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# SOME PROBLEMS OF AN EDUCATED MINORITY[1]

By Dr. OTIS W. CALDWELL

GENERAL SECRETARY, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE has been a constant factor in the education which has brought these young men and women to this, their graduation exercises. Science represents but one division of all the studies and experiences they have encountered. During most recent years their studies have been focused toward special careers, all scientific, broadly speaking. Previous to this specialization they and thousands of companions were engaged in what we call general education. To-morrow and afterward they look toward enployment in which they may use their general and their scientific education. Some have already found positions, others will find positions suitable to their training and ambitions. Some will not be so fortunate, if we may judge by the average results throughout American higher education. These average results are not primarily to be credited to or confused with current unemployment, but go to even deeper foundations in the American system of general and special education.

In this country we promise general education to all who wish it. Furthermore, we have laws which require that all young persons participate, so that those who do not wish education are more or less forcibly exposed to it anyway. Then, the educational system was asked to extend its years and to broaden its program so as to provide a living place for youth well toward their maturity. Some of these older youth are in educational institutions because they wish to be; some because they are nowhere else.

It is not news to any college administrator nor to the head of any professional college that the present educational situation causes many educationally drafted

[1] Address at the graduation exercises of the Medical College of Virginia, June 6, 1939.

but hardly scholarly students to seek places in technical lines—medicine, law, teaching, accounting, even the ministry. Indeed, our generous system of scholarship aid, originally designed to enable superior young people to gain the education they might otherwise miss, has sometimes been used to encourage mediocre minds to aspire to professions for which native capacity illy fits them. America's slogan of "Educational opportunity for each person" has been misunderstood by some to mean that any person, by means of enough education, may rise to the top in any profession. Doubtless, we shall continue to believe in educational opportunity for all. Literacy and a measure of participation in constantly growing knowledge are worthy purposes for every fairly normal human being. But creative scholarship is for those who have potentially creative minds. It is an unsolved problem of how a system of universal education can secure for all the general education needed, without raising false hopes for many who are not likely to succeed in the more specialized professional callings.

Some of the reasons for this dilemma are fairly clear. Hard physical labor by the many seemed unattractive when compared with what seemed to be the shorter hours, better and cleaner clothes and better pay of the professions. The shorter hours is a myth except for those who rise to less than the full measure of responsibility of the professions. There seems to be about as much card-playing, even bridge-playing, in one part of society as in another. Such things, in excess, are exponents of attitudes toward life rather than of mere quantity of education. If ease of living is one's major objective, higher professional education is hardly desirable.

Those now being graduated into higher scientific professions are welcomed into a fuller life, but not an easier life—a life in which well-intentioned mediocrity is not likely to be markedly successful. While the services of the sciences and arts are open to all who wish to know enough to enjoy them, the successful professional practice of the sciences and arts is open only to those of superior capacity, superior education and good social sensing of such callings.

The physician who cared for me during my childhood was a genius of his day. Let us not raise the question of whether he served society by helping me to live through the gamut of infectious diseases, then highly lethal, but now mostly under scientific control. That physician was almost self-educated. He read, rode and practiced under guidance of his predecessor of a still earlier generation. Whether his patients lived or died, he studied the results to guide him in subsequent cases. That doctor's fees were moderate though paid with difficulty and gratitude—sometimes paid mostly in gratitude. His house was the best in the whole community, his riding and driving horses the best, his advice and leadership gladly accepted by nearly all citizens. His occasional defeats by John Barleycorn were promptly forgiven by all except the preachers, who also forgave him when their next illness came upon them.

For this doctor's effective education, the community asked no return except the broad professional service which he gave. No one then thought of so-called socialized practice, which topic I shall not now discuss. But this truly educated man, hopelessly in the minority numerically, was almost a controlling factor in many aspects of community life.

In that early day there were but few successful physicians, and those, like other professional people, had little general education. The dentists always extracted offending teeth; any druggist was a pharmacist; the trained nurse had not appeared, and other professions were in similar stages of growth. Then, a system of public general education was developed, and slowly there came requirements of foundational education to precede specialization. To-day, we have the problem which arises from the tendency to rush through the years of general education toward the benefits of the special fields which can be reached only through higher and special education. We sometimes act as if we want to build the upper floors of our building without bothering much about the supporting foundations. Dean Le Baron R. Briggs, formerly of Harvard University, said:

> The university of today, carried away by its own development out of the college, has become dim-sighted toward two things: first, the relative importance of sound elementary training as compared with advanced scholarship, next the impossibility of advanced scholarship without such training. Few men can be original scholars; many may, by long and highly specialized work, become learned, and may find little to do with their learning when they get it. Tempting mediocrity to the higher learning has much to answer for. . . . No college ever made a man great; but many a college has helped a great man, and added efficiency to small ones.[2]

Minds of medium or average quality are far more common than are those either of *superior* or of *inferior* quality. But the ambition to participate in the superior intellectual callings is not limited to persons of superior minds. In a country in which education, even higher specialized education, is so nearly open to all, it is not surprising that so many teachers are illy prepared for teaching, that there are so many ordinary preachers, doctors, lawyers, dentists, nurses and pharmacists; that there occur so many well-meant but disappointing even tragic cases in practice by those who would have done better if they had been better.

"Oh," says our professional Pollyanna, "Look at

[2] L. R. Briggs, "Men, Women and Colleges," Houghton Mifflin and Company, 1925.

the magnificent improvements that have been made." Yes, they are very wonderful and one of the justly claimed glories of our day. In mechanical appliances we live farther from our great-grandparents than were they from the Pharaoh king, Tut-Ankh-Amen. But the material achievements, which almost surpass our appreciation, strongly illustrate the unbalanced development of specialized knowledge and practice. It probably requires the highest possible type of mind and of education to discover, invent or in some way to secure a development of masses of people who will make unselfish and constructive uses of our material achievements. Too many high-speed automobiles, bought upon hopeful-partial-payment plans, rush irresponsible groups to luridly advertised objectives, from whose exciting blandishments another homeward rush is made in order to be back on time at any regular post, if there be one, where productive employment is had. Surely it is a major problem, for the educated minority, to find good and attractive ways in which specialized knowledge may do the most good and least harm to society as a whole.

Times have changed greatly for most scientific professions, and other changes seem imminent. Since our whole educational system, including much higher professional education, has been opened to all and supported so largely by public expense and by endowment, as higher scientific training has become more costly, there has come increasing insistence that those with capacity to benefit from higher education owe part of their gains to the public. The problem is now presented as to whether education and the benefits therefrom belong wholly to any professional man.

An illustration of this is seen in the field of invention and patent rights. Highly trained and creative-minded men have discovered or devised mechanical improvements, new chemical combinations, new flower and food plants and plant products, and have secured patents covering their use. Patent rights have been issued upon many kinds of flowering and fruit plants and many thousands of mechanical devices and chemical and physical combinations. With new knowledge of chromosomes and genes, we may soon have patents not only on certain kinds of roses and hybrid corn as now exist, but might even have them upon milk cows and race horses. Accusations of infringement upon patents are constantly in the courts, based upon the legal right of those who secured the patents. Machines, medicines, books and all sorts of patented and copyrighted useful things are exponents of the growing stream of invention and creative work.

This problem directly concerns the discoverer or inventor, that is, a relatively small number of educated persons. It also concerns all people less directly, but no less certainly. And it is of tremendous import to present and future growth and use of knowledge.

We sometimes give too little attention to the fact that almost no great discovery, invention or combination of chemicals, of chromosomes or of physical forces is entirely new with the person or groups of persons who make the announcement. This fact does not lessen the importance of the announcement. Indeed, it increases its importance by showing that new things are usually merely additions to existing fundamental trends of thought and action. Adequate recognition of that which is new is desirable. But it is not desirable that a patent or copyright shall either allow the claimant to come into personal possession of the stream of thought of which his discovery is but one tributary or that his claim shall inhibit further discoveries of other tributaries which may later prove to be closer to the sources of the living springs of the whole stream.

Several persons and groups of persons in different nations had long been engaged in trying to make a vehicle which would operate without a horse to pull it. Success in this enterprise was almost simultaneously claimed by nearly a dozen independent workers. Similar principles and appliances appeared in all, as did dissimilar principles and appliances. Steam, gas and oil were each given a chance to supplant the inadequate horse. Although each worker doubtless wanted to know what others were doing, it seems likely that there was little actual stealing from one another. Rather, each worker had compassed the existing knowledge in the field and sought to add to it. The existing knowledge, in its previous development, showed the possible directions for the next steps, and independent workers sought to take those steps. That they took those steps almost simultaneously indicates some of the ways in which knowledge grows. To attempt to allow patent rights exclusively is to attempt to dam the huge stream of scientific thought. Such dams are soon undercut or washed aside, or the stream of advancing thought cuts around them.

The automobile also illustrates another phase of the problem. When it got started, vehicle-thinking was in terms of high wheels, narrow bodies, dashboards, buggy whips, high tops adjustable for rains and winds; and of roadways permitting a speed of four or five miles per hour. There was no need then of a club of drivers agreeing not to exceed 50 miles per hour. The first automobiles were little more than "horseless-carriages," named for the absence of the horse, resembling the old carriage which now operated while the unharnessed horse remained in the pasture. It required much constructive thinking, and will require much more, particularly in man's uses of it, to make a vehicle appropriate to the fundamental ideas of the automobile. Society is being taught to be uncomfortable when riding in an old model. Sales agents have learned the value of claims that new models include some of the sought-for added inventions. In fact, the

patents now being granted upon new automobile inventions do not stop, but merely delay the competitors.

The fundamental problem of "Whose are the inventions and the products of higher learning?" is not likely soon to be solved, but there are significant trends toward solution. Many years ago the University of Wisconsin rendered assistance to Professor Babcock in his research regarding milk production. The milk-tester which he invented sent the star-boarder cow to the butcher, gave a diploma of merit to the cow which more than paid her way, and gave a bank balance to the dairyman who decided to become scientific. But Babcock assigned the invention to his state university, and thus to the state which cooperated in his research.

Since the Babcock assignment the Wisconsin Alumni Research Foundation has been organized. To this foundation, university faculty members are invited to assign any patents they may acquire, the inventor receiving 15 per cent. of any financial returns therefrom. The rest of the proceeds from such patents are used by the university for further scientific research. During the past ten years over one million dollars of such funds have been used by the Wisconsin Alumni Research Foundation.

Certain other educational institutions now ask staff members to make assignments of patent rights, with varying recognition of the personal interests of the inventor. Such institutions are the California Institute of Technology, the University of California, University of Cincinnati, Columbia University, Harvard University, Iowa State College, Cornell University, Lehigh University, Massachusetts Institute of Technology, University of Michigan, University of Minnesota, Pennsylvania State College, Purdue University, St. Louis University, University of Toronto, University of Utah, and possibly others.

Then, there are separate research foundations to which patents are assigned, such as the Bartol Foundation of Philadelphia, Carnegie Institution of Washington, Chemical Foundation, National Research Council and Research Corporation of New York. These receive assigned patents, let them out to approved manufacturers, give an agreed percentage of the returns to inventors, and use the major part for further research. In the main these are non-profit organizations interested in the advancement of science.

Another type of control and use of new ideas is found in many industrial research organizations. Many years ago the Mellon Institute of Pittsburgh was established to discover, develop and use new ideas in industry. A cooperating industry makes a research allowance to the institute. The research worker is paid a salary. His results belong to the donor of his salary. The donor may give a bonus to his research worker if he chooses when the results of the research are financially valuable. All discoveries and resulting patents belong wholly to the donor of the research salary. Thus, the education, the labors and new ideas of the worker belong to the donor. Discoveries may be kept secret indefinitely if the industrial donor so desires.

At the other extreme is the policy of the Rockefeller Institute of Medical Research, which says all discoveries "are made freely available to the public. . . . Other than through the issuance of license, the Rockefeller Foundation does not participate in any way in the commercial preparation or sale of the manufactured chemicals; and it receives no royalties or other pecuniary benefits from the license it issues."[3]

A highly important corollary problem concerns new knowledge, discovery and invention in their relation to human employment. There is a wide-spread belief that new knowledge, as shown in new devices, destroys work opportunities. Scientific achievements are accused of removing workers from their jobs. The soap-box orator can point to the steam shovel in a building excavation and make his point by saying, "It is doing the work of twenty men." A mechanical wheat harvester was burned in my home county because laborers claimed it had lost them their wages. Yet even now, farmers can not secure adequate man power, at increased wages, to accomplish their tasks. What are the facts?

It is obvious that invention has reduced the quantity of demand for certain types of labor, and at the same time has changed the quality of labor needed.

In a recent address before the Florida Academy of Sciences, Dr. Allen presents figures which are illuminating. In the United States there are at least 18 major industries which were "entirely unknown 50 years ago."[4] During the past 50 years while our population has increased "118 per cent., the proportion of employed persons in the population increased 191 per cent." In Manhattan, New York, "there are now four times as many ways of earning a living as existed a quarter of a century ago." The manufacture and sale of transportation machinery now employs approximately ten times as many men as in 1900 were employed as "blacksmiths, stable operators, teamsters, harness workers and wagon and buggy builders." The electric refrigerator has stopped the daily trek of the ice man into the kitchen, and our 10,000,000 refrigerators demand more and better trained workers than previously handled ice. These operations now use tremendous quantities of products from farms, forests and mines, thus very greatly increasing the market for agriculture, forestry, mining and other productive enterprises.

[3] "The Rockefeller Foundation—A Review for 1938," Raymond B. Fosdick, 1939.

[4] Robert I. Allen, "Science versus Unemployment," SCIENCE, 1939.

This is not the proper occasion for further citation of such facts, but is the occasion for directing attention to the significance of such facts in relation to fundamental problems of our day. Persons who have had the benefits of higher education are needed as informed leaders. Instead of accepting and contributing to the disquiet of misunderstanding, instead of encouuraging the wishful thinking about the good old days, which can not come again, we need to redirect education in accord with the difficult but better present day and those which we should like to believe may be ahead of us.

The highly educated minority seems to be close to the crossroads in the progress of higher learning. Their leadership in thought and practice can continue only as they find effective ways to distribute useful knowledge and service and to lead the majority toward sympathetic participation in advancing knowledge. The mass of knowledge-consumers and users, even though they are not primarily discoverers, now need, and sometimes expect or demand, enough insight into new knowledge that they may appreciate its significance.

The older idea was based upon an authority possessed by the leader, who was an inventive scientist. But in our country, authority of persons as such will rapidly diminish. Known and demonstrable truth must be the final authority. They told Louis Pasteur in 1881 that he could not prevent anthrax in cows and sheep by his claimed vaccination. What authority did he use in proving his case? He said: "Provide cows and sheep for a public demonstration and we shall see the truth." On May 5, 1881, he vaccinated 6 of the 10 cows and 25 of the 58 sheep. Four cows, 23 sheep and 2 goats and 10 control sheep were not vaccinated. On May 17, 1881, the same sheep and cows were again vaccinated. On May 31, 1881, all cows and all sheep except the 10 control sheep were given fully virulent anthrax germs. On June 2, 1881, all unvaccinated cows, sheep and goats, except the 10 controls, were dead or severely ill. The truth was demonstrated and accepted.

Not only the material benefits from modern knowledge, but the science man's way of working need to be more fully understood and more widely used. Pasteur did little arguing. He presented truth and demonstrated the meaning of truth. He withheld nothing for himself. He sometimes expressed regret that so many uninformed people could not, or did not, wish to understand, but he found encouragement from those who did understand.

One of the biggest, probably the biggest, problem for an educated minority is that of extending the way of working, which is characteristic of discoverers, the real desire to know and use proved knowledge. Much has been said about this, but not enough has been done.

Man's inquiring and daring mind is a scientific fact of the greatest significance. Man is an adventurous animal, always attempting something which no one has yet succeeded in doing. At his best, man always wants to do something for society which has not yet been accomplished. His worthy curiosity is a catalyst by which new knowledge and new services may come to society.

Whose is modern knowledge? Is it the property of such workers as the scientist? The administrator? The practitioner? The inventor? The manufacturing industrialist? Or is it held in trust by the better educated, but with the unavoidable obligation that all may be led into its benefits?

Surely, society has the right to expect the educated minority to be its sure-footed leaders, rather than that their superior education may be used by them merely to gain increased personal benefits through exploitation of their advantages.

The creative scientist, the scientific practitioner, the trained social worker, the educator, indeed all those who have benefited through higher education, have their largest, the most difficult and the best task still to be met.

# OBITUARY

## ELMER PETER KOHLER

THE following minutes were placed upon the records of the Faculty of Arts and Sciences of Harvard University at the meeting of February 14, 1939:

ELMER PETER KOHLER

*Sheldon Emery Professor of Organic Chemistry*

Elmer Peter Kohler was born on November 6, 1865, in the village of Egypt, Pennsylvania. His immigrant ancestor, Jacob Kohler, from Mühlhausen in Switzerland, in 1728–30, was the first settler in the vicinity of Egypt and acquired there a large tract of fertile land by warrants from the Penn Heirs. Through succeeding generations the Kohlers remained in Egypt as prosperous farmers, millers and merchants.

Elmer grew up on the ancestral farm and in the ancestral mill, profiting greatly from the education that they afforded. An alert, venturesome, self-reliant boy, unusually observant and thoughtful, he made botanical and mineralogical collections and learned the peculiarities of plants and the ways of animals. In the mill and among the farm machines which his progressive father installed he developed that mechanical skill which proved so useful to him in his later life. Above all, and by much hard work, he mastered the science and the practice of farming.