

non-specific phase, the action of these phages seems to be most evident on the H antigen.

A motile strain that is made non-motile through the action of a phage remains non-motile so long as that culture carries that phage, because the phage propagates itself as the bacteria proliferate, and attacks any H antigen that may be formed.

One of us (M.L.R.) has also tested out the pathogenicity of these secondary cultures in mice. It may be reported that these non-motile cultures differ in their pathogenicity. One of the cultures is avirulent, while the other 2 are as virulent as the original smooth strain.

Sixteen other *Salmonella* strains that are susceptible to several of our phages have been tested, but in no instance have non-motile secondary cultures been obtained. One of us (M.L.R.) has succeeded in isolating 2 phages that attack 2 strains of *E. typhi* in much the same manner as that described above for *Salmonella poona*; both of these recently isolated typhoid strains were rendered non-motile after being in contact with these phages. These studies are being continued.

Conclusions. Three races of bacteriophages have been isolated which attack the H antigens of 2 strains of *Salmonella poona*. Two races of phage have been isolated which are able to attack the H antigen of *E. typhi*. This finding is another example of the selective activity of bacteriophages which is directed particularly against the non-somatic portions of the bacterial cell.

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Sulfonamide Drugs as Protective Agents Against Carbon Tetrachloride Poisoning.*

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During the last few years we have been interested in the mechanism whereby the subcutaneous injection of various substances such as xanthine, sodium ricinoleate, etc., increases a rat's resistance to the poisonous action of carbon tetrachloride or chloroform. Dur-

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TABLE I.
Protective Action of Sulfonamide Drugs Against Carbon Tetrachloride in Rats.

Exp. No.	Drug used									
	Sulfanilamide		Sulfathiazole		Sulfapyridine		Sulfanilic acid		Controls, no drug	
	lived	died	lived	died	lived	died	lived	died	lived	died
1	6	0	2	0					1	5
2	3	0	3	0					0	4
3	6	0							3	2
4	5	0							2	3
5	6	0							3	3
6	5	0							2	3
7					7	0			1	5
8					4	1	1	4	0	5
9	5	0			5	0	1	4	0	5

ing the course of this investigation, we were led to try the possible effect of oral administration of sulfanilamide on the animal's resistance to carbon tetrachloride. To our considerable surprise, it was found to reduce the mortality rate very markedly. Later experiments confirmed this finding and showed that orally administered sulfanilamide exerted a definite protective action against liver necrosis from acute carbon tetrachloride poisoning.

Experimental. Male and female rats, weighing from 200 to 300 g were used. In the individual experiments animals of the same sex and of approximately the same weight were used for control and treated animals. In the experiments recorded in Table I, the sulfonamide drugs were given by stomach tube in doses of 30 mg per 100 g of body weight. Two doses, one 20 hours, the other 3 hours before the time of acute poisoning, were administered. A few preliminary experiments were carried out with sulfanilamide in doses of 10 and 15 mg per 100 g of body weight. The degree of protection was apparently less than that with the higher doses, consequently the other drugs were not studied at the lower levels. The method of anesthesia was the same as described in a previous article.¹ In the experiments recorded in Table I, mortality alone has been considered as the evidence of protection. Similar experiments, however, have been carried out, involving 18 controls and 22 sulfanilamide-treated animals, in which the duration of anesthesia was reduced so that most of the control animals survived. The remaining animals were sacrificed approximately 36 hours after the time of acute poisoning, their livers removed, sectioned, and examined histologically. Although the degree of protection was not as great as that obtained by the subcutaneous administration of xanthine,

¹ Forbes, J. C., and Neale, R. C., *PROC. SOC. EXP. BIOL. AND MED.*, 1936, **34**, 319.

India ink, etc., it nevertheless was very definite. In some experiments a small amount of overlapping was obtained. At no time, however, has a treated animal been found with definitely greater liver damage than the best control.

Discussion. The mechanism for the protective action of orally administered sulfonamide drugs is unknown. It appears to be in some way related directly to the sulfonamide group since sulfanilic acid exerts very little, if any, protective action.

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Prophylactic Effect of Sulfaguanidine Against Ulcerative Cecitis in Rats.

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In the course of nutrition experiments carried out during the past year our results were badly confused by the development in the rat colony of a disorder which we have come to speak of as "cecal disease." Briefly, rats which at birth appear perfectly well begin unaccountably to lose weight. After several weeks one may feel a mass in the abdomen and finally after a further period the animals die. There has been no clinical diarrhea although the feces may be softer than the usual hard pellets. Most of our rats with this disease have been sacrificed when the illness was obvious. The earliest lesion appears on the mesenteric border of the mucosa of the cecum as a tiny, barely visible grey superficial erosion. Later there are clearly evident shallow ulcers covered by adherent filmy greenish yellow membrane. In further stages the ulcers are deeper and there is thickening of the cecal wall so that finally a mass several millimeters thick with deep ragged excavations one to 2 cm in diameter is found. After the earliest stages the cecal contents are usually abnormal; they consist of a thin yellow material which has a characteristic foul odor. A reaction around the cecum soon takes place so that coils of intestine and enlarged lymph nodes become adherent. In association with these masses there are cyst-like pockets of clear fluid. The other viscera as a rule show nothing remarkable except that the spleen may be enlarged. This "cecal disease" has been described by