investigation with a view to practical application, but it seems desirable to present this progress report to show the possibilities of root-knot nematode control through resistant fruit stocks.

J. A. McCLINTOCK

UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION

QUOTATIONS

THE MASSACHUSETTS COLLEGE OF PHARMACY

OUTCOME of an association founded by Dr. Ephraim Eliot of Harvard one hundred years ago, the Massachusetts College of Pharmacy on November 15 observed the centennial of that organization, which is, in a sense, the centennial of the college. It was a day of many speeches. Running through them all was expression of the idea that the occupation of the pharmacist, whether or not it may properly be called a profession, has been raised to professional dignity and importance. Perhaps it is well for the public to be reminded of this fact in these days when many a drug store contains articles of vast variety in nowise connected with drugs and remedies. It is easy to forget that somewhere in such establishment are the men who have been scientifically trained in the compounding of remedies for human ills.

Significance of the anniversary as bearing upon the problems of youth was also indicated. Payson Smith, commissioner of education, spoke of the boys who are drifting from job to job trying to find their proper place in life. The vocational school, whether it be a college of pharmacy or whether it be devoted to instruction in other occupation, makes appeal to many a boy who might otherwise become one of the drifters, and introduces him to a life of greater usefulness.

The Massachusetts College of Pharmacy is fortunate in the possession of the building given it by the late George Robert White, whose great gift to Boston has made possible the creation of the proposed health units which were described by Mayor Curley in his remarks at yesterday's observance. These health centers in crowded sections of a great city suggest the opportunity which the pharmacist has in common with other citizens to devote time and energy to the public service. But in a larger sense the pharmacists as a body are in the public service, inasmuch as they stand with the physician in the battle with disease and the maintenance of the public health. It is therefore, cause for general satisfaction that institutions such as our own college of pharmacy are to be found in the land, giving their students the technical training which they need and emphasizing the ideals which should guide them in their chosen occupation.—*Boston Evening Transcript.*

SCIENTIFIC BOOKS

Publications of the Astronomical Observatory of the University of Michigan, Volume 3. Published by the Observatory, Ann Arbor, 1923. 270 pages, 16 plates.

THIS volume is a compilation of recent investigations of the Detroit Observatory, chiefly in the field of stellar spectroscopy. The opening papers are continuations of a series by R. H. Curtiss on "Studies of Class B stellar spectra containing emission lines." It is shown that the widths of the hydrogen emission lines in any one of these stars bears a nearly linear relation to the wave lengths and that the lines so plotted for the stars intersect not far from wave length 3270 A.; so that, if the width of one emission line is measured, those of others in the same spectrum may be calculated quite accurately.

In the second paper Professor Curtiss discusses, among other features of Class Bp stars, their evolutionary status. These stars may be said to stand apart from normal helium stars not merely as having more extensive atmospheres, but also because of the excitation of their atmospheres to luminosity. They may have developed uniquely along one of the current evolutionary sequences which he reviews; or, as seems to him more probable, they differ from other Class B stars by virture of a stimulus received by encounters with diffuse nebulosities and differing only in degree from that which produces the novae.

One of these stars, Kappa Draconis, is found to be a spectroscopic binary of a peculiar type. Broad emission and underlying absorption lines oscillate in a period of nine days; but the narrow absorption lines which divide the hydrogen emission, including also the narrow K line of calcium, do not share this oscillation. The orbit of the Class Bp star Sigma Cygni is calculated by F. Henroteau. Another paper by the same author deals with radial velocities of Boss's antapex group of stars. The preferential motion of this group is found in substantial accordance with Boss's conclusions.

It is interesting to find, in a paper by C. C. Kiess, a complete confirmation of the remarkable behavior of Alpha Canum Venaticorum, to which Ludendorff and Belopolsky called attention ten years ago. Two groups of faint lines, attributed by some writers to the rare earth elements, vary reciprocally in intensity, and certain of them yield variable velocities of the same period as the intensity variations; while the majority of the lines, including the more prominent ones, are apparently invariable in both respects. Moreover, maximum intensity occurs coincidently with maximum velocity of approach. It seems to the reviewer

to be obvious, especially when Guthnick's light curves for this star are recalled, that we have here an extraordinary case of Cepheid variation and one that should be taken into account in theories of this perplexing type of variable star. Doubtless this is not the only example of its kind.

Among the sixteen papers in this volume two others, at least, are especially noteworthy. Under the title: "New silicon lines in Class B stars," W. C. Rufus, R. A. Sawyer and R. F. Paton identify many lines of hitherto unknown origin in the spectra of helium stars. These disclosures originated in recent laboratory investigations with the vacuum spark, in the course of which the known number of silicon lines was increased fivefold. In the closing paper, R. H. Curtiss and D. B. McLaughlin discuss the results of their spectroscopic observations of comets, especially Delavan's comet of 1913. An advance in this field is marked by their success in deriving accurate radial velocities from the reflected solar spectrum of the comet.

Excellent enlargements of stellar spectra illustrate the volume, among them a beautiful series of Nova Geminorum II by Professor Curtiss and a very valuable sequence of typical spectra by Dr. Rufus.

ROBERT H. BAKER

UNIVERSITY OF ILLINOIS

SPECIAL ARTICLES

EVIDENCE OF A SPARK LINE IN THE LITHIUM SPECTRUM[1]

EXPERIMENTS in this laboratory[2] have shown that the thermionic discharge in gas at low pressure is an effective means of exciting spark lines and that these lines are relatively strong at potentials only slightly greater than the critical voltage. The method has been applied to lithium vapor in an attempt to discover spark lines in this element. The design of discharge tube has been described elsewhere.[3]

Electrons from a tungsten cathode are accelerated by the potential applied between it and a nearby anode and the larger part of the electron path is in an equipotential region. The discharge is concentrated by the magnetic field (about 200 ampere turns) of a copper helix surrounding the tube. In this case the helix served at the same time as a heater to vaporize the lithium. Temperatures between 500° C. and 600° C. were used. The discharge was photographed with a large Hilger quartz spectograph.

Spectra were obtained at applied potentials ranging from 8 to 200 volts. The only noticeable change in the spectrum (apart from lines of known impurities) was the appearance near 50 volts of a line λ 2934.15 $\pm$ .1 I. A. This line appeared in one very long exposure at 45 volts. It was very faint at 55 and strong at 60 and above. The photographic density of the line at 100 volts was less than that of the fifth line of the principal series and greater than the sixth. Between 100 and 200 volts the intensity was only slightly increased.

The lithium used was not exceptionally pure. Sodium and hydrogen were always present. No likely impurity of the observed wave length is listed in Kayser's table of principal lines. A faint spark line of sodium is listed by Foote, Meggers and Mohler (*l. c.*) at λ 2934.4, but the absence of other stronger lines on the lithium plates excludes the possibility that the new line belongs to sodium. In one tube the lithium was contaminated with magnesium. The magnesium spark lines λ 2936.496 and λ 2928.625 were faintly visible on either side of the new line and served as convenient comparison standards. The plates were not, however, suitable for measurements of high precision.

To excite the spark spectrum of lithium the valence electron and one of the K electrons must be removed from the atom. Removal of the valence electron alone requires 5.3 volts and the potential for removal of the K electron alone we will call V_k. Removal of both by a single collision will require a potential greater than the sum of the two. The spark spectra of other alkalies are visible at the second ionization potential of the normal atom under conditions of current density comparable with those used with lithium, but are greatly enhanced at a potential four or five volts greater than this. This indicates that $V_k = 50$ volts with a probable error of at least 5 volts.

Holtsmark[4] and McLennan and Clark[5] have published critical potentials for the excitation of K radiation from solid lithium oxide and lithium. The former gives 52.8, the latter 42.4 volts. As the experiment is very difficult the results may be questioned without discrediting the ability of these physicists. However, the value here estimated for V_k is in agreement with Holtsmark's results.

The spark spectrum of lithium must resemble the arc spectrum of helium, but will have series terms from two to four times as great. Few lines will fall within the range of the quartz spectrograph. The line λ 2934 may correspond to the strong helium

[1] Published by permission of the Director of the Bureau of Standards of the U. S. Department of Commerce.

[2] Foote, Meggers and Mohler, "Enhanced spectrum of Mg.", *Phil. Mag.*, 42, p. 1002, 1921; "Enhanced spectra of Na and K," *Astro. Phys. J.*, 55, p. 145, 1922.

[3] Mohler and Ruark, "J O S A and R. S. I.", 7, p. 819, 1923.

[4] Holtsmark, *Phys. Zeits.*, 24, p. 225, 1923.

[5] McLennan and Clark, *Proc.* Roy. Soc. A., 102, p. 389, 1923.