

in a stretched liquid. His explanation is ingenious: that the close contact of the bodies liberates from a denser surface layer, liquid which will go to supply the prevailing demand, and so lower the energy of the stretched liquid.

Whether this be a quite correct explanation or not, does not the experiment suggest the possibility of an analogous phenomenon occurring in a tensile ether in which matter is immersed; giving rise to the effects which we appreciate as gravitational attraction?

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Trinity College, Dublin, November 6.

Homogeneity of Structure the Source of Crystal Symmetry.

To the lucid notice of my paper, "Ueber die geometrischen Eigenschaften homogener starrer Strukturen und ihre Anwendung auf Krystalle," contained in your issue of October 18, it is perhaps desirable to add a remark.

The paper referred to is purely geometrical; it starts with a definition, and not with a supposition. Consequently the various new theories advanced by the writers referred to in the notice receive no support from it.

Homogeneity of structure pure and simple, unaided by any theory as to the nature of matter, leads inevitably to all the varieties of symmetry presented by crystals. It is useless, therefore, to look to the facts as to this symmetry for any light upon the vexed question whether the seat of the symmetry is in the arrangement or in the configuration of the molecules, or, indeed, for any proof of the existence of molecules or separable units.

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THE PRESENT STATE OF PHYSIOLOGICAL RESEARCH.

THE following extracts from an article by Prof. Max Verworn, of Jena, on "Modern Physiology," published in the *Monist* for April 1894, seem to be well worth the attention of English biologists. It would be interesting to obtain in the pages of NATURE an expression of opinion from our physiologists as to how far the reproach is true, that "in treading the beaten paths we are making no progress in physiology, and have stood still for years on the same spot." How far is it true that physiologists must revert to the point of view of comparative physiology, or the physiology of the endless variety of lower and simpler forms of life which was that which formerly so fruitfully shaped the research of the great master Johannes Müller? Is it, or is it not, time that the methods of horological physiology were less dominant and gave place to a determined and persistent study of living structure in its varied manifestations other than the frog and the rabbit?

"Psychologically, it is a highly interesting phenomenon, and one of moment in the history of science, that now, almost immediately after the final suppression of the old vitalism by the new development of the natural sciences, we have again arrived at a point which corresponds in the minutest details to the reversion to mystical vitalism which took place after the clear and successful research of the preceding century. As a fact, the parallel between the conditions of the eighteenth century and those of to-day is unmistakable. Now, as then, the physico-chemical method of explaining phenomena of life looks back on a brilliant, almost dazzling sequence of successes; now, as then, the tracing of vital processes to physical and chemical laws has reached a point at which, for many years, with the methods now at our command, no essential progress has been made, where, on the paths hitherto trodden, a boundary line is everywhere distinctly marked; and now, as then, on the horizon of science the ghost of a vital force looms up. It has already taken possession of the minds of serious thinkers in Germany, with the dire prospect of more extensive conquests; and in France, too, it would seem, science is slowly opening its door to this invasion of genuine mysticism.

"To understand this phenomenon psychologically, and to acquaint ourselves with the means of staving off a general reaction into vitalism, it is desirable to examine more carefully

the present state of physiology. A review of the productions which appear in our different physiological journals, which will best exhibit the present state and tendency of the science, furnishes an extremely remarkable spectacle. Leaving aside the science of physiological chemistry, which is independently developing with great success, we find, with the exception of a few good contributions to the physiology of the central nervous system, as a rule, only extremely special performances of very limited scope and import, wholly without significance for the greater problems of physiology, whether practical or theoretical, and exhibiting no connection whatever with any well-defined general problem of physiology. In fact, what is called physiology is beginning here and there to degenerate into mere technical child's play. With every new number of our physiological magazines, the unprejudiced observer is gradually gaining the conviction that general problems of physiology no longer exist, but that inquirers, driven to desperation in the struggle for material, have no choice but to hunt up the old dry bones of science, on which they fall with the nervous rapacity of hungry dogs. And in the case of most of the productions, this impression is strengthened by the fact that the results, when once found, are wholly disproportionate to the tremendous expenditure of labour and time which it might be seen beforehand they would require. And yet all the time the great problems of physiology everywhere stare us in the face and seek solution. For, if we regard the problem of physiology as the investigation of the phenomena of life, we are certainly yet very far from the solution of even its most important and most general problems. We need not go to the extreme that Bunge does in his excellent text-book of physiological chemistry, of maintaining that the phenomena of our organism which we have explained mechanically are not genuine vital processes at all, no more than is 'the motion of the leaves and branches of a tree shaken by a storm, or the motion of the pollen which the wind wafts from the male to the female poplar.' But it is certainly no exaggeration to say that what the splendidly-conceived methods of the great masters of physiology since Johannes Müller have explained, are not elementary processes of life, but almost exclusively the crude physical and chemical actions of the human body.

"For what have we attained? We have measured and registered the motions of respiration, the mechanics of the gaseous exchange in the lungs in their minutest details. We know the motions of the heart, the circulation of the blood in the vascular system, nay, even the slightest variations of the pressure of the blood, as produced by the most diverse causes, as accurately as we do the phenomena of hydrodynamics in physics. We know that respiration and the motion of the heart are conditioned by the automatic activity of nervous centres in the brain. But no spirometer, no kymograph, no measuring or registering apparatus can give us the slightest idea of what takes place in the nerve-cells of the brain that condition the beating of the heart and respiration.

"Further, we have investigated the motions of the muscles, their dependence on the most diverse factors, their mechanical powers, their production of heat and electricity, as exhaustively as only the phenomena of the special departments of mechanical physics have hitherto been treated. But of what goes forward in the minute muscle-cells during simple muscular contraction, no myograph, no galvanometer has as yet given us the slightest hint.

"We know also the laws of the excitability of the nervous fibres, of the propagation of irritations, of the direction and velocity of nervous transmission, thanks to the ingenious methods of recent physiology, in all their details. But of what is enacted during these processes in the nerve-fibres and in the ganglion-cell from which it ramifies, no induction-apparatus or multiplier can give us the least information.

"We know besides, that the heat and electricity produced by the body, and the mechanical energy of muscular work, are the consequence of the transformation of the chemical energy which we have taken into our bodies with our food. But by means of what chemical processes the cells of the individual structures take part in these achievements, the most sensitive thermometer or calorimeter will not disclose, and no thermal pile or graphical apparatus will indicate.

"We might give any number of examples of this kind, but those adduced exhibit distinctly enough the point to be signalled. What we have hitherto attained is this: we have measured, weighed, described, and registered the gross