Letters to the Editor.

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Refractive Index of Gums and a Simple Method of determining Refractive Indices.

MANY microscopists must have had occasion to use the highly refractive gum-styrax as a medium for mounting. The genus Styrax is, I believe, native in Western Asia and Asia Minor, but which of the species furnishes the gum, or how the gum is collected and prepared, I do not know and should be glad if any of the readers of NATURE could supply information on these points.

The refractive index of the gums as sold is not far from 1·8—far in excess of that of any other organic product with which I am acquainted.

In connexion with some work on the refractive indices of organic structures, I have recently measured the indices of a considerable number of gums and their solvents by a method described below. Some of the results are here given. It appears that no fluid (at least no fluid in ordinary use) has a lower refractive index than water ($\mu = 1{\cdot}333$). For a large number, μ lies between 1·35 and 1·45; for most of the gums soluble in alcohol, ether, or benzole $\mu > 1{\cdot}45$ and $< 1{\cdot}55$, and for a few $\mu > 1{\cdot}6$. Between these and the μ for styrax there is a large gap which I have not been able to fill.

μ FOR VARIOUS SOLIDS AND LIQUIDS.

Solvents.	μ.	Gums.	μ.	μ as computed for solid gum.
Water	1·333	*Cherry gum	1·344	1·45
Ether	1·360	*Acacia gum	1·372	1·47
Acetone	1·360	*Gum Arabic	1·370	1·48
Alcohol	1·365	†Sandarac	1·520	
Amyl acetate	1·410	†Storax	1·540	
Chloroform	1·450	†Damar	1·560	
Benzole	1·530	†Copal	1·560	
Cedar oil	1·570	†Kauri	1·570	
Xylol	1·540	†Shellac	1·655	
Miscellaneous.		§Bensoin	1·610	
Treacle	1·58	§Guiacum	1·630	
Cane sugar	1·60	‡Styrax	1·810	
Albumen	1·38			
§Artist's copal varnish	1·57			

* Thick solution in water. † Gum melted in prism.
§ Thick solution in benzole. ‡ As sold.

The plan adopted in making these measures is indicated in Figs. 1 and 2. The slit S is mounted on the substage of the microscope and brought into the focus of a low-power objective O. An acute-angled prism P is formed by cementing a small piece of glass G to one end of a strip of thin glass and resting this on a glass slide which is placed on the stage (Fig. 2 (*a* and *b*)). The fluid to be examined, F, is run under the thin glass in sufficient quantity to fill about a tenth of an inch of the thin end of the prismatic space between the thin glass and the slide. The slide is moved about on the stage until two images of the slit appear in the field. One of these images, I (Fig. 2 (*c*)), is formed of pencils which pass through the slide only, the other, I_2, by the pencil refracted through the fluid prism. The distance between the two images is measured by a micrometer eyepiece E (Fig. 1), and supplies the data requisite for the determination of the refractive index of the fluid, provided that the corresponding measurement for some fluid of known refractive index has also been made. If n_x is the micrometer reading for a fluid the refractive index of which is μ_x it can easily be shown that $\mu_x = \dfrac{1}{1 - cn_x}$, and that if n_a is the corresponding reading for a fluid the refractive index of which is known the constant $c = \dfrac{\mu_a - 1}{\mu_a n_a}$.

Thus
$$\mu_x = \frac{1}{1 - \dfrac{\mu_a - 1}{\mu_a}\dfrac{n_x}{n_a}}.$$

Several of the gums examined could be fused in the prism and the refractive indices of the solid determined directly; in other cases solutions had to be used and the refractive indices the solids deduced from that

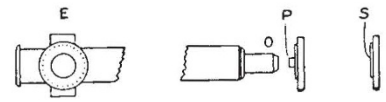

FIG. 1.—General arrangement of the parts of the apparatus: S, slit; P, prism; O, objective; E, micrometer eyepiece.

of the solutions. In a true mixture (*i.e.* a mixture in which the components have no chemical action on one another) of volumes a_1, a_2, etc. the refractive indices of which are μ_1, μ_2, etc., the refractive index of the mixture is $a_1\mu_1 + a_2\mu_2 + \ldots . / a_1 + a_2 + \ldots .$ If only one solid and one solvent are involved and the refractive index (μ_2) of the latter is known, and if also μ_s is the refractive index of the mixture and $a_1/\overline{a_1 + a_2} = \mathrm{P}$ per cent., then
$$\mu_1 = \mu_2 + \overline{\mu_s - \mu_2}/\mathrm{P}.$$
This relation was used in computing the values for the water-soluble gums when in the solid state.

The above described plan of measuring refractive indices has several advantages. The only measurement to be made is the reading of the eyepiece micrometer, and very small quantities of fluid (about as much as can be carried on the head of a stout pin) are sufficient to charge the prism. The accuracy is amply good enough if only the average refractive index is required, but it may be added that in those substances where the dispersion was large the observations refer to the yellow-green (between the D and E lines).

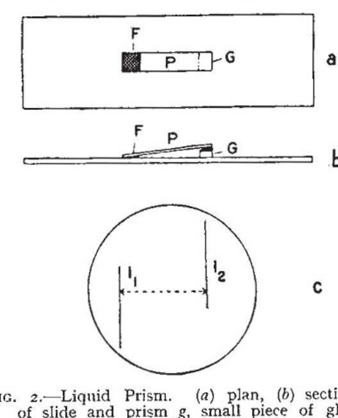

FIG. 2.—Liquid Prism. (*a*) plan, (*b*) section, of slide and prism *g*, small piece of glass cemented to the thin glass slip P. F, fluid under examination; (*c*) appearance in the field of the microscope of the direct image I, and refracted image I_2 of the slit.

A small correction of the micrometer reading should be made in order to allow for the lateral shift of the virtual image of the slit due to the thickness of the upper plate of the prism. This correction, which has the effect of increasing the refractive indices as observed, might be avoided by introducing a collimating lens between the slit and the prism.

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