potassium nitrate in solution, at a distance of, say, 10^{-7} cm., is found to be $6{\cdot}24 \times 10^{-11}$ dynes. If the particles were 'dissociated', the electrical attraction between the 'ions' at the same distance would be $2{\cdot}21 \times 10^{-5}$ dynes, which is of the order of a million times as great, and is impossible. Therefore, the potassium nitrate cannot be dissociated.

By taking into account the attractions between the particles, it is possible to account for the solubilities of different substances and to explain the mechanism of solution, which the dissociation theory was unable to do.

The results are evidence that the so-called failure of the classical dynamics is due, not to inherent defects in the method, but to the omission on the part of mathematicians to allow for the attractions of moving particles in close proximity to one another.

S. C. BRADFORD.

Science Museum,
South Kensington, S.W.7,
July 5.

The Nucleus of *Amoeba proteus* Pallas (Leidy) [= *Chaos diffluens* (Schaeffer)].

IN "Ergebnisse mit der Nuclealfärbung bei einigen Rhizopoden", Aug. 12, 1929,[1] Bogdanowicz describes the effect of Feulgen's nucleal reaction on the nucleus of *A. proteus*. In a letter to NATURE (June 22, 1929) I briefly summarised my results of a long series of experiments on the same subject. It will be seen from a perusal of the two publications that our findings agree with regard to the presence of a reticulum of chromatin in the karyosome (a conclusion I had already arrived at by a study of the development of the nucleus[2]), but differ with respect to the nature of the so-called 'chromatin blocks' in the periphery of the nucleus. Bogdanowicz fails to obtain a chromatin reaction for these blocks. Now these 'chromatin blocks' have a twofold theoretical significance: (1) they form the karyosomes of the Agametes, (2) they show a very primitive type of mitosis.[3] It is, therefore, important to arrive at a decision with regard to their exact character. There is, however, another reason for endeavouring to clear up any discrepancies in the various descriptions of the nucleus of *Amoeba proteus*. As I have already pointed out, two large free-living amoebae have been confused under the name of *Amoeba proteus*, namely, *Amoeba dubia* (Schaeffer) and *Amoeba proteus* [Pallas (Leidy) = *Chaos diffluens* Schaeffer]. Therefore in making any reference to papers published before 1916 care should be taken to ascertain to which of the two amoebae reference is being made. As I know from experience, it is not always easy to do this. But failure in this respect is a fruitful source of confusion. Hence the justification of this summary of the results of many years' study of the nucleus of *A. proteus*, in its development and in its adult condition, by the ordinary microscopical stains; these results being checked and confirmed by a later investigation by Feulgen's method.

The nucleus of *A. proteus* consists of (1) a more or less centrally placed karyosome, (2) a peripheral achromatic network in which are suspended 'chromatin blocks', the whole immersed in nuclear sap and surrounded by a nuclear membrane. The karyosome is in the form of a thick disc with rounded edge, so as to appear circular in plan, 'band' shaped in elevation. It presents a variety of appearances when being rolled about in the cytoplasm, and thus changing from its 'plan' to its 'elevation' position.

The karyosome is made up of an achromatic ground substance on which is to be seen a reticulum of chromatin. The consistency of the karyosome differs in different specimens and varies according to the age of the amoeba and other circumstances. The amount and the distribution of the chromatin in the karyosome varies at different times. In the young, that is, immature, amoebae the karyosome is well marked off and is a conspicuous structure in the nucleus. But the chromatin is very sparse. In fact, I failed to get any positive reaction for chromatin in uncut nuclei, except the merest trace, until I had examined hundreds of specimens.

In the older, that is, fully differentiated, and adult amoebae the karyosome sometimes stains deeply by Feulgen's method, showing well-marked blocks and patches of chromatin which differ in colour tone in no way from the fully developed chromosomes in dividing nuclei of other animals and plants used by way of controls. At other times the karyosome appears to contain less chromatin.

It is important to emphasise the fact that chromatin is a living substance. It is, therefore, ever-changing, growing, increasing in amount, differentiating out of the chemical substances which build it up, dividing. The changes described above are clearly brought out when large numbers of *A. proteus* are studied by Feulgen's reaction, as is also the case when large numbers of amoebae are treated with aceto-carmine, as I pointed out long ago.

In the adult amoebae clearly defined chromatin blocks are to be found in the periphery, giving the reaction for chromatin by Feulgen's method as already stated. These similarly grow, differentiate, divide; when a 'block' is ready to divide, it stains very brightly; when it is in the 'resting' condition, it is not so evident and it does not stand out so prominently from the underlying ground substance.

In conclusion, I may add that, through the kindness of Prof. Robert Chambers of New York, I have been able to examine the *Amoeba dubia* of the States (it differs in no wise from the material obtained locally), and so to assure myself that not only do the cytoplasmic characters of the two species differ, but also, there is no karyosome in the nucleus of *A. dubia*.

MONICA TAYLOR.

Notre Dame, Dowanhill,
Glasgow, June 23.

[1] *Zeitschrift für Zellforschung und mikroskopische Anatomie*, 10 Band, 3 Heft.
[2] *Quart. Jour. Mic. Sci.*, vol. 71, part ii., August 1927.
[3] "Amœba proteus: some new observations on its Nucleus, Life History, and Culture." *Quart. Jour. Mic. Sci.*, vol. 69, p. 126, part i., December 1924.

Molecular Rotation in the Solid State.

THE determined crystal structures of a number of primary alkyl ammonium halides indicate that in such compounds the carbon atoms are arranged collinearly [1] in a particular group. Thus in the case of primary amyl ammonium chloride [2] the X-ray diffraction data from powders and single crystals can be completely explained by a tetragonal unit of structure containing $2NH_3C_5H_{11}Cl$ with $a = b = 5{\cdot}01$ A., $c = 16{\cdot}69$ A. The space group is D_4^2, V_d^3, S_4^1, C_{4v}^1, C_4^1, D_{4h}^7, and the Cl, N and C atoms are at $o\frac{1}{2}u$, $\frac{1}{2}o\bar{u}$, with $u_{Cl} = c.\ 0{\cdot}095$. The absence of reflections in odd orders from planes $(hk0)$ with $(h+k)$ odd and the intensities of reflections from other planes such as (200) require the carbon atoms of the C_5H_{11} groups to scatter X-radiation as if they are arranged collinearly in each group.

Prof. Linus Pauling, of the California Institute of Technology, has recently suggested to me that the indicated collinear arrangement of carbon atoms might be in error. If the carbon atoms of an alkyl group really have a 'zig-zag' arrangement and the group is