

EMERGENT OKLAHOMA PHYSICS

Or what possible good comes from having men around who know hadrons occur in octets?

By DR. RICHARD G. FOWLER

Colleges rise by degrees said Upton Sinclair. He meant honorary degrees and did not intend his witticism to apply to universities like Oklahoma. An Oklahoma alumnus can pride himself that anyone sharing *his* degree must have earned it in the same hard school as himself. So it is literally true that OU has risen upon the degrees granted, with phenomenal speed, to monolithic stature. And this stature is not bred of a mere favorable contrast against that flat, blank, prairie background that stretched away before our first president David Ross Boyd as he left the train at the Norman station in 1892. It would do credit to any institution in the world.

In 1949 the Oklahoma Academy of Sciences met at Phillips University in Enid, and the banquet speaker, George Cross, explaining his long absence from those scientific activities he had once held dear, fired his now famous shot that he had been trying to build "a university the football team can be proud of." I can state personally that this shot, like the one at Concord, truly did echo around the world, for I have heard it repeated both in England and Australia. Those of us who heard him that night took up this challenge. In what follows I will present clear evidence that students and faculty have both labored mightily to meet it and have now gone a long way toward its fulfillment. Some might even suggest that there has been a reversal of the feet on which the shoe should fit.

I am about to examine the growth of the University of Oklahoma as reflected by the history of its physics department. I am fully aware that this is a mere spoonful of the stew, but if it is good, then there is every reason to believe the rest is good.

There was no such thing as a physics department at the University for the first seventeen years. Instruction in physics was confined to two elementary courses taught by Dr. Edwin DeBarr, professor of chemistry, as make-up work for those students who had not attended high school. These classes were conducted in the east wing of the old Science Hall using "\$600 worth of good apparatus suited to demonstrations in mechanics, heat, sound, light, electricity, and magnetism," to quote an old catalogue. Then, on the evening of Jan. 6, 1903, the whole \$600 worth of apparatus was destroyed by fire along with everything else in the old Science Hall. Shortly thereafter a Fort Smith high-school science teacher named Joseph Hallinen

was hired as tutor in physics, and for the next two years the teaching of these physics courses was his responsibility. In 1905, Cyril Methodius Jansky arrived on the campus, bearing the title of professor of physics and electrical engineering. Now, for the first time, physics courses were offered on the college level.

The year 1907 marked the end of an era in the history of Oklahoma. On November 16, Oklahoma was admitted to statehood by proclamation of President Theodore Roosevelt. Arthur Grant Evans took over as head of the new state university. One of the first official acts performed by President Evans in carrying out his reorganization program was the hiring of a young University of Pennsylvania physicist named William P. Haseman to organize and direct a department of physics at the University. Under Dr. Haseman, the embryonic department began to take shape. When he left in 1919 to join the Marland Oil Company, the curriculum had been expanded to include courses in advanced and theoretical physics and the teaching staff had increased to four members. Although Dr. Haseman successfully laid the groundwork, it was his successor, Homer L. Dodge, PhD from the University of Iowa, who for nearly one quarter of a century, first as chairman of the department and later as dean of the Graduate College, brought the plans for a significant, organized department to fruition.

Due mainly to the high caliber, enthusiasm, and progressive attitude of its new personnel—men such as J. Rud Nielsen, G. A. Van Lear, Duane Roller Sr., and William Schriever—the department's reputation continued to grow with each passing year. Consistently the department has ranked among the top ten institutions nationally in numbers of undergraduate majors receiving BS degrees (*see the chart at top of page 23*).

It was the foresight of this group that led to the establishment in Sept. 1924 of a School of Engineering Physics within the College of Engineering with Dr. Dodge as director. This pioneering effort to train students for research in basic engineering was so successful that other universities across the country soon added similar courses of study to their curricula, many of them based on our model.

Higher education has been perpetually misunderstood in Oklahoma, as almost everywhere, for this is by no means any one state's special failing. The reason lies in the knowledge explosion. At all times and stages since the birth of our university, the level attainable in education and knowledge by the students currently enrolled has outpaced that

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PHYSICS DEPARTMENT GRADUATES

(number of graduates in each year)

1922-5, 23-2, 24-7, 25-1, 26-2, 27-1, 28-3, 29-1
 1930-6, 31-5, 32-2, 33-4, 34-3, 35-3, 36-7, 38-1, 39-6
 1940-4, 41-3, 42-2, 43-2, 44-0, 45-0, 46-4, 47-6, 48-2, 49-15
 1950-13, 51-11, 52-10, 53-8, 54-8, 55-4, 56-12, 57-6, 58-14, 59-18
 1960-20, 61-15, 62-21, 63-22, 64-16, 65-6

ENGINEERING PHYSICS DEPARTMENT GRADUATES

1927-1, 28-0, 29-1
 1930-0, 31-0, 32-2, 33-0, 34-1, 35-0, 36-2, 37-5, 38-6, 39-5
 1940-3, 41-5, 42-7, 43-2, 44-2, 45-0, 46-2, 47-7, 48-12, 49-14
 1950-24, 51-18, 52-16, 53-8, 54-16, 55-7, 56-13, 57-16, 58-20, 59-19
 1960-23, 61-22, 62-21, 63-21, 64-10, 65-17

which had been attained by the older generation who were financing the program. Oklahomans, to their everlasting credit, have always rallied behind the idea of education. But when, in one of the first acts of their territorial legislature, they founded a tuition-free university, a bachelor's degree must have seemed a bit of a frill to the average man. Witness that Dr. Boyd found it necessary to offer a grades-through-high school preparatory program (his push class) for considerable numbers of his academic recruits. Witness also that success stories were lived by multitudes of Oklahomans without benefit of formal education. Today, when things have changed so that 60 percent of Oklahoma's high-school youth seek a college degree now held by roughly 10 percent of her citizens, we can say with some assurance that the bachelor's degree is generally understood and its standards are a matter of wide public concern. But now the frontier of possible attainment has moved on to the PhD level (and beyond, even), and once again it is rather doubtful that there is any deep general comprehension of the importance of having such highly educated people in society or the sacrifice that can be involved in the attainment of the PhD level.

Looking back, we may say that the final coming of age of the department of physics in the world of undergraduate education was marked by the founding in 1933 of a professional magazine, *The American Physics Teacher*, now called *American Journal of Physics*, with headquarters on the OU campus under the editorship of one of OU's "fearsome fivesome," Duane Roller Sr.

But a university, unlike a college, cannot be content with only a four-year educational program, however good it may be, and while winding up their campaign for a strong bachelor's degree, these same men were embarking on the other half of a university's responsibility—graduate training and research. They assisted in the founding in 1932 of the OU chapter of the National Research Society, Sigma Xi. Other departments, notably zoology, were already granting PhD degrees, but the first physics PhD, granted in 1934, cannot help but be something of a landmark in the emergence of OU as a true university, as well as for the department. For at first blush, physics is an anomaly on the Great Plains, where agriculture is king.

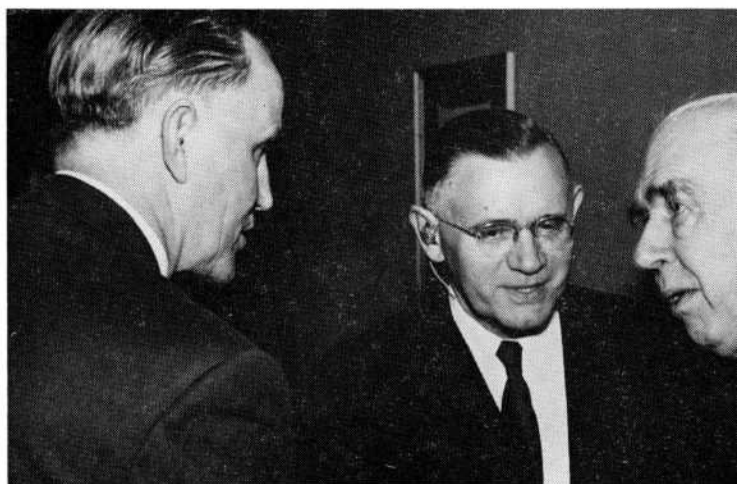
One asks what good can it possibly do for better beef-raising to have men around who know that the hadrons (various fundamental particles whose masses lie above that of an electron) occur in octets (groups of eight). And I think one must admit that it would be all too easy to answer "none" and surrender. There really is a direct benefit, however. The aim of today's farmer is to sell his products. Since his customers are remote, the Great Plains farmer operates at a disadvantage with respect to better situated competitors, first because of the shipping expense, and second because the processors reside near the population centers, and so he must pay double shipping on his own materials returned to him after processing for his

own use. His only real salvation is to work for a redistribution of population centers so that local demand will cover a major part of his production. In modern society this means attracting science-based industry, where men work who need to know that hadrons come in octets as well as many other esoteric things.

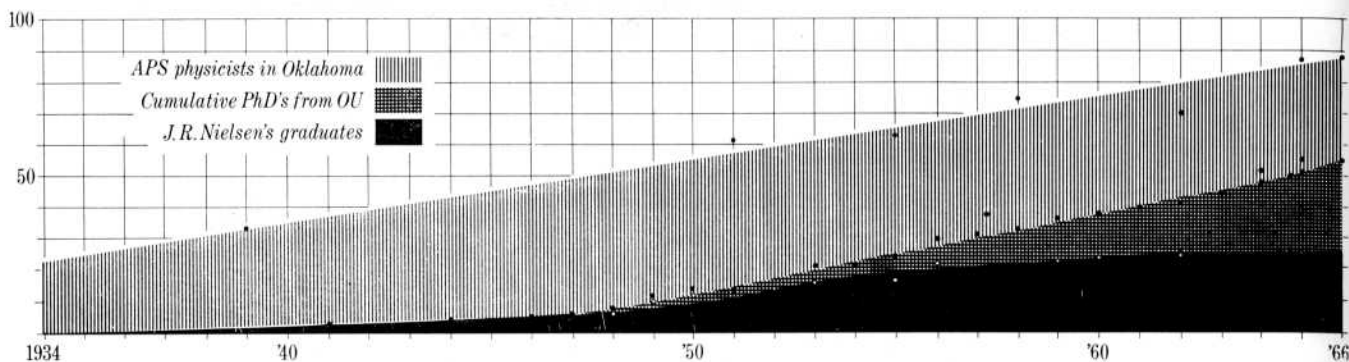
Certainly the most prominent industry in Oklahoma, the oil industry, found the value of having a strong physics department handy when, during the war years, Dr. J. Rud Nielsen began concentrating his attention on infrared and Raman spectroscopy. To him must go the accolade for pioneering the concept of research in physics at Norman, and even to a large extent in the entire University. If anyone was ever Mr. OU Research, it was he. He located space where there was no space and obtained equipment when none could be had to establish here one of the four great university laboratories in the world in infrared and molecular spectroscopy, which was at the same time without a doubt the leading laboratory in Raman spectroscopy. Even more important, he showed his colleagues that it was possible to do such things. The first great breach in the wall of obstacles to research in physics at OU was Dr. Nielsen's demonstration of what could be done with limited resources.

Educated at the Bohr Institute in Copenhagen and the California Institute of Technology, Dr. Nielsen has been with the department since 1924. During this time he has made numerous trips abroad to study and lecture in Europe. His student years and long acquaintance with Niels Bohr resulted in that eminent physicist paying several visits to the campus, the last being in 1963, when for the first time in history a science lecturer filled Holmberg Hall even into the corridors to the wild consternation of the fire marshal.

Perhaps at this point a really skeptical reader might
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Through his friendship with Dr. Nielsen, the internationally eminent physicist Niels Bohr (right) paid several visits to the campus. He is shown with Dr. Cross (left) and Dr. Nielsen during his 1963 visit.



agree that it is probably nice to have a few PhDs in physics in the state, but that since it has been shown clearly that 4 out of 5 PhDs educated by a university leave the state which educated them, do we really want to educate very many? For this one only needs to refer to the above graph. There I have plotted both the total number of PhDs educated in Oklahoma, and the total number employed here. One curve is slowly approaching the other, and if we keep on with the present level of effort it will be the year 2005 before we produce as many PhD physicists as we need. Perhaps this is a clue to the slow pace of industrial development in Oklahoma, and the state would be wise to accelerate things a little here. There is some hope on the horizon, because Oklahoma State University has just joined the effort with its first PhD in physics, and if its experience is similar to that of the University, the state will be self-sufficient for PhDs in 1985. There is also gloom on the horizon, for while Oklahoma has been growing steadily at the rate shown in the graph, we have not shown the aggressiveness in hiring physicists that has characterized surrounding states. Oklahoma's population of physicists has increased only 14 percent over the past 3 years, but Kansas physicists are up 24 percent, and the Arkansas figure is 56 percent. The national average is 18 percent. If and when Oklahoma accelerates its rate of acquisition of physicists by anything like these amounts, it looks as if we might be forever in catching up.

In 1944 the University administration clearly asserted its responsibility for sponsorship of research. A Post-War Curriculum and Planning Committee reported that second only to the function of instilling knowledge as a basis for

citizenship and leadership came the functions

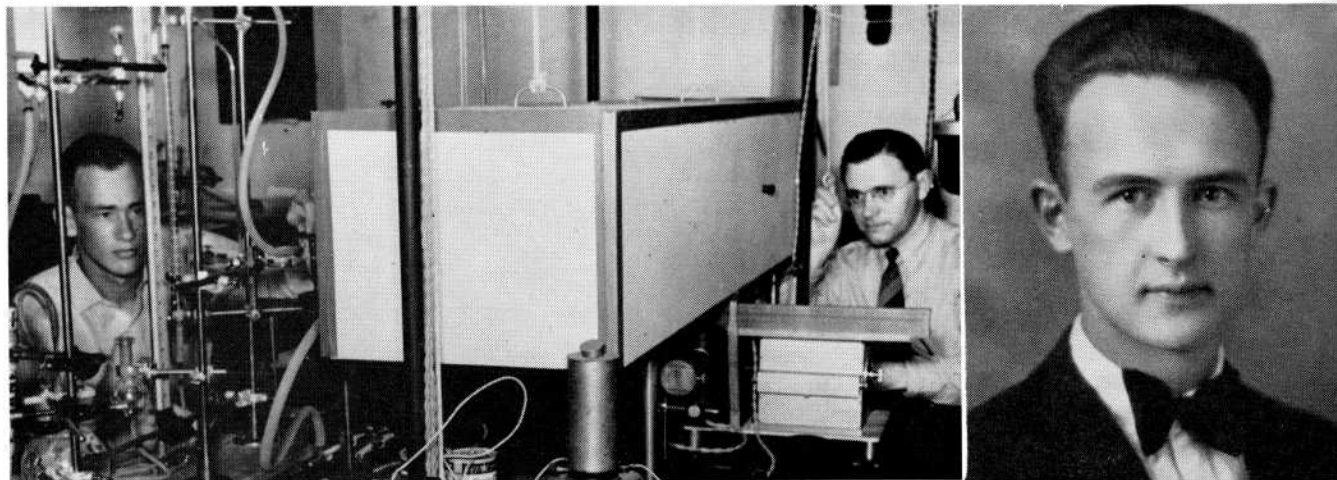
"To preserve the learning and wisdom of the past, to increase the store of learning and wisdom, and to pass it on to succeeding generations.

To encourage and conduct research and to foster scholarly activities which will advance knowledge for its own sake and for the benefit of society."

The physics faculty had been largely dispersed by the war. Many who were presumed to be on leaves of absence chose not to return, and when the first postwar faculty meeting convened, five of the eight faces present were new. Then followed a period of confused growth, during which Oklahoma was blessed with revolving funds, rotating chairmanships, and a transient staff. Two factors gradually brought stability into the physics department: the democratic spirit fostered by the administration, which appealed to the temperaments of just the kind of men needed for an effective department, and the new provision for research funds in relatively generous quantities by Federal agencies.

The pace of growth, once well begun, accelerated enormously. Each new faculty member added since the early 1950s has accepted Dr. Cross's challenge to be one of the triple-threat men (good teaching, good research, good administration) on which such a numerically small department as ours must depend to win recognition in the intense competition with the many more richly endowed and liberally staffed departments of physics of the United States.

This is the first of a two-part series. In the concluding article Dr. Fowler gives the standards for an institution's academic reputation and examines OU's national standing in physics.



Among Dr. Nielsen's students were Dr. Don C. Smith, shown with his teacher in the left photo, now director of research for Phillips Petroleum Co., and Francis W. Crawford, a 1928 graduate who was formerly research director at Phillips, is now a professor at Kansas State.