J. R. le B. Tomlin unreservedly turned over for the use of the editor his great manuscript list of the generic names used for mollusca, on which he has been working for many years.

Such a work as this serves to emphasize the international and cooperative features of scientific work, and to show that it is possible to maintain a great republic of workers, without regard for race and without any external coercion. In the field of science we have a working League of Peoples, which may well serve as a model for other efforts to unite humanity for the common good.

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A NEW COLOR REACTION OF VITAMIN B_1 (THIAMIN, ANEURIN)

STUDYING the influence of pure synthetic vitamin B_1 (thiamin, aneurin) on blood phosphate fractions[1] by Fiske and Subbarow's technic we were surprised by the great increase of the values when thiamin was added. More accurate investigations showed that pure thiamin produced alone an intense blue color by the use of ammonium molybdate in sulfuric acid solution and aminonaphthosulfonic acid solution. This reaction being nevertheless non-specific permits, however, the determination of the vitamin when the concentration is above 100γ in pure aqueous solution. Since the color reaction follows the Beer's law it was possible to determine the optimal spectral zone for photometric readings. A Pulfrich spectrophotometer was employed, using filter S 72. The absorption index, $\frac{\text{concentration}}{\text{extinction coeff.}}$ was calculated and found to be 0.375. The technic for the determination is easy and rapid. To a 25 ml flask the thiamin solution (more than 100γ) is added together with 5 ml of a 2.5 per cent. ammonium molybdate solution in 3N sulfuric acid and then 1 ml of a 0.25 per cent. aminonaphthosulfonic acid containing sodium bisulfite and sodium sulfite (as prepared for blood phosphorus determination by Fiske and Subbarow).[2] The flask is filled to the mark with distilled water and the color read after 10 minutes using a 3 ml cup and filter S 72 in a Zeiss photometer. The extinction value is multiplied by 0.375 to obtain the thiamin in the sample.

When phosphorus is also present in the solution the color intensity represents the vitamin plus phosphorus content. By destroying organic matter with sulfuric-nitric mixture in another sample and neutralizing, then proceeding as above, the color developed represents only the phosphorus content. The difference between the first and the second determinations gives the thiamin content.

[1] G. G. Villela and A. M. Leal, *Compt. Rend. Soc. Biol. Paris*, in press.

[2] C. H. Fiske and Y. Subbarow, *Jour. Biol. Chem.*, 66: 375–400, 1925.

A more detailed study of this reaction will be published elsewhere.

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ON THE NATURE OF FRICTION

FRICTION between solid surfaces is ordinarily thought of as due to the interlocking of surface irregularities. That static friction also depends on the molecular attractions between the surfaces has recently been shown in a series of experiments on the tangential force between two smooth, clean glass surfaces in contact.

We placed a short piece of fire-polished glass tubing inside of a longer straight glass tube. This tube had a sufficiently large bore so that the smaller piece could slide freely within it. This assemblage was thoroughly heated and carefully evacuated by means of an efficient mechanical vacuum pump after which the outer tube was sealed off in the evacuated state. The assemblage was then enclosed in a water jacket for temperature control and clamped on a tilt table. This arrangement permitted us to determine accurately the angle at which the small glass tube started to slide under gravity within the larger tube.

During the course of the experiments it was discovered that the static friction, as computed from the angle of slip, was much larger for surfaces baked in a vacuum than for surfaces which were exposed to the air in the laboratory. The lower friction of the exposed surfaces undoubtedly was due to a moisture and gas film between them.

Several assemblages were constructed, baked out and sealed under vacuum. In each the coefficient of static friction decreased almost rectilinearly with the number of passes of the slider. In one case, where both slider and enclosing tube were made of soft soda glass, the coefficient of static friction decreased to one half its original value in 44 passes of the slider.

The appearance of the sliding surfaces was much modified during the experiment. The fresh surfaces looked perfectly smooth under a microscope, but after a few passes of the slider the surfaces became pitted. The pits were approximately round and not elongated in the direction of the motion, showing that parts of the surfaces had been torn out as if welded junctions had been broken.

In all our experiments, using baked and evacuated apparatus, the coefficient of static friction decreased with wear. How far this decrease in friction continues is not known as yet, but it is not likely to go much below one half of its virgin value. Certain difficulties with the breaking of the outer tube due to the impacts of the slider have prevented us from extending the experiment indefinitely with a given tube.

Our interpretation of these results is that a large

fraction of the static friction between two clean, smooth glass surfaces in contact is due to molecular attraction between those parts of the surfaces which are so close to one another that their molecular adhesions come into play. This assumption would explain both the formation of the observed microscopic pits and the decrease in friction with decreased smoothness of the surfaces. If this interpretation applies to all friction between smooth, solid surfaces it would indicate that the friction is largely determined by the molecular attractions between the two surfaces in contact and by their mean distance apart.

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THE CONSCIENCE OF THE PAST AND THE PRACTISE OF THE PRESENT

INCREASING awareness among scientists of the barbaric uses to which their discoveries and inventions have so frequently been put—and in many cases are at the present time threatening the destruction of millions of human beings—has caused many scientists somewhat belatedly to take thought how best they can in future prevent such misuse of their labors. In our own day one of the greatest mechanical inventions of this or any other century, the aeroplane, has been turned into an instrument which power-crazed governments use to threaten not only the peace but the civilization of the world. It is therefore of peculiar interest for us to-day to hear what the inventor of the first airship, Father Francesco Lana (1631–1687), considered to be the strongest objection to his invention.

After enumerating the six technical objections which he foresaw to his invention (actually in his poverty he was unable to construct the ship), he goes on to say:

> Other Difficulties I see not, which may be objected against this Invention, besides one which to me seems greater than all the rest, and that is, That it may be thought, that God will never suffer this Invention to take effect, because of the many consequencies which may disturb the Civil Government of men. For who sees not, that no City can be secure against attack, since our Ship may at any time be placed directly over it, and descending down may discharge Souldiers; the same would happen to private Houses, and Ships on the Sea: for our Ship descending out of the Air to the sails of Sea-Ships, it may cut their Ropes, yea without descending by casting Grapples it may over-set them, kill their men, burn their Ships by artificial Fire works and Fire-balls. And this they may do not only to Ships but to great Buildings, Castles, Cities, with such security that they which cast these things down from a height out of Gun-shot, cannot on the other side be offended by those below.

This passage occurs in the author's "Prodromo," which was published in 1670. The first account and criticism of this work in English (probably by Robert Hooke) appeared in the *Philosophical Collections,* No. 1, 1680, pp. 18–29, and it is from this account that the translation given above is reproduced.[1]

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SCIENTIFIC BOOKS

SCIENCE IN AFRICA

Science in Africa. By E. B. WORTHINGTON. New York: Oxford University Press, 1939. Pp. xv + 746. Illustrated. Maps. $4.00.

LORD HAILEY, the director of the African Research Survey, writes in the Foreword:

> This book is one of a series of reports prepared in connection with the African Research Survey. The problems of Africa, as they present themselves to those whose concern is with the development of the continent, are discussed in "An African Survey." The purpose of this volume is to summarize the present position of studies in the various sciences which have a bearing on African conditions.

Mr. Worthington starts in by pointing out the interrelations between branches of science, and then as an aid to the appreciation of the interdependence of scientific studies in Africa he mentions important points about the changing environment. For example, he says, "The picture really presented by Africa is one of movement, all branches of physical, biological and human activity reacting on each other, to produce what biologists would refer to as an ecological complex."

Mr. Worthington's first chapter deals with some problems of research in which he makes many practical suggestions arising from his investigations; for example, he points out the practical advantages of separating research organization from the executive

[1] A contemporary English translation of the relevant fifth and sixth chapters from the "Prodromo" is "The Aerial Ship, by Francesco Lana." The Aeronautical Society of Great Britain, London, 1910, 12°, pp. vi–7–27. The following are the studies which I have thus far been able to discover relating to Francesco Lana's invention: Wilhelm Balthasar, "An der Wiege der Luftschiffart. Francesco Lana und Barthol. Laurenço de Gusmao." *Frankfurter Zeitgemässe Brorchüren,* Hamm, Vol. 28, pp. 137–198, 1909; Anton von Brandis, "Studien über die Verfassungs-Geschichte der Gemeinde Lana," *Zeitschrift des Ferdinandeums für Tirol und Vorarlberg,* 3 Folge, Heft. 18, pp. 159–196, (Geschichtliche Abtheilung), Innsbruck, 1873; Angelo Ferretti-Torricelli, "Padre Francesco Lana nel terzo centanario dalla nascita," Ateneo di Brescia. Commentari, Brescio, 1931/32, pp. 331–390. See also Francesco Lana Terzi, *Magisterium Naturae, et Artis,* Brixiae, Libri 3, (1) 1684, (2) 1686 and (3) 1692.