

The section on live stock runs on lines similar to those adopted for crops; tables are given showing the composition of feeding stuffs, typical rations, and methods of computing variants, together with much information about the animals themselves. Altogether the book will be found very useful for reference purposes, and, as it is well indexed, it is very easily consulted.

*Mineralogy.* By Dr. F. H. Hatch. Fourth edition, entirely rewritten and enlarged. Pp. ix+253 (London: Whittaker and Co., 1912.) Price 4s. net.

In this "fourth edition" a revision has for the first time been undertaken. The consequent doubling of its size and price is fully justified by the enhanced value of the work, which for twenty years has been handicapped by its modest size. The addition of eighty pages to the section dealing with descriptive mineralogy has allowed a much fuller treatment of the ores, this portion being trebled in length, while ore-dressing processes (electromagnetic, oil-concentration, &c.), find brief reference under properties of minerals. The portion on optical properties, formerly relegated to a couple of pages, is enlarged sevenfold, thus permitting of an explanation of double-refraction phenomena. Coupled with the fuller description of rock minerals, this renders the book of some use in microscope work. The use of the letters *a*, *b*, *c* to indicate elasticity axes is regrettable, owing to the likelihood of confusion (both in writing and speaking), with the *a*, *b*, and *c* crystallographic axes; the substitution of X, Y, Z, as adopted in Iddings's "Rock Minerals," avoids this difficulty.

The arrangement of the descriptive portion under the four heads Rock-forming Minerals, Ores, Other Salts, and Gems is convenient, if inconsistent, and it is supplemented by a list of mineral species, chemically classified. We are surprised to find so small a book including among "the more important minerals" metacinnabarite, hauerite, &c. The treatment of mineral names is not always satisfactory; thus nowhere is mention made of the name kupfernickel, so commonly used as a synonym of niccolite; dialogite appears in the text as such, but in the index as dialogite. Wolfram and wolframite (though used as synonyms) are used apparently indiscriminately in the text, but are separately indexed.

The typography is good and misprints very rare (on p. 57 *statical changes* evidently means *charges*), but some illustrations of crystals, like Figs. 63 and 75, might be improved. R. F. G.

*Revolving Vectors, with Special Application to Alternating-current Phenomena.* By Prof. Geo. W. Patterson. Pp. vi+89. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1911.) Price 4s. 6d. net.

This brief but excellent little treatise can be recommended as a good introduction to the modern topic of revolving vectors, and particularly to the use of the symbolic notation in the development of the subject. It opens with a brief historical note on the discovery in 1797, by Wessel, of the use of the imaginary  $\sqrt{-1}$  as an operator having a geometric function of rotation through a right angle. From this the author leads on to the treatment of complex quantities, and their use in representing harmonic motion. The latter half of the book deals with the application to alternating electric currents and other electrical matters. It is satisfactory that the author conforms to the convention adopted by the International Electrotechnical Commission in its recent session in Turin, in using the counter-clockwise sense of rotation as positive.

LETTERS TO THE EDITOR.

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Contour Diagrams of Human Crania.

In the last number of *Biometrika* (viii., 1, 2, 1911) Prof. Karl Pearson has edited and published a very valuable paper by the late Dr. Crewdson Benington on cranial type-contours. The work is based on long series of skulls of various races, e.g. English of the seventeenth century (from the Whitechapel Plague Pit), modern English (Royal Engineers), various Negro races from the Congo, Guanche, Egyptian, Eskimo, and the prehistoric Cro-magnon skull. For each series three typical contours are selected, viz.:—(1) a "transverse vertical," passing through the auricular points and the apex of the skull; (2) a sagittal or median section; and (3) a horizontal section through the glabella; and in each case all the individual skulls of a series are combined into a single "type" by a process of arithmetic averages. Lastly, the diagrams thus obtained are reproduced on tissue-paper, so that one may be superposed upon another, and the characteristic differences easily compared.

I venture to think that we may go a little further, and may, by a simple device, get a new series of diagrams which shall throw into still greater relief the presence and the amount of essential difference of form: for, after all, comparison of the two superposed contours is a matter of individual judgment, and there is a lack of fixity and

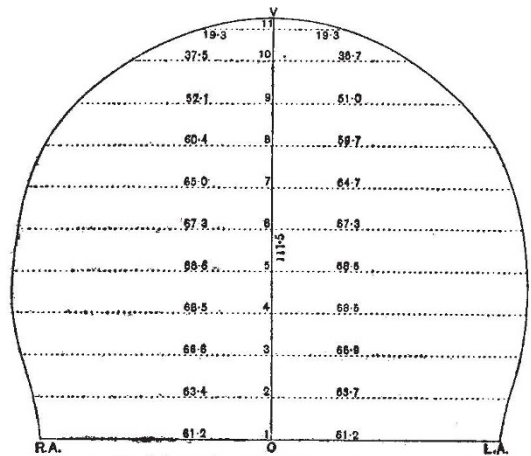


FIG. 1.—English crania, 17th century. Transverse contour.

precision in our interpretation of the result. Moreover, it is obvious that we have, in the first instance, no clear and easy distinction between differences of size and differences of form.

Taking the case of the transverse, or vertical interauricular, section of the skull, Dr. Benington's diagrams represent it for us as in Fig. 1, where a median vertical axis is divided into ten equal parts (the uppermost of these also by a point one-quarter of a division from the apex), and at each of these points of division the horizontal distance to the contour-line is measured and recorded. Thus we are in possession of such tabular statements as the following:—

Vertical Height	A	B
11	19.3	121
10	37.5	20
9	52.1	37
8	60.4	55
7	65.0	67
6	67.3	72
5	68.6	74
4	68.5	74
3	66.6	69
2	63.4	64
1	61.2	62

Dimensions (in mm.) of the transverse cranial section (right side). A English skulls of 17th century; B, Cro-magnon skull.