which time very slight injuries are sufficient to set up tetanus. Later, the spores became localized in the liver, spleen, lungs, kidneys, lymph glands, and marrow, where they may remain latent for some months.

Semple (1911) came to the conclusion that an injection of a solution of quinine might cause enough destruction of tissue to produce conditions favourable for the germination of spores.

It behoves us, therefore, to bear tetanus in mind, even though there be no history of injury, whenever we meet with symptoms similar to the premonitory symptoms mentioned by Evler and found to be present in so many cases of this disease.

PRESERVATIVES IN SERUM.

Most serums have a small amount of preservative (phenol, trikresol, chloroform) added to them, and when doses such as 120 c.cm. are given at one time the presence of preservatives requires consideration and raises the question as to how much preservative can be given without ill effect.

Baccelli (1911), who strongly recommends that tetanus should be treated with subcutaneous injections of carbolic acid, states that not less than 1 gram should be given daily; J. H. Haberland (1913) in a case of hydrophobia gave 22½ grains of phenol subcutaneously in twelve hours without any evidence, either locally or generally, of any deleterious effects; Natali (1899) injected 5.25 grams of phenol subcutaneously in eighteen days; and Ascoli (1898) gave 75 c.cm. of a 3 per cent. solution without any subsequent toxic symptoms.

The probability of ill effects being due to the preservatives in serum when administered intrathecally has been fully discussed and negatived by Flexner in the case of automeningococcal serum. It may, then, be safely assumed that the amount of phenol put into serum is not likely to have any serious consequences.

CONCLUSIONS.

Tetanus may be cured by the administration of antitoxin, provided that the serum treatment is begun early in the attack and is pursued vigorously and continuously. Unfortunately in the present state of our knowledge a diagnosis is as a rule made only when the disease is in a stage so advanced as to make the results of treatment uncertain, even though very large doses of antitoxin are used. These large doses are costly, and place the serum treatment of tetanus practically out of the reach of those with shallow purses—unless, of course, the serum be provided by the State. But in the prophylactic use of serum there is within the reach of every one a means of checking the disease. It has been proved beyond the shadow of a doubt that, wherever the prophylactic use of antitoxin has been carried out systematically, tetanus may be said to have disappeared. Tetanus should therefore be looked upon as a preventable disease, and, when one realizes this, there flashes across the mind the memorable question, "If preventable, why not prevented?"

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INSECTS AND WAR:

IV.—THE FLOUR MOTH IN SOLDIERS' BISCUITS.

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Where moth . . . doth corrupt.—MATT. vi, 19.

It is not only insects which destroy the continuity of the soldiers' integument which play a part in war. It has been well said that an army marches on its stomach, and the admirable commissariat arrangements which have been so distinct a feature of the British Expeditionary Force during the present war are the result of much patient care and attention during times of peace. Every one knows that recruits are frequently rejected for some defect in their teeth. A soldier, indeed, requires strong teeth, for his farinaceous food in the field is largely supplied to him in the form of biscuits—not that "moist and jovial sort of viand," as Charles Dickens described the Captain biscuit, but hard tack which challenges the stoutest molars.

During the summer of 1913 the authorities of the British Museum at South Kensington arranged a very interesting but somewhat gruesome exhibit in the Central Hall. The exhibit consisted mainly of army biscuits covered by horrible webs or unwholesome looking skeins of silky

Fig. 1.—*Ephestia kühniella*. Moth-infested biscuit.

threads, eaten through and through by the larva of a small moth. Together with these were certain long metallic coils and other apparatus used in investigating certain phases of the life-history of the moth and the manufacture of the biscuit. The exhibit illustrates an article¹ which had recently appeared on the baking of army biscuits, by

Mr. Durrant and Lieutenant-Colonel Beveridge, on the "biscuit moth" (*Ephestia kühlmeiella*), a member of the family Pyralidae, and records their efforts to arrive at a means of checking a very serious pest to service stores.

The biscuit moth, *E. kühlmeiella*, was described two years before its larva had been noted damaging flour at Halle. There has always been a certain amount of international courtesy in attributing the *provenance* of insect pests to other countries, and when *E. kühlmeiella* began, about ten years later, to attract attention in England it was believed to have been introduced from the United States via the Mediterranean ports in American meal. The American origin was, however, denied by Professor Riley, who, in a letter to Miss Ormerod, states, "I think I can safely say that this species does not occur in the United States." At the moment of writing these words Professor Riley was in the act of packing up to leave Washington for Paris. Possibly he was excited, certainly he was inaccurate, for the species was then known to occur in Alabama, North Carolina, and other States. In fact to-day it is recorded throughout Central America and the Southern States and in many more temperate regions of the New World.

The moth itself is rather insignificant, small, of a slaty-grey colour. The eggs, rather irregular ovoids, are laid on the biscuits, into which the issuing larvae bore. These latter are soft, and like most creatures which live in the dark, whitish but with a tinge of pink; the head, however, is brown and hardened. The larva is constantly spinning silken webs or tissues, which in the most untidy way envelop the biscuit, and finally entombs itself in a whitish silken cocoon, and herein it ultimately turns into a chrysalis or pupa.

Fig. 2.—*Ephestia kühlmeiella*. × 2.

and finally entombs itself in a whitish silken cocoon, and herein it ultimately turns into a chrysalis or pupa.

Fig. 3.—*Ephestia kühlmeiella*. A. Larva; B. pupa. Greatly magnified.

Another Pyralid moth—*Corecya cephalonica*—makes similar unpleasant webs all over biscuits, rice, or almost any farinaceous food, but, since its larvae are unable to live unless there be a certain degree of moisture in the biscuit, it is less injurious to baked food than the *Ephestia*, for whose larvae nothing can be too dry. *Corecya* seems originally to be a pest of rice, and to have been introduced into Europe with Rangoon rice, but it readily alters its diet in new surroundings, and will live on almost any starchy stuff.

The problem that Lieutenant-Colonel W. W. O. Beveridge and Mr. J. H. Durrant, of the British Museum, set out to solve was at what stage in the manufacture of the army biscuits were they infested, and whether any steps could be taken to avoid or minimize such infestation.

First, as to infestation. Biscuit must become infested either (1) at home before packing, (2) during transit, or (3) in the country where stored. The biscuits are packed in tins, hermetically sealed, and enclosed in wooden cases to prevent injury; it was therefore obvious that if insects could be found within intact tins it would be demonstrated at once that infestation must have taken place in the factories, and not subsequently. With a view to determine

the origin of infestation sample tins were withdrawn from stocks at various stations abroad, and inspected at Woolwich by experts, and tins which, after careful examination, had been pronounced intact, were found to contain

Fig. 4.—*Corecya cephalonica*. Moth-infested biscuit.

Ephestia kühlmeiella and *Corecya cephalonica* in various stages of development, thus proving conclusively that infestation had taken place in the factories before the tins were soldered, and indicating that preventive or remedial measures must be undertaken within the factories themselves.

It is obvious either that the heat acquired by biscuit in the process of baking is insufficient to destroy ova present in the moist dough, or that moths and beetles deposit their ova in or on the biscuits after baking, and during the process of cooling and of packing in the tins. Cooling before packing is necessary, to allow the moisture in the centre of the biscuit to become evenly distributed throughout, and it is during the time occupied in cooling and packing that the biscuit is exposed to the greatest risk of infestation; any risk occasioned by subsequent injury to the case must be quite exceptional, and is probably negligible.

By a series of most ingenious experiments, the two investigators were able to determine the temperature in the centre of the biscuits during the various stages of its baking and cooling. Army biscuits are made from dough which contains about 25 per cent. of water. When stamped out they are placed in rows on the moving floor of an oven and are submitted to a high temperature for twenty minutes whilst they travel over a space of 40 ft. The dough at first contains 25 per cent. of water, but during baking this is reduced to about 10 per cent., and the moisture now collects in the centre of the mass of the biscuit in consequence of the external hardening or "caramelization" as it is called. The holes which are pricked in so many biscuits of course assist this process.

Too little attention has been paid to the internal temperature of edibles which are being cooked. Very few people, for instance, have any conception of what is going on in the centre of a joint of meat whilst it is being roasted or boiled. After two hours' boiling the temperature in the centre of a large ham has only risen to 35° C.; after six hours' boiling to 65° C., and it is only after ten hours' continuous boiling that 85° C. is reached. I have, I am sorry to say, no conception as to how long a ham ought to be boiled, but it is obvious that to be really effective against such parasites as *Trichinella*, the cooking of pork and ham should be more prolonged and thorough than seems to be customary. But this is another story.

However, to return to our biscuits. The Colonel and Mr. Durrant devised an ingenious instrument which determined the temperature of the centre of the army biscuits. When the tip of their recording apparatus lay within the moist area of the baking biscuit, the temperature registered was only a little over 100° C., but when the tip of the instrument rested on the hard "caramelized" portion much higher temperatures were observed, even as high as 125° C. Colonel Beveridge and Mr. Durrant were thus able to

establish the fact that the temperatures of the biscuit were such during baking as to rule out the idea that the ova, which do not survive a temperature of 69° C. for twelve minutes, were deposited in the biscuit before cooking.

After the baking is completed the biscuits are always cooled, and it is at this period that they are most exposed to risk of infestation by *Ephestia kühniella*. This is an insect of great nuisance in flour mills. So persistent and numerous are they at times that they clog the rollers with their cocoons, and sometimes completely stop them. The webbing of the elevators in the mills gets covered with them and their silky skeins, and also stops working. They mat together the flour and meal with their silken excreta, and so uniform is the temperature of the mill, and so favourable to the life of the insect, that they complete their life cycle in this country in two months, and in the warmer parts of America even more rapidly. In well heated mills the proceeding is continuous, so that six generations at least may be produced each year.

The only method of getting rid of this pest is a complete and thorough fumigation of the premises with carbon bisulphide. But, as this substance is not only poisonous but inflammable, it is well to get a chemist to undertake the proceeding, and also to notify the insurance company. Fumigation by sulphur ruins the flour. Another remedial measure is that of turning the steam from the engines on to all the infected machinery and walls.

That this destruction of the biscuit is a matter of considerable importance is shown by the fact that biscuit rations exported to the colonies in hermetically-sealed tins have become quite unfit for consumption, and this has been noted in places as far distant from each other as Gibraltar and Malta, the Sudan, Mauritius, Ceylon, and South Africa. But it is also an old trouble, as shown by the following quotation from the diary of Sergeant Daniel Nicol, of the 92nd Gordon Highlanders, which he kept during the expedition to Egypt in 1801:

Some vessels were dispatched to Macri Bay for bullocks and others to Smyrna and Aleppo for bread which was furnished us by the Turks, a kind of hard dry husk. We were glad to get this, as we were then put on full rations, and our biscuits were bad and full of worms; many of our men could only eat them in the dark.²

With regard to the actual baking of the biscuit, Colonel Beveridge and Mr. Durrant suggest that the temperature conditions during the process of cooling should be made as unfavourable as possible for the moths by introducing screened cool air which can be forced in at one end and sucked out at the other. Could such a scheme be adopted it would be difficult, if not impossible, for the moths to lay their eggs, and the biscuit would thus be more rapidly cooled. In any case it should not be difficult to ensure that the cooling takes place in some chamber which is practically free from these destructive moths.

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THE Ohio State Board of Administration has, we learn from *Science*, established a psychological bureau for the study and care of juvenile delinquents. The chief of the bureau, Dr. Thomas H. Haines, Professor of Psychology in the Ohio State University, has a staff of eight assistants, including three psychologists, a diagnostician, and a bacteriologist.

THE Belgian News Fund has arranged to publish weekly a small newspaper, entitled *L'Echo de Belgique* (*De Stem uit België*), the object of which is to supply information primarily to the Belgian refugees of current events, both here and in their own country. Owing to the war, many thousands of Belgians have lost all trace of their families and friends, and a special feature will be the free insertion of notices asking for information of their whereabouts and welfare. The paper is printed in French and Flemish and published at 43, Palace Street, S.W., and 69, Lombard Street, and it is hoped that Belgians resident in this country and other sympathizers will assist the publication by subscribing 5s., which will entitle them to free copies weekly until the end of the year. Copies of the paper will be distributed gratis to the refugees at the various places where they are being accommodated. *L'Echo de Belgique* is published with the authorization of the Belgian Minister, Count de Lalaing, and it is issued for a philanthropic purpose and not as a commercial enterprise.

EIGHTY-SECOND ANNUAL MEETING

OF THE

British Medical Association.

Held in Aberdeen on July 29th, 30th, and 31st.

PROCEEDINGS OF SECTIONS.

SECTION OF DERMATOLOGY AND
SYPHILOLOGY.

ALFRED EDDOWES, M.D., President.

DISCUSSION ON
THE TREATMENT OF SYPHILIS.*

OPENING PAPERS.

I.—J. E. R. McDONAGH, F.R.C.S.

(Abstract.)

UNTIL we know the cause of a disease its treatment must be empirical. Knowing the cause of a disease, we cannot gauge the effects of the treatment until a sufficient number of years has elapsed to enable us to do so from clinical experience, since no tests can be sufficiently relied upon to take the place of clinical experience.

Most of you are no doubt aware that, in my opinion, the *Spirochaeta pallida* is not the actual cause of syphilis. It is merely the adult male of a complicated life-cycle. There is also a female, and spores result from the fertilization of the female cell by the *Spirochaeta pallida*. The adult sexual bodies are the main cause of the symptoms, while the spore is the cause of the disease.

Before describing to you the way in which I now treat syphilis, and giving you the reasons why such and such a course is adopted, it would be as well to make a few generalizations the knowledge of which is important, and which must be understood before treatment is prescribed.

It must be remembered that the tendency of all protozoal diseases, the symptoms of which are dependent upon the completion of a life-cycle by the organism causing infection, is towards spontaneous cure, as, the longer the parasite is in the host, the less able is it to complete its cycle and the less influence treatment has upon it.

Although treatment may do much to prevent the organism from completing its life-cycle, the host does more, and one may say, in effect, that treatment is only able to prevent the parasite from completing its cycles provided it is prescribed sufficiently early in the onset of the infection.

Salvarsan will kill the spores in the earliest stages of the disease, while it is without effect in the late stages. In the late stages the symptoms vanish, not from destruction of the spores, but from the destruction of the ripe gametes to which the spores give rise. Therefore it behoves us, more than ever before, to diagnose a recent infection as soon as possible, and without delay to give treatment which will be sufficient to cure the case.

Excision of the primary sore, when possible, is, in my opinion, essential, and a clinical observation in support of this view is the fact that many primary sores which become phagedaenic are not followed by further evidences of syphilis, or, in those which are followed by symptoms, their onset is frequently delayed for months.

Owing to the fact that salvarsan is the most potent anti-syphilitic drug we at present possess, the remarks I have to make about the treatment of syphilis can be curtailed if they are made to centre around this drug. In discussing the action of salvarsan, reference will be made to the preparation which is now supplied, since it is considerably feeble in its action than the drug which was first used.

The majority of the cases of primary syphilis to which one injection was given over four years ago are now both clinically and serologically sound.

The majority of the cases of primary syphilis to which two injections of salvarsan were given when the drug

* This discussion took place in the combined Sections of Dermatology and Syphilology and of Naval and Military Medicine and Surgery.