Letters to the Editor.

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Representation of Crystal Structure.

THE atomic structure of crystals is not an altogether simple matter to represent on paper. What is required, of course, is a portrait of a unit cell: that is, of any selected parallelepiped, with atoms at its corners and with just enough volume to include within itself a complete sample of the crystal pattern. A common device is to reproduce in picture form a three-dimensional model of such a cell. Another is

FIG. 1.—Atomic plan of sodium chloride on cube face (001). The symbols bear no relation to atomic volumes. Compare "Introduction to Crystal Analysis", Fig. 32.

to map out the contents of the cell upon one of its six faces. The rays employed for the purpose of projection must be parallel with that edge-direction of the cell which is inclined to the chosen face: thus in some cases the projection is orthogonal, and in others oblique.

Further, it is necessary to adopt a notation to indicate the depth of individual atoms represented on the plan. This depth is always stated as a fraction of the depth of the unit cell as a whole. Two conventions

FIG. 2.—Atomic plan of diamond on cube face (001). Compare "Introduction to Crystal Analysis", Fig. 33.

are in common use: (1) the depth of an atom may be shown by varying the depth of shading employed in the ornamentation of its symbol; or (2) it may be expressed by attaching an appropriate number, such as $\frac{1}{2}$ or $\frac{25}{100}$, where 25 means 25 per cent. Both conventions become difficult at a very early stage of complexity.

The notation illustrated in Figs. 1-3, while equally simple in principle, admits of wider application. The depth of any atom is indicated in these figures by a pointer, which rotates in clock fashion. If the pointer is directed downwards, the atom lies in the lower half of the unit cell, and vice versa. A depth scale, vertical in the cases illustrated, but oblique

where necessary, is added to complete the picture. It is drawn to the same scale as the plan, and its length can be stated in angstrom units.

It is easy with this notation to indicate depths of two or more atoms which happen to be superimposed in plan, even where these atoms belong to different chemical elements. It is also easy to proceed from

FIG. 3.—Atomic plan of calcite on base (0001). The symbols bear no relation to atomic volumes. Compare "Introduction to Crystal Analysis", Fig. 45.

one plan to another—in fact, to map out the crystal on any desired plane. For example, one can map diamond or calcite at right angles to its cleavage; in which case the origin of the cleavage becomes manifest in alternations of open and close spacing of the atoms.

Figs. 1-3 were drawn while reading Sir William Bragg's illuminating "Introduction to Crystal Analysis", and may be compared with the rather more complex originals, upon which they are based.

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Oct. 21.

Effects of Inadequate Feeding on Insect Metamorphosis.

MR. DOVER in his communication on this subject¹ has confused the phenomenon of metamorphosis with that of moulting. These two phenomena are entirely distinct. It is well known that, whereas all insects periodically moult during their life-cycle, only certain groups undergo metamorphosis. Regarding moulting, his observations support the views to which I subscribed in my papers quoted by him. My conclusions² were that the number of moults is in proportion to the length of the larval life, and that moulting cannot be solely, and possibly is not mainly, correlated with growth but is primarily connected with metabolism. Mr. Dover observed that when the larvæ of *Orgyia turbata* completed their life-cycle sooner, they underwent a lesser number of moults than is normally the case. He concluded that the decreased number of moults was due to a lesser accumulation of waste nitrogenous matter. The only difference between our views seems to be that, whereas I connect moulting with general metabolism (which includes excretion), he connects it specifically with excretion, but without advancing evidence in support of his conclusions.

The question of the influence of inadequate feeding on metamorphosis, with regard to which there seems to be a radical difference between Mr. Dover's views and those of many other entomologists, including