

(after elimination of the vagus effect) can be explained only for a small part by hormonal mechanisms. It must be mainly a nervous phenomenon.

The considerable drop in pressure, which occurs when the high initial current is reduced, may be due to a period of decreased responsiveness of the sympathetic system after the strong stimulation. Normal stimuli and those set up by the lower maintenance current would

then be unable to maintain the high or even the normal blood pressure. This is supported by the observation that, when electronarcosis is repeated at intervals of 10 minutes, this drop tends to become more marked.

The second maximum in blood pressure (Fig. 1) may be caused by impulses produced in the sympathetic by the smaller maintenance current, after this system has recovered from the effects of the high initial current.

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Fungistatic Action of Hair Fat on *Microsporon audouini*.*

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In the last few years ringworm of the scalp caused by *Microsporon audouini* has been endemic among school children in the major cities of the United States. This infection disappears spontaneously with oncoming adolescence, and the scalp hair of adults is completely immune to the invasion of the fungus. The non-hairy skin remains susceptible in adults.¹ It has been obvious that the change in susceptibility during adolescence is due to the sudden development of sebaceous glands of the scalp under the influence of sex hormones, and to the associated changes in the chemical composition of the sebum. In this laboratory it was attempted to trace these changes in order to find the explanation for the immunity of adults' hair.

Experimental. Hair of adults was pooled from barber shops and extracted with hot ether. The hair fat was added to Sabouraud's agar medium in graded concentrations. The agar tubes were then inoculated with a standard culture of *M. audouini*. It was found that hair fat had an inhibitory action on the growth of the fungus, and that the minimum concentration preventing growth was 0.5%. Examining the hair of medical students who did not use any hair tonic or pomade in a

one-week period between washing and cutting the hair, we ascertained that the fungistatic effect was not caused by extraneous material. Fat from children's pooled hair had $\frac{1}{2}$ the fungistatic action of adults' hair fat.

Adults' hair fat was fractionated and the activity of the fractions was assayed on *M. audouini* cultures (Table I). By treating the fat with cold 1% NaOH the free fatty acid fraction was split off. This fraction contained the whole fungistatic principle whereas the remainder, containing neutral fats, cholesterol, and other unsaponifiable material, was inactive. Subsequently, steam distillation of the free fatty acid fraction was carried out, and the active principle was recovered from the steam distillate. The final step was fractionation of the steam distillate. The first fraction distilling over between 90 and 105°C at 1 to 2 mm Hg pressure contained most of the fungistatic material.

This active fraction was isolated in 2 separate experiments. In both cases 12 kg of hair was used. The yield of active fraction was 20.3 mg and 35.5 mg respectively. A second fraction (55.5 mg) distilling around 110°C was isolated once and had similar fungistatic power to the lower boiling fraction. Microanalysis of these samples (Table II)[†] indi-

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¹ Rothman, S., *Hygeia*, 1945, **23**, 436.

[†] Microanalyses were performed by Dr. T. S. Ma, Department of Chemistry.

TABLE I.
Minimum Fungistatic Concentration of Fractions Preventing Growth of *Microsporon audouini* in Sabouraud's Medium.

Total fat	0.6 %	Free fatty acid	0.05 %	Remainder	5.0 %
Free fatty acid	0.05 %	Steam distillate	0.005 %	"	<0.4 %
Steam distillate	0.005%	First portion of fractionate distillation	0.0005%	"	0.005%

cated that the material was not pure. The C:H relation roughly corresponded with that of aliphatic fatty acids, but a strong purple color with ferric chloride indicated the presence of a phenolic compound. In each sample the neutral equivalent was higher than the molecular weight (camphor method), an indication that the impurities were not acids. Strong unsaturation reaction was observed. No sulfur and only traces of nitrogen were present.

In a third experiment we succeeded to separate the phenolic impurity by freezing the distillate. Upon warming it slowly a large oil droplet could be easily pipetted off from the top of the still hard frozen phenol. The oily drop gave no color reaction with ferric chloride and no unsaturation reaction. The phenolic impurity, causing these reactions in earlier samples, had no fungistatic action.

The most active fatty acid fractions in our experiments inhibited the growth of *M. audouini* between 0.0002 and 0.001%. This is in the range of the fungistatic activity of the C₇, C₉, and C₁₁ straight chain aliphatic fatty acids on the same fungus.

At present the fat from 45 kg of hair is being fractionated. This amount possibly will be sufficient for separation and final chemical analysis of the fatty acids present in the active distillate.

Summary. Hair fat of adults contains free saturated aliphatic fatty acids which inhibit the growth of *M. audouini* in concentrations of 0.0002 to 0.001%. Preliminary chemical analyses of the still impure fractions, molecular weight estimations, and the range of fungistatic activity indicate that the fraction contains saturated aliphatic fatty acids between C₇ and C₁₁.

TABLE II.
Quantitative Chemical Analysis of Fractional Distillation Products.

	Fraction* May, 1945	Fraction I* July, 1945	Fraction II July, 1945	Fraction† Oct., 1945
H	10.54%	10.40%	11.34%	10.30%
C	68.57%	69.52%	73.25%	65.79%
Neutral equivalent	176	198	223	159
Molecular weight	145	154	185	133
Test for phenolic group				
Purple color	distinct	distinct	none	none
Test for unsaturation				
(KMnO ₄) decolorization	very rapidly	rapidly	slowly	very slowly
Test for unsaturation				
(Br ₂) decolorization	slowly	slowly	slowly	none

* Contains phenolic impurity.

† Phenolic impurity removed.