In the 1958 annual meeting of AALGCSU, Dr. Burton W. DeVeau of Ohio University and charter member of NACTA, was invited to speak on the topic "A Look at the Land-Grant Agriculture Colleges by a Non-Land-Grant State University Member." At later liaison meetings the following topics have been discussed:

Transfer and substitution of credits
General agriculture
Relationship of extension to NACTA schools
Improving communications with experimental personnel for advancing data
Using NACTA facilities for cooperative experiments
Problems of recognition and stigmas of "accreditation"
Increased emphasis on science and business in agricultural curricula
Survey of curriculum patterns
How to continue liaison

As a result of these meetings, each association has invited the other to send delegates to regional and national meetings.

It was my privilege to attend the Southern Regional meeting of deans of resident instruction as a NACTA delegate last year. At this meeting the problem of good teaching was a major topic. In discussing this, one of the deans pointed out the need to approach the solution from the standpoint of agriculture and not separate subject-matter groups. He lamented the splintering that has taken place and referred to the need for an overall organization. This need has been expressed by many others. You will, no doubt, hear it expressed again in this symposium.

As we look to the future, it seems imperative that all of us cast aside our littleness and prejudices and cooperate in establishing a unified, comprehensive organization for higher education in agriculture. CEANAR has informally discussed this need for a continuing overall organization for agriculture.

Duane Acker, chairman of RICOP and a member of NACTA, said in a recent letter to RICOP members, "I would compliment them (NACTA) sincerely for opening their doors and making their structure available to those of us in land-grant colleges so that perhaps one organization might serve a master role on behalf of instruction in all colleges of agriculture."

The various disciplines do include teaching sections in their professional societies, but we believe there is still a need for one inclusive organization dedicated to the improvement of college teaching to which all disciplines can contribute.

NACTA encourages membership in professional societies and welcomes their assistance. We would especially welcome articles suitable for undergraduate instruction for publication in the NACTA Journal. In turn, the editor of the NACTA Journal is interested in listing a bibliography of articles published in the journals of professional societies relating to agricultural instruction.

Through the Liaison Committee, NACTA has been working on the revision of its constitution and by-laws so that NACTA will become a more suitable organ for all agriculture teaching. We believe that NACTA is plastic enough that it can be molded to this purpose.

Any organization seeking to further the teaching of agriculture will need to serve many special needs, including those of administrators and faculty, public and private schools, and large and small schools. Many professional organizations do provide for variations of interest within their group. For example, at national and regional meetings specialized meetings are held in addition to general sessions.

We urge the Liaison Committee to continue to work toward the goal of a national agriculture organization for college teaching. We are committed to this effort. We do not insist that the organization be NACTA; we would welcome any movement toward this end.

The need for improvement in our profession is obvious. *Time* magazine, May 6, 1966, reports on the state of college education, quoting a number of educators. President Landrum Booling of Earlham College says, "It's a myth that once a man gets a Ph.D., he's a good teacher." Clark Kerr deplores the fact that "nothing is being done" to train teachers. Danforth Foundation's Merrimon Cuninggim states that "the teaching profession is the only profession that has no definition for malpractice." Abraham Kaplan, University of Michigan, says, "Students are not getting the best minds." *Time* concludes, "probably there will always be many dull timesavers for every man with a calling. But such inspired men — found, rewarded and planted firmly in the classroom — can and undoubtedly will give U. S. colleges a new luster built on the mysterious moments when mind confronts mind and a student suddenly senses the power and richness of his own intellect."

We cannot decide whether there shall be land-grant and non-land-grant colleges. They are a reality. We can decide whether we shall work together to improve instruction in agriculture. I believe that agriculture teachers can lead the way for all teachers in creating a truly professional corps. Frequently we hear it said by one of the professions, "If we don't improve practices and set standards, then it will be done for us." I have no fear of this. My fear is that if we do not do the job, it won't be done.

PANEL DISCUSSIONS
ANIMAL SCIENCE

J. E. OLDFIELD
Professor of Animal Nutrition, Oregon State University;
President, American Society of Animal Science

In common with other types of agriculture, the business of animal production is experiencing a type of industrial revolution. Production units are becoming larger — cattle feedlots housing up to 5,000 animals are not uncommon, and the trend in the swine industry is to have confinement units marketing 3,000 to 10,000 animals annually. In some cases, swiftly advancing technology has forced changes from traditional patterns of livestock feeding and management. For example, use of low-roughage rations for finishing beef cattle has been hastened by the development of the pickersheller in the midwest. Moreover, retrieval of data on various phases of animal production and their interpretation by computer methods has resulted in a more quantitative approach in the animal industries.

It is both desirable and logical that animal science, the discipline in which undergraduate training for the animal industries is provided, should recognize or anticipate these changes in its study programs. This trend has been evidenced for several years by the metamorphosis of departments of animal husbandry into departments of animal

science, which implies an approach based on scientifically gathered facts.

In addition, developments in the areas of research, particularly in the biological sciences, have had a marked effect on animal science teaching. Examples are the elucidation of the genetic code and radiotracer methodology to explain the processes of animal metabolism.

Changes in the animal science curriculum, some subtle and some overt, attest to this "new look" at its subject matter. Course programs in animal science have frequently been assembled into options of area specialization oriented towards the training of students for careers in research, in the business aspects of animal industry, or in production technology. Such options, established in recognition of the need for some specialization in the diverse areas of animal science training, are now offered by many colleges and universities.

Within these areas of specialization, courses have generally reflected increasing quantitation. While this has been most noticeable in the "science" option, it has occurred to some extent in the other two. Grounding in the physical sciences and mathematics has, in general, become more thorough, and increased emphasis is placed on the statistical treatment of data. These changes are applicable to agriculture as a whole. A more specific example in the animal science area is provided by instruction in livestock evaluation. For many years, this area was served by courses in livestock judging which were purely subjective "eyeball appraisals" of animals on the hoof. The modern tendency is to make such instruction more meaningful by exposing the student to quantitative production data and allowing him to correlate these with animal appearance. Accumulation of dairy herd production data and the staging of meat-animal "carcass contests" have been most useful in providing the necessary factual information.

More subtle changes lie in the methods of obtaining the data used as a basis for undergraduate teaching in the animal sciences. Students are taught to assess the nutritional status of animals by blood analysis and liver biopsy, and to assess the production status of meat animals by using such instruments as the "sonarscope" and "lean-meter." They are shown how to prepare and operate artifical rumen apparatus and thus throw the light of scientific inquiry on what we used to call the "darkest spot on earth." They are familiarized with indirect means of estimating biological phenomena by description and sometimes demonstration of the dilution technique with radioactive isotopes and indicator methods in digestion studies with range animals. All of these items, and others like them, are useful in providing facts upon which animal science instruction for future application can be based.

The American Society of Animal Science recognizes its responsibility in education, as it does in the allied area of animal research. Almost from its inception, nearly 60 years ago, it has maintained a Standing Committee on Teaching, which has had the primary responsibility for organizing a section on resident instruction for the animal meeting program. The ASAS also has four sectional groups each of which schedules an extensive annual program. Recently, these, too, have held teaching symposia. During the current year, for example, the Midwestern Section held such a session at their meeting in Chicago, and the North Atlantic Section has planned a symposium on "Teaching Innovations" for its meeting in Ithaca. The latter symposium will highlight ways in which animal science teachers are recognizing and illustrating recent developments in biology in their classes. Meanwhile, the teaching committee of the national Society has been working for several months on program planning for a 2-day symposium at its meeting in Reno next summer on the general theme of "Utilization of Resources in Education of Animal Scientists." This meeting is to be co-sponsored by the Commission on Education in Agriculture and Natural Resources (CEANAR) of the National Academy of Sciences — National Research Council. It will include sessions on specific aspects of the educational process, including "New Dimensions and Goals in Courses and Curricula:," "The Student-Teacher Interface," and "Theory and Practice in Educational Technology."

The Society is serving the cause of undergraduate education through other means. These consist of communicating with and recognizing students at the undergraduate level. In the belief that the choice of a discipline, and perhaps of an area of emphasis within that discipline, is at once vexing and of crucial importance to most students, the Society has attempted to provide reliable information as an aid to making the choice. Through a specially appointed committee, a career brochure has been assembled. This publication contains up-to-date information on colleges and universities offering animal science training and their general requirements; it includes a description of the industry served and its particular educational demands. Information for this latter part was received from various segments of the industry, which have been generous with both advice and financial support. Single copies of this publication are supplied free, on request, to bona fide high school counsellors and to others concerned with directing young people into academic programs. Bulk copies are sold at a moderate price.

The Society has recognized the desirability of communicating with the undergraduate animal science student as early in his career as possible about scientific developments in his field. To this end, through the cooperation of the Block and Bridle Club, a national organization that has been influential in stimulating interest in animal husbandry, an affiliate membership in the ASAS has been established. Student club memberships in the Society are encouraged and students are brought, earlier than previously, into contact with original research in their field, through the *Journal of Animal Science.*

The Society has also attempted to recognize excellence of performance in undergraduate animal science study. Such recognition takes the form of undergraduate scholarship awards and certificates. Recipients are selected by instructional staffs of animal science departments in participating institutions.

The American Society of Animal Science has devoted some of its efforts to the other half of the instructional team — the teacher. Through its Distinguished Teacher Award, the Society recognizes ingenuity, versatility, innovation, and overall effectiveness of teaching performance, and provides an inspiration to the profession at large.

DAIRY SCIENCE

F. E. NELSON

Professor, Dairy and Food Technology, University of Arizona; Immediate Past President, American Dairy Science Association

On behalf of Professor Raymond Albrectsen, the current President, I extend the greetings of the American Dairy Science Association. We appreciate the invitation to participate in this panel and benefit from the exchange of ideas.

Although the program is long, I must confess to some surprise at the omission of such fields as food science and technology and of sciences such as chemistry and microbiology. These are of great and increasing importance in agriculture.

WILDLIFE

JOHN E. WOOD
Associate Professor of Wildlife Science,
New Mexico State University
(representing the Wildlife Society)

The field of wildlife management is one of the younger academic fields to be discussed in this symposium. It had its academic birth in the late 1920's, but it was not until the mid-1930's, with the inception of the Cooperative Wildlife Research Units in 12 land-grant colleges across the country, that wildlife management was generally accepted as an academic area for specific study. At this time, there was no base plan upon which to build, and the wildlife management training was at the Master of Science level following a Bachelor of Science degree in agriculture, forestry, or biology. As undergraduate training in wildlife developed, the colleges leaned heavily upon the curricula that earlier were accepted as the proper background for graduate study in wildlife management. This resulted in the creation of two trends in undergraduate training. One followed the more basic biological approach to replace the Bachelor of Science degree in biology, and the other followed the more applied approach of resource management to replace the B.S. degree in agriculture or forestry. These two trends are quite evident today in the undergraduate curricula of the some 60 colleges and universities offering the B.S. degree in wildlife.

There have been changes in the curricula and changes in the emphasis in both the basic and the applied approach to undergraduate training. Both have moved to a more scientific approach by adding courses such as population dynamics and statistics and thinking in terms of producing "scientists" rather than "managers." This is evident in the current trend to change the name of the curriculum area, the department, and the degree from the older name of "wildlife management" to "wildlife science" or "wildlife biology." Another trend in both the basic and the applied approach is a movement away from the influences of plant ecology that dominated the earlier philosophies of wildlife. The trend today reflects the advances made in animal ecology and particularly in the branches of population ecology and animal behavior. This results in an emphasis upon the population as a management unit, and a move from the earlier concept of the habitat as the management unit.

Within the colleges and universities adhering to the basic or biological approach, the trend is to minimize the course requirement in the applied areas. The curriculum varies little from what would be required to earn a degree in vertebrate zoology or ecology. The emphasis is almost exclusively biological. The graduate is well versed in the use of the tools of the biologist and has a solid background for moving into the research areas.

The colleges and universities leaning to the applied approach do not ignore the biological principles underlying wildlife management. They, as do the basic schools, require a good background in the biological sciences, and the graduate is not handicapped in moving into the area of research or into graduate studies. Schools with the applied approach *differ from* those with the basic in that they replace some of the (pure) biology courses with applied courses in wildlife management that emphasize the problems in resource management and the relationship of wildlife to land use. The graduates have a broader outlook in resource management and a clearer understanding of the problems that they will have to cope with in the jobs available through most resource management agencies.

In the schools with the basic approach, there has never been the tendency to stress the game species over the non-game, but in the schools with the applied approach, little concern was formerly given to the non-game species of wildlife. In recent years, the trend in the applied schools has changed in response to the demands of the outdoor recreationist and the increasing public awareness and interest in all forms of our wildlife resources. These changes represent a trend towards broadening the philosophies of wildlife training to include all forms of recreational use of wildlife and to give more emphasis to the multiple-use concept of land management. This trend is accomplished, generally, by a change in emphasis in the existing courses, rather than through addition of new courses in an already crowded curriculum.

A final trend that can be cited — one that is common in the wildlife areas — is an increasing demand for more graduates in the wildlife field. New wildlife curricula are being initiated in colleges and universities across the country. Many of these curricula are offered in existing college departments, and many of the older established wildlife curricula are administered by foster departments. Though this may provide the essentials for the B.S. degree and the demand for wildlife training by both students and employers, it tends to inhibit the professional growth and development of the area on the campus. It tends, also, to minimize to the student, the administrators, and the public, the significance of the importance of wildlife science as a separate academic and professional field.

The trends in all academic areas change with advances in technology and with the demands that are put on the profession. Occasionally there must even be painful changes in the basic philosophies as new uses and demands for the services of our graduates arise. In the wildlife area, as in most agricultural areas, new emphasis must be considered to cope with the ever-developing pressures. In this area, the professional socities can perform a great service to both the profession and the universities.

The Wildlife Society in its effort to promote the undergraduate education has undertaken several activities. It has set minimum standards for schools to follow in setting up curricula leading to the Bachelor of Science degree in wildlife. These minimum recommendations deal only with the major area of wildlife and the supporting area of the natural and physical sciences; they do not attempt to compete with the college curricula planning committee in all the breadth of undergraduate training.

The Wildlife Society aids the student by providing a special student membership based on the cost of the professional journal and special monographs provided each year, and it encourages and supports student chapters on the college campuses. It annually supports both eastern and western student conclaves where students visit the campuses of other wildlife schools and observe the practices and problems of areas different from their own. Some of the state chapters and regional sections of the Society assist the students in attending conclaves by providing travel funds.

The Society has a professional standards committee that is working with both the professional field and the academic institutions.

The Society publishes and distributes a brochure on wildlife management as a profession, which assists the universities in explaining the wildlife profession and assists in the recruitment of students.

Through its executive secretary and the Wildlife Society News, the Society notifies all student members of job openings as they occur anywhere in the world.

The Wildlife Society has written and published a techniques manual that is regularly revised and has been adopt-

ed as a standard text in most undergraduate curricula. It has also co-sponsored the publication of a manual on technical writing that is available for undergraduate use.

The office of the executive secretary has surveyed the schools offering wildlife degrees and has published, in the Society News, statistics that are useful to the universities and their students.

For the future, the Wildlife Society is considering, among other things, the possibility of becoming involved in a student scholarship program and is also considering the possibility of establishing a pool of visiting lecturers for universities to use.

ENTOMOLOGY

HOWELL V. DALY

Associate Professor of Entomology, University of California, Berkeley; Member, Committee on Education, the Entomological Society of America

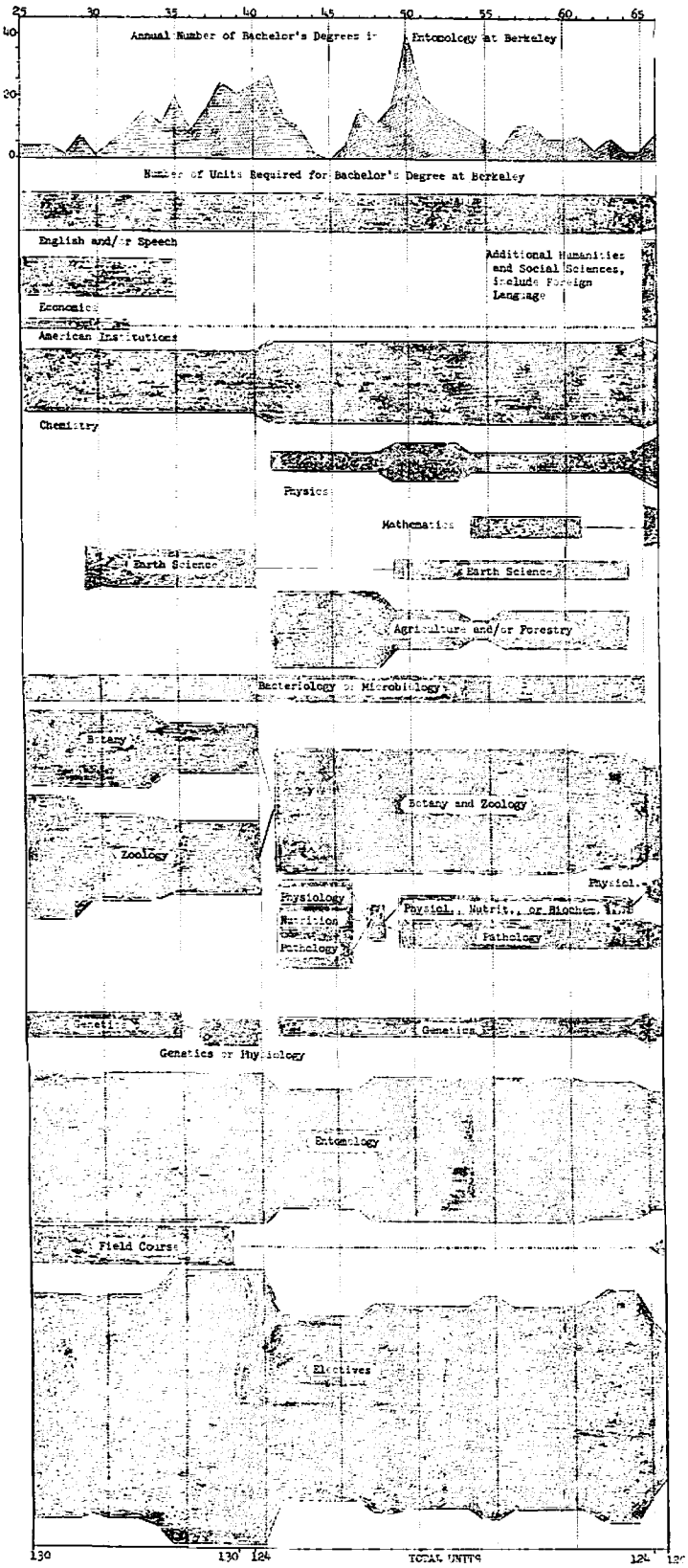
This is an especially appropriate time to discuss trends in undergraduate education in entomology. Many important changes are taking place. What I will say is largely based on my experiences in the state of California. Although the situation there is not fully representative of the nation as a whole, it remains true that more entomologists are trained and employed in California than in any other state. Furthermore, California is the leader in producing the professional entomologists who later become responsible for teaching programs in other states.[1] The curricula they develop will reflect to some extent the kind of educational environment they had as students. I would like to divide my presentation into three parts, dealing first with the large land-grant universities, then the state colleges, and finally the educational activities of the Entomological Society of America.

The older, well-established departments of entomology have grown with the original land-grant institutions. It is both unfortunate and ironic that these distinguished faculties benefit so few undergraduates. The outstanding factors and influences which are bringing about the trend to fewer undergraduate students may be summarized as follows: First, it is becoming increasingly difficult to provide a single bachelor's degree program which is adequate for immediate professional employment and also adequate as preparation for advanced degrees. Second, undergraduate enrollment in entomology has declined, partly as a result of the general status in agricultural enrollments and partly because a major in biology or zoology is often encouraged as a preparation for advanced work in entomology. On a large campus with many science courses available, fewer students enroll in entomology as an elective. Third, entomology is one of the classic fields of the biological sciences. As such, it is oriented along taxonomic lines in the same manner as classical botany or zoology. A major reorganization of the biological sciences along functional lines is now in progress and has reached a revolutionary magnitude. Undergraduate training in the biological sciences has also been reoriented toward the study of processes common to all living things together with a stronger background in the physical sciences.

The net result is that the traditional entomology departments have fewer undergraduate majors and have placed the emphasis in their programs on preparation for graduate work. The curricula have been modified to more nearly correspond to the training in modern biology, and the courses in entomology emphasize fundamental rather than applied aspects. To examine this situation in detail, I have attached a graph showing the number of degrees awarded at Berkeley since 1925. As you can see, the number of majors has dwindled and we do not anticipate a marked increase. This illustration also shows the changes in the undergraduate requirements over the same 41-year period. Certain subjects have always been required in about the same number of units (English or speech, genetics, bacteriology, botany and zoology, chemistry, and courses in the major field.) Early requirements in economics (primarily agricultural economics), the earth sciences, and agricultural subjects have been abolished over the years. In 1941, certain areas of biology were specified such as physiology, nutrition, and pathology. This has persisted and has been incorporated in our present major. The changes which are most noteworthy are the recent expansions of requirements in physics, mathematics or statistics, and in the humanities and social sciences, including a foreign language. Although these expansions were made largely at the expense of the general electives, each student is permitted greater freedom to choose courses in satisfaction of the requirements.

We feel our present curriculum especially remedies a need for more training in the physical sciences and mathematics and provides flexibility. This need was underscored by the responses we have received to a questionnaire which was sent to our alumni. One question asked what courses did the alumnus wish he had taken as an undergraduate. Out of all possible courses, six or more indicated the following: statistics (36), biochemistry (24), mathematics (21), calculus (14), organic chemistry and physics (each 8, and philosophy (6). Considering the decline in numbers of undergraduate majors and the increasing similarity of the program to that in biology, we asked if they favored abolishing the major in entomology in favor of a broad biology major. The majority of the alumni who had taken their undergraduate work at Berkeley voted no; the majority of those who had not received their bachelor's at Berkeley voted yes. The faculty also voted to retain the entomology major as one of several routes to an education in the biological sciences.

Turning now to the state colleges in California, the situation is refreshingly different. At least one course in entomology is taught in each of the 14 larger state colleges. Some junior colleges also offer courses. The state colleges at Long Beach and at San Jose each have several entomologists on their faculties and each offers more than a dozen courses. Although the graduates are awarded a degree in biology, they select entomology for emphasis and receive sufficient training to become employed as entomologists. We can look then to the state colleges to provide a terminal bachelor's degree. The largest program is being given at San Jose State. About 30 students are now enrolled as biology majors with emphasis in entomology. A considerably larger number of students take courses in entomology. Two of their elementary courses are listed among the courses which satisfy the general college requirements in science. With fewer science courses competing for the students, entomology courses have become very popular and enrollments run as high as 80 to 100 per semester. Since insects provide excellent material for the demonstration of living processes in the classroom, biology majors find the courses useful as preparation for teaching. Other students are attracted because insects play an important role in man's relation to nature. Possibly one of the most significant factors in building a popular program has been the activities of the Entomology Club at San Jose. All students enrolled in the courses, regardless of major, are invited to become members. The social contacts as well as the opportunity to continue their interest in entomology have stimulated students to remain active members long after the courses are over. At a typical meeting one can expect to see students drawn from all parts of the campus. Little doubt can exist that the members further advertise the courses to their friends and that the club helps to recruit students to choose entomology as a career.



Finally, the Entomological Society of America has a long history of interest in the education and recruitment of entomologists. Current activities can be summarized by briefly describing the duties of the following committees:

Standing committee on professional training, standards, and status. Six members charged with a wide variety of tasks. Those concerned with education include among their interests the possible accreditation of institutions offering programs in entomology and the definition and educational standards of entomology as a profession.

Special committee on Biological Curriculum Study. Three members who review and comment on the commercial editions of the Biological Sciences Curriculum Study Textbooks for high school biology.

Special committee on use of insects in biological teaching. Seven members who will prepare a pamphlet giving teachers basic information about insects and who will later distribute a series of publications describing laboratory exercises using insects.

Special committee on Youth Science Program Development. Five members who coordinate efforts to stimulate youth interest in all aspects of entomology through appropriate channels. Includes activities with Boy Scouts of America and 4-H clubs.

Special committee on Education. Three members, including myself, who are charged with the task of producing a directory of undergraduate and graduate schools in entomology.

In addition to these committees, we have a representative on the Governing Board of the American Institute of Biological Sciences (AIBS). At nearly every annual convention of the society, one afternoon is devoted to the subsection on teaching. The regional meetings of the society also include symposia on local problems in teaching. Some of these contributions are published in the proceedings of the respective regions or in the *Bulletin of the Entomological Society of America.*

EXPLANATION OF FIGURES

The illustrations are divided into two sections to show trends in undergraduate education in entomology at the University of California, Berkeley. At the top of the figure is an irregular graph depicting the annual number of bachelor's degrees awarded from 1925 to 1966. The rest of the figure is devoted to a graphic illustration of trends in the requirements for the bachelor's degree from 1925 to 1966. The widths of the horizontal bands represent the number of units required in each of the subjects.

1. The Department of Entomology and Parasitology at Berkeley, in 1966, was ranked first among all departments of entomology by the American Council on Education. Major graduate programs in entomology are also offered on the Davis and Riverside campuses.

AGRONOMY

A. W. BURGER

Professor of Crop Production, University of Illinois
(representing the American Society of Agronomy)

Perhaps the most efficient way to treat the subject "Trends in Undergraduate Education in Agronomy" is to make a listing of items based on (a) responses from more than 30 department heads of agronomy, (b) responses from colleagues in crop science teaching, and (c) my own views:

1. There is increasing emphasis on teaching principles and concepts as contrasted to mere facts.
2. There is increased emphasis on the international dimension, e.g., the role of agronomy in feeding world populations today and tomorrow. There is some orientation of teaching programs to fit international agronomy demands.
3. There is a shift in teaching from the practical to more theoretical and technical.
4. At some institutions there appears to be a tendency toward disappearance of sharp boundaries between agronomy and horticulture. Thus, "plant science" courses have appeared at a few colleges in lieu of a course in each department, agronomy and horticulture. This shift has had successes and failures.
5. There is a change in relations of land-grant colleges and many state and junior colleges. The state and junior colleges tend to emphasize applied aspects. and land-grant colleges emphasize basic, theoretical, and technical agronomy.
6. There is better preparation in high schools for course work at the university level.
7. There is a trend to require fewer courses in agronomy and more emphasis on the physical and biological sciences. This has caused course consolidation and less course proliferation.
8. There is increased use of scientific equipment to solve real problems by individuals and small teams of students.
9. There is more teaching by men who must rely on a formal education, rather than experience, for a knowledge of farming.
10. There is an increasing number of nonagricultural students in agronomy courses.
11. Although just beginning, there is increased use, with a high degree of success, of self instruction. Improvement in instruction is slanted toward improved student learning rather than improvement in teaching.
12. There is increasing concern that special consideration need be given to terminal BSA students and not just to advanced degree students.
13. There is increase in use of visual aids, e.g., single concept films, video tapes, overhead projections, slides, tape recorders, etc.
14. There is increased emphasis on extracurricular activities, e.g., essay, speech, soil judging, and crops judging contests.

What is the American Society of Agronomy doing to promote improvement in undergraduate education?

1. The Resident Education Division (A-1) of the American Society of Agronomy, composed of ASA members interested in resident education and student affairs, meets annually to:
   (a) Develop and disseminate information on teaching and curriculum improvement, e.g., compilation of lists of references for high school and college reading.
   (b) Promote the exchange of ideas among teachers in agronomy courses, e.g., compilation of sourcebooks of laboratory exercises in crop and soil science.
   (c) Sponsor the Student Activities subdivision, which has as its objectives:
      * To stimulate interest in agronomic work among college or university students, e.g., through speech and essay contests and competition in soils, crops, hay, and silage judging.
      * To foster a spirit of cooperation and mutual helpfulness among agronomy students, e.g., committee activities in the national organization.
      * To provide leadership opportunities and training, e.g., officers and committee chairmen in the national organization.
      * To provide an opportunity for wider acquaintance with agronomic workers and activities of other divisions of the American Society of Agronomy, e.g., attend annual meetings and provide visitation for any segment of the program of the American Society of Agronomy.
      * To correlate activities in agronomy with those in closely related fields of endeavor; e.g., speakers from horticulture, forestry, and other disciplines are invited to agronomy programs.
2. The Teaching Improvement Committee (of A-1) strives to:
   (a) Continuously seek and review ideas and techniques in improved teaching methodology for improved instruction in agronomy-related subject matter.
   (b) Carefully evaluate information relating to objective (a) and effectively present results of this committee's studies, when appropriate, to Division A-1.
3. The Crop Science Society of America Teaching Improvement Committee has as its purpose:
   (a) To make studies of crop science teaching on a continued basis.
   (b) To identify means of improvement of crop science teaching.
   (c) To help maintain crop science teaching excellence consistent with the highest standards attainable from all the resources (both personnel and equipment) within the crop science world.

   This committee had its first semiannual meeting in Washington, D.C., March 22 to 24, 1967, for the specific purpose of nominating writing teams for the objective of completing a series of compilations on "Foundations of Modern Crop Science" for undergraduate crop science readers. This writing effort is to be accompanied by work with instructional resources personnel for the purpose of coordination of modern visual aids media and techniques in order that the teaching of crop science using the written materials may proceed efficiently.
4. The American Society of Agronomy Agronomic Education Committee, composed of members from government, industry, and universities, has the following four functions,
   (a) To maintain a continuing evaluation of the manpower training needs for the present and future, in relation to present accomplishments, as to numbers, type, and quality of such training, e.g., Committee on Employment of Agronomists.
   (b) To work closely with other committees of the associated societies to maximize benefits in the field of education.
   (c) To maintain liaison with other agencies concerned with scientific and professional training, including the Association of Land-Grant Colleges and Universities, the U. S. Office of Education, the Commission on Education in Agriculture and Natural Resources of the National Academy of Sciences-National Research Council, and other organizations dealing with scientific manpower problems.
   (d) To prepare status reports for presentation to organizations and institutions concerned with

education in agriculture and for presentation to other organizations, agencies, and institutions that should be interested in utilizing trained agronomists and soil scientists.

5. The *Committee on Training of Soil Scientists* of the Soil Science Society of America certifies baccalaureate graduates who have completed a prescribed minimum program of courses.
6. *Agronomy News*, a publication of the American Society of Agronomy, devotes, regularly, a section to agronomic education, which reflects teaching activities and student preparation in agronomy.
7. The *Agronomic Administrators Roundtable*, an administrative group of the associated societies in agronomy, considered the problem "Recruitment of High Quality Students" at their last annual meeting at Stillwater, Oklahoma, in August 1966.
8. The *Agronomic Education Award*, $200 in cash, is awarded by the American Society of Agronomy annually to a teacher for effective and stimulating instruction and counseling in agronomy.
9. Selected members of the associated societies in agronomy travel to non-land-grant colleges and universities for presentation of seminars and classroom lectures, and for staff consultation (the visiting scientist program sponsored by the National Science Foundation).
10. The *Agronomic Science Foundation* is being established to administer funds for activities such as providing scholarships, sponsoring achievement awards, sponsoring group science studies by teachers or students, sponsoring seminars and conferences on science and education, awarding travel grants, sponsoring printing and distribution of publications, and supporting visiting science programs.

HORTICULTURE

E. E. BURNS
Associate Professor of Horticulture, Horticulture Section, Department of Soil and Crop Sciences, Texas A & M University
(representing the American Society for Horticultural Science)

Horticulture is a broad, yet intensive, area which includes a major portion of those things which make human life healthy and pleasant. On a per-pound basis alone, fruits and vegetables are the major item in our diets. Esthetically, the plantings of our homes, parks, and highways create a pleasant environment. Horticulture is the most intensive type of agriculture. As the effective land area for production shrinks and civilization moves into a more crowded environment, horticultural principles will doubtless be extended throughout society.

MAJOR TRENDS IN EDUCATION

The classical education in horticulture was concerned to a great extent with the manual art and artistic approach to growing fruits, vegetables, nuts, flowers, and ornamentals. Skills were highly important. Manual labor was an important and integral part of the profession. Changes in the past 25 years, however, in the areas of entomology, pathology, soils, water, physiology, marketing, merchandising, and even attitudes of labor, have reduced the importance of manual skills in the training of horticulturists. An informed horticulturist today must be dynamic and base decisions upon sound training in the basic and applied areas of biology, chemistry, physics, and the social sciences.

The recent trends in curricular design have been towards eliminating a profusion of horticultural electives and increasing the level of basic area sciences. Courses in the production methods for particular groups of horticultural crops have been combined. In some institutions this has included agronomic crops as well. Courses in systematic horticulture are practically extinct. Some institutions have even eliminated "horticulture" as a degree-earning area and have instituted "plant science." The more moderate approach recognizes the unique character of horticultural science and maintains this as a distinct area which can be serviced by appropriate and well-designed upperclass electives in the student program. Emphasis on the intimate knowledge and skills necessary to grow horticultural plants is maintained.

SOCIETY ACTIVITIES IN EDUCATION

An unbelievable amount of soul-searching has gone on within the American Society for Horticultural Science in the last 10 years. Symposia have been held at the annual meetings. Regional and national conferences have been held. A standing Committee on Education has been structured with membership on the Board of Directors, and a section of the annual meeting program has been designated for consideration of education in horticulture. Undergraduate students have been involved by the creation of collegiate branches of the ASHS at the regional and national levels. They are encouraged to present original papers, and a section of the annual program is set aside for them. Scholarly presentations are recognized with plaques, certificates, and prizes.

Education of the professional horticulturist is under scrutiny and is being modified in keeping with the needs of society.

PLANT PATHOLOGY

IRA W. DEEP
Associate Professor of Plant Pathology, Oregon State University[1]
(representing the American Phytopathological Society)

In a recent issue of *BioScience*, Dr. Kenneth V. Thimann asks why plant pathology is so often centered on the parasite and its life cycle when it is the host-parasite relationship (or perhaps the infected plant) that is the biological unit.[2]

This same question was asked by Dr. George McNew in a symposium on the teaching of plant pathology in 1950. Dr. McNew outlined a course based on the diseased plant rather than the pathogen, and he presented a logical rationale for this organization. The McNew "disease types system" has had an impact on plant pathology teaching but primarily at the graduate rather than the undergraduate level. It appears that most teachers who experimented with this system in the general course have returned to the pathogens orientation. The reasons for this seem to be at least two-fold. In spite of the strength of philosophical arguments, present knowledge of physiology of the diseased plant is too fragmentary to be used as the center of focus in a general course. It also seems that students are more knowledgeable about general phases of host physiology than about pathogenic agents. Widely different pathogens may cause essentially the same disease from the standpoint of influence on host physiology. The student readily understands this, but in considering details of the host-parasite

interactions, he is confused by the large number of terms used in describing the different kinds of pathogens.

Although general plant pathology courses still tend to have a pathogens orientation, it is unfair to say that courses have not changed. For example, more attention will be given today to the probable role of pectolytic enzymes in soft rot and vascular wilt diseases, the influence of phytoalexins on host resistance, and the physiological differences between normal and tumor tissue. Although no sweeping reorganization seems apparent, information available through recent research is being incorporated into courses.

Correspondence with a number of plant pathologists who are concerned with undergraduate education generated the following suggestions:

1. The main trend has been the use of the experimental approach in the laboratory stemming primarily from the Sourcebook. Laboratory experiments tend to emphasize quantitative rather than mere qualitative measurements.

2. More fresh materials, from greenhouse and field, are being used. Dry mounts and pickled specimens are fast disappearing. There is greater use of slides and films.

3. Attempts are being made to develop slide series and audio-visual tapes which might adapt certain phases of the course to the individual interests of the students. For example, floriculturists and agronomists might study diseases of different plants, through concerned with the same basic disease cycles.

4. I cannot say that there is a trend toward teaching principles rather than diseases *per se*. Rightly or wrongly, the idea persists that one cannot formulate principles until one has a large number of facts on which to base them.

5. There appears to be a trend toward development of an undergraduate pesticides or plant protection curriculum incorporating training in plant pathology, entomology and chemistry.

6. Some of the especially active areas of research in plant pathology today are virology, soil microbiology, and physiology of parasitism.

The American Phytopathological Society has long been concerned with improvement of undergraduate education. Some of the programs in which the Society has been involved are listed below:

CONFERENCES

The Teaching Committee has stimulated proposals to NSF for funds to support conferences at which college teachers would seek to improve their competence in plant pathology. Examples are the conferences held at Rutgers in 1963 (directed by Dr. Benjamin H. Davis) and at South Dakota State in 1965 (directed by Dr. C. M. Nagel). These conferences have been designed for teachers of biology, botany, horticulture, agronomy, etc., who have not been able to keep up with recent developments in plant pathology. Tentative plans have been made to develop a conference for plant pathologists who are teaching the beginning course.

SHORT COURSES

In order to acquaint high school biology teachers with the field of plant pathology, short courses have been provided in connection with national meetings of the Society. Examples are short courses held at Oregon State University in 1962 and at the University of Massachusetts in 1963.

AMERICAN BIOLOGY TEACHER ISSUE ON PLANT PATHOLOGY

In another effort to reach high school and college biology teachers, the Society made arrangements to have an entire issue of the *American Biology Teacher* (volume 28, No. 6, August 1966) devoted to plant pathology. The basic information on nature and cause of disease in plants dissemination of plant pathogens, effect of weather on prevalence of disease, and control of plant disease makes this a valuable reference for teachers in several fields of agriculture. Brief descriptions of 32 laboratory exercises are included. These can serve as a starting point for investigations by students.

SOURCEBOOK

A *Sourcebook of Laboratory Exercises in Plant Pathology* was produced by a committee which was formed by the Teaching Committee. Many of the exercises are based on new research techniques and ideas, and they serve as a valuable tool in the laboratory. This book has been available in mimeographed form for 3 years and is scheduled to be published in June 1967 by W. H. Freeman and Company.

PLANT DISEASE TRANSPARENCY SETS AND PLANT DISEASE PROFILES

The Extension Committee has prepared colored slide transparency sets depicting 15 groups of plant diseases (examples: tree fruit disease, turf diseases, vegetable diseases). The profiles illustrate inoculum source, transmission, penetration, establishment, and disease expression for each disease. Transparency sets and profiles can be purchased through the Photo Science Department, Cornell University, Ithaca, New York.

CAREERS BROCHURE

The public Relations Committee has produced a brochure, *Careers in Plant Pathology*, describing the nature of the field and the rewards and opportunities available to plant pathologists.

1. On leave from position as Staff Biologist, Commission on Undergraduate Education in the Biological Sciences, Washington, D.C.

2. Thimann, Kenneth V. 1967. "General Biology Teaching," BioScience, 17, 91-94.

FORESTRY

PAUL Y. BURNS
Director, School of Forestry and Wildlife Management, Louisiana State University;
Chairman, Committee for the Advancement of Forestry Education, Society of American Foresters

I. MAJOR TRENDS IN UNDERGRADUATE EDUCATION IN FORESTRY

In the U.S., there are 47 schools of forestry. Fall enrollment in 1966 totalled 11,118 undergraduates. About 7,000 of these are in general forestry and the remainder are distributed among wildlife management, wood technology, range management, and forest recreation. Major trends in undergraduate forestry education are:

1. Increase in enrollment since 1953; also increase in number of B.S. degrees granted.

2. Slow increase in number of forestry schools, and also in number of forestry schools accredited by the Society of American Foresters (31 are now accredited).
3. Slow and steady increase in number of women enrolled (105 in fall 1965)
4. Expansion of physical facilities, including new buildings; increase in number of faculty members; decrease in teaching load.
5. More options and curricula, including such things as forest recreation, forest wildlife management, and a forest science curriculum for students planning to take graduate work.
6. More math and science in the curriculum; fewer credits in forestry.
7. Less emphasis on how-to-do it and more on basic principles; more emphasis on the products of the forest other than wood.
8. More transfer students from Junior colleges and from small colleges where forestry is not offered.
9. More 1- and 2-year forestry technician schools, particularly in the far West.

II. WHAT THE SOCIETY OF AMERICAN FORESTERS IS DOING TO IMPROVE UNDERGRADUATE EDUCATION

1. The SAF published an exhaustive study in 1963 by S. T. Dana and E. W. Johnson as a book, *Forestry Education in America Today and Tomorrow.* The findings have been studied by most of the forestry school faculties and by a few other foresters. A special committee on Programs in Forestry Education was subsequently established by the SAF to follow up the recommendations of the Dana-Johnson report; this committee is trying to inaugurate a study of the role of foresters and forestry technicians in resource management.
2. The SAF has had a Division of Education for many years. The Division meets annually; invitational papers are presented and published in a Proceedings.
3. The SAF's official monthly magazine, the *Journal of Forestry,* carries articles from time to time on forestry education; it has "Points of View" and "Letters to the Editor" sections where anyone can give his opinions about forestry education.
4. Since 1936, the SAF has accredited programs of forestry education in higher education, using published standards, which are revised every few years. The accrediting spadework is done by the Committee for the Advancement of Forestry Education. Although this committee has a broad charge—to bring about improvement in forestry education—to date its accomplishments have largely been restricted to accreditation of first-professional-degree programs.
5. The SAF recently established a Committee on Training of Forest Technicians. This committee has defined the roles of a forest technician, inventoried technical and vocational forestry training programs in the U.S., estimated future needs for forest technicians, and established guidelines for forest technician training.

RANGE MANAGEMENT[1]

THADIS W. BOX
Organizational Director,
International Center for Arid and Semi-Arid Land Studies,
Texas Technological College;
President, Range Management Education Council
(representing the American Society of Range Management)

Range management, as compared to the other professions discussed today, is a relatively new field. This year the American Society of Range Management celebrates its 20th anniversary. We do not have the precedence that many other professional societies have, and we are currently defining how the Society can best help undergraduate education.

We are faced with a new and growing demand for our graduates. Traditionally, governmental agencies were the primary employers of people graduating with a degree in our field. More recently, ranchers, industry, and others have been hiring range management graduates.

As the demand for our people increases, there is an apparent trend for more and more options and diversity in the range management degree. However, all of these options are centered on a core of professional courses which we are now in the process of defining and standardizing. Added to this basic core of range management courses are electives in selected fields. Of course, all options presuppose a cultural core that is necessary for an educated individual.

It is not uncommon to find three to five options in a range management department. For instance, we at Texas Technological College offer the general range management degree, an option in wildlife habitat management, and a third in range business management for students going back to the ranch. Utah State University now has three options in addition to the general range management degree: forest-range management, range-watershed management, and range economics. Each year we find more diversity in opportunities for employment of our range students, and in order to properly equip students for the different jobs I think we will continue to see a branching out of curricula under the general heading of range management.

Another major trend in undergraduate education in the range management field is toward a multiple-use type of training. Very few of our curricula are still "cows and grass" oriented. As our population continues to increase and people have more leisure time, more and more emphasis will be placed on broad multiple-use training in the range management field.

Although I know of no school that has an option in its catalog designed for preparing the student for graduate school, there is a growing tendency for the range management student to continue his education to the master's or doctorate level. It is quite common for students to be advised to strengthen themselves in mathematics and other basic science areas if they show indication of proceeding toward advanced degrees. As many of the panelists have discussed today, there is a general tendency within all of our education for more science-oriented curricula, and certainly range management is no exception.

I think that there is a unique relationship between the American Society of Range Management and undergraduate education in that the Society normally takes action only with the aid and counsel of the Range Management Education Council (RMEC), an organization of representatives of 21 schools offering undergraduate work in range management. The representatives from these institutions meet annually, usually one day before the meeting of the American Society of Range Management, to discuss curriculum improvement, strengthening of courses, and other matters dealing with undergraduate education. Although the RMEC is not a part of the American Society of Range Management, there is a strong liaison between the two groups. The RMEC normally invites an observer from the Board of Directors of the Society, and informs the professional Standards Committee of the Society of its actions. The Professional Standards Committee then submits the findings of the RMEC to the Board of Directors of the Society where Society endorsement may or may not occur.

An example of the close relationship between the RMEC and the Society can be seen in the makeup of the current Professional Standards Committee of the American Society of Range Management. Four of the members of the Professional Standards Committee are also members of the

RMEC. As president of the RMEC, I sit in on the meetings of the Professional Standards Committee of our Society and advise them on academic matters.

Some of the actions taken by the RMEC and our Society may be of interest to this group. Prior to this last summer only 6 semester hours of range management were required for a student to qualify as a range conservationist in Civil Service examinations. The RMEC has agreed that a minimum of 16 credit hours in range management is necessary in the professional core of courses. During this last year members from RMEC and the Society have worked closely with the Civil Service Commission to get the hour requirement raised to 12 semester hours credit in range management. Although this falls short of that recommended by the RMEC, it marks an improvement in the requirements, and both the RMEC and the Society are continuing efforts to insure that standards will be raised even further.

During our last meeting which has just concluded in Seattle, Washington, the RMEC approved an outline of the body of knowledge that should be included in the 16 semester hours of range management. This outline is being forwarded to the Professional Standards Committee of the Society. It is hoped that they will present it to the Board of Directors for approval as the core of knowledge necessary for a professional range man. In addition, the Council is working toward standardization of course names and course contents, curriculum improvement of member schools, and other activities similar to those discussed by other professions today.

In general our Society is covering much of the ground that is familiar to older societies represented here today. We are relatively new, and are just now firming up the policies regarding undergraduate education. I think it would be safe to say we are moving toward a more standardized curriculum in range management, but at the same time, injecting more diversity in programs through options and careful selection of electives.

We are already looking into the future. Professor James K. Lewis, from South Dakota, challenged the Council and the Society last month in Seattle to be looking toward training the range man of 1985. This may mean a considerable change in the existing curricula with courses in areas that seem foreign to us now. But as our world problems become more complex, our professional training must become more complex.

There is considerable concern among our members that we may not be able to meet the challenge in a 4-year curriculum. If we are to give the student the general knowledge that will enable him to become an educated individual and allow him to function articulately in society, we now have a full curriculum. Add to this the core of professional courses needed in today's agriculture, and we have a program of little flexibility.

When we start talking about a program for 1985, it becomes obvious that we must do one of two things: we must drastically rearrange material in our curriculum or go to a 5-year program. Neither step is acceptable to us today, but we must face the challenge of educating to live in today's complex world. In this respect range management is like the other professions discussed here today.

1. Contribution number 26, International Center for Arid and Semi-Arid Land Studies, Lubbock, Texas.

AGRICULTURAL ECONOMICS

R. G. F. SPITZE

Professor of Agricultural Economics, University of Illinois
(representing the American Farm Economic Association)

Agricultural economics emerged as a distinct discipline only a half century ago, with one of its founders still active at the enviable age of 94 years. It was forged out of the joint interests of two separate disciplines—namely, the management interest of agronomists and the agricultural interest of economists.[1]

AGRICULTURAL BUSINESS

Today, professional agricultural economics work concerns the off-farm as much as the farm business. This common interest in commerce and agriculture has been a major thrust for agricultural economics since World War II.[2] Underlying this trend is: first, a functional integration among three kinds of businesses—farm production, farm input suppliers, and marketing agencies. Second, the economic theory of management. It is useful to the farm business, and equally appropriate for the non-farm business. Third, increasing numbers of agricultural economics graduates find careers in the off-farm agricultural businesses.

As a consequence, new curricula have sprung up, often under agricultural economics auspices, designated variously as agricultural business, agricultural industries, or business management.[3] These curricula are distinctive, with approximately equal requirements in the commerce fields (e.g., economics, marketing, finance, personnel, and business law) and in fields of agriculture. In addition, new courses have been spawned with such titles as "economics of food distribution," "farm supply purchasing," and "financial management."

ECONOMETRICS

During the past 15 years, a pronounced trend has involved new applications of mathematical and statistical tools to farm and agribusiness problems. The impetus partially arises from developments in mathematics, but also from more mathematically sophisticated economists. For example, linear programming, game theory, Markov chain analysis, and computer use appear in undergraduate topic outlines. New courses also appear, such as "operations research," "systems analysis," and "computer programming." The agricultural economics student previously required to master algebra or analytic geometry now feels the need to include calculus or contemporary tracks of mathematics. A result is pressure on time for humanities, social sciences, communicative skills, and biological and physical sciences.

ECONOMIC DEVELOPMENT

"Toward an international dimension" is a new and growing refrain for agricultural economics.[4] Though involving every discipline, the development of a community, a region, or country encompasses problems of allocation, of organization, and of macroplanning for which economics seems to offer sought-after handles. New courses are appearing with such titles as "economics of agricultural development," "economic development," and "resource development." Some new curricula have been designed for the future rural-development specialist, resource economist, or foreign-development adviser. But the common accommodation is within existing agricultural economics curricula.

THE PROFESSIONAL SOCIETY AND UNDERGRADUATE EDUCATION

Improvement of undergraduate education was not the major reason for organizing the American Farm Economic Association, the primary professional home for the agricultural economist. The Association's main concerns are ongoing research, graduate education, and issues of governmental policy. Yet, it can be reported that our professional society has supported the vital role of undergraduate education by expanding related commitments over the past 15 years. Credit goes to persistent and dedicated leadership among teachers within the society and to particular officers.

STUDENT ACTIVITIES COMMITTEE

Since 1948, the American Farm Economic Association has maintained a standing Student Activities Committee,

from which new undergraduate programs have been generated. One of the two elected vice-presidents serves in a liaison capacity between the Executive and Student Activities Committees. The Student Activities Committee sponsors a national student organization (composed of clubs at some 43 colleges) and supervises student contests. Contests have been expanded to include debating, public speaking, and essay writing. Any agricultural economics student may participate. A full student program is planned for the annual meeting, including participation in the general awards program and a banquet featuring the president of the parent society. The profession stands to gain through increased undergraduate knowledge and professional interest.

TEACHING IMPROVEMENT WORKSHOPS

The Student Activities Committee has also directed the attention of the profession toward improved instruction. A second 3-day workshop for teaching improvement involving 90 teachers from 33 land-grant and 15 non-land-grant colleges was held in August 1966, sponsored by the parent society, the Commission on Education in Agriculture and Natural Resources (CEANAR), and contributing firms and foundations. In 1963, an earlier workshop (exclusively underwritten by the society) also featured topics basic to the educational process and practical teaching problems. Preceedings from each were published, the last in the professional journal.[5] In addition, the annual meetings have featured sessions on education. Occasionally, education has been the subject of articles accepted by the Journal. Thus, in-service training of teachers has taken its place with the research workshops, prevalent in our field for decades.

UNDERGRADUATE TEACHER AWARD

In 1965, the society presented its first Distinguished Undergraduate Teacher Award.[6] Here again, this was preceded by years of planning and persuasion by the Student Activities Committee. As chairman of the selection committee for this new award during the past 2 years, I am prepared to argue that teaching performance is no harder or easier to evaluate than research. With this award, the undergraduate teacher—his innovations, contributions, and professional status—are recognized by professional peers and symbolized for the young and aspiring educator.

IN SUMMARY

It is reasonable to conclude that as a worthy professional performance, undergraduate education in agricultural economics is accepted, even nourished, by its professional society. If future undergraduate education is undernourished, I believe we as undergraduate and graduate teachers must answer.[7] The idealistic excitement for teaching resides in our students. Unless we disillusion them while they are in our charge, I have no fear that we will thwart their proper performance.

1. H. C. Taylor, the surviving founder, traces this origin in The Story of Agricultural Economics (A. D. Taylor, co-author), Ames, Iowa State Press, 1952.

2. Impetus was given this development by Harvard economists with their popular book A Concept of Agribusiness, by J. H. Davis and R. A. Goldberg, Boston, Harvard University, 1957.

3. Elaboration on this and related curricula redirections appears in "Trends and Issues in Education in the Agricultural Sciences," Commission on Education in Agriculture and Natural Resources, Bio-Science 15:711-15, November 1965.

4. As symbols of this tone, the most recent three keynote presidential addresses to the American Farm Economic Association by D. G. Johnson, K. L. Bachman, and L. W. Witt, dealt exclusively with international development issues, and a majority of the last seven national student debate topics were similarly focused.

5. Workshop on the Improvement of Undergraduate Instruction of Agricultural Economics, University of Missouri (Processed), 1964; Proceedings of a Symposium for Teachers of Agricultural Economics, Journal of Farm Economics, 45:259-338, February 1967 (Part II).

6. Research awards were instituted in 1950 and an Extension award in 1966.

7. My optimism and argument are developed in my article "Agricultural Economics Teaching and Our Domestic Problems," Journal of Farm Economics, 44:1339-49, December 1962.

AGRICULTURAL EDUCATION

O. E. THOMPSON
Chairman, Department of Agricultural Education
University of California, Davis
(representing Division of Agriculture,
American Vocational Association)

Undergraduate preparation of teachers of vocational agriculture, while relatively stable during the first half-century of its existence, is undergoing major change. Historically, students who wished to teach "Smith-Hughes agriculture" had to receive their preparation in special programs which were approved and supported financially by the state agencies for vocational education. In order to qualify for federal funds, the programs for undergraduate preparation of these teachers had to meet certain standards approved by the U. S. Office of Education. The policy standards emphasized that the primary purpose of high school vocational agriculture was preparation for farming, and, as such, required that the teacher be competent in plant sciences, animal sciences, management, and mechanics. In essence, these men were prepared to teach how to farm and to work in a one-man department. There was little change in this preparation until the passage of the Vocational Education Act of 1963, which modified the purpose of vocational agriculture to include preparation for "any occupation involving knowledge and skills in agricultural subjects whether or not such occupation involves work of the farm or of the farm home." While programs in vocational agriculture in a few states had begun reorientation to include preparation for off-farm occupations during the past decade, most states were hesitant to make any modifications until the law was changed.

This report is based upon responses from over 40 teacher preparation programs in both land-grant and non-land-grant institutions to questions regarding changes in their programs during the past 5 years. The following four major trends were found:

1. Undergraduate education in colleges of agriculture across the United States is in a period of transition. Changes include reorganization of administrative structure, realignment of curricula, and a general reevaluation of academic and research missions in agriculture.

2. Curricula in agricultural education are also undergoing reorganization and realignment in many colleges. This follows a general acceptance of a "new objective of vocational agriculture."

3. There are major changes in the clientele in vocational agriculture, both those preparing to be teachers and those being served in the high schools and junior colleges.

4. There is a revived awareness in colleges of agriculture of the need for improvement in quality of teaching.

The undergraduate agricultural education curriculum is unusual in that it draws upon various other curricula in the college for most of its courses. The staff in agricultural education generally provides the professional teacher education sequence of courses, which, in most colleges, will constitute perhaps less than 20 percent of the requirements of the overall curriculum. Obviously, then, any trends in general college requirements or course changes in other departments of the college affect agricultural education.

Of major significance is the general movement to consolidate introductory courses in the various production departments into single courses which cover a generalized area. Examples are introductory courses in plant science and animal science. Each of these courses may replace two to four departmental introductory courses.

The revolution in biological science has created a greater demand for in-depth study of the biological science processes and related sciences. In addition, there has been a general increase in requirements in general education, the humanities, and the social sciences in most colleges of agriculture during the past 5 years.

As a result, it has become increasingly difficult to maintain broad requirements in courses in technical agriculture once found in the agricultural education curriculum. Something had to be reduced, and generally it has been the emphasis upon technical preparation in agriculture. The professional courses for teacher preparation are usually required for licensing, and, as such, change little.

Most of the colleges in the sample had undergone major curriculum revisions in the past 5 years. Twenty-one had overall curricula reorganization within their college, while in another eight the reorganization of curricula had included only agricultural education. Most of these changes were precipitated by change in emphasis in vocational agriculture in high school, by increases in general education requirements, and by general updating of courses in agriculture and realignment of objectives. In many colleges the decrease in the number of units required in technical agriculture courses was as high as 25 percent. In spite of this reduction, there was a general increase in flexibility of requirements; this permitted agricultural education majors to specialize rather than generalize. It is hoped that the increase in flexibility will result in upgraded instruction in vocational agriculture in the high school and junior college, by providing a teacher who can offer in-depth instruction in a subject area, a necessity for the worker in modern agriculture.

Agricultural education curricula in many colleges now include courses in occupational information, vocational guidance, and studies of off-farm occupations in agriculture. The time-honored requirement that a student must have completed the curriculum in agricultural education before teaching vocational agriculture is gradually being replaced. Many schools now permit double majors. Others will accept students from any major as teacher candidates. For example, only 10 of the 40 schools surveyed held to the traditional requirement that only agricultural education majors could qualify for teaching vocational agriculture. This relaxation of requirements permits many colleges to prepare nonagricultural education majors for teaching vocational agriculture in as little as one college quarter. Undergraduate curricula in many schools are now sufficiently flexible to permit the preparation of teachers who can direct programs for students interested in occupations in agricultural business and industry, in landscape horticulture, and in other vocations for which an understanding of agriculture is essential.

The American Vocational Association, which I represent, has long been interested in undergraduate preparation in agricultural education and in quality teaching. It was instrumental in establishing the National Center for the Study of Vocational and Technical Education at the Ohio State University in 1964. This center has done much work on curriculum materials and has sponsored numerous conferences on vocational guidance, administration, supervision, teacher education, and technical education. One activity which our teacher education section sponsors is an annual award for the outstanding teacher educator in agricultural education. The primary qualification for this $500 award is contribution to the improvement of teaching of agriculture.

There is a renewed interest in quality of instruction in most colleges of agriculture. Many colleges had in operation, or were planning, some program mechanism for the improvement of college teaching. For example, at the Pennsylvania State University, the Agricultural Education Department offers a course in college teaching for both inexperienced and experienced staff members. The Ohio State University and the University of Maryland offer outstanding teaching awards with stipends of $1,000. Others have active student-faculty groups studying and evaluating teaching. Unfortunately, it appears that much of the motivation for improvement of teaching comes from students rather than, as it should, from the profession.

In summary, then, the trends in undergraduate preparation in agricultural education include:

1. A relaxation of the rigid requirements to qualify teachers for vocational agriculture.
2. A reorientation of the curriculum from emphasis upon production agriculture to the inclusion of preparation for other occupations in agriculture.
3. Admission into the teaching of vocational agriculture of individuals prepared in majors other than agricultural education.
4. General increase in the general education and science requirements, with an accompanying reduction in the agriculture-related courses.
5. A change in the objectives of vocational agriculture, reflected in the preparation of teachers.
6. Improvement of undergraduate teaching in agriculture now recognized as a significant problem. Steps are being taken to effect changes, and many of these changes are being implemented through agricultural education departments in the colleges.

Truly, then, undergraduate preparation in agricultural education is in evolution, as it should be, since it is involved in preparing teachers for the world's most dynamic industry—agriculture.

AGRICULTURAL ENGINEERING

KENNETH K. BARNES
Professor and Head, Agricultural Engineering Department, University of Arizona;
Chairman, Curriculum and Course Content Committee, American Society of Agricultural Engineers

The first responsibility in discussing educational activities in agricultural engineering is to clearly define and differentiate between two objectives. One objective is education of potential professional engineers. The other objective is the education of agriculturists in physical technology related to agriculture.

Agricultural engineering curricula aimed toward education of potential professional engineers are normally developed in the pattern adopted by the parent institution's college of engineering. Usually agricultural engineering curricula are designed to be in accord with requirements for accreditation by the Engineers' Council for Professional Development. Curriculum accreditation by ECPD is actively sought by most departments offering agricultural engineering curricula.

The accreditation criteria obviously dominate curricular patterns in egineering. However, these criteria develop from the thinking of the membership of the various engineering professional societies and perhaps most directly from the activities of the American Society for Engineering Education. Mr. W. Leighton Collins, Executive Secretary of ASEE, last year gave NACTA a thorough explanation of his organization.

ASEE is in the final stages of developing recommendations for future engineering education under a study, "Goals of Engineering Education," initiated in 1963. A preliminary report of this study issued in October 1965 elicited a broad spectrum of violent reaction from engineering educators. The final report, not yet available, will have a strong influence on all engineering curricula, including agricultural engineering.

There is an Agricultural Engineering Division in the American Society for Engineering Education. Many ASAE members who are particularly concerned with education are members of ASEE. ASAE members in education working through their colleges of egineering have had opportunity to contribute to the ASEE "Goals of Engineering Education" study.

The American Society of Agricultural Engineers supplies ECPD with a list of ASAE members qualified to serve on accreditation visitation teams. ASAE has within the past year become a participating member of ECPD and is represented on the ECPD board of directors and on the various committees of ECPD.

An important trend in agricultural engineering curricula is a move away from hardware-oriented courses toward courses planned to emphasize the application of basic sciences in engineering for agriculture.

A look at the lists of professional agricultural engineering courses offered by two major universities will illustrate this change.

UNIVERSITY A	UNIVERSITY B
Farm Tractors	Tools and Materials
Surveying and Soil and Water Engineering	Control of Environment
Farm Machine Characteristics and Mechanisms	Analytical Methods
Design of Farm Structures (2 courses)	Bioengineering Parameters
Design of Concrete Structures for Agriculture	Analysis of Agricultural Production Systems
Electricity in Agriculture (2 courses)	Functional Design of Field Machines
Instrumentation and Measurements	Soil and Water Conservation Engineering
Design of Agricultural Machinery	Electrotechnology for Agricultural Production
Tractors and Prime Movers	Design of Functional Engineering Systems
Soil Conservation Structures	
Land Drainage	
Agricultural Process Engineering	

University A's courses are an excellent offering of a modern version of curricular content which has been successful in agricultural engineering for over 50 years. University B's courses illustrate a change that is an accomplished fact in several universities. There is sharp disagreement between the proponents of these contrasting approaches to agricultural engineering course structure. It is only fair to note that those departments adhering most closely to the traditional (University A) type of curriculum are also those departments maintaining the larger enrollments. However, the curriculum changes are *not* the cause of smaller enrollments in other departments.

Agricultural engineers are vitally concerned with what was above referred to as "physical technology related to agriculture." This is not an accepted phrase. The terms "farm mechanization," "agricultural mechanization," "mechanized agriculture," and "applied agricultural engineering" are all used, but have many deficiencies. In fact, one of the big problems with this area is lack of appropriate definition. Most students in general agriculture are given thorough grounding in biology, some background in chemistry, and much training in the practical application of these subjects in agricultural production, development, and research. For these general agriculture students, the application of physical sciences and mathematics in agricultural production and research is often minimal. Agricultural engineering departments offer and historically have offered both curricula and individual courses for the student interested in the application of physics and mathematics in agricultural production. Areas of particular interest are, of course, power units and associated machinery, buildings from both a structural and an environmental viewpoint, and the development, control, and utilization of water resources. The student of agriculture is interested in understanding these things as tools to be applied in agricultural production. He is interested in their performance characteristics rather than in the details of their design.

The American Society of Agricultural Engineers last December received a detailed report developed by a committee which had been charged with consideration of programs in applied agricultural engineering. This rather extensive report defines the needs and functions of agricultural engineering technicians and technologists. It suggests curriculum content for training personnel in these fields. The report is not subject to summarization here. However, its essential focus lies in this statement:

> "Over the past 20 years there has been a widening gap: (a) between the professional engineer and the craftsman, (b) between the professional agricultural engineer and those segments of the agricultural industry which his findings are intended to serve, and (c) between the professional agricultural engineer and the general agriculturist."

This type of gap has developed in all areas of engineering. ASAE is not unique among engineering societies as it seeks its role in bridging the chasm. ECPD now offers accreditation to engineering technology programs.

The ASAE committee on Programs in Applied Agricultural Engineering suggests 2-year curricula as training for such functions as agricultural equipment technician and soil conservation technician and a 4-year program for agricultural engineering technologists.

The American Society of Agricultural Engineers carries out its education-related activities through its Education and Research Division, which is one of the five major and parallel divisions of the Society. The division includes committees on Curriculum and Course Content, Instruction in Agricultural Mechanization, Graduate Instruction, and Career Guidance. Through these committees facts and opinions are exchanged and sound bases for educational programs are sought.

SYMPOSIUM PAPERS

Four-Year Non-Land-Grant Universities And The Professional Societies

DANIEL O. ROBINSON
Director, Division of Agriculture, Arizona State University;
Vice President, NACTA

At first glance my topic, "Four-year Non-Land-Grant Colleges and the Professional Societies," appears to have little that would be either challenging or of great concern. Let me hasten to say, however, that in my opinion there is a need for considering this topic that few suspect. The gentlest inquiry will reveal many emotionally charged prejudices regarding agriculture in non-land-grant institutions. It is as though the great educational breakthrough which originated with the Morrill Act, and established agriculture schools and colleges across the nation and opened the door of education to all segments of American society, was acceptable only in the 19th century. It appears that some consider the development of educational centers for agriculture in the 20th century or beyond a great heresy.

As a matter of fact, centers for education and training in the various fields of agriculture have grown up side by side with land-grant institutions. Wise leaders in both state and private institutions have established agricultural curricula, facilities, and faculties wherever these educational needs have been demonstrated and students could be served.