

### Letters to the Editor.

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#### Monomolecular Films.

IN a recent communication to the Société Française de Physique (cf. *Le Journal de Physique et le Radium*, March, vol. 9, p. 378; 1928), Mr. H. Devaux describes a continuation of his beautiful work on monomolecular films, in this case for films on mercury. He states that "Dans les cas, très nombreux, où l'on obtient une lame très mince continue, liquide ou solide, on peut tenter la mesure de l'épaisseur minimum réalisable. Cette mesure m'a donné des résultats satisfaisants quand j'employais le benzine comme dissolvant, par exemple pour l'acide abiétique. Au contraire, pour les substances présentées en dissolution dans l'eau j'ai trouvé des lames toujours trop étendues, qui auraient fait attribuer à la substance un diamètre moléculaire très inférieur au diamètre théorique. En voici des exemples :

Lame de saccharose	0,20 à 0,40.10 <sup>-7</sup>	au lieu de	0,73,	diamètre théorique.
Glucose	. . . 0,14 à 0,21		" 0,58,	"
Glycérine	. . . 0,06 à 0,08		" 0,50,	"
Gomme arabique	. . . 1,2 à 1,3		" ?	"

"Résultats analogues avec la dextrine, l'amidon, l'albumine (environ de 1,5.10<sup>-7</sup>), le tanin, l'acide picrique.

"Il est évident que pour toutes ces substances l'emploi de l'eau avait provoqué l'altération du mercure, de sorte qu'une impureté expérimentale augmentait indûment la surface."

Since 1926 we have been investigating thin films of various substances on mercury, the original object being to obtain further information on the molecular dimensions of cellulose and its derivatives. The investigation was extended to cover other 'high molecular compounds,' and the results seem of sufficient interest to permit brief description of the method and of their relation to Mr. Devaux's conclusions. The method consisted in allowing drops of solutions of the substances of varying concentration to spread on a mercury surface cleaned by the sweeping procedure, the amount of substance being insufficient to cover completely the liquid surface. The film area was developed with talc powder and measured by a planimeter. On plotting the thickness of the film calculated by assuming the density of the massive material against concentration, a point is arrived at where this thickness value becomes independent of the concentration (or dilution). The limiting values for cellulose nitrates out of acetone were of the order 3 to 5 Å. The value found for stearic acid out of ether at 25° was 22 to 24 Å., for oleic acid 11·2, for elaidic acid 12·2 Å., for *n*-capric acid 13·6 Å.

These results indicated that the fatty acids gave values comparable with those obtained by Langmuir, Adam, and others, so that these substances were apparently ordering themselves to oriented monomolecular films, not quite in the closest packing possible, but approaching it. On the other hand, the very low values for the 'high molecular' bodies either mean a casual net-work structure, of great porosity, or a molecular dimension which cannot be the length of the molecule, but may be the thickness of a polymeric chain or sheet. The former conclusion is in disagreement with the reproducibility and the behaviour of the films to compression by an encircling oil film. The latter view seems in accord with certain

theories at present developing on polymerisation, and with the atom-group orientation theory of colloid micelle formation suggested by one of us in a previous letter to this journal ("The Nature of the Emulsoid Colloid State," S. E. Sheppard, NATURE, Mar. 17, p. 73; 1921).

By the same method we have obtained values of the minimum thickness for proteins out of water of the order 6 to 7 Å. This is in good accord with the values for protein films on water obtained by E. Gorter and F. Grendel (*Trans. Farad. Soc.*, 22, p. 477; 1926).

In view of the similarity of our results in non-aqueous solution to those obtained in aqueous solution, we suggest that Mr. Devaux's results do not necessitate his conclusion, "pour toutes ces substances," etc.

The tendency for strongly bipolar molecules, such as the fatty acids, to end-on orientation, at either a water or mercury surface, need not be expected in more complex bodies, such as the carbohydrates and proteins, which possess a multipolar structure, relative to simple dipoles. This conclusion is not incompatible with Mr. Devaux's suggestions concerning the effect of ionisation, and is in good accord with his remarks in a previous communication (Communication to the Société Française de Physique, Séance du 17 Février, 1928, *Journal de Physique*, p. 348; 1928) concerning the formation and function of monomolecular films at the surface of living cells. We expect to present this material in conjunction with some work by Mr. A. H. Nietz at the Symposium on Polymerisation of the American Chemical Society in September of this year.

S. E. SHEPPARD.

R. L. KEENAN.

Eastman Kodak Company,  
Rochester, N. Y., May 23.

#### Active Nitrogen.

DR. H. SPONER, in an article published some time ago (*Zeit. f. Phys.*, vol. 34, p. 622; 1925), advanced the hypothesis that active nitrogen is simply an atom of nitrogen, basing her argument on the parallel properties of active nitrogen and active hydrogen. The hypothesis seems to have found favour with many physicists. Now it is known that active hydrogen shows Balmer lines strongly, and if active nitrogen is also atomic in structure, this may also show the lines of atomic nitrogen. In order to test this point we have photographed the spectrum of active nitrogen in the near infra-red, after an exposure of 42 hours on neocyanine plates. A new band system, extending from 7500 Å. to 8900 Å., has been discovered. The well-known group of lines of atomic nitrogen discovered by C. C. Kiess (*J.O.S.A.*, vol. 11) about the region 8200 Å. is absent, though the exposure was long enough to photograph a weaker band in the vicinity.

This new band system photographed by us for the first time in the spectrum of active nitrogen, was first noticed by A. Pfund (*J.O.S.A.*, vol. 9, p. 193) and Coblenz, a few years ago in their investigations of the infra-red radiations of nitrogen by the galvanometric method, and recently Poetkar (*Phys. Rev.*, Dec. 1927) has photographed it by using ordinary nitrogen discharge tubes. We have also obtained these bands in the ordinary discharge tube of nitrogen. There is no doubt that they owe their origin to the N<sub>2</sub> molecule. There are some indications that this band system is present in the solar spectrum, and may provisionally be identified with the band noted by Meggers about 8230 Å.; and is due to the absorption of solar light by atmospheric nitrogen. Prof. M. N.