

which is assumed in stereo-chemistry if such a reversal of the magnetic axis were accompanied by a change in the nature of the compound. Such modifications, however, might conceivably account for mutarotation. It was thought that in the case of a double bond, such as exists in cinnamic acid, it might be possible to have a larger number of isomerides than would be given by the ordinary theory, but a close examination of the structural formulæ based on the cubical atom has shown that (subject to the limitation already referred to) this is not so.

The view here suggested appears to afford an adequate basis for a theory of optical activity. Such activity arises from a difference effect, and can be manifested only when there is lack of compensation amongst the electrons associated with the various parts of the molecule. If the chemical bond is to be attributed to a pair of electrons, it is easy to understand how such compensation can be brought about in the great majority of chemical compounds. In the case of a single asymmetric carbon atom, the symmetrical arrangement of each of the four electron pairs is disturbed by the presence of the adjacent groups, resulting in only partial compensation. Thus in the compound  $Cabcd$ , the pair of electrons associated with group  $a$  is under the influence of the unlike groups  $c$  and  $d$ , and, therefore, cannot be symmetrical. But if  $c$  and  $d$  are made alike, the whole molecule will have a plane of symmetry indicated by the broken line in the left half of Fig. 3. Thus the molecule will be inactive through "internal compensation" with respect to the electrons which form the outer shell of the carbon atom. I may add that the ring electron, constrained to move backwards and forwards along its linear axis, is admirably adapted to replace the ordinary electron moving backwards and forwards along a spiral path postulated in Drude's theory of rotatory liquids.

It may be permissible in this connection to emphasise the remarkable success that has attended Langmuir's development of the "octet" theory, by means of which it is possible to predicate the physical and chemical qualities of a substance, and even its crystalline structure. Langmuir states that the theory seems to explain all the cases of stereo-isomerism with which he is familiar. "For example, in the amine oxides,  $NR_2R_3O$ , nitrogen is quadricovalent, so that these substances exist as optical isomers, just as in the case of a carbon atom attached to four different groups." Such a compound is, in fact, represented by the diagram already given. H. S. ALLEN.

The University, Edinburgh, March 2.

### The Principle of Equivalence and the Notion of Force.

I SHALL be grateful to be permitted to make an inquiry in connection with the principle of equivalence through the medium of the columns of NATURE.

In the recent forms of the theory of relativity it has been asserted that in the neighbourhood of matter we may alternatively conceive the existence either of a field of gravitational force or of a distortion in the space-time continuum, the two conceptions being equivalent. The point then arises, however, as to whether, in arranging the body of ideas and propositions constituting physical science in logical sequence, the idea of force (at any rate, "force" in the sense of "action at a distance") or that of distorted space-time should be regarded as logically prior. The possibility of adopting the idea of distorted space-time as prior, and hence of finally dispensing with the notion of force from the physical scheme, evidently depends on a further generalisation of the principle

of equivalence. For a difficulty seems to arise in connection with other forms of action at a distance, such as the forces in a magnetic or an electrostatic field. Apparently we cannot regard these as equivalent to a space-time distortion, for they lack the universality of gravitation, seeing that only bodies of specific types of material are deflected by them.

I should therefore like to ask two questions:

(1) Is it possible to extend the principle of equivalence in any way so as to include *all* forms of action at a distance?

(2) If not, is there anything gained, even from a purely logical point of view, by discarding the notion of gravitational force while we are still unable to discard by the same method the notion of certain other forces which in many respects exhibit a close analogy to gravitation?

C. A. RICHARDSON.

4 The Crescent, St. Bees, Cumberland,  
March 1.

### Expenses of Scientific Work.

A JOINT committee of the British Association of Chemists, the Institute of Chemistry, and the National Union of Scientific Workers is putting forward the claim that the following expenses should be allowed as a charge against income in arriving at the assessment of those who earn their living either by purely scientific pursuits or by the application of science to industry:—

(1) Subscriptions to scientific and technical societies and libraries, and to scientific and technical periodicals.

(2) Purchase and renewal of scientific and technical books, instruments, apparatus, chemicals, and other materials.

(3) Rent and expenses of study or laboratory.

(4) Travelling and other expenses incurred in attending scientific meetings.

(5) Provision of special clothing for work and renewal of clothes damaged in the course of employment.

(6) Other expenses incurred in the course of research.

A form of memorial to be presented to the Lords of the Treasury is being sent to all bodies representative of scientific workers for their consideration and support.

Some claims for abatements under the above headings have already been made by individuals with varying success. I should be grateful for any information available in support of the petition.

A. G. CHURCH,  
Secretary.

National Union of Scientific Workers,  
19 Tothill Street, Westminster,  
London, S.W.1, March 15.

### Scientific Reunions at the Natural History Museum.

I WRITE to correct a small error that has crept into the note on the meeting of the International Council for the Exploration of the Sea which appeared in NATURE for March 11. When the members of that council visited the Natural History Museum on March 2 they were entertained, not by the Trustees, but by the Staff Association, the occasion being a scientific reunion, as was, indeed, stated in a later note in the same issue. I may add that these reunions are held with the approval and permission of the Trustees.

G. F. HERBERT SMITH,  
Hon. Secretary.

Natural History Museum Staff Association.