

Five Years of Progress

By

Harry F. Lewis

This, the Park College meeting of MACTLAC is the fifth meeting since the organization was formally established at Appleton in 1953. In a way it is really the sixth meeting for MACTLAC had its inception in the meeting held to celebrate the centennial of Monmouth College the year before. It had been my intention to prepare a report of these five years for comparison with the report which was submitted at the Appleton meeting covering the period from 1948-1953. Unfortunately, the meeting this year came a week or two early and there has not been sufficient time since the opening of the school year to get returns from the full group of MACTLAC members. We have done pretty well, however, in being able to incorporate the reports from 57 colleges. For practical purposes the summarized results will serve their purpose. It is my hope, however, that those of you in the audience who have not submitted your questionnaire yet will do it immediately so that I can prepare some kind of a small article for publication either in the Journal of Chemical Education or in Chemical & Engineering News on the above subject.

It will be recalled that in 1953 an attempt was made to show the relation between the "productivity" of a college in terms of providing the baccalaureate origins of Ph.D.'s with the so called "creativity" of the college which was represented in terms of income for research grants. The averaged data did permit some kind of a valid conclusion that there

was a definite relationship between the two. The report today, however, indicates that there is some research going on in all but 4 of the 57 colleges which have reported up to this time. A creative enterprise is under way in 53 of the 57 colleges. I think this is one of the real achievements of MACTLAC. If possible, we should make an attempt to provide aid of a kind for those colleges without grants.

Five years ago I attempted to prepare some kind of a rating of colleges in terms of their Ph.D. productivity. This was reported in the Journal of Chemical Education and the basic data thus gathered provided the index of productivity for the MACTLAC colleges. At that time we used the report of the Office of Scientific Personnel covering the Ph.D. years 1936-1945. A later report was issued by the same office covering the next five years and in 1955 it was suggested that a second rating be prepared. The more I thought about this the less desirable it seems, however, for the Ph.D.'s of 1945-1950 were the undergraduates of the immediate prewar years and any classification based upon those years would seem to me to merely provide figures without substance. Possibly sometime in the not-to-distant future it will be worth while to carry on another study by baccalaureate origins on the part of the MACTLAC schools. There is one disadvantage of any rating of this kind; it holds only for one area of activity, that area the stimulation and training of graduate students. It does serve to indicate the colleges which attract the students who have a natural ability in the field of chemistry

but it may do an injustice to those colleges operating well in other perfectly valid functions of departments of chemistry. We talk about the paper industry as being the fifth industry in size but whether it is or whether it isn't depends entirely on what kind of a measuring stick we use. We are the fifth in terms of the volume of net sales but we are only the fourteenth in terms of the number of production workers and eleventh in terms of the value added by manufacturers. Similarly the chemistry faculty of one college may provide a very fine preparation for graduate school but this same faculty may also give a very poor appreciation of chemistry to the average student in the general education program.

I am going to present the questionnaire results in the order in which they appeared on the questionnaire. This does not necessarily mean that this order indicates the order of importance of the subject.

The first question dealt with the research activities of the chemistry department. Here we were interested in knowing the total number of staff in the departments or their full time equivalent, the number who were carrying on research, whether this was done in the school year or the summer, the number of students who were doing research and whether they did this in the school year or in the summer. I shall not attempt to provide a listing of all the answers but will rather summarize. In the 1954 report it was stated that 64 faculty were carrying on research in 43 colleges. In 1955 the number had risen to 105 or 60% of the total

162 full time teaching staff reported. The present report for only 57 colleges of the 61 colleges show 106 faculty researchers in a total of 168 faculty or approximately the same as 1955. If we had the report from the same 61 colleges instead of 57 there might be a few extra but this is not important. I think we can conclude there has been no loss of faculty interest in research. This year 93 of the faculty researched in the school year, 70 researched in the summer and 62 did no research. The student figures show real progress. The 1954 report listed 128 students researching in 36 colleges, the 1955 report had 169 students in 42 colleges working in the school year and 19 had 42 working in the summer. The important figure here I think is that student research was being done in 47 of the 61 reporting colleges. For the current year for the number of undergraduates doing research has jumped to 227 with undergraduate research being carried out in 46 of the 57 colleges. Eighty per cent of the reporting colleges now have undergraduate research programs. As mentioned earlier, if we put together the faculty and the undergraduate research it can be shown that in 54 of the 57 colleges some type of a research program is under way, either faculty or student or both. This to me is a very real sign of achievement.

The next question dealt with the matter of financing of research activity, the number of grants, the size of the grants and the source of

the grants. The total amount of the grants for the five years before MACTLAC, as reported in Appleton, listed income from all sources for research as amounting to \$286,774.00 or an average per year of \$57,336.00. In 1953 we reported for the one-year period a total income of \$138,083.00 and in 1954 \$143,790.00. This current year the income reported by 38 colleges comes to \$173,790.00 or an increase of \$30,000 since 1955. This money came in 89 separate grants with 18 from the Research Corporation, 16 from Du Pont, 12 from Standard Oil of Indiana, 8 from the National Science Foundation and the rest distributed between 28 separate sources. Industrial support comes from quite a number of different companies including the Marathon Foundation, Minnesota Mining and Manufacturing, Dow, Culligan, Evans Corporation, National Aluminate, Socony, Cyanamid, Merck-Sharp Dohme, Elder Company, Parker Pen, Spencer Chemical, Meaher Company, Propellex Chemical Company, Hercules, Monsanto, and Johnson's Wax. Among the foundations are the Hill Foundation, the Kettering Foundation, the Wilson Foundation and the Petroleum Research Foundation. The government organizations beside the National Science Foundation include the U. S. Public Health Service, the Ordnance Department and the Office of Naval Research. The societies include the Illinois State Academy of Science and the American Cancer Society. In addition there are supporting grants from unnamed companies and from three of the reporting colleges. The sum total of grants made in the pre-MACTLAC five-year period total in amount \$286,774.00. In the MACTLAC five-year period the sum total of grants made to 42 colleges comes to \$660,776.00 or an increase by

a factor of 2.3. The question was asked as to how much additional money could be profitably used and for what. The principal reason given for asking for more money was in order to permit either a start or an expansion of undergraduate research. Seven schools without grants but carrying on undergraduate research asked for a total of \$5800.00. Twelve schools with grants also carrying on undergraduate research asked for a total of \$38,700.00. In addition, two schools without either grants or undergraduate research asked for \$3000.00. These requests are being followed up. A few requests were listed in support of faculty research. It is quite evident that the big need now is for support of the undergraduate research and I am pleased to report that there is a great deal of interest nationally in funds for this particular purpose. I hope those MACTLAC schools interested in getting money for this purpose will be able to get the kind of help they need.

A subsection of the question on grants was directed toward the material fruits of the grants--equipment and research material for the library. Twenty four colleges reported specific research equipment acquired including the following--pH meters-4, hydrogenation equipment-4, nuclear magnetic reactor, equipment for gas chromatography, for paper chromatography-2, a polarigraph, a Klett colorimeter, a Spencer colorimeter, a varian recorder, an ionization pressure gauge, one Spectrograph-\$3000, one DK2-\$8000, a tetrimeter, semi-micro combustion unit, a scalar, a moniter, a calculating machine, a refractometer and two temperature baths. MACTLACERS must be hydrogenating extensively, they are making

structural studies requiring spectrometers, at least one is doing organic research on a scale requiring semi-micro combustions, one at least is working with isotopes, another is glad to substitute a calculator for a log book. Check these up on the MACTLAC credit side.

Twenty six colleges reported specific additions useful in research to their libraries as might be expected. The most popular is Beilstein. Sixteen have either bought or completed their Beilsteins, one (Coe) has the microcard edition. Three report Mellor, two Gmelins, two Decennial Indexes for Chemical Abstracts. Sets bought include J. Res. Bur. Standards, J.C.S., Beriche by 2, J. Electrochem. and J. High Polymers. Reference works--Elsevier, Heilbron, Organic Synthesis complete (2), Organic Reactions complete, reference material on spectroscopy, Kirk-Chem. Eng. Ency., and Monographs, Elderfield-Hetereo-cyclic compounds 6v., Nuclear Energy Series, and MACTLAC must be credited with an assist here. In addition ten colleges reported the addition of general reference works. Twelve reported no acquisition of this nature.

Another section of the questionnaire was directed toward a summary of the activity of the group in the publication field. In 1955, we reported on the extent of publication for 1952 and 1953, and 1954 and 1955. The current report covers only the past year. In this period 29 colleges reported 21 publications in professional journals and 30 papers presented at national, regional and sectional meetings of the

A.C.S., Academies of Science, etc. This represents both an increase in publications and in the number of colleges active in the field. Compare this one-year period with the 1953-1955 two-year period when 25 colleges published 30 reports and presented 53 papers and with the 1951-1953 two-year period when the analagous figures were 22 colleges, 27 publications and 10 papers presented.

Still another question dealt with the participation of MACTLACERS in summer institutes and conferences. Twenty seven schools answered in the affirmative when asked whether their staff members had attended institutes and conferences. In addition members from seven colleges had served as staff members at least twenty such meetings. Possibly this is the place to stress the value of institutes and conferences, particularly for instructors in the smaller colleges where opportunities for bull sessions for others of like interest are fewest. The current N.S.F. program provides this opportunity and with an income sufficient to meet the costs. Such an opportunity may not quickly come again. Keep your eyes open for the forthcoming notice of 1958 institutes. In reviewing the list of the colleges which have participated, it would appear that the ones active in research and liberally supplied with grants, have also been the ones sending their men to such meetings. With the new financial policy of the N.S.F. it should be possible for even the poorest college man to go.

The question with reference to A.C.S. membership was just a teaser. To my surprise 131 of the 168 faculty members are members of the

American Chemical Society and 91 are members of the Division of Chemical Education; the other 40 should join at once. The Secretary, John Baxter, Department of Chemistry, University of Florida, Gainesville, Florida will send you blanks. It costs just one dollar. Twelve MACTLACERS serve on committees of the Division. One is chairman on the committee on the Teaching of Chemistry. Another is chairman of the Visiting Scientist Committee. A third chairs the Industrial Film Committee (unfortunately he is leaving the MACTLAC area).

A great deal of interest exists today in two other types of research, in this case in the field of chemical education. The first comes under the heading of research into better methods of the presentation of the subject matter of chemistry in our classrooms--research in the curriculum. The second deals with methods for the presentation for the subject matter of chemistry in high schools. This is associated with course content and the order of its presentation, with the training of high school teachers so that they may better understand and present the principles of chemistry for those high school students who plan on college or university and finally with the development of a different type of approach to the values of chemistry for the 70% of the high school student body who lack the urge to go to college or who feel they may not have the ability to carry on the college course in science or engineering.

In this group there must be hidden many potential scientists. This may be classified as research in the direction of high school chemistry.

Let's take the first--research in curriculum. This was the essence of the recent conference on the Teaching of Chemistry held at Reed College under the sponsorship of the Division of Chemical Education. A report will shortly appear in the Journal of Chemical Education reviewing the findings of the Reed Conference. Seventeen MACTLAC colleges report work in progress on the better handling of specific fields of chemistry or the more effective handling of the important basic principles. A few of the subjects under the first include as illustrations independent study for freshmen, instrumental methods in the freshmen course, up-to-date laboratory experiments in general chemistry, student planning of laboratory experiments, two separate studies of a better way to handle what we now call quantitative analysis--one of these involving the problem approach, the use of student tutors and discussion groups in beginning chemistry, the use of senior projects, the use of the project method in the teaching of organic chemistry and an integrated course dealing with both physics and chemistry in the freshman year. Two MACTLAC colleges have already started to reorganize the entire four-year curriculum and reorganize it not only in terms of presentation but also the content and general philosophy. I would hope that during the Park College meeting Larry Strong of Earlham, Bill Oelke of Grinnell, Ed Haenisch of Wabash and Luke Steiner of Oberlin may have had the chance to tell of the success of their efforts in these

directions, or better still that representatives of the 17 colleges reporting interest in the field may all have been heard.

Research in the field of high school chemistry is not quite so easy to describe or define. The Reed Conference group included some 35 outstanding high school and college chemistry teachers. MACTLACER Larry Strong and Kent Wilson of Tufts were asked to head a committee to work on an outline of a new high school course in chemistry for the college preparatory students. This has been done and a preliminary outline has been circulated to members of the committee set up to help these two and also to members of the conference. It is to be hoped that funds will be available to permit this committee to work aggressively during the present year and that funds will also be available for another conference next June similar to the Reed Conference in scope and type where the next step can be planned. I am sure Larry Strong would be glad to discuss the assignment. This to me is upgrading the high school course in chemistry.

Approaches of the problem to upgrading the high school teacher may be found in the summer institutes and conferences for high school teachers. Ohio Wesleyan had such an N.S.F. financed institute last summer and Bill Manuel could report on this. Beloit also had a high school science teachers conference and plans another one for next summer. Fred Matthews would know the inside of this. Another program somewhat related has been the short conference sponsored and financed by industry.

Such a conference was the Marathon Conference held at Lawrence College and The Institute of Paper Chemistry in the summer of 1956. Thirty five high school teachers from the geographical area around Appleton were brought together with Bob Carleton of the National Science Teachers Association and John Baxter of the Division of Chemical Education acting as co-directors. The staff included Bill Kieffer, Art Campbell, Bob Rosenberg of Lawrence and Baxter from the standpoint of content and four high school people from the standpoint of method. The Marathon Conference has been a very valuable source for statistics on the interest of high school students in science and particularly in chemistry. Two conferences of a similar nature were held this summer, one for the teachers of the West Virginia Pulp and Paper Company mill communities held at the University of Maryland, the other for the high school teachers of chemistry in Delaware County in Pennsylvania held at Swarthmore College and sponsored by the Scott Paper Company. Another program of value to the high school teachers is one involving week-end programs for a series of weeks put on by local colleges for high school teachers in their general community. Dick Ramette of Carleton could tell you about the experiment at Carleton. This happened to be financed by a chemical company.

Another approach to upgrading the high school teachers is found in the summer program of research for the high school teachers in a college laboratory. One of the most effective of these has been carried on at

Reed College for several years. In fact, out there they let the high school teachers come in for research during the school year as well as in the summer. It is not necessary to go as far west as Portland, however, for Joe Danforth of Grinnell has a N.S.F. grant for this purpose and he would be glad to tell you about the program at Grinnell of the past summer.

And with this we come to the end of this fifth year report. I am sorry not to be able to present it to you in person for I think these five years of MACTLAC have provided an object lesson for college teachers of chemistry all over the country. In fact, as you are meeting on the Park College campus, teachers of lower Ohio and Indiana, Kentucky and northern Tennessee are meeting at Bellarmine College, 2000 Norris Place, Louisville, Kentucky, for an organization meeting of that particular group patterned on the MACTLAC plan. If the conference so desires, a wire of congratulations, etc. could be sent to Professor H. S. Wilson of Bellarmine College, Chemistry Department. Similarly the chemistry teachers in Ohio and western Pennsylvania have set up a group meeting which is patterned after their own particular interests that I suspect has for its objective something of the same end result which is achieved in MACTLAC. The meeting this year will be at Antioch. As I have gone around the small colleges as a Visiting Scientist this past year, I have been increasingly conscious of the need for similar organizations in other sections of the country. So many of these men and women are lost in the crowd at the national meetings of the American Chemical

Society and feel inadequate to participate in a group largely dominated by interest in research.

As I see it through MACTLAC the research potential of many college teachers in the Middle West has been reactivated. A surprisingly large number of students in the majority of the MACTLAC colleges have had their introduction to the stimulation of creative chemistry. Departmental libraries have been improved, equipment and facilities for creative chemistry have been made available, chemistry teachers have gone back to school from MACTLAC meetings or from summer institutes and conferences with renewed enthusiasm for their jobs and their opportunities and a wonderful spirit of good fellowship exists among the chemistry teachers in these mid-western states.

A good beginning has been made. What of the future? Sister Marie James of Saint Catherine, one of our most potent MACTLACERS says we have to be careful not to get into the rut of repetition of old problems year after year and she is right. The past is behind us and the future is ahead and that is the direction we must point our thinking. To this end I asked you for your suggestions for the future as well as your comments on the past. Many of you have given these questions consideration and the results have been forwarded to President Gier. Many good ideas are included. Let's use them and continue to build up interest in what we are trying to do. Who would have thought back when

we talked about our troubles in the Monmouth meeting (and those troubles seemed to be largely financial) that five years later the group would have received almost \$700,000.00 to use for the improvement of chemistry departments in those same colleges. Who would have expected that virtually all of the colleges to report this year of 1957 would have embarked on some kind of a research program. Certainly I never expected the publication record of MACFLAC members over the last three years to be at the level it is. We must make sure that after another five years we can report still other developments and I am sure this can be done. All kinds of organizations have begun to realize the potential existing in the liberal arts colleges, a potential which can be developed. Money is available in amounts we did not dream about five years ago. For example, I have recently returned from a college on the West Coast which had received something like \$140,000.00 this year for research. This is a three man department. The grants made possible the addition of research associates, of equipment, of library materials well beyond the dreams of the staff. Not only that, they can plan ahead with some degree of stability. But money is not the only need; ideas and enthusiasm and hard work are more important.

I cannot close without bearing testimony to the fine work being carried on in the field of chemical education by the individual members of MACTLAC. It is always dangerous to pick one or two to commend but at

the risk of getting in trouble I am going to do it. I know you all join with me in congratulating Jim Culbertson of Cornell on his selection of Iowa Award Winner last spring. Likewise if you had had as close contact as I had with Ed Haenisch the last year with reference to the Visiting Scientist program, you would feel as I do, that he has done a remarkable job. The handling of an enormous volume of correspondence, the tactful way in which he has brought together the Visiting Scientists and the chemistry people in the schools and the large number of visits which were made have all taken time and real attention. Ed Fuller from Beloit as chairman on the Committee on Teaching of the Division of Chemical Education has a lively program under way. The Journal of Chemical Education under the leadership of Bill Kieffer provides chemical educators with the only journal in the field in the world as far as we know. But as far as I am concerned, congratulations go to each one of you for your own accomplishments, many of them unsung for a lack of knowledge by others of what you are doing. It has been a real pleasure to be with you for five years. I only hope I will have the added privilege of being able to write the ten years report. May God go with you.