the lighter portion of the alloy; the silver remains pure and free from base metal. Silver may be separated from copper in the cupel by continual addition of lead until it appears in a state of purity. . . . Gold may be purified from silver and copper in two ways. From copper alone it may be refined by the method used to purify silver from copper, namely, cupellation with addition of lead. If it is desired, sulphur may be added as well; this burns the copper and the gold remains pure. Gold may be refined from lead by the method used to refine silver from lead. The purification of gold from silver may be carried out in two ways, one by means of minerals and the other by means of salts. The former method is as follows: the gold alloyed with silver is beaten out into thin leaves and these are placed on a bed of a mixture of hæmatite and salt and covered with more of the same mixture followed by a layer of red clay. The whole is then heated in the oven known to men of science as the 'refining-furnace,' when the silver is absorbed by the earthy matter and the gold leaves are left pure, containing nothing but the most refined gold.

"This operation may also be carried out in a similar way by using alum and salt, or by means of baked clay. The clay is finely powdered and mixed with an equal amount of salt and the two well powdered again. The mixture is then spread in a layer on a layer of red clay. A gold leaf is then added, followed by another layer of the mixture of clay and salt, and so on until all the gold has been added. A covering layer of clay and sand is then placed on the top and the whole strongly heated, when the gold is purified and extracted from the silver. . . . This is the process known as *shahīra* [refinement] by the people of this art. Gold may also be separated from silver in the same way that it is separated from copper. The gold-silver alloy is mixed with a little copper and the mixture fused, with addition of red sulphur from time to time. The gold refines away from the silver and is left pure. The former method, however, is the more efficient.

"The silver which is removed from the gold in the process called *shahīra* may be recovered merely by the addition of mercury to the earthy residue. The mercury thickens and coagulates until it becomes like dough, and this is the sign [of the completion of the action]. When it has become like dough it is placed in a crucible over the fire and the mercury then volatilises away from the silver." E. J. HOLMYARD.

Clifton College, May 29, 1922.

The Notion of Asymmetry.

MODERN refinements in our ideas of atomic and molecular structure at once demand a more precise definition of what exactly is meant by molecular asymmetry. Whether this asymmetry be due to certain groupings around a particular atom, or to the structure of the molecule as a whole, such physical properties as optical activity or enantiomorphism must ultimately be shown to be definitely related to the electronic and nuclear arrangements in the molecule itself.

Langmuir has shown that substances with molecules possessing similar electronic environments closely resemble each other in many of their physical properties, and he calls this phenomenon isosterism, the substances themselves being denoted isosteres. In this brief discussion it will only be necessary to consider the application of this idea to the simplest case of stereoisomerism.

The molecule *Cabcd*, where *a*, *b*, *c*, *d*, are all different atoms or groups, is asymmetric. It exists in two stereoisomeric forms, one the mirror image of the other. The substance having this molecular structure may crystallise in two enantiomorphously related forms, and may rotate the plane of polarisation of light. Now let *d* be replaced by *c′*, where *c′* is an isostere of *c*. Such a molecule is now no longer asymmetric as regards the arrangement of its electrons, but is certainly asymmetric if we take into account the inner nuclei. If the rotation of the plane of polarisation of light is dependent entirely on electronic movements, such a substance may not be optically active, and it may not even crystallise in two forms. We have not sufficient data to decide this matter; but it is obvious that the application of this idea to the case of isotopic elements entering into combination might lead to some interesting investigations. We will only consider the substance $CH . SO_3H . Cl_{35} . Cl_{37}$, where Cl_{35} and Cl_{37} are the two principal isotopes of chlorine. This compound, like *Cabcc′*, is asymmetric as a whole, but so far as its electronic environment is concerned, the two stereo forms are identical.

Now this particular variety of di-chlor-methane-sulphonic acid must be formed to a certain extent in the ordinary preparation of the substance, and it would seem that its isolation could be effected, only if it *did* actually exist in two enantiomorphously related forms. From what has been said this seems rather unlikely, but still, an investigation in this direction would throw some light on the matter, one way or the other. THOMAS IREDALE.

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The Evolution of Plumage.

MAY I be allowed to refer to some of the statements in the article on the Evolution of Plumage published in NATURE of May 20, p. 662.

(1) The writer (H. F. G.) states that in the case of ducks and penguins "the difference between their nestling coat and the final dress is enormous." In my paper on "The Nestling Feathers of the Mallard," I point out that the tail-quill protoptiles consist of a calamus, containing cones, a shaft and a distinct after-shaft, and especially that the barbules at the tip of the shaft in having hook-like cilia are more specialised than in some of the true metaptile feathers of the adult; hence it follows that feathers of the first nestling coat, instead of being simpler, may be more complex than true feathers of the adult coat.

(2) It is stated that in the emus the differences between the nestling feathers (protoptiles) and the feathers of the second and later generations "are reduced to a question of mere size." As the figures in my paper clearly show, the aftershaft of the feathers of the first generation is represented by a few simple barbs, whereas the aftershaft in the following generations is as long and as complex as the shaft.

(3) Owls and petrels are said to "have as thick and fluffy and long-lasting mesoptile coats as any penguin." In the case of the tawny owl the mesoptile coat is poorly developed and (in specimens I reared) shed soon after growth is completed—perhaps, like Pycraft, the writer of the article regards the feathers forming the first coat of true feathers in the tawny owl as mesoptiles; the feather figured in "A History of Birds" (p. 270) is not a mesoptile but a true (metaptile) feather. In a young petrel I received last autumn from Dr. Eagle Clarke, the mesoptile coat consists of simple feathers less than half an inch in length—in penguins the mesoptiles are complex and sometimes reach a length of four inches.

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(1) Surely the coats differ, almost beyond recognition in penguins; even in ducks, in which the first dress does not consist only of tail-quills.