Table 2. *T. lewisi* parasitemia (organisms per ml of whole blood) and hemolytic complement levels in each group of rats

Group	No. of parasites/ml (mean ± SD)	Complement levels before *S. typhimurium* infection (mean ± 1 SD)	Complement levels 48 h after *S. typhimurium* infection (mean ± 1 SD)
1	$6.01 \times 10^9 \pm 2.54 \times 10^9$ (10)**	1.0 ± 1.41 (10)	0.6 ± 0.97 (10)
2	$1.39 \times 10^9 \pm 0.76 \times 10^9$ (10)	7.0 ± 4.35 (10)	ND*
3	$1.38 \times 10^9 \pm 0.60 \times 10^9$ (10)	7.2 ± 2.53 (10	8.0 ± 1.00 (10)
4	–	1.2 ± 2.14 (10)	1.33 ± 1.15 (3)
5	–	1.2 ± 2.14 (10)	0.4 ± 0.84 (10)
6	–	20.0 ± 6.47 (10)	22.4 ± 7.93 (9)
7	–	24.0 ± 11.31 (10)	23.6 ± 11.18 (10)
8	–	0 (6)	0 (6)
9	–	0 (6)	ND
10	$5.83 \times 10^9 \pm 3.41 \times 10^9$ (6)	0 (6)	0 (6)

* ND, not done due to 100% mortality within group. ** Number in bracket denotes number of animals in the group.

From the experiments reported in this communication, it is quite clear that deprivation of C3 by CoF, followed by infection with *S. typhimurium* increased the susceptibility of the rats to this bacteria. However, interference at the C1 level of the complement sequence by injection of CAF-T or on *T. lewisi* infected rats had much more severe consequences after infection with *S. typhimurium*. Thus all the rats in the latter griups died with classical symptoms of Salmonella enteritis while only 70% of the CoF-treated rats succumbed to the infection. In addition, all death occurred in the *T. lewisi* infected group and the CAF-T treated group 5–12 h after *S. typhimurium* infection while CoF treated rats also injected with *S. typhimurium* did not begin to die until 18 h after infection. It is realized that *T. lewisi* infection may contribute to increased pathogenicity of *S. typhimurium* in other ways than by lowering hemolytic complement levels, however, no such influences should be the case in animal treated with CAF-T, as the control group (8) showed no other adverse effects within the duration of the experiment.

It was also noted that CoF and CAF-T treatment of rats previous to infection with *T. lewisi* (groups 1 and 10 respectively) increased the blood parasitemia of both groups. This again would indicate that interference with the nonspecific host defense mechanisms allow infections to proceed relatively unhindered. This phenomenon may be the result of several mechanisms, for example, initial and continued depletion of complement would not allow normal immune clearance of the parasite thus allowing it to circulate within the body in much greater numbers.
A great deal more work is required to establish mechanisms by which trypanosomes interfere with host defenses especially in view of their ability to localize in microenvironments and produce a variety of soluble substances for instance, hemolytic factors[14], complement activating factors[2] and mitogenic factors[15].

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The effect of epinephrine on granulocyte adhesion

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Summary. Preincubation of blood from normal human volunteers with epinephrine significantly decreased the granulocytes ability to adhere to nylon fibres. Possible significance for the in vivo correlation is discussed.

Granulocytes must adhere to the endothelial walls of capillaries and then diapedesis through the vessel wall in order to become localized in an area of infection. Kinetic studies have revealed that over half of the granulocytes within the vasculature normally are adherent to the endothelial walls[2]. These marginated granulocytes are in equilibrium with freely circulating ones.
Defects in granulocytes' ability to adhere to endothelial linings might be expected to be associated with increased incidence of infection. The granulocyte adhesiveness to nylon fibres or glass in vitro has been used as a measure of adhesion in vivo but whether the in vitro testing system parallels what occurs in vivo remains to be proven. Since epinephrine has been shown to decrease granulocyte adhesion in vivo, it would be expected to cause a decreased adhesion in vitro as well. The purpose of this study was to determine if epinephrine inhibits granulocyte adhesion in vitro.
Methods and materials. The adhesion of granulocytes to nylon fibres was measured using a modification of a previously described method[3]. Nylon fibre (3 denier, 4 cm, Type 200, Fenwall Laboratories, Morton Grove, Illinois) was weighed and 70 ± 0.5 mg was packed into a Pasteur

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pipette to a length of precisely 15 mm in the pipette. Each pipette has an aperature just large enough to allow passage of a 21-gauge needle. The pipettes are placed in a test tube rack with their tip suspended into a test tube and incubated at 37 °C. Venous blood was drawn in heparinized tubes from healthy human volunteers. Each volunteer serves as his own control in that each sample of blood was divided into equal portions. To each ml of test sample 0.01 ml of epinephrine (1:1000 dilution) was added. The blood was then incubated for 10 min, mixed by gentle turning and 1 ml aliquots were added to the pipettes and allowed to filter through over 10 min. Each experiment with and without epinephrine was run in triplicate. The number of granulocytes in the blood was measured before and after passage through the column and the percentage of granulocyte adherence was calculated.

Results. The adherence of granulocytes was decreased by 27.9% in the presence of epinephrine (table). This was statistically significant at $p < 0.0025$ level analyzed by the Student t-test.

Discussion. Many clinical conditions with increased susceptibility to infection cannot be explained by decreases in granulocyte phagocytosis or chemotaxis alone and additional granulocyte function defects must be considered. Granulocyte adherence to nylon fibres or glass may be used as measure of their ability to adhere to endothelial walls but this requires further proof.

It has been shown by MacGregor et al.[3] that anti-inflammatory drugs inhibit granulocyte adherence to nylon fibres and suggested that this may be the explanation for their effects in vivo. Other agents have also been shown to inhibit granulocyte adhesion such as ethanol[3], iodoacetamide[5], and EDTA[3,6], cyclic AMP[7], colchicine[4], and glycolitic inhibitors[5], whereas oxidative inhibitors[5] had no effect. The presence of certain ions (magnesium and perhaps calcium)[3,6] appear to be necessary.

Abnormal granulocyte adhesion has been demonstrated in several clinical condititions, i.e. leukemia[8] and acute poststreptococcal glomerulonephritis[9]. In the latter, this abnormality can be followed as a measure of resolution of disease.

The administration of epinephrine in vivo causes the granulocytes to demarginate and enter the circulation. This study showed a decreased granulocyte adhesion to nylon fibres in the presence of epinephrine in vitro suggesting that similar mechanisms may operate in both systems. Granulocyte adhesiveness should be studied in clinical situations associated with an increased susceptibility to infection. Information obtained from these studies may provide better understanding of the role granulocyte adhesion plays in preventing infection.

Effect of Epinephrine on granulocyte adhesion

	Percent adhesion ± SEM
Control	75.7 ± 5.0
Epinephrine	47.8 ± 6.4
	$p < 0.0025$

Each value represents 8 experiments performed on blood from healthy male volunteers.

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Accumulation of 2-μm latex particles in mouse Peyer's patches during chronic latex feeding[1,2]

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Summary. 2-μm latex particles accumulated in macrophages in intestinal Peyer's patches of mice given latex suspensions as drinking fluid for 2 months. The number of particles accumulating was a direct (but nonlinear) function of the number ingested. Some of the latex particles were still present in Peyer's patches 6 weeks after the cessation of latex feeding.

The epithelium of gut-associated lymphoid tissues (GALT; Peyer's patches, appendix, sacculus rotundus) appears to be a route by which small inert particulates pass the mucosal barrier of the mammalian intestinal tract[6,7]. Previous morphological studies have described the migration of carbon, trypan blue, and ferritin particles into the GALT[8–12]. These particulates are small, less than 0.1 μm in diameter, and were seen with the light microscope because of their accumulation into aggregates. The present communication describes the penetration of the mouse Peyer's patch epithelium by much larger particles, namely latex spheres of 2-μm diameter. Latex particles resist degradation in the intestine and are large enough to be seen and counted with the light microscope, permitting a semiquantitative assessment of their uptake and distribution. The results indicate that many thousands of latex particles accumulated in Peyer's patches during chronic feeding of mice with latex suspensions. Furthermore, many of the particles were retained for more than 6 weeks after the cessation of latex feeding.

Materials and methods. 3 water suspensions of polyvinyltoluene latex (mean particle diameter ± SD, 2.02 ± 0.014 μm; particle density, 1.027; identification No. LS-1078-B, The Dow Chemical Co.) containing 1.0, 0.1 and 0.01% solids were given as drinking fluid to 3 groups of 11-week-old female Swiss mice. The mice were given free access to the suspensions and to standard pelleted mouse food. The latex suspensions were given for 61 days followed by a period of 2 to 6 weeks during which the mice received latex-free water. A control group was given tap water to drink. No attempt was made to determine the amount of latex ingested by each mouse; however, the volumes of fluid consumed by the 4 groups did not appear to differ. All mice gained weight normally and appeared healthy.