was not Pavlov's fault, and he had no part in it. He was a great and simple and completely honest man, and one who was altogether unspoilt, morally and intellectually, either by public adulation or by the reverence of his colleagues.—*A. V. Hill, in the British Medical Journal.*

SPECIAL ARTICLES

DETERMINING THE AVERAGE FIBER LENGTH IN WOOL YARNS

IN studies relating to the standardization of fabricated wools, one of the problems is that of determining the average fiber length in yarns forming the material. Inasmuch as the methods in use are far from satisfactory, a new method based on a simple principle, namely, the number of fiber ends in a given section of a sample, is presented.

Since the number of ends is twice the number of fibers, one obtains the aggregate length of all fibers, assuming them continuous, and divides the result by one half the number of ends. The latter determination is based on an average from a series of counts in random cross-sections under a microscope. Thus knowing the length (s) of any sample, the number (n) of fibers in a cross-section and the average number of ends (e), the formula for average length (l_1) is expressed by a simple equation (1)

$$l_1 = 2\ (sn/e) \quad \text{.....(1)}$$

applicable to any textile thread of yarn composed of ordinary fibers.

There are several peculiarities in yarns, however, which need consideration, one the irregular arrangement of fibers, particularly in woolens, the other the twisting of the yarn in spinning. While fibers composing a worsted are relatively long and straight, those in a woolen yarn are short and irregular in position. This irregularity usually presents some recurved fibers, particularly at the surface, and the number thus added to a cross-section gives results approximating those obtained for worsteds. In connection with the process of spinning, one may consider the fibers as helices with an angle (θ) measuring the pitch. This presents two possibilities.

If the axial fibers are not under a longitudinal tension due to spinning, one may substitute $s/\sin\theta$ for (s) in equation (1) and the average length (l_2) is indicated by equation (2).

$$l_2 = 2\ (s/\sin\theta)\ n/e \quad \text{.....(2)}$$

If, however, the axial fibers are under tension, a different mathematical treatment is needed, since the lengths of the assumed continuous fibers will vary from the lengths of the axial fibers (s) to those of the peripheral fibers ($s/\sin\theta$), the distribution about the axis corresponding to the square of the radius. Using (R) for the radius of the segment and (r) for the varying radii, the total length of all helices (Σh) is exhibited by equation (3).

$$\Sigma h = (sn/\pi R^3 \tan\theta) \int_0^R 2\pi r \sqrt{r^2 + R^2 \tan^2\theta}\ dr \quad \text{.....(3)}$$

and the average length (l_3) is shown in equation (4).

$$l_3 = 4\ sn \cdot \tan^2\theta\ (\csc^3\theta - 1)\ /3e \quad \text{.....(4)}$$

The differences in the values obtained by (1), (2) and (4) are relatively small and experiments with fibers of known length are closely in agreement with the theoretical values. Any factor for average fiber length will need a modifier, probably of an exponential nature, determined in connection with subsequent experimental work, since the increase in strength of yarns will not continue to be proportionate to the increase in fiber length.

The development of standards for materials along the lines suggested, presenting something more than arbitrary objective tests, is decidedly desirable under our present economic system. Such studies are now in progress.

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THE SYNTHESIS OF THE HEPTACETYL METHYL ESTER OF GENTIOBIURONIC ACID[1]

THE term "aldobionic acid" has come to be applied to those disaccharides containing a uronic acid as one of the component sugars. The aldobionic acids were first discovered among the products of hydrolysis of the specific polysaccharides of certain pathogenic microorganisms and have since been obtained from various plant gums. Apart from their chemical interest, there is evidence to believe that these sugar acids have an important function in determining the immunological specificity of encapsulated microorganisms.[2]

The chemical synthesis of aldobionic acids has awaited the development of the chemistry of the hexose-uronic acids. The recent preparation of the acetohalogen derivatives of glucuronic and galact-

[1] From the Hospital of the Rockefeller Institute for Medical Research, New York.

[2] W. F. Goebel, *Jour. Biol. Chem.*, 110: 391, 1935.