jacket, but the bird was unable to remain upright. It lolled over about 15° to port, or to starboard, as set; and, from such data, the position of the centre of gravity could be obtained with reasonable accuracy.

As regards the suggestion that a check might be employed to measure the actual water displaced, this is not so simple a matter as it may appear. It seems necessary to define the word 'displacement' as applied to flotation.

A waxed needle can be made to float by the aid of surface tension, and, when doing so, actually displaces a volume of water more than seven times its own volume, however absurd this may seem. In a similar sense, a bird weighing 5 lb. on land may, and must, displace a volume of water weighing 5 lb. In the case of the needle, the weight of water below the line of contact of needle and water surface is only about one fourteenth of the weight of the needle; in the case of the bird, I contend that the weight of water displaced below the line of contact between bird and water surface is only about one-third of the weight of the bird. Possibly surface tension accounts for $\frac{13}{14}$ of the weight of the needle, and for $\frac{2}{3}$ of the weight of the bird. Are we sure, however, that surface tension is the supplementary force in action in the latter case? The usually observed characteristics of surface tension do not seem to be apparent.

The usual meaning of the term 'displacement', when applied to ships or other floating bodies, is restricted to the volume of the body which lies below the line of its contact with the water-surface; and in this sense it was used in the paper to which the comments referred.

FRANCIS H. ALEXANDER.
Armstrong College,
Newcastle-on-Tyne, Aug. 5.

IN his original paper, Mr. Alexander, while examining curious suggestions such as that the super-inflation of the internal air-sacs might account for flotation, did not mention the possibility of, and made no allowance for, increased displacement due to the fluffing out of the feathers. Therefore his calculation regarding the amount of water displaced was invalid. His argument against the practical value of the suggestion, that it would cause instability, ignores the power of the living bird to control its balance by its peculiarly adapted feet and perhaps also by feather adjustments. Yet this is the one power that his waterproof jacket experiment demonstrated, for although he actually lowered the centre of gravity, the bird became unstable—obviously because its control had been interfered with. We still think that Mr. Alexander's data are insufficient; until he has measured the actual displacement of the swimming duck and found the water displaced to weigh less than the bird itself, it is futile to argue about supplementary forces of 'levitation' or any other force. Last week, I watched a grebe at one time swimming high in the water, at another time almost submerged. That suggests an alteration in specific gravity, that is to say, since the bird's weight is constant, in volume; and the raising or adpressing of the feathers, with a corresponding increase or decrease in the air-jacket, seems a possible and natural explanation of the change.

THE WRITER OF THE NOTE.

Crystal Structure of Normal Paraffins.

DR. MÜLLER has recently (*Proc. Roy. Soc.*, A, vol. 127, p. 417) made a detailed study of the effect of temperature on the crystal structure of the normal paraffins. He found two modifications, a 'normal' structure *A*, and a second form *B*, the *A* form having a 001 spacing 2 A. longer than the *B* form. Paraffins having more than 22 carbon atoms were found only in the 'normal' *A* form, whilst those of carbon content from 11 to 22 could assume both modifications. The 'normal' form of these was only stable at temperatures near the melting points.

We have recently examined specimens of hexacosane (26), triacontane (30), and tetratriacontane (34). They were supplied by Prof. Garner, and had been prepared by electrolysis of the pure acids, purified by distillation and crystallisation from alcohol, and finally digested with concentrated sulphuric acid at a temperature of about 130° C. Final crystallisation was from alcohol or benzene. Hexacosane and tetratriacontane showed two *stable* forms at room temperature. One had the normal *A* spacing, whilst the other spacing, about 4 A. shorter, was obviously not the *B* 'second form'. In hexacosane this *C* form occurred alone in the crystals from benzene and from alcohol, whilst a melted layer showed both *A* and *C* spacings, the former being the stronger. Crystals of tetratriacontane from benzene gave only *C* spacings, a layer evaporated rapidly from benzene had equally intense *A* and *C* lines, whilst melted specimens showed only the *A* or 'normal' form. The triacontane did not yield quite such brilliant photographs and was in the 'normal' form under all conditions. The spacing of this preparation was rather high, and we believe it to have been less pure than the other two. In no case did we obtain a spacing corresponding to Müller's *B* form.

It seems probable that pure *even* numbered hydrocarbons crystallise in the *C* form if the chain has 26 or more carbon atoms. This is in striking contrast to the odd numbered paraffins, for the single crystal of nonacosane (29) examined by Müller (*Proc. Roy. Soc.*, A, vol. 120, p. 437) had an *A* spacing and was undoubtedly of the highest purity.

This alteration of habit of the longer odd and even numbered hydrocarbons is in accord with the behaviour of similar compounds. Even numbered monobasic fatty acids of 16 or more carbon atoms have two stable crystalline forms at ordinary temperatures, whilst at similar temperatures corresponding odd acids exist in only one modification. One of us has found the same habit in the primary alcohols. In paraffins and alcohols the odd chains favour the form with the longer spacing, whilst the even molecules adopt the shorter modification. In acids this is reversed. Dr. Müller has given reasons on geometrical grounds for differences in the behaviour of odd and even chains (*Proc. Roy. Soc.*, A, 129, p. 317).

The spacings below are in agreement with Dr. Müller's values for the *A* forms, and the divergence of the *C* from the *A* values shows that if the *A* molecule is vertical to the planes the *C* chain must be inclined.

No. of Carbon Atoms.	Setting Point °C.	Spacings.	
		A	*C*
26	56·2	35·0	31·05
30	65·3	40·5	. .
34	72·4	45·3	40·00

An important feature of the *C* spacings is their approximation to the *A* values of other paraffins. Tetracosane has an *A* spacing of 31 A. compared with 31·05 for the *C* form of hexacosane, whilst the *A* spacing of triacontane corresponds to the *C* of tetratriacontane. We have only found the *C* spacings in the best specimens we have examined, and believe their appearance to be a very good criterion of purity.

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