In his discussion of "Human Influenza," F. L. Horsfall, Jr., considers the problem in its broad clinical sense of a symptom-complex which may be of divergent etiology and identified in terms of its distribution as pandemic, epidemic or endemic influenza. The major portion of the discussion deals with the epidemic disease, the etiology of which has been recognized in recent years. An extremely valuable review of the widespread studies is made, especially those concerned with the factors influencing resistance and the efforts toward prophylactic vaccination in which the author has been particularly interested. Critical evaluation is given of certain debated but hypothetical points. This lecture necessarily differs from others of the series in that it is concerned with the broad problem of a disease rather than detailed consideration of specific mechanisms.

The final lecture of the series, "Viruses and Tumors," is by Peyton Rous. In this, for the first time, he summarizes his views on mammalian tumors derived under a variety of influences. The clarification of the differences between the effects of viruses and chemical carcinogens is especially valuable, pointing out the *actuating* effect of the viruses in that each induces a specific type of tumor, whereas, the type of tumor evoked by the carcinogens is primarily dependent upon the natural tendencies of the host and the nature of the tissue to which the material is introduced. Further, the relation of viruses to chemical tumors, to the milk influence and to cancerous changes is presented. It is an important consideration of numerous aspects of a highly controversial subject, dealing as the author does with the biological mechanisms involved. Undoubtedly dissenting views will be expressed.

In conclusion, the purpose of this review has not been to find fault. Blunt criticism can be made of nearly any lecture for the absence of proof for ideas or the lack of interpretation of other data. Nevertheless, the purposes of a lecture are to present a point of view, correlative information and interpretations in an interesting manner. The present volume fulfills these functions to such an extent that it is highly recommended as provocative reading to biological investigators at large.

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STELLAR SPECTRA

An Atlas of Stellar Spectra with an Outline of Spectral Classification. By W. W. MORGAN, PHILIP C. KEENAN and EDITH KELLMAN. Chicago: The University of Chicago Press. 35 pp. 2 figs. 55 photographic reproductions. 1943. $10.00.

THE "Atlas of Stellar Spectra," by Morgan, Keenan and Kellman, has for some time been awaited with keen anticipation by astronomers engaged in the practical problems of spectral classification and the determination of absolute magnitudes. At first sight it seemed rather disappointing that the text accompanying the beautiful atlas should be limited to a descriptive outline of the classification system, without any discussion of the diverse criteria employed elsewhere; and without any analysis of the astrophysical implications. An examination of the contents, however, proves the wisdom of the omissions. Such detours might incite astrophysical discussion more than the practical application which is the unique primary purpose of the Atlas.

The objective of the work has been to set up a system of classification that would be as precise as possible and that could be applied to stars of the eighth to tenth magnitudes with good systematic accuracy. This objective required a two-dimensional system: the usual coordinate correlated with temperature and the new coordinate representing the absolute luminosity. The luminosity classification introduced (in terms of groups Ia, Ib, II–V) is as arbitrary as the usual spectroscopic classification: the luminosity is simply implied in this case, as temperature was implied in the other. The procedure of classification suggested is (1) the determination of an approximate spectral class (in the usual sense); (2) determination of the luminosity class, and (3) the derivation of a more accurate spectral class by comparison with a sequence of stars in the same luminosity class. Here the emphasis is somewhat different from that ordinarily encountered: we have been accustomed to hearing astronomers call for more accurate spectral classes in order that the subsequently determined absolute magnitudes might be more accurate; here, on the other hand, the luminosity classes are necessary in order to improve the spectral classes themselves. The two problems, of course, can not be solved independently, since all the spectral lines vary to some extent both with temperature and luminosity. Thus a few successive approximations are needed for their satisfactory solution.

The Atlas itself, consisting of 55 superb photographic reproductions of Yerkes spectrograms, is an exemplification of a purpose well achieved. First, sequences of spectra illustrate the fundamental progression of spectral class for stars of the main sequence. Then, for stars of the same spectral class, the variations with luminosity are illustrated. Finally groups showing the variation of spectral class among stars of various other luminosity groups (*e.g.*, giant or supergiant) are added. Although emphasis is placed on the more common classes of stars—one of the major purposes of the proposed system of classifi-

cation being its application to the statistical discussion of the distributions of stars—many peculiar objects are also illustrated and briefly discussed. Thus the entire array of prints is well selected to cover the great majority of problems and obstacles that the student of stellar classification is apt to encounter.

In general the criteria adopted by the authors are qualitatively in accord with the criteria Miss Annie J. Cannon employed for the massive Henry Draper Catalogue. Often the actual lines used in the two instances differ, while the elements represented are the same. There are, however, some marked discrepancies, the most conspicuous being in the utilization of the K-line of ionized calcium, which played a heavy role in all Miss Cannon's work but is not employed at all in Morgan, Keenan and Kellman's Atlas. Stars (mainly of the A and early F-types) classified on the new system will consequently show conspicuous systematic deviations from the Henry Draper system. This problem of the classification of the A- and F-type stars has arisen often before in this field of investigation. The criteria used for these classes at Mount Wilson and at Harvard, for example, have been conspicuously discordant, the Mount Wilson observers preferring to base their estimates on comparatively faint metallic lines rather than on the strong calcium line. The problem arose in the first place apparently because the K-line was ill placed at the weak violet extremity of the Mount Wilson spectra, whereas the fainter lines used at Mount Wilson do not show up well on the extremely small dispersion employed for the bulk of the Henry Draper Catalogue. Morgan's Yerkes spectra appear to represent a spectral purity in between the other two, and hence have the practical advantage of effecting a compromise between the faint apparent magnitudes accessible with the Harvard small dispersion objective prism spectra, and the detail and accuracy obtainable from the Mount Wilson equipment.

The descriptions of the various peculiar groups of A–F stars will unquestionably be helpful to other investigators. These stars can be arranged not only according to the temperature and luminosity classes; but numerous sub-groups exist which, from the abnormal intensities of certain lines, have been called silicon, strontium, manganese or metallic-line stars. To the last group, particularly, belong the problematic stars that are assigned to appreciably different classes when different criteria are employed. During work in progress by the reviewer, on the sub-classification of bright stars, two spectral classes are now being recorded for such stars. In extreme cases the discrepancy may amount to a whole spectral class. Although the proportion of stars with ambiguous spectral classes is small, the actual number is evidently too great to be ignored in problems of classification. Earlier work by Dr. Morgan paid much attention to the A stars, and his judgment on which criteria are most suitable, *i.e.*, best correlated with temperature, should be given high weight.

The authors stress the fact that the Atlas has been constructed from slit spectra having a dispersion of about 125 Ångstroms per millimeter. (The reproductions have been enlarged to about 8Å/mm). Just which criteria are most desirable and adequate for the determination of systematically accurate spectral classes depends very appreciably on the dispersion and purity of the spectrograms obtained. Very many of the criteria adopted at Victoria or Mount Wilson, for example, are unsuited to the small dispersion Yerkes spectrograms. Several of the spectral lines included among the Yerkes criteria, on the other hand, are too weak for the smaller dispersion objective prism spectra that Miss Cannon had used. Many of the Yerkes criteria outlined and illustrated appear admirable for the much larger-dispersion objective prism spectra (45Å/mm) used in similar work by the reviewer. Others of the Yerkes criteria, however, are not suited to these larger-scale photographs, because the pairs of lines easily compared in small dispersion are too far separated or situated where background differences in photographic density make intercomparisons awkward. Numerous instruments throughout the country (including those at Harvard) are, however, equipped to yield spectra for which the criteria given in the Atlas are admirably suited.

It is a pleasure to know that this much-needed guide to two-dimensional spectral classification is now available, and to recommend it not only to those who will use it as a research tool, but likewise to teachers who frequently need first-rate illustrations of typical spectra and of absolute magnitude effects. Moreover, the Atlas should go far toward bringing about a desirable greater uniformity in stellar classification in the future.

DORRIT HOFFLEIT

SPECIAL ARTICLES

OBSERVATIONS ON THE NATURE AND PROPERTIES OF THE FLUORESCENT FACTOR F_2[1]

THE accompanying publication of Huff and Perlzweig[2,3] prompts us to make the present report.

[1] From the Department of Pediatrics of the Johns Hopkins University and the Harriet Lane Home of the Johns Hopkins Hospital, Baltimore, Maryland.

[2] J. W. Huff and W. A. Perlzweig, SCIENCE, 97: 538, 1943.