from the alimentary canal, so that the oral dose is little more than the parenteral dose. The degree of drug toleration is slight, and is not sufficient to cause difficulty in determining the requisite dose of the drug. The action is more prolonged than that of pentolinium or of chlorisondamine, so that the degree of control over the blood-pressure level is better, provided that a sufficient dose can be administered. Adequate control over the blood-pressure level is hindered in some instances by the occurrence of parasympathetic side-effects, which appear to be rather more prominent in most cases than those we have encountered with pentolinium. There are, however, individual differences in patients such that, with equal falls of blood pressure, side-effects may be less in some patients when they are treated with mecamylamine and less in others when they are treated with pentolinium.

Mecamylamine may be used satisfactorily in combination with rauwolfia alkaloids. Delayed toxicity has not been encountered with mecamylamine during our experience of eight months.

This work was supported in part by the Life Insurance Medical Research Fund of Australia and New Zealand. We wish to acknowledge the generosity of Messrs. Merck, Sharp, and Dohme in the supply of mecamylamine, and to thank Miss Noeleen Richardson for her assistance with the secretarial work.

REFERENCES

Ford, R., Dennis, E., and Moyer, J. H. (1955). *J. Lab. clin. Med.*, **46**, 815.
Freis, E. D. (1955). *Lancet*, **2**, 977.
—— and Wilson, I. M. (1955). *Circulation*, **12**, 707.
—— —— (1956). *A.M.A. Arch. intern. Med.*, **97**, 551.
Keith, N. M., Wagener, H. P., and Barker, N. W. (1939). *Amer. J. med. Sci.*, **197**, 332.
Moyer, J. H., Kinard, S. A., Conner, P. K., Caplovitz, C., Ford, R., Herschberger, R. L., and Dennis, E. W. (1955). *Med. Rec. (Houston)*, **49**, 390.
Restall, P. A., and Smirk, F. H. (1950). *N.Z. med. J.*, **49**, 206.
Smirk, F. H. (1953). *Lancet*, **1**, 457.
—— and Alstad, K. S. (1951). *British Medical Journal*, **1**, 1217.
—— and Hamilton, M (1956). Ibid., **1**, 319.
Stone, C. A., Torchiana, M. L., O'Neill, G. Q., and Beyer, K. H. (1956). *J. Pharmacol.*, **116**, 54.

Q FEVER DOWN THE DRAIN

BY

M. G. P. STOKER, M.D.
Department of Pathology, University of Cambridge

There is nothing very original about Q fever contracted in the laboratory. Since the early days of research on this disease in Australia and the United States infections have regularly occurred in institutes where live organisms (*Rickettsia burneti*) have been handled, although the incidence has probably diminished since vaccination was introduced in 1948 (Smadel *et al.*, 1948). In most published accounts the mode of infection is apparently airborne, sometimes after transport on clothing (Oliphant *et al.*, 1949 ; Beeman, 1950), and often after very short exposure.

The main purpose of this paper is to describe two infections in the Department of Pathology, Cambridge, by a route which this highly versatile organism has not previously succeeded in exploiting. Since the investigation of Q fever has now ceased in the department, the opportunity is also taken to review briefly other infections which occurred among members of the staff while the work was in progress.

General Arrangements and Vaccination Procedure

Research on Q fever was carried out in a set of three rooms on the top (third) floor of the department, in an animal-room and post-mortem room on the same floor, and in five small huts on the roof.

Serological investigation of Q fever began in 1947, but living strains of *R. burneti* were not handled until October, 1949. From this date until March, 1955, the rickettsia was grown in large numbers for production of antigen and other purposes. All those who worked in the Q fever laboratory itself were given a course of two or three injections with vaccine kindly supplied by Dr. H. R. Cox, of the Lederle Laboratories. From December, 1953, vaccination was extended more widely to those who were known to visit the laboratory, and, in all, 31 of a total of 83 members of the staff of the department were vaccinated.

Vaccination was not more extensive, because of limitation of supply and also because a chronic sterile abscess sometimes formed at the site of inoculation. In two individuals this progressed to form a discharging sinus which took many months to heal. This complication is thought to occur more frequently after booster injections (Meiklejohn and Lennette, 1950), so these were not generally given.

No cases of Q fever were identified between 1949 and 1953. Between October, 1953, and July, 1954, however, five members of the staff developed typical attacks of Q fever, which were confirmed serologically. Investigation failed to reveal outside sources, and it was assumed that infection took place within the department.

Several outbreaks of Q fever in other laboratories have followed the first growth of *R. burneti* in the yolk sacs of chick embryos, which yield very highly infective material. The number of eggs harvested and the method of processing in Cambridge had not varied much since 1949, however, and the onset of laboratory infections in late 1953 seemed to coincide more with an increase in the number of workers who were handling the organisms, even though, with one exception, they did not themselves succumb.

Of the five individuals who developed Q fever, four (patients B, C, D, and E) worked elsewhere in the building and were unvaccinated. They had all been in their occupations for a number of years. The remaining patient (A) had recently arrived to work on Q fever and was consequently vaccinated. Two patients (D and E) were infected together from a blocked drain. The remainder were unconnected sporadic infections.

Sporadic Laboratory Infections (Not Associated with the Blocked Drain)

Patient A received 1-ml. injections of vaccine on January 4 and 11, 1954. On January 21 he harvested yolk sacs heavily infected with *R. burneti*. On February 11, 21 days after this exposure, he developed Q fever. Complement-fixing antibody was absent on the third day, but appeared on the fourth day—very much earlier in the course of the disease than is usual—and was presumably due to the previous vaccination. The attack was nevertheless moderately severe, until after chlortetracycline was given on February 15.

It is clear that insufficient time had elapsed between completion of the course of vaccination and exposure to large numbers of rickettsiae.

Patient B worked in the histology department on the first floor. Eighteen days before the onset of his illness, on February 21, 1954, he briefly entered the Q fever laboratory to deliver a message. He had no other contact that could be discovered, and it seems highly probable that he was infected during the few seconds that he was in the laboratory.

Patient C, who became ill on October 4, 1953, also worked in the histology department on the first floor. Although he lived in the country no obvious source of *R. burneti* to which he was exposed could be discovered outside the department. He paid occasional visits to the Q fever laboratory, but could remember none during the probable period of exposure. He had contact, however, with one of the assistants in the Q fever laboratory who often took tissues (not infected with *R. burneti*) for sectioning, and it is possible that the rickettsia may have been carried in the clothes or hair (see Beeman, 1950).

Laboratory Infections from the Blocked Drain

Patients D and E both developed Q fever on July 2, 1954. Since they did not meet outside working hours and had no obvious contact with external sources of *R. burneti*, it seemed likely that they were both infected in the department and at the same time. D had been in charge of the media and autoclave rooms for many years. E worked in the histology room, but he occasionally helped D with autoclaving when there was a lot to be done.

Material from the Q fever laboratory was sometimes taken to D's autoclaves, but until autoclaving was complete it was handled by Q fever laboratory staff and not by D himself. Moreover, E had not been assisting with the autoclaves during the period when infection probably occurred. D did go upstairs to the door of the Q fever laboratory, but not inside, on June 8 or 9 (23 or 24 days before the onset of his illness), but E claimed that he had not been near the Q fever laboratory at this time.

On June 11 at the probable date of infection, 21 days before the onset, a drain had been opened in the media room, flooding the floor. Both D and E were present, and subsequent inquiries strongly suggested that they were both infected at this time.

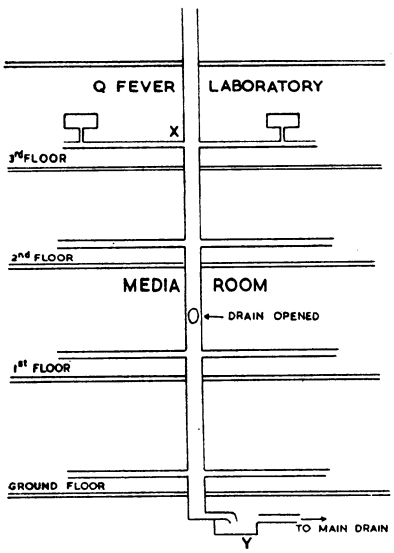

Diagram of relevant part of waste-water-drain system in the Department of Pathology. X=Junction which often became blocked. Y=Trap to main drainage.

The relevant part of the drainage system of the department is shown in the accompanying diagram. Waste water from sinks in the Q fever laboratory ran to a central drain-pipe which descended vertically to the ground floor and thence, through a trap (Y), into the main drainage system. This vertical drain-pipe ran inside the building through the rooms, including the media room on the first floor, collecting the waste water from lateral drains.

The lateral drain in the Q fever laboratory on the third floor was almost horizontal and the flow was very slow, so that it often became blocked at the junction (X) with the vertical drain and had to be opened at this point to be cleared.

The drain was blocked and cleared in this way on June 10, but on June 11 the obstruction recurred. This time it was lower in the vertical pipe and could not be cleared from the junction (X) in the Q fever laboratory. No clearing-points were present lower in the vertical drain for removing this obstruction, and the pipe was therefore cut open as it descended through the media room. This procedure, which had never been necessary before, released a flood of black sludge on to the floor of the room.

Twelve individuals were present or entered the media room shortly afterwards to see what was going on. Of these twelve, one had had Q fever previously (patient B) and three had received Q fever vaccine. Of the remaining eight susceptible individuals who were exposed, two developed Q fever (patients D and E). Serum was obtained later from four of the six susceptibles who remained well, but there was no antibody rise to suggest asymptomatic infection.

It seemed probable that patients D and E were infected by inhalation of droplets containing *R. burneti* from the deluge of sludge. Specimens of sludge were therefore collected from the junction of the horizontal and the vertical drain in the Q fever laboratory (X) and from the trap at the bottom of the pipe (Y). These specimens, which were taken in November, 1954, were centrifuged at 2,000 r.p.m. for 10 minutes, and the supernatants were mixed with penicillin and injected into guinea-pigs. *R. burneti* was isolated in this way from the sludge at the top of the drain, but not from the trap at the bottom.

Viable rickettsiae had not been deliberately poured down the sink in the Q fever laboratory. Infected glassware and other equipment, as well as discarded egg and animal tissues and infected fluids, were normally autoclaved, and some pieces of special apparatus were boiled. An exception was made for Tenbroeck tissue grinders and Waring blenders, however. The heavy coating of yolk which usually remained after processing of eggs made it extremely difficult to clean these pieces of apparatus after sterilization by heat. They were therefore soaked in lysol (approximately 5%) overnight, then were washed in the sink. In earlier investigations of the inactivation of *R. burneti* by disinfectants (Malloch and Stoker, 1952) lysol was easily the most effective of those tested at room temperature. 1% lysol reduced the infectivity of yolk-sac suspensions by a factor of more than a million in three hours, at room temperature.

Nevertheless the most likely source of the living rickettsiae in the drain was the lysol-treated material. This may have occurred through a mistake in the time of inactivation or the concentration of lysol, which was not accurately measured, or through failure of the disinfectant to penetrate large lumps of yolk tissue. Once in the drain the lysol would rapidly be diluted out, and surviving organisms might remain embedded in the sludge for many months.

Undiagnosed and Asymptomatic Infection of Department Staff

In view of these attacks of Q fever an attempt was made to find out if asymptomatic or undiagnosed infection had occurred more widely than was suspected while work on *R. burneti* was being carried out.

Of 83 members of the staff in October, 1954, 31 had been vaccinated. Excluding the 5 patients and 10 others who were not available, specimens of serum were obtained from 68 individuals and tested for Q fever antibody by the complement-fixation test.

Of 42 unvaccinated members of the staff, four had antibody (two at 1/5, one at 1/10, one at 1/20). This could have been due to unrecognized infection in the department, but the numbers were too small to show a significant increase over the proportion of the general adult population (blood donors) with antibody. There is no suggestion that unrecognized infection was at all common in the department.

Twelve out of 26 of the vaccinated group had antibody at 1/5 or greater. Antibody was present in all the six vaccinated individuals who were heavily exposed to the rickettsia in the Q fever laboratory, but in only 6 out of 20 of those who were rarely exposed.

Summary and Conclusions

Two Q fever infections in the Department of Pathology, Cambridge, are described: these occurred by an unusual route. A review is also given of other infections which occurred among the staff.

Except for Patient A, the laboratory infections occurred amongst unvaccinated individuals who had a rare and unlucky experience of the rickettsia. It is curious, however, that no infections were ever detected among those of the staff who had close contact with the Q fever laboratory but were nevertheless unvaccinated.

In 1953, before vaccination was offered more widely, nine unvaccinated workers from an adjoining laboratory were sharing a refrigerator in the Q fever laboratory, which they repeatedly entered. None developed either clinical or serological evidence of infection. On the other hand, Patient B entered the laboratory for a few seconds and later succumbed to the disease.

This effect might be due to chance or individual variation in susceptibility. It is possible, however, that small repeated infections produce an immunity which is not detectable by conventional tests for antibody.

The resistance of *R. burneti* to adverse environmental conditions has allowed its transfer to new hosts by varied and often devious routes. The two infections, which resulted from contamination of the drain-pipe, suggest that the possibilities are not exhausted, but it is fortunate that the circumstances of this particular incident are unlikely to recur frequently.

I am grateful to Professor H. R. Dean for permission to publish this paper.

REFERENCES

Beeman, E. A. (1950). *Publ. Hlth Rep. (Wash.)*, **65**, 88.
Malloch, R. A., and Stoker, M. G. P. (1952). *J. Hyg. (Camb.)*, **50**, 502.
Meiklejohn, G., and Lennette, E. H. (1950). *Amer. J. Hyg.*, **52**, 54.
Oliphant, J. W., Gordon, D. A., Meis, A., and Parker, R. R. (1949). Ibid., **49**, 76.
Smadel, J. E., Snyder, M. J., and Robbins, F. C. (1948). Ibid., **47**, 71.

A SURVEY OF DIABETES IN WEST CORNWALL

BY

C. T. ANDREWS, M.D., F.R.C.P.
Physician, West Cornwall Clinical Area

The objects of this survey were (1) to determine the incidence of diabetes in the West Cornwall clinical area, which is an isolated geographical entity with a population of a quarter of a million, largely shut off from the rest of England by Bodmin Moor; and (2) to find out to what extent the diabetic patient constitutes a load on the community. In assessing the second object four main agencies were considered: the home, the district nurse, the general practitioner, and the hospital service.

Incidence

Approximately one-third of the population has been surveyed through general practitioners, the doctors taking part being chosen so as to obtain an even geographical distribution and a balance between town and country practices.

In the spring of 1953 preliminary invitations were sent to 55 general practitioners, and a subsequent letter invited each one who agreed to co-operate to survey his list and complete a short questionary (see Appendix). In this way figures were obtained covering the practices of 48 doctors distributed from near Land's End to Camelford and Bodmin. These varied in size from just over 500 to one partnership of nearly 13,000. The results are given in Table I. The rate per 1,000 is seen to be 5.6. The incidence varied within the practices surveyed from 3.2 to 8.4 per 1,000.

Of the 593 patients accepted as diabetics, the diagnosis had been confirmed in 579 by attendance at a diabetic or general medical clinic, by blood-sugar investigation, or by previous investigation as a hospital in-patient. The remainder were accepted after careful scrutiny, and, in some cases, after personal discussion with the doctor making the return. No significant difference was found in the predominantly rural and predominantly urban practices. A cross-check on these findings was made by counting the number attending general medical and diabetic clinics, and the number (1,141) was found to accord closely with the estimated figure obtained from the general-practitioner returns (1,167).

TABLE I.—*Incidence of Diabetes in West Cornwall*

Total population of West Cornwall	266,389
No. of list patients surveyed	104,827
Percentage of total population surveyed	39·92
Total number of diabetics found	593
Number of diabetics per 100,000 population	565·7
Estimated number of diabetics in West Cornwall	1,507
Percentage attending diabetic or general medical clinics	77·4
Estimated total number attending diabetic or general medical clinics	1,167
Actual number found attending	1,141

Very little information is available on the incidence of diabetes in this country. During the second world war the necessity to obtain a medical certificate for special rations afforded an opportunity of arriving at an approximate figure. In 1947 it was thought that nearly all diabetics were availing themselves of the extra allowances. The incidence calculated from medical certificates in this year was 231 per 100,000 for England and Wales. It is possible, however, that many of the milder diabetics in rural areas did not avail themselves of the special rations.

The advent of the National Health Service has made it possible to enlist the help of the general practitioner in investigations of this type. In a recently published survey of the work of eleven practices covering the years April, 1952, to March, 1954, it was found that the annual rate of patients having consultations for diabetes varied from 2 to 7 per 1,000 population within the practices investigated. The average annual rate for all the practices was 3.6.

A partial explanation of the high incidence of the disease in Cornwall is provided by a study of the population structure. In this area approximately 19% of the population is aged 60 or over, as compared with 15% for the rest of the country. As diabetes predominates in the older age groups a higher incidence would be expected. A more powerful reason is probably provided by the isolation of the area, with consequent inbreeding in the past. Isolation in West Cornwall has meant a great deal more than lack of intercourse with the rest of England. The small fishing village and rural township have kept themselves apart to a degree rarely seen in the rest of England. Local geography has fostered this isolationism, for many of the coastal villages even to-day have no more than one bus a day or even one a week.

Sex Distribution

The distribution between the sexes is given in Table II, and is compared with that derived from a count of special ration certificates for the whole of the country in 1947. It will be seen that the sex distribution in Cornwall closely follows that of England and Wales as a whole. The

TABLE II.—*Sex Distribution*

	Males		Females	
	No.	%	No.	%
General-practitioner survey	234	39·5	359	60·5
Old clinic cases	173	39·3	267	60·7
Present Truro Clinic	178	36·9	304	63·1
England, 1947 (special ration certificates)		38·0		62·0