The possibility exists, however, that definitely planned experiments may enable us to regulate time and dosage of hormones better than is done in this experiment of nature; the results of such experiments cannot of course be foreseen. Nor can it be predicted in advance what the results of the inverse experiment might prove to be, i.e., treatment of the male zygote from the beginning of six-differentiation with female hormones. Such experiments will be necessary for the full solution of the stated problem. We can, however, state, confidently on the basis of the present results that sex-determination in mammals is not irreversible predestination, and that with known methods and principles of physiology we can investigate the possible range of reversibility.[11]

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THE CRYSTAL STRUCTURE OF MAGNESIUM

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Magnesium is assigned by crystallographers to the holohedral class of the hexagonal system, with axial ratio 1.624. The structure given below agrees with this symmetry. The arrangement of atoms is that of hexagonal close packing, the arrangement which equal hard spheres assume when closely packed, except that the structure is shortened by about one-half of one percent in the direction of the hexagonal axis. This is the fourth type of arrangement of atoms in elementary substances thus far observed, viz.: the diamond type, characteristic of diamond, silicon, bismuth and antimony, where each atom is surrounded by four equidistant nearest neighbors; the centered cubic lattice, characteristic of iron, and probably also of nickel and the alkali metals, where each atom is surrounded by eight equidistant nearest neighbors; the face-centered cubic lattice, or closest-packed cubic arrangement, of which aluminum, copper, silver, and probably gold and lead are examples, where each atom has twelve equidistant nearest neighbors; and the closest-packed hexagonal arrangement described below, of which magnesium is at present the only example, where the number of equidistant nearest neighbors is also twelve, but in a slightly different arrangement from those of the face-centered cubic lattice.

The X-ray analysis was made in two parts. First, single small crystals were mounted with definite orientation on the spectrometer table, and photographed while slowly rotated and exposed to a monochromatic beam of X-rays. This gave the approximate structure. A picture was then taken of magnesium powder, in the manner described in a previous paper (*Phys. Rev.* **9**, 85, Jan. 1917), which checked and confirmed the results of the first method.

Three small samples, formed by vacuum distillation, were used for the single photographs. The first was mounted with its basal plane (0001) parallel to the rays, and was rotated about the axis (0001) – $(10\bar{1}0)$ for about 30° on each side of the center. This should give reflection from (0001) and the flatter pyramids $(10\bar{1}3)$, $(10\bar{1}2)$, $(10\bar{1}1)$, etc. The second was mounted so as to rotate about the same axis, but with $10\bar{1}0$ parallel to the rays at the center position. This should give reflection from $(10\bar{1}0)$ and the steeper pyramids $(30\bar{3}1)$, $(20\bar{2}1)$, $(10\bar{1}1)$, etc. The third was rotated about the axis (0001), (1120), with rays parallel to $11\bar{2}0$ at center, so as to give reflection from $(11\bar{2}0)$, $(11\bar{2}1)$, $(11\bar{2}2)$, etc.

The observed lines and spacings are given in table 1.

TABLE 1

CRYSTAL 1			CRYSTAL 2			CRYSTAL 3		
Position of line	Spacing of plane	Plane	Position of line	Spacing of plane	Plane	Position of line	Spacing of plane	Plane
3.10	2.59	0001	2.90	2.75	$10\bar{1}0$	5.02	1.60	$11\bar{2}0$
2.90	2.75	$10\bar{1}0$	3.10	2.59	0001	5.50	1.48	$11\bar{2}1$
3.30	2.44	$10\bar{1}1$	3.30	2.44	$10\bar{1}1$	6.0	1.36	$11\bar{2}2$
4.20	1.90	$10\bar{1}2$	6.05	1.34	$20\bar{2}1$			
5.50	1.48	$10\bar{1}3$	8.92	0.92	$10\bar{1}3(3)$			
6.27	1.30	$20\bar{2}1$	5.9	1.38	$10\bar{1}0(2)$			

The first column gives for each crystal the distance of the observed line from the center, the second the spacing of the corresponding plane, as calculated from this distance, and the third the indices of the plane.

A triangular prism having the spacing $d_{11\bar{2}0} = 1.61$ A and axial ratio 1.624 would have a height $1.624 \times 2d_{11\bar{2}0} = 5.23$ A, which is exactly twice the spacing of the (0001) planes found above, and suggests that the lattice is composed of *two* sets of triangular prisms each of side 3.22A and height 5.23A, the atoms of either set being in the center of the prisms of the other. The number n of atoms per unit prism is, if ρ is the density, M the mass of an atom of Mg, and a and h represent the side and height of the prism, respectively:

$$n = \frac{\sqrt{3}}{4} \frac{a^2 h \rho}{M} = 1.03$$

which is equal to 1 within the limit of accuracy of a, h, and ρ, and is correct for the assumed structure.

The second step in the analysis was to check this assumed structure by a photograph taken through finely powdered magnesium, which should show all the lines required by the assumed structure *and no more.* Table 2 gives the position of the observed lines and the corresponding spacing

TABLE 2

DISTANCE OF LINE FROM CENTER	ANGLE OF REFLECTION	INTENSITY (ESTIMATED)	SPACING OF PLANE IN ANGSTROMS		INDICES OF PLANE
			Experimental	Theoretical	
cm.					
2.92	7.40°	70.	2.75	2.75	$10\bar{1}0$
				2.59	0001
3.30	8.33	150.0	2.44	2.44	$10\bar{1}1$
4.23	10.74	50.0	1.91	1.90	$10\bar{1}2$
5.03	12.75	70.0	1.61	1.60	$11\bar{2}0$
5.50	13.90	60.0	1.48	1.48	$10\bar{1}3$
				1.38	$10\bar{1}0$ (2)
5.95	15.00	60.0	1.36	1.36	$11\bar{2}2$
6.05	15.30	20.0	1.34	1.34	$20\bar{2}1$
				1.30	0001 (2)
6.65	16.80	10.0	1.23	1.23	$10\bar{1}1$ (2)
6.90	17.40	0.5	1.18	1.18	1014
7.52	19.00	15.0	1.09	1.08	$20\bar{2}3$
7.96	20.10	30.0	1.04	1.05	$21\bar{3}0$
8.10	20.50	0.5	1.02	1.03	$21\bar{3}1$
				1.01	$11\bar{2}4$
8.41	21.3	20.0	0.98	0.97	$21\bar{3}2$
					$10\bar{1}5$
				0.94	$10\bar{1}2$ (2)
8.83	22.4	0.3	0.93	0.92	$10\bar{1}0$ (3)
9.15	23.1	15.0	0.90	0.89	$21\bar{3}3$
9.48	24.0	10.0	0.87	0.87	$30\bar{3}2$
					0001 (3)
9.90	25.1	0.5	0.83	0.83	$10\bar{1}6$
					$20\bar{2}5$
				0.82	$10\bar{1}1$ (3)
					$21\bar{3}4$
				0.80	$11\bar{2}0$ (2)
10.95	27.7	10.0	0.77	0.77	3140

of the planes, together with the theoretical spacing for the lattice described above. The agreement is within the limit of error of the measurements, except that some of the predicted lines are too faint to show. This is to be accounted for by the distribution of electrons in the atoms, and will be discussed in a future paper.

THE STRUCTURE OF HIGH-STANDING ATOLLS

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The structure of high-standing atolls has seldom been studied in detail, and is perhaps seldom sufficiently revealed for close study. Attention is therefore drawn here to only one structural feature, namely the relation of atoll limestones to their supposed foundation of volcanic rocks. According to Darwin's theory of intermittent subsidence, the limestones of atolls should lie unconformably on an unevenly eroded, submountainous volcanic mass, the top of which may be buried to any depth, as in section M of sector L, figure 1: the section of the volcanic

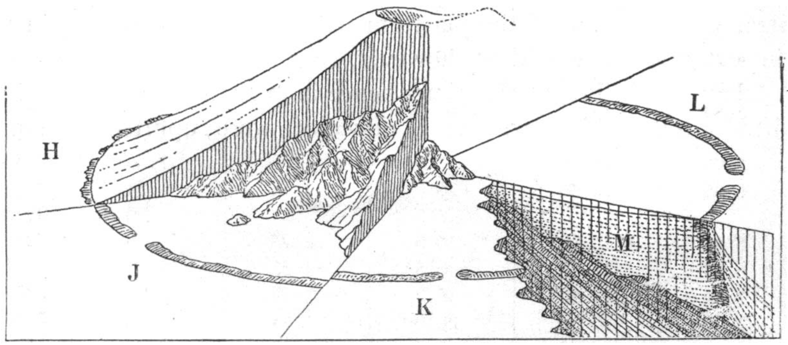

FIG. 1.

foundation here shown resulting from the dissection and progressive subsidence of a volcanic cone, as shown in sectors H, J, K. According to the Glacial-control theory, which is today the only fully formulated competitor of Darwin's theory that deserves consideration here, the limestones of atolls should as a rule unconformably overlie a flat platform of volcanic and calcareous rocks, produced by the following processes: A preglacial volcanic island, sector A, figure 2, is supposed to have stood still so long as to have been worn down to low relief, as in sector B, while a reef plain was built by outgrowth around it: during the Glacial period, when the ocean was lowered about 40 fathoms and