## Scaliness of Wool Fibres

According to a theory of milling which was developed some years ago, fabrics are capable of undergoing milling shrinkage only when some or all of the component fibres possess a surface scale structure, are easily deformed, and show perfect recovery from deformation[1]. It should, therefore, be possible to make wool unshrinkable by modifying its elastic properties instead of by the customary method of attacking the surface-scale structure. The truth of this deduction has been established in a number of ways[2,3,4]. Perhaps the most convincing is the recent demonstration that woollen flannel can be made unshrinkable by treatment with mercuric acetate or benzoquinone[4]. Both reagents increase the resistance of the fibres to deformation; both *increase* the scaliness of the fibres, as measured in soap solution by means of the lepidometer[5,6]. In the light of these results it was concluded that mercuric acetate and benzoquinone make wool unshrinkable by modifying the elastic properties of the fibres, and not by attacking or masking the surface-scale structure.

The scaliness measurements, on which the validity of the preceding conclusion depends, were carried out under conditions which reproduce the fibre-travel responsible for milling shrinkage: single fibres were suspended, root end downwards, from a tension-measuring device and rubbed longitudinally in soap solution between the rubber surfaces of the lepidometer. The maximum tension developed by the creeping fibre was taken as a measure of its scaliness. Precisely similar results are obtained when the scaliness of fibres treated with mercuric acetate or benzoquinone is measured by the older 'violin bow' method[7], which is, however, less satisfactory in being less closely related to milling conditions. It consists simply in determining the angle of tilt necessary to cause a 'bow' of fifty fibres to slide on a face cloth, first in the direction of the root end ($\theta_1$) and then in the direction of the tip ($\theta_2$), the scaliness ($S$) being defined as:

$$S = \frac{\tan \theta_2 - \tan \theta_1}{\tan \theta_1} \cdot 100.$$

The results obtained by this procedure are given below:

| Treatment | Percentage shrinkage in area of fabric in milling | Scaliness of fibres in: | |
|---|---|---|---|
| | | Air | Sodium oleate solution (0·2%) |
| Untreated | 37·3 | 32·6 | 142 |
| Mercuric acetate | 4·4 | 31·2 | 182 |
| Benzoquinone | 20·2 | 31·4 | >200 |

Thus, whether the scaliness is measured under static or dynamic conditions, whether it is measured on wool or rubber surfaces, the results indicate that the unshrinkability of fabric treated with mercuric acetate or benzoquinone is not due to reduced scaliness of the fibres.

The preceding results, like those given by the lepidometer, are in sharp contrast with those recently obtained by Bohm[8], and the most probable cause of the discrepancy is his use of a hard, inflexible surface —glass—for the friction measurements. Although Bohm's data are therefore of doubtful value in relation to the milling process, some explanation must be offered for his observation that the two coefficients of friction (towards the root and towards the tip) of fibres treated with mercuric acetate or benzoquinone are so nearly alike, whereas those of untreated fibres are far apart. A possible explanation is to be found in terms of Rudall's model[9], which was originally devised to explain why untreated fibres migrate when they are rubbed longitudinally between wet glass plates. A wooden ratchet was provided with rubber 'scales' as shown in the sketch. When the model was pushed towards the 'root' end on glass, the friction was less than when it was moved in the direction of the 'tip', owing to the different configurations adopted by the edges of the 'scales', as shown in (*a*) and (*b*), respectively. It is obvious that no such difference would arise on glass plates if the rubber were replaced by a more rigid material. Since cross-linking reactions increase the resistance of wool fibres to deformation, the differential frictional effect will be correspondingly reduced on glass, if the scales of the fibres behave in the same way as the 'scales' of the model. As has already been shown, however, the difference in friction would still be observable on flexible surfaces, and it seems likely that Bohm's observations are a measure of the effect of mercuric acetate and benzoquinone in modifying the elastic properties of the fibres.

(*a*) (*b*)

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## Mechanism of the Feulgen Reaction

The Schiff reaction for aldehydes using the addition compound of sulphurous acid with fuchsine was applied by Feulgen for his well-known reaction for the localization of desoxyribosenucleic acid in cells. The specificity of this localization in the reaction has recently been questioned[1], and led to the series of investigations to be described, from which it is concluded that the reaction is essentially one of adsorption, and that nucleic acid is not necessarily concerned in the reaction. Normal, malignant and embryonic tissues of mouse, fowl and normal rabbit tissues, fixed by various methods, were used in the staining tests.

(1) *Colour of the stain.* It can readily be shown that though neutral fuchsine stains filter paper or sections bright red, the typical mauve colour is produced if the dye is used in weakly acid solution, as in the usual Feulgen method. Though the colour is washed out of filter paper by sulphur dioxide water, it is not removed completely from other materials such as newsprint, poor quality cotton wool, or alumina. Furthermore, a section stained bright red by neutral dye will show the typical Feulgen colour if dipped