(*School and Society,* December 23, 1944). It shows that the teaching staffs of Columbia and California include more than 2,300 persons, while several other universities have more than a thousand teachers. Conversely, some strong schools have fewer than 300 staff members.

Column III is the number of scientists starred in 1933–1944 per 100 members of the 1944 teaching staff. It indicates that in this respect the leading universities are the California Institute of Technology, Princeton, Massachusetts Institute of Technology, Chicago, Michigan and Stanford. Thus the three leaders in total numbers (Column I) fall behind the fourth (Chicago), but three which are among the second five in Column I lead in Column II, and seven surpass Harvard. This is possible because these three specialize in the sciences in which starring is done, while Chicago, Harvard and Columbia, for example, offer instruction in many fields not recognized by starring, the humanities, and the social sciences, law, education and divinity, for example. Column III gives support to the claims of alumni of certain other schools that Harvard's average scientific faculty strength is not as great as Princeton's or Chicago's, for example, despite its leadership in the number of starred scientists on its staff.

Another manner of rating the strength of institutions in so far as it is revealed by starred scientists is the number of alumni who win stars. Collegiate alumni are considered in Columns IV, V and VI. Column IV is the number of scientists first starred in 1933, 1937 or 1944 who received their college degree at the institutions in this list which graduated three or more. It shows that Harvard led with 44 such alumni, followed by Chicago 36, California 30, Cornell 21 and Yale 18. Since enrolments vary widely, an effort has been made to discover the output in proportion to enrolments.

Column V is the approximate number (nearest 100) of undergraduate college men in attendance November 1, 1922, according to Raymond Walters' report (*School and Society,* February 24, 1923). The approximate median date of graduation of these scientists is 1922.

Column VI is a ratio between attendance and starred collegiate alumni. It is based on the reasonable assumption that the 1922 enrolment of men in the college was approximately the average number enrolled during the years when most of the scientists who were starred in 1933–1944 graduated from college. The numeral is the approximate number of starred college alumni per 1,000 male college students. It was obtained by dividing eleven times the enrolment into the number of starred college alumni (the starring was spread over eleven years). Men only are considered, as very few women won stars—only 4 of the 250 starred in 1944. College men, instead of all undergraduate men, are considered because most starred men attended the college rather than the schools of agriculture, engineering or education, for example.

According to the information at hand, presented in Column IV–VI, the leading colleges in the yield of starred alumni of the last three starrings in proportion to size are Chicago, Cornell, Hopkins, Harvard and Yale, with Chicago doing about 50 per cent. better than Harvard or Yale.

Other colleges which have had relatively many of their college alumni starred lately, but for which data comparable to those in Table I are not at hand, are Amherst, California Institute of Technology, Dartmouth, Denison, Haverford, Missouri, Nebraska, Pomona, Oberlin and Swarthmore.

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THE SOCIETY FOR FREEDOM IN SCIENCE

IT has come to our knowledge that statements have been made in the United States alleging that the Society for Freedom in Science is partly a political organization. Such allegations are completely untrue. The society includes members of all shades of political opinion from Conservative to Socialist. It opposes totalitarianism in the sphere of science whatever the political complexion of the Government imposing it.

J. A. CROWTHER
A. G. TANSLEY
JOHN R. BAKER, *Secretary*
Executive Committee of the Society

SCIENTIFIC BOOKS

CLIMATOLOGY

Methods in Climatology. By VICTOR CONRAD. 228 pp + x, 3 App. Index, 46 figs. and 46 tables. Harvard University Press. 1944. $4.00.

THE impact of weather on military strategy and tactics in the present global conflict has confronted innumerable planners and operators, journalists and scientists with "practical" problems in applied climatology—a field which *ante bellum* meagerly supported only a very small "profession." Dr. Conrad's book therefore appears before an eager group of consumers for whom no other adequate guide book on climatological method is available in English. However, readers expecting instructions for correlating clima-

tological phenomena with technological or biological data, and especially suggestions for the solution of forecasting problems, probably will find themselves rather disappointed in this book, for the author has not set himself any such utopian objective.

The author perhaps should have selected a title with narrower connotations, for the aim of his methods is mainly the traditional one of Hann and the "Austrian School" of climatologists, who have concerned themselves first and primarily with objective methods of *description* of the average state of the atmosphere (*i.e.*, the climate). The chief task has been to make the series of meteorological observations taken at various places over the earth comparable, preliminary to analyzing the results for "laws" of distribution and relationship. The influence of Hann and Köppen in the latter part of the last century brought the meteorological services together in international conventions which standardized observational methods, as well as the forms of summarizing and publishing results of observations. The next objective was to generalize these published results of observations, in maps and graphs, for homogeneous periods and given epochs, and to find rational explanations for this *climatography*. Principles so derived offered possibilities of extrapolating and interpolation in time and space where observations may be lacking. In a generation such work created a lovely self-contained system of knowledge.

But during the last three decades these rigid traditions have tended to cramp the growth of climatology. For in recent years the rapid development of synoptic meteorology and of the ecological sciences have beckoned climatology into new directions for which the classical methodology does not well provide. However, the original aim of describing the world's climates has meanwhile only very partially been achieved. The disciples of Hann and Köppen, of whom Dr. Conrad is now the acknowledged leader, have not lost sight of the fundamental place that an objective-comparative-descriptive climatology will always hold. Ecological and applied climatology must start from that foundation even though they aim very far afield from it. For this reason "Methods in Climatology" is a much needed type of work. It is particularly welcome in this country because no professional book on the subject has heretofore existed in English, for which reason too much of the American university and collegiate training in the subject has been provincial and shallow.

Dr. Conrad had published a methodological treatise in Germany in 1936 (Köppen-Geiger, "Handbuch der Klimatologie," Bd. I, Teil B), the first of its kind in any language since Hugo Meyer's pioneer little handbook of 1891. The high price of the German book and the language barrier have prevented its wide use in English-speaking countries. Dr. Conrad has now written an entirely new book in English, arranging his materials in a form more suitable for American students. Detailed examples and bibliographical references, so numerous in his German work, are kept to a minimum and selected as far as possible from literature in English. Unfortunately, the kind of climatology outlined can only be well exemplified by reference to Continental literature; that in English fits into the scheme very spottily at best.

American students will no longer have any excuse for omitting from their background the spirit and methods of the very productive German and Austrian climatologists. American climatologists have not been uninfluenced by the European methods, but the economic and academic conditions in this country have not offered much encouragement for such detailed and often rather abstract types of analysis. The late Dr. O. W. Fassig, who had studied with von Bezold and Hellmann at Berlin in the golden age of German meteorology, produced upon his return to this country an elaborate monograph after the German model ("The Climate of Baltimore," 1908). It is still a very suggestive work from the methodological point of view, but, alas, seems to be little known. Other Americans of the last generation, such as R. de C. Ward, W. M. Davis, Cleveland Abbe, F. H. Bigelow, were much stimulated by European methods, and more recently C. F. Brooks has carried on their tradition. Ward's translation of Hann's "Treatise on Climatology" (1903) has long been a "bible," though it is only by inference a methodology. Conrad's book brings us up to date.

It is organized in three parts. Part I, "General Methods," is largely devoted to statistical methods for defining the homogeneity and elementary characteristics of series of observations; extremes, averages, frequency curves, variance, curve fitting and harmonic analysis. Most of this part is not peculiar to climatology and can be gotten from elementary statistics text-books. For one already familiar with statistical methods, these pages will only serve to illustrate what methods have been generally used by European climatologists, whereas the reader untutored in statistics will probably not always find sufficient explanation to properly understand the procedures. Part II, "Representation of Characteristic Features of Different Elements," reviews examples of statistical characteristics of the elements: temperature, pressure, water vapor, wind, cloudiness, precipitation, etc.—at a given point. This, the real meat of the book, will be the part of most interest to both specialists and general readers, since it illustrates typical results found in the large and scattered literature. One gets an idea of what has been tried but seldom a hint as to what else needs to be done.

Part III, "Methods of Spatial Comparison," is an extension of Part II to indicate how statistical characteristics of the elements at one point are to be compared with those at other points. This includes reduction to standard period and epoch, correlation coefficients, graphs, maps, anomalies, roses and streamlines. Included here are integrated or synthetic elements such as continentality, air-mass climatology and climatic boundaries. Unfortunately, the discussion of and examples of streamlines are not very sound nor sufficiently explicit, but the matter is not of great importance. Part IV, "The Climatography," indicates briefly the desired type and organization of contents of a monograph on the climate of a region.

There is much room for difference of opinion as to the proper methods to use in a descriptive climatology. This review is not the place to introduce other approaches; but we do miss any reference to the new Russian methods. Dr. Conrad has given us an excellent account of the methods found in the German literature, to which he himself has made many interesting contributions, and organized them according to a well-established and consistent point of view. It will be a firm starting point for the new generation of climatologists now emerging.

R. G. STONE

ANALYTICAL GEOMETRY

Analytical Geometry of Three Dimensions. By W. H. MCCREA. (University Mathematical Texts, No. 7.) vii + 144 pp. Edinburgh: Oliver and Boyd. New York: Interscience Publishers. 1942. $1.75.

THIS is a remarkably concise exposition which is at the same time rigorous and easy to read. It could not be recommended (and was not intended) for a student who has no supplementary help; but it is a university text, which means that it will, as the author says, "be used in connection with lectures or other personal instruction." The opening chapters, on "Directions, Planes and Lines," and "The Sphere," are orthodox but neatly expressed. (The third includes a good account of stereographic projection.) Then "Points at Infinity" are introduced in an unusually careful manner. Homogeneous coordinates are used to determine a space $\bar{\mathcal{E}}$, part of which is isomorphic with the Euclidean space $\mathcal{E}$ previously considered. The remaining "special" points of $\bar{\mathcal{E}}$ are defined on page 43, but it is not until page 51 that our suspense is relieved by the proof that "two ordinary lines are parallel if and only if they meet in a special point."

Chapter V may seem more difficult to some readers, but a careful study of it will be found well worth while. Here quadrics are classified first in $\bar{\mathcal{E}}$ and then in $\mathcal{E}$. The results are very neatly tabulated. The general quadric is denoted by

$$a_{rs}\, x_r\, x_s = 0$$

in accordance with Einstein's convention of summation. Chapter VI, on Standard Forms, is enlivened by instructions for making solid models. The final chapter deals interestingly with some extra topics such as twisted cubics and confocals. In particular, a focus of a quadric is defined (on page 134) as a point which is the vertex of a single infinity of orthogonal conjugate trihedra. It is proved that the foci constitute an ellipse in one plane and a hyperbola in another and that any focus which lies on the quadric is an umbilic.

To quote the author's preface again, "Care has been taken to frame the theory so that it does strictly apply to *real* space. This explains the avoidance of certain familiar short-cuts, which actually depend on jumping difficulties about reality conditions."

Possibly more use might have been made of the duality (in $\bar{\mathcal{E}}$) between point-coordinates and plane-coordinates (compare P. W. Wood's tract on "The Twisted Cubic," Cambridge, 1913, or A. Robson's "Introduction to Analytical Geometry," Cambridge, 1940, where this duality is indicated by the consistent interchange of small and capital letters). The author shows on page 70 that "the necessary and sufficient condition for a plane to be a tangent plane is that it should contain its pole," and that the pole of a given plane $[\xi_1, \xi_2, \xi_3, \xi_4]$ is obtained by solving the equations

$$a_{rs}\, y_r = \xi_s.$$

The customary work on page 84 could have been simplified by carrying out this solution in the form

$$y_s = b_{rs}\, \xi_r,$$

which shows that the condition for ξ to contain its pole is

$$b_{rs}\, \xi_r\, \xi_s = 0.$$

Again, the cross ratio of four collinear points (page 52) and of four coaxial planes (page 53) might have been deduced simultaneously from the expression

$$\frac{(\xi \cdot \mathrm{x})\,(\eta \cdot \mathrm{y})}{(\xi \cdot \mathrm{y})\,(\eta \cdot \mathrm{x})}$$

which is valid for any two points and two planes $\mathrm{x}, \mathrm{y}, \xi, \eta$.

But these are minor criticisms, and on the whole this is probably the best text-book ever provided for university teaching of analytical stereometry. The printing is excellent. Apart from some missing letters at the beginning of two lines on page 130, the only error detected was the transposition in "Joachimstahl" on page 59. Finally, there is a good index.

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COLORIMETRIC DETERMINATION OF TRACES OF METALS

Colorimetric Determination of Traces of Metals. By E. B. SANDELL. 487 pages, with index. Cloth