between boards on the floor, or at the bottom of a dog kennel or bird's nest. Mr. Butler recalls the case of a gentleman who collected on four successive mornings 62, 78, 67, and 77 cat-fleas' eggs from the cloth his cat had slept upon. Altogether 280 eggs in four nights! The date of hatching varies very much with the temperature. *Pulex irritans* takes half as long again—six weeks instead of four—to become an adult imago in winter as in summer, but in India the dog-flea will complete its cycle in a fortnight.

When it emerges the larva is seen to be a whitish segmented little grub without any limbs, but with plenty of bristles which help it to move about; this it does very actively. There are two small antennae and a pair of powerful jaws, for the larva does not take liquid food, but eats any scraps of solid organic matter which it comes across; dead flies and gnats are readily devoured. The larva casts its skin several times, though exactly how often it moults seems still uncertain.

After about twelve days of larval existence it spins itself a little cocoon in some sheltered crevice, and turns into a whitish inert chrysalis or pupa. During its pupal existence it takes, of course, no food, but it grows gradually darker, and after undergoing a tremendous internal change, breaking down its tissues and building up new ones, the chrysalis case cracks and the adult flea jumps out into the world.

There are many superstitions about fleas. March 1st is in some way connected with them, and in the south of England the house doors are in some places closed on that day under the belief that this will render the building immune for the following twelve months. The most successful insecticide is said to be prepared from *Pyrethrum*, which is grown in the near East in large quantities for this purpose. Wormwood (*Artemisia*) is also recommended.

While wormwood hath seed, get a handfull or twaine,
To save against March, to make flea to refrain;
When chamber is swept and wormwood is strowne,
No flea for his life dare abide to be known.

TUSSER.

The author of *A Thousand Notable Things* suggests the following plan, but, so far, I have not met any one who

Fig. 3.—Pupa of flea.
(After Westwood.)

Fig. 4.—*Ceratophyllus gallinulae*. Male (above) and female (below). Drawn to scale and both highly magnified. These specimens taken from a grouse are of the same genus as one of the plague-conveying fleas.

has tried it: "If you mark where your right foot doth stand at the first time that you do hear the cuckoo, and

then grave or take up the earth under the same; where-soever the same is sprinkled about, there will no fleas breed. I know it hath proved true."

Plastering a floor with cow-dung, which is a common practice in South Africa, is said to be a very efficacious means of keeping down fleas.

But we must, in the long run, treat fleas seriously. Although the *Pulex irritans* is a very common insect, the greatest living authority on fleas tells me it has never been accurately drawn. We have Blake's "ghost of a flea," but what did Blake know of entomology? In distinguishing one flea from another—fleas which may attack man and fleas which have hitherto declined to do so—every hair, every bristle counts (Fig. 4). Hence I illustrate this article with accurate outlines of certain fleas found on the grouse, and for whose accuracy I can vouch. As I have said above, a certain rat-flea (*Xenopsylla cheopis*) and another (*Ceratophyllus fasciatus*) undoubtedly conveyed the bacillus of plague from rats and other Murinae to man and vice versa. The *Bacillus pestis* is unlikely to establish itself in the present war, but *quien sabe!* The Black Death of 1349-51 was conveyed by fleas, and so was Pepys's plague of 1665. Plague—flea-borne, we must remember—is still endemic in places as near Europe as Tripoli, and in numerous centres in Asia. Not a disease altogether to be neglected; but still not a very threatening one in Europe in the twentieth century.

BACILLI AND BULLETS.

AN ADDRESS TO THE OFFICERS AND MEN IN THE CAMPS
AT CHURN.*

BY SIR WILLIAM OSLER,

REGIUS PROFESSOR OF MEDICINE, OXFORD.

I HAVE been asked to say a few words on the question of health in war time, that you may realize its importance. Formerly an army marched on its belly; now it marches on its brain. Only by utilizing existing knowledge, in all grades from commander-in-chief to private, is the maximum of success available. To put the largest number of the enemy out of action with a minimum of loss to his own men is the aim of every general. While in one way modern war merges the individual in a great machine, on the other hand the intelligent action of the unit has never been so important a factor in making the machine work smoothly and efficiently. After all, it is the man behind the gun who wins the victory.

What I wish to urge is a true knowledge of your foes, not simply of the bullets, but of the much more important enemy—the bacilli. In the wars of the world they have been as Saul and David—the one slaying thousands, the other tens of thousands. I can never see a group of recruits marching to the dépôt without mentally asking what percentage of these fine fellows will die legitimate and honourable deaths from wounds, what percentage will perish miserably from neglect of ordinary sanitary precautions? It is bitter enough to lose thousands of the best of our young men in a hideous war, but it adds terribly to the tragedy to think that more than one-half of the losses may be due to preventable disease. Typhus fever, malaria, cholera, enteric, and dysentery have won more victories than powder and shot. Some of the diseases I mention need no longer be dreaded. Typhus, and malaria, which one hundred years ago routed a great English army in the Walcheren expedition against Antwerp, are no longer formidable foes. But enough remain, as we found by sad experience in South Africa. Of the 22,000 lives lost in that war—can you believe it?—the bullets accounted for only 8,000, the bacilli for 14,000! In the long arduous campaign before us more men will go into the field than ever before in the history of the Empire. Before it is too late, let us take every possible precaution to guard against a repetition of such disasters. I am here to warn you soldiers against enemies more subtle, more dangerous, and more fatal than the Germans—enemies against which no successful battle can be fought without your intelligent co-operation. So far the world has only seen one great war waged

* Copies of this address in pamphlet form can be obtained from the Oxford University Press, London, Edinburgh, Glasgow, New York, Toronto, Melbourne, and Bombay, price one penny net.

with the weapons of science against these foes. Our allies, the Japanese, went into the Russian campaign prepared as fully against bacilli as against bullets, with the result that the percentage of deaths from disease was the lowest that has ever been attained in a great war. Which lesson shall we learn? Which example shall we follow—Japan, or South Africa with its sad memories?

We are not likely to have to fight three of the greatest former scourges—typhus, malaria, and cholera—though the possibility of the last has to be considered. But there remain dysentery, pneumonia, and enteric, against two of which we should be able to bring to bear successfully resources of modern science.

Dysentery, an inflammation of the large bowel, has been for centuries one of the most terrible of camp diseases, killing thousands, and, in its prolonged damage to health, one of the most fatal of foes to armies. So far as we know, it is conveyed by water, and only by carrying out strictly, under all circumstances, the directions about boiling water can it be prevented. It is a disease which, even under the best of circumstances, cannot always be prevented; but with care the incidence should be reduced to a minimum, and there should never again be widespread outbreaks in the camps themselves.

Pneumonia is a much more difficult disease to prevent. Many of us, unfortunately, carry the germ with us. In these bright days all goes well in a holiday camp like this; but when the cold and the rain come, and the long marches, the resisting forces of the body are lowered, the enemy, always on the watch, overpowers the guards, rushes the defences, and attacks the lungs. Be careful not to neglect coughs and colds. A man in good condition should be able to withstand the wettings and exposures that lower the system, but in a winter campaign pneumonia causes a large amount of sickness, and is one of the serious enemies of the soldier.

Above all others one disease has proved most fatal in modern warfare—enteric or typhoid fever. Over and over again it has killed thousands before they ever reached the fighting line. The United States troops had a terrible experience in the Spanish-American war. In six months, between June and November inclusive, among 107,973 officers and men in ninety-two volunteer regiments, 20,738—practically one-fifth of the entire number—had typhoid fever, and 1,580 died. Fortunately, in this country typhoid fever is not prevalent in the districts in which camps are placed. The danger is chiefly from persons who have already had the disease, and who carry the germs in their intestines, harmless messmates in them, but capable of infecting barracks or camps. You can easily understand how flies lighting on the discharges of such typhoid carriers could convey the germs far and wide. It was in this way probably, and by dust, that the bacilli were so fatal in South Africa. Take to heart these figures: There were 57,684 cases of typhoid fever, of which 19,454 were invalided, and 8,022 died. More died from the bacilli of this disease than from the bullets of the Boers. Do let this terrible record impress upon you the importance of carrying out with religious care the sanitary regulations.

One great advance in connexion with typhoid fever has been made of late years, and of this I am come specially to ask you to take advantage. An attack of an infectious disease so alters the body that it is no longer susceptible to another attack of the same disease; once a person has had scarlet fever, small-pox, or chicken-pox, he is not likely to have a second attack. He is immune, or has what is called immunity. When you expose a solution of sugar to the air, or if you add to it a pinch of yeast, a process goes on which we call fermentation, accompanied by a growth of little germs of the yeast in the fluid, and by an increase in temperature (in fact the solution has a fever), and the composition of the fluid alters, so much so, that you can inoculate it afterwards again and again with the same germ, but no further change takes place. Now this is what happens to us when bacilli make a successful entry into our bodies. They overcome the forces that naturally protect the system, and grow just as the yeast does in the sugar solution; but the body puts up a strong fight, all sorts of antibodies are formed in the blood, and if recovery takes place, the patient afterwards has immunity, for a time at least, from subsequent attacks. The body has mobilized its

forces, and is safe for a few years at least against that disease. It was an Englishman, Jenner, in 1798, who found that it was possible to confer this immunity by giving a person a mild attack of a disease, or of one very like it. Against small-pox all of you have been vaccinated—a harmless, safe, and effective measure. Let me give you a war illustration. General Wood, of the United States Army, told me that, when he was at Santiago, reports came that in villages not far distant small-pox was raging and the people without help of any kind. He called for volunteers, all men who showed scars of satisfactory vaccination. Groups of these soldiers went into the villages, took care of the small-pox patients, cleaned up the houses, stayed there until the epidemic was over, and not one of them took the disease. Had not those men been vaccinated, at least 99 per cent. of them would have taken small-pox. Now, what I wish to ask you is to take advantage of the knowledge that the human body can be protected by vaccination against typhoid fever. Discovered through the researches of Sir Almroth Wright, this measure has been introduced successfully into our own regular army, into the armies of France, the United States, Japan, and Germany. I told you a few minutes ago about the appalling incidence of typhoid fever in the volunteer troops in America during the Spanish-American war. That resulted largely from the wide prevalence of the disease in country districts, so that the camps became infected; and we did not then know the importance of the fly as a carrier, and other points of great moment. But in the regular army in the United States, in which inoculation has been practised now for several years, the number of cases has fallen from 3.53 per thousand men to practically nil. In a strength of 90,646 there were in 1913 only three cases of typhoid fever. In France the enteric rate among the unvaccinated was 168.44 per thousand, and among the vaccinated 0.18 per thousand. In India, where the disease has been very prevalent, the success of the measure has been remarkable. In the United States, and in France, and in some other countries this vaccination against the disease is compulsory. It is not a serious procedure; you may feel badly for twenty-four hours, and the site of inoculation will be tender, but I hope I have said enough to convince you that, in the interests of the cause, you should gladly put up with this temporary inconvenience. If the lessons of past experience count, any expeditionary force on the Continent has much more to fear from the bacillus of typhoid fever than from bullets and bayonets. Think again of South Africa with its 57,000 cases of typhoid fever! With a million of men in the field, their efficiency will be increased one-third if we can prevent enteric. It can be prevented, *it must be prevented*; but, meanwhile, the decision is in your hands, and I know it will be in favour of your King and country.

A CASE OF RUPTURED ECTOPIC GESTATION COMPLICATED BY SPLENO-MEDULLARY LEUKAEMIA.

By LIONEL E. SUTCLIFFE, M.B., CH.B. SHEFFIELD,
CHESTERFIELD.

THE combination present in the following case of spleno-medullary leukaemia with pyrexia of such a marked character and for so prolonged a period, together with the fact that it was complicated with ruptured ectopic gestation, that there was shrinkage of the spleen coincident with the haemorrhage, and that it enlarged markedly and rapidly during the reactionary stage, are features of great interest.

S. A., aged 21, was admitted to the Lowestoft Hospital at 5 p.m. on January 10th. On January 8th, at 1.30 a.m., she had been seized with acute abdominal pain accompanied by vomiting. Three weeks previously she had menstruated normally, and had never missed a period since her marriage, twelve months earlier. The abdomen was distended, motionless, and universally tender. Rigidity was most marked on the right side, and the patient localized her most acute pain in the right iliac fossa. The temperature was 101.4°F., and the pulse 135.