mutation frequency of 13 per cent per M_1 spikes obtained in our studies does not appear to represent the optimum mutagenic efficiency of this compound since the treatments applied had little effect on seedling growth and survival.

The mutation frequency of 5 per cent per M_1 spikes reported here for MMS is low in comparison with the results of Minocha and Arnason⁵ (32.5 per cent), Ehrenberg¹ (16 per cent), and Heslot and Ferrary³ (7.8 per cent). However, it seems possible that higher doses may increase the mutation rate to a level comparable with that reported by other investigators. The concentration used by Minocha and Arnason was ten times higher than that in the experiments of Heslot and Ferrary³ and the work recorded here. However, it is difficult to understand that a treatment time for 2 h at 20° C (used by Minocha and Arnason⁵) was sufficient for diffusion of the mutagen solution into the seeds and for the induction of 32.5 per cent mutations, unless most of the mutations were caused by delayed action of the mutagen. MMS as well as other methylating sulphonates used in recent investigations on barley appear to be more toxic, that is, methylating compounds cause more physiological damage and death at similar doses than other sulphonates, so that 1/10 of the concentration had to be used (Froese-Gertzen, unpublished results).

The exploration of isoPMS as a mutagen for barley was initiated by determining its chemical reactivity. The first order hydrolysis rate constant ($6.4 \times 10^{-3}/\text{min}$ at 20° C) was similar to that of diethyl sulphate ($3.45 \times 10^{-3}/\text{min}$ at 20° C) (ref. 4), and similar treatment conditions were developed. Accordingly, the 0.0063 M isoPMS solution was renewed every 50 min after 30 per cent of hydrolysis had occurred. Thus, these treatments cannot be compared with those of Heslot and Ferrary in which 0.055 M solutions were applied without renewal for 24 h at 24° C and in which 10 per cent mutated M_1 spikes were obtained. The higher mutation rate of 20 per cent observed for isoPMS in our experiments is probably due to the fact that a higher concentration of mutagenically active agent was available when the solution penetrated into the germinal tissue.

EMS has repeatedly been reported to be a 'good mutagen' on barley. Some recent results obtained with EMS are cited here for comparison with the other sulphonates. This comparison shows that nBMS, nPMS and isoPMS especially merit further investigation.

Data obtained from barley seeds (14 per cent moisture content) exposed to 30 kr. of X-rays at room temperature show that the induction of mutation in 8 per cent of the spikes is associated with chromosome aberrations of 53 bridges and 309 fragments per 100 cells. This level of injury to chromosome structure, as well as to seedling growth and plant survival in relation to the amount of induced mutation, demonstrates the lower mutagenic efficiency of radiation compared with that of most chemical mutagens investigated here.

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VIROLOGY

Effect of Ether on Rabies Virus

Andrewes and Horstmann¹ grouped rabies virus as other resistant, based on reports of other investigators^{2,3}. During a recent investigation in this laboratory, strains of arctic rabies virus lost 95–97 per cent of their infectivity following exposure to 20 per cent ether at 4° C for 16 h. This observed reduction in infectivity and the variations in reported methods for determining the effect of ether on rabies virus led to investigations comparing the action of ether on different strains of rabies virus.

Five strains of rabies virus were tested: 2 arctic strains isolated from foxes from Greenland; a bat rabies virus isolated from a Mexican freetail bat; a street virus obtained from a naturally infected cat; and fixed virus (CVS-25). A 20 per cent infected brain suspension prepared with 10 per cent egg-yolk diluent was mixed with anaesthetic ethyl ether (20 per cent by volume) and incubated at 4° C for 16 h. Ether was removed by evaporation in an open Petri dish. Control specimens without ether were tested simultaneously. Serial ten-fold dilutions were prepared, and 0.03 ml. of each dilution was inoculated intracerebrally into five 3-week-old mice.

Table 1. EFFECT OF 20 PER CENT ETHER ON DIFFERENT STRAINS OF RABIES VIRUS AT 4° C FOR 16 H

Virus strain	Titre (MLD_{50})		Reduction in infectivity	
	Control	Treated	Logs	(%)
Arctic 209	3.16	1.49	1.67	97.9
Arctic 219	4.49	3.15	1.34	95.4
Street rabies	4.49	2.5	1.99	99.0
Bat rabies	4.0	2.83	1.17	93.2
Fixed (CVS)	6.3	4.0	2.3	99.5

Table 2. EFFECT OF VARIOUS CONCENTRATIONS OF ETHER ON ARCTIC RABIES VIRUS AT DIFFERENT TIME-INTERVALS AND TEMPERATURES

Concentration of ether (%)	MLD_{50} titre of virus	
	37° C for 2 h	4° C for 16 h
5.0	3.49	3.49
10.0	1.49	2.88
20.0	< 1.0	2.63
Control	3.67	3.63

Results are shown in Table 1. Loss in infectivity varied from 93.2 to 99.0 per cent with the field strains. Reduction in fixed virus infectivity was shown to be slightly greater (99.5 per cent).

In one experiment the effect of anhydrous ether on fixed virus was compared with that of anaesthetic ether, with no apparent difference.

The effects of various concentrations of ether at different time-intervals and temperatures were examined with one arctic strain. The results are given in Table 2. The quantitative reduction in virus infectivity was shown to range from 0.18 logs (12.6 per cent) with 5 per cent ether to greater than 2.67 logs (99.8 per cent) with 20 per cent ether at 37° C for 2 h.

Andrewes⁴ has also recently demonstrated fixed rabies virus to be ether sensitive.

The property of ether sensitivity supports the recent suggestion that rabies virus may be related to the myxovirus group^{5,6}.

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