Laboratory, Colindale, London) The traveller newly arrived at his destination, particularly if a warm climate, is commonly affected by acute diarrhoea within 14 days, a condition usually referred to as 'traveller's diarrhoea'.

In 1965 a bacteriological study was made on 540 men belonging to an Army unit which moved by air from the United Kingdom to Aden.

Cases of diarrhoea commenced about four days after arrival; the incidence reached a peak at 10 days and then dropped off to 14 days. In the subsequent weeks cases of diarrhoea continued to occur but no peak incidence was found. Thirty-eight soldiers suffered an attack of diarrhoea during their first 14 days after arrival. Faecal specimens were investigated from 35 of these subjects. A new serotype of *Escherichia coli* 0148K ?H28 was isolated in the acute phase from 19 subjects (54·3%).

Two cases (5·7%) suffered from gastroenteritis due to a Salmonella and in the remaining 14 (40%) of cases *E. coli* of various O groups were found which could not be related to diarrhoea. The peak of the isolations of *E. coli* 0148K ?H28 corresponded with the peak incidence of the cases of diarrhoea. This serotype was not isolated from a healthy subject in Aden nor has it been found in the United Kingdom, except in a case of laboratory infection associated with this work.

This work suggests that in Aden in 1965 this specific serotype of *E. coli* caused the diarrhoea in about 54% of the cases of traveller's diarrhoea.

ANTIBACTERIAL ACTION OF COMBINATIONS OF COLISTIN AND THE SULPHONAMIDES

N. A. SIMMONS (*Chase Farm Hospital, Enfield*) The activity of colistin *in vitro* combined with sulphamethoxazole against 184 strains of Gram-negative bacteria was investigated. Seventy-four of the organisms were *Pseudomonas aeruginosa*, 37 *Escherischia coli*, 21 Proteus spp, 30 *Klebsiella aerogenes*, 12 Shigella spp, and 10 Salmonella spp. All the strains of Proteus were sensitive to sulphamethoxazole and resistant to colistin, but the activity of sulphamethoxazole was enhanced by colistin. Seventy of the 74 *Ps. aeruginosa* were sensitive to sulphamethoxazole as were 27 of the 37 *Esch. coli*, 24 of the 30 Klebsiellae, eight of the 12 Shigellae, and all 10 of the Salmonellae. All of the organisms other than Proteus were sensitive to colistin whose activity against sulphamethoxazole-sensitive organisms was enhanced by the sulphonamide. Sulphamethoxazole did not enhance the activity of colistin against sulphamethoxazole-resistant organisms. Investigations carried out on 29 of the organisms showed that with sensitive strains colistin was bactericidal, sulphamethoxazole was only bacteriostatic, and combinations of the two drugs were bactericidal.

CHANGES IN ANTIBIOTIC SENSITIVITY OF STAPHYLOCOCCI IN A NON-HOSPITAL POPULATION DURING THE PAST 20 YEARS

D. J. GOLDIE, V. G. ALDER, AND W. A. GILLESPIE (*Bristol*) The proportion of antibiotic resistance in *Staph. aureus* isolated from skin sepsis and nasal carriers outside hospital has been determined periodically since 1949. Penicillin resistance, originally less than 4%, began to increase in 1952, reached 57% in 1967 and has not changed significantly since. Resistance to other antibiotics was first observed in 1957 when it quickly rose to 17%; this was due to the spread of multiresistant type 80 staphylococci from hospitals in which it was behaving epidemically. By 1967 the proportion of multiresistance had fallen again to 8%, and has not changed significantly since. Methicillin resistance, first looked for systematically in 1969, has not been found.

The failure of phage group III multiresistant staphylococci to proliferate outside hospitals, though prevalent inside them, perhaps may be explained by their relative inability to colonize noses and their susceptibility to drying (as discussed in the next paper).

In 1969, 6% of non-hospital staphylococci and 44% of hospital staphylococci were resistant to sulphonamide. None were resistant to trimethoprim. Treatment of infections by such strains with sulphonamide-trimethoprim mixtures might promote the development of resistance.

THE SURVIVAL OF *staphylococcus aureus* ON SKIN

R. W. LACEY, V. G. ALDER, and W. A. GILLESPIE (*Bristol*) Experiments were performed to determine whether some strains of *Staph. aureus* consistently survive longer than others on the skin. Suspensions containing known numbers of cocci were dried on the forearms of volunteers and the survivors counted after five hours by an adhesive label technique.

In preliminary experiments, day-to-day and person-to-person variations in survival of single strains were sufficient to mask possible differences between strains. To overcome this, mixtures of three staphylococci were inoculated, one of which was a standard strain with which the survival of the others could be compared. The component colonies of the mixture on recovery from the skin were distinguished by two independent properties on milk agar, pigmentation and colony size; lipase-negative strains gave larger colonies than lipase-positive strains.

As a group, strains isolated from primary skin sepsis and strains in phage groups I and II survived longer than other strains. Although it was not known whether the source or the phage pattern was primarily associated with long survival, it was concluded that length of survival on skin may be related to the production of cutaneous sepsis. Similar differences were found when the strains were dried on glass, but were diminished by increasing atmospheric humidity. Hence variation in the survival of strains on dry skin can be explained, in part at least, by differences in their susceptibility to desiccation.

STUDIES ON STAPHYLOCOCCI FROM COLONIZED VENTRICULO-ATRIAL SHUNTS

R. J. HOLT (*Queen Mary's Hospital for Children, Carshalton, Surrey*) Bacterial colonization of the shunt associated with indolent bacteraemia is a major complication in children with ventriculo-atrial shunts for the relief of

hydrocephalus. In a series of 70 such episodes, colonization was almost invariably caused by coagulase-negative staphylococci; application of Baird-Parker's classification scheme for micrococcaceae revealed that all such organisms recovered from colonized shunts belonged to his subgroup Staphylococcus II. Because this subgroup was found very commonly in skin and nasal cultures from hospital patients and staff, it was necessary to devise a scheme capable of distinguishing biotypes within this subgroup.

The biotyping procedure revealed that (1) more than one biotype may occasionally coexist in the shunt, ventricles and blood of these patients; (2) successive recolonization of replaced shunts is not necessarily caused by the same biotype; and (3) the colonizing biotypes are almost always present at at least one body site, either skin, faeces, or nose.

The significance of these observations is discussed.

AN LDH ISOENZYME ANOMALY

E. L. PEEL (*Stepping Hill Hospital, Stockport*) The ensuing is a preliminary report on a case presenting an unusual anomaly in the pattern of serum lactate dehydrogenase isoenzymes. Many anomalies in such patterns have been reported in recent years, but in general these have involved either the presence of one or more additional components or a component with an altered electrophoretic mobility. In the present case, however, four of the usual five isoenzymes are lacking.

The patient in question, a farmer's wife aged 41, was admitted to hospital with severe chest pain suspected of being due to a myocardial infarction. The initial ECG was equivocal but a later one showed no evidence of infarction. The serum transaminases (both GOT and GPT) and serum lactate dehydrogenase were all raised to approximately five times the upper limit of normal, but, contrary to the normal trend in myocardial infarction, these levels showed no significant change during the first two weeks of illness. The serum LDH isoenzyme pattern run on cellulose acetate was remarkable in showing only a single component, this being in the LDH_5, *ie*, M_4, position thereby indicating the absence of those isoenzymes containing 'H' subunits.

A possible explanation of this abnormality was sought. (1) The existence of a familial abnormality was virtually ruled out by the finding of normal isoenzyme patterns in the patient's four children. (2) A haemolysate of the patient's washed red blood cells revealed a normal isoenzyme pattern, *ie*, having a preponderance of the fast-moving components, thereby indicating the patient's ability to produce H subunits and suggesting the presence in the patient's serum of an inhibitor or antibody to these H subunits. (3) The latter possibility was supported by demonstrating the suppression by the patient's serum of the fast-moving isoenzymes of control red cell haemolysates and of sera from cases of myocardial infarction.

The presence of a circulating antibody would seem to be the most feasible explanation of the anomaly, but the possible origin of such an antibody at present remains obscure.

Investigation of the serum immunoglobulins is at present being pursued.