Science in the Liberal Arts College

Harry Fletcher Lewis
This occasion marks the rededication of the Stephenson Hall of Science. The original building was opened with some ceremony just fifty years ago, and the catalogue of that year would have us believe, and with some justification, that the building was fully as complete for its purpose as any science building in any school. Since that day a half a century back many generations of Lawrence students have within its walls passed (or failed to pass) the rigors of Elementary Physics and the odors and occasional excitements of Elementary Chemistry. Here they have dissected dog fish and frogs, examined tons of rock, and classified everything from the lowly fungus up to the largest plant, the tree. The museum has provided a trysting place for couples searching erudition while the engineering-drawing classroom has seen many a man learn his letters.

With the passing of the years, the building which provided the last word at the turn of the century became old and wrinkled, so a plastic surgeon was called in and her face lifted. According to the psychologist, this should give her a new personality. Together with the face lifting, a complete replacement of the rundown and worn out vitals of the structure has also been effected, and now there is ready for future generations of Lawrence students a new building within and without, newly equipped with modern laboratory benches, with
a modern auditorium provided with comfortable and squeakless seats, with staff offices in pastel shades to match the individualities of their occupants, and the over-all effect—light, quiet, and extremely usable. Whether the new building is productive per se of a higher quality of scholarship is doubtful to me, since some of the best college teaching does not appear to depend upon its immediate environment, but if staff and students are stimulated to new endeavor by their cheerful surroundings and if the facilities in themselves draw to the college each year even a few promising students who might otherwise have gone elsewhere, then the efforts of administration and Lawrence friends will not have been in vain. If the new environment makes the bitter pill of required science taste enough better to fine arts and humanities majors to result in a subsequent improvement in its digestion, then there has been an extra dividend from the investment.

So we congratulate Lawrence College on the new building and extend our hopes that the objectives for which the rebuilding funds were given will be met in full. To you members of the class of 1949 who have majored in one of the natural sciences, we must extend our condolences for completing your undergraduate program before the new building was in full working shape. Many of your advanced courses in science have been carried out under handicaps, for the professor often had to compete for your attention with a cacophony of air hammers, the whine of the hoist, and boisterous repartee between the stone masons on the scaffolding of the third floor and Edgar, the genial building
superintendent, down on the ground. You faculty who are so fortunate as to work in Stephenson Hall are to be congratulated for having your needs so fully met. The accomplishments of those who labored in old Stephenson Hall under less attractive surroundings should be a challenge to you to do even better than they. Finally, I know I am expressing a universal feeling in extending hearty thanks to the men who have provided the funds which have made the rebuilding possible. It required courage and faith in the undertaking to breast the opposition of constantly higher costs and scarcity of skilled labor. That the job has been done and well done is a tribute to all who participated therein.

So with the new Stephenson Hall as the backdrop, let us take time today to examine the role of the Liberal Arts college in general in training men and women for science careers. With the glorification of the specialist and the research team coming from the procedures developed in winning World War II, I rather think there has come a tendency to belittle the part played by the Liberal Arts colleges and their science professors. In the field of training, they have over the years been prodigious producers of young scientists. They have served the difficult role of interpreting the meaning of science to the great body of undergraduates whose primary concern might be centered in the field of the fine arts, the humanities, or even physical education, and in the first quarter of the twentieth century (the first half of the Stephenson Hall life span), they contributed significantly to the body of scientific literature through their laboratory studies.
The last twenty-five years have seen a remarkable expansion in the field of science in the United States and a significant change in the part played by the Liberal Arts college. With your permission, I'll use my own experience as a case in point. Thanks to the life-extending properties of vitamins, hormones, antmycotics, and the like, I am not yet an old crock. Yet when I went to Wesleyan University in Middletown, Connecticut, as a freshman in the fall of 1908, I was registering in a Liberal Arts college with a student body of less than 300 and an endowment of approximately a million dollars. The school had no swimming pool, no student center, no faculty club house, but it was already a leader in the use of the experimental method in teaching. Our science building housed geology, botany, zoology, and chemistry, together with a full fledged museum. Compared with the new Stephenson Hall, it was in all probability a dark, smelly, poorly ventilated fire trap, with evidences of past explosions on the ceilings and of earlier floods on the floors. In 1908, I am sure I considered it to be an imposing edifice. The teaching staff working in that building included three men in the chemistry department, two in the department of biology, and one in geology. The man to whom I reported for freshman chemistry was a tall, dynamic individual, an excellent lecturer and experimentalist, who liked to sit after class on the top of his lecture desk with his long legs crossed under him and chat with the inquiring students either on the cloudy issues of the class period or on questions of theology (in which he took the liberal view), on the fine points of sailing and fishing, or on the latest developments in the field of liquid air research. He immediately captivated the
interest and imagination of at least one student who was permitted to participate in the operation of the first plant in New England for liquifying air. If my memory is not playing tricks, this machine supplied the liquid air used by Harvard, Yale, and other eastern universities for their low temperature studies, but the cryogenic laboratory where we made the liquid air was located in a wooden structure we would be tempted today to call a barn. On the second floor I studied bacteriology with one of the early workers in the field of food bacteriology. "Herbie," as he was known to the irreverent college boys of that generation, permitted me while still an undergraduate to participate in some of the researches for which he is remembered today. I suspect that that was my first experience stepping out on my own. I thought then I was really contributing to the field; I know now that that great teacher used this as a method to stimulate the imagination and what the interest of the prospective scientist. When my four years as an undergraduate were over, I stayed to carry on research in the basement of that old building, in a homemade laboratory built in the area used by Atwater and Benedict a few years earlier in their work in the field of nutrition. Here Wesleyan students of a former generation rode endless miles on fixed bicycles while Benedict measured the work they did and the energy consumed. This in itself, together with the fact that the chemical library was largely Professor Atwater's personal library, provided a stimulating environment for the young tyro in the field of chemical research.

As I put down on paper the past glories of Wesleyan, I began to wonder whether time had served to paint a more glorious picture
of research activity than actually had existed. My old professor may really never have done the vast amount of research I had remembered, so to check I went back to the faded tomes of 1909 in our Institute library, thumbed through the indexes and found that the three men who were teaching chemistry at Wesleyan in 1909 actually had been even more productive than my memory had led me to expect; before I finished reading the papers they published that year, I had gone over 69 pages of research on a wide variety of subjects. Now I know that this was a remarkable achievement, for they did their researches in corners of the cluttered stockroom or in their offices, and their work was pretty largely done by their own hands or with eager but inexperienced assistants such as I must have been.

That college was a stimulating place for me. The science teachers were citizens of the town in the best sense, and the campus was in truth a real cross section of life. But the interest of these men in their scientific and civic enterprises never made them forget for long their major responsibilities—the students—and from Wesleyan young scientists streamed out to graduate schools all over the country, the majority on fellowships and assistantships obtained for them by their professors.

What was done at Wesleyan was in process on the campuses of many other Liberal Arts colleges.

With the coming of the two world wars and the upsurge of research interests by industry and the government, the relative im-
portance of the colleges as research centers began to decline, and that function, together with many of the research-minded college professors, was taken over by industry and government and by the universities.

Even in the universities changes are underway. Back in 1915 when I was in graduate school at the University of Illinois, one of the great Illinois chemists, W. A. Noyes, had his own research laboratory where, with one assistant or two, he worked with his own hands in a wide variety of fields; on the side he edited CHEMICAL ABSTRACTS which he has been instrumental in starting. Today his successors serve industry as consultants or work for government, directly or indirectly, as contractors on army or navy research contracts and are prominent in the activities of the National Research Council and similar agencies. The research formerly done by the professor is now carried on by a large group of graduate students and by postdoctoral fellows. Meanwhile the professor in the Liberal Arts college, without consulting income or graduate assistants, finds it harder and harder to carry on research and at the same time do the good job of teaching expected of him. In the fifteen years following 1927, ten Liberal Arts colleges together published two-thirds of all the Liberal Arts college chemical research appearing in the JOURNAL OF THE AMERICAN CHEMICAL SOCIETY. Nine of the ten colleges were located in the northeastern section of the United States, the exception being DePauw. All ten were comparatively well to do financially, as we in the middle west view the physical resources of an institution. It is a matter of interest, to me at least, that the average amount of material published by these ten schools in the
fifteen-year span was just about the same as the production of the three men in the chemistry department at Wesleyan University back in my sophomore year alone.

What I've been trying to say is that a few decades ago the science departments of the Liberal Arts colleges were serving a threefold purpose—they were training men to carry on either graduate or professional work in the science fields, they were interpreting the meaning of science to the great body of nonscience majors, and in addition they were carrying on significant research, and now this last function has been largely absorbed by other groups. Does the loss of this function take away sufficiently from their over-all accomplishment to the point where a student who wishes to prepare for a career in science might better go elsewhere? Is it possible for the college teacher of chemistry or physics who is not primarily interested in research to be a good teacher in terms of preparing a man for a career in science?

I think the answer is that it depends upon the teacher; actually not all good teachers are good research men, nor are too many good research men good teachers. But the assumption which has been held too long that in order to be a good college teacher of science one must have a practicing interest in research, well "it ain't necessarily so."

I have just said that good teachers may or may not be good research men, and good research men may or may not be good teachers.
We can evaluate the research interest and activity of a man, at least in part, by measuring the volume and quality of his publications. Difficult as it is to determine this research capacity with some degree of accuracy, it is even more difficult to judge good teaching objectively, particularly when we're trying to compare the jobs done by the university, on the one hand, and the various colleges, on the other.

One way to do this might be to devise a way to estimate the quality of the graduates of each school. That is what is done in the paper business by discriminating purchasers. While it is not too easy to do in the field of technical training, attempts have been made. For example, the American Chemical Society has made an extensive study of the work done by colleges and universities in the field of professional training and has accredited 157 felt to be well qualified for professional training of chemists by facilities, staff, number of books in the chemistry library, the quality of students sent to graduate school, and the like. Of the list, only 27 are Liberal Arts colleges, including three midwest conference colleges—Lawrence, Monmouth, and Carleton.

Still another method of evaluation has been attempted by the Office of Scientific Personnel of the National Research Council. This group has been seriously concerned with the problem of maintaining an adequate group of scientists for national defense. In order to get factual information on the sources in which the scientists of the country were being trained, they undertook a study of the baccalaureate origins of the science doctorates awarded in the United States between 1936 and 1945. The figures thus accumulated were made available to the
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President's Scientific Research Board, of which John Steelman was the chairman, for their study of "Science and the Public Policy." It should be stressed that these surveys concern themselves only with the effectiveness of the colleges and universities as producers of professional scientists, and this is only one of the teaching functions of a department.

The results of the National Research Council survey are both reassuring and alarming. Reassuring in that, according to the Steelman report, they show that a few of the hundreds of Liberal Arts colleges in the country are producing scientists out of all proportion to their size, prestige, and financial condition, and alarming in that they show that the greater proportion of the Liberal Arts colleges are largely unproductive. Also in proportion to their enrollments, the big universities send few of their graduates to graduate schools and into scientific careers.

Naturally the figures supplied in this report have created quite a lot of interest—interest on the part of the schools making a good record and interest on the part of schools of good reputation but making a poor showing in the report. The report presents in tabular form the number of students going from the school to complete the Ph.D. in 28 fields of science in some one of the 90 graduate schools of the country. Calculating machines have been busily used trying to interpret the data. My own slide rule has had an extra workout while I was collecting data for this address. At one stage my wife began to look with some suspicion at the sight of me with slide rule and a tabulating notebook. Finally, unable to contain herself any longer, she opened an
issue of Public Health Nursing to the statement that "Some writers have a tendency to use statistics as a drunkard uses a lamp post, more as a means of support than for illumination." and pointedly hinted that a Commencement address was meant to be inspirational rather than factual.

In spite of that admonition, I completed my figuring of the percentage of students graduating from various colleges who then went on to the doctorate in science. Although the returns are not yet complete, by using certain assumptions it seems probable that there are some 22 schools in an empirical top classification. This is the group sending three per cent or more of their graduates on through the Ph.D. in the sciences. Of the 22, one is a high-class relatively small technical school, one is the small undergraduate Liberal Arts college of a large private university; the other 20 are Liberal Arts colleges. The leading Liberal Arts college, a co-educational school, sent almost seven per cent of its graduates to science doctorate—calculated to the men graduating, the figure is doubled. Three co-educational Liberal Arts colleges, led by one of our sister schools in the Midwest Conference, have sent better than three per cent of their graduates on to chemistry doctorates; in the top school, also co-educational, seven of every 100 men graduating became chemistry Ph.D.'s.

It is almost impossible to see what these 20 Liberal Arts colleges have in common, apart from their common tradition and record of achievement in this field. Some of them were well to do, as Oberlin with its 23-1/2 million endowment and budget of 3-1/4 millions, Emory with its 8-1/2 million dollars worth of buildings and equipment. Some
probably consider themselves hard up—for example, the endowment of Iowa Wesleyan in 1947 was only $700,000, the value of buildings and grounds at Nebraska Wesleyan $632,000, and the budget of Mississippi College $270,000. But the majority might be considered as middle of the road schools financially.

In view of the importance generally placed upon activity in research as a necessary attribute of a good teacher, we might expect that there would be one community of interest, but only three of the twenty (DePauw, Swarthmore, and Wesleyan) were among the list of ten colleges reported to have published two-thirds of the Liberal Arts college research in chemistry; a few of the 20, I suspect, do no research at all of the conventional type. We might think that the students attending these schools represent a group carefully selected from the most promising high school and preparatory school graduates. However, some have highly selective student bodies and some do not. In the main, the students come from homes where the old fashioned virtues still are advanced and not many have any excess funds for Joe College activities, but I'm sure they are not to be classed as "grinds."

Life on these campuses is not greatly different in its outward aspects than life on a hundred others. So it's not fine buildings, complete libraries, remarkable opportunities for hearing outside lecturers, nor the absence of these advantages that identifies this group, nor is it the research activity of the staff nor the superior quality of the student body.
been established over the years and this was going to be maintained by
the department at all costs.

I suspect that the opportunities which would result from a
successful undergraduate career in chemistry were held up as a bait to
the freshmen and a prize to the seniors, and the reward would be the
opportunity to go to graduate school. I further suspect that there
were disciplines enforced in the science courses not to be found else­
where on the campus. I would not have you think that life in that
department was a grim struggle. Far from it; it most nearly represented
life in a large family—something like the family in "Cheaper by the
Dozen." The day I was there staff and students were planning a picnic
to a neighboring state park, and a fine relationship was much in
evidence.

As far as I was concerned, there were four factors responsible
for the productivity of that department, all of which tie back to the
faculty. Opportunities were provided for undergraduate participation
on a colleague level in significant research. A successful graduate
school tradition had been built up over the years and this has had
a positive effect in maintaining departmental standards. A warm personal
relationship existed between staff and students, and this extended
beyond the temporal confines of the campus. Finally, chemistry at
that school seemed to be the personal responsibility of staff, students,
and alumni.

These qualities in differing ratios are apparent in the
science departments of many other schools on the list. In some the
graduate school tradition is stronger, in some the opportunity for student participation in research, in many a close contact was maintained between alumni and department, but all of them acknowledged the part played by certain faculty men and women. Many of these people I know personally. As a group, they are genuinely interested in the student, and this makes them insist on their students making the most of their opportunities; this applied to the C and D students as well as to those up in the higher echelons. Most of them seem to have a good sense of humor and not too great a regard for their own importance. Quite a number of the men received their own training back when the graduate schools were small and were staffed by men of broad interests; hence, they had never become narrow specialists.

It should be viewed with regret and with some concern that the circle of these unusual teachers is being cut into by death and retirement. It will be interesting to see whether the young research-minded instructors of more recent years who replace them will be able to do as well.

It is unfortunate that these real teachers do not have more opportunity to pass on to the new recruits and to some of the uninspiring teachers of the graduate school the virtues they have distilled during their fruitful days. I know of one retired university teacher of organic chemistry who is devoting his time without compensation to enlarging the research interests of staff and students of a number of small colleges. What is really needed is to have that work in reverse, to send some of the good college teachers who have retired back to the universities to initiate the graduate students who plan to teach in the
brotherhood of good teachers.

That may seem like a brash suggestion, but while I'm making it, I'd like to make another one. Industry and our learned societies have made medals and stipends available for those who make outstanding contributions through research. This should be broadened to include those who make outstanding contributions to undergraduate teaching. Here the excellence of the teaching might be determined by an objective study of the products of that teaching. These awards would serve a double purpose; they would provide tangible recognition of accomplishment in one of the most difficult professions and might help to keep the good men in college work.

You may think from what I've been saying that I think the science functions of the Liberal Arts college are its most significant. I do not. What I've said I believe applies equally to the other sectors of the curriculum. The over-all opportunities and responsibilities of the independent Liberal Arts college were never greater than they are today. Let us be wise enough to see our advantages and to build upon them to the fullest.

And now may I speak, in loco parentis, to the members of the class of 1949, graduate and postgraduate. You have now completed the formal programs you started way back on your first matriculation day. Some of you have covered a great deal of space and time since that day. Your outlook on life has been influenced to a much greater degree by your experience than is generally the case in the normal college span. Some of the values which seemed important to you at the time have become insignificant; others have risen to take their place. I
need not remind you that you're starting out under different conditions than have existed during the past several years. The great needs for people in teaching and industry are beginning to fill up, the demand for scientifically trained technicians has been largely met, and now you're going out into a buyer's market to compete for your own place.

What you are encountering is no different from what has been taking place in industry during the past months. The wise companies are having unnecessary frills taken off all kinds of production in an effort to make them more interesting to price-conscious buyers. Devices are being used to cut production costs and overhead with the same end in view. Salesmen are now trying to recover their old skills in the all but lost art of selling. When goods were scarce and money easy, the purchaser could not afford to be critical, and cars had to be taken with all the gadgets or not at all.

The same condition applied in the manpower market. Employers needed help in all categories to design, produce, and distribute goods on the markets established in this country by wartime necessity and postwar reconstruction and through Lease Lend and the ECA all over the world. These extra markets no longer exist, and as a result, our economy is at least part way back to the days of free enterprise and competition. Just as industry and its sales representatives have lost their keen edge during the days of the so-called honeymoon, so did its manpower. With lots of jobs in all kinds of communities, there was no longer the need to stay through the "indoctrination period" if some small irritations
arose. Salaries increased in some cases out of all proportion to the
services rendered. As a result, the fat is being melted out of those
soft jobs, whether they be in technology, management, or in production.

The change from the buyer's to seller's market in manpower
will have a profound effect on you who are starting out this year. Your
degrees, whether they be Bachelor’s, Master’s, or Doctor’s, mean prac-
tically nothing to your employers or fellow workers. You're going to
have to stand alone on your own two feet and prove that you have earned
the right to your job and to an advancing position in your organization.
You'll not get it just by outlasting the other fellow; you're going to
have to be smart looking, smart thinking, and smart operating, without
at the same time being a smarty.

Your education in this Liberal Arts college and its affiliated
Liberal Science graduate school will have given you some ideas of the
foundations on which your life will be built. You have not been taught
to become skilled artisans—rather you have been trained to think for
yourselves. How you go from this point on will depend in large part on
you, but if the structure is to grow according to the lines of the
foundation, it will be necessary for you to continue to read, study, and
plan. I cannot emphasize too strongly the fact that you can learn
much from your associates. Everyone has something to give—you, in turn,
have an obligation to give to others.

Unless you are different than most people, there will be a time
on that first job and on probably every move you make thereafter when
you'll feel you've made a terrible mistake in taking that job and you had
better move on into something else. That period comes anywhere from two
weeks to six months after you start work. It's not to be confused with a similar symptom which may come after you've been on the job for a period of years, when you feel that you could better yourself by changing jobs. Frequently you'll be right. If you're smart, you'll never let your employer get the same idea.

You're going out to be working citizens of a community. As an educated man, you will be expected by society to participate in its affairs, thoughtfully and actively. Let it be said of you that you are a positive member of the community. Work for and support financially the agencies established to build it up. Get out of the grandstand and onto the playing field, for only in this way can democracy work.

Finally, be an active alumnus of Lawrence College and The Institute of Paper Chemistry. Come back for the football games, sure, but do more than that. Let the administration know you're backing them with your money, your time, and your interest. Keep your names out of the "address unknown" section of the alumni files, sometimes known as the college dead letter office. Talk Lawrence to high school students and their parents. If you are an alumnus in the best sense of the word, you'll do your share to keep this liberal Lawrence College free and independent. If the graduates of a school do not believe in the school to the extent of backing it, it's hard to persuade someone who is not an alumnus to put time and money into the school. And so to you all Bon Voyage! May your journeys be fruitful, your landfalls secure.
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