Letters to the Editor.

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Heliotherapy and Phototherapy.

IT is to be regretted that in the brief historical review on phototherapy which appeared in NATURE of December 15 under the title "The Treatment of Disease by Artificial Light" no reference is made to the work of Dr. O. Bernhard, of St. Moritz. Dr. Bernhard is one of the founders of modern phototherapy. He discovered in 1902 the remarkable action of sunlight at the high altitude of the Engadine on the healing of wounds, and he was then led to investigate the general therapeutic action of sunlight in other surgical conditions, including surgical tuberculosis. A few years ago he reported that among the first 1000 cases of surgical tuberculosis treated by him he obtained 858 cases of cure and 120 of definite improvement. He is, however, careful to point out that heliotherapy is not a specific against tuberculosis, but like Sir Henry Gauvain looks upon it as a powerful adjuvant. It was Dr. Bernhard's early observation in 1902 which induced Dr. Rollier in 1904 to open his sanatorium at Leysin, with the brilliant results which are now so well known.

The neglect of Dr. Bernhard's work in Great Britain is the more remarkable as he is the author of two excellent monographs on the subject—"Heliotherapie im Hochgebirge mit besonderer Berücksichtigung der Behandlung der chirurgischen Tuberkulose" (Stuttgart, Enke, 1912) and "Sonnenlichtbehandlung in der Chirurgie" (Stuttgart, Enke, first edition 1917, second edition 1923). In these volumes Dr. Bernhard gives not only the clinical aspects of the subject, but tries to place it on a sound physiological basis. Dr. Bernhard goes very fully into the literature, and the volumes mentioned are a mine of valuable and interesting information on the physics and physiology of heliotherapy. Thus, in his monograph published in 1917, Dr. Bernhard points out the action of sunlight as an important factor in the ætiology of rickets, and gives a striking example.

In connexion with the article in NATURE of December 15, two points may be mentioned. Dr. Bernhard recognises that the effect of sunlight can be imitated by artificial light. But he gives weighty reasons for his view that the therapeutic value of sunlight is superior to that of artificial light, and he discusses in detail the importance of factors other than light, such as the radiant energy of sunlight, climatic conditions, which form part of heliotherapy as distinct from phototherapy. W. CRAMER.

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The Thirty-two Classes of Crystal Symmetry.

THE fact that crystals may be classed according to their symmetry into thirty-two different classes is widely known, but there are very few who could enumerate all these classes, or state the exact symmetry that each possesses. They are not, as a rule, arranged on any intelligible principle, nor are the various names they have received generally self-explanatory or easy to remember. It has been proposed, indeed, to refer to them by consecutive numbers, like the omnibuses of the London streets, but this is a counsel of despair.

The accompanying table (p. 81) affords an arrangement, a nomenclature, and symbols, which have at least the merit of simplicity. They can be readily understood, and remembered without difficulty, while the relations that exist between the symmetry of the different classes are seen at a glance.

They are, in the first place, arranged according to the highest axial symmetry in the crystal. This may be two-fold—digonal; three-fold—trigonal; four-fold—tetragonal; or six-fold—hexagonal. Each occupies a column. There is, in addition, a column for classes with no axial symmetry, and another for those with four trigonal axes of symmetry—in other words, cubic crystals.

The columns correspond to the crystallographic *systems*. The only exception is the digonal column, which includes two systems, the monoclinic and the orthorhombic.

The horizontal rows possess an importance equal to that of the columns, for in every class in the same row the same relation exists between the terminations or ends of the principal axis or axes of symmetry. These may be unlike, or related to one another by some form of symmetry, either a centre of symmetry, a lateral digonal axis, or the *inverse* character of the principal axis of symmetry. The last requires a word of explanation.

The nature of an ordinary or simple axis of symmetry may be expressed by saying that if the crystal is rotated about it through a fraction of a circle of which the denominator is 2, 3, 4, or 6, it will coincide exactly with its original configuration. If, on the other hand, it is necessary, in order to obtain such coincidence, not only to rotate the crystal about the axis of symmetry, but also to subject it to inversion—that is to say, to the reversal of every direction in it—the axis is said to be an inverse axis. The importance of inverse axes was first pointed out by Prof. Hilton.

The nomenclature employed is somewhat analogous to that adopted by Sir Henry Miers. The name of each system is followed by an adjective expressing the relation between the terminations of the principal axis of symmetry. If the principal axis of symmetry lies in two or more planes of symmetry, so that the succession of faces round it is the same in both directions, the syllable "di" is prefixed to the name of the system. Such classes form the last three rows of the table.

The symbols scarcely require explanation: the first part expresses the cyclic number of the principal axis, the second the presence or absence of planes of symmetry intersecting in the principal axis of symmetry, and the third the relation between the terminations. The table shows the "symmetry number" of Shearer in each class; this expresses the greatest number of similar faces that can exist in any class. In two rows it is equal to the cyclic number of the principal axis of symmetry. In four it is twice that amount, and in one row four times.

Two classes, the hexagonal inverse and dihexagonal inverse classes, appear at first sight to be trigonal, but they are essentially hexagonal.

In each class the information is given in the following order: (1) symbol, (2) name, (3) substance crystallising in the class, (4) symmetry, (5) symmetry number. "Centre" means centre of symmetry, and ii., iii., iv., vi. indicate digonal, trigonal, tetragonal, and hexagonal axes of symmetry.

Further details and explanations will be given in a volume by Mr. George M. Davies and myself, shortly to be published. JOHN W. EVANS.