out, or whether the dietetic treatment was an important factor, it is impossible to say with certainty, but from the observations of Dalyell²¹ on the effect of small additions of animal fat to the diets of children suffering from arrested development in Vienna, my impression is that the general dietetic treatment played an important part in the improvement which occurred. (See weight charts.)

Summary.

My observations on these cases are, therefore, so far as they go, in accordance with the fairly general belief that rickets is a dietetic disease and commonly develops in children receiving insufficient fat and too much carbohydrate in the food, and that it shows itself most commonly among those who have been bottle-fed. In the case of one child known to have developed rickets while at the breast it is evident that the mother was receiving an inadequate diet, and it is probable that the infant's diet was also inadequate as a result.

The number of cases observed was unfortunately small, but they gave no indication that fat in the form of cod-liver oil, butter, or cottonseed oil exerts any specific curative influence on the disease in doses of 5ij daily. On the other hand, there was a marked improvement in a group of 18 cases treated during July, August, and September with larger doses of cod-liver oil, together with advice as to diet, but it is certain that this improvement was in part due to the season of the year.

Still has drawn attention to the fact that children suffering from coeliac disease in which there is failure to absorb fat "show a remarkable freedom from rickets."²⁰ In two experiments recently carried out at the Lister Institute, kittens given a diet deficient in fat-soluble A developed a condition showing a striking resemblance to that of children with coeliac disease: together with arrest of growth and distension of the abdomen there was muscular feebleness and apathy with a "pathetic interest in food." A small liver appears in many cases to be a feature of the disease. All these are points to which Still draws attention in coeliac disease in children.²² These facts would suggest the conclusion that a deficient absorption of fat-soluble A accounts for the picture in coeliac disease. If that be so, some other factor and not a deficiency of fat-soluble A alone must be concerned in the production of rickets.

In conclusion, I should like to express my great indebtedness to Dr. C. J. Martin for his help and for his kindness in arranging that the expense of this investigation should be defrayed by the Lister Institute; to Dr. E. A. Barton, who took much trouble in collecting suitable cases for me at his infant consultations at University College Hospital; to Miss S. E. Jacob, pharmacist to the Queen's Hospital, and to the many others who were kind enough to send me cases and to co-operate in other ways.

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THE VALUE OF EXTENSIVE INOCULATION OF A COMMUNITY DURING AN EPIDEMIC OF TYPHOID FEVER.

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DOUBT can no longer exist concerning the incalculable value of antityphoid inoculation as a means of preventing typhoid fever in military communities. The published figures of the incidence of typhoid fever in all armies during the late war prove this point conclusively. In this case the inoculation has almost invariably been carried out under favourable circumstances and in the absence of an epidemic prevalence of the disease.

The question arises as to the value of inoculation as a means of protection—first, to the individual, and secondly, to the community as a whole—during an actual epidemic. The opportunities for the study of this subject on a scale large enough to give any reliable results have been few. It seems desirable, therefore, to place on record any evidence which will enable an opinion to be formed concerning inoculation under these circumstances.

The opinions hitherto expressed on the matter are of a rather divergent nature. Spooner, speaking of a water-borne epidemic in a Vermont village, remarks that "inoculation in the time of epidemic must be performed with care, since it is inevitable that many must be inoculated during the incubation period. The result of this accident is not serious, however. My experience would indicate that the onset of symptoms was hastened by this step, but that the infection was shorter and of a less severe character." He also notes in another instance the small morbidity among a number of nurses and others intimately exposed to infection before and during inoculation, and points out that this agrees with the observations of Pfeiffer, Leishman, and Russell, that the period following inoculation is one of increased resistance.

Elmer, recording a food epidemic in a hospital at St. Louis, says: "The fact that only 20 out of the 261 who received the vaccine developed typhoid speaks against any marked increase of susceptibility, and the fact that 20 did develop typhoid is against any marked increase of resistance following recently given vaccine."

Basten reports the result of inoculating 245 members of a Sanitäts Kompagnie, in which 15 cases of typhoid fever had occurred, 3 of which died. Three doses, of $\frac{1}{2}$ c.cm., 1 c.cm., and 1 c.cm., of antityphoid vaccine were given at intervals of eight days. After the first inoculation, 13 cases of typhoid occurred, two being fatal; after the second, 9 cases occurred, one being fatal; after the third, one case occurred. In a field hospital 4 cases occurred after one inoculation; one after the second, while after the third, five men had elevation of temperature for five days, one of whom died after a relapse during the third week.

Furth, Pfugbeil and Oertel describe the results of compulsory inoculation of the inhabitants of Ostend in 1915 and 1916. Typhoid fever was endemic, and the number of cases in August, 1915, was 38. The population of the town in 1915 was 32,811, and 27,472 received three doses of vaccine. A similar procedure was repeated the following year. They express their results as follows:

"Consequences injurious to health were observed in no case. Two facts in particular speak for the excellent effect of vaccination: Before inoculation, typhoid fever occurred sporadically over the whole area. Its complete disappearance was afterwards directly proportional to the degree of inoculation in the various districts. It disappeared in the districts in the order in which they were inoculated, and did not show signs of abatement until inoculation had taken place. It ceased entirely with the completion of inoculation.

"In the area in question the results of inoculation can be tabulated thus:

	No. of Typhoid Cases.	Deaths.
Period before inoculation (Dec., 1914, to Nov., 1915)	213	18
Period after inoculation (Dec., 1915, to Nov., 1916)	6	0

Of the latter 6 cases of typhoid fever, 4 had not been inoculated, and the remaining 2 cases, who were inoculated, lived with a typhoid carrier."

This inoculation at Ostend was the first instance of compulsory inoculation applied to a large general community.

The object of this paper is to put on record another similar case of compulsory inoculation which occurred in the winter 1918-19, shortly after the Armistice. On the arrival of the British Army of Occupation in Germany it was found that at Euskirchen, a town of 13,000 inhabitants, situated about twenty miles west of Bonn, there was a considerable outbreak of typhoid fever. It will be remembered that the German army had, during November and December, been beating a hasty and more or less disorganized retreat across the Rhine. Euskirchen was situated on one of the main roads of the retreat, and had been largely used as a billeting town, and it will be understood how cases of typhoid fever could arise and be overlooked until there was quite an unsuspected epidemic in the community.

In addition to the outbreak in Euskirchen itself, there were two other minor outbreaks in groups of surrounding villages. The three epidemics were probably not all interdependent. The second outbreak in the village of Gross Venrich was probably spread by water from Euskirchen, the latter town being situated higher up the Erft stream and having no proper system of sewage disposal, and the former village being dependent to a certain extent for its water supply on this same stream.

The third epidemic, however, was probably of quite an independent origin, but is considered here because the three were all coincident and gave similar results.

It is unnecessary to detail all the inquiries which were made to trace the origin of the epidemic—the water supply, the milk supply, butter, etc. All these points were investigated by one of us (A. R.) in conjunction with a German Kreisassistentarzt, Dr. Josef Basten. The investigations led to no definite conclusion. Most of the cases were probably of contact nature, and the original source of infection was not discovered.

It should be pointed out that in the investigation and handling of the epidemic the closest co-operation took place between the German civilian and the British military medical authorities. Conferences were held at frequent intervals by the D.D.M.S. of the corps whose headquarters was situated in Euskirchen, and they were attended by the Kreisarzt and the Burgomester. The factors involved in the epidemic were considered, and instructions were issued to the civil authorities for the carrying out of certain measures of precaution.

A serious drawback in the early stages of the investigation was the fact that all samples requiring bacteriological and chemical examination had to be sent to laboratories in Cologne and Bonn, which involved considerable delay before the results could be communicated to us. Ten days after the presence of the disease in the town was notified a military bacteriologist began to assist in the examination, and four days later a British mobile bacteriological laboratory was stationed at Euskirchen and materially facilitated the work.

Although no definite source of infection could be discovered, investigations showed that the avenues for contact infection were many. The inhabitants were badly nourished, and in no fit state to resist disease. The schools were closed, the children played in the streets, consorted with German troops, visited one another's houses to an increased extent, and frequented the banks of the local stream, the Erft, and its branches, into which the untreated sewage of the town discharged. A lack of disinfectants at the hospital, and the fact that several privies in the poorer quarters discharged directly into the various tributaries of the stream, no doubt also conduced to widen the distribution.

Inoculation of Civilian Inhabitants.

Inoculation of the civil community was performed in each of the three districts where the outbreaks occurred, and this process can now be briefly described.

1. Euskirchen.

On January 7th, 1919, orders were issued by the British military authorities for the compulsory inoculation of the civilians with British T.A.B. vaccine. An attempt had been made previously by the Kreisarzt to obtain a supply of German antityphoid vaccine from Berlin for voluntary inoculation, but circumstances rendered its delivery impossible.

T.A.B. vaccine contains in 1 c.cm.—

<i>B. typhosus</i> ...	1,000 millions
<i>B. paratyphosus</i> A ...	500 "
<i>B. paratyphosus</i> B ...	500 "

The routine method in the British Army is to give two doses at intervals of ten days. It was decided that all persons between the ages of 6 and 45 years should be inoculated, with the exception of those certified by a doctor to be suffering from an ailment which contraindicated such treatment and of women three months before and two months after childbirth. The limit of 45 years was afterwards felt to be inadvisable, and when inoculation of the other districts was practised, it was raised to 55.

The doses were graduated according to age—the first dose being as follows:

For persons between 6 and 10 years ...	1 c.cm.
" " 11 and 17 years ...	1 c.cm.
" " 18 and 45 years ...	1 c.cm.

Instructions to the above effect were issued to the Kreisarzt, and at a meeting of German doctors which he convened a detailed scheme was planned on the lines of that followed at Ostend in 1915, when the Germans inoculated the inhabitants of that town. On January 7th, 1919, the Kreisarzt contributed an article to the local press in which he pointed out the value of inoculation against typhoid, and urged the people to volunteer to be inoculated as soon as the necessary arrangements could be made. Three days later a further notice appeared in the same paper to the following effect:

The British military authorities have ordered the inoculation of the inhabitants of the town between the ages of 6 and 45 years. The inoculation will be done in two doses, with an interval of ten days between them. The following are exempt:

- (1) All persons suffering from a fever.
- (2) All persons with serious lung disease.

These are required to furnish a medical certificate to the police at 7, Bischofstrasse.

Also exempted are women three months before and two months after childbirth. They will be required to show a medical or midwife's certificate.

The inoculation will take place on the following days: (A list of centres follows at which dwellers in specified streets had to present themselves on particular days.)

Everybody must be inoculated on the day ordered.

The dates for the second inoculation will be published later.

The inoculation was carried out by German doctors at six public centres and also in private. T.A.B. vaccine, hypodermic needles, and methylated spirit were supplied by the British medical authorities. The staff at each centre consisted of:

1. A German doctor.
2. A clerk who took down the name, age, address, etc., of each person inoculated.
3. A female attendant who prepared the site of injection with iodine.
4. An attendant to sterilize the needles.
5. A policeman.

Members of the Administrative Medical Service visited the centres daily.

The population of Euskirchen was 13,010, of whom 8,385 were between the ages of 6 and 45. About 1,200 people were inoculated each day until 8,339 cases had been dealt with.

The first inoculation began on January 11th and ended on January 17th. The second doses were begun on January 21st, and by January 28th 8,076 had been done. On February 4th an additional 112 absentees were done, the number thus being brought up to 8,198. It is apparent, then, that about 62 per cent. of the population had been vaccinated.

2. *Weilerswist and Gross Vernich.*

The combined population of these two villages was estimated at 2,492. The villagers were informed by proclamation by the Burgomeister of the arrangements made for inoculation. They were similar to those adopted at Euskirchen.

The numbers receiving first and second doses were 1,763 and 1,738 respectively, thus over 70 per cent. of the population of the villages were protected by two doses. The age limits were fixed at 6 and 55 years.

3. *Secktem, Merten, Tripplesdorf, and Walberberg.*

These four villages were very closely adjacent, and their total population was given as 5,010. Similar orders were issued, and the numbers inoculated at the first and second period were respectively 3,314 and 3,417. Between 65 and 70 per cent., then, had received the two doses.

CASES OF TYPHOID FEVER.

There were 199 cases of typhoid fever in the three epidemics in the town and villages of a combined population of about 20,000, and of these cases 34 died—approximately 17 per cent.

Four of these deaths occurred in people who had been recently inoculated twice. The onset of the disease began within the first twenty-four hours after the second inoculation (2 cases), on the eighth day after, and on the nineteenth day after the second dose. Two other deaths occurred in cases after the first inoculation, and in each case the symptoms began within the first twenty-four hours.

There were altogether thirty-eight cases of typhoid following inoculation, and amongst them there were six deaths—that is, mortality = 15.7 per cent. With the exception of these six deaths practically all these cases were of a light nature.

SUMMARY.

It is hardly justifiable to arrive at any definite conclusion from the above figures. The daily numbers of onset were very much on the decrease before the inoculation was begun, but it must be remembered that some cases were not removed at once to the hospitals for isolation and they were acting as sources of infection for some time afterwards. During the early period of inoculation there were probably more sources of infection "at large" than appear at first sight, and one would be inclined to imagine more people, as a result, incubating the disease. The fact that there was in each epidemic a recrudescence of cases immediately after inoculation tends to support this theory.

The arguments against inoculation during an epidemic do not appear to be supported by facts, and it is claimed that additional evidence has been brought to light in favour of inoculation under these circumstances. The advantageous effects of the inoculation may for convenience be described under three heads—(a) direct, (b) indirect, (c) remote.

(a) *Direct.*—One of the most difficult problems in dealing with an epidemic of this type is the notification and consequent isolation of light cases in which no medical aid has been sought. It is apparent that the inoculation brought some of these to notice so that they could be removed and isolated more quickly. It is also suggested that some cases incubating the disease developed symptoms more rapidly than they would otherwise have done, and these again were more quickly found out and removed as sources of danger. The sudden cessation of the epidemic after inoculation is very striking.

(b) *Indirect.*—The indirect advantage lies in the accessory administrative handling of the epidemic. Undoubtedly much good was done by the issue of orders to the effect that exemption could only be allowed by medical certificate. This, accompanied by an energetic house-to-house inquiry, in the case of defaulters, brought several cases to light which would otherwise have lingered on in their own homes.

(c) *Remote.*—There can be no doubt that many cases were saved by the fact that contacts of some of the later cases had been inoculated. The almost dramatic termination of the epidemic gave a feeling of satisfaction and security to the inhabitants, and the precautionary orders regarding water and dairy supplies, etc., which were

issued were withdrawn or modified at an earlier date and with more confidence than could otherwise have been the case.

It is regrettable that the incidence and mortality amongst the inoculated were so high, but it may perhaps be added that in the neighbouring Kreis of Rheinbach, where immediate inoculation of all contacts of all new cases occurring in the area was ordered, there were practically no secondary cases of the disease and no deaths.

In conclusion, therefore, the opinion is put forward that an extensive inoculation during an epidemic of typhoid fever is beneficial, probably to the individual in particular and almost certainly so to the community as a whole.

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IMMEDIATE SURGICAL COMPLICATIONS OF DYSENTERY.

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"DYSENTERY" is a general term applied to conditions characterized by passage of blood and mucus in the stools. In amoebic dysentery the mucosa and submucosa of the colon is invaded by *Entamoeba histolytica*, which can ingest red corpuscles; this property is employed in the recognition of its vegetative form in microscopic preparations. Other manifestations of this infection are acute hepatitis or acute liver abscess. The majority of cases of these conditions fail to give a history of dysentery, although in all there has been possible exposure to infection by *E. histolytica*.

Bacillary dysentery is due to infection of the wall of the colon with a variety of organisms distinguished from one another by fermentation and serological reactions. The two chief groups are:

1. The *B. dysenteriae* (Shiga) group, which give rise to an intensely acute and severe form, and
2. The *B. dysenteriae* (Flexner) group (the chief perhaps being Flexner's Y bacillus), which give rise to a milder clinical type.

Both of these subgroups include a very large number of organisms which have the common group fermentation reaction, but in other respects have been shown to be distinct and separate entities.

The immediate complications of dysentery may be given in a comprehensive way as:

- A. Acute hepatitis.
- B. Acute liver abscess.
- C. Perforation of the colon (gangrenous colitis).
- D. Gangrenous proctitis.
- E. Synovitis with effusion into the larger joints.

A. and B. are due to infection by *E. histolytica*, and, amoeba having been found in the portal capillaries, this may well be the path by which it reaches the liver from the intestine. C. and D. are due either to infection by amoeba or bacilli, plus a secondary infection with intestinal organisms. E. is a complication of bacillary dysentery only.

A. *Acute Hepatitis.*

Acute hepatitis is often difficult to diagnose from liver abscess. After a period of malaise the liver is found to be enlarged and tender. Pyrexia is present, but is not so remittent as in liver abscess. Evening temperature may reach 103° F. Leucocytosis is generally present, varying from 10,000 to 20,000 per c.mm. The patient is sallow and the conjunctivae are icteroid.