Table 1

Type of patient	No. of patients	Mean concentration 5-OH indoles ngm./ml.	Significance of difference
Group 1	4	313 ± 51*	$P < 0.001$
Group 2	4	83 ± 15	

* ± *S.E.* of the mean.

instances with negative results (concentration < 1 ngm./ml.).

A second series of investigations is in progress on the 5-hydroxyindole concentration in lumbar cerebrospinal fluids. A comparison has been made between neurological patients requiring diagnostic air encephalography and psychiatric patients suffering from depressive psychoses. Table 2 shows a significantly lower concentration of 5-hydroxyindoles in the latter group.

Table 2

Type of patient	No. of patients	Mean concentration 5-OH indoles ngm./ml.	Significance of difference
Neurological patients	10	32·2 ± 2·8*	$P < 0.001$
Depressive psychoses	9	13·2 ± 2·5	

* ± *SE.* of the mean.

We wish to express our thanks to Dr. Elizabeth Robertson, Craig House, Royal Edinburgh Hospital; Dr. Hermann, Ward 20, Royal Infirmary, Edinburgh; Dr. Simpson and Dr. Stanton, Neurological Unit, Northern General Hospital, Edinburgh; and Dr. M. Vogt, Department of Pharmacology, University of Edinburgh, for their help and co-operation during this work.

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[1] Weissbach, H., Waalkes, T. P., and Udenfriend, S., *J. Biol. Chem.*, **230**, 865 (1958).

Detection of N-Oxides of the Pyrrolizidine Alkaloids

Reagents for the detection of alkaloidal N-oxides on paper chromatograms are few and are usually rather insensitive or of low selectivity. Reaction with acetic anhydride, which is known to produce highly coloured by-products with the N-oxides of many alkaloids[1], provides sensitive and characteristic tests for those of the pyrrolizidine series.

Paper chromatograms are dipped in acetic anhydride/benzene/petrol ether (1 : 4 : 5 v/v), hung at room temperature for not longer than 2 min., and then placed in an air oven at 90–100° C. N-oxide spots become fluorescent in ultra-violet light and also develop visible colour.

The fluorescence is excited by ultra-violet lamps having maximum emission either at 3650 or at 2536 Å.; but background fluorescence is less with the former and so sensitivity is greater. Maximum fluorescence results after heating usually for 10–15 min., and thereafter lessens either in the oven or at room temperature. N-oxides of alkaloids derived from heliotridine or retronecine produce a golden-yellow fluorescence detectable with 2–3 μgm./cm.²; those of supinine a medium brown, of sarracine a bluish-white and of anagyroidine (after 30 min.) a light yellow fluorescence, all detectable at 5 μgm./cm.².

The visible colour becomes maximal after the same period of heating but is permanent. With N-oxides of alkaloids derived from heliotridine or retronecine, it is dark brown, detectable at 5–10 μgm./cm.². Supinine N-oxide yields a warm brown with greater sensitivity and sarracine and anagyroidine N-oxides, light browns with less sensitivity.

Epilupinine N-oxide, not of the pyrrolizidine series, gives a bluish-white fluorescence and a weak orange-brown colour, and it is likely that N-oxides of some other alkaloidal groups would also be detectable.

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[1] Culvenor, C. C. J., *Rev. Pure and App. Chem.*, **3**, 104 (1953).

(+) S-Methyl-L-Cysteine Sulphoxide: an Inhibitor of Aspartic Acid Utilization in *Leuconostoc mesenteroides*

The dextro (+) form of S-methyl-L-cysteine sulphoxide has been isolated from turnips[1] and from cabbages[2], and its widespread occurrence in crucifers has been inferred from chromatographic evidence[1,2]. The next higher homologue, methionine sulphoxide, acts as an inhibitor of glutamic acid utilization by *Lactobacillus arabinosus*[3,4]. This structural relationship suggested that S-methyl-L-cysteine sulphoxide might act as an inhibitor of aspartic acid in an analogous manner. The two diastereoisomeric sulphoxides of S-methyl-L-cysteine ((+) and (−) S-methyl-L-cysteine sulphoxide) were tested as aspartic acid antimetabolites in *Leuconostoc mesenteroides*. The natural isomer (+) S-methyl-L-cysteine sulphoxide inhibits the utilization of aspartic acid, but (−) S-methyl-L-cysteine sulphoxide has no measurable activity. On several counts this system can be contrasted with the methionine sulphoxide–glutamic acid system.

L. mesenteroides (*ATCC* 8042) was maintained on liver tryptone agar between trials and on liver tryptone broth prior to use. The complete medium of Steele *et al.*[5] with the exclusion of aspartic acid and asparagine was used in inhibition studies. In general, the final volume per tube was 9 ml. and growth was measured by titrating the acid produced after 72 hr. incubation at 37° C. Over a range of 0–25 μgm. aspartic acid per tube-growth is linear.

With (+) S-methyl-L-cysteine sulphoxide, consistent growth inhibition was apparent from turbidity observations and acid measurements, whereas (−) S-methyl-L-cysteine sulphoxide had no detectable effect. An equimolar mixture of the (+) and (−) forms had an activity equivalent to the (+) form

Table 1. Effect of S-Methyl-L-Cysteine Sulphoxide (MCSO) on the Utilization of L-Aspartic Acid by *Leuconostoc mesenteroides*. Each figure represents the mean of three determinations

L-aspartic acid μmoles	Molar ratio sulph-oxide : aspartic	Ml. of 0·02 *N* acid produced			Inhibition by (+) MCSO (per cent)
		Control	(+) MCSO	(−) MCSO	
0·11	100 : 1	5·98	5·50	6·25	8
0·15	133 : 1	8·87	7·49	8·71	15
0·11	1,000 : 1	5·98	2·75	6·05	54