

Educational Adventures

An address delivered by the late George Shannon Forbes on the occasion of receiving the first James Flack Norris Award on May 10, 1951. He was introduced by the late Prof. Athur B. Lamb of Harvard, editor of the Journal of the American Chemical Society.

Let me express my profound gratitude to the Northeastern Section, and to the late Mrs. James Flack Norris for this splendid award, What an honor and delight to be mentioned in the same breath as my old friend Sunny Jim! His enthusiasm for science, the magic of his lectures, his concern for his students, his love of nature, of music and of art his joy in the companionship of men of every kindred and tongue, excited the wonder and admiration of all who were privileged to know him. How appropriate it is that the guardianship of his memory should be entrusted to this Section, which owes so much to his energetic and inspired participation!

In the Kentucky mountains, there lived a character who finally succumbed to a shotgun blast. He had been so much of a local problem that the preacher began his funeral address in a hesitant fashion. But the good man became so hypnotized by the sound of his own voice that at last one small boy said to another: "Go and see whether it's still Uncle John in that box." Just now, I have found it difficult to identify myself with the subject of Dr. Lamb's gracious remarks. "But," I said to myself, "at least I am still very much alive, and part of my teaching lies ahead, so what has been said can serve as an incentive, and not as an epitaph." With this thought in mind, I should like to talk about educational adventures as human experiences, distinct from the more abstract theories of education. Surely, such adventures fall to the lot of pupils and teachers alike. If that be true, I must begin by recounting my early associations.

The urge to teach was ingrained on both sides of the family. My father's older brother, the Reverend Jesse F. Forbes, a Ph.D. of New York University, found time outside of his pastoral duties to lecture on Hebrew and on church policy at Union Theological Seminary. He was three times moderator of the New York Presbytery. Another brother, Edwin H. Forbes, a Ph.D. of Yale, was for many years high school principal, later superintendent of schools, in Torrington, Connecticut, also an ardent crusader for reforms in the curricula of the period. My mother, born Elizabeth L. P. Shannon, enjoyed intellectual advantages far beyond the average for young women of her day. Before marriage, she taught at the Everett School in Boston. For the sheer love of it, she continued in private teaching almost to the end of her long life. Her sister, Martha A. S. Shannon, lectured for many years upon colonial days in New England. When about eighty, she made the last of her numerous appearances in the Boston Public Library series. Clad in the pink brocade in which an actress was said to have danced with Lafayette, she addressed the well-filled auditorium, without notes, on "Peter Faneuil, Bachelor." Both my sisters, before marriage, held positions of responsibility in secondary schools. Teaching was to us more than a livelihood; it was a major part of life itself.

I am truly grateful to Dr. Lamb for his summary of the educational activities of my father, George Fairfield Forbes. His pioneering work as a teacher of experimental physics at the Roxbury Latin School was widely appreciated, sixty years or more ago, and ought not to be forgotten. He was a most skillful craftsman, building with his own hands apparatus for demonstration and study which served as models for many other schools. I submit in evidence the card-dealing machine which he constructed for his whist club, to do away with complaints about poor hands. This top was spun around, and whenever a player pushed the knob opposite him, a card fell into a box underneath. When I was about eight years old, his lecture on pendulums, given before the school and guests on an open house day, opened a whole new world to me. That platform still stands before me in an almost photographic memory. There were many pendulums, big and little, which seemed to obey my father's instructions to the last detail. At the end, a funnel filled with black sand and suspended from three wires, traced out fascinating patterns on big sheets of sticky paper. I began to attempt crude experiments in the cellar of my home.

In the year 1889-90 my father served as acting headmaster of the old school, but his untimely death occurred in the following September. My mother resolved that her children should have opportunities not inferior to those which her husband would have provided. She rapidly acquired a reputation as a private teacher, for she was a potent intellectual catalyzer, and imparted something of her own character and ideals as well. She rented a large house, and took into the family boys who were attending Roxbury Latin or otherwise preparing for college. Quite a few of these came from Cuba or South America, and several attained real distinction in later life. Three years ago, I was deeply moved when the ambassador to the United States of a vast republic, flanked by members of his official staff, called at my office, and said that he had never forgotten the debt which he owed to my mother.

When I was about twelve years old, the parent of a schoolmate confided that her son was having trouble with Latin, especially the "subcessive" mood. Would I straighten him out for twenty-five cents an hour! The prospect of sudden riches, plus a chance to imitate my parents, prompted an enthusiastic assent, and other clients presently appeared. Then graduation drew nearer, and in the last year the class progressed to the translation of Homer. Under the spell of William C. Collar, the ancient heroes came to life again, so that we seemed to share their experiences. I resolved to become a professor of the classics.

In sophomore year, I took Chemistry 3, a full course in qualitative analysis, the second half of which required the analysis of forty solids. W. P. Cohoe, whose genial countenance you often see in the NEWS, moved about the assistants' room in a dense cloud of sulfur trioxide smoke. He had a real gift for concocting diabolical mixtures. The challenge which these presented aroused my combative instincts, and provided real excitement. I will maintain that difficult "unknowns" are unexcelled as a means for early development of the urge to solve chemical problems. Gradually, the classics were supplanted by a new enthusiasm. Then followed a truly decisive event. Professor Charles R. Sanger told me that next year's class would be larger than usual. Would I like to serve as assistant without stipend? Of course I said "Yes," and so, not long after my eighteenth

birthday, I became a duly appointed officer of instruction in Harvard University, continuing on through senior year. In the hard way, I learned the importance, to any teacher, of detailed factual information, and the ability to apply it instantly to unexpected situations. I have never been able to subscribe to the view that long study of educational method, plus a good text book, is sufficient equipment for classroom work. Ten years later, this adventure had a direct influence upon my fortunes. When Professor Sanger's health became impaired, I was asked to collaborate with him. Upon his death, I took charge of qualitative analysis, and thus my feet became planted upon the academic ladder.

In my second graduate year, there began a close association with Theodore William Richards, later Nobel laureate, which was to continue for a quarter of a century. Following completion of a doctoral thesis on an electrochemical topic, I undertook, under his direction, a revision of the atomic weights of nitrogen and silver, the outcome of which has stood unshaken ever since. From 1909 on, I divided with him the lectures in the second half of the old Chemistry 6 (physical chemistry), also the lectures of a half-course on the historical development of chemical theory. The latter was in many respects a forerunner of science in a general education program. In addition, a number of students who wanted to work with Richards were assigned to my research course in their first year of residence. I cannot express the extent of my obligations to that remarkable man for his example, his counsel, his backing. He was a master of exposition, and as we planned coming lectures together, there came some intimations of the secret of his power. Beyond question, tonight's award belongs to him as well as to me. A part belongs also to many other associates, whose performance helped me to improve myself. Instruction is an art quite as much as a science, and some of its most important factors will continue to defy analysis, just like the essence of musical composition or painting. But you will at least agree that great teachers such as Richards and Norris have a real liking for young people, and a genuine interest in their problems. Such a question should always occur, or be put, to all those who think of assuming the overwhelming responsibilities which are inseparable from the profession. We all realize how profoundly academic standing is affected by financial problems, family rifts, love affairs, religious conflicts, and now the draft; but too often we stand helpless. A teacher can seldom comprehend much of a student's inner life, but sometimes we can displace the worry by glimpses of the fascination of science. If that can be done, the student is more likely to take him into his confidence.

On the other hand, mental muddles are always up to the instructor. In a college laboratory, his accessibility is a great advantage, not shared by all members of the faculty. Why is it that some students can extract nothing from the pages of a book, but instantly comprehend when the same argument is presented man to man? A conscious effort to correlate two versions of the same statement is always helpful. No teacher can discuss every difficulty with every student, so the next best thing is to urge the class to compare their lecture notes with treatments of the same topics in one or more recommended texts. Most students feel that there must be some forms in which a difficult point will be comprehensible. But a few will moan that they can never understand it, and then you have to say: "Are you going to take your intellectual beating lying down?"

Haven't you any 'Irish' in you?"

The first meeting of a large class is always a memorable event. The room is now comfortably full, but others are still arriving. The loyal instructors and teaching fellows are sitting together at the left. In the front row are some hearing aids and thick spectacles. An animated hum of vacation anecdotes is much in evidence. The head monitor reports, and a student asks if his football practice will interfere too much with laboratory work. In a moment of reverie, you think of the endless procession passing into the college gates and out again into a competitive and often merciless world. How great the differences in financial success, in domestic happiness, in span of life, in service to their generation! How many of these men will ever return to say that this course has helped them, and will anyone harbor the secret conviction that he has been let down? Then, almost with surprise, you hear your own voice cutting through the din, and a new adventure has begun.

Intriguing enough are the problems of the lecture room. The dangers of the academic rut are proverbial. Some say that each course ought to be worked out every year starting from scratch, and few will deny the advantages of substantial changes. There will be a mental or written list of the points that failed to click, the year before, and the applications can always be made more timely, especially nowadays, when science figures so much in the news. A well considered plan for presentation should be combined with a readiness to follow a lead which suddenly suggests itself, or which is furnished by a question. The unexpectedness of such situations wakes the class up. I must have taught qualitative analysis a hundred times, and the lecture table has always been well covered with bottles and other accessories, so that additional experiments could be improvised without delay. If the teaching fellow in charge of the set-up pointed out that much of the equipment was never used, he was told that any of those items might have been indispensable. Laboratory work provides plenty of opportunities of the same sort. In qualitative analysis, novel complications and "new elements" appear at almost every session. Sad to say, it is impossible to prepare green teaching fellows to cope with all such situations, and in the absence of an instructor, puzzled students will often make no further effort to obtain a sufficient explanation. But I have been talking too much about qualitative analysis, a subject which has few apologists today. Please don't forget that over the years, various emergencies have propelled me into nearly everything else, not even excepting organic chemistry. What an adventure that was!

Occasionally, it does pay to write out parts of lectures, just to make sure that obscure or slovenly modes of expression are not becoming habitual. But is it well to polish whole lectures until the words melt in the mouth? A well-known educator once said that nothing is so easily forgotten as a perfect demonstration. Indeed, I have listened to lectures so elegant and so effortless that one could never have recognized the difficulties with which the subject bristled. And oratory soon fails as a means of sustaining student attention. You will recall the schoolboy's essay which said that in Massachusetts bad people are put to death by elocution. Curiously enough, a slip of a lecturer's tongue, or the experiment which fails ingloriously, will seldom fail to produce a lasting impression. Perhaps you must, in a sense, fight your way straight through the hour. And to what extent ought you

to dwell upon your own scientific experiences and enthusiasms? How far can a skeptical audience be convinced that the subject under discussion is really tied in with its own interests? In a word, are the lectures "getting across"?

Up to the present time, the techniques of college teachers, unlike those of actors and professional musicians, have seldom been exposed to public criticism. But already there are signs that in the future, formal student appraisals of professors and their subordinates may become a part of scientific routine. Such polls, if conducted in an atmosphere of fairness and restraint, can improve instruction and mitigate well-known objections to the system of permanent tenure. There would be fewer of those academic tragedies whereby young instructors first become aware of their shortcomings upon the occasion of their dismissal. But even now, the day of wrath arrives at stated intervals. Examination books are more eloquent than the "confidential guide" published by the college daily. When a professor undertakes even a part of the grading, he finds that out for himself. The dismay of the helpless student in the examination room finds its counterpart when the same blank space or the same misapprehension appears in one bluebook after another. What a pitiless light is thrown upon the exposition of that point! These are not pleasant adventures, but any instructor will bypass them at his own peril.

At this point we encounter the divided responsibilities of the teaching fellow. Except in the largest courses, his thesis subject is usually assigned by the instructor in charge. There was a period of about fifteen years when my research laboratory always had a graduate from a certain large college in California, working on photochemistry and assisting in one of my courses. Such an arrangement avoids competition between two professors for a man's time, but it increases the responsibility of the research boss for turning out a well-balanced product. Occasionally, excessive zeal for teaching turns out to be only a mechanism for escape from experimental difficulties. To be sure, apparatus building is an invaluable experience, but what of the student who postpones the essential requirements of his thesis, and who shuns the library, just to blow more glass or to create needless embellishments? Then, perhaps, someone else says he would rather work with his head than with his hands, but that may be because his hands have never been trained. Rarely is it justifiable to lean too heavily upon laboratory mechanics or to install a complicated assembly in a sealed case which grinds out all the necessary data. Versatility, resourcefulness, adaptability, will continue to be factors in scientific survival, just as they have been in the history of biological evolution. Such qualities must be developed as much as possible during predoctoral years, but after twenty it is not easy to make a man all over.

It has always been hard for me to decline a commitment which promised a novel sidelight on education in action. Enlightening was a long term as chief reader in chemistry for the College Entrance Examination Board at a time when its papers were very widely used. This organization provided well planned and impartial tests by which teachers, quite as much as students, could be appraised. In late June and early July, a dozen of us sat around a long table in New York, and we had plenty of good laughs over the boners. Each bluebook was graded by at least two readers, one from a school and one from a college. If these failed to agree, the chief reader stepped in. Then it had to be decided whether given

answers were really bad, or whether the writer had merely failed to include details and phraseology insisted upon by an over-methodical colleague. The pupils of some of these must have had some real adventures. I well remember a gigantic Scotch-American of ferocious appearance but jovial disposition, who was wont to demand that everything be learned by heart, ready for recitation without errors or omissions, all within a specified time interval. Only two grades were ever assigned,--one hundred percent or zero. Yet it was said that he was well liked in a large city school, and that his students were very successful. One day, we challenged him to repeat the names of the chemical elements alphabetically within the standard two minutes; but there was so much kidding that he blew up when he reached praseodymium, and we all yelled "ZERO!" Next, I served as a member of the Board's committee on revision of requirements in chemistry. At our meeting, we wrangled from nine in the morning almost till midnight with very little time out to eat. Finally, the others got so fed up that a motion to adopt the neatly mimeographed plan recommended by my own department was carried without protest, amid the snores of those whose staying power had become exhausted. Perhaps the most revealing experience of this kind was a twenty-year term as a member of the Committee on Admission to Harvard College. We examined many thousands of school records and confidential Documents which described every imaginable scholastic and personal trouble that can beset a schoolboy. Normally, our deliberations assumed quite a serious tone, but occasionally they were enlivened by the wit of Neilson or Grandgent, or by racy anecdotes about school officials and school happenings.

Over a decade ago, as an associate of the Committee of the American Chemical Society on the Professional Training of Chemists, I visited a number of colleges and universities, usually in the company of another associate. We plied professors and administrators alike with searching questions until we felt ready to write a detailed report covering the strong and weak features of staff, curriculum and equipment. Particularly unwelcome seemed our requests to look at recent examination bluebooks. But we were remembered as benefactors whenever the Committee wrote to a college president, pointing out how shabbily he was treating his own chemistry department. The element of human interest was seldom absent. Once, with a well-known professor from Princeton, I visited a small college for girls, maintained by a religious order. The principal was a lady at great refinement and charm. After the inspection, we returned to her office to make sure that the gaps observed in the Committee's list of essentials would not be reported erroneously. With tears in her eyes, she exclaimed, "Yes, that is all true, but we were hoping for a miracle!"

"On a bright May morning in 1944, I sat in my office, perhaps thinking that I had achieved a pretty good coverage of things academic. At that moment the telephone summoned me to the Provost's office, and so great are the exigencies of wartime that soon after I emerged as department chairman. At Harvard, such appointees are not department heads, but liaison officers, who implement the votes of their colleagues, and that can be much worse than making decisions oneself. Even so, there was responsibility enough, and endless paper work. Draft boards cast covetous eyes on our teaching fellows and assistant professors, so that frantic long distance calls and affidavits in triplicate become the order of the day. Then the veterans returned with their rapidly increasing

progeny, under such great pressure to obtain their degrees in the shortest possible time that some of them would have cracked up had it not been for the steadying influence and the unflagging optimism of their young wives.

Preoccupied with such matters, I must have lost track of birthdays, for the sudden realization of impending retirement at Harvard stunned me for a moment. But colleagues and friends suggested new enterprises, and these became just as engrossing as the ones which I had been obliged to discontinue.

What diverse adventures return to remembrance at this time! There was Bryn Mawr; Harvard, including over thirty summer sessions; Radcliffe in the era of separate instruction; and now Northeastern University. A son and a daughter pressing on from the cradle to professional activities. Not forgotten are tutor-companionships in the Maine woods or the Adirondacks; a small summer school in cooperation with my mother and my older sister; foreign universities; a group of underprivileged colored boys in Philadelphia; a science club at a settlement; an adult education project; the Navy V-12 boys; a class of earnest young women preparing to teach in Sunday school the following year. These experiences, and still others as well, have been milestones along the road which led toward clearer understanding of the intricate relationship which exists between teacher and student, or of the possibilities latent in every fleeting lecture period.

Counting student assistantships, this is my fiftieth year as a college teacher, and Northeastern has been so generous as to express the hope that more such years lie ahead. I must confess to you that there have often been moments when I thought that it might be my duty to cut teaching to the lowest respectable minimum, and to immerse myself in additional scientific problems. But whenever I met any of the fine men and women who had been in my classes, I felt reassured. Tonight, your heart-warming tribute makes me certain that the years ought not to have been spent otherwise.