

LETTERS TO THE EDITOR

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Asymmetry and Vitalism.

In your issue of September 22, Prof. Pearson, referring to the views expounded by Prof. Japp in his interesting address on "Stereochemistry and Vitalism," shows that, if chance be the only factor at work in the replacement of asymmetrical groups in symmetrical molecules, the production in nature of an excess, however small, of compounds of one-sided asymmetry must undoubtedly have taken place. But, ignoring the mechanical interpretation of the phenomenon (thus avoiding the stumbling-block hinted at by Prof. Pearson), and taking, according to present experience, for granted that, in the artificial introduction of asymmetry into a symmetrical compound, equal amounts of two inversely-active bodies are formed, so as to give rise to an optically inactive mixture or compound (in a way recalling to mind the separation of equal and corresponding amounts of positive and negative electricity), other objections may, in my opinion, be brought against Prof. Japp's views.

The point at issue is this: out of inactive material, vegetal and animal organisms are building up substances with asymmetrical molecules, and optically-active, such as albumins and carbohydrates. In which fact, joined with the chemists' then ascertained inability to prepare artificial active compounds from inactive substances, Pasteur saw an essential difference between the forces that are acting in living nature and such as are coming into play in our laboratories; he called, accordingly, the former asymmetrical, the latter symmetrical forces. This alleged barrier fell to the ground after the successful preparation, by Perkin and Duppa and by Jungfleisch, of racemic acid from succinic acid, and the separation, by means of a simple crystallising process, of sodium ammonium racemate into dextro- and lævo-tartrate, differing by their inverse hemihedral faces, and mechanically separable from one another. Being aware that the spontaneous separation of racemic acid into its two active forms afforded a strong argument against his theory, Pasteur uttered the belief that, even in that phenomenon, some asymmetrical outward agent, such as the organic germs contained in the atmosphere, might be the separating cause; but that hypothesis, inadequately supported by Joubert and Bichat with the doubtful evidence afforded by their experiments, cannot hold its ground against the facts discovered by Scacchi and Wyruboff, and especially by Van't Hoff and Deventer, respecting the so-called "transition-point" of some double salts, a class of compounds among which the racemates are but a particular case.

On Prof. Japp's view the asymmetrical forces are brought into play in another way and at another moment than on Pasteur's. He contends that, while simple asymmetry (exemplified by dextro-tartaric or levotartaric acid) is caused by asymmetrical actions, double asymmetry, as displayed by racemic acid, is caused by symmetrical actions: no asymmetry comes into play in the latter case, not even when the racemate is separating into its two enantiomorphs, as for every right-handed crystal a corresponding left-handed one is formed. But here is the point. When "the two kinds of crystals are to be picked out, and placed each in a vessel by itself," the intervention of an intelligent force, the intelligent and living (whether mediate or immediate) act of man is needed, as, both kinds having the same solubility, specific gravity, melting point, &c., behave in the same way towards all the separating symmetrical and non-living agents we dispose of in our laboratories. The conscious separation, carried out by man, may be compared with the unconscious one caused by bacteria and moulds, which agents are also able to destroy one kind rather than the other: the common side of both actions is that they are brought about by living organisms, formed of asymmetrical material, and therefore able to act asymmetrically.

Now, granting that, according to Prof. Japp's interpretation of facts, intervention of life cannot be dispensed with in the above separation, I believe that, supposing no substance endowed with molecular asymmetry to exist on our planet, it would be, not merely conceivable, but actually possible to produce as much simple asymmetry as might be desired, by means of an amount of one racemic compound (such as some racemate) liable to separation into active kinds, by the crystallising process, without any interfering asymmetrical force. In point of

fact, after the spontaneous separation (the suitable temperature being granted) into the enantiomorphous crystals, we may always imagine a force, neither intelligent nor living, and acting in a symmetrical way, that would by chance single out one crystal: from that single, asymmetrical crystal (whether right- or left-handed), as was shown among other similar instances by Fischer and Wallach, other compounds can, on introducing asymmetrical groups, be prepared, displaying (without any previous separation into enantiomorphs) simple asymmetry. For, while a racemic compound always comes into existence when we start the synthetic process with a symmetrical and therefore inactive substance, such is not the case when we are operating on active, already asymmetrical compounds, as one active kind rather than its enantiomorph (with respect to the newly-introduced group) may be formed, the other one being partially or totally excluded. The pre-existing asymmetry has a directing influence upon the newly added atoms: asymmetry begets asymmetry, as life begets life. This argument does not only fit the hypothesis that a single crystal be selected: provided that the supposed force act for so short a time as to allow but a small part of the crystals to be removed, there is some chance for there being an excess, however small, of either one or the other enantiomorph to which the above remarks may as well apply.

The following illustration may perhaps convey a clearer idea of the fact stated. Supposing molecular asymmetry to have come on to our planet from outward space (an origin ascribed by some to life), let us imagine one primordial racemic compound to have spontaneously separated into its two enantiomorphs, and these to have been whirled round and scattered about vacant space by some vortex, so as to allow one simply asymmetrical particle to reach our globe. This may, without the intervention of any peculiar force differing at all from such as are acting in chemical synthesis, have originated all the now existent asymmetrical compounds. Some other planet might nevertheless have been reached by a particle of the other enantiomorph; the ensuing molecular asymmetry would accordingly have been the perfect reverse of ours: that celestial body might be inhabited by living creatures akin to ourselves, but built up of dextrogyrous albumins; its vine-grapes would yield *l*-glucose instead of *d*-glucose, &c. I do not mean to contend that there is any probability of such events having taken place, and am only pointing out that such an hypothesis is in no way absurd or inconceivable. Nay, it might even be enlarged. Although unlikely, a universe (in which our planet might well be included) can be imagined, being formed by pairs of celestial bodies endowed with equal and inverse asymmetry, so as to be comparable with a set of enantiomorphous crystals, into which a mixture of racemous compounds would separate. It matters little whether the enantiomorphs be near one another, as in the case of a crystallising solution, or as wide apart as the celestial bodies we are considering: there is in both cases in a determinate point of space one kind of simple asymmetry (the other one being excluded), a result attained without any absolutely asymmetrical action, and especially life, coming into play.

That the way followed by living organisms in their preparation of active substances, differs from the processes carried on in laboratories, is quite another question: the capital point is that, in one way as in the other, the final result is the same, and that the formation of the first asymmetrical group is not necessarily connected with that of the first living particle, as Prof. Japp contends. In my opinion, the problem of spontaneous generation is not likely to be ever reduced to the far simpler question of the origin of molecular asymmetry.

Turin, October.

GIORGIO ERRERA.

I WILL endeavour to reply to the various criticisms which have appeared in NATURE on my address to the Chemical Section of the British Association.

Prof. Karl Pearson points out—what was, of course, obvious—that if only a small number of asymmetric molecules—say twenty—were to be formed under the influence of symmetric forces, there might be a preponderance of either right- or left-handed enantiomorphs, or even that all might be of one kind. He then goes on to suggest that such asymmetric compounds might have been spontaneously formed in the past, and might "be endowed with a power of selecting their own asymmetry from other racemoid compounds," and might thus act as "breeders."

This is a view which, as I have found in private discussion,