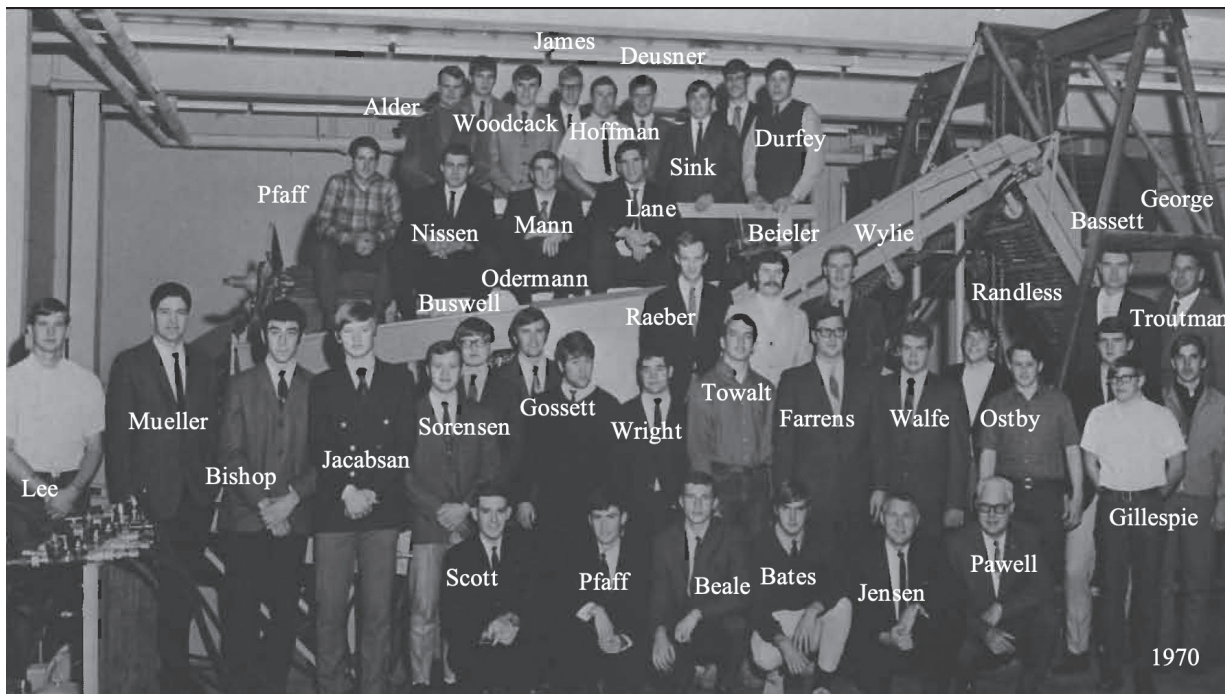


1967	Denny Cecil Davis Donald Lee Jensen Carl Gerhard Kroll Gerald Dewey Lenssen Ronald D. Schaal Michael E. Schu Thomas Wayland Steele Bruce Lyle Warman	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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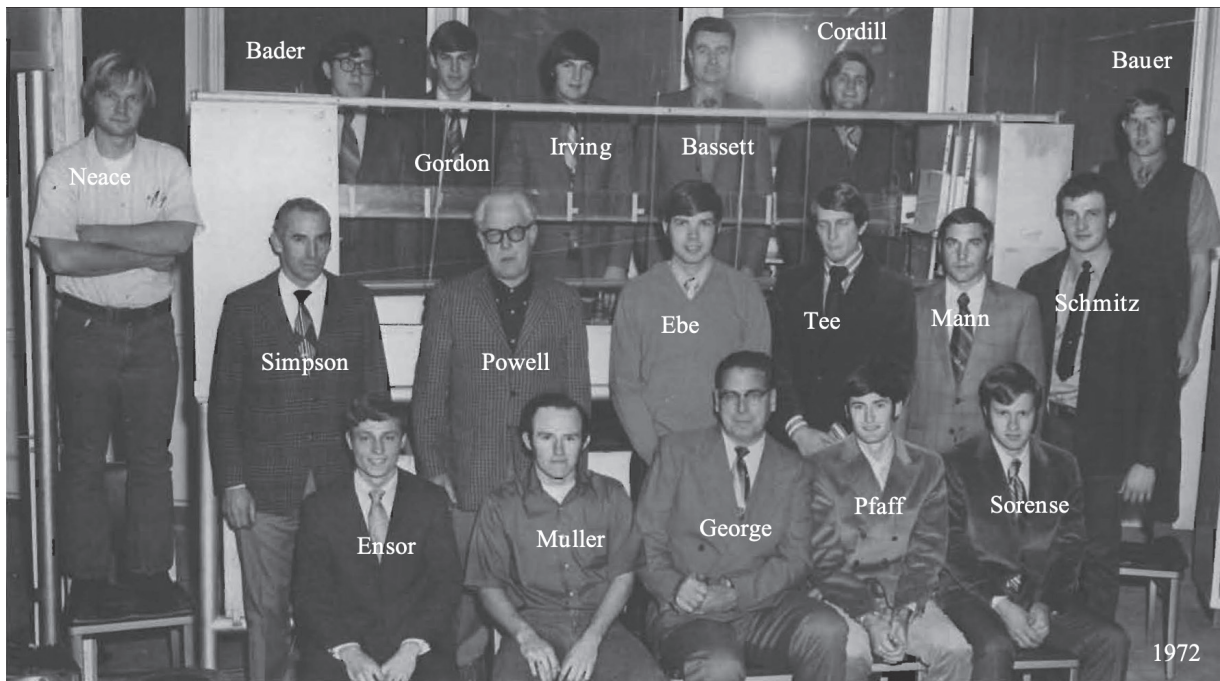


1968	Gary Glen Gomes Mark Herbert Hemingway Chester Arno Jahns Jr. Michael Logan Senske Carl Bernard Tweedt	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1969	Alfred Jay Anderson Calvin Walter Ek Alan Curtis Johnson Verl Leroy Long Guard N Sundstrom James W. Trull	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering

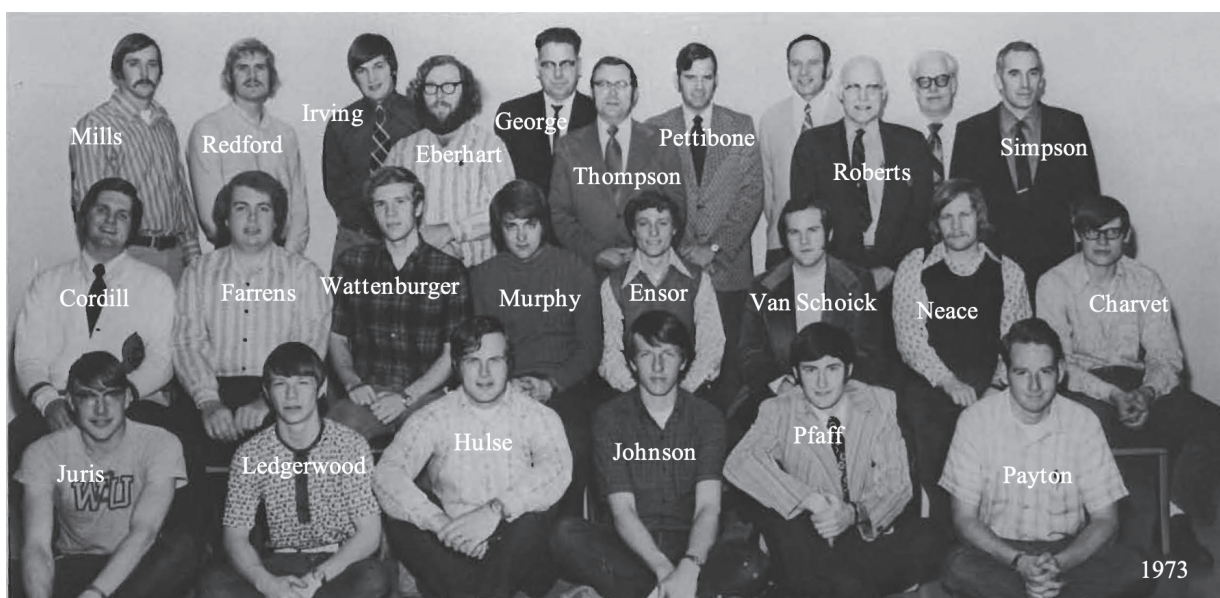
1970	Roger Walter Beiler Theodore Edward Deusner, Jr. Michael Jerome Herres Larry George James Michael Lee Lane Richard Cleve Pfaff Curtis Benjamin Wylie	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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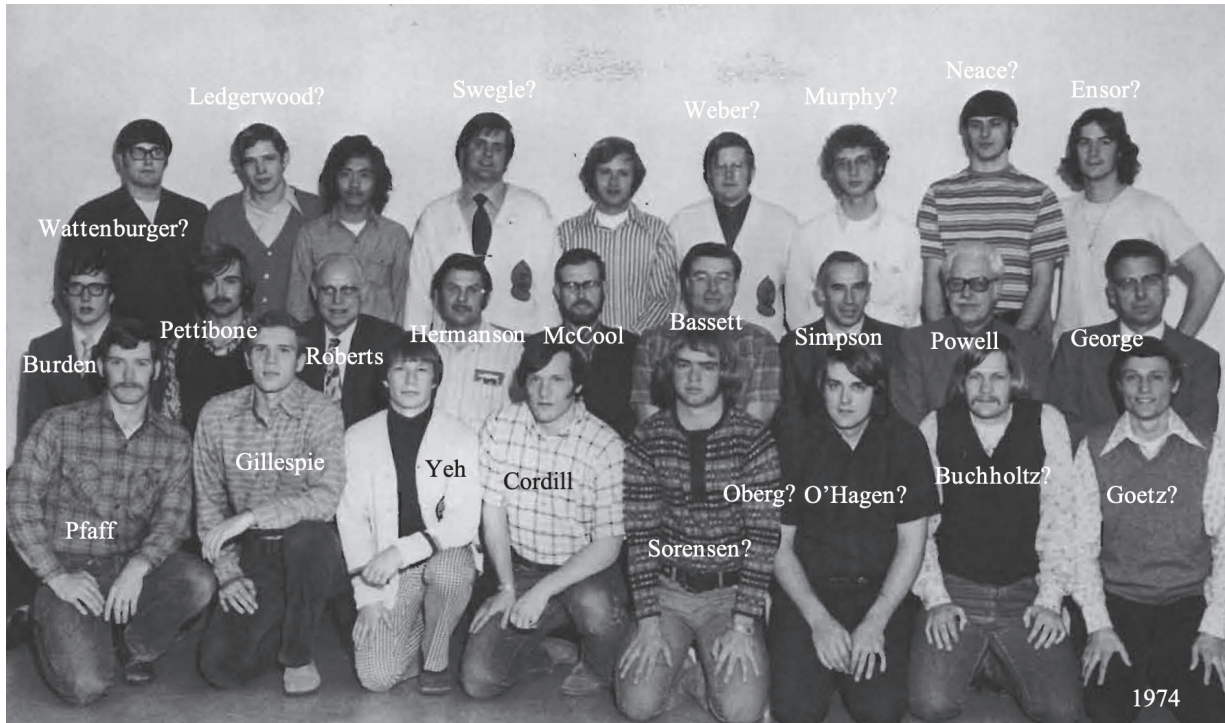
1970	James Brain Cabe Donald Floyd Johnson Richard Greg Scott Dennis Reymind Smart Charles Maine Tewalt	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1971	Michael Carl Eneroth Dwight Arthur Gottschalk Bill Randles Steven Jay Wright	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1971	Warner Stephen Alder Thomas Michael Herres James Kenneth Killingsworth Walter Christopher Mundt Steven I Nissen	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1972	Richard Myrlen Bader Stephen Carl Ebe Jonathan Franklin Gordon David Lee Morrell David John Muller Wayne Lewis Neace	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1972	Brian Tennis Asae Edward Lee Bauer Timothy James Burch Allan L. Gohl Robert Glen Wilson Jr.	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization



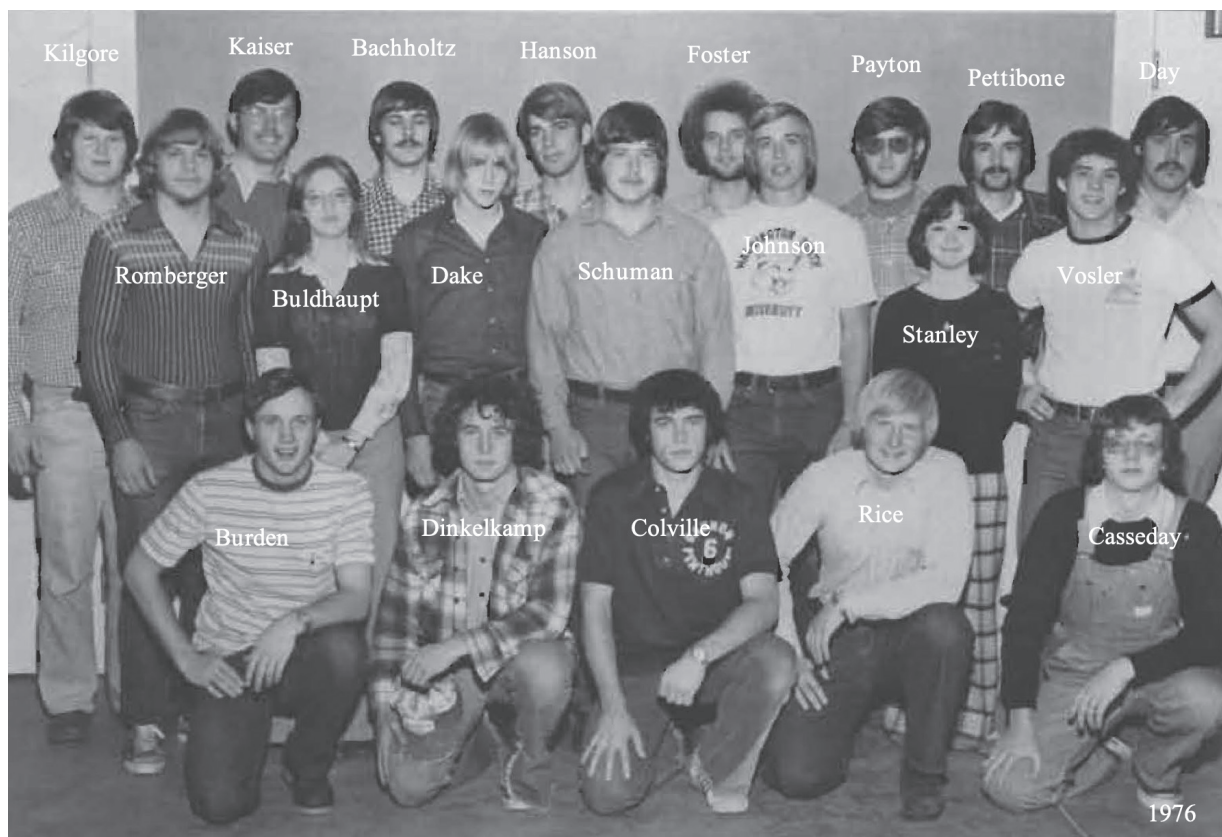
1973	Roger Craig Eberhart Greg Paul Farrens Jay Robert Mills Michael Johnson Pfaff Douglas Earl Redford Andreas Mpkayipheli Sukati (Swaziland)	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1973	Steve Arche Claassen Douglas Lyle Fitzsimmons John F. Hinton William C. Irving Brian H. Johnson James Warren Payton Jr. Douglas Earl Redford Stuart Charles Skidmore William Lester Weger	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization



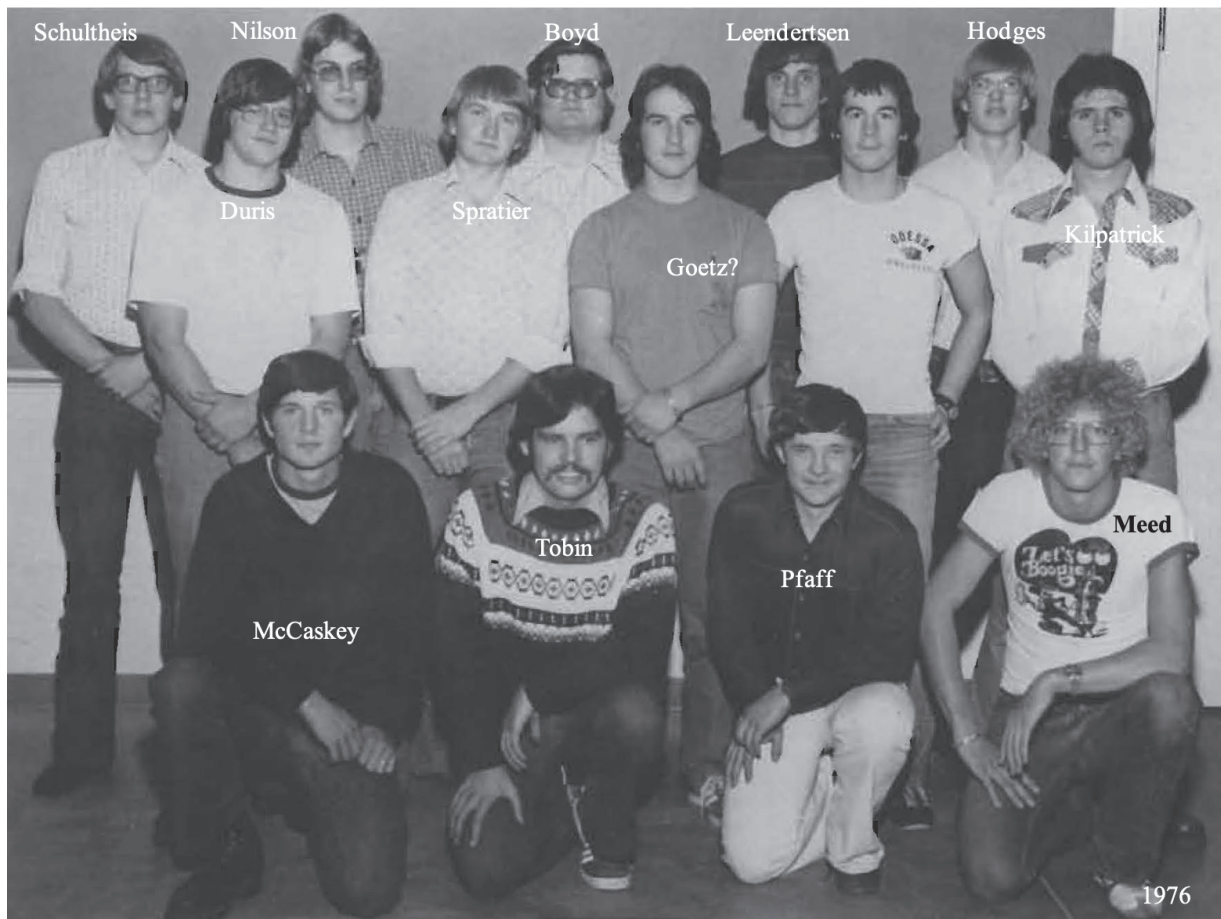
1974	Douglas Edwards Ensor Patrick Richard O'Hagan David Lewis Olson	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1974	Bruce Keith Allert Nelson Albert Cordill Jr. John Herbert Hulse Douglas William Meyer James Philip Sorensen James T. Tobin	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization



1975	Anthony Emile Carvet Ronnie Eugene Coyne Channon Keith Murphy Richard David Swegle Hsiu-Jen Yeh (Japan)	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1975	Thomas Glenn Beechinor Christopher David Kroll Dennis Lawson Pfaff James Earl Weber William Lester Weger	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1976	Thomas Ralph Buchholtz Trygve Lief Hanson Channon Keith Murphey Kenneth Von Neace Douglas Marc Payton Paul Lynn Wattenburger	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering



1976	Wayne Maurice Allert Bruce Glen Enyeart Rulon Earl Gray Ronald David Juris Paul Raphael Ledgerwood Lyle N. Oberg Richard Louis Reil Melvin Earl Young	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
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1977	<p>Otto Lawrence Burden</p> <p>Owen Irville Day</p> <p>Luis Victor DeGrande</p> <p>Ronald Thomas Stillmunkes</p>	<p>B.Sc. in Agricultural Engineering</p> <p>B.Sc. in Agricultural Engineering</p> <p>B.Sc. in Agricultural Engineering</p> <p>B.Sc. in Agricultural Engineering</p>
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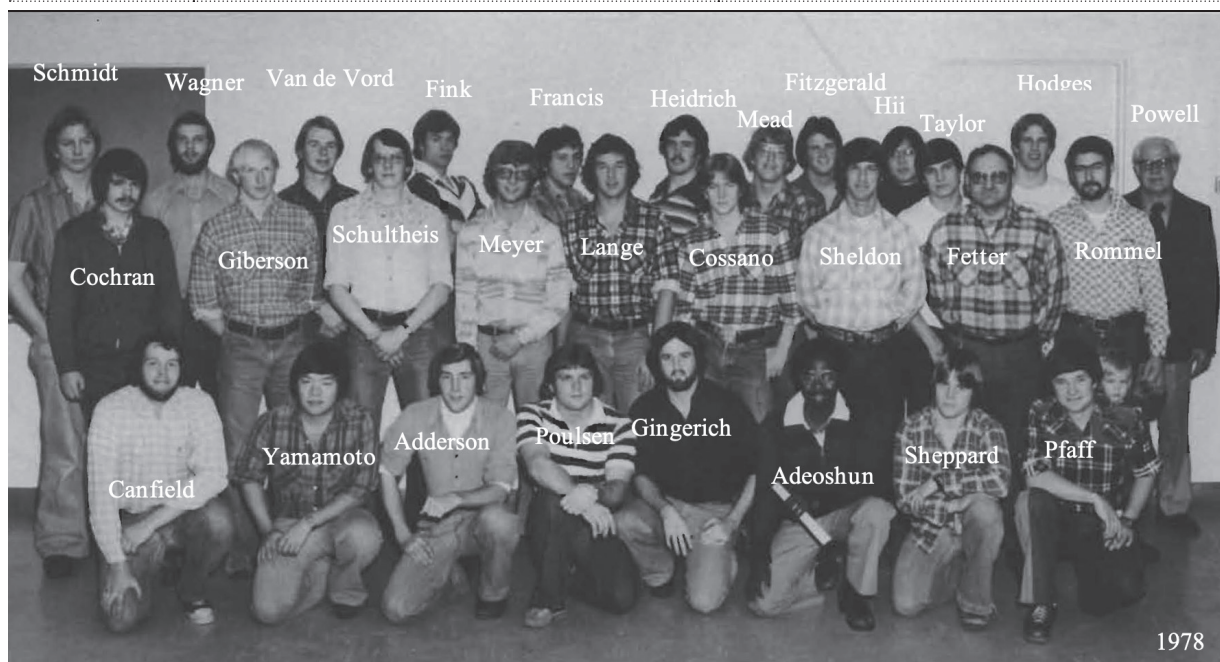
1977	Dean Lawrence Benedict Daniel Arthur Boyd Mark Cedric Hall William Everett Higginbotham Lawrence Joseph Holdener John Elwood Kalin David Jon Lindberg Daniel Edward Maughan Stephen Arthur Nilson Jeffrey Alan Oswald Halfred Dirk Van de Vord	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1978	Edward Joseph Albers Mark James Emmick David Winton Foster Mitchell Floyd Johnson Charles Ellis Kaiser Paul Francis McMahan Ronald Erick Oscarson Richard Alan Pettibone Terry James Poe Dr. Michael Powell Donald Eugene Rice Jeffrey Scott Romberger Kyle Clayton Rumble Walter Mark Shannon	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering



1978

W. John Alderson
Daniel Alan Bruce
Brian McCall Crow
James Francis Fitzgerald
Thomas Arthur Garrison
Thomas Elbert Giberson
Kenneth Ross Kilpatrick
Michael John McCaskey
James Edward Meyer
Sidney Wallance Morrison
Jeffrey Alan Oswald
Robert Arthur Schultheis
Halfred Dirk Van de Vord

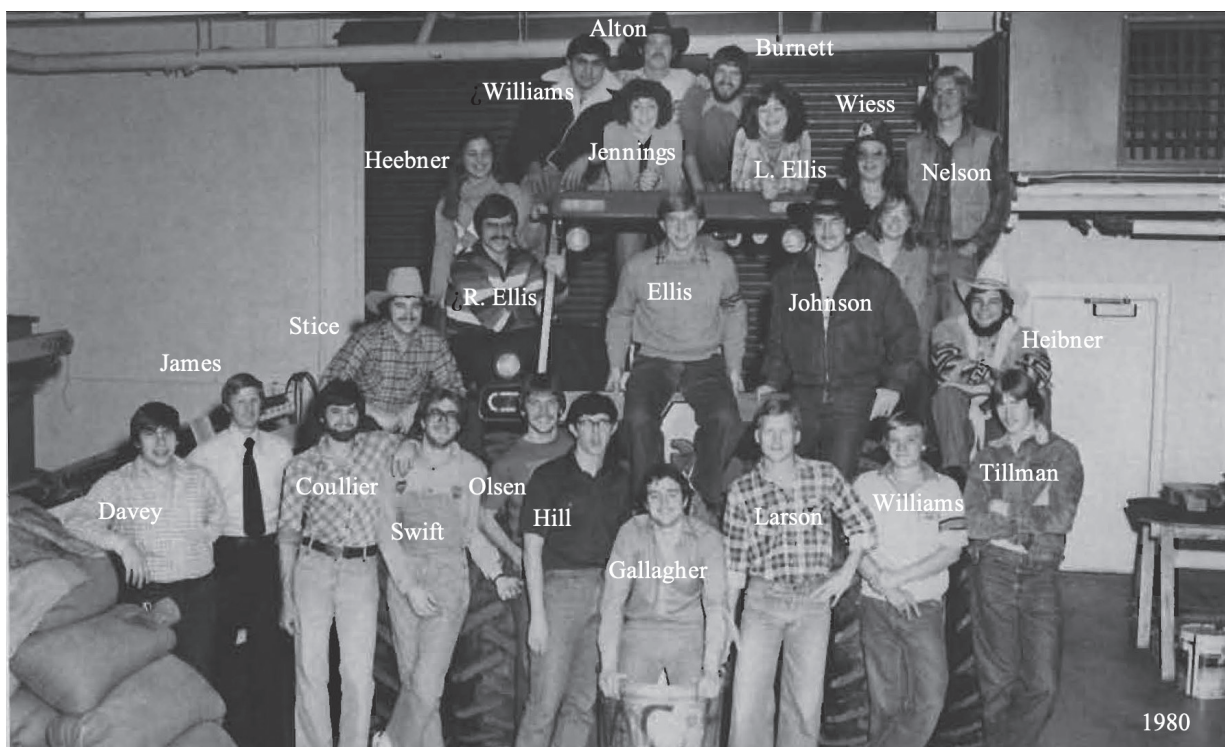
B.Sc. in Agricultural Mechanization
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B.Sc. in Agricultural Mechanization
B.Sc. in Agricultural Mechanization



1978

1979	Peter Neilsen Binn	B.Sc. in Agricultural Engineering
	Stephen Ronald Bogert	B.Sc. in Agricultural Engineering
	Erik Emery Colville	B.Sc. in Agricultural Engineering
	George Laten Crawford	B.Sc. in Agricultural Engineering
	Randolph Brian Fritcg	B.Sc. in Agricultural Engineering
	Lon Kerry Insba	B.Sc. in Agricultural Engineering
	Dan Edward Kelly	B.Sc. in Agricultural Engineering
	Dennis R. King	B.Sc. in Agricultural Engineering
	Karl Victor Krama	B.Sc. in Agricultural Engineering
	John Cristopher Rowley	B.Sc. in Agricultural Engineering
	Craig Andrew Sanford	B.Sc. in Agricultural Engineering
	Jesse H. Van Schoiak	B.Sc. in Agricultural Engineering
1979	Gary Marr Waddoups	B.Sc. in Agricultural Engineering
	Erwin Paul Bollweg	B.Sc. in Agricultural Mechanization
	Paul Henry Buchholtz	B.Sc. in Agricultural Mechanization
	Larry Lee Cole	B.Sc. in Agricultural Mechanization
	Eric Lee Drage	B.Sc. in Agricultural Mechanization
	Brian Kent Elfers	B.Sc. in Agricultural Mechanization
	Kenneth Michael Gingerich	B.Sc. in Agricultural Mechanization
	Ronald James Hall	B.Sc. in Agricultural Mechanization
	James Lee Hayles	B.Sc. in Agricultural Mechanization
	Jon Thomas Heudrich	B.Sc. in Agricultural Mechanization
	Bradley Thornson Hodges	B.Sc. in Agricultural Mechanization
	Jack Bruce Jensen	B.Sc. in Agricultural Mechanization
	Kenneth R. Kilpatrick	B.Sc. in Agricultural Mechanization
	Franck Edwin Lange	B.Sc. in Agricultural Mechanization
	John Donald Leendertsen	B.Sc. in Agricultural Mechanization
	Charles Summer Mead	B.Sc. in Agricultural Mechanization
	Gary Joseph Morford	B.Sc. in Agricultural Mechanization
	David Stanley Pfaff	B.Sc. in Agricultural Mechanization
	Ron Louis Poulsen	B.Sc. in Agricultural Mechanization
	Steven Paul Rommel	B.Sc. in Agricultural Mechanization
	John Lyle Sheldon	B.Sc. in Agricultural Mechanization
	Stacy Randell Smith	B.Sc. in Agricultural Mechanization
	Alan Kyle Walkley	B.Sc. in Agricultural Mechanization
	Timothy Craig Yamamoto	B.Sc. in Agricultural Mechanization

1980	Mark Aaron Hewitt Alton	B.Sc. in Agricultural Engineering
	Mark E. Blanc	B.Sc. in Agricultural Engineering
	Gregory Kevin Cuillier	B.Sc. in Agricultural Engineering
	Charles Stuart Davis	B.Sc. in Agricultural Engineering
	David Robert Dishman	B.Sc. in Agricultural Engineering
	Leanne Marie Ellis	B.Sc. in Agricultural Engineering
	Raymond Otis Ellis	B.Sc. in Agricultural Engineering
	Michael William Gallagher	B.Sc. in Agricultural Engineering
	Matt W. Hall	B.Sc. in Agricultural Engineering
	Frank K. Hamada	B.Sc. in Agricultural Engineering
	Mark Edward Hill	B.Sc. in Agricultural Engineering
	Kenneth Ian Johnson	B.Sc. in Agricultural Engineering
	Gregory Charles Larson	B.Sc. in Agricultural Engineering
	Richard L. Longbones	B.Sc. in Agricultural Engineering
	Bruce Ian Nelson	B.Sc. in Agricultural Engineering
	Stephen Robert Olsen	B.Sc. in Agricultural Engineering
	Patrick Malcolm Paul	B.Sc. in Agricultural Engineering
	Vivian De Haas Sarles	B.Sc. in Agricultural Engineering
	Patrick Dean Stice	B.Sc. in Agricultural Engineering
	Stephen Swift	B.Sc. in Agricultural Engineering
	James Irvin Vosler	B.Sc. in Agricultural Engineering
	John Scott Williams	B.Sc. in Agricultural Engineering
	Phillip Micheal Williams	B.Sc. in Agricultural Engineering



1980	Joshua A Adeoshun Erwin Paul Bollweg John Rose Burnette Patrick Emmett Burrows Alan Jay Childers Frank John DeVries Brad Lee Dodson Jeff Francis Druffel Thomas John Duris Kab-Yii Francis-Hii Stephen Frederick Gfeller Donald Duane Hillesland Walter Steven Juneman Paul Frederick Klein Frank Edwin Lange Alan Lee Mehlenbacher Gary Joseph Morford Kimberly John Pennick Abdul Hussain Ganem Skihi Stacy Randell Smith Patrick Nels Walen Timothy Joseph Wiggins Charles Clark Wright	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1981	Robert Thomas Becker Kevin Neil Davey Michael Wayne Fridley Teresa Kay Reed Jennings Gary Brian Kromann Jeffery Alan Strole Allen Lee Thompson Matthew Dean Todd Michael Albert Treiber Michael John Wierman Douglas William Woodruff	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1981	Vincent Edward Bator Kevin Thomas Curfman Ronald Gene Edwards Kamron Hossain Fakhrieh Alan Paul Kirpes John Garland Maybew Gary Joseph Morford Kimberly John Pennick Roger Warren Reimer Michael Lee Sheppard Edward N. Skelton Marin Andrew Taylor Edward John Warner	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization

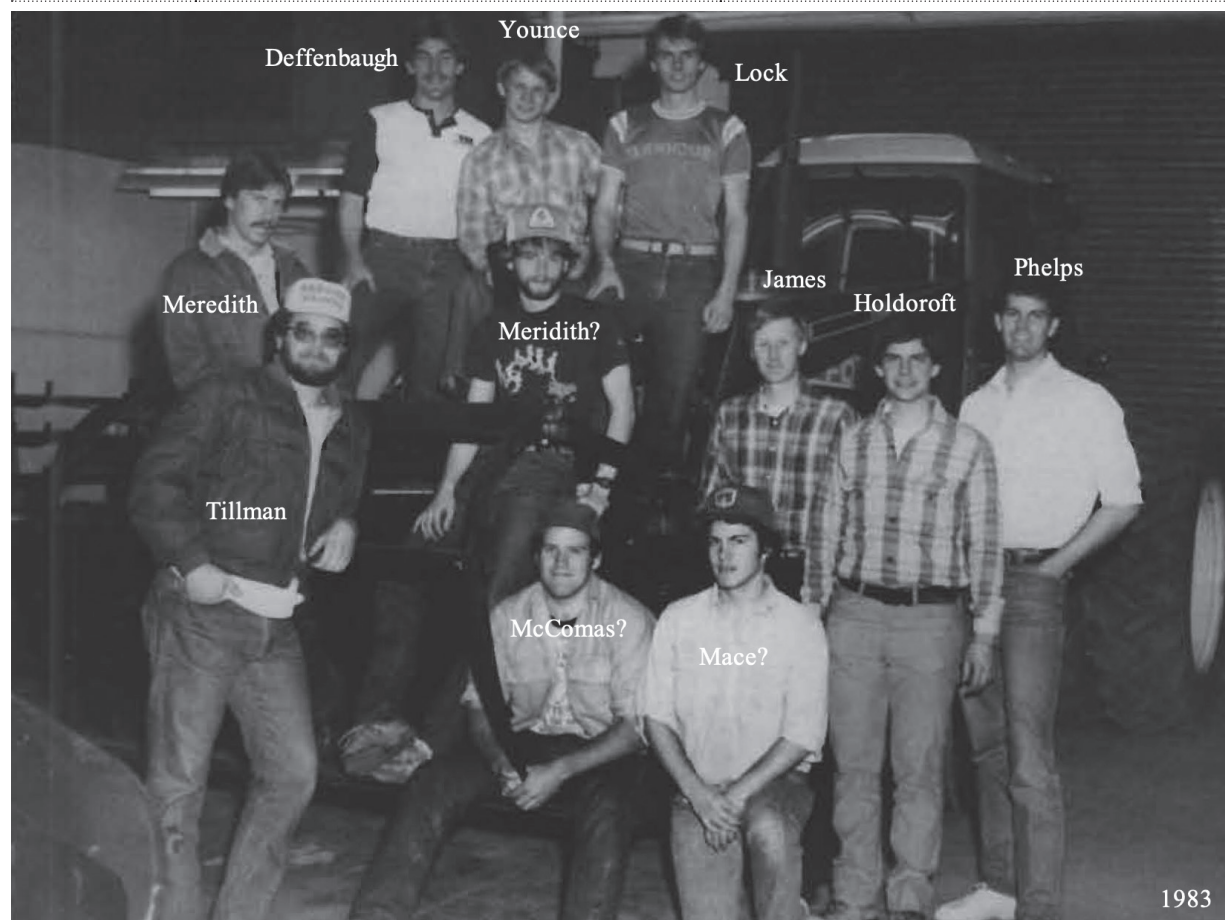
1982	Duaine Kay Anderson Richard John Babawicz Alan John Burrows Laura D. Crain Alan Michael Crowe David Jack Danforth Brian Keith Dennis Maria Joan Jensen Robert Kenneth Jungquist Alan Eugene Kottwitz Robert Jack Lacy Nicholas B. Mason Hassan A. Nammah Kenneth Wayne Porter Brian Walter Sauer Stanley Joel Shupe	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
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1982	Sulaiman Amer Almahrazi	B.Sc. in Agricultural Mechanization
	Brett Steven Baardson	B.Sc. in Agricultural Mechanization
	Scott A. Baugh	B.Sc. in Agricultural Mechanization
	Greg Alan Bothman	B.Sc. in Agricultural Mechanization
	Joel Terry Boune	B.Sc. in Agricultural Mechanization
	Michael Donald Buckley	B.Sc. in Agricultural Mechanization
	James Donald Colbert	B.Sc. in Agricultural Mechanization
	Bradley William Haberman	B.Sc. in Agricultural Mechanization
	V. Eugene Helsel II	B.Sc. in Agricultural Mechanization
	Scott William Johnson	B.Sc. in Agricultural Mechanization
	Olufemi A, Osunde McFoy	B.Sc. in Agricultural Mechanization
	Franklin Brent Møllergaard	B.Sc. in Agricultural Mechanization
	Timothy James Patterson	B.Sc. in Agricultural Mechanization
	Garry Lawrence Penning	B.Sc. in Agricultural Mechanization
	William Scott Roseburg	B.Sc. in Agricultural Mechanization
	Everett Anthony Scharpf	B.Sc. in Agricultural Mechanization
	Philip Wesley Siemers	B.Sc. in Agricultural Mechanization
	Audu Aujara Usman	B.Sc. in Agricultural Mechanization
	Timothy Joseph Wiggings	B.Sc. in Agricultural Mechanization



1983	<p>Thu-Tram Thi Bui Mark Linn Camenzind George Truman Greenland Kelli Arden Heebner John Joseph Hurley Douglas James Jackson Marry W. Kroeger John Thomas Palmer Kenneth Alan Pfaff Gary James Weatherly</p>	<p>B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering</p>
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1983	Daniel James Bator	B.Sc. in Agricultural Mechanization
	Raymond Howard Bitney III	B.Sc. in Agricultural Mechanization
	Gary Gene Breiler	B.Sc. in Agricultural Mechanization
	Robert Rankin Brown	B.Sc. in Agricultural Mechanization
	David John Floren	B.Sc. in Agricultural Mechanization
	Curtis Paul Grant	B.Sc. in Agricultural Mechanization
	Brian Lee Largent	B.Sc. in Agricultural Mechanization
	Harland Rowe Lippold	B.Sc. in Agricultural Mechanization
	Jon Bradley Mathison	B.Sc. in Agricultural Mechanization
	Stacy Browne Mellick	B.Sc. in Agricultural Mechanization
	Byron Hugh Moore	B.Sc. in Agricultural Mechanization
	Scot James Roetcisoender	B.Sc. in Agricultural Mechanization
	Dean Alan Smiley	B.Sc. in Agricultural Mechanization
	Paul Sigmund Spartveit	B.Sc. in Agricultural Mechanization
	Sheldon Keith Stine	B.Sc. in Agricultural Mechanization
	Mark S. Valencsin	B.Sc. in Agricultural Mechanization
	Michael Allen VerMulm	B.Sc. in Agricultural Mechanization
	Karl Gregory Wilson	B.Sc. in Agricultural Mechanization



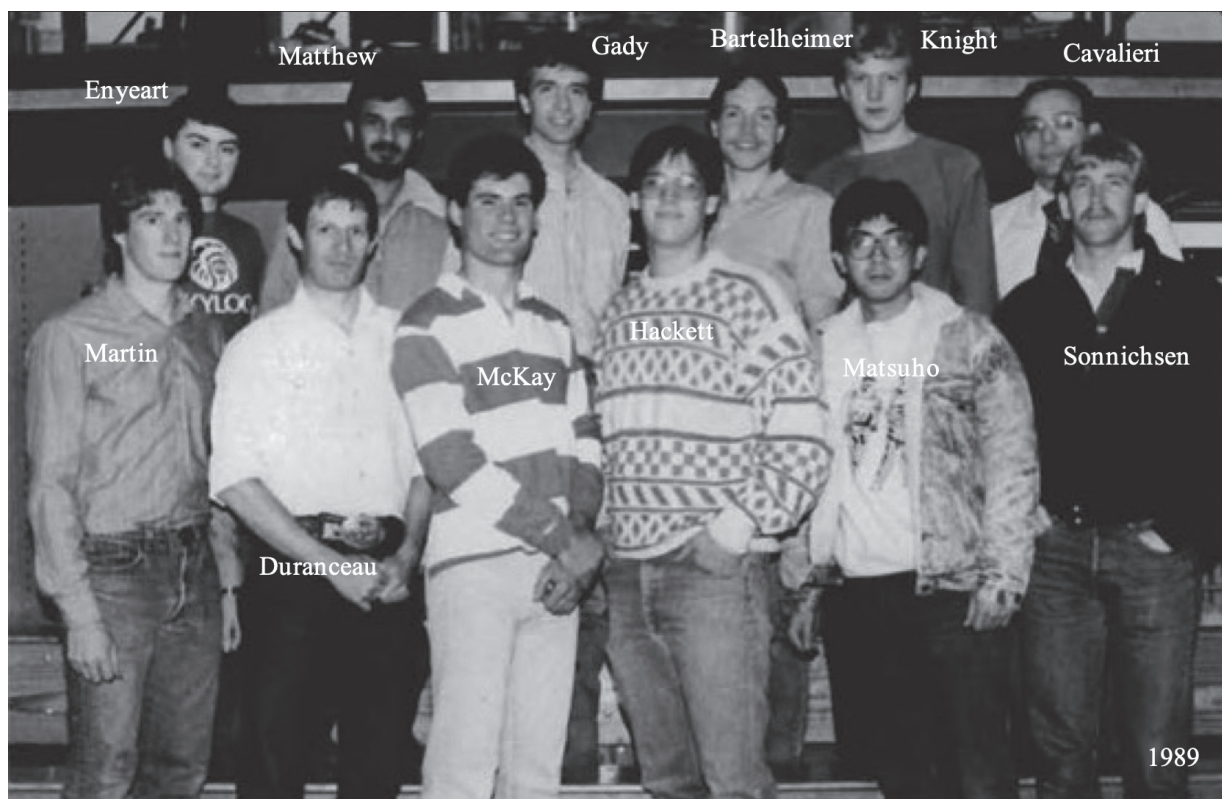
1984	<p>Thu-Tram Thi Bui Mark Linn Camenzind George Truman Greenland Kelli Arden Heebner John Joseph Hurley Douglas James Jackson Marty W. Kroeger John Thomas Palmer Kenneth Alan Pfaff Gary James Weatherly</p>	<p>B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering</p>
1985	<p>Christopher Eric Adolf Kenneth Russell Best Randy Jay Carstens Daniel Scott Hamilton Jerry Donald Harper David Paul Hawkins Frederick Joseph Lock David Scott Lohman Alan Guy Mace Douglas Boyce McComas Gilbert Wain McNabb James Martin Oshie Glen Lourie Piehl Kevin Ernest Scholz Kurt Martin Waananen</p>	<p>B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering</p>
1985	<p>Joshua Adeoye Adeosun Jeffrey R. Brown Craig Robert Clerf John Scot Cocking Eugene Frank Curcio Randall Scott Emtman Paul Sunday Ezechukwu Ambrose Vincent George Gerald Todd Gwin Rick Allen Hanson Brian Carl Higby Gary Willian Hofmann Jeffrey Duane Langer Jeffrey Martin Miller Larry Donald Nagle Allen Walter Robison Calvin Charles Rozell Thomas Richard Sheer Scott Douglas Spanker Douglas Joseph Wendt Stuart Douglas Wilson</p>	<p>B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization</p>

1986	<p> Scott Keith Bucher Mark Eugene Feldman Douglas Todd Hemenway Robert Allen Hibbs Joel Douglas Hille Gregory James Janson Richard Morris Lloyd Bruce Frederick Schlittler Eric V. Stolte Mark Alan Wasemiller Robert Austin White Ruth Kathleen Younce Frank Younce </p>	<p> B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering </p>
1986	<p> Gerald Jay Anhorn Mark Alan Charlton Timothy Alan Gallagher Donald E. Harto Nathan L. Kulp R. Lane McAllister Ronald Edwin Muzzall Stephen Bradly Page Jeffrey Charles Rains Jeffrey Craig Stormont </p>	<p> B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization </p>
1987	<p> Trae Edwin Buchert Edward M. Favilla Kenneth J. Hodges Michael Allen Huizinga Bret Jon Larreau Craig Eric Meredith Steven Lee Scot Damon Arden Smith Timothy Dean Strecker </p>	<p> B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering </p>
1987	<p> James Scott Archer Kurt James Harder Donald Earl Harto Thaddeus John Keller David G. Lange Charles Maynard Mallonee Doyle Ellis Schmidt Douglas Westfield Schuster Louis Roger Sheffels Mark Russell Tisler Daniel Doran Van Boven </p>	<p> B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization </p>

1988	David Allan Duranceau Lewis Allen Martin Patrick John O'Callaghan Taiye Osaretin Ovbiebo Karet Alan Prulett Roger P. Sonnichsen Mark Bruce Swanson Gregory James Wilson Keith R. Zaugg	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1988	Jay Ben Harris David Wayne Hilton Thaddeus John Keller Scott Lowell Kessler Mark Bjoring Perry Michael Edward Tobin	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization



1989	Marie Huong Do David Ralph Gady John Paul Hein Joseph Michael Lange	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1989	J. Scot Cocking Erick Robert Ness Randy Starr Price Robert J. Wilkins	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization



1990	John Thomas Enyeart Steven A. Martin Yutaka Matsuno D. Andrew McKay Michael John Mercer Christopher M. Schultheis	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1990	Eric David Appel Charles Randal Barger Michael Davis John Fuerst Eric Joseph Hall John Thomas Harding Edward Albert Summers Dennis Eugene Swinger, Jr Glen Alan Tanke	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1991	Mark Lewis Johnson Patrick Ryan MacQuarrie Dennis Paul Mickelsen Eric Michael Wylie	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1991	Darren Michael Peha Frederick Roth Smith	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization

1992	Rick Wendell Bajema Ryan Stanley Bartelheimer Scott Allen Hackett Jennifer Ann Jenks Kevin Monrow Knight Wade A. Rehberg	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1992	Willard F. Bauscher, Jr. Jeffrey Alfred Duren Michael David Weller	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1993	Eric Clifford Coppock	B.Sc. in Agricultural Engineering
1993	Medhi Golkar Eric Douglas Reiber	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1994	Erin Scott Brooks Jeremy Allen Hailey Andrew Paul Hall Paul Earl Majer	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1994	Aaron Bradley Blaisdell Bart William Blauert Medhi Golkar Richard Alton Rock	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1995	Andre Lamont Baritelle Dale. L. Buys Lance Byron Horning Andrew Thomas Jones Jeffrey Brian Schneider	B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng
1995	Douglas Wayne Burt Dale L. Buys Andrea Sharon Grove Trevor Lee Howard Kristian Carl Peterson	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1995	Aaron Bradley Blaisdell Jeff Joseph Jefferson David Michael Schroeder	B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization B.Sc. in Agricultural Mechanization
1996	Theodore Martin Boyl-Davis Gregory Blaine Harting Wade Lynn Lafferty	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1996	Robert Lach Larson Brian Patrick Moore Miho Nakano	B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng
1996	Michael H. Dymkoski	B.Sc. in Agricultural Mechanization
1997	Karl Anthony Enyeart Wade Lynn Lafferty	B.Sc. in Agricultural Engineering B.Sc. in Agricultural Engineering
1997	Adel Abdulla Al-Dakheel Christopher Lee Robinson	B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng
1997	Magid K. Yoosefi	B.Sc. in Agricultural Mechanization

1998	Brannin James Beeks Nanci Lea Bergman Adam Joseph Brennan Christopher Allen Clark Abdulhamid Abdullah Hejjou Todd Matthew Krause Seth John Paul	B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng
1999	Todd Michael Curtis Clara Marie Garcia Douglas Robert Higbee Michael John Martin Dayna Louise Scheele Robert Frank Wesseliuss	B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng B.Sc. in Biological Systems Eng

Chronological Listing of Graduate Students

**Compiled by Manuel Garcia-Perez, Nina M. Willis, Valentina Sierra and Veronica Crow
from WSU Commencement records, thesis, and dissertations**

Year	Name	Degree
1934	Gustave Henry Bliesner Thesis: Rural Distribution Line Extension Policies and Construction Specifications Advisor: Q. D. Sloan	M.Sc. Agricultural Engineering
1935	Arthur Charles Jacquot Thesis: The Development of a Hydraulic Type Indicating Dynamometer for Measuring the Draft of Various Farm Implements Pulled by Tractors Advisor: Harry L. Harves	M.Sc. Agricultural Engineering
1939	Gustav Henry Blierner Thesis: Farm Electric Studies in the Pacific Northwest Advisor: H.V. Carpenter	Professional degree in Agricultural Engineering
1942	Wesley S. Plercey Thesis: Use of Typical Columbia Basin Soils for the Construction of Stabilized Adobe Bricks, Using Emulsified Asphalt Advisor: L. J. Smith	M.Sc. in Agricultural Engineering
1946	John Birge Dobie Thesis: Mow Hay Drying in the State of Washington with Forced Air Circulation Advisor: L. J. Smith	M.Sc. Agricultural Engineering
1948	Walter McNab Miller Thesis: Laboratory investigations on the suitability of sodium silicate for irrigation canal linings Advisor: Aldert Molenaar	M.Sc. Agricultural Engineering
1949	William Harold Johnson Thesis: A study of cranberry Harvesting Equipment Advisor: June Roberts	M.Sc. Agricultural Engineering
	Gregory Marion Hastings Thesis: Controlling the ground water level in the Kittitas Valley by pumping from wells Advisor: Aldert Molenaar	M.Sc. Agricultural Engineering
1950	Hugh Duncan Ayers (Canada) Thesis: Ground water studies as related to seepage and drainage problems on irrigated land Advisor: Aldert Molenaar	M.Sc. Agricultural Engineering

1951	Robert O. Gilden Thesis: The effects of open-shed and conventional housing on daily calves Advisor: Jaelents	M.Sc. Agricultural Engineering
	Lowell Roy Williams Thesis: An analysis of methods land leveling design Advisor: Aldert Molenaar	M.Sc. Agricultural Engineering
1952	M. Conner Ahrens Thesis: The development of a package type farm refrigeration unit with capillarity tube expansion on device Advisor: June Roberts	M.Sc. Agricultural Engineering
	Robert A. Aldrich Thesis: Flow of water in pipes with multiple outlets Advisor: Aldert Molenaar	M.Sc. Agricultural Engineering
	Adrian R. Chamberlain Thesis: Application of pressure-momentum theory to measurement of fluid flow through trapezoidal sections Advisor: Albert Molenaar	M.Sc. Agricultural Engineering
1953	James Leander Pearson Thesis: Bean drying with forced heated air Advisor: June Roberts	M.Sc. Agricultural Engineering
	Walter Edward Matson Thesis: Comparative study of poultry brooding systems Advisor: June Roberts	M.Sc. Agricultural Engineering
1954	Amnon Benami (Israel) Thesis: Evaluation of losses in branching-flow sprinkles couplers Advisor: Mark C. Jensen	M.Sc. Agricultural Engineering
1960	Donald Alger Backus Thesis: A comparison of self-feeding model silos Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
1961	Dipak Rajnikant Shah (India) Thesis: Relationship between pan evaporation and competitive use of water by beans under controlled environment Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Gene Thomas Thompson Thesis: The effect of varying humidity and temperature on the ratio of evaporation to consumptive use by beans grown under controlled environment. Advisor: Max C. Jensen	M.Sc. Agricultural Engineering

1963	Mohammad Reza Alishahi (Iran) Thesis: Irrigation requirements for Russet Burbank Potatoes Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Daniel L. Collins Thesis: Terminal profile of water flowing over a porous bed having constant infiltration Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Edward J. Hengen Thesis: Investigation of methods of automatic fan control for the combine shoe Advisor: June Roberts	M.Sc. Agricultural Engineering
	Warren Eugene Kruger Thesis: Hydraulic of unsteady state flow over a porous bed having constant infiltration Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
1964	Gary Don Haynes Thesis: The control of carbon dioxide in greenhouses by light intensity Advisor: June Roberts	M.Sc. Agricultural Engineering
	John B. Simpson Thesis: A study of the effect of front-rear slope on combine shoe performance Advisor: June Roberts	M.Sc. Agricultural Engineering

1965	Mirjan Batistic (Yugoslavia) Thesis: Influence of Irrigation Treatments on Russet Burbank Potatoes Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Bogomir Cimperman (Yugoslavia) Thesis: The effect of glow discharge radiation on germination of sweet clover seeds at different moisture contents Advisor: June Roberts	M.Sc. Agricultural Engineering
	Danilo Goriup (Yugoslavia) Thesis: Effect of notching in combination with split ring timber connectors in joints between wood members Advisor: Dr. A. E. Powell	M.Sc. Agricultural Engineering
	Brane I. Maticic (Yugoslavia) Thesis: The effect of the velocity on the relationship between pan evaporation and evapotranspiration by beans under controlled environment Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Khalid Pervez (Pakistan) Thesis: Evaluation of the extreme evaporation occurrences in Washington Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	C. Alan Pettibone Thesis: Some effects of gas plasma radiation on the germination of alfalfa seeds Advisor: June Roberts	M.Sc. Agricultural Engineering
	David L. Schreiber Thesis: Hydraulic description of recession of shallow flow over a porous bed Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Chiun Shing Tong (Taiwan) Thesis: Temperature gradients in irrigated soils Advisor: Max C. Jensen	M.Sc. Agricultural Engineering

1966	Mohammad Darwish Hani (Jordan) Thesis: The effect of light on the relationship between pan evaporation and evapotranspiration by beans under controlled environment Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Eldon Leroy Johns Thesis: Piezometric head change along level concrete pipe lines having equipped branching flow Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Mohammad Rafi (Pakistan) Thesis: Influence of irrigation methods and treatments on production of red Mexican beans Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Ghulam Mustafa Sheikh (Pakistan) Thesis: Effects of irrigation on soil temperature and thermal diffusivity Advisor: Max C. Jensen	M.Sc. Agricultural Engineering
	Robert John Boyden Thesis: A study of the vocational education needs of the Olympia, Washington area. Advisor: C. Oscar Loreen	M.Sc. Agricultural Engineering
	Walter L. Roys Thesis: The contribution of vocational agriculture to leadership development in selected Washington high schools Advisor: C. Oscar Loreen	M.Sc. Agricultural Engineering
1967	Jafar Ali Shah (Pakistan) Thesis: Agricultural skills and abilities needed by teachers of agriculture in West Pakistan Advisor: C. Oscar Loreen	M.Sc. Agricultural Engineering
	Jay Milton Wood Thesis: The high school education needed for entry into occupations in the farm machinery business in Spokane County, Washington Advisor: C. Oscar Loreen	M.Sc. Agricultural Engineering
1969	Gary M. Hyde Thesis: Analysis and synthesis of an automatic feed-proportioning system Advisor: June Roberts	M.Sc. Agricultural Engineering
1972	Gulzar Ahmed (Pakistan) Thesis: Freezing ground beef by air blast mechanical refrigeration and the nitrogen process Advisor: June Roberts	M.Sc. Agricultural Engineering
	Dean Michael Renner Thesis: Computerized surface drainage system design for irrigated areas with sensitivity analysis of input parameters Advisor: Charles C. Mueller	M.Sc. Agricultural Engineering
1973	Nivar Kulkanjanatorn (Thailand) Thesis: A mathematical model of water advance I furrow irrigation Advisor: Day L. Bassett	M.Sc. Agricultural Engineering

1974	Gene Thomas Thompson Thesis: A theory of Flow Resistance for Vegetated Channels Advisor: Prof. John A. Roberson	Ph.D. Engineering Science
1975	Alejandro A. Valenzuela (Chile) Thesis: The behavior of the Evapotranspiration and Evaporation Equations Under Varying Climatic Conditions Advisor: Prof. Donald Lee Bender	Ph.D. Engineering Science
1976	Harry J. Yeh Thesis: Mathematical Model of Subsurface Water Movement Advisor: Prof. Al Pettibone	M.S. Agricultural Engineering
1977	Yu-Mei Yang (Taiwan) Thesis: Procedures for evaluating clogging potential in trickle irrigation Advisor: Day L. Bassett	M.Sc. Agricultural Engineering
1978	Muriel Steenstra Robinette Thesis: Geophysical Investigations of the Pullman, Washington-Moscow, Idaho Ground-Water Basin Advisor: Prof. James W. Crosby	Ph.D. Engineering Science
1979	Silvestre Cawit Andales Thesis: Two-dimensional cooling of bulk stored sugar beets Advisor: Prof. C Alan Pettibone	Ph.D. Engineering Science
	Sushil Kumar Thesis: An analytical model for computation of rough pipe resistance Advisor: Prof. John A. Roberson	Ph.D. Engineering Science
1980	R.C. Small Title: Solar Energy Compatibility to Use in Food Processing Advisor: Denny Davis	M.S. Agricultural Engineering
1981	P.F. McMahan Title: Rheology of Cooked Potatoes Advisor: Denny Davis	M.S. Agricultural Engineering
1982	J.S. Romberger Title: Mathematical Model of Solar Collector Advisor: Denny C. Davis	M.S. Agricultural Engineering
	O.I. Day Title: Harvester Boom Height Control Advisor: Gary Hyde	M.S. Agricultural Engineering
	G.K. Cuillier Title: Harvester Chain Speed Control Advisor: Gary Hyde	M.S. Agricultural Engineering
	M.L. Stone Title: Simulation of Hop Drying Advisor: Glenn Kranzler	Ph.D. Agricultural Engineering
	D.W. Woodruff Title: Soil Separation from Potatoes Advisor: Gary Hyde	Ph.D. Agricultural Engineering

1983	Heinz Borg Thesis: Estimating Soil Hydraulic Properties from Texture Data Advisor: Larry G. King	Ph.D. Engineering Science
	Jobaid Kabir Thesis: Mathematical Modeling of Sediment Discharge from Furrow Irrigation Advisor: Larry G. King	Ph.D. Engineering Science
	Syed Ali Madani Thesis: Development of New Infiltration Function for Irrigated Furrows Advisor: Larry G. King	Ph.D. Engineering Science
	Bijayananda Naik Thesis: Mechanics of Mudflows Treated as the Flow of a Bingham Fluid Advisor: John A. Roberson	Ph.D. Engineering Science
	Michael W. Van Liew Thesis: Effects of Vegetation, Tillage and Land Management Practices on the Hydro-sediment Response of Agricultural Watersheds Advisor: Keith E. Saxton	Ph.D. Engineering Science
	R.C. Harrell Thesis: Control of Solar Pasteurizer Advisor: Glenn Kranzler	Ph.D. Agricultural Engineering
	Nick B. Mason Thesis: Solar & Biomass Utilization Advisor: Denny Davis	M.S. Agricultural Engineering
1984	C.H. Wu Thesis: Modeling Apple Drying Advisor: Glenn Kranzler	Ph.D. Agricultural Engineering
	D.W. Woodruff Thesis: Soil Separation from Potatoes Advisor: Gary Hyde	M.Sc. Agricultural Engineering
	Mohamed HA Thesis: Modeling fruit storage environments Advisor: Denny C. Davis	Ph.D. Agricultural Engineering
1986	Washington L. C. Silva Thesis: Modeling Spray Evaporation and Microclimate Changes Downwind of a Low Pressure Spray Sprinkler Advisor: Larry G. James	Ph.D. Engineering Science
	Patrick D. Stice Thesis: A Center Pivot Simulator With Digital Control and Data Acquisition Advisor: Larry G. James	Ph.D. Engineering Science
1987	Richard William Van Klaveren Thesis: Hydraulic Erosion Resistance of Thawing Soil Advisor: Donald K. McCool	Ph.D. Engineering Science
	Frank L. Younce Thesis: Dynamic Sensor for Fruit Firmness Advisor: Denny Davis	M.S. Agricultural Engineering

1988	Gerald N. Flerchinger Thesis: Simultaneous Heat and Water Model of a Snow-Residue-Soil System Advisor: Keith E. Saxton	Ph.D. Engineering Science
	Ashok Kumar Katyal Thesis: Surface Irrigation Hydraulics as Influenced by Soil Texture and Plant Water Uptake Advisor: Larry G. King	Ph.D. Engineering Science
	Kenneth C. Mitchell Thesis: Characterizing and Modeling Water Level Fluctuations in Irrigation Canals Advisor: Larry G. James	Ph.D. Engineering Science
	Mekki Abdellatif Omer Thesis: Measurement and Simulation of Mulch and Tillage Effects on Soil Water Conservation Advisor: Keith E. Saxton	Ph.D. Engineering Science
	Sylvio Julien Tessier Thesis: Zero-Till Furrow Opener Geometry Effects on Wheat Germination and Seed Zone Properties Advisor: Keith E. Saxton	Ph.D. Engineering Science
	Timothy D. Strecker Thesis: Prediction of Apple Maturity Advisor: Denny C. Davis	M.S. Agricultural Engineering
1989	Jim Gleason Field Thesis: Irrigation Scheduling by Thermal Emittance and Spectral Reflectance Advisor: Larry G. James	Ph.D. Engineering Science
1991	Kai Zhao Thesis: Gas Liquid mixtures Used as Separation Media Advisor: Gary M. Hyde	Ph.D. Engineering Science
	Keith Zaugg Thesis: Energy Conservation in CA Storages Advisor: Denny C. Davis	M.S. Agricultural Engineering
	R. Mathew Thesis: Potato Bruise Susceptibility Advisor: Denny C. Davis	M.S. Agricultural Engineering
	Jerry F. Kenny Thesis: (1991) Measurement and Prediction of Tillage Effects on Hydraulic and Thermal Properties of Palouse Silt Loam Soil Advisor: Keith E. Saxton	Ph.D. Engineering Science
1992	John Mathew Thesis: Tempering Effects on Wheat Milling Advisor: Denny C. Davis	M.S. Agricultural Engineering
	Mark Henning Thesis: Asparagus Tenderness Separation Advisor: Denny C. Davis	M.S. Agricultural Engineering

1993	Kerby Mathew Cole Thesis: Predictive Modeling of Hydraulic Properties and Their Spatial Distribution in Layered Soils Advisor: Larry G. King	Ph.D. Engineering Science
	Abdul Majeed Thesis: Computer Model for Managing Saline Waters for Irrigation and Crop Growth Advisor: Larry G. King	Ph.D. Engineering Science
	Qinghua Zhang Thesis: Modeling, Instrumentation and Control of Vegetable Blanching Operations Advisor: Ralph P. Cavaliere	Ph.D. Engineering Science
	Wu Naiqiang Thesis: Apple Structure & Vibrational Properties Advisor: Marvin Pitts	M.S. Agricultural Engineering
1995	Leonard Sive Ndlovu Thesis: Weather Data Generation and Its Use in Estimating Evapotranspiration Advisor: Claudio O. Stockle	Ph.D. Engineering Science
	Weihua Zhang Thesis: Apple Impact Bruise Analysis Advisor: Gary M. Hyde	Ph.D. Engineering Science
1996	Rick W. Bajema Thesis: Measurement and Analysis of Impact Failure in Potato Tuber Tissue Advisor: Gary M. Hyde	Ph.D. Engineering Science
	Jorge Carlos Jara-Ramirez Thesis: Water Use of Corn (Zea maize L.): Field Experiment and Simulation Advisor: Claudio. O. Stockle	Ph.D. Engineering Science
	Li Ma Thesis: Rheological Characterization of Selected Food Gums Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Usha Rani Pothakamury Thesis: Preservation of Foods by Nonthermal Processes Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Michael Todd Walter Thesis: Winter-Time Hydrologic Modeling over a Three Dimensional Landscape Advisor: Larry G. King	Ph.D. Engineering Science
	H. Yan Thesis: Rheology of Powdered Foods Advisor: Gustavo Barbosa Canovas	M.S. Biological Systems Engineering

1997	James Furman Kjelgaard Thesis: Methods for Estimating and Measuring Transpiration and Evapotranspiration of Field Crops Advisor: Claudio O. Stockle	Ph.D. Engineering Science
	Jorge Fernando Vélez-Puiz Thesis: Rheological Properties of Concentrated Milk Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Naiqiang Wu Thesis: Investigating Physical Properties of Apple Cells Using Finite Element Method Advisor: Marvin J. Pitts	Ph.D. Engineering Science
1998	Enrique Palou Garcia Thesis: Food Preservation by High Hydrostatic Pressure. Process Variables and Microbial Inactivation Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
1999	H. Yan Thesis: Physical Properties of Food Powders Advisor: Gustavo Barbosa Canovas	Ph.D. Biological Systems Engineering
2000	Andre LaMont Baritelle Thesis: Impact Properties and Viscoelastic Theory Applied to Selected Fruits and Vegetables Advisor: Gary M. Hyde	Ph.D. Engineering Science
	Hao Feng Thesis: Microwave Drying of Particulate Foods in a Sprouted Bed Advisor: Juming Tang	Ph.D. Engineering Science
	Julian Nneji Ikediala Thesis: Quarantine Treatment for Apples and Cherries Using Microwaves and Radio Frequency Energy Advisor: Juming Tang	Ph.D. Engineering Science
	Jose Maria Peralta Alba Thesis: Modeling the Hydrology of a Small Agricultural Watershed in the Pacific Northwest Advisor: Claudio O. Stockle	Ph.D. Engineering Science
	B. Abonyi Thesis: Refractance Window Dryer Advisor: Denny C. Davis	M.Sc. Agricultural Engineering

2001	Juan Jose Fernandez-Molina Thesis: Milk Processing by Pulsed Electric Fields in Combination with Other Preservation Technologies Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Maria Marcela Góngora Nieto Thesis: Food Preservation by Pulsed Electric Fields Evaluation of Critical Processing Parameters and Process Optimization. Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Ming Hwei Lau Thesis: Microwave Pasteurization and Sterilization of Food Products Advisor: Juming Tang	Ph.D. Engineering Science
	Hong Yan Thesis: Selected Physical Properties of Food Powders Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	J. Grubbs Thesis: Teacher Development Needs Advisor: Denny C. Davis	M.S. Agricultural Engineering
2002	Jatuphong Varith Thesis: Use of Thermal Properties for Non-Destructive Assessment of Apple Quality Advisor: Gary M. Hyde	Ph.D. Engineering Science
	Timothy Wig Thesis: Sterilization and Pasteurization Using Radio Frequency Heating Advisor: Juming Tang	Ph.D. Engineering Science
	Federico Harte Thesis: High Hydrostatic Pressure in Yogurt Manufacturing Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Aría Fernanda San Martin Thesis: Nonthermal Processing of Foods Advisor: Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Gipsy E. Tabilo Munizaga Thesis: Comparative Study of Surimi Gels Treated by High Hydrostatic Pressure Advisor: Gustavo V, Barbosa-Cánovas	Ph.D. Engineering Science
	Yifen Wang Thesis: Applications of Radio Frequency (RF) Heating of Food Advisor: Juming Tang	Ph.D. Engineering Science

2003	<p>Dongshen Guan Thesis: Thermal Processing of Hermetically Packaged Low-Acid Foods Using Microwave-Circulated Water Combination (MCWC) Heating Technology Advisor: Juming Tang</p> <p>Armen Kemanian Thesis: Application of Crop Simulation Models to Precision Agriculture Advisor: Claudio O. Stockle</p> <p>Jose J. Rodriguez Thesis: Processing Foods by High Hydrostatic Pressure Advisor: Gustavo V. Barbosa-Cánovas</p> <p>David R. Sepulveda Thesis: Preservation of Fluid Foods by Pulsed Electric Fields in Combination with Mild thermal Treatments Advisor: Gustavo V. Barbosa-Cánovas</p>	<p>Ph.D. Engineering Science</p> <p>Ph.D. Engineering Science</p> <p>Ph.D. Engineering Science</p> <p>Ph.D. Engineering Science</p>
2004	<p>Yaseen Ahmed Al Mulla Thesis: Flex-Cropping and Chemical Fallow Potentials for Dryland Farming Advisor: Claudio O. Stockle</p> <p>Yokiushihilmara Estrada Girón Thesis: High Pressure Treatment on Selected Components of Soy Milk Advisor: Gustavo V. Barbosa-Cánovas</p> <p>José Angel Guerrero Beltrán Thesis: Nonthermal Approaches to Process Fruit Products Advisor: Gustavo V. Barbosa-Cánovas</p> <p>Gabriel A. Mancilla Thesis: Rill Transport and Delivery Modeling for the Inland Pacific Northwest Advisor: Shulin Chen</p> <p>Guadalupe Isela Olivas Thesis: Edible Films and Coatings: Its Use for the Preservation of Quality of Minimally Processed Fruits. Advisor: Gustavo V. Barbosa-Cánovas</p> <p>C. Mack Thesis: Agricultural Issues Advisor: Denny Davis</p>	<p>Ph.D. Engineering Science</p> <p>Ph.D. Engineering Science</p> <p>Ph.D. Engineering Science</p> <p>Ph.D. Engineering Science</p> <p>Ph.D. Engineering Science</p> <p>M.S. Agricultural Engineering</p>

2005	Jorge Antonio Jerez Briones Thesis: Aluminosilicate-coated silica sand for reactive transport experiments Advisor: Claudio O. Stockle	Ph.D. Engineering Science
	Kunchalee Luechapattanaanon Thesis: Microbial Safety of Radio Safety of Radio Frequency Sterilization Process Advisor: Juming Tang	Ph.D. Engineering Science
	Guobin Fu Thesis: Modeling the Water Availability and Its Response to Climatic Change and Land Use/Land Cover Change (LUCC) for the Spokane Watershed Advisor: Shulin Chen	Ph.D. Engineering Science
	Wei Liao Thesis: Co-Production of Fumaric Acid and Chitin Using Rhizopus Oryzae (ATCC 20433) Fermentation on a Nitrogen-rich Agricultural Residue-Dairy Manure Advisor: Dr. Shulin Chen	Ph.D. Engineering Science
	Jian Ling Thesis: Optimizing of Nitrogen Removal from Wastewater with High Organic Material Advisor: Dr. Shulin Chen	Ph.D. Engineering Science
	Yan Liu Thesis: Co-Production of Lactic Acid and Chitin from a Pelletized Filamentous Rhizopus oryzae Culture Using Agricultural Residue-Cull Potatoes Advisor: Dr. Shulin Chen	Ph.D. Engineering Science
	Jaime Mejias Thesis: Phosphorus Pollution of Receiving Waters from Highly Manure-Impacted Soils Advisor: Dr. Claudio O. Stockle	Ph.D. Engineering Science
	Ricardo L. Oyarzun Thesis: Contributions Toward the Development and Application of a Generic Fruit Tree Model Advisor: Dr. Claudio O. Stockle	Ph.D. Engineering Science

2006	Alejandro Jose Antunez Barria Thesis: Plant, Soil and Water Relations in Bing ‘Mazzard’ Sweet Cherry Trees (<i>Prunus avium</i> L.) Advisor: Dr. Claudio O. Stockle	Ph.D. Engineering Science
	Sohan Birla Thesis: On Potential of Radio Frequency Heating as Quarantine Treatment of Fresh Fruits Advisor: Dr. Juming Tang	Ph.D. Engineering Science
	Gilbert Kabelo Gaboutloeloe Thesis: Wastewater Treatment by Subsurface Flow Constructed Wetlands for Nitrogen Removal Advisor: Dr. Claudio O. Stockle	Ph.D. Engineering Science
	William Johnson III Thesis: The Design of a Novel Moving Bed Bioreactor and Solids Clarifier for Application in Recirculating Aquaculture Systems. Advisor: Dr. Shulin Chen	Ph.D. Engineering Science
	Cristian Kremer Thesis: Evaluating the Worldwide Transferability of Simple Transpiration-Use Efficiency Approaches for Biomass Production Advisor: Dr. Claudio O. Stockle	Ph.D. Engineering Science
	Ram Bhuwan Pandit Thesis: A Computer Vision Method to Determine Cold Spot in 915 MHz Microwave Sterilized Foods. Advisor: Dr. Juming Tang	Ph.D. Engineering Science
2007	Ali S. Alshami Thesis: Dielectric Properties of Biological Materials: A Physiochemical Approach Advisor: Dr. Juming Tang	Ph.D. Engineering Science
	Fanbin Kong Thesis: Kinetic Study on the Quality Changes of Muscle Foods During Thermal Process as Related to Microwave Heating Advisor: Dr. Juming Tang	Ph.D. Engineering Science
	Jian Wang Thesis: Study of Electromagnetic Field Uniformity in Radio Frequency Heating Application Advisor: Dr. Juming Tang	Ph.D. Engineering Science
	Bilge Altunakar Thesis: Food Preservation by Pulsed Electric Fields Advisor: Dr. Gustavo Barbosa-Cánovas	Ph.D. Engineering Science
	Gurram Subba Rao Thesis: High Pressure and Ultrasonification Technologies for Manufacturing Yogurt Advisor: Dr. Gustavo Barbosa-Cánovas	Ph.D. Engineering Science
	Li Wang Thesis: Modeling reactive transport of strontium-90 in heterogeneous variably-saturated subsurface Advisor: Dr. Joan Wu	M.Sc. Agricultural Engineering

2008	Luz Daniela Bermudez-Aguirre Thesis: Nonthermal Processing Milk Advisor: Dr. Gustavo V. Barbosa-Cánovas	Ph.D. Engineering Science
	Hao Chen Thesis: Compute Simulation of Combined Microwave and Water Heating Processes for Packaged Foods using Finite Difference Time Domain Method Advisor: Dr. Juming Tang	Ph.D. Engineering Science
	Anjela Begmatova Thesis: Irrigation system cost comparison model Advisor: Dr. R. Troy Peters	M.Sc. Agricultural Engineering
	Shuhui Dun Thesis: Simulating Winter Hydrology Processes Using the WEPP Model Advisor: Dr. Joan Q. Wu	Ph.D. Engineering Science
	Craig Frear Thesis: A New Scientific and Engineering Approach to Anaerobic Digestion of Flush Dairy Manure Advisor: Dr. Claudio Stockle	Ph.D. Engineering Science
	Prabhakar Singh Thesis: Modeling of Tillage Effects on Hydrological and erosion Processes in the Pacific Northwest Advisor: Dr. Joan Q. Wu	Ph.D. Engineering Science
	Hanxue Qiu Thesis: Snow redistribution and soil water storage as impact by surface residue conditions Advisor: Dr. Joan Wu	M.Sc. Agricultural Engineering
2009	Robert Johnson Thesis: Hot water pretreatment to improve the selectivity of cellulose thermo-chemical reactions towards the production of anhydrosugars Advisor: Dr. Shulin Chen/Manuel Garcia-Perez	M.Sc. Bioenergy
	Simon Smith Thesis: Thermodynamic Analysis of Anaerobic Digestion Model I. Advisor: Dr. Claudio Stockle	Ph.D. LAWREE
	Chun Mei Yao Thesis: Rill Erosion Initiation and Effect of DEM Resolution on Erosion Prediction Advisor: Dr. Claudio Stockle	Ph.D. LAWREE

2010	Pallavi Ramkrishna Mohekar Thesis: Plant cell wall analog Advisor: Dr. Marvin J. Pitts	M.Sc. in Biological and Agricultural Engineering (Automation)
	Mythreyi Chandoor Thesis: Biodegradation of lignocellulosic biomass in soil : structural changes of lignin Advisor: Dr. Shulin Chen	M.Sc. in Biological and Agricultural Engineering (Bioenergy)
	Xiaochen Yu Thesis: Evaluation of pretreatment technologies for the simultaneous production of lipids and ethanol from lignocellulosic materials Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Yubin Zheng Thesis: Investigation of lipid production by oleaginous yeast <i>Cryptococcus curvatus</i> from effluents of food wastes hydrogen fermentation Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Oisik Das Thesis: Effects of pretreatments on the yield and composition of bio-oil from the auger pyrolysis of woody biomass Advisor: Dr. Manuel Garcia-Perez	M.Sc. in Engineering (Bioenergy)
	Gangsheng Wang Thesis: Parametrization and Uncertainty in Modelling of Soil Greenhouse Emissions Advisor: Dr. Shulin Chen	Ph.D. in Biological and Agricultural Engineering (Bioenergy)
	Nicole Uslar Thesis: Gaseous emissions and nutrient fate modeling in dairy operations Advisor: Dr. Claudio Stockle	Ph.D. in Biological and Agricultural Engineering (LAWREE)
	Tamara Mobbs Thesis: Effects of four soil surfactants on four soil-water properties in sand and silt loam Advisor: Dr. R. Troy Peters	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Luis Bastarrachea Thesis: Biodegradable poly(butylene adipate-co-terephthalate) film incorporated with nisin : characterization, effectiveness against <i>Listeria innocua</i> , and nisin release kinetics Advisor: Dr. Shyam Sablani	M.Sc. Biological and Agricultural Engineering (Food Engineering)
	Venkata Vaddella Thesis: Ammonia Emission Management and Modeling from Dairy Manure Storages Advisor: Dr. Pius Ndegwa	Ph.D. Engineering Science (LAWREE)

2010	Kereilemang Mokwena Thesis: Barrier Properties of Ethylene Vinyl Alcohol Films in Thermal Processing Advisor: Dr. Juming Tang	Ph.D. Engineering Science (Food Engineering)
	Gopal Tiwari Thesis: Evaluation of Heating Uniformity of Dry and Fresh Food Product Under Radio Frequency Heating Advisor: Dr. Juming Tang	Ph.D. Engineering Science (Food Engineering)
	Robert Gerlick Thesis: Capstone Assessment Development and Adoption Advisor: Denny C. Davis	Ph.D. Engineering Science
2011	Chao Miao Thesis: Sequential Hydrothermal Liquefaction of Yeast Biomass and Subsequent Catalytic Hydrothermal Deoxygenation of Lipid to Hydrocarbon Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Tina Karimi Thesis: Revising crop coefficients for Washington State Advisor: Dr. Claudio Stockle	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Romulus Okwany Thesis: The impacts of sustained deficit irrigation management on mint and canola oil crops in the Columbia Basin, Pacific Northwest, USA Advisor: Dr. R. Troy Peters	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Dongje Shen Thesis: Simulating snow distribution using the Water Erosion Prediction Project (WEPP) model Advisor: Dr. Joan Wu	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Balunkeswar Nayak Thesis: Effect of thermal processing on the phenolic antioxidants of colored potatoes Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)

2012	Nicholas Paul Kennedy Thesis: Biogas Purification: A Novel Technique Using Pretreated Digester Effluent Advisor: Dr. Shulin Chen/Craig Frear	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Jing Ke Thesis: Lignin Unlocking Process in Wood-Feeding Termites for Efficient Biomass Sugar Release Advisor: Dr. Shulin Chen	Ph.D. Engineering Science (Bioenergy)
	Jijiao Zeng Thesis: Degradation Wheat Straw Cell Wall by white Rot Fungi Phanerochaete Chrysosporium Advisor: Dr. Shulin Chen	Ph.D. Engineering Science (Bioenergy)
	Jingwei Ma Thesis: Biomass Retention with influent solids for enhanced Anaero- bic Digestion of Flushed Dairy Manure Advisor: Dr. Shulin Chen/Craig Frear	Ph.D. Biological and Agriculture Engineering (Bioenergy)
	Liang Yu Thesis: Simulation of Flow, Mass Transfer and Bio-Chemical Reac- tions in Anaerobic Digestion Advisor: Dr. Shulin Chen/Craig Frear	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Shoujie Ren Thesis: Catalytic Microwave Torrefaction and Pyrolysis of Douglas Fir Pellet to Improve Biofuel Quality Advisor: Dr. Hanwu Lei	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Chao Miao Thesis: Sequential Hydrothermal Liquefaction of Yeast Biomass and Subsequent Catalytic Hydrothermal Deoxygenation of Lipid to Hydrocarbon Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Sunil Kumar Thesis: Thermal degradation kinetics of anthocyanins in red rasp- berry (Rubus idaeus L.) Advisor: Dr. Shyam Sablani	M.Sc. in Engineering (Food Engineering)
	Tina Karimi Thesis: Revising crop coefficients for Washington State Advisor: Dr. Claudio Stockle	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Xiangdong Liu Thesis: Effects of surface coal mining on soil hydraulic properties Rosebud Mine, eastern Montana, USA Advisor: Dr. Joan Wu	M.Sc. Biological and Agricultural Engineering (LAWREE)
		Ph.D. in Biological and Agricultural Engineer- ing (Food Engineering)

2012	Roopesh Syamaladevi Thesis: Physicochemical Stability of Selected Frozen and Dehydrated Food: In Relation to State/Phase Transitions Advisor: Dr. Shyam Sablani	Ph.D. in Biological and Agricultural Engineering (Food Engineering)
	Ofero Caparino Thesis: Physicochemical Properties of Mango Powder (Philippines “Carabao” Var.) Made from Different Drying Systems. Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Shunshan Jiao Thesis: Development of Non-chemical Postharvest Treatments for Disinfecting Agricultural Products Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Fermin Resurreccion Thesis: Microwave Assisted Thermal Processing and Heterogeneous Good Packed in a Polymeric Container Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Peter Thomas Davey Thesis: Rapid triacylglyceride detection in live oleaginous microorganisms with quantification in phototrophic microalgal cultures via liquid state ¹ H NMR Advisor: Dr. Shulin Chen	M.Sc. Engineering (Bioenergy)
	Allan Gao Thesis: Pretreatment of wheat straw with ozone and soaking aqueous ammonia Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Bikram Adhikari Thesis: Identification of pruning branches in tall spindle apple trees for automated pruning Advisor: Dr. Manoj Karkee	Ph.D. Biological and Agricultural Engineering (Automation)
	Li Wang Thesis: Channel Routing using discrete Hayami Convolution Method with applications to the Water Erosion Prediction (WEPP) Model Advisor: Dr. Joan Wu	Ph.D. Biological and Agricultural Engineering (LAWREE)

2013	<p>Xiaochen Yu Thesis: Utilization of Lignocellulosic Biomass for Microbial Biomass and Lipid Production. Advisor: Dr. Shulin Chen</p> <p>Tao Dong Thesis: Microalgae Biorefinery for Biofuels and Value-added Co-products Advisor: Dr. Shulin Chen</p> <p>Zhouhong Wang Thesis: Understanding Cellulose Primary and Secondary Pyrolysis Reactions to Enhance the Production of anhydrosugars and to better predict the composition of Carbonaceous Residues Advisor: Dr. Manuel Garcia-Perez</p> <p>Kedar Koirala Thesis: Characterization and Modeling of Ammonia Volatilization from Dairy Manure Advisor: Dr. Pius Ndegwa</p> <p>Debjit Ray Thesis: Elucidating Genes and Pathways Required for Meiosis in Yeast and Mammals Advisor: Dr. Ping Ye/Claudio Stockle</p> <p>Jing Peng Thesis: Quality Evaluation of Vegetables Processed by Microwave Sterilization Pasteurization Advisor: Dr. Juming Tang</p> <p>Brian Bodah Thesis: Effective Suspended Sediment and Soluble Nutrient Load Mitigation in Irrigated Agricultural Return Flows through the use of Vegetative Filter Strips Advisor: Dr. Jeff Ullman</p> <p>Anurag Srivastava Thesis: Modeling of Hydrological Processes in Three Mountainous Watersheds in the US Pacific Northwest Advisor: Dr. Joan Wu</p> <p>Natalie Wagenbrenner Thesis: Measuring and Modeling winds in Complex Terrain Advisor: Dr. Joan Wu</p> <p>Xin Gao Thesis: Optimization and Prediction of Biomass Production for the Green Microalgae: Haematococcus pluvialis Advisor: Dr. Shulin Chen</p>	<p>Ph.D. Biological and Agricultural Engineering (Bioenergy)</p> <p>Ph.D. Engineering Science (Bioenergy)</p> <p>Ph.D. Biological And Agricultural Engineering (Bioenergy)</p> <p>Ph.D. Engineering Science (LAWREE)</p> <p>Ph.D. Engineering Science (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (Food Engineering)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p> <p>M.Sc. Engineering Science (Bioenergy)</p>

2013	Ellen Bornhorst Thesis: Sodium Chloride Diffusion in Selected Low-Acid Foods During Thermal Processing Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Yubin Zheng Thesis: Two-Stage Heterotrophic and Phototrophic Culture Technology for Microalgal Biofuel Production Advisor: Dr. Shulin Chen	Ph.D. Engineering Science (Bioenergy)
	Jieni Lian Thesis: Lignocellulosic Material Pyrolytic Byproduct to Lipid and Ethanol Conversion by Yeast Advisor: Dr. Shulin Chen/Manuel Garcia-Perez	Ph.D. Biological And Agricultural Engineering (Bioenergy)
	Prossie Nakawuka Thesis: Effect of Deficit Irrigation on Yield, Quality and Grower Returns of Native Spearmint and Hops in Washington State Advisor: Dr. R. Troy Peters	Ph.D. Engineering Science (LAWREE)
	Sumeet Dhawan Thesis: Polymeric-Based Multilayer Food Packaging Films for Pressure-Assisted Thermal Sterilization and Microwave-Assisted Thermal Sterilization Advisor: Dr. Shyam Sablani	Ph.D. Engineering Science (LAWREE)
	Bandar Alfaifi Thesis: Desinfestation of Dried Fruits Using Radio Frequency Energy Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Timothy Ewing Thesis: Two Novel Floor-Scale Anaerobic Digester Systems for Processing Food Waste – Part 1: Multi-Reactor, Liquid Recycle System for High Solids Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Pierre Wensel Thesis: Advances towards photosynthetic Biorefinery for Aviation Fuel, Biodiesel and Co-products. Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Shuai Zhou Thesis: Understanding Lignin Pyrolysis Reactions on the Formation of Mono-Phenols and Pyrolytic Lignin from Lignocellulosic Materials Advisor: Dr. Manuel Garcia-Perez	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Quan Bu Thesis: Catalytic Microwave Pyrolysis of Biomass for Renewable Phenols and Fuels Advisor: Dr. Hanwu Lei	M.Sc. Engineering Science (Bioenergy)

2013	Mariana Dobre Thesis: Effects of Forest Management and Environmental Variables on Forest Hydrology in Small Pacific Northwest Watersheds Advisor: Dr. Joan Wu	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Joseph Wagenbrenner Thesis: Post-Fire Stream Channel Process: Changes in Runoff Rates, Sediment Delivery Across Spatial Scales and Mitigation effectiveness Advisor: Dr. Joan Wu	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Meng Wang Thesis: A Hand-held Mechanical Blossom Thinning Device for Tree Fruit Production Advisor: Dr. Qin Zhang	Ph.D. Biological and Agricultural Engineering (Automation)



2014	Charles Degan Thesis: (Non-Thesis Exam) Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Difeng Gao Thesis: Morphology Engineering of Oleaginous Fungus <i>Mortierella Isabellina</i> for Lipid Production Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Aleana Gongal Thesis: Over-The-Row Machine Vision Systems for Improved Crop-Load Estimations Advisor: Dr. Manoj Karkee	M.Sc. Biological and Agricultural Engineering (Automation)
	Tianyan Guo Thesis: Modeling Transport of Metals in Urban Stormwater Runoff through Bioretention Facility and Vadose Zone in the Puget Sound Area Advisor: Dr. Joan Wu	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Chao Miao Thesis: Hydrothermal Process of Microbial Biomass to produce Bio-oil and Hydrocarbon Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Mark De Kleine Thesis: Semi-Automated end-Effector Concepts for Localized Removal and Catching of Fresh-Market Apples Advisor: Dr. Manoj Karkee	Ph.D. Biological and Agricultural Engineering (Automation)
	Donglei Luan Thesis: Application of Computer Simulation Models in Developing Industrial Scale Microwave Heating Process Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Wenjia Zhang Thesis: The Development of Time-Temperature Indicators for Microwave Assisted Pasteurization Processes. Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Lishi Yan Thesis: Kinetic Characterization of Acidic Hot Water Pretreatment of Biomass Advisor: Dr. Bin Yang	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Jingjin Zhang Thesis: Canopy Light Interception Measurement in Modern Training Orchards Advisor: Dr. Qin Zhang	Ph.D. Biological and Agricultural Engineering (Automation)

2014	Tingting Li Thesis: Exploring efficient Cultivation Strategy for Microalgal Biofuel Production Advisor: Dr. Shulin Chen	Ph.D. Engineering Science (Bioenergy)
	Shi-Shen Liaw Thesis: Understanding the Formation and Separation of C1-C4 during the Pyrolysis and Torrefaction of Lignocellulosic materials Advisor: Dr. Manuel Garcia-Perez	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Yasin Osroosh Thesis: Automatic Algorithms for Precision Irrigation of Fuji Apple Trees in the Pacific Northwest Advisor: Dr. R. Troy Peters	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Yang Jiao Thesis: Heating Behavior Study of Low Moisture Food in Radio Frequency Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	M. Raul Pelaez-Samaniego Thesis: Thermochemical Pretreatment of Underutilized Woody Biomass for Manufacturing Wood Composites. Advisor: V. Yadama	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Jianfeng Zhou Thesis: Mechanical Harvesting Technologies for Fresh Market Sweet Cherry Advisor: Dr. Qin Zhang	Ph.D. Biological and Agricultural Engineering (Automation)

2015	Allan Gao Thesis: Process and Economic Advantages of the Ozone and Soaking Aqueous Ammonia Pretreatment Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Suraj Amatya Thesis: Detection of Cherry Tree Branches and Localization of Shaking Positions for Automated Sweet Cherry Harvesting Advisor: Dr. Manoj Karkee	Ph.D. Biological and Agricultural Engineering (Automation)
	George Mathew Neerackal Thesis: Mitigation of Ammonia Emissions from Confined Dairy Operations Advisor: Dr. Pius Ndegwa	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Xiang Wang Thesis: Measurements of Gaseous Emissions from Naturally Ventilated Livestock Barns Advisor: Dr. Pius Ndegwa	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Rossana Villa Rojas Thesis: Influence of Different Factors on Desiccation Survival and Thermal Resistance of Salmonella and Radiofrequency Pasteurization of Low-Moisture Foods Advisor: Dr. Juming Tang	Ph.D. Biological and Agriculture Engineering (Food Engineering)
	Yuxiao Xie Thesis: Effect of light intensity and nitrate concentration on the correlation between lutein and chlorophyll contents of green algae <i>Chlorella Sorokiniana</i>	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Diana Zapata Thesis: Modeling the Key Phenological Stages and Dormancy of Individual Grapevine Cultivars Advisor: Dr. Garry Hoogenboom	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Rodrigo Ferreyra Thesis: Estimating the Upper Limit of the Soil Water Holding Capacity Using Hydraulic Properties and Computer Simulation Modeling Advisor: Dr. Claudio Stockle	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Sergio Baravalle Thesis: Rethinking Equality; a New Concept for the Redistribution of Natural Resources and Sustainable Development Based on Renewable Energies Advisor: Dr. Bin Yang	M.Sc. Engineering Science (Bioenergy)
	Yi Wei Thesis: Upgrading of Pyrolysis Oil via Liquid-Liquid Extraction and Catalytically Upgrading Advisor: Dr. Hanwu Lei	Ph.D. Biological and Agricultural Engineering (Bioenergy)

2015	Sayed Hossein Sadeghi Thesis: New Methods to evaluate and Adjust the Design and Operation of Center Pivot and Micro-Irrigation Laterals for Improved Uniformity Advisor: Dr. R. Troy Peters	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Yupeng Liu Thesis: Torrefaction of Douglas Fir Pellets and Bio-oil Upgrading Advisor: Dr. Hanwu Lei	M.Sc. in Engineering Science (Bioenergy)
	Paul Gamble Thesis: Methane Production Analysis of Inhibited Poultry Digestion Effluent after Dilution and Ammonia Volatilization Advisor: Dr. Pius Ndegwa	M.Sc. in Engineering Science (Bioenergy)
	Xi Wang Thesis: Metabolic Engineering of Cyanobacteria for the Biosynthesis of Lipid and Carotenoid Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Jesus Garcia-Nunez Thesis: Evolution of Palm Oil Mills into Biorefineries Advisor: Dr. Manuel Garcia-Perez	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Waled Suliman Thesis: Towards an Understanding of the Role of Biochar as an Agro-Environmental Tool: Potential for Control Water Release, Bacterial Retention, and Greenhouse Gas Emissions Advisor: Dr. Manuel Garcia-Perez	Ph.D. Soil Sciences (Bioenergy)

2016	<p>Alex Dunsmoor Thesis: Color Abatement of Anaerobically Digested Dairy Manure Advisor: Dr. Manuel Garcia-Perez</p> <p>Parish Nalavade Thesis: Development and assessment of application technologies and spray-drift quantification Techniques and spray-drift quantification technique in tree-fruit crops. Advisor: Dr. Lav Khot</p> <p>Abhishesh Silwal Thesis: Machine Vision System for Robotic Apple Harvesting in Fruiting Wall Orchards Advisor: Dr. Manoj Karkee</p> <p>Lei Zhu Thesis: Development of Microwave Pyrolysis Biochar as Carbon Catalyst for High Value Chemicals and Hydrocarbons Advisor: Dr. Hanwu Lei</p> <p>Mohammad Amini Thesis: Irrigation Strategies for Water Conservation: Evaluation of Application Efficiency, Uniformity, and Runoff under Linear-Move Irrigation System Advisor: Dr. R. Troy Peters</p> <p>Hongchao Zhang Thesis: Gas Barrier Properties of Polymer Packaging: Influence on Food Shelf Life Following Microwave-Assisted Thermal Sterilization Advisor: Dr. Shyam Sablani</p> <p>Muhammad Azeem Khan Thesis: Satellite Remote Sensing-Based Estimation of Evapotranspiration, Crop Growth and Yield Advisor: Dr. Claudio Stockle</p> <p>Keyvan Malek Thesis: Climate Change Impacts on Agricultural Water Supply and Demands, Irrigation Efficiency and Farmers' Adaptation Decisions: A Case Study of the Yakima River Basin Advisor: Dr. Claudio Stockle</p> <p>Sadeg Abdurahman Thesis: Arundo Donax (Giant Reed) Phytoremediation Function of Chromium (Cr) Removal Advisor: Dr. Claudio Stockle</p>	<p>M.Sc. Biological and Agricultural Engineering (Bioenergy)</p> <p>M.Sc. Biological and Agricultural Engineering (Automation)</p> <p>Ph.D. Biological and Agricultural Engineering (Automation)</p> <p>Ph.D. Biological and Agricultural Engineering (Bioenergy)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (Food Engineering)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p>
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2016	Ellen Bornhorst Thesis: Development of Model Food Systems for Quality Evaluation of Thermally Pasteurized Foods Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Jose Martinez Fernandez Thesis: Continuous Sequential Hydrothermal Liquefaction Process for Bio-oil & Nutrient Recovery from Wet Microalgae Biomass Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Lin Parlina Thesis: Pretreatment Method Using the Mixture of Ammonium Carbonate and Ammonium Hydroxide to Enhance the CH ₄ Generation of Oil Palm Empty Fruit Bunch (Op-EFB) Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Yaojing Qiu Thesis: Anaerobic Digestion as a New Method of Breaking Microalgal Cell Wall for Further Lipid Extraction Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Samantha The Thesis: Effect of High-Low Light Intensity Cycle on the Photosynthetic Efficiency and Growth Rate of Haematococcus pluvialis Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Pengdong Wang Thesis: Metabolic Engineering of Oleaginous Yeast Yarrowia Lipolytica for the Production of Fatty Alcohols Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Gabriela Pereira-Ferraz Thesis: Hot Water Extraction of Anaerobic Digested Dairy Fiber for Wood Plastic Composites Manufacturing Advisor: Dr. Manuel Garcia-Perez	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Anamaria Pires Thesis: Chemical Composition and Fuel Properties of Alternative Jet Fuels Advisor: Dr. Manuel Garcia-Perez	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Patrick Scharf Thesis: Optimization of Basecutting Parameters in Laboratory Setting to Minimize Requirements for Sugarcane Harvesting Advisor: Dr. Manoj Karkee	M.Sc. Chemical Engineering (Bioenergy)
	Mohammadali Azadfar Thesis: Investigating the Use of Lignin and Black Copolymers as Self-Assembling Nanoreactor in Effluents Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Automation)

2016	Na Pang Thesis: Effects of Carbon Assimilation and Light on Growth and Cell Activity of <i>Haematococcus pluvialis</i> under Mixotrophic Conditions Advisor: Dr. Shulin Chen	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Golnaz Badr Thesis: Spatial Suitability Analysis for Site Selection of Vineyards Using Bio-physical Models and Computational Intelligence Advisor: Dr. Gerrit Hoogenboom	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Xuesong Zhang Thesis: Renewable Hydrocarbons for Jet Fuel via Microwave-induced pyrolysis and hydrogen saving process Advisor: Dr. Hanwu Lei	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Kanishka Bhunia Thesis: Polymeric Packaging for Thermal Pasteurization Process Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Yunxiang Ye Thesis: A Study on Maneuverability Technologies for a Robotic “Bin-Dog” System for Automated Bin-Handling in Tree Fruit Orchards Advisor: Dr. Qin Zhang	Ph.D. Biological and Agricultural Engineering (Automation)
	Pei-Yu Leu Thesis: (Non-Thesis Exam) Advisor: Dr. Bin Yang	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Libing Zhang Thesis: The Controlling Factors Involved in Biomass Aqueous Pre-treatment: Fundamentals to Applications Advisor: Dr. Bin Yang	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Xin (Tommy) Gao Thesis: Optimization and Prediction of Biomass Production for the Green Microalgae: <i>Haematococcus pluvialis</i> Advisor: Dr. Shulin Chen	Ph.D. Engineering Science (Bioenergy)
	Matthew Smith Thesis: Characterization and Modification of Biomass Pyrolysis Char for Environmental Applications Advisor: Dr. Manuel Garcia-Perez	Ph.D. Chemical Engineering (Bioenergy)

2017	Momtanu Chakraborty Thesis: Ground and Aerial Remote Sensing based Canopy Parameter Estimation Advisor: Dr. Lav Khot	M.Sc. Biological and Agricultural Engineering (Automation)
	Prashant Pokhrel Thesis: Processing Carrot Juice by Selected Nonthermal Technologies as Hurdles Advisor: Dr. Gustavo Barbosa-Canovas	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Ali Abghari Thesis: Engineering Safe Yeast Platform for Sustainable Fuel and high Value Oleo-chemicals Production Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Deepali Jain Thesis: Electromagnetic and Thermal analysis of Microwave Heating in 915 MHz Single Mode Cavity Systems Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Shuxiang Liu Thesis: Study of Enterococcus Faecium NRRL B-2354 as a surrogate for Salmonella in Low-Moisture Foods and its use in Microbial Validation of Radiofrequency Pasteurization Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Ravi Tadapaneni Thesis: Influence of Water Activity on the Thermal Resistance of Salmonella in Low Moisture Foods Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Hao Ruan Thesis: Converting Lignin to Hydrocarbon Fuel: A Renewable Way of Fueling Future Transportation Advisor: Dr. Bin Yang	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Chongyuan Zhang Thesis: Development of high-throughput automated phenotyping system for controlled environment studies Advisor: Dr. Sindhuja Sankaran	M.Sc. Biological and Agricultural Engineering (Automation)
	Hector Camargo Alvarez Thesis: Modeling dormancy in grapevines (vitis vinifera L.) Advisor: Dr. Claudio Stockle/Salazar-Gutierrez	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Innu Chaudhary Thesis: Enzymatic Systems in Biological Lignocellulosic Degraders and their Role in Lignin Modifications Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)

2017	Filip Stankovikj Thesis: Understanding the Behavior of the Oligomeric and Water Soluble Fraction in Pyrolysis Oils Advisor: Dr. Manuel Garcia-Perez	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Brennan Pecha Thesis: Understanding and Controlling Lignocellulosic Pyrolysis for Renewable Fuels and Chemicals Advisor: Dr. Manuel Garcia-Perez	Ph.D. Chemical Engineering (Bioenergy)
	Iftikhar Zeb Thesis: Enhanced Anaerobic Digestion of Dairy Wastewater Advisor: Dr. Pius Ndegwa	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Poonam Bajaj Thesis: Microencapsulation of Oils Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Reza Ovissipour Thesis: Kinetic Study of Quality Degradation of Atlantic Salmon Muscle During thermal Processing and in Response to Electrolyzed Water and Mild-Thermal processing Combination. Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Tina Karimi Thesis: Climate Change Impacts and Mitigation on Wheat Systems in Pacific Northwest Advisor: Dr. Claudio Stockle	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Tariq Khalil Thesis: Green House Gas Emission and Nutrient Fate on Dairy Confined Animal Feeding Operations Advisor: Dr. Claudio Stockle	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Cindy Angelia Thesis: Effect of Oxoglutarate Dehydrogenase Complex Insertion in Cyanobacteria Synechocystis sp. PCC 6803 Advisor: Dr. Shulin Chen/Hanwu Lei	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Jason Selwitz Thesis: Design and Assessment of an Associate degree-level Plant Operations Technical Education Program. Advisor: Dr. Birgitte Ahring	Ph.D. Engineering Science (Bioenergy)
	Sujala Bhattarai Thesis: Simulation and Modeling of Pretreatment Techniques Advisor: Dr. Shulin Chen/Aurora Clark	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Rishikesh Ghogare Thesis: Metabolic Engineering of Yarrowia Lipolytica for Synthesis of value Added Chemicals and Biofertilizer Production Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Shuai Zhang Thesis: Termite's Biomass Degradation Strategy and Termite-Based Bio-Mimic Biomass Treatment Process Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)

2018	Xiaoyun Xue Thesis: Biological Removal of Nitrogen from Dairy Wastewater via Alcallgenes facilis No. 4 Advisor: Dr. Pius Ndegwa	M.Sc. Biological and Agricultural Engineering (LAWREE)
	Alexander Taylor Thesis: Engineering Analysis of Plant and Fungal Contributions to Bioretention Performance Advisor: Dr. Birgitte Ahring	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Kapil Khanal Thesis: Cane Management in Red Raspberry Industries: A Proof of Concept Towards Mechanization Advisor: Dr. Manoj Karkee	M.Sc. Biological and Agricultural Engineering (Automation)
	Abirami Rajendran Thesis: Biogenic marker detection for high-throughput phenotyping of Aphanomyces root rot resistance in pea Advisor: Dr. Sindhuja Sankaran	M.Sc. Biological and Agricultural Engineering (Automation)
	Andres Pena Quinones Thesis: Uncertainties Associated with the Use of Air Temperature as Input in Decision Support Systems Advisor: Dr. Garry Hoogenboom/Claudio Stockle	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Nydia Munoz Thesis: Using Oxygen and Bio-preservation as Hurdles to Improve Safety of Cooked Food During Storage at Refrigeration Temperature Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Armando Quintanilla Thesis: Vacuum Impregnation of Firming Agents into Red Raspberries Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Seyedehsanaz (Sanaz) Jarolmasjed Thesis: Development of Advanced Sensing Tools for Phenotyping Traits in Apples Advisor: Dr. Sindhuja Sankaran	Ph.D. Biological and Agricultural Engineering (Automation)
	Carlos Zuniga Espinoza Thesis: Evaluation of Water Stress in Horticultural Crops Using Proximal and Remote sensing Techniques Advisor: Dr. Sindhuja Sankaran	Ph.D. Biological and Agricultural Engineering (Automation)
	Jungang Wang Thesis: Quality Changes of Seafood in Microwave Assisted Pasteurization Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)

2018	Kalidas Mainali Thesis: Identification and quantification of trace oxygenated compounds in alternative jet fuels: Fluorescence methods for fast detection of phenolic compounds in operational field conditions Advisor: Dr. Manuel Garcia-Perez	M.Sc. Biological and Agricultural Engineering (Bioenergy)
2019	Marco Perez Reyes Thesis: Thermal Inactivation of Salmonella Enteritis PT 30 and Enterococcus faecium in Egg Powders at Different Water Activities Advisor: Dr. Juming Tang Moriko Qian Thesis: Biomass-Assisted Synthesis of Hierarchical Zeolites for Catalytic Fast pyrolysis of Lignocellulosic biomass and waste plastic Advisor: Dr. Hanwu Lei ElMarch Villota Thesis: Development of Carbon-based catalyst for Microwave-assisted Pyrolysis of Lignocellulosic Biomass Advisor: Dr. Hanwu Lei Xiao Fu Thesis: Manganese Assisted Fungal Treatment of Lignocellulosic Biomass for Biofuels Production Advisor: Dr. Shulin Chen Pavitra Krishna Kumar Thesis: State and Phase Transitions and Quality Changes in Frozen Starch-rich Foods Advisor: Dr. Shyam Sablani Abdelmoneim Mohamed Thesis: Optimizing and Modeling the Performance of Moving Sprinkler Irrigation Systems Advisor: Dr. R. Troy Peters Abid Sarwar Thesis: Experimental and Modelling Techniques for Accurate Measurement of Wind Drift and Evaporation Losses to Improve Water Application Efficiency of Moving Sprinkler Irrigation Systems in Washington Advisor: Dr. R. Troy Peters Ga Young Shin Thesis: Equivalent Processing for Pasteurization of a Juice Blend by Selected Nonthermal Technologies Advisor: Dr. Gustavo Barbosa-Canovas Lin Chen Thesis: A Weeding Robot auto-leveling system for typical vegetable fields in the Pacific Northwest Region Advisor: Dr. Qin Zhang/Manoj Karkee Li-Huei (Emily) Chen Thesis: (Non-Thesis Exam) Advisor: Dr. Shyam Sablani Jie Xu	Ph.D. Biological and Agricultural Engineering (Food Engineering) Ph.D. Biological and Agricultural Engineering (Bioenergy) Ph.D. Biological and Agricultural Engineering (Bioenergy) Ph.D. Biological and Agricultural Engineering (Bioenergy) Ph.D. Biological and Agricultural Engineering (Food Engineering) Ph.D. Biological and Agricultural Engineering (LAWREE) Ph.D. Biological and Agricultural Engineering (LAWREE) M.Sc. Biological and Agricultural Engineering (Food Engineering) Ph.D. Biological and Agricultural Engineering (Automation) M.Sc. Biological and Agricultural Engineering (Food Engineering) Ph.D. Biological and Agricultural Engineering

2019	<p>Jie Xu Thesis: Control of Salmonella in Low Moisture Foods: Thermal Death Kinetics and Microbial of Radio-Frequency Processes Advisor: Dr. Juming Tang</p>	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	<p>Haitham Yaqout Bahlol Thesis: Engineering Solutions for Improved Spray Applications in Perennial Specialty Crops Advisor: Dr. Lav Khot</p>	Ph.D. Biological and Agricultural Engineering (Automation)
	<p>Rajeev Sinha Thesis: Solid Set Canopy Delivery System (SSCDS) Customized for High Density Apple Orchards and Vineyards in the State of Washington Advisor: Dr. Lav Khot</p>	Ph.D. Biological and Agricultural Engineering (Automation)
	<p>Andre David Bergeron Thesis: Moving Towards Sustainable & Economical Bioproducts: Bioremediation of Waste Streams and Improving Product Titers Advisor: Dr. Shulin Chen</p>	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	<p>Na Pang Thesis: Synergy of Photosynthesis and carbo metabolism on Microalgal growth and biosynthesis under mixotrophic conditions. Advisor: Dr. Shulin Chen</p>	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	<p>Ayca Seker Thesis: Adsorptive Recovery of Polyphenolic antioxidants from winery by-products using polyethylene Glycol (PEG) Grafted Silica Particles Advisor: Dr. Shulin Chen</p>	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	<p>Maryam Davaritouchaee Thesis: Persulfate oxidizing system for biomass pretreatment and process optimization Advisor: Dr. Shulin Chen</p>	Ph.D. Chemical Engineering (Bioenergy)

2020	<p>Mugal Samrat Dahal Thesis: WEPP Simulation of Water Erosion on Cereal Grain Cropland in the Inland Pacific Northwest Advisor: Dr. Joan Wu</p> <p>Evan Terrell Thesis: Development of a Microkinetic Framework for Analysis of Biomass and its Thermochemical Conversion Advisor: Dr. Manuel Garcia-Perez</p> <p>Santosh Bhusal Thesis: Unmanned Aerial Systems (UAS) for Bird Damage Control in Wine Grapes Advisor: Dr. Manoj Karkee</p> <p>Atisheel Kak Thesis: Characterizing Oxygen Transport in Microcapsules Using a Fluorescence-Based Method Advisor: Dr. Shyam Sablani</p> <p>Juhi Patel Thesis: Shelf Life Studies of Ready-to-Eat Meals in High Barrier Packaging Processed via Microwave-Assisted Thermal Sterilization (MATS) technology Advisor: Dr. Shyam Sablani</p> <p>Jonathan Flores Thesis: Estimating River sediment discharge in the Upper Mississippi River using Landsat imagery Advisors: Dr. Claudio Stockle and Joan Wu</p> <p>Supriya Charuhas Karekar Thesis: Applications of Homoacetogens Advisor: Dr. Birgitte Ahring</p> <p>Fidel Maureira Sotomayor Thesis: Sustainability intensification of Food System in Columbia River Basin Advisor: Dr. Claudio Stockle</p> <p>Jaza Alshammari Thesis: Sorption Isotherms of High Sugar Content Products and their influence on thermal resistance of Salmonella Advisor: Dr. Juming Tang</p> <p>Yuqiao Jin Thesis: Thermal Resistance of Salmonella in low Moisture Foods as Influenced by Water Activity at Elevated Temperature Advisor: Dr. Juming Tang</p>	<p>M.Sc. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (Bioenergy)</p> <p>Ph.D. Biological and Agricultural Engineering (Automation)</p> <p>Ph.D. Biological and Agricultural Engineering (Food Engineering)</p> <p>Ph.D. Biological and Agricultural Engineering (Food Engineering)</p> <p>M.Sc. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (Bioenergy)</p> <p>Ph.D. Biological and Agricultural Engineering (LAWREE)</p> <p>Ph.D. Biological and Agricultural Engineering (Food Engineering)</p> <p>Ph.D. Biological and Agricultural Engineering (Food Engineering)</p>
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2020	Michael Apasiku Thesis: Contributions to the Development of Engineered Amorphous Carbons for Environmental Applications Advisors: Dr. Manuel Garcia-Perez and Jean-Sabin McEwen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Zongmei Gao Thesis: Application of hyperspectral imager for biotic abiotic stress detection in special crops Advisor: Dr. Qin Zhang	Ph.D. Biological and Agricultural Engineering (Automation)
	Yaqoob Majeed Thesis: Machine Vision System for the Automated Green Shoot Thinning in Vineyard Advisor: Dr. Qin Zhang	Ph.D. Biological and Agricultural Engineering (Automation)
	Xin Zhang Thesis: Study of canopy-Machine (interaction in mass Mechanical Harvest of Fresh Market apples Advisor: Dr. Qin Zhang	Ph.D. Biological and Agricultural Engineering (Automation)
	Jose Martinez Fernandez Thesis: Sequential Hydrothermal Extraction for the Recovery of Valuable Bioactives to Repurpose and Valorize Potato Peels Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Saleh Alghamdi Thesis: Flexible and Semirigid Packaging for Pressure and Micro-wave-based Pasteurization and Sterilization Process Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Chandrashekhar Sonar Thesis: In-Package Thermal Pasteurization: Evaluating Performance of Flexible Packaging and Oxygen Sensitivity of Food Components Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Muhammad Usman Khan Thesis: Pretreatment to Enhance the Anaerobic Digestion of Recalcitrant Lignocellulosic Biomass Materials Advisor: Dr. Birgitte Ahring	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Ying-Tsui Wang Thesis: Apple Shoot Growth Dynamics in the Pacific Northwest: Analysis and Consideration of Polycyclism in Mappelt Model to Predict Architectural Development Advisors: Dr. Gerrit Hoogenboom and Claudio Stockle	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Ren Yang Thesis: The Protective Effect of Oil on Bacterial Thermal Inactivation in High-fat Low-Moisture Foods: Mechanism and Solutions Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)

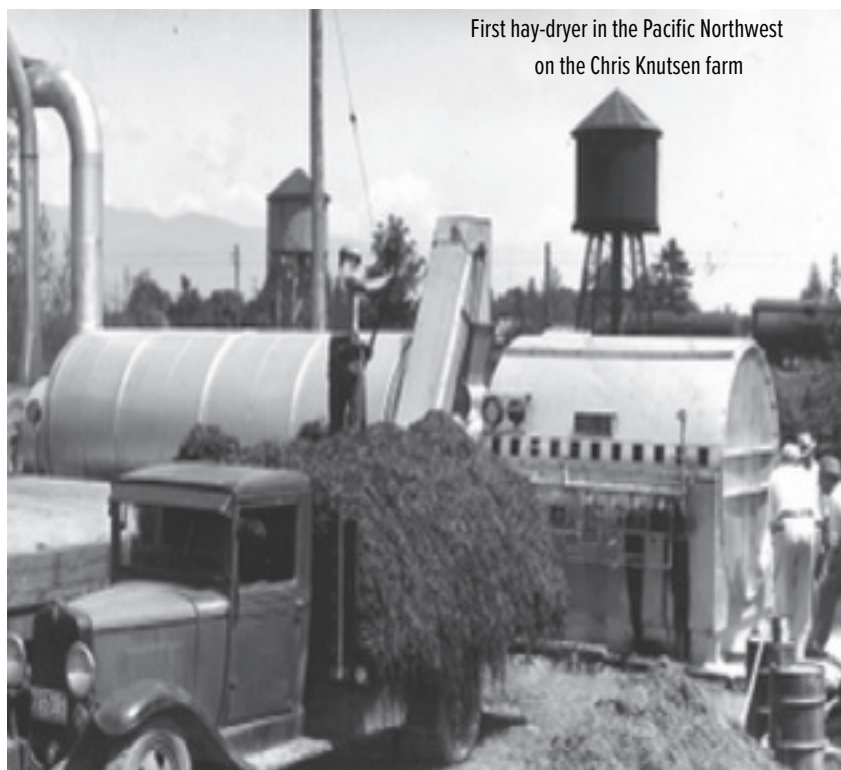
2020	<p>Yinglei Han Thesis: Alternative Transportation Fuels Production from Cohydro-treatment of Vegetable Oil and Pyrolysis Oil Derived from Biomass and Tires Advisor: Dr. Manuel Garcia-Perez</p> <p>Xiangyu Gu Thesis: Fractionation of Biomass via Sequential Hydrothermal Liquefaction to Produce Value-Added Products and Techno-economic Analysis Advisor: Dr. Shulin Chen</p> <p>Chongyuan Zhang Thesis: High-Throughput Phenotyping of Cool-Season Crops Using Non-Invasive Sensing Techniques Advisor: Dr. Sindhuja Sankaran</p>	<p>Ph.D. Biological and Agricultural Engineering (Bioenergy)</p> <p>Ph.D. Chemical Engineering (Bioenergy)</p> <p>Ph.D. Biological and Agricultural Engineering (Automation)</p>
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Liquid manure tank owned by Carl Schraeder, Skagit, 1941

2021	Jose A. Almodovar Thesis: Maximizing Carbon Conversion Efficiency through Acid Carbonization to Increase C Advisor: Dr. Manuel Garcia-Perez	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Gilbert Miito Thesis: Treatment of Dairy Wastewater using a Low-cost Vermifilter Technology Advisor: Dr. Pius Ndegwa	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Sushma Thapa Thesis: Irrigation Management in Vineyards: Modeling Water Stress Using Hyperspectral Imaging Advisor: Dr. Manoj Karkee	M.Sc. Biological and Agricultural Engineering (Automation)
	Alia Nasir Thesis: Nutrient Removal and Recovery from Dairy Digestate Advisors: Dr. Manuel Garcia-Perez and Pius Ndegwa	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Yaime Jefferson Milan Thesis: Pollutants removal from composting processes using bio-char from locally available bio-resources Advisor: Dr. Manuel Garcia-Perez	M.Sc. Biological and Agricultural Engineering (Bioenergy)
	Xiaolu Li Thesis: Fundamentals of Bioconversion of Biorefinery Wastes to Lipids by Rhodococcus Strains Advisor: Dr. Bin Yang	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Wendy Mateo Thesis: Development and Optimization of Catalytic Pyrolysis Process of Lignocellulosic Biomass over Sulfonated Carbon-based Catalyst Advisor: Dr. Hanwu Lei	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Sumeyye Inanoglu Thesis: Impact of Microwave-Assisted Pasteurization System and High Pressure Processing on Microbial Safety and Quality Parameters of Green Beans. Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Abhilash Chandel Thesis: Small Unmanned Aerial System Based Remote Sensing to Map Geospatial Water Use of Field and Perennial Specialty Crops Advisor: Dr. Lav Khot	Ph.D. Biological and Agricultural Engineering (Automation)
	Rakesh Ranjan Thesis: Crop Physiology Sensing Integrated Automated Solid Set Canopy Delivery System for Loss Management in Deciduous Crops and Vineyards. Advisor: Dr. Lav Khot	Ph.D. Biological and Agricultural Engineering (Automation)

2021	Abid Tanzil Thesis: Strategies to improve Economic and Environmental Indicators to Produce Sustainable Aviation Fuel Advisor: Dr. Manuel Garcia-Perez	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Femi Alege Thesis: Densification and Blending of Manure Nutrients via Pelleting to Enhance transport and Utilization Advisor: Dr. Pius Ndegwa	Ph.D. Biological and Agricultural Engineering (LAWREE)
	Yuxiao Xie Thesis: Exploring Possibilities for Increasing Accumulation of Structural Carotenoid through Synthetic Biology Advisor: Dr. Shulin Chen	Ph.D. Biological and Agricultural Engineering (Bioenergy)
	Yoonki Hong Thesis: Improved Performance of Microwave Assisted Thermal Processing System and Processes Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Zhi Qu Thesis: Thermal pasteurization of vegetables and organ meat: safety and quality Advisor: Dr. Juming Tang	Ph.D. Biological and Agricultural Engineering (Food Engineering)
	Ashutos Parhi Thesis: Development of Polymer Packaging for In-package Thermally Sterilized Shelf Stable Food Products Advisor: Dr. Shyam Sablani	Ph.D. Biological and Agricultural Engineering (Food Engineering)



Chronological Listing of Visiting Scholars

**Compiled by Manuel Garcia-Perez and Dorota Wilk
from Departmental archives**

Year	Name	Title	Country	Inviting BSE Faculty
2014	Ilce Medina Meza	Adjunct Faculty	Mexico	Gustavo Babosa-Canovas
	Hector Flores	Adjunct Faculty	Mexico	Gustavo Babosa-Canovas
	Camila Garcia Jange	Visiting Scholar	Brazil	Gustavo Babosa-Canovas
	Andrea Lezama	Visiting Scholar	Mexico	Gustavo Babosa-Canovas
	Maria Paciulli	Visiting Scholar	Italy	Gustavo Babosa-Canovas
	Garnica Romo	Adjunct Faculty	Mexico	Gustavo Babosa-Canovas
	Filippo Villani	Adjunct Faculty	Italy	Gustavo Babosa-Canovas
	Hairong Yuan	Adjunct Faculty	China	Shulin Chen
	Ping Ai	Adjunct Faculty	China	Shulin Chen
	Yonghong Meng	Visiting Scholar	China	Shulin Chen
	Guokun Wang	Visiting Scholar	China	Shulin Chen
	Quan Li	Adjunct Faculty	China	Shulin Chen
	Abooli Golzary	Visiting Scholar	Sweden	Shulin Chen
	Pablo Arazo	Adjunct Faculty	Spain	Manuel Garcia-Perez
	Lucia Botella	Visiting Scholar	Spain	Manuel Garcia-Perez
	Geraldo Ferreira David	Visiting Scholar	Brazil	Manuel Garcia-Perez
	Gabriel Garcia	Visiting Scholar	Mexico	Manuel Garcia-Perez
	Janet Sanchez	Visiting Scholar	Mexico	Manuel Garcia-Perez
	Electo Eduardo Silva Lora	Visiting Scholar	Brazil	Manuel Garcia-Perez
	Jonathan Pulgarin Leon	Adjunct Faculty	Colombia	Manuel Garcia-Perez
	Nancy Soto	Visiting Scholar	Colombia	Manuel Garcia-Perez
	Ming Li	Visiting Scholar	China	Lav Khot
	Li Li	Adjunct Faculty	China	Shyam Sablani
	Pengqun Kuang	Visiting Scholar	China	Shyam Sablani
	Josue Iglesias	Visiting Scholar	Mexico	Shyam Sablani
	Honghong Gao	Adjunct Faculty	China	Sindhuja Sankaran
	Maria Carmen Gimenez Padilla	Adjunct Faculty	Spain	Claudio Stockle
	Eduardo Ramos	Adjunct Faculty	Spain	Claudio Stockle
	Qingping Zhong	Adjunct Faculty	China	Juming Tang
	Xue-Dong Yao	Adjunct Faculty	China	Juming Tang
	Huojie Shi	Adjunct Faculty	China	Juming Tang
	Jianzhong Sun	Adjunct Faculty	China	Joan Wu
	Doachen Zhu	Visiting Scholar	China	Bin Yang
	Honglaing Wang	Adjunct Faculty	China	Bin Yang
	Haisheng Pei	Adjunct Faculty	China	Bin Yang

2015	Ilce Medina Meza	Adjunct Faculty	Mexico	Gustavo Barbosa-Canovas
	Cesar Femat-Castaneda	Visiting Scholar	Mexico	Gustavo Barbosa-Canovas
	Semanur Yildiz	Visiting Scholar	Turkey	Gustavo Barbosa-Canovas
	Dirlei Kieling	Adjunct Faculty	Brazil	Gustavo Barbosa-Canovas
	Maria de Lourdes Meza Jimenez	Visiting Scholar	Mexico	Gustavo Barbosa-Canovas
	Isabela Rodrigues	Visiting Scholar	Brazil	Gustavo Barbosa-Canovas
	Andrea Lezama	Visiting Scholar	Mexico	Gustavo Barbosa-Canovas
	Hairong Yuan	Adjunct Faculty	China	Shulin Chen
	Abooli Golzary	Visiting Scholar	Sweden	Shulin Chen
	Ping Ai	Adjunct Faculty	China	Shulin Chen
	Dianlong Wang	Visiting Scholar	China	Shulin Chen
	Yonghong Meng	Visiting Scholar	China	Shulin Chen
	Guilherme Goncalves de Godoy	Visiting Scholar	Brazil	Shulin Chen
	Guokun Wang	Visiting Scholar	China	Shulin Chen
	Yugin Li	Adjunct Faculty	China	Shulin Chen
	Demao Li	Adjunct Faculty	China	Shulin Chen
	Yiqing Yao	Adjunct Faculty	China	Shulin Chen
	Lemei Chen	Adjunct Faculty	China	Shulin Chen
	Chenfeng Liu	Adjunct Faculty	China	Shulin Chen
	Jorge Ivan Montoya Arbelaez	Visiting Scholar	Columbia	Manuel Garcia-Perez
	Chi-Tran Cong	Visiting Scholar	Canada	Manuel Garcia-Perez
	Hungmai Xia	Adjunct Faculty	China	Manoj Karkee
	Supod Kaewkorn	Visiting Scholar	Thailand	Manoj Karkee
	Gaili Gao	Adjunct Faculty	China	Manoj Karkee
	Lijun Wang	Adjunct Faculty	China	Manoj Karkee
	Ming Li	Visiting Scholar	China	Lav Khot
	Li Li	Adjunct Faculty	China	Shyam Sablani
	Honghong Gao	Adjunct Faculty	China	Sindhuja Sankaran
	Yongsheng Si	Adjunct Faculty	China	Sindhuja Sankaran
	Muhammad Aqeel Aslam	Adjunct Faculty	Pakistan	Claudio Stockle
	Maria Carmen Gimenez-Padilla	Adjunct Faculty	Spain	Claudio Stockle
	Eduardo Ramos Real	Adjunct Faculty	Spain	Claudio Stockle
	Qingping Zhong	Adjunct Faculty	China	Juming Tang
	Long Xie	Visiting Scholar	China	Juming Tang
	Shaojin Wang	Adjunct Faculty	China	Juming Tang
	Zhihui Zhu	Adjunct Faculty	China	Juming Tang
	Xue-Dong Yao	Adjunct Faculty	China	Juming Tang
	Jianzhong Sun	Adjunct Faculty	China	Joan Wu
	Tianjiao Cheng	Adjunct Faculty	China	Joan Wu
	Doachen Zhu	Visiting Scholar	China	Bin Yang

2016	Ilce Medina Meza	Adjunct Faculty	Mexico	Gustavo Barbosa-Canovas
	Dirlei Kieling	Adjunct Faculty	Brazil	Gustavo Barbosa-Canovas
	Taise Toniazzo	Visiting Scholar	Brazil	Gustavo Barbosa-Canovas
	Chenli Zhou	Adjunct Faculty	China	Gustavo Barbosa-Canovas
	Rosa Ortiz Basurto	Adjunct Faculty	Mexico	Gustavo Barbosa-Canovas
	Yugin Li	Adjunct Faculty	China	Shulin Chen
	Dianlong Wang	Visiting Scholar	China	Shulin Chen
	Demao Li	Adjunct Faculty	China	Shulin Chen
	Limei Chen	Adjunct Faculty	China	Shulin Chen
	Chenfeng Liu	Visiting Scholar	China	Shulin Chen
	Ya Xin	Visiting Scholar	China	Shulin Chen
	Chi-Trang Cong	Visiting Scholar	Canada	Manuel Garcia-Perez
	Supod Kaewkorn	Adjunct Faculty	Thailand	Manoj Karkee
	Lijun Wang	Adjunct Faculty	China	Manoj Karkee
	Hongxing Peng	Adjunct Faculty	China	Manoj Karkee
	Juan Quiros	Visiting Scholar	Brazil	Lav Khot
	Anura Rathnayake	Adjunct Faculty	Sri Lanka	Lav Khot
	Fakhara Khanum	Visiting Scholar	Pakistan	Shyam Sablani
	Alejandra Mencia	Visiting Scholar	Costa Rica	Shyam Sablani
	Aujcharaporn Pongpichaiudom	Visiting Scholar	Thailand	Shyam Sablani
	Ting Zhou	Visiting Scholar	China	Shyam Sablani
	Jin-Hong Zhao	Adjunct Faculty	China	Shyam Sablani
	Xiaodan Ma	Visiting Scholar	China	Sindhuja Sankaran
	Angela Castano	Visiting Scholar	Colombia	Claudio Stockle
	Eduardo Ramos-Leal	Adjunct Faculty	Spain	Claudio Stockle
	Maria Carmen Gimenez-Padilla	Adjunct Faculty	Spain	Claudio Stockle
	Umara Qadeer	Visiting Scholar	Pakistan	Claudio Stockle
	Thammanoon Auksornsri	Visiting Scholar	Thailand	Juming Tang
	Long Xie	Visiting Scholar	China	Juming Tang
	Tianjiao Cheng	Adjunct Faculty	China	Joan Wu
	Aparna Ramchary	Visiting Scholar	India	Bin Yang

2017	Chenli Zhou	Adjunct Faculty	China	Gustavo Barbosa-Canovas
	Rosa Ortiz Basurto	Adjunct Faculty	Mexico	Gustavo Barbosa-Canovas
	Claudia Garcia-Betanzos	Visiting Scholar	Mexico	Gustavo Barbosa-Canovas
	Camille Boulet	Visiting Scholar	France	Gustavo Barbosa-Canovas
	Mariana Granado	Visiting Scholar	Brazil	Gustavo Barbosa-Canovas
	Ya Xin	Visiting Scholar	China	Shulin Chen
	Zhiyou Zong	Visiting Scholar	China	Shulin Chen
	Sasa Zuo	Visiting Scholar	China	Shulin Chen
	Nadia Ruiz-Gomez	Visiting Scholar	Spain	Manuel Garcia-Perez
	Erendira Valencia-Aviles	Visiting Scholar	Mexico	Manuel Garcia-Perez
	Roberto Garcia-Esquivel	Visiting Scholar	Mexico	Manuel Garcia-Perez
	Martin Carbajal Gamarra	Adjunct Faculty	Brazil	Manuel Garcia-Perez
	Li Dai	Adjunct Faculty	China	Manoj Karkee
	Cai Kun	Visiting Scholar	China	Manoj Karkee
	Hongxing Peng	Adjunct Faculty	China	Manoj Karkee
	Hongjie Liu	Visiting Scholar	China	Manoj Karkee
	Qiu Fang Dai	Visiting Scholar	China	Lav Khot
	Guobin Shi	Visiting Scholar	China	Lav Khot
	Haiou Guan	Adjunct Faculty	China	Lav Khot
	Sheila Marie Villota	Visiting Scholar	Philippines	Hanwu Lei
	Dengle Duan	Visiting Scholar	China	Hanwu Lei
	Behnaz Molaei	Visiting Scholar	Iran	R. Troy Peters
	Ting Zhou	Adjunct Faculty	China	Shyam Sablany
	Renata Queiroz Bezerra	Visiting Scholar	Brazil	Shyam Sablany
	Jin-Hong Zhao	Adjunct Faculty	China	Shyam Sablany
	Carolina Paccola	Visiting Scholar	Brazil	Shyam Sablany
	Xiaodan Ma	Visiting Scholar	China	Sindhuja Sankaran
	Umara Qadeer	Visiting Scholar	Pakistan	Claudio Stockle
	Maria Carmen Gimenez-Padilla	Adjunct Faculty	Spain	Claudio Stockle
	Eduardo Ramos Real	Adjunct Faculty	Spain	Claudio Stockle
	Shen Fei	Visiting Scholar	China	Juming Tang

2018	Frederik Juhl Pedersen	Visiting Scholar	Denmark	
	Mariana Granado	Visiting Scholar	Brazil	
	Leticia Aline Goncalves	Visiting Scientist	Brazil	
	Zhiyou Zong	Visiting Scholar	China	
	Yanfang Zhang	Adjunct Faculty	China	
	Sasa Zuo	Visiting Scholar	China	
	Hongliang Cao	Adjunct Faculty	China	
	Erendida Valencia-Aviles	Visiting Scholar	Mexico	
	Roberto Garcia-Esquivel	Visiting Scholar	Mexico	
	Matin Carbajal Gamarra	Adjunct Faculty	Brazil	
	Nadia Ruiz-Gomez	Visiting Scholar	Spain	
	Li Dai	Adjunct Faculty	China	
	Cai Kun	Visiting Scholar	China	
	Hongjie Liu	Visiting Scholar	China	
	Qiu Fang Dai	Visiting Scholar	China	
	Guobin Shi	Visiting Scholar	China	
	Haiou Guan	Adjunct Faculty	China	
	Yunfeng Zhao	Adjunct Faculty	China	
	Dengle Duan	Visiting Scholar	China	
	Coulibaly Sifolo Seydou	Adjunct Faculty	Ivory Coast	
	Carolina Paccola	Visiting Scholar	Brazil	
	Juan Jose Quiros Vargas	Visiting Scholar	Costa Rica	
	Carmen Gimenez	Adjunct Faculty	Spain	
	Eduardo Ramos-Real	Adjunct Faculty	Spain	
	Shen Fei	Visiting Scholar	China	
	Jianwu Dai	Visiting Scholar	China	
	Xiaoyu Wu	Visiting Scholar	China	
2019	Frederik Juhl Pedersen	Visiting Scholar	Denmark	Birgitte Ahring
	Beatriz Franco Goncalves	Visiting Scholar	Brazil	Gustavo Barbosa-Canovas
	Manolya Oner	Adjunct Faculty	Turkey	Gustavo Barbosa-Canovas
	Yanfang Shang	Visiting Scholar	China	Shulin Chen
	Baosheng Ge	Adjunct Faculty	China	Shulin Chen
	Hongliang Cao	Adjunct Faculty	China	Manuel Garcia-Perez
	Rupan Katakai	Adjunct Faculty	India	Manuel Garcia-Perez
	Erika Bartolomei	Visiting Scholar	Italy	Manuel Garcia-Perez
	Wanrong Gu	Visiting Faculty	China	Manoj Karkee
	Bin Wang	Visiting Scholar	China	Lav Khot
	Erguang Huo	Adjunct Faculty	China	Hanwu Lei
	Yunfeng Zhao	Visiting Scholar	China	Hanwu Lei
	Coulibaly Seydou	Adjunct Faculty	Ivory Coast	Pius Ndegwa
	Hamada Baheiry	Visiting Scholar	Egypt	Troy R. Peters
	Juan Jose Quiros Vargas	Visiting Scholar	Costa Rica	Sindhuja Sankaran
	Victor Garcia Gutierrez	Visiting Scholar	Chila	Claudio Stockle
	Maria Carmen Gimenez-Padilla	Adjunct Faculty	Spain	Claudio Stockle
	Eduardo Ramos-Real	Adjunct Faculty	Spain	Claudio Stockle
	Jianwu Dai	Adjunct Faculty	China	Juming Tang
	Lina Wei	Adjunct Faculty	China	Juming Tang
	Teng Cheng	Visiting Scholar	China	Juming Tang
	Xiaoyu Wu	Visiting Scholar	China	Bin Yang

2020	Shiv KuMarch Lohan	Visiting Scholar	India	Manoj Karkee
	Wanrong Gu	Visiting Scholar	China	Manoj Karkee
	Bin Wang	Visiting Scholar	China	Lav Khot
	Xiaoming Chen	Visiting Scholar	China	Lav Khot
	Yunfeng Zhao	Visiting Scholar	China	Hanwu Lei
	Erguan Huo	Visiting Scholar	China	Hanwu Lei
	Vivicius Francking	Visiting Scholar	Brazil	Shyam Sablani
	Shuang Zhang	Visiting Scholar	China	Juming Tang
	Lina Wei	Adjunct Faculty	China	Juming Tang
	Teng Cheng	Visiting Scholar	China	Juming Tang
	Patricio Sandana	Visiting Faculty	Chile	Claudio Stockle
	Sunil Kadam	Visiting Faculty	India	Claudio Stockle
2021	Misbah Murid	Visiting Scholar	Pakistan	Shyam Sablani
	Shuang Zhang	Visiting Scholar	China	Juming Tang
	Sunil Kadam	Adjunct Faculty	India	Claudio Stockle
	John Vincent Nate	Visiting Scientist	Philippines	Manuel Garcia-Perez
	Carlos David Martinez Smit	Visiting Scholar	Columbia	Manuel Garcia-Perez
	Raiza J. Manrique Waldo	Visiting Scientist	Columbia	Manuel Garcia-Perez
	Eduardo F. Carlos	Adjunct Faculty	Brazil	Sindhuja Sankaran



Engineering Education Research Center

By D.C. Davis

The Engineering Education Research Center (EERC) was formed to facilitate engineering education research and other scholarly activity. This was in response to the need for engineering education scholarship at WSU, which is vital to the success of research universities and to the economic well-being of the United States. The EERC was established in January 2005 with Dr. Denny Davis and Dr. Gerald Maring serving as co-directors. Leadership shifted to Dr. Davis when Dr. Maring retired, and the Center lost support as Dr. Davis approached retirement in 2011.

The Engineering Education Research Center worked alongside faculty to catalyze greater scholarly productivity. By leveraging teaching and research activities, faculty were better able to increase research grant funding while also enhancing their success in teaching and mentoring of graduate and undergraduate students. The EERC provided vital services, especially to young faculty, to enhance their competitiveness for NSF CAREER, BIRGE, and other program

grants that required integrated research and teaching components. The EERC led, advised, and contributed to grant proposals for which scholarly education and assessment were required in graduate education, undergraduate education, or K-12 education (e.g., proposals for NSF IGERT, REU, GK12, STEP, DRK12, REESE programs). The EERC also offered formal and informal instruction that prepared current and future faculty for effective, efficient teaching in Science, Technology, Engineering and Mathematics (STEM) fields.

The table below lists funded projects conducted in affiliation with the Engineering Education Research Center between 2005 and 2011. Funded projects, totaling over \$4 million in revenues, address student recruitment, retention, attitudes, and learning, as well as curriculum for mathematics and engineering and assessments for student achievement. Sixteen educational or other institutions were collaborators on these projects. Projects were led by 18 different individuals from nine different departments or units at WSU,

Project Name	PI	Collaborators	Funding	Dates
CLEAR (Collaborative Learner-Constructed Engineering Articulation & Representation)*	D. Davis	COE	NSF DLR 0530708 (\$100,000)	09/01/2005- 08/31/2007
CREAM (Culturally Relevant Engineering Applications in Mathematics)*	D. Davis	COE, COS	NSF DGE 0538652 (\$1,540,800)	02/15/2006- 07/31/2010
Malawi Treadle Pump (student project)*	D. Davis	COB	NCIIA 334-06 (\$12,500)	08/01/2006- 08/31/2007
Underrepresented Engineers as Math Teachers in their Home Communities	R Olsen	COE	NSF (\$329,000)	08/01/2006- 07/31/2011
Collaborative Research: CPATH CB: Exploring Studio-Based Instructional Models for Computing Education	Hundhausen	COE	NSF CNS 0721927 (\$269,000)	1/22/2007- 4/29/2009
Initiation of Collaboration for Interdisciplinary STEM Education*	D. Davis	COE, COS	WSU Rsch/EERC (\$5,000 + \$5,000)	06/01/2007- 12/31/2008
Malawi Treadle Pump (student project)*	D. Davis	COB	NCIIA 334-06 (\$8,000)	08/01/2007- 11/01/2007

Capstone Engineering Design Assessment: Development, Testing & Adoption Research*	D. Davis	COE; UI, SU, Tuskegee U	NSF DUE 0717561 (\$549,850)	09/15/2007-08/31/2010
SWEET (Summer at WSU Engineering Experiences for Teachers)*	R. Zollars	COE	NSF EEC 0338868 (\$160,000)	04/01/2008-3/31/2009
A National Model for Engineering Mathematics Education	S. Brown	COS; Wright State U	Subcontract: NSF DUE 0817332 (\$30,000)	08/01/2008-07/31/2009
Malawi Irrigation (student project)*	H. Davis	COB	NCHIA 5673-08 (\$18,000)	08/01/2008-08/01/2009
Learning Pedagogies in Engineering Process Transport Phenomena Desk-Top Modules	B. Van Wie	CTLT; Ahmadu Bello U	NSF (\$125,000)	09/01/2008-12/31/2008
Inventory of Evaluation Tools for Engineering Education Projects*	D. Davis	COE	NSF DUE 0839898 (\$96,000)	10/01/2008-9/30/2009
In-Class Peer Tutoring in Mechanics of Materials Classes*	S. Brown		NSF EEC 0836013 (\$95,000)	01/01/2009-12/31/2009
SWEET (Summer at WSU Engineering Experiences for Teachers)*	R. Zollars	COE	NSF EEC 0808716 (\$170,000)	04/02/2009-03/31/2010
Curricular Materials & Methods for Student Conceptual Understanding in Mechanics of Materials*	S. Brown		NSF DUE 0837749 (\$150,000)	08/01/2009-07/31/2011
IDEALS (Integrated Design Engineering Assessment and Learning System)*	D. Davis	COE; UI, SU, Smith C	NSF DUE 0919248 (\$150,000)	09/01/2009-08/31/2011
Course Module Leading to Online Learning in Highway Geometric Design	S. Brown	U Alaska Fairbanks	WA DOT TRAC (\$32,400)	05/01/2008-12/31/2009
Collaborative Research: CPATH II: Broadening Studio-Based Learning in Computing Education	C. Hundhausen	COE	NSF CNS 0939017 (\$203,000)	4/28/2009-9/29/2009

* EERC director led or contributed significantly

The Engineering Education Research Center sponsored engineering education speakers to promote excellence in engineering and related teaching and learning at WSU. Through interaction with expert speakers and project advisors from across the nation and visibility from scholarly work presented at conferences and published, WSU gained recognition

as one of the leaders in engineering education scholarship during this period. The table below lists awards and recognitions received by EERC faculty for work done through the Center.

Year	Award or Recognition	EERC Personnel
2011	Sahlin Faculty Excellence Award for Leadership	Denny Davis
2009	Marion E. Smith Faculty Achievement Award	Bernard Van Wie
2009	ASEE Zone 8 Paper Award	Shane Brown
2009	ASEE Outstanding Paper Award	Ashley Ater-Kranov, Carl Hauser, Robert Olsen, and Laura Girardeau
2008	ASCE ExCEED National New Faculty Excellence Award	Shane Brown
2008	ASEE PNW Section Best Paper Award	Ashley Ater-Kranov
2008	ASEE Kauffman Award for Excellence in Engineering or Technology Entrepreneurship Education	Robert Olsen and Denny Davis
2007	Honorable Mention, Benjamin Dasher Outstanding Paper Award, FIE National Conference	Shane Brown

2007	ASEE ERM Division Apprentice Faculty Award	Shane Brown
2007	PNW ASEE Outstanding Teacher Award	Shane Brown
2006	Best Paper Award, IEEE Symposium on Visual Languages and Human Centric Computing	Christopher Hundhausen
2006	Research Affiliate Recognition by Center for Advancement of Scholarship on Engineering Education, National Academy of Engineering	Engineering Education Research Center
2005	ASEE ERM Division Apprentice Faculty Award	Jennifer Light

As the retirement of Dr. Davis was anticipated, the EERC sought to obtain university commitments to hire a national leader in engineering education to fill this vacancy. However, budget constraints and

institutional pressure to grow other areas of scholarship caused this request to be rejected, and the EERC disappeared upon Dr. Davis' retirement in 2012.



Bio-products Science and Engineering Laboratory

By Birgitte Ahring

The Tri-Cities, as it is known today, has origins that are rooted deeply in energy and scientific discovery.

It is home of one of the largest technological feats in the world—the development of the world's first nuclear reactor. It is also home of the Pacific Northwest National Laboratory (PNNL), which also has origins in the Manhattan Project. The PNNL is internationally renowned for its discoveries and advancements in science, the energy sector and national security.

When Washington State University, PNNL, and community leaders started to discuss what was next for the Tri-Cities community, a joint research effort only made sense. WSU Tri-Cities chancellor Dr. Larry G. James participated in these discussions and had a major role in conceiving, planning, and securing funding for BSEL in 2005. Construction of the \$24 million, 57,000 square foot BSEL building began on the WSU Tri-Cities campus in Richland in fall 2006.

At PNNL and WSU, there was a group of scientists ready with new ideas about how to grow a new bio-based industry in the area. A plan was drafted between PNNL and WSU for collaboration in bioproduct and bioenergy research central to a new building that would house PNNL and WSU scientists working together for growing the bio-economy in Washington state.

In the early days of this century, the Tri-Cities community was concerned about the time after Hanford. What would happen when the site no longer had major cleanup activities? Or would new priorities related to clean-up effort at Hanford get adapted? The area experienced lay-offs of Hanford workers and it affected the housing market and activity in the region.

WSU Pullman professor Shulin Chen led the effort, establishing the WSU Center for Bioproducts and Bioenergy that was strongly supported by Ralph P. Cavalieri, director of the Agricultural Research Center, and Jim Petersen, vice provost for research at WSU. WSU submitted a funding request to the 2006 legislature with support from other state agencies. The request was approved by the state and the center was decided to be housed in a new building named the Bioproducts, Sciences and Engineering Laboratory

(BSEL) at WSU Tri-Cities.

In the spring of 2007, engineer Birgitte Ahring was called at the Technical University of Denmark and asked if she would be interested in coming to Richland to give a talk. She was informed about the BSEL enterprise, which at that time was under construction through a \$ 24 million investment from the state of Washington. During the following year, she attended several meetings during which she met administration members at WSU Pullman, and then Gov. Christine Gregoire. In Feb. 2008, she accepted the position as Director of BSEL and moved to the Tri-Cities in the summer of 2008.

From the summer of 2008 to 2009, the WSU sector of BSEL grew from a hall of empty laboratories to an active working research enterprise. The labs were equipped and put into operations. Staff and three postdoctoral researchers were hired and began their research together. WSU then initiated a major search and hired three new assistant professors: Xiao Zhang, Hanwu Lei and Bin Yang – who all started mid-Aug. 2009. With these hires, the BSEL team now covered different fields of biomass conversion with a broad research interest within the biomass field – submitting grants and receiving research funding. The graduate student body grew large, featuring 8 to 10 graduate students who graduated year over year after 2011.

During these years, a pilot plant facility was built at Einstein Avenue, which contains a modern pretreatment and fermentation unit capable of producing biofuels and bio-products at conditions simulating industrial production. This facility delivered pretreated materials for a number of large U.S. Department of Energy Projects, as well as the U.S. Department of Agriculture's Northwest Advanced Renewable Alliance program.

In 2020, BSEL faculty began teaching as part of the graduate program in the Voiland School of Chemical Engineering and Bioengineering. Teaching is now broadcast from WSU Tri-Cities to other WSU campuses through a remote video conferencing system. BSEL faculty also assisted Walla Walla Community College in establishing a new Workforce Program in Energy and Food Processing and Wastewater Treat-

ment which has been active since 2013.

The BSEL partnership with PNNL was strengthened through a large number of collaborative projects. BSEL faculty have continued to work with the Environmental Molecular Sciences Laboratory at PNNL on several projects, including one of its first research campaigns—focusing on biochemical processes that have generated new analytical approaches and tools that are leading to high-value products from biomass sources. Two faculty members, Xiao Zhang and Bin Yang, achieved the status of adjunct senior research at PNNL and EMSL. Ahring was also appointed a Wiley Research Fellow. The tight connections between the two organizations have proven to work.

In 2015, all three assistant professors at BSEL were granted tenure and were promoted to associate professor. In mid-2016, after a successful tenure, Ahring stepped down to devote more time to her research, and Akram Hossain brought BSEL to a new level with a reorganization focusing on safety. In Aug. 2018, BSEL received a new Director, Manuel Garcia-Perez, with a mandate to further grow BSEL as a center of excellence in biomass processing and products. Dr. Garcia-Perez left BSEL in 2020 to start

as BSE department chair and was replaced by Prof. Michael Wolcott. During the tenure of Prof. Wolcott, BSEL further consolidated as a center of excellence in bio-products development. BSEL received its new director, Prof. Joshua Heyne in 2022.

After its first 15 years, the future of BSEL looks bright with the creation of the WSU-PNNL Bio-products Institute, one of the three joint institutes between PNNL and WSU to further strengthen research ties.

Precision Agriculture Center

The Advanced Technology Initiative (ATI) for Precision Agriculture was proposed in late 1998 as part of a three-part initiative to the Washington State Legislature in its 1999-2001 operating budget to establish “faculty clusters” focusing on three areas - semiconductor manufacturing, reproductive biology, and precision agriculture. The ATI was approved and funded at half of the \$3 M request for three entities beginning on July 1, 1999. Denny Davis, Professor, Biological Systems Engineering Department, and Bill Dean, Horticulture and Landscape Architecture, were



The Bio-products Science and Engineering Laboratory (BSEL) located on the WSU Tri-Cities campus.

appointed as Interim Director and Associate Director of this ATI effort, tasked with writing the proposal for the Center for Precision Agricultural Systems (CPAS) for approval by the Washington State University Faculty Senate, which received approval in April 2000. Among the 19 WSU faculty members identified as part of CPAS, seven were faculty members in Biological Systems Engineering. After an extensive national search, Dr. Francis J. Pierce became the Center's first Director in September 2000. He established the Center at the WSU Irrigated Agriculture Research & Extension Center (IAREC) in Prosser, Wash., in the heart of irrigated agriculture in eastern Washington.

The mission of the Center was to foster collaborative research, education, and outreach programs that create practical technologies and management systems for Precision Agriculture that support competitive production of Washington's agricultural commodities, stimulate the state's economic development, and protect the region's environment and natural resources. The Center's purpose was to advance the science and practice of Precision Agriculture in Washington State and beyond.

As CPAS director, Dr. Pierce faced a number of critical issues in establishing a viable center including funding, personnel, infrastructure, and the state of agricultural commodities. The ATI funding was only one half of that requested, the major corporate donor decided to end their relationship with WSU in mid-2000, and national funding for precision agriculture in 2000 was very limited. As a result, of the 19 CPAS faculty in 2000, six left WSU for other positions, three retired, two moved into WSU administrative positions, and five were not actively involved in late 2000. This included those who managed the Public Agricultural Weather System (PAWS) which Dr. Pierce assumed leadership for in the fall of 2000. The PAWS network was aging and underfunded. To overcome those unexpected challenges, Dr. Pierce took a strong leadership stance to find solutions, including but not limited to creating a Technology Roadmap for Tree Fruit Production – which was first proposed by Dr. Pierce to the leaders of the Washington State tree fruit industry in early 2001. The first version of the “Technology Roadmap for Tree Fruit Production 2010” laid out the main priorities and goals for achieving technological innovation in the Pacific Northwest with the vision statement: “For the Pacific Northwest

Tree Fruit Industry to compete globally, it must reduce the cost of production of its highest quality fruit 30% by the year 2010.” This effort later became the National Tree Fruit Technology Roadmap, supported by USDA-ARS, that provided federal legislation to create the Specialty Crop Research Initiative in the 2008 Farm Bill, which continues to be the major national funding source for precision and automated agriculture. As a result of the Roadmap effort, CPAS received the largest grant ever approved from the Washington Tree Fruit Research Commission over a five year period. The grant focused on the development and implementation of numerous wireless and sensor technologies, including AgFrostNet, a wireless frost detection network for orchards and vineyards.

Based on new wireless and sensor technologies as well as software created by CPAS with funding from the American Farmland Trust/EPA Region 10, the Washington Tree Fruit Research Commission, and other sources. In 2005, the Washington State Legislature funded the WSU request for \$300,000 for equipment acquisition needed to expand AgWeatherNet to 135 stations. In 2006, AgWeatherNet received permanent state funding to greatly expand the weather network and increase the scope of its operation. Once the funding was approved, Dr. Pierce requested that AgWeatherNet be moved from CPAS to a new director for AgWeatherNet, Dr. Gary Grove, beginning July 2006. AgWeatherNet remains a major asset to agriculture in Washington State.

In 2005, WSU received \$2.5M from the Washington State Legislature for the construction of a new AgTech building located at WSU, IAREC. Due to costs, only half of the proposed building was completed at that time. In 2013, WSU received another \$1.7M from the State Legislature to complete the other portion of the building with shop space to furnish the necessary facilities for machinery development and testing. The building addition was completed in 2015, and the Center acquired additional funds from external sources to equip the shop with a lathe, a CNC machine, a 3D printer, and a few other machine tools to gain the essential manufacturing capacity for research prototype development.

It was clear early on that the success of precision agriculture in agricultural systems in Washington State would require a concerted effort in automation engineering and robotics.

In 2008, Dr. Pierce submitted a plan to the WSU College of Agriculture to develop an integrated mechanical engineering and automated agricultural systems engineering team at Washington State University. The plan called for up to 6 new faculty positions in addition to the current director, led by a Senior Scientist: Automated Systems Engineer who would also act as the Associate Director of CPAS with one associate professor, a mid-career scientist in Automated Systems Engineering, and up to four assistant professors in mechanical engineering (or other core engineering disciplines) with 9-month appointments, plus technical and administrative staff. After a national search, Dr. Qin Zhang was hired as the Senior Scientist in 2009 and Dr. Manoj Karkee hired in 2010 as an agricultural automation and mechanization engineer.

Because of his outstanding contribution and achievement as the Director of CPAS, Dr. Pierce received the first Pierre C. Robert Precision Agriculture Award for a Senior Scientist/Profession in 2008. He was also honored as a Fellow in the American Society of Agronomy and Fellow in the Soil Science Society of American, also in 2008. He served as President of the American Society of Agronomy in 2010. Dr. Fran Pierce retired from the Director position in 2010, Dr. Qin Zhang succeed the responsibilities as the second Director for the Center.

To face the new challenges in technology advancement for Washington agriculture, the Center, with guidelines provided by ARC, has redefined its priorities to agricultural automation and related technologies with an emphasis on specialty crop production. This research priority shift aligns with WSU strategic plan Goal – to “achieve national and international preeminence in innovation, discovery, and creativity” through developing world-class research and education and growing international collaboration efforts in agricultural automation. To reflect this priority shift, the Center was renamed as “Center for Precision and Automated Agricultural Systems (CPAAS)”, refined its mission to “develop a world preeminent and Washington relevant research and educational program in the areas of agricultural automation and precision farming.” Striving for the preeminence, CPAAS set its priority for 2011-16 to: (1) create a critical mass of expertise in the subject area, and (2) develop a more intimate management structure for

encouraging faculty to engage in interdisciplinary research. After a 5-year continuous effort, CPAAS affiliated faculty has increase from 2 to 15 by 2016 and includes 8 WSU units – the Departments of Biological Systems Engineering, Crop & Soil Sciences, Horticulture, Schools of Chemical Engineering and Bioengineering, Economics Sciences, Electrical Engineering and Computer Science, and Mechanical and Materials Engineering – as well as WSU Extension, to engage in shared common research interests in agriculture automation. This affiliated faculty group advised graduate students, post doctorates, student interns, and visiting scientists from 13 countries. CPAAS has also succeeded in establishing international joint centers with universities in Australia, Germany, Japan, and Spain to host academic exchange and research collaboration that have extended our research efforts across the globe and given WSU CPAAS worldwide recognitions. In 2018, CPAAS was ranked as one of the top 25 Precision Agriculture Programs Worldwide by peers and relevant industry.

While it is difficult to list the successes of all its members since CPAAS’s inception due to the complexity in reporting channels, a set of documented accomplishment from three core members (as noted in annual CPAAS reports, involves Dr. Manoj Karkee, Dr. Lav Khot, and Dr. Qin Zhang) between 2017-21 could very well represent the high impact research and accomplishment achieved by this outstanding CPAAS faculty team: published 5 technical or textbook books, written 23 separate book chapters, published 65 peer reviewed journal articles, made 63 presentations at various professional conferences, given 74 keynotes or invited talks at different conferences, symposiums, or workshops, and granted 3 US patents. In terms of student training from 2017-2021, CPAAS has trained 6 undergraduate interns, 6 M.S. students, 12 Ph.D. students, plus 3 joint-training Ph.D. students with our international peer institutes, with 13 graduated with their graduate degrees (8 Ph.D. and 5 M.S.). In addition, CPAAS has also trained 5 post-Doctorial researchers and hosted 12 visiting scientists from 3 different countries. Further evidence showing the high-quality graduate student training includes two of CPAAS graduate students (Suraj Amatya, 2016; Xin Zhang, 2020) receiving the Giuseppe Pellizzi Prize in 2020, a prestigious prize for International Best PhD Dissertations on Agricultural Mechanization, selected

and awarded by the European agricultural mechanization professional body. To date, only 14 dissertations have been awarded worldwide since 2010! In addition, multiple CPAAS graduate students and post-docs have received multiple awards from national and international

professional organizations, such as ASABE Superior Paper Awards, ASABE Graduate Research Awards, etc.

In summary, CPAAS and its faculty team have made recognizable accomplishments in the agricultural mechanization industry, and they remain committed to continue these successes.



Sanaz Jarolmasjed, Chongyuan Zhang and Carlos Zuniga, WSU Biological Systems Engineering graduate students, hold a drone used in phenomics. WSU precision-ag practices help scientists use sensors and drones to understand variability in their crops. Photo by Seth Truscott-WSU CAHNRS.

The Departments of Agricultural Engineering and Biological Systems Engineering Relationship with the Irrigated Agriculture Research and Extension Center

by L. G. James



The Department's formal relationship with the Irrigation Experiment Station, subsequently renamed the Irrigated Agriculture Research and Extension Center (IAREC), began in 1950 when the Institute of Agricultural Sciences created an irrigation engineering position in response to post-war, stakeholder needs for irrigation research. William O. Pruitt, who grew up in Cowiche, WA and earned BS (1949) and MS (1951) degrees in agricultural engineering from Washington State College (WSC), now Washington State University (WSU), was WSC/WSU's first irrigation engineer at IAREC. During his six years in Prosser, Mr Pruitt innovated the use of evaporation pans and weighing lysimeters to quantify crop irrigation requirements. He worked closely with Professor Max Jensen in Pullman before leaving IAREC in December 1956 to continue his work at the University of California, Davis. At UC Davis, Mr Pruitt gained international recognition as a pioneer in the field of crop irrigation requirement measurement and prediction. He received a WSU Alumni Achievement Award in recognition of his major contributions and accomplishments in 1986.

Stephen J. Mech, who first came to IAREC in 1943 as supervisor of irrigation investigation for USDA, was appointed associate agricultural engineer in 1951 after serving as a WSC soil conservationist for two years. In 1955, he transferred back to USDA and

retained a WSC/WSU courtesy appointment until he passed away suddenly in 1968 at age 58. Mr Mech was a nationally recognized expert in wind and water erosion from irrigated lands.

The first irrigation engineers at IAREC were, however, employed by USDA. Coulson C. Wright was a USDA irrigation engineer stationed at Prosser from 1921 until his resignation in 1930. His USDA replacement was soil scientist Carl A Larson, who was replaced by agronomist Emil Nelson in 1942.

Harry G Nickle, assistant engineer with USDA, came to Prosser in 1939 as part of a cooperative agreement between WSC and the USDA Soil Conservation Research Division. Mr Nickle, who received a BS in Civil Engineering from the University of California at Berkley in 1926, began February 7, 1939 and resigned April 23, 1942. He was replaced by Mr Mech March 23, 1943.

James A. (Pat) Middleton, with a BS in Agricultural Engineering in 1950 from what is now New Mexico State University, replaced Mr Pruitt August 1, 1957. Mr Middleton collaborated with Professors Jensen and Day Bassett to develop and refine a method of scheduling irrigations and estimating crop irrigation requirements based on pan evaporation measurements. He also had a major role in the development and adoption of trickle irrigation in Washington.

Mr Middleton retired from WSU in 1980.

Dr. Robert G. Evans replaced Mr Middleton in October 1980. Dr. Evans received a BS in agricultural engineering (1970), a MS in civil engineering (1971), and a PhD in engineering science/agricultural engineering (1981) from Colorado State University. He was the state extension irrigation engineer for Colorado for 5 years prior to coming to WSU.

At WSU, Dr. Evans worked in the areas of agricultural hydrology, agrometeorology, and irrigation system design, operation, and management, often as a member of a collaborative, interdisciplinary team.

He is internationally recognized for contributions in crop-specific water management in arid regions, nutrient management, micro-irrigation, crop-specific regulated deficit irrigation of tree fruits and wine grapes, cold temperature protection and sunburn of fruit crops, and site-specific irrigation with both micro-irrigation and center pivots.

Dr. Evans resigned in early 2001 to become supervisory agricultural engineer, research leader USDA-ARS, Northern Plains Agricultural Research Laboratory, Agricultural Systems Research Unit in Sidney, MT. In 2010, the American Society of Agricultural and Biological Engineers elevated Dr. Evans to membership grade Fellow in recognition of his long career of engineering achievement. He also received the Royce J. Tipton Award for outstanding contributions to the advancement of irrigation and drainage engineering from the American Society of Civil Engineers in 2014.

Dr. Clyde Fraisse replaced Dr. Evans in 2002 after serving as a senior research scientist with Cargill for four years. Dr. Fraisse had a BS in civil engineering (1982) from the Universidade Federal do Parana (Curitiba, Brazil), a MS in irrigation engineering (1988) from KU Leuven (Belgium), and a PhD in agricultural engineering from Colorado State University in 1994. He resigned in 2003 for a faculty position in the agricultural and biological engineering department at the University of Florida.

Melvin A. Hagood was the first extension irrigation engineering specialist at IAREC. He began in 1961, after being an extension agent in Grant County for 10 years and leading the Settlers Assistance Program. This US Bureau of Reclamation funded program helped new settlers in the Columbia Basin clear, level, and develop farms for irrigation. Mr Hagood was responsible for training and providing technical assistance to as many as 28 Settlers Assistance Agents involved in surveying for farm unit boundaries, land leveling, and water distribution systems as well as overall advising on farm development. (Professor Bassett was a Settler Assistance Agent prior to joining the Department in 1954.) Mr Hagood retired in 1977.

Dr. Gene T. Thompson replaced Mr Hagood in 1979. Dr. Thompson earned BS and MS degrees in agricultural engineering from WSC/WSU in 1951 and 1961, and a PhD in civil engineering from WSU in 1974. He was a settler's assistant Extension agent

in Grant County Washington, and held agricultural engineering positions with the Bureau of Reclamation, the Arabian American Oil Company, and the US AID before joining the WSU agricultural engineering faculty in 1966. He took an irrigation engineering position with Harza Engineering in Chicago in 1976 and returned to WSU in 1979 as an Extension specialist at IAREC. Dr. Thompson remained at IAREC until resigning in 1981.

Dr. Thomas W. Ley replaced Dr. Thompson in July 1983. Dr. Ley received BS (1977) and MS (1978) degrees in agricultural engineering from Colorado State University and a PhD in irrigation engineering from Utah State University in 1995. His foci were irrigation system operation and management, crop irrigation requirements, and irrigation scheduling. His most significant accomplishment at WSU was establishing the PAWS (now AgWeatherNet) statewide network of automated agricultural weather stations and decision models. Dr. Ley resigned in April 1997 for an international assignment with Winrock Engineering in Egypt.

Dr. Brian G. Leib replaced Dr. Ley in 1998 after completing a PhD in agricultural engineering at Pennsylvania State University (1998). He previously received a BS in agricultural engineering in 1982 from Penn State and a MS in agricultural engineering from Colorado State University in 1989. His focus at WSU was irrigation systems and water management with a special interest in soil moisture monitoring systems. He left WSU for a faculty position at the University of Tennessee in 2003.

Dr. R. Troy Peters, who earned a BS in manufacturing from Brigham Young University in 1997 and a PhD in irrigation engineering from Utah State University in 2003, replaced Dr. Leib in March 2006. His areas of focus include deficit irrigation, irrigation scheduling and management, crop water use, irrigation automation, low energy precision application, and low elevation spray application. Dr. Peters is also affiliated with the Center for Precision and Automated Agricultural Systems (CPAAS).

The Department's activities at IAREC were expanded to include precision agriculture in 2000 when the Center for Precision Agricultural Systems (CPAS), now Center for Precision and Automated Agricultural Systems (CPAAS), was established. CPAS was a major component of WSU's successful

Advanced Technology Initiative funding request to the Washington Legislature in 1999. CPAS was designed to bring together engineers, scientists, Extension personnel, and growers to advance management and mechanization of large agricultural systems considering variability in time and space.

Dr. Fran Pierce, a BSE faculty member, began as CPAS's first director in September 2000. He skillfully guided the Center through its early years until early retirement in 2010. Dr. Qin Zhang, the current director and BSE faculty member, replaced Dr. Pierce. CPAS was renamed Center for Precision and Automated Agricultural Systems, CPAAS, in 2010.

A new Agricultural Technology Building at IAREC was opened in 2009 to support CPAAS faculty, graduate students, and staff. Offices and laboratory space were added to the Ag Tech building in 2015.

CPAAS has three core faculty, all members of the BSE faculty:

- » Dr. Qin Zhang, expertise in the area of mechatronics and automation,
- » Dr. Manoj Karkee, expertise in the areas of machine vision and agricultural robotics,
- » Dr. Lav Khot, expertise in the areas of precision/smart agriculture (ground and aerial crop sensing, data to decision support, and variable rate technology development).

CPAAS also includes faculty affiliates at WSU Pullman and WSU Tri-Cities from Crop and Soil Sciences, Horticulture, Economic Sciences, Electrical and Computer Engineering, Mechanical and Materials Engineering, Chemical and Biological Engineering, and WSU Extension.

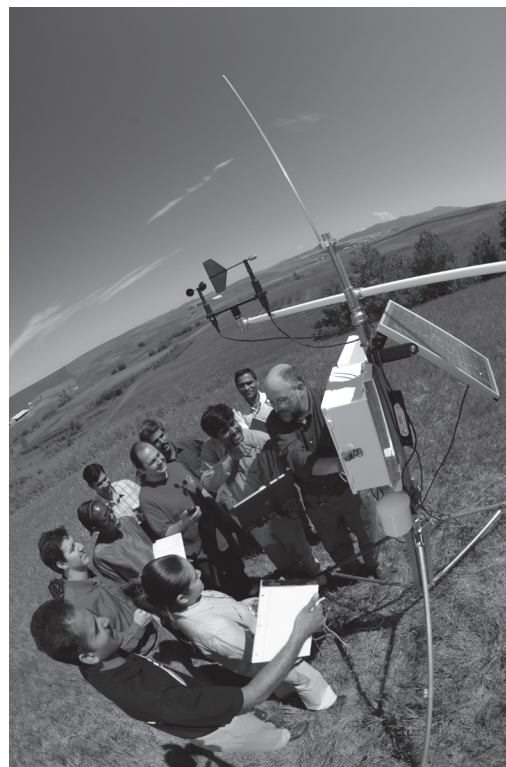
Department faculty also had a major role in the formation and development of AgWeatherNet. Tom Ley, Extension agricultural (irrigation) engineer at IAREC, secured funding from Washington's share of the Big Tobacco Master Settlement Agreement of 1988 to purchase 15 automated weather stations. These units replaced several discontinued US Weather Service stations that provided essential weather data for critical agricultural locales. The network, known as the Public Access Weather System or PAWS, began in the Yakima Valley and extended north through the Wenatchee and Okanogan Valleys and east to Walla Walla with the help of outside funding from a variety of private and public sources.

In 2002, Dr. Fran Peirce and other faculty associ-

ated with WSU's Center for Precision Agricultural Systems secured grant funding from the American Farmland Trust for further expansion of PAWS. Later, the Washington Legislature appropriated funding for equipment (2005) and permanent operating dollars (2006) to expand PAWS into a statewide network of automated weather stations. PAWS was renamed AgWeatherNet and began functioning as a separate unit of CAHNRS and Extension on July 1, 2006.

Today, AgWeatherNet provides farmers, gardeners, researchers, and policy makers with near real-time weather data from a network of nearly 400 solar-powered automated weather stations in non-forested areas throughout Washington. It serves the agricultural community as well as citizens across the state. AgWeatherNet also includes several weather-related decision-support tools for improving agricultural production (yield and quality), efficiency, and profitability while minimizing environmental impacts. Decision support models for predicting cold events, disease outbreaks, temperatures, and much more are included. In recent years, IAREC agricultural (irrigation) engineer Dr. Troy Peters developed a downloadable mobile application for irrigation scheduling for everything from crops to lawns.

Dr. Lav R. Khot, associate professor of Biological Systems Engineering, began a two-year term as interim director of AgWeatherNet in 2021.



Evolution of Agricultural Mechanization to Agricultural Technology and Management: 1992-2006

By James Durfey

In 1992, Agricultural Mechanization was renamed Agricultural Technology and Management (AgTM,) which was housed in Agricultural Engineering, which was renamed Biological Systems Engineering. At that time, there were only 12-15 total students in the Bachelor of Science

degree in the AgTM program. The variety of courses taught in the different subject matter areas varied based on faculty expertise. As a general rule, there were 5-6 faculty that taught the required courses for the AgTM program.

Fundamentally, the AgTM program name did not accurately reflect the old Agricultural Mechanization curriculum that was in place. With the help of faculty, numerous courses were dropped and others added. The time from 1992-2002 reflected many course changes to focus on what the new name actually meant from a technology and management position. The framework was sound but lacked a critical skill set to create a more well-balanced program. During this time period, from 1992-2002, the AgTM program was modified to its present form.

The major revision within the program was to upgrade current courses to address technology in the various subject matter, coupled with business. Today, many graduates complete their degree in Agricultural Technology and Management with enough courses to qualify for a certified minor in B.A. Administration.

I was hired in 1992 to evaluate and implement change where necessary. While teaching in the department, I noticed that, as time evolved, so did the curriculum and the name for various degree programs. This was related to the ever-changing needs of the specific graduate degree. The one major flaw in



changing the name and program of study was not in the fact that it was headed in the wrong direction, but rather, the developers of the program were no longer able to decode the program to prospective students and their parents. I observed faculty in various departments who,

having gone through degree program name changes, could not tell a future student or parent what their program was about in five minutes or less. Today's parents and students are somewhat impatient, and you need to be able to fully explain the degree program in a short time period.

Seeing this flaw, as I watched faculty decode or explain their program to prospective students, it dawned on me that students and parents would understand a picture or design easier. It was then I had an epiphany and developed the "three-circle model." As I would tell the student, parent, or donor about the program, I asked them to imagine three circles with the intersection of the circle being the student:

Circle 1. SCIENCE. Students from this AgTM program secure three times as much science as required of a graduate. One year of chemistry, one year of biology, adding crops, soils, entomology, weeds and animal science.

Circle 2. TECHNOLOGY. Students have one year of precision agriculture using GIS/GPS, adding electricity, hydraulics, irrigation, risk management, and power machinery.

Circle 3. BUSINESS. Students take one year of accounting (managerial and financial), finance (both personal and corporate), management, marketing, real estate and economics. This sets them up for a Business Administration minor.

After the interested students and parents hear how the program is structured, it provides a clear understanding of the degree program, all packaged into the 120 semester hours required for graduation. This took years of evolving the program and listening to the Human Resources representatives of national agricultural companies, in order to develop curriculum to meet the needs of agriculture. It is this blend of the three areas of Science, Technology, and Business that has grown a program that was dying, into one of the outstanding degree programs in CAHNRS.

Personally, I have developed seven different courses with the AgTM program. This involved curriculum development, week by week, which was subject to the approval of the faculty senate. My vision was based on a student academic load of 12-18 hours. With the majority of the courses at WSU falling into the 3 or 4 credits per class, equating to 18 hours was challenging for advisors. My philosophy was, if you are paying for 18 hours of tuition, take a full 18-credit load. Anything over 18 would cost the student extra tuition.

I was even so creative to develop three 1-credit courses that ran for 5 weeks each but were back-to-back for a 15-week semester. One faculty member in a different department said it would not work, but it did, and it worked well. However, as time evolved, there were other creative ways to fill the 18 hour per semester while not overwhelming the student with course work. Not only was I interested in teaching up to date material for each class but advising each individual student on their classes for each semester became a challenging task of strategy for me.

Aquaculture was and is an upcoming area of growth. To address this area of agriculture, I decided to develop a course, AgTM 469, based on fish production. With my experience in production aquaculture, along with field trips and fish production software, I gave the students insights in this growing area of agriculture. Unfortunately, due to faculty retiring in the AgTM area, I needed to assume additional teaching responsibilities and later eliminated the course due to lack of faculty to teach the course. When Dr. Shulin Chen was hired, we teamed up to develop an Aquaculture lab in one of the old Carver Farms buildings. We felt that Aquaculture had a place in Pacific Northwest Agriculture. This wet lab provided a place where we could raise fish and evaluate different feed for production. As the WSU Veterinary

Medicine program continued to expand its buildings, the Carver Farm Aquaculture lab was demolished for a parking lot. That ended research and development for Aquaculture.

Using my AgTM 413 Risk Management class, I provided a full semester of Washington State Private Pesticide Education, Ag Safety 296-307, Agricultural Safety, and Global Gap, an international standardization for agricultural production. During the semester, students who were interested in one of several pesticide licenses offered by the state had the opportunity to take the state exam. I would set aside time outside of class for these exams. Many students commented that it was because of their successful passing of the state exam, that they achieved employment in the farm chemical industry.

I introduced precision agriculture to the AgTM curriculum in 1995. Many faculty asked me what this was about, and my best reply was "This will change the future of agriculture and how we manage our resources". I created AgTM 305 Precision Agriculture.

In 1998, Dr. Tim Fiez and I organized the first Western Precision Agriculture Conference, with the help of WSU Conferences and Institutes. To consider the conference successful, we were hoping for 150 people in attendance. The attendance hit 325 people. The three-day conference, with concurrent sessions and lab activities, was popular beyond our expectations. We have Dr. Larry James, former department chairman of Agricultural Engineering and then associate dean in CAHNRS, to thank for financially backing this venture. Aside from awakening Pacific Northwest agriculture to the potential of precision agriculture technology, our goal was to make enough money to purchase lab equipment for the newly created AgTM 305 class.

With the help of WSU Conferences and Institute we took the program to Boise in 1999. Again, the positive reviews asked if we would be willing to do the same thing in California? I said "No"! The work involved, while trying to advise students and grow the AgTM program, was too much. I was hired at WSU to grow the AgTM program.

Following the success of the two conferences, Dr. Fiez and I secured a \$40,000 USDA Challenge Grant to develop 13 online training modules for precision agriculture. The goal for the online training modules was to allow faculty to make changes and upgrade the

modules as needed over time. Books on this subject are quickly outdated and expensive to print. Using these training modules allowed me to create a synchronous course so campus-based students interacted with students at a distance. I will grant you, there were challenges, especially when you send expensive GPS units out to a distance student for lab activities and hope they will send them back.

As the field of precision agriculture grew, so did the need for software to manage the increasing amount of data. At one time, there were 15 software companies trying to sell their latest and best software. All these companies wanted the AgTM program to pay “per seat.” Prices ranged from \$500-\$1000 per seat per year. None of the companies would budge or give a discount even though, as I reminded them, we were not profiting from this, but trying to educate the next generation of agriculturalists.

Finally, only one company was willing to work me on this issue. That company was FarmWorks Software from Indiana. They gave me an unlimited site license to renew each year for \$500/year. I was a little nervous about this commitment because if I was wrong, teaching a software package that would be outdated or difficult to use would be a serious mistake. My gamble paid off and they eventually developed educational modules for all phases of their software package. The company was later acquired by Trimble Navigation, one of the world’s largest companies producing GPS equipment and software.

Using the backing from the FarmWorks Software company, Dr. Marvin Kleene and I secured a \$40,000 grant to develop curriculum in the high schools. We targeted three different districts in different geographical locations and provided precision agriculture training to high school Agricultural Education faculty. Not only did we have monies in the grant for software but GPS units for each site.

Seeing the need for additional course materials, I developed the AgTM 405 Advanced Precision Agriculture Class. Teaching the basic AgTM 305 gave me insight to what was needed at the next level. I partnered with a successful farmer from Iowa who had 10 years of yield data. Each year he would send me the previous year’s crop yields for classroom usage. We had access to all 3000 acres of land, chemicals, fertilizer used and line of machinery. Students formed teams and treated this information as their own operation,

developing a full, realistic enterprise budget. Students had the previous years (10+ and growing) crop yield to make predictions for the current year’s crop. They were to sell the crop by April of the following year by playing the futures using the Chicago Board of Trade Market. Each team would present their findings to the board of directors, all selected from outside the university, but knowledgeable in agricultural commodities.

What better way to prepare students for the real world? It is no wonder that WSU AgTM was listed in the top three schools in the nation for teaching precision agriculture. The farmer in Iowa was very willing for us to evaluate his farming operation as he knew no one in class would be in competition with him. I would send the farmer the result from each team and he then evaluated and made decisions based on the results. The highlight of this real-world project was the farmer used the information to renegotiate his leases on farmed property.

In 1999 I teamed with AgCareers.com, an online Human Resource company. Even though I was not Human Resources, they invited me into their inner circle of private employment data. Basically, I was given what the hiring policies were for all the multi-national ag-based companies, plus starting salaries. What a resource to be able to make connections with H.R. personnel and provide contacts for my graduating seniors! I attended the AgCareers summer roundtable conferences to continue to gain insight into what the agricultural industry required for employees. These roundtable conferences were usually held in the mid-west with attendees from all of the major multi-national agriculture companies. Attending these roundtables provided invaluable help to me as I continued to modify and adjust the courses I taught in the AgTM program.

In 2006 the B.S. of AgTM was folded into one degree called B.S. (AFS) Agricultural Food Systems. AgTM became a major under the B.S. AFS. Several other B.S. degrees from Organic Ag, Ag Ed. Ag Economics and Ag Food Security became majors in CAHNRS. There was major restructuring within CAHNRS to create an umbrella degree with a common core of classes. AgTM has since evolved into the Agricultural Technology and Production Management major with the B.S. AFS degree. It was during this time that the Agricultural Technology and

Production Management and Agricultural Education degree program with faculty were moved to the Department of Crop and Soil Sciences.

Current financial resources from CAHNRS are limited. As the Ag Technology and Production Management major continues to grow, so does the need for faculty and facilities to support that growth. Space in the L.J. Smith building is seriously out-dated, with undersized labs. This demand on university resources pushed to the college to develop a building plan focused on the Agricultural Technology and Production Management and Agricultural Education degree programs. The Advisory committee for the program is starting a fund-raising campaign for the building.

Agricultural Technology and Production Management has continued to grow to the point when I retired, I was advising 110 students and teaching all 8 classes required to graduate. Demand for grad-

uates has reached the point where many graduates are signing with companies in the fall of their senior year at least one semester before graduation, and for most graduates, there are at least three employment opportunities available to them. Fully paid internships are the norm.

Jim and Ann Moore, and Joe and Candi Roach, Eastern Washington wheat farmers, felt so strongly about this program that they have donated more than \$500,000 for a building. After being interviewed by another philanthropic donor, she is giving \$1.5 million to the AgTM program, and it should be noted that AgTM has received an ever-increasing number of donations. These are exciting times for AgTM. The next generation of agricultural leaders and managers will come from the WSU Agricultural Technology and Production Management program.



Pilot-scale Microwave Assisted Pasteurization System (MAPS) developed by Dr. Tang's team for control of viral and bacterial pathogens in ready-to-eat chilled or frozen meals. MAPS was an outcome of a USDA AFRI supported project between 2011 and 2016. The technology has been patented and licensed for global commercialization.

Biological Systems Engineering and Agricultural Engineering Facilities

By L. G. James

Agricultural Engineering's first home was Science Hall, with botany, zoology, horticulture, geology, and eight other College of Agriculture programs. The entire College of Agriculture was moved to Wilson Hall, now Wilson-Short Hall, as soon as construction was complete and the new building opened in 1916. Agricultural Engineering would remain there for the next 31 years until the L J Smith Agricultural Engineering Building opened in 1947.

Agricultural Engineering offices and laboratories in Wilson hall were located in the sub-basement and basement area east of lecture room 8. In 1920 when Professor Smith began as chair, the Department had about 550 square feet of office space and nearly 9,500 square feet for a tool room and three laboratories: a building and concrete construction laboratory, a gas engine and farm repair shop laboratory, and a gas tractor laboratory. The department also had a 24-foot by 50-foot storage shed immediately south of Wilson Hall. There was not enough space for a desperately needed farm machinery laboratory, however.

The tractor and gas engines laboratories were moved to the newly constructed Mechanical Engineering Shop in the early 1930's to make room for College of Agriculture expansion in Wilson Hall. The size of the Department's Wilson Hall laboratories was further reduced when the sub-basement and basement were remodeled to accommodate additional expansion of College of Agriculture programs. The remodel also necessitated tearing down the department's storage shed.

More critically needed laboratory space was lost when the size of the tractor and the gas engines laboratories (in the Mechanical Engineering Shop) was halved during World War II. Mechanical Engineering had a contract to produce light metal parts for B-29 bombers and needed the space formerly assigned to Agricultural Engineering for cleaning, testing, and shipping these light metal parts so essential to the war effort.

Inadequate laboratory space was a major impediment to accrediting the BS of Agricultural Engineering and to offering high quality service courses

for agriculture students. The following excerpt from a letter written in 1946 by the State Supervisor of Vocational Agricultural Education Bert Brown to Dr. Joseph Knott, Director of the WSC Institute of Agricultural Sciences, articulates and explains the service course problem and need for more and better facilities.

As you know, practically every one of the vocational agriculture teachers who graduated from the State College has a major in the field of farm shop and agricultural mechanics. The number of graduates in the agricultural education field comprise from 50 to 70 percent of the agricultural graduates in any normal year. It is very essential ... that our teachers ... obtain the type of training in farm mechanics that they need... We feel, under the present conditions, that this training is somewhat lacking, since we have a large number of high school farm shops with more floor space, better facilities and equipment than afforded in the farm shop department of the State College. This is particularly true of work in the care and repair of farm machinery. At the present time work in farm machinery at the State College is a lecture course. You know of the large program of farm machinery repair conducted by vocational agriculture for adult farmers during the war. The impetus given to this program by the war effort has carried over into peacetime and we find groups of farmers demanding the extension and expansion of this program. Our men must be well-qualified in farm mechanics to satisfactorily handle this program...

Furthermore, the acute shortage of agricultural engineering laboratory space occurred as burgeoning agricultural development and farm mechanization was occurring in the Columbia Basin following the completion of Grand Coulee Dam in 1942. Many Institute of Agricultural Science citizen advisory boards were demanding agricultural engineering research in farm machinery and mechanization, irrigation and

drainage, farm structures, and uses of electricity on the farm and in the house (Institute of Agricultural Sciences letter dated April 4, 1947 to WSC President Wilson Compton).

Upon recommendation of the Institute of Agricultural Sciences, WSC included \$40,000 for an Agricultural Engineering Laboratory in its post-war building plan dated August 22, 1945. The proposed building was planned expecting that Agricultural Engineering would retain its offices and laboratories in Wilson Hall. Hence, only three laboratories were included in the proposed building: one for the long awaited and essential farm machinery laboratory, and two laboratories to replace the existing gas engines and tractors laboratories in the Mechanical Engineering Shop. The scope of the project grew during architectural planning. On June 6, 1946, the Governor released \$140,000 for a building large enough for Agricultural Engineering to completely vacate Wilson Hall and the Mechanical Engineering Shop and add the desperately needed farm machinery laboratory. WSC Regents authorized another \$15,000 for the project on April 28, 1947, bringing the total cost of the new Agricultural Engineering building to \$155,000.

WSC Regents approved naming the new building the L J Smith Agricultural Engineering Building on September 16, 1949 to honor Professor Smith for 27 years of tireless leadership and service to Washington Agriculture, WSC, and the Department. A dedication ceremony was held November 18, 1950. Professor Smith recommended Everett Thomas, a 1938 Agricultural Engineering graduate, to be the featured speaker. The text of Mr. Thomas' dedication speech is

in Appendix A.

The Department moved from Wilson Hall into the new building in August 1947. The just completed building had two floors and a basement. There were, as can be seen in Figure 2, ten individual offices, a central departmental office and file room, two classrooms, a seminar room, and a drafting room on the second floor with laboratories for engines and tractors, irrigation, rural electrification, farm machinery, wood working, welding, and metal working on the first floor. Student lockers, pumps and storage tanks for the irrigation laboratory, and storage were in the basement (not shown in Figure 2). The new 15,600 square foot building provided almost 6,000 more square feet than the peak amount of space Agricultural Engineering had in Wilson Hall in 1920.

The Department also had two other buildings. The first, shown in Figure 3, was a 24-foot by 48-foot building originally used for rural electrification research. Located across the driveway and east of the engines and tractors laboratory (room 114), this 1,103 square foot building was constructed in 1948 or 1949. USDA began using it in the 1970s. It was affectionately known as the "White House" and was demolished in 2001.

The other building was a 95-foot-long by 25-foot-wide storage building located along the south side of the main building. This building, shown in Figure 4, was constructed in 1948 or 1949 after the "White House" in Figure 3 (see picture in Appendix B, dated 1948?). The west end of the building was torn down during the 1968 remodel to make room for a new metals shop. The east end was replaced by the



Figure 1. L. J. Smith Agricultural Engineering Building prior to occupancy in 1947. Single-storey portion is the engines and tractors laboratory (room 114).

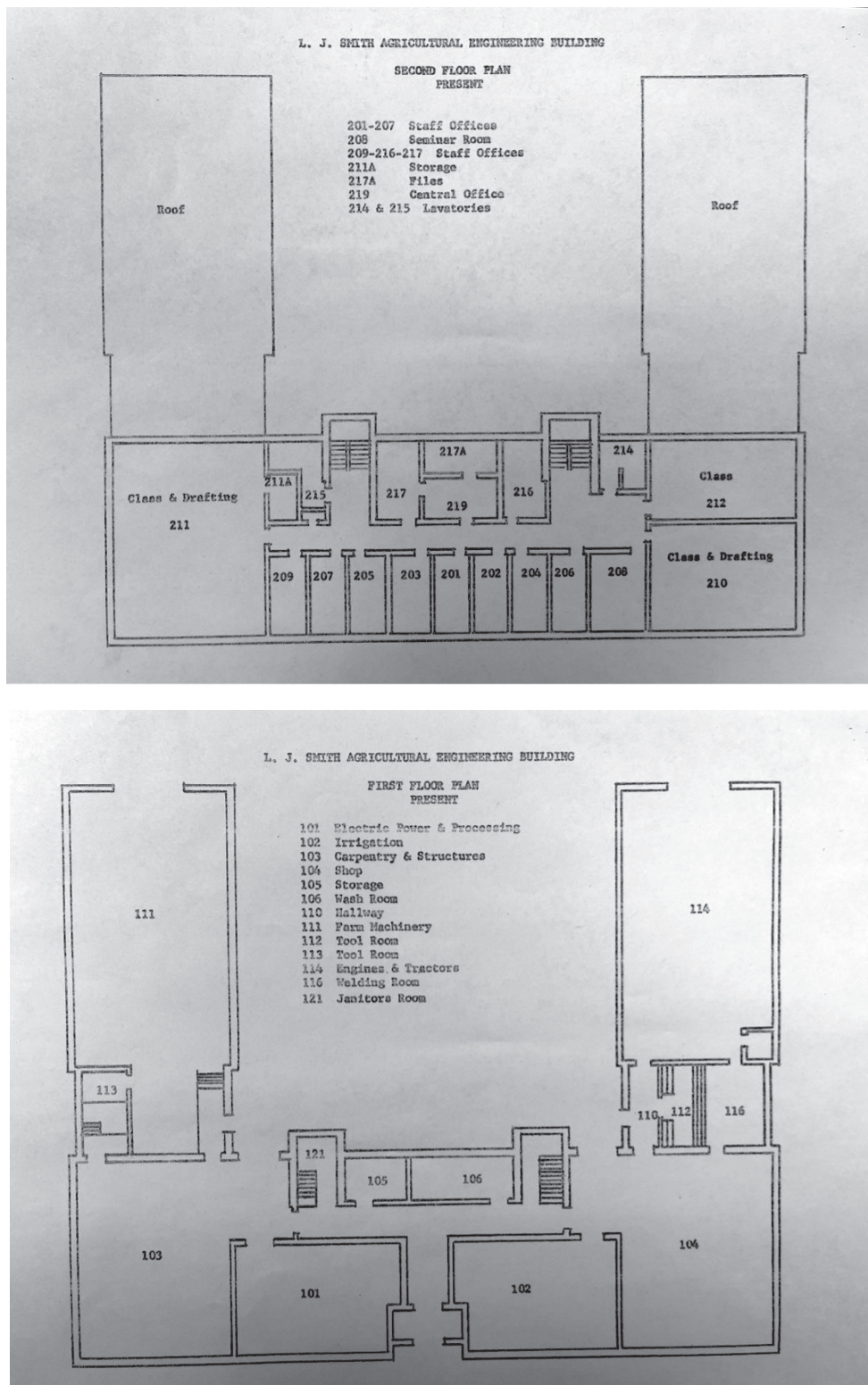


Figure 2. Layout of the first (bottom) and second (top) floors of the L. J. Smith Agricultural Engineering Building 1947-1968



Figure 3. The “White House” in 1954

new wood shop (room 120) in 1981.

The L. J. Smith Agricultural Engineering Building was constructed during a period of steel shortages which necessitated substituting wood for steel and reducing the size of two major laboratories. The single-story wings where the farm machinery and the engines and tractors laboratories were located (rooms 111 and 114, respectively) were made eight feet narrower and twenty feet shorter. This lowered the effective capacity of these laboratories about 50 percent.

Professor Smith expressed his concerns about the size of the proposed building to Dr. Knott (Director of the Institute of Agricultural Sciences) in a letter dated May 2, 1946. He complained that the planned building “provide[d] my department with what I would call the minimum laboratory space to carry out our work in a satisfactory manner...” To support his claim, Professor Smith provided a space survey of agricultural engineering facilities in nine representative institutions that showed the proposed

15,600 square foot WSC building was 41 percent of the average size (38,000 square feet) of the agricultural engineering facilities at the nine institutions surveyed.

State Supervisor of Washington Vocational Agricultural Education Bert Brown echoed Professor Smith’s concerns in his May 23, 1946 letter to Dr. Knott. He told Dr. Knott that after looking over the plans for the new building, “it would appear to me that the State College would do well to consider the future of agricultural engineering and lay plans for a still larger program and building and facilities, in order to still be abreast of the times in the agricultural engineering field in five or ten years.”

These concerns were apparently heard, because plans were developed for a second agricultural engineering building east of the first building. The construction of Spillman Hall in 1947 (the same year as the L.J. Smith building was built) thwarted this plan, however.

Occupation of the new building proved Professor Smith’s concerns to be well founded. Space was especially short in the farm shop and carpentry laboratories due to very high demand for shop courses by the numerous veterans flooding WSC after World War II. The Department’s request to expand these laboratories was number 13 of 66 on the College Architect’s December 28, 1949 prioritized list of buildings and land for Agriculture and Veterinary Medicine. The request was never funded.

The Department’s efforts soon shifted to securing a major expansion and remodel of the L.J. Smith

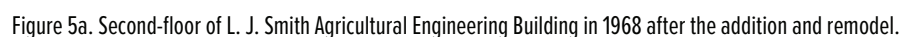


Figure 4. L. J. Smith Agricultural Engineering Building in 1949 with storage building to the right

quality graduate education, and that more office space was needed for additional research faculty, graduate students, research support staff, and moving Extension and USDA-ARS agricultural engineers into the L. J. Smith building. Professor Roberts argued that having teaching, research, Extension, and USDA-ARS agricultural engineers together in one building would facilitate and enhance synergy between and within every departmental program through increased collaboration, and equipment/resources pooling.

The expansion and remodel of the L. J. Smith Agricultural Engineering Building was included in WSC's ten-year building plan developed in 1955. The initial plans proposed covering the courtyard between the machinery and engines laboratories (rooms 111 and 114) to create two new research laboratories. By 1962, this plan had evolved into the 13,800 square foot addition and remodel in Figure 5. Key elements in this plan included covering the courtyard, adding a second story above the courtyard, and building a new south wing for the welding and metal shop areas. Additionally, the plan:

» Provided sufficient office space for the present staff plus two Extension and two USDA-ARS Agricultural Engineers.



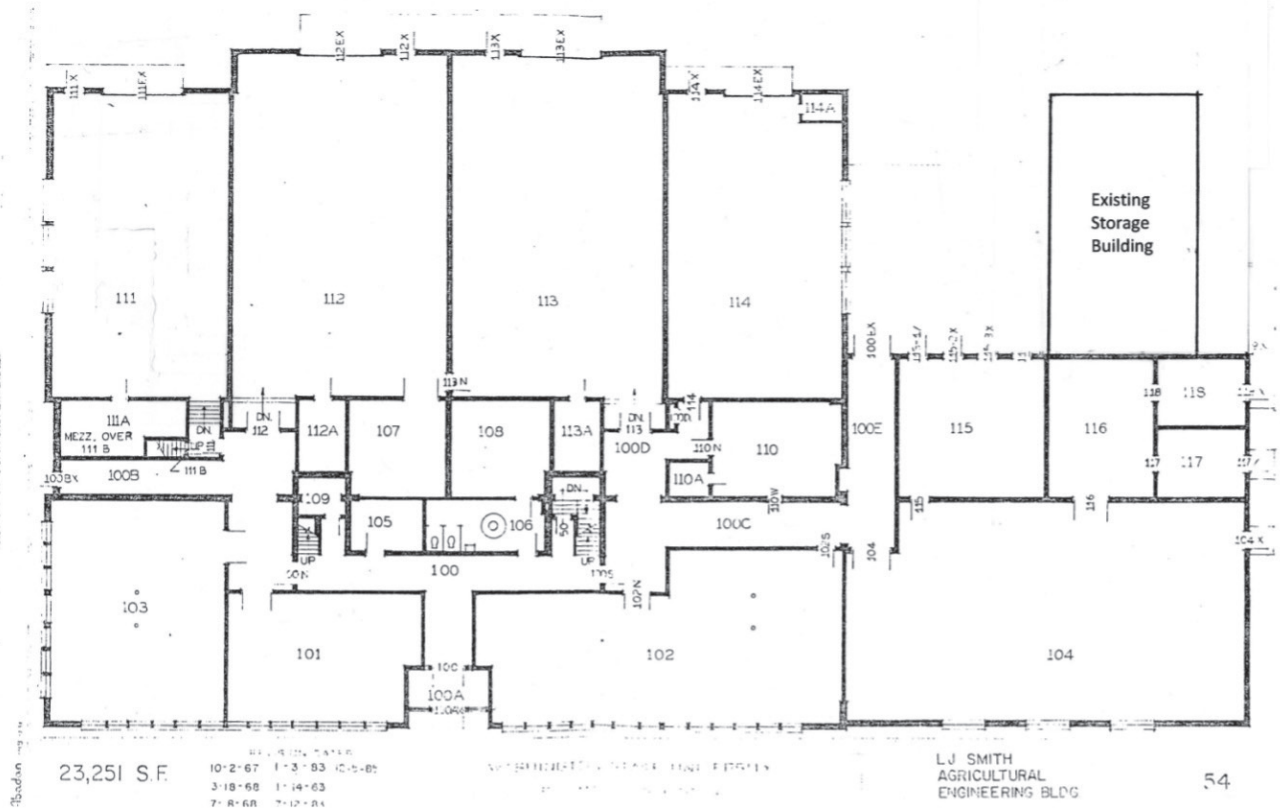


Figure 5b. First floor of L. J. Smith Agricultural Engineering Building in 1968 after the addition and remodel.

- » Doubled the size of the central office.
- » Added two classrooms for the Institution.
- » Added a departmental library/seminar room.
- » Provided adequate teaching space in the metals shop and farm structures areas.
- » Provided space for a teaching laboratory for electric power and processing.
- » More than doubled research space for irrigation and electric power and processing.
- » Provided two large, general purpose research laboratories for faculty and graduate students.

The WSU Regents authorized architectural planning for the expansion and remodel project on September 30, 1966 and entered into the construction contract on June 12, 1967. The project was completed in September 1968 at a total cost of \$535,275.

Three other major changes were made to the L J Smith Agricultural Engineering Building during the Department's Agricultural Engineering Era (prior to 1992).

- » Sept. 25, 1981. WSU Regents authorized \$128,052 to demolish the storage building located south of the engines and tractors laboratory (room 114)

and construct a new carpentry laboratory, offices, and rest room.

- » March 1984. A 639 square foot mezzanine was added in Room 111, bringing the L J Agricultural Engineering Building to 36,429 square feet.
- » 1990. Second-floor class and drafting room (room 211, Figure 5a) converted to administrative office, chair office, and small conference room to provide space for a computer laboratory (in the former location of the administrative and chair offices).

These changes are included in Figure 7a.

More recent changes during the department's Biological Systems Engineering era included:

- » Rooms 111, 112B, and 101 converted to a Biomass Processing Laboratory in 2006.
- » Created Biomass laboratory in room 113 in 2009.
- » Converted rooms 104, 115-118 to Clean Energy Laboratory in 2012.
- » Remodeled room 263 in 2019.

Additional pictures of the L J Smith Building through the years are included in Appendix B.



Figure 6. L. J. Smith Agricultural Engineering Building in 1971 after the 1968 addition and remodel.

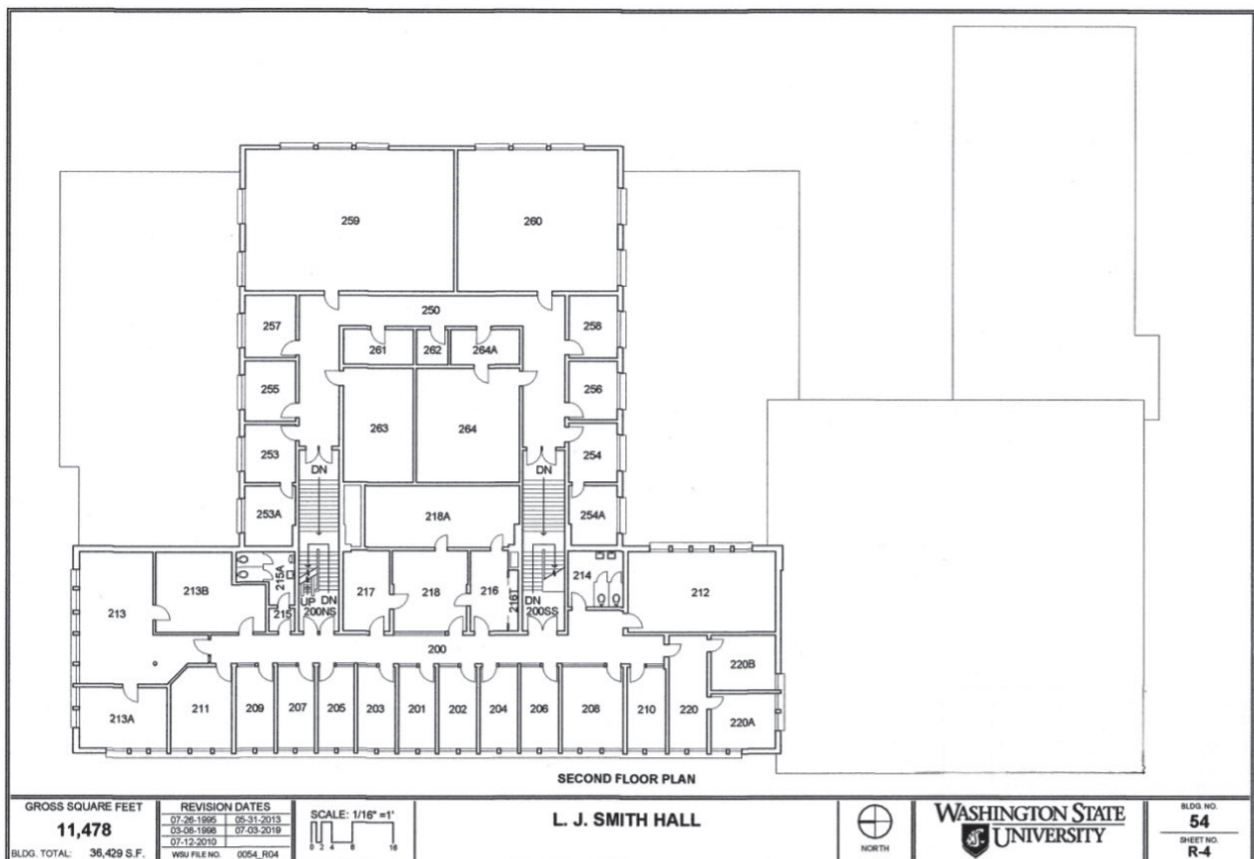


Figure 7a. Second floor L. J. Smith Building in 2013.

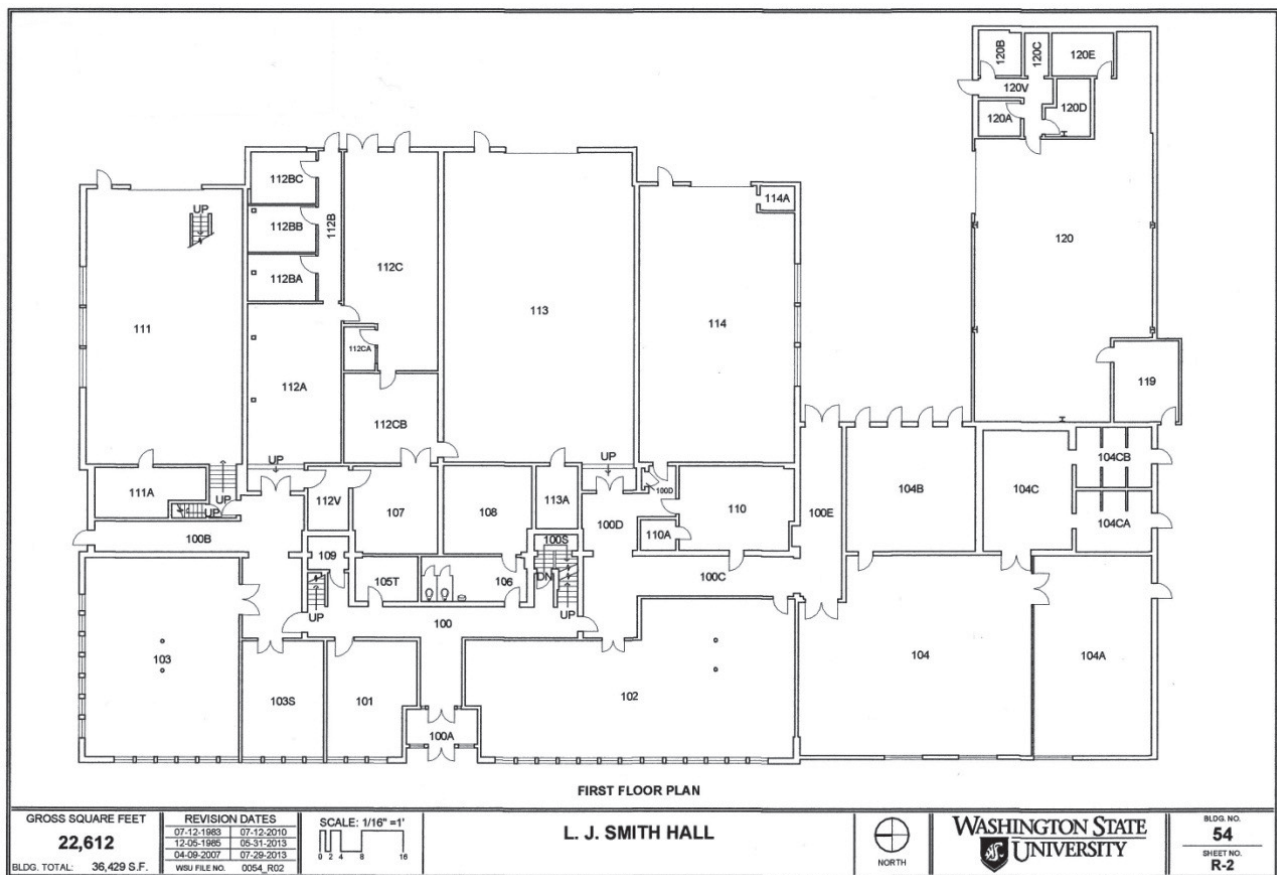


Figure 7b. First floor L. J. Smith Building 2013.

Other Facilities Used by the Department

Outdoor Irrigation Laboratory

In 1954, the Department began a two-year effort to secure an outdoor irrigation laboratory so undergraduate and graduate students could observe and study sprinkler, furrow, and border irrigation systems in operation in Pullman without traveling hundreds of miles to irrigated farms. The laboratory was located on 2-acres of land owned by the US Soil Conservation Service south of Paradise Creek and immediately east of the intersection of the Moscow-Pullman Highway and Terre View Drive. The project required negotiating an agreement with SCS to access and use the land; securing a permit from the State of Washington to construct a dam and to pump water from Paradise Creek; and obtaining \$5,000 from the College of Agriculture to fund the project. It also required the Board of Regents to grant an exception to policy allowing the expenditure of University funds to construct permanent structures (dam, water conveyance and control structures, and a classroom) and install University

owned pumps on property not owned by the University.

Figure 8 is a schematic diagram of the outdoor irrigation laboratory. The dam raises the level of Paradise Creek so that water can be pumped into an underground pipeline that empties into Box 1. Risers from the pipeline supply water to the corrugations for furrow irrigation demonstrations and experiments. Otherwise, the risers are closed and all the water flows into Box 1, and into an open ditch that conveys water through the drop structure to Box 2. Water then flows to Box 3 in an open ditch before returning to Paradise Creek. Water can be withdrawn from the ditch between Boxes 2 and 3 for border irrigation. Weirs in each of the three boxes enable flowrate measurements to determine ditch losses, application rates for the borders, and the amount of water returned to Paradise Creek.

For sprinkler irrigation, water is pumped from Paradise Creek into a portable aluminum pipeline

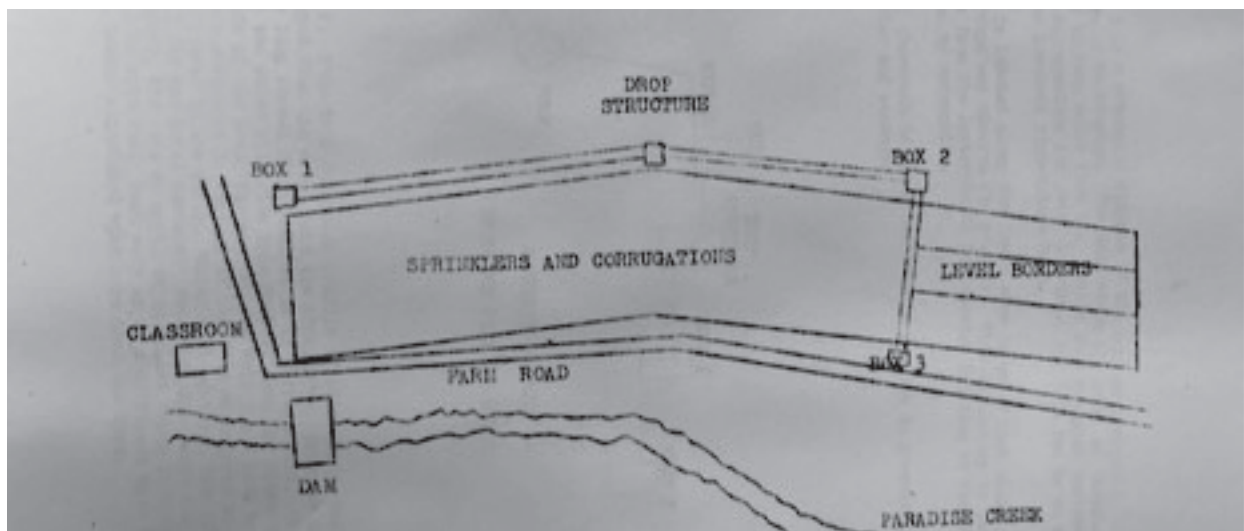


Figure 8. Schematic Diagram of Agricultural Engineering's Outdoor Irrigation Laboratory (from document prepared by Professor Donald Backus in 1956).

laid on the land surface between the dam and Box 1. A lateral line with sprinklers is hooked to the supply pipe to spread water over the field in Figure 8.

The laboratory was used for the first time in the fall of 1956 and remained in use until the late 1980s when US-SCS opted out of the 1955 agreement.

Spillman Hall

The Department utilized about 1,400 square feet of space in Spillman Hall for faculty and graduate student offices from the 1970's until the building was demolished in 2001.



Figure 9. Dam in Paradise Creek shortly after construction. Flash boards placed behind the black angle irons raise the water level. The hole in the concrete wall under the walkway is for the supply pipe to Box 1. (Source: document prepared by Professor Donald Backus in 1956.)

Food Processing Pilot Plant

The Department has utilized this 7,100 square foot facility in the Food Science and Human Nutrition Building in Pullman since 1989 when the building opened. Research on microwave, high pressure and pulsed electric field processing and other novel food processing technologies is conducted in the Pilot Plant.

Irrigated Agriculture Research and Extension Center in Prosser

The Department has utilized research facilities at the Irrigated Agriculture Research and Extension Center (IAREC) in Prosser and for several years, the research farm administered by IAREC located near Othello.

In 1950, a research agricultural/irrigation engineer (Bill Pruitt) joined the IAREC faculty and in 1961, an extension agricultural/irrigation engineering specialist (Mel Hagood) moved to Prosser. The Department had two faculty members, one in research and a second in extension, with offices and staff in Prosser from 1961 until 2003. The Department's presence at IAREC increased in 2000 with the expansion of AgWeatherNet and the addition of the Center for Precision Agricultural Systems, now the Center for Precision and Automated Agricultural Systems. The department currently has four faculty stationed at IAREC.

A new Agricultural Technology Building was opened in 2009 to provide offices and laboratories

for the Center for Precision and Automated Agricultural Systems (CPAAS). An addition to the Ag Tech Building was completed in 2015.

Bioproducts, Science, and Engineering Laboratory at WSU Tri-Cities

Three Biological Systems Engineering faculty (Drs. Ahring, Lei, and Yang) currently have offices and conduct research and graduate education in the \$24 million, 57,000 square foot Bioproducts, Science,

and Engineering Laboratory (BSEL) building on the WSU Tri-Cities campus in Richland. They work with graduate students to develop engineering processes for producing useful, high-value products from the bioproducts of agricultural operations and other sources of plant biomass.

The Chancellor of WSU Tri-Cities, Dr. Larry James, played a major role in conceiving, planning, and securing funding from the Washington Legislature for the BSEL building and initial programming.



BSE's Dr. Shulin Chen with graduate students and research technician at an anaerobic digester facility he helped develop.

Photo courtesy WSU Photo Services.

Interactions with College of Engineering

By D. C. Davis

Over its history, the Biological Systems Engineering Department has had a close relationship with the College of Agriculture (CAHE, then CAHNRS) but less consistent relationships with the College of Engineering (later the College of Engineering and Architecture). The Department has reported to and received funding through the College of Agriculture, so the Department head or chair has had a seat in administrative and planning meetings in Agriculture. Since the comparable seat in Engineering does not affect budgetary decisions for the Department, the chair's participation has varied depending upon the priorities of the Dean and relevance of discussions.

Perhaps the highest visibility of the Department in the College of Engineering occurred between 1970 and 1982, while Carl W. Hall served as Dean of the College. Dr. Hall was a national leader in agricultural engineering, conducting research and publishing widely regarding biological aspects of food engineering. While at WSU, he invited Denny Davis to co-author revisions of textbooks on processing and storage of agricultural materials. Dr. Hall was elected to the National Academy of Engineering in 1989 for fundamental research in agricultural product processing and food engineering.

The Department's engineering degree coursework has always had ties to the Engineering College. The Department's engineering degree programs and courses have been coordinated with the College of Engineering so the Department's courses are approved as engineering equivalents. Therefore, students in the Department have been eligible to enroll in other engineering courses, and other engineering students are allowed by their programs to enroll in Department courses as electives.

Because WSU's undergraduate engineering degrees receive accreditation by the Accreditation Board for Engineering and Technology (later named ABET), the Department has worked closely with the College of Engineering to maintain accreditation for the B.S. Agricultural Engineering degree and the B.S. Biological Systems Engineering degree. The Department prepares accreditation self-studies in cooperation with the College of Engineering, communicates with

accreditation visitors through the Engineering College, and participates with other engineering departments when visited by program reviewers.

With the introduction of outcomes-based accreditation just prior to year 2000 (ABET 2000), the Department played a major role in helping the College of Engineering and Architecture to be successful in their first accreditation reviews under the new criteria. Dr. Denny Davis, who was serving as Associate Dean for Engineering Undergraduate Programs during this period, helped engineering departments define program learning outcomes, establish procedures for conducting learning outcomes assessment, and prepare data giving evidence that graduates met program learning outcomes. His leadership was built upon engineering design learning and assessment grant work he had been doing with National Science Foundation funding in years leading up to the establishment of the ABET criteria changes. The Department's first ABET visit under the new criteria in fall 2001 resulted in continued accreditation of the B.S. Biological Systems Engineering degree, also receiving visitor commendation for our program's assessment.

Engineering graduate degrees awarded to students in the Department have had close ties to the Engineering College. For many years the Department did not have its own engineering graduate degrees, so graduate students received Master of Engineering degrees and Ph.D. in Engineering Science degrees. For years, the Department's graduate students in the Ph.D. Engineering Science degree program were the largest percentage of students in the program. After the Department received its own graduate degrees, the number of students receiving the former degrees dropped, but many graduate student committees continued to have graduate faculty from other departments.

Collaborations between the Department and the College of Engineering and Architecture were active during periods in which Dr. Davis remained in the Associate Dean position. He involved Department faculty in recruitment and outreach activities to facilitate student recruitment to the program. When the Boeing Scholars Program was started in 2001,

Dr. Davis brought multidisciplinary projects into the Department's senior design sequence. For example, two years in a row, design teams of students from our Department worked with Business and Engineering students to design transport systems for animals as air cargo. From that point forward, senior design projects brought practical business perspectives into the design of biological systems engineering solutions.

Department faculty also participated in numerous activities designed to improve teaching and learning of engineering concepts. Dr. Davis co-led the Engineering Education Research Center (EERC) from 2005 through 2010. National leaders in engineering education were invited to speak and conduct workshops on teaching, learning, and assessment. Faculty in the Department participated in these events and developed improved educational practices.

The Department also played leadership roles in engineering research. Some developed or led research centers associated with the Engineering College. Dr. Claudio Stockle led the State of Washington Water Research Center. This center led researchers from around the state to conduct applied water-related

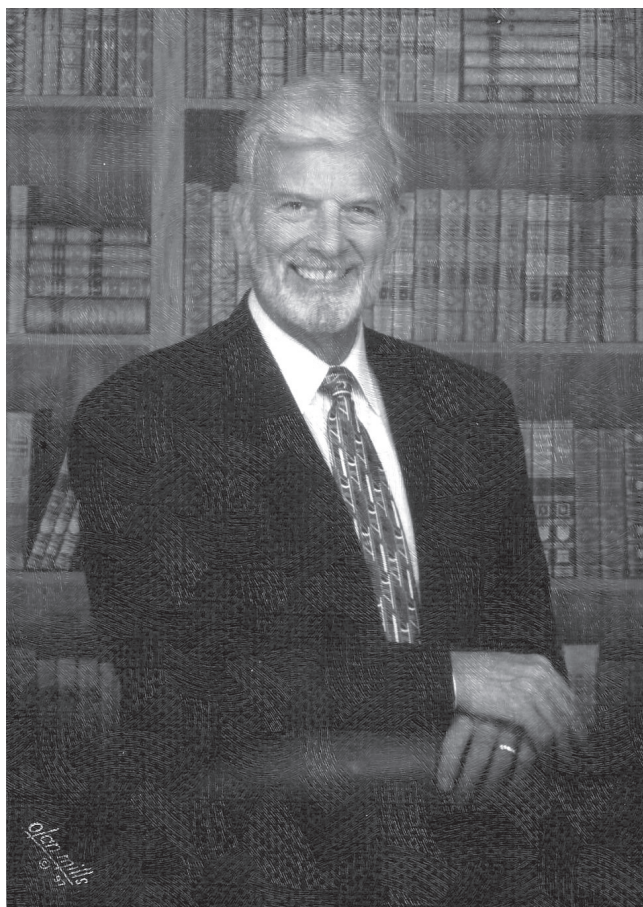
research within the context of economic, social, and cultural well-being. Dr. Davis led the Engineering Education Research Center to aid faculty in development of research projects and obtaining external funding that enhances engineering education. EERC had over 25 engineering faculty participants in 2005, including four from the Department.

The Department also played a pivotal role in bringing together resources from colleges of Agriculture, Engineering, and Veterinary Medicine for the development of the Bioengineering Program at WSU. Three faculty members assigned to support this program were initially part of the Department's faculty. The Bioengineering Program was initiated in 2001 with Dr. Davis as its interim director, at which time he stepped down from the Department chair position. Through his effort, WSU obtained legislative funding in 2005 to help fund faculty and staff positions and laboratory facilities for the Bioengineering Program. In 2005, the Bioengineering program was transferred to the College of Engineering and Architecture and was housed within the School of Chemical Engineering and Bioengineering in 2004.



A Gallery of Alumni Profiles

Alan Pettibone '54



When Alan Pettibone '54 got to Washington State College, he had a purpose: to get back to the farm in Steptoe, just a few miles from Pullman.

"I grew up on a wheat farm in Eastern Washington and Washington agriculture is really a part of my history," he says. "My parents wanted me to go to college," so off to Pullman he went, majoring in agricultural mechanization.

Almost immediately upon graduation, Pettibone entered the Army Corps of Engineers as an officer. "When I got discharged," Pettibone says, he came home to Steptoe. On a visit to Pullman, he stopped by the ag engineering department "just to visit with some of the professors that I had known. And Professor Max Jensen said, 'I'll offer you a job as an experimental assistant and you can come here and get your ag engineering degree.'"

To say the rest is history would be an understatement.

Pettibone got his engineering degree while working as an irrigation research technician. He then took a position with USDA in Pullman. A few years later, he filled in for a professor on leave and taught in the Department. "I taught a couple of courses and I loved it. I really liked teaching and working with students. And in 1965, the Department had a faculty opening. They offered me the job and I took it."

By the late 1960s, Pettibone decided he needed to earn a Ph.D. to advance his career. With a National Science Foundation fellowship, Pettibone and his family moved to New York, where he earned his doctorate at Cornell University. After graduation, Pettibone says, "I had a good job offer from Cornell, but I wanted to come back to WSU. When I did, it was obvious to me that the department was behind the curve in terms of research and graduate programs. They had a good, solid faculty but the faculty were overloaded with teaching and not producing the research the university expected."

When the position of chair became open in 1975, Pettibone applied, thinking he might have some insight on how to advance the Department's position. He says that "the only way to move the Department forward was to hire new faculty, young faculty with some research and teaching experience at other universities. I took a proposal to the College administration and they bought it. I accepted the chairmanship and went to work immediately to create more of a research culture. We kept the solid teaching, but emphasized the need for more research."

A few years later, the position of associate dean and director of resident instruction came open in the College of Agriculture and Home Economics. "I wanted to see if I could make some changes in the way teaching was rewarded at the university level, particularly within the College," Pettibone says.

During the Winter break at the end of 1984, Pettibone and his wife were visiting their daughter, at the time an accountant at a casino in Reno. Pettibone was playing blackjack when he heard his name broadcast over the casino's loudspeaker

system. There was a phone call for him.

“It was the transition team for newly elected Governor Booth Gardner saying that ‘the Governor wants to meet with you about the position of director of the Washington State Department of Agriculture. He’d like to meet you on New Year’s day.’ And I said ‘Whoa, what? I don’t know anything about this.’ And I said ‘besides that, I watch football on New Year’s Day! Well,’ I told them, ‘give me a few days, I have to think about this.’ When we came home I talked to the College administration and they said ‘It’d be interesting to have a contact with the new governor.’

“I knew the state ag industry really well,” Pettibone continues. “And I knew the processing industry, and the leaders of most of the commodity associations really well. I’d done research for some of the commodity commissions. I went over and talked to the Governor on New Year’s Day, and I liked him. Booth Gardner was a great guy, open about what he needed and willing to consider some changes in the Department. I told him I really wasn’t interested in coming over just to manage a regulatory program, although it was a good sized one, 500 employees. There were employees located all over the state, eight divisions. It was a big and challenging job. I said, ‘If I can have some impact on how the government views agricultural policy with regard to the environment and with regard to marketing agricultural commodities and

processed food products, I’d be interested.”

Pettibone was able to build a “really solid international marketing program, recognized as one of the best state marketing programs in the country. It made a lot of money for the industry and the State. It was a big challenge and a lot of fun.” As director, Pettibone oversaw the opening of trade offices in Japan and Taiwan, and travelled the world seeking opportunities to sell Washington agricultural products. He hosted an International Food Show in Seattle that was attended by exhibitors and buyers from all over the world.

In 1993, Pettibone came back to WSU. This time, though, he served as director of the Research and Extension Center in Puyallup. He retired in 1996.

As for engineering, Pettibone says that he thinks “an engineering degree is probably the best degree anyone can have no matter what you’re going to do. Engineers are problem solvers. Here’s a problem, how do you solve it? What do we know about it? What else do we need to know? Whether it’s how to store potatoes for 12 months or how to build a bridge or whatever it is, it’s the same process. And I used the same process of analyzing problems when I was department chair, when I was associate dean, when I was State Director of Agriculture. I think my engineering degree served me very well and I hope it did the same for all the graduates of the Agricultural Engineering Department.”

Norman Scott '58

Norm Scott grew up on a farm in Mead, Washington, a small town northeast of Spokane. “We grew everything,” Scott says. “My father had the perspective that everything couldn’t go to bad at once. So, we grew, during the time I was on the farm, alfalfa, oats, wheat, barley, cabbage, and potatoes. We had a fair number of swine, we had a couple hundred chickens or so, and about a dozen cows and several beef animals.”

In high school, Scott says he was active in FFA and engaged with “science, chemistry, physics, and all of that sort of stuff in addition to agriculture.” Through FFA, Scott got interested in public speaking and parliamentary procedure, at a state FFA meeting at Washington State College, he met June Roberts, then

the chair of the agricultural engineering department.

“I think it was the spring of 1953,” Scott recalls, “and Roberts talked about agricultural engineering, which got my attention because as I was on the path for chemical engineering.” Scott had already applied to several universities, including Stanford, where he was accepted. But WSC was 90 miles from the farm, so it made economic sense to matriculate as a Cougar.

“And that’s how I got into agricultural engineering,” he says. “And in those days, agricultural engineering was what really might be well called general engineering, because we took something from almost everywhere on campus, which other engineers didn’t and still don’t, for that matter. We took courses in the College of Engineering: statics, dynamics, structures,



Back, L-R: Steven Gross; Sarah, Joey, and Joseph Urbanski; Mai-Lin, Kevin, and Liena Gross; David and Nanette Talaski; Robin Gross; Shirlene Scott; Daria Talaski and Raj Waghela; Catherine Betulan and Andrew Talask. Seated: Norman and Sharon Scott. Photo courtesy National Academy of Engineers.

electrical circuits, metallurgy, and thermodynamics. In the department we had courses in structures, machinery, electrical systems, irrigation, and mechanic arts, including welding, too.”

It wasn’t easy, and Scott was one of only a handful of ag engineering students to finish in four years. “It usually took an extra semester,” he says, and then adds, “I was shocked when I was named one of the Top Ten Seniors of my graduating class,” in 1958.

His next stop after graduation was graduate school at Cornell University. His parents, who had never been back East, drove with him across country in a ’47 Plymouth. They dropped him off at Cornell before going on to visit relatives in Pennsylvania.

After completing his Ph.D. dissertation in 1962, Scott figured he might do all sorts of different things as he weighed various options from industry and universities, but late one night while driving home he had what he describes as a sort of “road to Damascus” epiphany. “It was like a light hit me and said, ‘Based on your interest and everything, you should stay at Cornell.’” Which is precisely what he did: “except for sabbaticals and lots of travel,” Scott taught and conducted research at Cornell until his retirement in 2011.

In his time at Cornell, Scott also served

as department chair (1979-84), and director of the Cornell University Agricultural Experiment Station for five years starting in 1984. He served an additional nine years as Vice President for Research and Advanced Studies. In 1998, he rejoined the ag engineering faculty until official retirement. In the 1960s, he had started thinking about the basis of the discipline. If “chemistry is the basis for chemical engineering, and machinery for mechanical engineering, and structures for civil engineering, what was the defining discipline of agricultural engineering? And my answer to that was biology.”

That insight led Scott to become more involved with sustainability. He says he’d been introduced to the concept by Sam Johnson, then chairman of SC Johnson & Sons in Racine, Wisc. A Cornell trustee, Johnson had handed out copies of *Changing Course* by Stephan Schmidheiny, chair of the Business Council for Sustainable Development. Published by MIT Press, the book argues that by retooling business and manufacturing practices to be more sustainable, not only does the environment win but so, too, does the company’s bottom line.

“I read it and it made so much sense to me as an engineer that we needed to think more about what

we were doing in terms of using resources, recycling resources, and what's now called circularity. So, I shifted my focus to sustainability and started a course in 1999 that was strictly online. This preceded MOOC courses, the massive online open courses, but that's what it was."

Later, Scott continues, "research shifted also to renewable energy." At Cornell, in the heart of one of the world's major dairy regions, research focused on "management of animal waste, particularly through anaerobic digestion and conversion of manure and food waste into biogas. Another thing was looking at sustainable communities. How can you put together communities that would be more sustainable? There are great examples in Europe of bioenergy villages, that bring a kind of circular concept to living. So, essentially, live, work, play—putting these three together rather than isolating them."

One of Scott's Ph.D. students, Scott Cloutier, now at Arizona State University, has continued his research studying the eight sustainability factors: urban design, renewable energy, business and economic development, green buildings, food production, waste management, transportation and water management. "Thus, if you look at these eight areas and integrate them, you could put life together in a more sustainable fashion using fewer resources."

Scott's career has spanned decades of change: "my time on the farm goes all the way from working with a pitchfork and loose hay and shocking alfalfa, now to the period where I'm talking about synthetic foods, Beyond Burgers, Impossible Burgers, cell-cultured foods, 3D printed foods and digital agriculture involving artificial intelligence, biosensors, drones, and robots.

Honors

Elected to National Academy of Engineering, 1990
Magnolia Silver Medal, Shanghai People's Government, Sept. 2019
Chair (2009-2015), Board on Agriculture and Natural Resources (BANR) of the National Resource Council (NRC), National Academy of Sciences (board member 2006-2015)
President, Institute of Biological Engineering (IBE), 2001
President, ASABE: American Society for Agricultural and Biological Engineering, 1993-1994
Received the McCormick-Case Gold Medal (ASABE), 2002
Received the Henry Giese Award (ASABE), 1989
Elected Fellow of ASABE, 1986
Elected as a Founding Fellow of American Institute for Medical and Biological Engineering (AIMBE), 1992
Elected Fellow of American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), 1996
Received four paper awards from ASABE in recognition of outstanding research publications in ASABE Transactions
Alumni Achievement Award, Washington State Alumni Association, 1991
J.P. and Mary Barger Excellence in Teaching Award, Cornell College of Engineering, 2003
Chancellor's Award for Excellence in Faculty Service, State University of New York, 2007
Kenneth A Goldman Excellence in Teaching Award, Cornell College of Engineering, 2008
Outstanding Faculty Award, College of Agriculture & Life Sciences, CALS Alumni Association, 2011
Author or co-author of over 100 refereed publications. Holder/co-holder of three patents

Denny C. Davis '67

by Denny C. Davis

Denny C. Davis has had a long history in the Department—from student to Department Chair. After graduating from Wapato High School in 1963, he enrolled at Washington State University that fall. He graduated with B.S. Agricultural Engineering with distinction in 1967, recipient of top GPA awards in College of Agriculture and Home Economics and College of Engineering during his time at WSU. The summer following graduation, Davis worked for Mr. Pettibone on controlled atmosphere research for plant growth and crop storage.

Davis began graduate study in Agricultural Engineering at Cornell University in fall 1967 on a National Defense Education Act fellowship. He completed his M.S. in Agricultural Engineering, conducting research on dynamics of falling apples striking tree limb B.S. during machine harvest, under the direction of Dr. Gerry Rehkugler. During this period, he faced demoralizing personal issues and looming military draft for the Viet Nam war, which prepared him for major life change. A fellow graduate student in the Department led him into a personal relationship with God through Jesus Christ. This new-found relationship set him on a path to a meaningful life helping others learn, develop professionally, and find purpose in life.

Davis began work on a doctoral program in fall 1969, conducting research on simulation of tractor overturns for improved design of rollover protection, under direction of Dr. Rehkugler. He gained teaching experience and mentoring from Dr. Ron Furry, Dr. Norman Scott, and Dr. Dave Ludington – sparking a passion for teaching. He married Irma Friesen on March 18, 1972, in Ithaca, NY, launching a wonderful marriage lasting over a half century. Davis received Ph.D. in Agricultural Engineering from Cornell University in fall 1973.

In June 1973, Davis began his first faculty position with the University of Georgia, located at Georgia (Experiment) Station, where he conducted research and extension in countryside engineering. In June 1976, he was hired by Al Pettibone (Chair of Agricultural Engineering) at WSU for teaching and research in postharvest engineering. This fit his desire to teach as a faculty member. Although his background

was power and machinery, Davis was mentored by Dr. Pettibone and Dr. Carl Hall (Engineering Dean and noted postharvest agricultural engineer) to gain Dept.h in the postharvest area.

Over the next 10 years, Davis developed research projects for energy use in food processing, solar energy for juice pasteurization, ventilation of sugar beet storage piles, measurement of food texture and quality, harvesting cranberries, and human-powered bean threshing. He obtained grant funding from USDA and Washington commodity commissions. He received an outstanding paper award from the American Society of Agricultural Engineers (ASAE) in 1980 and was cited in American Men and Women in Science in 1979 and Who's Who in Technology in 1980. Dr. Davis received approximately \$100,000 of research funding for technical projects he led and \$600,000 where he was co-investigator.

Davis sought out improved teaching methods and worked diligently to improve his teaching. He was named outstanding teacher in the Department numerous times, and in both colleges of Agriculture and Engineering in 1981. In 1982, he received the AW Farrall Young Educator Award given by ASAE. He spent a sabbatical year 1982-83 at Cornell University, working with Dr. J Robert Cooke, developing software for teaching the finite element method using microcomputers. Their published teaching software received a national award for Best Engineering Educational Software in 1989. Dr. Davis went on to receive WSU's prestigious Sahlin Faculty Excellence Award for Teaching in 1999.

In January 1986, Dr. Davis was appointed (3/4-time) Associate Dean for Undergraduate Programs in the College of Engineering and Architecture (CEA), while continuing (1/4-time) teaching and research in the Department. He led student recruitment, serving underrepresented students, scholarships, and teaching improvement across the college. He began writing multi-investigator, multi-institution grant proposals submitted to the National Science Foundation (NSF) for improving engineering education. He led funded grants focused on engineering design teaching, learning, and assessment. This was a major shift in Davis' research, from technical agricultural engineering research to engineering education research.

Through his interaction with the CEA Advisory Board, Davis learned about employer dissatisfac-

tion with the preparation of engineering graduates. During the 1990s, the Boeing Company and other companies were challenging engineering educators to prepare graduates with a fuller set of professional skills (teamwork, design, ethics, business, etc.) in addition to technical knowledge. Davis took a sabbatical leave year at The Boeing Company in 1995-96 to better understand industry's needs for engineering education. Industry influenced revision of ABET accreditation criteria, producing EC 2000 which required educational programs to define student learning outcomes, assess student learning, and continuously improve the program. To help departments prepare for EC 2000, Dr. Davis taught workshops on outcomes-based engineering education at ASEE conferences and elsewhere from 1996 to 1999. Dr. Davis also served as an ABET evaluator for Agricultural and Biological Engineering degree programs in 1998 and 1999. Dr. Davis was elected to the rank of Fellow of the American Society for Engineering Education in 2002.

This was the period when agricultural engineering programs were exploring an expanded role of biological sciences in their curricula. Dr. Davis served on the Biological Engineering Task Force in the American Society for Engineering Education (ASEE), providing leadership nationwide for developing Biological Engineering Curriculum. He was a charter member of the Institute of Biological Engineering (IBE), formed for multidisciplinary support of Biological Engineering; he hosted their 2000 national conference. Dr. Davis was on the steering committee for a USDA-HEP grant at the University of California-Davis developing curriculum for Biological Engineering, including an Engineering Properties of Biological Materials course and a Biology for Engineers course. He was an active contributor in discussions of biological content in the engineering undergraduate program in the Department.

Dr. Davis helped to develop WSU's engineering education research achievements to national recognition. His scholarly work in engineering education began in 1989 with NSF grants addressing broader engineering curricula that were transferable among community colleges and universities. His research expanded to include other engineering and mathematics topics, K-12 engineering curriculum, international student projects, entrepreneurial projects, and capstone engineering design teaching and assess-

ment. Dr. Davis and Dr. Gerald Maring of the College of Education formed and directed the Engineering Education Research Center in 2005 to facilitate multidisciplinary engineering education research at WSU, leading to over \$4 million in grant funding for WSU collaborators in five years. In 2015, after his retirement, Dr. Davis was co-principal investigator on an NSF grant at The Ohio State University on assessments for industry-desired capabilities. Dr. Davis has been principal investigator for approximately \$5.5 million in funding and co-principal investigator for approximately \$2 million in funding for engineering education-related programs and research.

Dr. Davis helped advance teaching excellence across WSU. As a founding member of the President's Teaching Academy in 2004, he hosted talks and workshops by educational experts and led development of teaching assessment tools. He also helped guide teaching reviews of tenure-track faculty. In 2011, Dr. Davis's contributions to WSU were recognized by the Sahlin Faculty Excellence Award for Leadership.

Dr. Davis served as chair of the Biological Systems Engineering Department from April 2000 through Sept. 2001. During this time, he established the Center for Precision Agricultural Systems at the Irrigated Agriculture Research and Extension Center (IAREC) and hired its first director, Dr. Francis Pierce. He also led strategic planning for the department during a period of tightened budgets and a need for greater focus on excellence. He hired two faculty members (Drs Lin and Vasavada) for the department's human and animal engineering area, supported by three colleges. When the university decided to spin off a separate Bioengineering program, Dr. Davis was asked to serve as its interim director. At that time he resigned from his chair position to focus on Bioengineering and his Engineering Education research.

As Interim Director of Bioengineering, Dr. Davis led development of curriculum for a B.S. Bioengineering degree and in 2001 obtained Faculty Senate and Higher Education Coordinating Board approvals for the degree. He sought and obtained Washington State high-demand enrollment funding in 2004 to support the Bioengineering (BE) program. Dr. Davis finished his interim Director appointment in July 2004, when the program was incorporated into the Department of Chemical Engineering and Bioengineering. The program produced its first three B.S. Bioengineering

graduates in spring 2004, growing to twelve in 2006. Dr. Davis led program assessment and helped obtain ABET accreditation for the B.S. Bioengineering degree in 2008.

Dr. Davis retired in 2012 and moved to Illinois to be near his growing family. Forming Verity Design Learning, he began self-publishing teaching materials based on his engineering education research. He soon became involved as a coach for a middle school homeschool FIRST® Lego® League team, taking them to the world championship tournament and receiving a national Mentor of the Year award in 2013. As his grandkids grew, he coached their high school

FIRST® Tech Challenge (FTC) team, taking them to several world championship tournaments. He began converting his knowledge into books for FTC teams, self-publishing through Kindle-Amazon: Pre-Engineering Primer, Designing Competitive FTC Robots, and others on design and professional skills to come. He also published a book, Hope Beyond High-Risk Multiple Myeloma, to help others benefit from his amazing cancer journey. Dr. Davis's passion for engineering education and walk with God have indeed yielded a life of satisfaction and many contributions to future generations of engineers.

Bruce Nelson '79



Bruce Nelson may never have been a farmer but he loved agriculture. As a young man, he says, “I had a terrifically formative experience on my relative’s farm. My mother was a farm girl, and I worked for her brother in Nebraska on the farm. I worked for my uncles kind of in and around Marysville, which is where I grew up, over on the West Side. And just really fell in love with the lifestyle, the farm, all of that.”

When Nelson came to college at Washington State University in the 1970s, he entered the general agriculture track. “I’ve forgotten how,” he explains, “but I somehow gravitated to the ag engineering department.” He was at first interested in the non-math agricultural mechanization major but, his father

being an engineer (and a Washington State College graduate), “I quickly got it through my head that I’ve got as good a mind as the rest of these guys. And engineering’s always been a great living for my dad. And so I dropped right into ag engineering. And just loved it. Loved the department, loved the professors. It was just this tremendously good fit for me given life doesn’t go in straight lines.”

Nelson was interested in machine design, one of the three tracks in ag engineering at the time. “That was my big interest in school, and what I thought I’d really like to do is go to work for John Deere or Caterpillar or something like that designing machinery. And so there was a lot to do with soil dynamics, and then all the traditional machine design stuff.”

Focusing on machine design, Nelson took plenty of electives through the mechanical engineering department. After graduating in 1979, he interviewed with Caterpillar and landed a job. “I had lived and worked for my uncle in Nebraska, but never in the Midwest proper, like Illinois. My wife and I spent a year there. But having grown up in the west, and born and raised on the salt water, the coast, and then loving eastern Washington, too, just loving everything about our state—we fled the Midwest after a year!”

His boss may not have been too happy about it but, as Nelson reiterates, life is a non-linear path. He and his wife landed in Colville, in northeast Washington, where he went to work for Colmac Coil Manufacturing, which makes heat exchangers for commercial

refrigeration and freezer applications. To thrive in the family-owned company, Nelson says he “had to shift gears. I went from machine design to heat and mass transfer, thermodynamics, refrigeration. The last 40 years have for me been about getting to support the agricultural industry by making stuff really cold.”

One of Nelson’s classmates in the ag engineering program had been Lon Inaba, who went back to his family’s farm in the Yakima Valley after graduation. Lifelong friends, Nelson says, “My interaction with Lon was, well, you’re very good at growing, producing, doing all this stuff, so let me help you keep it cold and get it to the market. So that was what we got to do.”

Thinking back, Nelson says, “When I walked in the door that first day at Colmac, I think there were 12 people on the shop floor, and another six of us in the office.” Some of Nelson’s first sales calls were in Seattle, “to freeze salmon with blast-freezing equipment. And then it was cooling apples, and then cooling stuff for Lon and all the growers in the Yakima Valley. And that expanded to California. I remember we did a million dollars’ worth of business that first year. When I retired in July, we’re at about 300 employees doing fifty to sixty million a year.”

Colmac also has a global reach, Nelson says, which took him all over the world. “We had some big contracts in Dubai and Saudi Arabia. I spent a lot of time in Cairo. I also travelled to the Far East, Australia, India, Africa. We had big markets in Mexico and South America, the

Andean countries. We did a lot of business in Canada, too, as well as the U.K. and Europe.”

Starting as an engineer for Colmac, he soon was promoted to design engineer, then chief engineer and vice president. In 1997, he was named president of the company.

After retiring in 2021, Nelson started a consulting company. “That’s allowing me to do product development work. That’s the thing that gets me going and excited and passionate, the wonky heat and mass transfer stuff.”

Nelson says that WSU’s ag engineering program was like a “general engineering” degree, in that you learned enough about all the various aspects of engineering to be able to solve problems for clients.

“It really was a great fit for me,” Nelson says. “And then to get to have a career at a smaller company like this, where, if there’s an order out there and we can build it and make money, let’s go get it. I remember coming into my boss’ office after a trade show. I’d only been at the company about three or four years. And some Japanese clients had come into the booth at the trade show and said, ‘Can you build this for us?’ And I said, ‘Yes, of course.’ Not knowing if we could or not!”

But build the needed equipment they did. Colmac sold the Japanese company “several hundred big heat exchangers for their very special refrigeration system to freeze tuna. Very low temperatures are needed for freezing ahi tuna. So, next time you get your ahi sushi with the wasabi and the soy sauce, you can think of me because we helped freeze all that stuff.”



Sylvester Andales, Ph.D., conducting potato storage research c. 1977

Lon Inaba '79

At first, Lon Inaba '79 intended to major in biology and become a research scientist. But soon after starting college, one of his uncles asked him, "How long do you intend to be in school?" A Bachelor's degree in biology wasn't going to take him very far, his uncle explained: Inaba would need to go on for a Ph.D. That, the young Lon thought, was a bridge too far.

Looking around at other majors available in the late 1970s at Washington State University, Inaba discovered agricultural engineering. The program was a perfect match: as a third-generation Japanese-American who had grown up on a family farm established in 1907 in the Yakima Valley, Lon had discovered his calling. Inaba plowed into the program.

Looking back, Inaba says that "my time at WSU was probably the best years of my life. I think what the ag engineering program did for me was it helped me to be willing to kind of step out of my comfort zone and be a little creative."

After graduating, and well prepared as an engineer with a wide range of skills, Inaba took a job with Battelle, the non-profit agency that administers the Hanford Nuclear Reservation and other federal research facilities. He wasn't there long before his father asked

him to return to the farm to design and build packing and cooling facilities. Although he only intended to take a six-month leave of absence, Inaba never did return to Hanford, in part, he says, because that same year "Our greenhouses burned down so I stayed to design and rebuild the greenhouse facilities."

Life on the farm was good, although not always terribly profitable. But Inaba made things work because, as he says, he'd had great problem-solving training at WSU. He also had connections: many of his classmates also worked in agriculture in the Northwest so, when needed, he could call on them for help.

"It worked out well for me," Inaba says. "I have very, very fond memories of my professors and my fellow students."

After seeing in action a hydrojet planter mudding-in transplanted bell peppers, Inaba thought he needed a machine like that, too. So he built one. Bell peppers are started in a seed house and then later transplanted into the field. The hydrojet uses a stream of water to drill a small hole into which each plant is placed. This gives the plant a leg up, helping it get over transplant shock sooner.

His years at WSU may have been some of the best, but the intervening decades haven't been too bad,



Lon Inaba checks cabbage seedlings in his family farm's greenhouse. Photo courtesy the Inaba Family.

either. Ag engineering gave him such a “great background that it was really a perfect fit.” Over the years, Inaba built, modified, and repaired a lot of the equipment used on his family farm. Seeing the way farm economics was headed, he helped move his family farm into organic production. “We did a lot of things,” he says. “We built some farm worker housing, expanded our greenhouses and our warehouses.”

But farm work is hard; as Inaba says, for a farmer, an eight-hour day is “just half a day’s work.” By the time he was in his mid-sixties, he says, he was looking for an “exit strategy.”

“I’m on the board for our local irrigation district,” he says, and at a meeting a couple years ago “this guy from the Yakama Nation made a presentation about ground that they want to develop. And the last thing he said was, ‘The first thing we’re looking for is a small packing house and cold storage facility.’ And I thought, ‘Hmmm.’ I asked him if he thought the tribe would be interested in my farm, which is in the middle of the Reservation. They pretty much jumped at it. It took us two years to close the deal but, as of the first of January, 2022, we became Yakama Nation Farms.”

The Nation bought the farm because members are hoping to establish a path to food sovereignty and to promote healthy eating. Eventually, the Yakama people will be able to help other Native American tribes develop farms. The Nation asked Inaba to stay on to teach the next generation of Native farmers. “I have a good history with a lot of tribal members, having gone to school on the Reservation,” he says, and besides, as Inaba recently told Northwest Public Broadcasting, “my family’s proud, and I know my dad would be proud, so I don’t want to walk away.”

Teresa Reed-Jennings’ father thought that if she was going to major in engineering it ought to be in civil engineering. But Reed-Jennings was persuaded by a presentation Al Pettibone gave at her high school in 1975. WSU, she recalls, was “recruiting people to come” to the agricultural engineering department, “and also especially females, so I decided that that would be a great thing. My dad was not particularly happy,” but Pettibone reassured him that “this’ll be a great degree. She’ll have lots of jobs.”

Focusing on water and soils, Reed-Jennings’ plan was to graduate with her B.S. and then head for the Middle East to get irrigation experience as a Peace Corps volunteer. “About the time I graduated,” she recalls, “the Middle East fell apart”—the revolution in Iran caused major disruptions in the region and her professors strongly advised her to “do something else.”

So the young graduate pivoted and went to work for Boeing. Employing what she had learned about structural engineering in her undergraduate education, “I worked on the structural finite element analysis and ran the models for Boeing’s portion of the stealth bomber.” In the mid-1980s, analyses like these ran on supercomputers, Reed-Jennings says. “We would model our portion of the airframe, and then we’d get together with the other companies we worked with merge everything on a Cray,” the widely used supercomputer of the era. “I’ve crashed a Cray,” Reed-Jennings says with a slight smile. “It’s not a pretty thing.”

Rebooting a Cray supercomputer, she says, “takes getting yelled at by your boss.”

After five or six years with Boeing, Reed-Jennings moved up to Bellingham, where she went to work for a private civil engineering firm. “I got my license in civil engineering.” A few years later, “I opened up my own civil firm. And so I had that for 17, 18 years.”

After dissolving her firm, she came full circle and worked briefly for Pasco, Wash., as an irrigation engineer. Currently, in what she calls the “sunset phase” of her career, she works for the City of Redmond on the Microsoft campus refresh. For that project, she is a plans reviewer working to “protect the city’s interest.”

Starting with a four-floor underground parking garage, the new 80-acre campus is being built literally from the ground up. “There’ll be no vehicles on campus,” she says, other than fire and other essential safety services. Limited

to pedestrian and bicycles, the company also planned for “a lot of sustainability things like harvesting rain water for toilet flushing and geothermal heat and cooling from geothermal.”

Thinking back to her years in college in Pullman, Reed-Jennings says, “I loved it. I had never seen wheat waving like ‘amber waves of grain.’ It’s just like the ocean, when the wind goes across it, only it’s gold.” She says that in Bellingham, where she grew up, they had rain, “but it was this continuous anonymous drizzle.” She was deeply impressed by weather on the Palouse, where “all of a sudden this big nasty thing would come rolling over and pound down rain.”

She is appreciative of the breadth of education she received in ag engineering. “One of the weirdest things I ever did, but is still stuck in my head, was we had to design the air conditioning and heating system for a pig farrowing barn. It was a really cool degree and I got a taste of everything.”

Reed-Jennings says that she “had enough knowledge in civil, structural, and water for my first three jobs. I didn’t hit the ground running, but I certainly hit the ground walking. And just later on in my career, when it got to the point where I was hiring other people” she hired WSU agricultural and, later, biosystems engineering grads.

Ahead of her time when she had her own firm, from 1996-2012, Reed-Jennings allowed her employees to bring their babies and dogs to work. She was ahead of her time in other ways, too, such as in stormwater runoff management by incorporating bioswales and wetlands into development projects.

Reed-Jennings was probably only the third woman to graduate with a degree in ag engineering. “Somewhere through my degree, I got married. And one of the older instructors actually asked me, ‘Well, what does your husband think about you being an engineer?’” She had a snappy answer: “He doesn’t. He’s trying to get his schoolwork done, too. I remember what Dr. James said to me: ‘I want you to do three things.’ One of them was don’t ever get anybody coffee. The second one was don’t type letters for people. And the third was to stand up for yourself.”

Laurie Crain '82

Laurie Crain grew up in Pullman where her father taught mechanical engineering at Washington State University. Crain figured she'd follow in her father's footsteps. But she also loved linguistics so, when she graduated from WSU in 1982, she had earned two Bachelor's degrees: one in agricultural engineering and the other in general studies with an emphasis in linguistics. Crain and two other of her five siblings went into engineering.

"I was really interested in working in a developing country so I went into ag engineering," Crain says. "I really wanted to go overseas and I figured agricultural engineering was a good field for finding a job or some kind of position." She laughs and then adds, "Things turned out differently, as they often do in life, but that was my reason for majoring in ag engineering."

In the summer of 1982, Crain married Hassan Kasraie '83, and they stuck around Pullman while he finished up his ag engineering degree. "There weren't many jobs available for people just out of college, even in engineering, which is usually a good field to find a job. So neither of us had a job in engineering." Nevertheless, the new couple moved to Seattle so Crain could take graduate courses in linguistics at the

University of Washington.

Another year flew by, in which Crain applied to various graduate programs in linguistics. Having been accepted by a few programs, she decided to go to the University of California, Los Angeles. Crain's doctoral work focused on syntax, the description of the inner workings of a language's grammar. She wrote a master's thesis on Farsi, one of the primary languages spoken in Iran. For her doctoral research, she studied aspects of Nepali. To gather data for her project, she travelled to Nepal where she spent time interviewing storytellers. in order to understand how native speakers used certain grammatical features of Nepali.

By the time Crain completed her Ph.D. at UCLA, she was a new mother. She and Kasraie had also moved to Ventura, up the coast from Los Angeles. Crain taught linguistics at nearby UC Santa Barbara for a few quarters. She also worked for Educational Testing Service, writing questions for the Graduate Record Exam.

In 1997, Crain returned to engineering. Her husband, who was working as an engineer in Ventura County, suggested she apply to work with some



Photo courtesy Laurie Crain.

friends of his who needed an engineering technician. “I said, well, it’s been 15 years since I graduated, and I hadn’t done any engineering in the meantime, but I thought, Okay, I could do that. I also wanted a part-time job because I had two kids by then.”

In addition to doing a lot of drafting for the small engineering firm, Crain taught herself AutoCAD and GIS, as well as some hydrology software. “We were doing lots of maps and some hydrology, and mostly I was cutting sections a lot and running HEC programs,” Crain recalls.

In 2005, she started a new job with the County of Ventura. The job, in watershed protection, was advertised for a civil engineer but Crain’s wide-ranging ag engineering degree got her the job. “The degree itself shows that you have some technical understanding—your brain works that way, you know?”

Crain worked in the permitting department, “issuing permits to people if they want to do anything that impinges on one of the channels in Ventura County. So could be building bridges across a channel or pipelines underneath, or it could be bank protection or even anything that goes into the Watershed Protection District right of way.”

Crain acknowledges that permitting has a bad reputation. “There’s a lot of red tape, and lots of times it’s paperwork, like making sure the applicant has their insurance and making sure they’ve signed this or

that form and boring stuff like that. But the part that I liked the most about my job, the part that mattered to me, was I liked helping customers. They’re required to get permits, and I can’t change the rules, but I felt that I could show them a good side of government or at least show them that not all government workers are lazy and officious and unresponsive.” More than once she was told, “You’re the first person who ever answered their phone when I called.”

Crain says that “any education is good education.” Sure, she says, the usual view is that we go to college to learn what we need to get a job. “But I also think, more generally, an education is to prepare you for life and to teach you things you might not otherwise know and to have a broader view of the world, just to have a broader knowledge base.”

The connection between linguistics and engineering may seem tenuous, but Crain points out that both disciplines are in some sense analytical methods of solving problems. When she taught linguistics, she says, “I was always looking for problems. I wanted my students to do analysis and solve problems as opposed to writing a paper.” And solving problems is exactly what engineers do, she continues: “You have these parameters, and you have to figure out some answer. It’s very detailed, and I think that in the figuring out of these minuscule details, there’s a lot of correlation between engineering and linguistics.”

Maria Brady '82

Hailing from Soap Lake, Wash., Maria Brady '82 thought she wanted to be a doctor. When she was 15 or 16 years old, though, she realized how many years of schooling it would take to reach that goal. She thought she might have to forego having a family in order to dedicate herself to earning an M.D.

Brady's father, Francis Jensen '63, is an alum of the Washington State University agricultural engineering program and it was he who suggested that, since she enjoyed math and science, "that maybe engineering would be a good choice."

Father and daughter jumped in the car and headed for Pullman to pay some visits to faculty members. "We stopped at payphones on campus and called department heads of chemical, electrical, civil, and agricultural engineering," Brady says. "And we actually just made on-the-spot appointments that day."

That managed to get a meeting with Alan Pettibone, who was chair at the time, who "had been a Ph.D. student when dad was going to school at WSU. So they knew each other. I liked the idea of agricultural engineering—it had a lot of different disciplines within the discipline. I knew I did not want to design streets and I did not want to be a geotech. But the agricultural engineering thing appealed to me and it gave me an opportunity then to maybe pick and choose a little bit later down the path—food engineering, irrigation drainage, or electrical, as it turns out, because computers were just starting to be the thing."

Although she doesn't recall his name, Brady says she remembers an instructor who taught mechanization giving a talk about safety "and he'd rub his glass eye with three fingers."

When Brady graduated, she was one of three women in her ag engineering class. She immediately went on to Colorado State University for a Master's degree. There, among other things, she studied irrigation technology. Computers and digital automation were just beginning to be used, and Brady was fascinated by computers and programming languages.

Master's in hand, Brady set about looking for a job. She found work with the Franzoy Corey Engineering Company (now Stantec). "They were doing irrigation and drainage designs," she says, "in particular for the Central Arizona project. So, they probably designed

five or six different irrigation districts. And I arrived in time to help in Tucson to do an irrigation design for the Tohono O'odham Indian tribe."

Soon, though, the company started to downsize. Brady survived the transition because, as she says, "water still goes downhill. So I started doing water systems, and sanitary sewer systems, and then we did treatment plants." Thirty-seven years later, she's still with Stantec. "I've been a project manager, a program coordinator, and worked on a lot of different projects over that timeframe. Most of my technical background is still more on the hydraulic side of things inside of a wastewater treatment facility. And, too, working on the big picture planning of projects like that, making sure all the components are coming together, that we've got the permitting, all those detailed things that need to be done."

Agricultural engineering, Brady says, set her up well for her career. "Because of the diversity of background, you get used to knowing a little bit about a lot of things. If you focus on a particular area for a while, you become pretty knowledgeable about that. But then, if you need to, you can switch to this other specialty and become knowledgeable about that. So I don't think I've ever really been too worried about taking on projects where I didn't already have 10 years of experience—you go and get people who are experts. You make sure they've got all the tools they need, and then you put the projects together and move forward."

Brady has seen a lot of changes over time. She says her father "sent me off to school with a slide rule and I said, 'Dad, they're not going to use those. They're going to use calculators. Even in high school we've a calculator that could add, and subtract, multiply, and divide, and do square roots.' But it was chained to the desk so nobody could steal it, because it was \$400!" But some things haven't changed. For her senior design project at WSU, Brady and her team worked on building solar food driers. "It is interesting that I started with solar energy and I ended with solar energy. Here we are 40 years later and we're still thinking about powering cars that way."

Hassan Kasraie says he came to the United States in the late 1970s with a mission: “The idea was to go to college here in States and then go home and save the world.” Originally from southern Iran, Kasraie’s plan was foiled when the Shah was overthrown in the Iranian Revolution. So Kasraie stayed put in the U.S.

“I went to Bellevue Community College for two years, finished there in pre-engineering. And I went to WSU primarily to study agricultural engineering, because at the time the government in Iran, they said that you can only study agriculture, you can study engineering, you can study medicine.”

Engineering was Kasraie’s first love, so he saw a path to serving not only his own interests but those of his people in Iran and the world. “So ag engineering became a pretty obvious choice for me personally, and WSU has one of the best programs in ag engineering—I was very lucky to get into the program.”

Although Kasraie was from an urban area, his hometown was situated in Iran’s breadbasket, a region rich in not only agriculture, but oil and minerals, as well.

When he graduated in 1983, Kasraie had a tough time finding an engineering job. He and his wife had moved to Seattle, a city not known for its agriculture. “I worked at Big Olaf Ice Cream Shop. I worked at Richmark, the label maker for everything from the labels on jars of pickles to those on baby diapers. I was a machinist working on the machines and printing labels and things like that. I also worked at the university bookstore.” At one point, Kasraie says, he was working three jobs to make ends meet.

But then his wife, Laurie Crain '82, also an alum of the WSU ag engineering program, decided she wanted to further her study of linguistics. She got a scholarship to study at the doctoral level at UCLA, so off they went to Southern California. With a note of bemusement in his voice, Kasraie says, “I was the same guy, with the same resume and same background, and I got a job as a civil engineer within two weeks. With the knowledge I gained in college, I reinvented myself as a civil engineer and a hydrologist.”

Kasraie’s studies at WSU included an emphasis on water management—drainage, erosion, and irrigation—issues that, to this day, are critical to life in Southern California.

Wanting to earn a Master’s degree in engineering,

Kasraie discovered Loyola Marymount University, situated near LAX airport. “They’ve got a really great engineering program which allowed me to work full time and take classes in the evening.” In 1987, he got his Master’s degree in civil engineering, and a license as a Professional Civil Engineer. “And also along the way, I became a licensed Professional Hydrologist with the American Institute of Hydrology.” He’s also picked up certification as a Floodplain Manager. “That’s a big deal where we are,” Kasraie points out. “There’s plenty of flooding everywhere.” There aren’t a lot of certified floodplain managers, and Kasraie says that “we’re like the Marines—the few, the proud.”

For the next few years, Kasraie worked for engineering firms that focused on flood control. “Then I landed a job with Ventura County Flood Control District,” a little north of Los Angeles, where he worked for 12 years.

After the public agency work, Kasraie started his own engineering consultancy, Kasraie Consulting, that is now in its 20th year of business. “We have six engineers and hydrologists, and serve many of the local municipalities, city agencies, county agencies, and water districts. We also work for private development projects and individuals who need our help.”

While there’s no such thing as a typical day at



Photo courtesy Hassan Kasraie

Kasraie Consulting, “all of our work is related to drainage engineering, surface water hydrology, floodplain management and flood control, and storm water management.”

For a municipal client, the firm might look at “the whole city to determine where the water’s coming from, where it’s going, how it’s being conveyed, if the drainage system is big enough to handle the water moving through it.”

While the work Kasraie does may not be directly related to agriculture, “we do protect lots of agricultural areas because Ventura County is still primarily agricultural to this day, even though we have very successful businesses in everything from pharmaceuticals to internet-based tech companies.”

While global warming is bearing down on all of us, Southern California, with its large population and limited water supply, faces especially urgent challenges. “All of our projects have a very strong environmental impact component to them,” Kasraie says. “And all the environmental impact studies require hydrologic analysis long in advance of the project ever becoming public.”

Instead of slapping in a concrete culvert, as was once the norm, engineers today who want to slow water down so it doesn’t erode the landscape now think in other terms, such as wetlands, if the space is available, or parks, if working in a more urban or developed area. In Ventura County, Kasraie says, they have strict laws under the umbrella of SOAR: Save Our Agricultural Resources. “A lot of our agricultural areas are protected from development, and there’s far more scrutiny about things like mitigation measures that have to be implemented” before a project can proceed.

Kasraie is passionate about what he does—and about mentoring young engineers, too. He urges “anyone who has an interest in solving problems and helping people to become an engineer.”

Keith Zaugg '87 and '90

Keith Zaugg got both a B.S. and a M.Sc. in agricultural engineering from Washington State University. While working on his master's degree, Zaugg worked for Ralph Cavaliere on energy-related issues. After graduation he went to work for the Washington State Energy Office doing energy audits.

"We did industrial energy audits," Zaugg says, "of everything from giant sawmills to food processing plants." Lots of energy gets used drying lumber or dehydrating potatoes, he explains. "We would manage the energy loss of different systems, and try to figure out how we could reduce the amount of energy they used and still produce what they were producing. We'd find where energy was being wasted, and then we would propose an application that would conserve that energy." Audits such as this save companies lots of money while also reducing the size of their carbon footprints.

Take apples, one of the state's most important agricultural products. To store apples, "they put these apples in boxes and stack those boxes in a large room that's climate controlled [for temperature] as well as for carbon dioxide." Increasing the amount of CO₂ in the storage facility puts fruit into a dormant state, making it possible to store apples for many months. But these storage systems "have huge evaporator fans

inside these huge rooms that would run 100 percent of the time. When you run a fan motor inside a closed space, you're adding energy, you're adding heat. What I did in my thesis was prove to industry folks that they didn't have to run it all the time. They actually could run it one day out of seven and still maintain the temperature of the fruit that was so critical to them. Seven days versus one day, there's a direct energy savings."

From the state's Energy Office, Zaugg moved on to a food processing company, Basic American Foods, where he worked first as a plant engineer, which led to a position as a maintenance and engineering manager, which led to the design of a computerized resource management system to ensure quality control. "It's kind of a weird career," Zaugg says with a laugh.

A career full of zigs and zags, perhaps, but as Zaugg points out, "Engineering leads you to a lot of things because you get exposure and experience with a lot of different things." First among that variety is a method for addressing challenges.

Zaugg grew up on a farm in Weiser, Idaho. There, his family grew onions, sugar beets, wheat, hay, and sweet corn. "We had a cow-calf operation there, too," he says. He'd started college at Brigham Young University studying agronomy and soil science. But in



Photo courtesy Keith Zaugg

his junior year, he decided to get married and return to the farm. “I was 32 years old when I went back to school,” Zaugg says.

After BYU, he decided to give WSU a try. He wanted to diversify his education and focus less on agriculture and more on the biological and food-processing aspects of engineering.

“Ralph Cavalieri was my major professor and he really helped me a lot. He kept me going to finish that master’s degree. I enjoyed all of the professors there. They were really willing to help you out, from the secretary—I think her name was Sandy though I don’t recall her last name—to the faculty, everybody was willing to help you out.”

Zaugg says he was happy to see the Department’s name change to Biological Systems Engineering. “If you have a chemical engineering degree, there’s a broad spectrum of what chemical engineering can do. If you had that biosystems engineering education, you’re now melding things together where you have not only the engineering background of all engineers—like thermal heat transfer, maintenance, mechanics and materials. Everybody has all of that, and the math, too, but it just broadens the thinking of a potential employer of how that employee could be utilized. I mean, look how my career changed over time. I think a lot of that background really helped me.”

Zaugg says he knows that “not a lot of people go back to college at the age I did, especially with kids.” By the time Zaugg got back to WSU to finish his education, he and his wife had five children. “But I think it’s important for others who are struggling in a career, to know that it’s not too late to go back and change your career. It just takes time and dedication.”

Kasey Schertenleib ’90

When Kasey Schertenleib earned a Bachelor of Science degree in 1999, he was one of the last undergraduates from Biological Systems Engineering. Soon after, the program was redesigned to only offer graduate degrees.

Schertenleib grew up in Tonasket, which he describes as “a small, rural, agricultural community up in the Okanagan Valley” of north-central Washington State. Both sets of his grandparents had apple orchards, “so I grew up with that background. My dad sold agricultural chemicals for Wilbur-Ellis, so he was like the doctor and pharmacist for the orchards. He went through the tree fruit program at Wenatchee Valley College and then transferred to WSU to finish up with a horticulture degree. So that was my tie to WSU.”

Schertenleib says that his first inclination was to study computer science, as he “liked working on computers, and the internet was just starting” when he enrolled at WSU in the mid-1990s. But when he got into his first computer science class, he realized it was not for him.

“I did a quick change of direction, and after bouncing around a little bit, ended up meeting with Ralph Cavalieri, who explained to me what Biological Systems Engineering was. I liked the idea of taking what I was good at, the math and science, and applying it to solving problems in the agricultural world.”

Schertenleib’s engineering classes were challenging, he says, and he’d have to “figure things out as you went along and solve academic problems as well as engineering problems.” But once he got to hands-on projects, like designing a plant that pasteurizes apple juice, “it really started making sense.”

“I worked with Frank Younce as an undergraduate in the Food Science Pilot Plant,” Schertenleib says. There, scaled-down versions of the equipment found in major factories facilitated student learning as well as research projects. “One day we were making strawberry fruit roll-ups, and the next day we were making Ferdinand’s ice cream, and the next day we were doing something with raw eggs that just smelled awful.” Schertenleib says he enjoyed the complexity of working with biological systems, in part because “things didn’t always work out the



Kasey Schertenleib holds a bear cub in 2005, working on a bioengineering research project at the WSU Grizzly Bear Research Center.

way you were expecting, and you had to figure out a solution and make it work somehow.”

For his senior design project, Schertenleib and his fellow students worked on developing a device that measured photosynthetic activity in plant leaves. “In theory,” he says, “a farmer could go out and see how healthy their plants were just by clipping this device to a leaf on a plant.”

After graduation, Schertenleib went to work in a bioengineering research lab. “It was the same kind of thing: you’re working on a research problem, but you have to do engineering to get to the point where you can collect the data because a lot of the instruments haven’t really been invented yet. It’s a matter of figuring out what can we build, what can we order off the shelf, and how can we make it work to get the data that we’re looking for?”

While at WSU, Schertenleib met and married his wife, who was finishing her education at WSU, including earning a Master’s in teaching. Schertenleib himself expanded his education by going through

WSU’s MBA program. And although they had originally intended for him to work in the food processing industry, by the time his wife had finished her schooling, “we came to the decision that Pullman was really a place where we wanted to be.”

For the past 13 years, Schertenleib has served as the student services manager in the Voiland College of Engineering and Architecture. “I talk with a lot of undergraduate students and perspective students now because part of my job is selling our engineering and computer science programs. I draw on a lot of the experiences I had, both as an undergraduate student and as part of a research team. What I always come back to is, when you’re learning to be an engineer, you’re learning to be a technical problem solver. Those skills are universal across all different disciplines and career pathways. So you never really know where your engineering degree is going to take you. But it gives you a skillset that’s very adaptable, and it gives you a lot of advantages when you’re out in the workforce.”

Wei Liao '05

When it comes to fermentation science, Dr. Wei Liao (Ph.D. '05) has covered the waterfront. In his native China, he earned bachelor's and master's degrees in fermentation science before then working in a brewery. But fermentation is not limited to beer and wine. Fermentation is an essential process to chemical and biological systems engineers, as the production of ethyl alcohol is critical to the manufacture of other industrial chemicals including acetaldehyde, acetic acid, and ethyl acetate which are widely used in the production of pharmaceuticals, foods, paints, and perfumes.

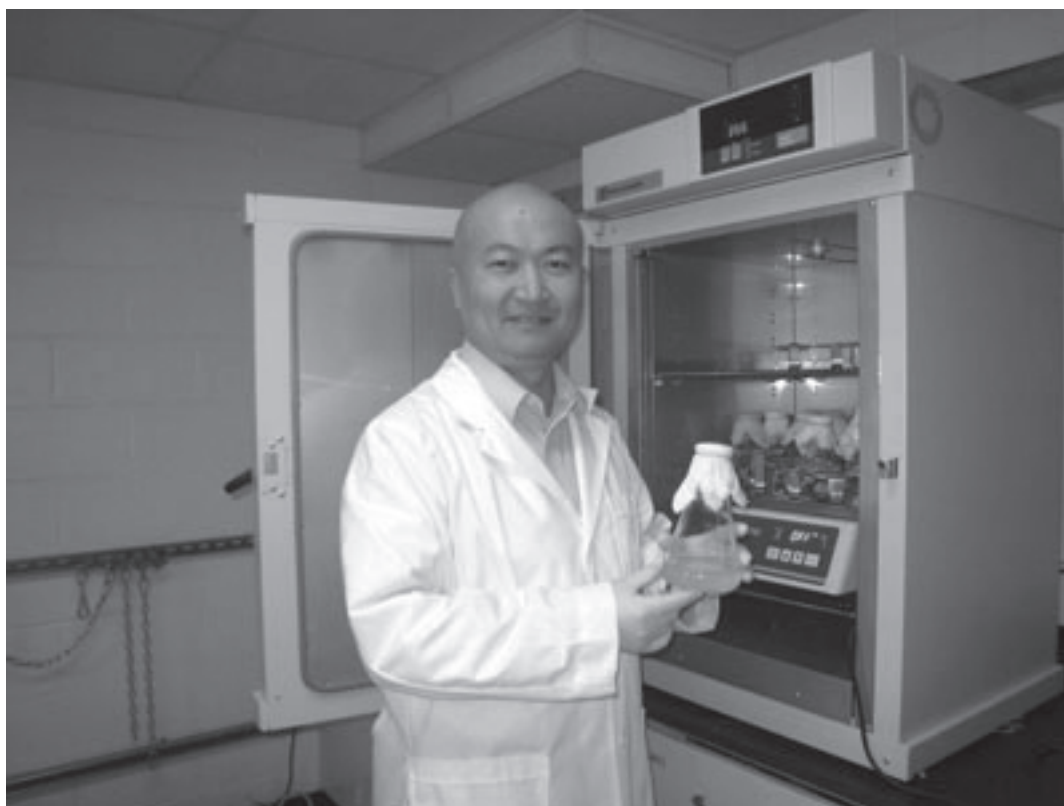
Beer, Wei Liao points out, is “just one of many [fermentation-derived] products in the food area.” Fermentation can also be used to produce energy. When he was working for a Japanese company with a brewery in Shanghai in the late 1990s and early 2000s, producing bioenergy through anerobic digestion was “pretty new, and pretty intriguing. This is why, back then, I decided, ‘Okay, get out of the brewing industry, and move to a newer area, like using fermentation of biologic waste to do something good, like turning organic waste into value-added products.’”

That's what brought Wei Liao to Washington State University. He says that faculty in the Department of Biological Systems Engineering were “on top of that research area.” That's saying something for a scientist who is now the director of Michigan State University's Anaerobic Digestion Research and Education Center—a leader in innovating ways of converting “organic residues into bioenergy and chemical products,” according to the Center's website.

Wei Liao's research group also works on the cultivation of algae to capture CO₂ and generate value-added products, as well as the “integration of solar, biological, and electrochemical technologies to develop novel waste utilization systems.”

And while producing energy and industrial chemicals is certainly important, Wei Liao also feels strongly that his group's research “makes some major contributions in terms of sustainability, the environment, clean air, clean water, and a beautiful landscape.”

He says that while he already had the desire to find ways to apply technology and science to developing a more sustainable future, “WSU really amplified that whole notion.” At Michigan State, Wei Liao is making



Wei Liao in his lab at Michigan State University. Photo courtesy MSU.

that notion a reality. MSU, with a student population of about 50,000, offers a great test bed for working out ways of converting “organic residue” into energy and value-added products.

“We’re handling all the organic residue—we don’t call them waste—such as food residues” produced on-campus, “and then all the agriculture residues, including livestock manure.” To turn these residues into something useful requires a systems approach, involving experts in biological, genetic, and mechanical processes.

This would be important work anywhere, but in the Great Lakes region, which is one of the planet’s major reservoirs of fresh water, protecting water quality while also managing huge dairy herds in critical. Wei Liao and the Center he directs have numerous partners, from MSU’s green campus initiative to the Department of Defense, which is keen to insure a sustainable supply of fresh water through reclamation and nutrient recovery, especially of phosphorus and nitrogen. “They want to recycle all the water in a spaceship, literally getting wastewater recycled back to potable water. We’re trying to do that. We’re not there yet, but we’re working on that piece.”

That means doing everything from basic research “in the test tube” to scaling up processes to industrial levels. The Anaerobic Digestion Research and Education Center draws on faculty from “engineering, microbiology, chemistry, economics, and even social scientists to develop systems. And that’s just in the United States,” Wei Liao says. “We have a research hub in Costa Rica,” he explains, that works with partners from Mexico to Brazil. In Mexico, researchers are working with the tequila industry to “expand this energy and water system concept to treat their agriculture residues.”

The Center also has collaborations in Nepal, Sicily, Kazakhstan, and India, among others. But no matter how far-flung the location, Wei Liao says WSU prepared him and many other researchers for the challenges that lie ahead. “They are really doing great things and they train a lot of good people. You look around the world and see quite a few people from Biological Systems Engineering.”

When he was a doctoral student at Washington State University, Fanbin Kong worked with food engineering pioneer Juming Tang, specifically on Tang’s microwave sterilization project. “My focus was on food quality, how the quality of salmon is affected by temperature and time,” he says. Kong graduated with his Ph.D. in 2007.

Now a professor of food engineering at the University of Georgia in Athens, Kong continues to conduct research on food. Part of his focus is on radio frequency heating as a way of pasteurizing foods. “What I learned in Dr. Tang’s lab has helped me a lot to do the research here in radio frequency heating,” Kong says, adding that “many of the research methods are similar.”

Kong is also investigating the ways food is digested and how nutrients are extracted. He and his team have developed a model digestive system that simulates the contractions of the stomach as it breaks down food. By studying the physical process of peristalsis using their “gastric simulation model,” Kong and his colleagues gain insight into the bio-availability of nutrients and how they are extracted from the food matrix. This is critical work for lots of reasons: for a better understanding of how food is processed by the body; for the design of healthy foods, especially for people with severe allergies or intolerances; and in establishing baseline verification of analytical techniques.

Kong says the digestion simulation research is also important to understanding how humans gain and lose weight. “Our main purpose, though,” he says, “is to provide a realistic simulation of a human GI system. We want to look at the behavior of food and drugs and medicine, how they behave in the stomach. And testing how nutrients or the active ingredients in drugs are released and absorbed. Because otherwise we must do clinical trials using human test subjects, which is expensive, time-consuming, and constrained by ethical considerations. But with this model, we are time and cost efficient.”

In China, after earning a master’s degree in environmental engineering, Kong worked for a water treatment company. “I worked on a project where the goal was reclaiming the nutrients from the wastewater of a soybean processing plant.” That project introduced

him to food processing technology and got him interested in learning more.

The connection between that project and his current research, Kong explains, is chemistry. “The digestion model seems to be very different from the environmental engineering project, but they are both basically engineering and chemistry. Chemistry plays a very important role in both food engineering and environmental engineering.

“In wastewater treatment we use chemical and microbial measures to treat wastewater,” Kong continues. Parallel “chemical reactions and bacterial processes” are at work in our digestive systems. “So that’s how we can actually look at different areas and find these internal correlations which show that at least some of the processes are pretty similar.”

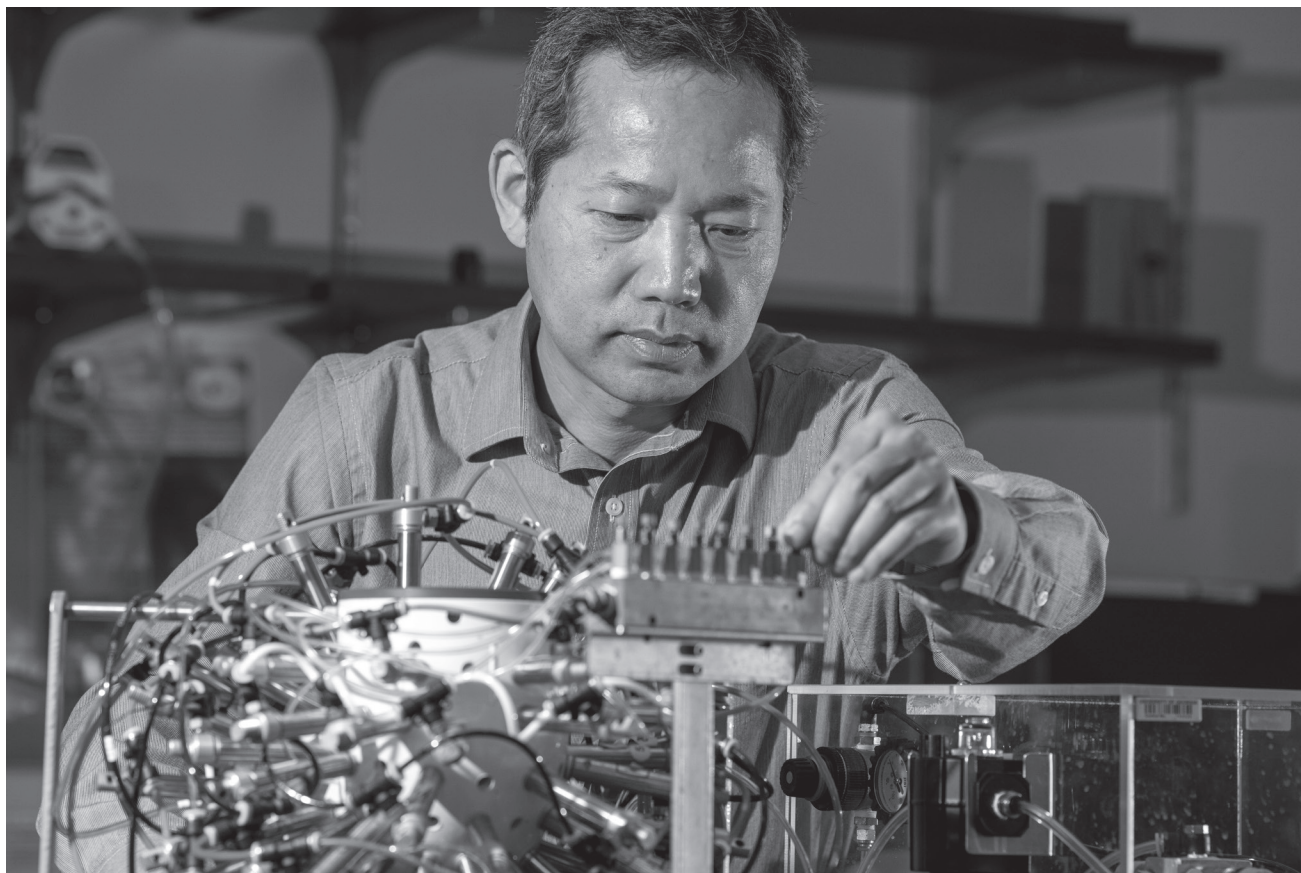
One of the challenges food scientists and engineers confront is getting nutrients into the body in a way the body can extract and use. Nutrients in isolation behave differently than when combined in a matrix: ascorbic acid, for instance, behaves differently in pure form as a vitamin C tablet than when delivered to the body in the form of an orange.

“We want to improve nutrient bioavailability and

make food healthier,” Kong says. “To do this, we focus on micro-encapsulation. Micro-encapsulation is a technology that can encapsulate nutrients, vitamins, and bioactive compounds like probiotic bacteria, so they are protected when they go through the stomach. Because the stomach is very acidic, that environment can destroy nutrients and bioactive compounds. With an encapsulation technology, there’re more nutrients and bacteria compounds, including probiotics, that can be transferred to the colon or intestine that will, hopefully, improve the health benefits of the foods that we eat.”

Kong says that the training he received at WSU has “framed my career.” He feels lucky to have worked with Juming Tang, one of the few food engineers who is a member of the National Academy of Engineering—as is Kong’s post-doctoral mentor from his time at UC Davis, Dr. Paul Singh.

“I still talk to Dr. Tang when I have problems in research and also just to stay in touch. And every time when I talk with him, I get very good guidance and instructions that benefit me.” No doubt about it, Kong says: “a great advisor really plays a significant role that helps students in their future careers.”



Fanbin Kong, professor of food engineering at UGA's Department of Food Science and Technology, works to build artificial gastrointestinal systems and study the digestion of food and nonfood materials. Photo by Dorothy Kozlowski and courtesy of UGA

Appendix A

L. J. Smith Agricultural Engineering Building Dedication Speech Nov. 18, 1950

DEDICATION COMMENTS OF MR. EVERETT H. THOMAS
ON THE OCCASION OF NAMING THE L. J. SMITH
AGRICULTURAL ENGINEERING BUILDING NOVEMBER 18, 1950.

"Then I dipped into the future far as human eye could see,
Saw the vision of the world and all the wonders that would be,
Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight dropping down with costly bales."

- - -

That early poet doubtless was ridiculed by those who read his prophesy, yet even the least skeptical of them would be amazed beyond description were he to step into 1950 and see how accurately the engineering wonders of today in transportation, in industry, and in science had been portrayed by Mr. Tennyson.

Along with engineering developments that have affected everyone in almost every phase of our living, the engineering progress in agriculture is outstanding.

In 1920 there were 19,000 farms in the state of Washington enjoying that simple necessity -- running water. Today, in 1950, there are, not 19,000, but 70,000 farms enjoying to the fullest this great blessing of nature.

In 1920 there were 9,000 farms in this state using electricity. In 1950 there are 72,000 such farms whose economy of operation has been improved and whose farm homes are enjoying a richer life through that modern servant of man.

- 1 -

In 1910 there were about 900 farm tractors in the entire United States performing all or a major part of agricultural work. Today there are 600,000 such tractors shortening the farmer's day, improving his living standards and doing a far better job than the old gray mare or the lop-eared mule ever did.

In 1900 there were 48,000 acres of farm land under irrigation in the state of Washington. Today, half a century later, there are 650,000 acres in our state flourishing under life-giving water brought to thirsty acres through the engineering genius of American men.

On this subject of irrigation I would like to digress momentarily and emphasize the need for continued reclamation and irrigation here in the West. Those who do not understand reclamation and irrigation today, and how they are related to our national economy and related to our population trends, are now speaking of farm surpluses, the unbalanced federal budget and the need for military spending as subjects to be considered before any further reclamation is accomplished. A careful and impartial study of the benefits of reclamation both from the economic and from the humanitarian points of view denounces such shortsighted thinking.

Then there has been much engineering progress in farm drainage -- a very important phase of much of our Western Washington agriculture.

Improved design of farm buildings of all kinds for more practical and efficient farm operation are a part of engineering development in agriculture.

Our tardy attention to more sound practices of conserving our soils has accelerated progress in the design and construction of farm implements and equipment.

These progressive engineering developments I have mentioned -- and I have mentioned but a few -- for better farming and more enjoyable living on the farm are to a large extent the result of the work done by agricultural engineers and the agricultural engineering departments of our colleges and universities. Hard working research men who through the last half century have doggedly searched for new truths have made a great personal contribution in the specific field of agricultural engineering. Such a man is Mr. L. J. Smith whom we are especially honoring today. In 1906 he saw his first gas tractor. In 1909 he

started the Agricultural Engineering Department at Manitoba University and in 1910 he conducted his first tractor short-course there. In August, 1920, Mr. Smith came to W.S.C. which, by the way, was the first college on the Coast to inaugurate a technical course leading to a degree in agricultural engineering. The tractor and farm equipment shop, the blacksmith shop and the woodworking shop were all located in Wilson Hall and remained there until this new building was erected to accommodate new facilities made necessary by an increased interest in and an increased demand for agricultural engineering.

Mr. Smith has written a half hundred bulletins covering extensive research in every field of agricultural engineering. He has published hundreds of articles in farm journals and magazines. He has made radio talks and personal appearances beyond numbers. He has completed much valuable research with the West Coast Lumbermen's Association, the Washington State Farm Structures Research Foundation and the Washington Committee on the Relationship of Electricity to Agriculture. I could go on and on with the contributing activities of this man in the field of agricultural engineering.

Through the years Mr. Smith has made a practice of soliciting the help and the experience of private industry in working out his research problems of whatever nature. I would like to cite for you an example: Long before the REA and the PUD became the pet children of a tax supported government, private Northwest power companies had poured millions into research and experimentation in the field of electricity that they might better serve the public need. These government or semi-government organizations owe their existence to early work done by private industry, our departments of agricultural engineering and individuals like Mr. Smith. His fine association with private industry in the field of electrical research has meant a great deal in our present use of electricity on the farm toward a more abundant living.

In other fields, as in the power field, we are too often carried along with great programs pushed by the federal government forgetting that private initiative, private capital and profits have made America the greatest nation on earth. Let us continue to encourage those fine virtues in men -- individual initiative and vision, individual pride in work, individual monetary gain for service rendered, that America may remain

a strong state, governed by the people instead of becoming a strong state governing its people.

I would be very unfair if I did not make reference to the fine personal characteristics of Mr. Smith as a friend and as an instructor. I am in a position to do that because he worked on me for four years in an untiring effort to make a man out of the boy. Always courteous, always polite, always a perfect gentleman, never showing anger but instead having an untiring patience in teaching engineering and in developing men -- there are some of the sterling qualities of the man.

So, Mr. Smith, on behalf of the Board of Regents of Washington State College, for your students, for agricultural engineers everywhere, and with a great deal of personal pride and pleasure, I make these dedication remarks in naming this building the L. J. Smith Agricultural Engineering Building.

Appendix B

Photographs of L. J. Smith Building from WSU Archives



L.J. Smith prior to occupancy in 1947



L.J. Smith prior to occupancy in 1947



Engines and Tractors Laboratory (Room 114) prior to occupancy, 1947



Front steps of L.J. Smith prior to occupancy in 1947 with unknown observer



Quad Area: men's dorms were constructed in 1946-47 to handle an influx of World War II veterans. The dorms were demolished between 1962 and 1965. L. J. Smith Building in upper left of photo.



A storage building with men's dorms (right), probably ca. late 1950s.



L. J. Smith Building with "White House" Building in background, ca. 1948



L. J. Smith with a large storage building on right, ca. 1949



L. J. Smith in the 1950s

Appendix C

Schedule of Studies B.S. in Agriculture Engineering, 1926 WSU Catalog

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The State College of Washington

AGRICULTURAL ENGINEERING

(Professional Course)

Freshman Year

First Semester—	Hrs.	Second Semester—	Hrs.
Forge Shop (M. E. 2).....	2	Eng. Drawing (M. E. 6).....	4
Farm Mechanics (A. E. 10)....	3	Elementary Analysis (Math. 26) 3	
Trigonometry (Math. 2).....	3	Rhet. & Comp. (Eng. 2).....	2
Rhet. & Comp. (Engl. 1).....	2	General Inorganic Chem.	
Gen. Inorganic Chemistry		(Chem. 72)	3
(Chem. 71)	3	Types & Classes of Farm	
Types & Classes of Farm		Animals (A. H. 1) or	
Animals (A. H. 1) or		Field Crops (F. C. 1)	3
Field Crops (F. C. 1)	3	Military	1
Military	1	Physical Education (P. E. 8)...	½
Physical Education (P. E. 7)...	½		

Sophomore Year

General Physics (Physics 1)...	4	General Physics (Physics 2)....	4
Differential Calculus (Math. 21) 3		Integral Calculus (Math. 22)..	3
Gas Tractors (A. E. 5) or.....	2	Gas Tractors (A. E. 5).....	2
Surveying (C. E. 7).....	3	Surveying (C. E. 7)	3
Machine Design (M. E. 7).....	2	Mechanism (M. E. 8)	2
Agricultural Economics		Intro. to Literature (Engl. 8)..	2
(Econ. 12)	4	Farm Buildings (A. E. 6).....	2
Military	1	Military	1
Physical Education (P. E. 9)...	½	Physical Education (P. E. 10)...	½

Junior Year

Soils (Soils 1).....	3	Bldg. & Const. (A. E. 7).....	2
Theor. Mech. (C. E. 9).....	4	Mat. of Eng. (M. E. 40).....	2
English (elective)	2	Mat. Testing (M. E. 42).....	2
Prime Movers (M. E. 12).....	4	Applied Mech. (C. E. 29).....	4
* Elective	3	Steam Tractors (A. E. 4) or	
Physical Education (P. E. 51)...	½	Auto Shop (M. E. 35)	2
		Farm Machinery (A. E. 15)....	3
		Hydraulics (C. E. 30).....	2
		Physical Education (P. E. 52)...	½

Senior Year

Direct Currents (E. E. 2).....	4	Alt. Current Mch. & Laboratory	
Irrigation Farming (Soils 6)...	2	(E. E. 3 and 38).....	3
Drainage (A. E. 8) or		Irrigation Engineering	
Mechanics of the Farmstead		(C. E. 15)	2
(A. E. 12)	2	Steam Tractors (A. E. 4) or	
Marketing of Farm Products		Auto Shop (M. E. 35)	2
(Econ. 51) or		Marketing of Farm Products	
General Farm Management		(Econ. 51) or	
(F. M. 3)	3	General Farm Management	
Farm Explosives (Mining 2)...	1	(F. M. 3)	3
Machine Design (M. E. 23)....	2	Elective	6
Elective	2		

* See general requirements in Index.

Appendix D

Schedule of Studies Farm Engineering Minor, B.S. in Agriculture, 1926 WSU Catalog

AGRICULTURE—FARM ENGINEERING

(For outline of the four year professional course in Agricultural Engineering, see Department of Mechanical Engineering in Index.)

Junior Year

First Semester—	Hrs.	Second Semester—	Hrs.
Principles of Feeding (A. H. 3).....	3	Soil Fertility (S. 2).....	3
Forage Crops (F. C. 2).....	2	English	2
Rural Landscape Art (Hort. 40).....	2	Agricultural Entomology	
Gas Tractors (A. E. 5).....	2	(Zoo. 43)	2
Trigonometry (Math. 2).....	3	Farm Management (F. M. 3)....	3
Forge Shop (M. E. 2).....	2	Farm Explosives (Min. 2).....	1
Farm Drainage (A. E. 8).....	2	Farm Machinery and Repairs	
Physical Education (P. E. 51).. $\frac{1}{2}$		(A. E. 1 and 2).....	4
		Physical Education (P. E. 52).. $\frac{1}{2}$	

Senior Year

Mechanics of the Farmstead		Steam Tractors (A. E. 4).....	2
(A. E. 12).....	2	Farm Building Construction	
Marketing of Farm Products		(A. E. 7)	2
(Econ. 51)	3	Advanced Gas Tractors	
Irrigation Engineering		(A. E. 11)	3
(C. E. 15)	2	Automobile Shop (M. E. 35)....	2
Elements of Elec. Eng.		Electives	7
(E. E. 2)	3		
Machine Shop (M. E. 11).....	2		
Electives	4		

*Of the electives, 17 hours are required in technical agriculture. It is advised that some of these be completed in each semester of the junior and senior years. Students who have not had one year of physics in an accredited high school will be required to take Physics 13 and 14 in place of five hours of non-agricultural elective. It is advised that this be done in the junior year.

Appendix E

Letter from WSU Institute of Agricultural Sciences to President Compton Regarding Governance of Agricultural Engineering

extra
April 4, 1947

President Wilson Compton
C A M P U S

Dear President Compton:

As Director Knott indicated to you over the telephone the other day we in the Institute of Agricultural Sciences are deeply concerned about the proposed change in organization structure which would result in the transfer of the agricultural engineering work of the Institute of Agricultural Sciences to the College of Engineering. We appreciate the opportunity of presenting our viewpoint on this matter.

We realize that there was no indication in your letter of March 22 of just how all-inclusive a shift was being considered. We believe, however, that the training of agricultural students in agricultural engineering subjects, the research work in agricultural engineering and the extension work in agricultural engineering have common objectives and are so closely allied that it is impossible to consider the shift of any phase without seriously jeopardizing the work of the others. One of the main functions of the Institute of Agricultural Sciences is "...to coordinate and integrate the work in those fields of teaching, research and extension closely associated with agriculture and rural life both within the institution and throughout the state and to provide the most effective use of public funds, personnel and facilities so that the State College may render the highest possible service."

We believe that service to agriculture can be and will be much more effective if the basic sciences and engineering are brought together in focus on the problems of agriculture and rural life through departments and divisions in the Institute of Agricultural Sciences. We have been striving valiantly, and apparently with some success, ever since the Institute of Agricultural Sciences was formed to develop and effectuate a coordinated approach to the problems that confront our rural people. To do so, it is essential that we study the problems in the field and to bring to bear upon those problems every facility that we have available. These problems include not only research and extension problems, but the training of farm people and leaders in all phases of agricultural work. If we are to do this effectively we must be able to directly and effectively bring to bear upon these problems the basic sciences and engineering that have a bearing on the problems. To do this, we must have them applied by people who work with and know agriculture. The more direct the line of application and the more this application is administered through people with training, understanding and a sense of service to agriculture, the more effective will be our contribution.

Agricultural engineering in the training of agricultural students in research and in extension is an extremely important part of our effort. We definitely have embarked on an improved agricultural engineering program in cooperation with the other departments of the College of Agriculture. We have for the first time made very definite progress toward greater service to agriculture in the field of agricultural engineering. Our advisory boards, farm organizations, soil conservation districts and a number of other private and public organizations have requested increased service in this field. We have indicated to these people that we accept their challenge and the responsibility of developing the agricultural engineering work in conjunction with all phases of agriculture and rural life, so that it may be of more direct and greater service.

There are four fields of service in agricultural engineering that need to be considered in an analysis of the proposed organization change. These are:

1. Training of professional agricultural engineers.
2. Training of agricultural students in agricultural engineering.
3. Agricultural engineering in research and experimentation.
4. Agricultural engineering in cooperative extension work in agriculture and home economics.

We have given serious consideration to these matters and sincerely have attempted to be as objective as we can under the circumstances. We have tried to view this whole matter not from the standpoint of any petty jealousies as to where certain work might be located, but from the standpoint of the greatest service to the people we hope effectively to serve. We have considered information available from other institutions, not to be orthodox, but to determine what they have found to be the most effective way of answering the problems that confront them as well as us. We are presenting below under the four headings above, the results of these considerations.

1. Training of professional agricultural engineers.

This responsibility already rests in the College of Engineering. The curriculum and courses for training professional agricultural engineers are under the administration of the College of Engineering. Because members of the Department of Agricultural Engineering who teach courses for the training of professional engineers also teach service courses for agricultural students, they should be selected by the head of the Department of Agricultural Engineering in consultation with the Dean of the College of Agriculture and the Dean of the College of Engineering. All of our agricultural engineering staff at the present time are graduate engineers. Facilities for teaching professional courses that are given in the laboratories and shops of the College of Agriculture should be approved by the Dean of Engineering.

There has been a considerable discussion with regard to the accrediting of the training of professional agricultural engineers. We are informed that the National Accrediting Committee includes no agricultural engineers. Also, we are informed that there are only two institutions; namely, Iowa and Kansas, which are accredited. We can see no reason why, under our present dual setup, this institution cannot be accredited if, as we now have it here, the curriculum, courses, personnel and facilities that contribute to the training of professional agricultural engineers are under the administration of the College of Engineering. These items currently are being much improved also with the addition of new staff and the erection of a new building.

We in the Institute of Agricultural Sciences have no desire to take away from the College of Engineering the training of professional agricultural engineers. We are eager to cooperate with the College of Engineering to the end that agricultural engineers of the best professional competency be graduated from the College of Engineering in the State College of Washington. We believe that this can be done without making changes in the training of agricultural students and in the fields of research and extension which would make it extremely difficult, if not impossible, to be of greatest service to the people in our state in the field of agricultural engineering.

April 4, 1947

2. Training of agricultural students in agricultural engineering.
The Department of Agricultural Engineering in the College of Agriculture offers service courses for agricultural students in the following subjects:

- Farm repairs
- Farm machinery
- Gas engines and gas and diesel tractors
- Farm buildings
- Concrete construction on the farm
- Electricity on the farm
- Farm mechanics
- Irrigation principles and practices
- Dairy plant mechanics
- Land clearing and reclamation
- Land drainage
- Materials, technique and methods of farm shop
- Soil conservation engineering

Separate courses already have been set up to segregate professional engineers from agricultural students taking the service courses.

The courses listed above are closely related with enterprises on farms as they are found in the different parts of the State of Washington. They are provided for the training of agricultural students in farm shop and the engineering applications that are closely related to and coordinated with the work offered in other departments of the College of Agriculture. They are built up and are taught on the basis of the needs of agriculture graduates, in such lines of work, for example, as vocational agriculture, dairy farming, irrigation farming, in horticulture and the other agricultural fields.

We are attaching a copy of a letter concerning the training of vocational agriculture teachers which was written by Bert Brown, State Supervisor of Vocational Agricultural Education. We are enclosing a copy of a letter from J. Murray Lee, Dean of the College of Education, which gives his reaction to such a change from the standpoint of training teachers of vocational agriculture. We are attaching also a copy of a letter from Dr. M. E. Ensminger, Head of our Department of Animal Husbandry, giving his reaction with regard to the relationship of agricultural engineering to animal husbandry in his department and in the state.

Staff members in the College of Engineering repeatedly have stated that they do not wish to give service courses in the College of Engineering; their interest is in the training of professional engineers. The student in the general course in agriculture ordinarily enrolls in a number of these courses, depending on his objective, of course. Students majoring in specialized fields of agriculture take one or more of these courses. For example, a student preparing to operate a farm will be benefited by courses in farm repairs, farm machinery, gas engines, diesel tractors, farm buildings, concrete construction, and electricity on the farm, and these courses should be made available to him. These people want to be farmers, not engineers. The professional agricultural engineering courses do not provide the type of training needed to fit them for operating a farm. A student preparing to operate an irrigated farm will, of course, need the above courses and will need the courses in irrigation practices. They cannot and will not take the time to take the professional courses in hydraulic engineering.

The operation of a general farm combines work in agronomy, in livestock, and in agricultural engineering. Many of our farms have farm shops in which much of the machinery repair work of the farm is done by the farmer and his helpers. They should not be required to take the number of professional engineering courses needed to fit them for this work. They will have to do the work whether or not they have had training. As a matter of fact, some of our best developments in farm machinery have come from shops on farms. The modern farm of today is mechanized, and it is impossible to disassociate engineering from farming. It is not essential, however, that a farmer have a professional engineering degree. They need training in many of the skills that are involved and they need this training from men who understand agriculture and are close to the problems of agriculture. The men who teach these courses must be in constant touch with the other departments in agriculture.

In connection with our course for dairy manufacturing students in dairy plant mechanics, for example, some years ago we tried very hard to get a service course in refrigeration primarily for dairy manufacturing students. This work is done in the College of Engineering and it was impossible to arrange any such course. The only alternative was to take the courses that had to do with refrigeration that were given to the people who were training as professional engineers in refrigeration.

The teaching of applied courses should be done by people who do applied research. These people should be, and are, trained engineers, but if they are to be effective they must have close and organic contact with the phases of agriculture they seek to serve. We know it is impossible adequately to train agricultural students without these service courses. Also, we are convinced that it is highly impractical, if not impossible, to have these applied courses taught by people other than those who are interested in their application and know agriculture and are in close touch with the other departments in the field of agriculture.

3. Agricultural engineering in research and experimentation.

Plans have been made in consultation with the agricultural advisory boards for considerable expansion in the research program of the Agricultural Engineering Division. New or expanded research programs are contemplated in the following fields: (1) farm machinery, (2) irrigation and drainage, (3) farm structures, and (4) uses of electricity on the farm and in the home.

In each of these fields more or less coordination is desirable and necessary between the related programs of the Washington State Institute of Technology and the Division of Agricultural Engineering in the Experiment Stations. This can be done, and we think is being done, through good working relationships between administrators and workers in the Engineering Experiment Station, the Division of Industrial Research, the Agricultural Experiment Stations and the Division of Agricultural Engineering. Further coordination is provided for by the inclusion of the Director or his deputy of the Washington State Institute of Technology as a member of the Coordinating Committee for the Institute of Agricultural Sciences, and vice versa.

Coordination between the agricultural engineers and the engineers is necessary and desirable. In points of contact, and in numbers of contact, however, a more difficult problem is that of the close correlation of the work of the agricultural engineer with other phases of agriculture and with farmers.

The possibilities in farm machinery work, for example, include such things as the development of improved conservation equipment. Work on this has been requested by the Association of Soil Conservation District Supervisors, by the Grange, and by the Farm Bureau Federation. In this activity there should be cooperation among and between workers in Agricultural Engineering, Soils, Farm Crops, and perhaps Agricultural Economics Divisions of the Experiment Stations; operations and research divisions of the Soil Conservation Service, including personnel of the soil erosion experiment station; and the Crops, Soils and Agricultural Engineering sections of the Bureau of Plant Industry, Soils, and Agricultural Engineering of the United States Department of Agriculture. These groups should obtain the advice of farmers and organizations of farmers, such as those that initiated this request. Workers closely associated with agriculture and the applications of engineering to agriculture, such as those now in the Division of Agricultural Engineering, or those whom we plan to hire in that division, are better prepared because of their close alliance with agricultural work and farm people to work on problems of this type than they would be if they were more closely associated with "pure" engineering.

Again in the farm machinery field, agricultural engineering assistance is desirable in the development of farm equipment designed to do other farm jobs in a more satisfactory manner. Cranberry pickers; poultry house litter stirrers; poultry house cleaners; frost expellers; silage, hay, and grain feeding mechanisms; and many others are on the list. These improved farm tools to do specific jobs will be best developed in close cooperation with the Divisions of the Agricultural Experiment Stations having most to do with the phase of agriculture for which the machine is necessary. Much of this followup work can be done by research and extension workers other than agricultural engineers who would be more likely to be familiar with the work were it located in agriculture than if it were administered in engineering.

Machines designed to improve methods of doing experimental work also will require considerable engineering assistance. Small cutters and small threshing machines, fertilizer placement devices, transplanters, seeding machines, and the like, can be, and are being, developed further to improve experimental results in Soils, Farm Crops, Horticulture, Entomology, and other segments of the Agricultural Experiment Stations. Again, the relationships with other agricultural groups are more multitudinous and more important than are those with the engineering group.

Almost half of the state's farm income is at present produced within irrigation agriculture. With the addition of the Columbia Basin area this percentage will increase. Irrigation problems, such as the relationship between sprinkler and rill irrigation systems, water requirements, canal lining, and the like involve relationships with soils, crops, horticulture, and other agricultural sciences more than they do with hydraulics and engineering. They involve the application of engineering science to these agricultural uses.

In the farm structures field, the agricultural engineer will be, or should be, requesting more assistance from poultry, dairy and animal husbandmen, home economists, crops specialists, horticulturists, and agricultural economists and farmers than he will be from civil engineers. He is more likely to get proper cooperative relationships established with these groups if he is within the same organization than if he is not.

The work in electricity on the farm also involves more relationships with agricultural groups than with engineering groups. Close association and coordination of the agricultural engineering program is desirable and necessary with animal, dairy and poultry husbandry; with horticulture; crops, soils; agricultural economics; and other agricultural sciences groups and farmers if the best job is to be done. Again, this cooperation is more likely to be achieved if agricultural engineering is a part of the farm family than if it is not.

Farming and farm problems are becoming more complicated. Likewise the problems of the Agricultural Experiment Stations are becoming more involved. The farmer wants a complete answer to a general problem and not just an answer to a certain phase. The dairymen, for example, in the western part of the state are confronted with roughage problems. To get the complete solution, the dairy specialist needs to cooperate with chemists, physiologists, agronomists and soils specialists. The work of the Agricultural Experiment Stations needs to be fully coordinated and steps are being taken in that direction. The help of agricultural engineers is required in many problems. This can be accomplished best if the Division of Agricultural Engineering is a part of the Agricultural Experiment Stations.

The agricultural engineer is trained to do engineering work as applied to agriculture. If he is to do the most effective research work it must be with agricultural problems. Consequently, it follows that he cooperate with the other divisions in the Agricultural Experiment Stations. It seems obvious that this cooperation can be achieved best under administration by the Agricultural Experiment Stations.

Various federal funds are available for the support of agricultural research through grants-in-aid to the Agricultural Experiment Stations. Allocations from most of these funds properly can be made, and should be made, to the field of agricultural engineering. One of the most important regional projects under the provisions of the new Hope-Flannagan Act deals with farm structures research. Others have important agricultural engineering implications. The federal funds are made available specifically to Agricultural Experiment Stations. Presumably they would not be available to the Division of Industrial Research or to the Engineering Experiment Station if research work in agricultural engineering were to be administered there.

The Division of Agricultural Engineering, like most other agricultural sciences, focuses engineering science into its agricultural applications. This does not mean that there should be no provision for fundamental research in agricultural engineering, but it does recognize that the major emphasis will be placed on applications. In this regard, agricultural engineering is in the same position as are agronomy and plant pathology in relation to botany; soils in relation to geology; agricultural economics in relation to economics, etc. It should be said, however, that neither workers in these fields nor the Director of the Agricultural Experiment Stations would be content to say that important developments in addition to applications of known information have not been made by the applied workers.

Agricultural engineering should remain a division of the Agricultural Experiment Stations because (1) research in agricultural engineering will be a part of the solution of agricultural problems, (2) cooperation with other agricultural workers--experiment stations, college of agriculture, extension service and U.S.D.A.--and with farmers is easier than it would be if agricultural engineering research were administered elsewhere, (3) such contacts are essential in the translation of engineering principles into agricultural applications and more important than contacts with the engineers although such contacts less frequently and less multitudinous also are desirable and necessary, and (4) federal funds for support of agricultural engineering research are available to the Agricultural Experiment Stations.

4. Agricultural engineering in cooperative extension work in agriculture and home economics.

The extension service properly emphasizes the farm family approach in its educational work throughout all of the counties and communities in the state. Dr. Ralph Tyler of the University of Chicago in one of his addresses before the western states supervisors' conference restated this fundamental plan of extension work; namely, "...that the extension program is a unified effort developed from the viewpoint of the rural family." The Agricultural Extension Service, in cooperation with the College of Agriculture and the Agricultural Experiment Stations is attempting, with considerable success, to make the public and the people served aware of the principle of the farm family approach or the problem approach with all specialties or fields contributing to that end. Other governmental and state agencies giving service in agriculture have tended to obscure this important principle. The college should help to emphasize and implement this approach to the problems of our people with effective and complete coordination and cooperation of all phases that have a contribution to make.

We believe that the suggested change in administration of agricultural engineering would tend to confuse the minds of our rural people in the State of Washington. Work done by our county workers through community and county planning committees is rapidly being re-established following the war emergency years when immediate objectives were, of necessity, emphasized at the expense of long-time educational objectives. This county and community planning approach is fundamental in the development of people who are capable of participating in a democracy. This farm family and problem approach has been demonstrated to be the most effective way of enabling our rural people to meet their responsibilities and obtain their reasonable objectives. If this approach is to be used successfully by our county workers through county and community planning, our subject matter folks in agricultural engineering must work in closest cooperation with subject matter folks in other fields. This is true not only in extension, but also in teaching and research.

Close working cooperation, applied research, and the training of students in agricultural engineering work are essential to the work of our extension people in foods and nutrition, home furnishings, farm buildings, land clearing, farm management, animal husbandry, dairy husbandry, home management, and in fact all others. Farmers and other rural people do not want to go through more agencies to get information--they want to go through the already existing offices and services. The basic sciences and engineering should form the basis for applied agriculture, but these must be brought together and applied to our farm problems if they are to be effective.

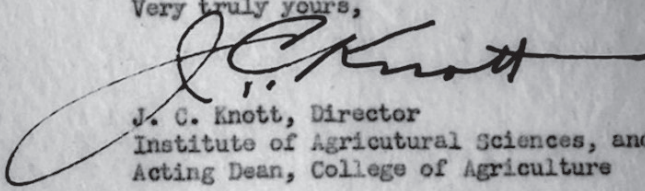
President Wilson Compton

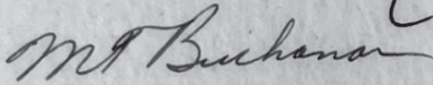
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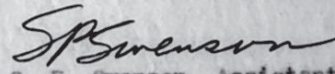
April 4, 1947

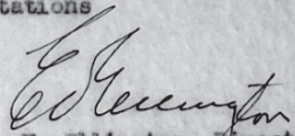
In the October 1946 issue of the journal AGRICULTURAL ENGINEERING, there appeared an article "Whither Agricultural Engineering Education". This article is by H. B. Walker, Professor of Agricultural Engineering and head of this division of the University of California. The entire article would be of interest to you but we are attaching some selected quotations from this article which seem to bear more particularly on the point in question.

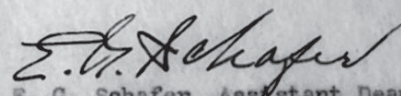
Very truly yours,


J. C. Knott, Director
Institute of Agricultural Sciences, and
Acting Dean, College of Agriculture


M. T. Buchanan, Vice-Director
Institute of Agricultural Sciences,
and Director, Agricultural Experiment
Stations


S. P. Swenson, Assistant Director
Agricultural Experiment Station


E. V. Ellington, Director
Agricultural Extension Service


E. G. Schafer, Assistant Dean
College of Agriculture

jck ba
Enclosures--4

cc--Dean R. D. Sloan
Dean J. Murray Lee

Appendix E

Agreement between Institutes of Technology and Agricultural Sciences Regarding Governance of Agricultural Engineering

E.H. Hopkins

I agree thoroughly with R.D.S. I think this has been a splendid arrangement and that we can adequately serve both fields only with such an arrangement. I don't think there has been any confusion on this for years although one who is not familiar with it might be somewhat confused. We have something that works. Let's not spoil it for the purpose of classification or simplification on paper. J.C.K.

COPY

October 10, 1947

Dr. William A. Pearl
Director, Washington State
Institute of Technology

Dear Sir:

It is my understanding that the status of the Department of Agricultural Engineering with reference to the Institute of Agricultural Sciences, the College of Agriculture, the Institute of Technology, and the College of Engineering is being discussed. I would like to submit the following comments with reference to this matter.

Yes. J.C.K.	1. The curriculum offered by this Department in Agricultural Engineering should be considered within the College of Engineering and under that college as far as the approval of the schedule of studies, course content and teaching faculty is concerned. Furthermore, the members of the departmental staff who teach courses in this curriculum should be considered members of the College of Engineering Faculty and so shown in the catalog.	Yes E.H.H.
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Yes J.C.K.	2. The curriculum in Farm Mechanics (formerly called Farm Engineering) should continue to be listed only under the College of Agriculture and graduates in this course continue to receive the B.S. in Agr. degree.	Yes E.H.H.
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3. For budget matters and general administration, the department should continue in the College of Agriculture. This is more or less traditional and the research activities of the Department are closely connected with those of the Agricultural Experiment Station. Under this arrangement, the Department would certainly be

Appendix F

President Compton's Approval of Agricultural Engineering Governance Agreement

November 1, 1947

E. G. S. ✓ Ag Eng.
MTB ✓
SPB ✓ Swell!
JCK
T

✓ Dr. J. C. Knott
Dean C. C. Todd
Dr. S. T. Stephenson
C a m p u s

Gentlemen:

In response to my letter to you jointly on October 3rd with respect to the position of the Department of Agricultural Engineering and relation to the Institute of Agricultural Sciences, the College of Agriculture and the Washington State Institute of Technology, I have received copy of a letter under date of October 10 to Dr. Pearl from Dean Sloan of which copy is attached. The notations attached to this copy indicate the concurrence of those to whom the original inquiry was directed.

I therefore approve of the provision outlined in the enclosed copy and have asked the Vice President to arrange to have ~~these~~ *published* and other appropriate provision, for the information of the faculty and staff.

Yours sincerely,

Wilson Compton
Wilson Compton

WC:lj

cc: E. H. Hopkins
June Roberts

