APPLIED SCIENCE AND THE CLASSICS—FULL CIRCLE IN A CENTURY

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In Illinois a century ago, research in applied science—research formalized to the extent of being recorded in print—was just getting under way. The time was one of rapidly expanding agriculture, hordes of hungry insects, and distressed and vocal farmers. Because this research came in answer to the needs of the time, most of it was biological.

Making known the results of scientific research was then, as now, a major problem. Of the few technical journals then in existence in North America, most were published on the distant Atlantic seaboard.

Organization of the Illinois State Agricultural Society in 1853 and the Illinois State Horticultural Society in 1856 opened to Illinois biologists of the mid-nineteenth century two important publication outlets. The transactions of these societies carried many well-written papers based on careful observation, experiment, and study. Subjects of papers included the origin and character of prairie soils; birds of Illinois most interesting to the agriculturist; strawberry culture on the prairies; cultivation, use, and value of the osage orange hedge; tree culture on the prairies; and the education of farmers' daughters.

Founding of the Illinois Natural History Society in 1858 gave biologists of the state still other opportunities for making known results of their research. At annual meetings of the society, well-conceived papers on biology were read, and most of them were later published.

Previous to 1853, the *Prairie Farmer*, founded in Chicago 12 years earlier, was the principal publication outlet for Illinois biologists. Although this periodical was frankly slanted toward the practical tiller of the soil, it regularly published technical reports by well-trained, even though largely self-trained, scientists. The high quality of these reports was in contrast to the character of some of the articles by farmer-readers with less exacting standards of research; in those days every farmer was his own agricultural experiment station.

Prominent among Illinois biologists of mid-nineteenth century—men who stressed the application of science—were John A. Kennicott, a physician, school teacher, and horticulturist; William Le Baron, physician, ornithologist, and entomologist; Cyrus Thomas, lawyer, preacher, teacher, mammalogist, and entomologist; Jonathan Baldwin Turner, college professor, horticulturist, and espouser of causes; Benjamin Dann Walsh, classical scholar, farmer, lumberman, and entomologist.

Applied biological research of the time took mainly two courses: 1) propagation of varieties of plants adaptable to the prairie soils; and 2) attempts to reduce the numbers of insects that with frustrating regularity ruined the crops.

With the opening of the Illinois country to settlement had come travelers or pioneer residents interested

in naming the plants and animals. Although interest in systematics continued, by 1860 the emphasis in most biological research had become principally utilitarian.

Many individuals contributed to this change. In response to needs of the time, they shifted the emphasis to life history studies that had direct bearing on the control of noxious insects, to the breeding and culture of plants, and to other studies that promised to make life pleasanter on the prairies. They employed trial and error techniques that by present standards would be considered clumsy and crude. However, they were scrupulous observers and prodigious workers who had no fear of new ideas. Among their written records are to be found scientific concepts that seem modern even today.

For example, they were aware that catastrophic environmental changes may be caused by man. Nearly 100 years ago, Walsh (1861:339) wrote: "Now it is universally the case, that whenever man, by his artificial arrangements, violates great natural laws, unless by some artificial means he can restore the overturned balance, he pays the penalty affixed to his offense."

Illinois biologists of a century ago were aware that man possesses possibilities of controlling nature through nature—that injurious insects can be controlled by natural agents, not only by birds but by other insects. Walsh (1861:340-341) advised his readers that "one of the most effective means of controlling noxious insects is to be found in the artificial propagation of such cannibal species as are naturally designed to prey on them," and that, so far as he was aware, "cannibal insects have never yet been bred for utilitarian purposes, yet it is by no means an uncommon practice to collect such as are found at large in the woods and fields, and apply them to subdue some particular insect that is annoying us."

The mid-century effort to make science practical, to bring it to the level of people who could make immediate use of it, was not an isolated movement. It abetted and was abetted by the crusade for industrial education. A number of individuals active in one cause were involved in, or at least sympathetic toward, the other. Jonathan Baldwin Turner, dedicated leader of the industrial education movement, was a prominent member of the State Horticultural Society and first President of the Illinois Natural History Society.

In a long letter addressed to a committee representing farmers who had heard him speak at Granville, Illinois, in November, 1851, Turner outlined his plan for industrial education. Of its background he wrote (Turner, 1855: 369-370): "All civilized society is, necessarily, divided into two distinct co-operative, not antagonistic classes — a small class, whose proper business it is to teach the true principles of religion, law, medicine, science, art and literature; and a much larger class, who are engaged in some form of labor in agriculture, commerce, and the arts. For the sake of convenience, we will designate the former the PROFESSIONAL, and the latter the INDUSTRIAL class; not implying that each may not be equally industrious— the

one in their intellectual, the other in their industrial pursuits."

Turner maintained that the colleges and universities of his time were designed for the professional class and he advocated the establishment of institutions of higher learning specifically adapted to the education of mechanics and farmers—the 95% of the population he thought might be included in the industrial class.

In a pamphlet entitled *The Industrial League of Illinois* (Carriel, 1911 : 115-119), Turner asked, "Can, then, no schools and no literature, suited to the peculiar wants of the industrial classes, be created by the application of science to their pursuits? Has God so made the world that peculiar schools, peculiar applications of science, and a peculiar resultant literature are found indispensable to the highest success in the art of killing men, in all states, while nothing of the kind can be based on the infinitely multifarious arts and processes of feeding, clothing, and housing them?"

He lectured and lobbied ceaselessly, until his friend Abraham Lincoln in 1862 signed the Morrill Act that provided for land grant colleges—and then until the Illinois Industrial University at Urbana, now the University of Illinois, was chartered in 1867.

In agreement with Turner in the effort to make scientific learning available to the masses, Walsh (1868 : 9), as the first State Entomologist of Illinois, wrote that his annual report for 1867 was "intended chiefly for the use of common folks."

Walsh (1868 : 10) wrote further, "If there is one thing which I have at heart more than another, it is to popularize Science—to bring her down from the awkward high stilts on which she is ordinarily paraded before the world—to show how sweet and attractive she is when the frozen crust, in which she is usually enveloped, is thawed away by the warm breath of Nature—and more especially to demonstrate how delightful that particular branch of science [entomology], to which I have devoted half a life-time, may be to any one, who will keep his eyes wide open as he walks through his garden or his orchard."

Paradoxically, some of the most influential leaders in the industrial education movement, the effort to popularize science, and the new emphasis on applied biology had received classical educations.

Le Baron, second State Entomologist of Illinois, had been graduated from Harvard Medical College, where the classics were required subjects. Turner had taken prizes in English composition and Greek while a student at Yale College and had taught Latin and Greek at Illinois College, Jacksonville. Walsh, an Englishman, had been educated at Cambridge University, from which he had received a master's degree. As a classical scholar, he had published a work on the comedies of Aristophanes in 1837, the year before he moved to a farm in Illinois.

Probably these men could not have foreseen that, in their zeal to make science and other learning available to all, they had started a movement that too often has resulted in a type of education tending to be both narrow and shallow. Today, a century after J. B. Turner pleaded the

cause of industrial or vocational education, university and industrial leaders are taking a new look at the training of scientists.

We may doubt whether Turner would have approved of the industrial type of education many scientists now receive, for at one time he specifically included scientists in the professional class.

Pressure for a more liberal education for both scientists and engineers is coming today from many directions.

In a speech delivered in April, 1955, before the Phi Beta Kappa Association of the Chicago area, Lloyd Morey, then President of the University of Illinois, cited the results of a business survey reported in the April, 1953, issue of *Fortune* magazine; the conclusion was that overspecialization is robbing business of potential top management material. President Morey (1955: 10) added his own conclusion, that vocational education "has been accorded too significant a place in college and university programs." He said: "I do not mean to suggest that we should not teach law to the lawyers, or engineering to the engineers, or accounting to the accountants. But I would like to make them all *educated people* and not merely *technicians.*"

Grayson Kirk (1959:18), President of Columbia University, wrote recently, "In the college curriculum, the task must be that of continuing for the science-motivated student his long-range interest in his field while giving him enough of a broad educational base on which to build his professional specialization."

Henry T. Heald (1957:179), President of the Ford Foundation, in addressing a group of engineers in New York City, declared, "Scientists and engineers, no less than doctors, lawyers, or the managers of industrial enterprise, need to stand as intelligent, liberally educated men, regarding their knowledge not as a narrow, isolated specialty but as a particularized competence which they, in their general wisdom, can share with the rest of society."

Nathan M. Pusey (1958:69), President of Harvard University, befor a University of California audience at Berkeley, pleaded for an acceptance by the public of "the fact that learning is apt to be most useful, even within professional schools, when it does not aim too intently or too directly at the goal of immediate utility."

Massachusetts Institute of Technology in 1953 established a department of humanities as a recognition of the need for liberal studies in a technological institution.

The Wenner-Gren Foundation, in setting up conditions for pre-doctoral fellowships in anthropology, apparently has tried to assure that students who receive grants will be well-rounded scientists. The Foundation recommends that the applicant for a grant "have a prior degree in some discipline other than anthropology, or be planning to secure such a degree, or its equivalent, in the course of his studies, and be a graduate of some institution other than the one nominating him for a Pre-Doctoral Fellowship."

In a word, the pressure from higher education and industry today is for scientists with the breadth of interests of Turner, Walsh, Le Baron, Kennicott, and Thomas.

We have now come full circle in

the education of scientists. Pressure is beginning to be felt for scientists educated as Turner, Walsh, and other early Illinois scientists had been educated—in the classics.

Werner Heisenberg (1958: 60-63), German winner of the 1932 Nobel Prize for Physics, related that as a student he improved his understanding of atomic theory through his reading, in the original Greek, of one of Plato's dialogs and he paid tribute to the influence of Greek thought upon his own thinking. Those who "wish to get to the root of things in their chosen vocation," he stated, "whether it be in technology or medicine, are bound sooner or later to encounter the sources of antiquity, and their own work can only benefit if they have learnt from the Greeks how to discipline their thoughts and how to pose questions of principle."

The plea for the classics in the education of scientists comes not alone from a theoretical physicist. It comes from — of all places — industry. T. R. Henn (1958:1325-1326), member of the faculty and an administrative officer of St. Catharine's College at Cambridge University, wrote, "Great industrial firms appear to find that, while the supply of *competent* technologists is adequate for their purposes, the supply of men for the very top posts —men who know enough science to direct research, yet whose concern is mainly with wider issues and problems of the highest magnitude —is relatively poor. Many of these firms find it profitable to select arts men — preferably, and strangely, classicists—and train them for such posts. A world-famous electrical firm has just taken seven men with first-class degrees in classics and is converting them, by an intensive three-year course, into physicists and mathematicians."

What is the explanation of this long unsuspected but now beginning-to-be-appreciated relationship between the classics and science—even applied science? Perhaps it is that scientific research— research that is to be imaginative, dynamic, and of the highest order—should be based on the postulate that man gets a longer view of Earth from Venus than he gets from Earth.

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