The help of Private Webster, A.I.F., and Private Whally, R.A.M.C., has been invaluable in the care of the animals, and our thanks are also due to Private Urquhart, R.A.M.C., our laboratory attendant, for much hard work in the preparation of media.

NOTE BY COLONEL S. L. CUMMINS, C.M.G., A.M.S.,
Advisor in Pathology, British Armies in France.

While Major H. G. Gibson, R.A.M.C., was actually engaged in preparing the above summary he was himself attacked by the disease in its severest form. He and his colleagues had been working for long hours in the laboratory at cultural and passage experiments with the organism believed to be the "filtrable virus" of influenza, and the attack found him overdone and weary from his self-forgetting efforts to solve a problem of pressing military and general importance. Major Gibson had no opportunity of revising or even finishing the summary, which has had to be completed from his notes and records.

His death, a grievous loss to medical science and to the Royal Army Medical Corps, was still such an end as a soldier would have chosen. Laborious tasks cheerfully undertaken and dangers resolutely faced are no less glorious in the laboratory than in the trenches.

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SYMPTOMS OF HYPERTHYROIDISM OBSERVED IN EXHAUSTED SOLDIERS.

BY

W. JOHNSON, MAJOR R.A.M.C.(S.R.).

THE close association between emotional states and Graves's disease has long been pointed out. During the course of the present war reference to mild conditions of the disease occurring in soldiers has been fairly frequent, and warrant a consideration of the question of the relation between emotion and hyperthyroidism.

In the later part of the year 1917, in a certain forward area, I was able (largely with the help of Captain F. S. Walker, R.A.M.C.T.) to observe and take brief notes on fifty cases in which the condition was clinically demonstrable. These cases were admitted into a centre for psychoneuroses and formed a small percentage of the total admissions.

EMOTIONS AND THE INTERNAL SECRETIONS.

The observations of Cannon have thrown considerable light on the intimate relation existing between emotions and the internal secretions.

Beginning by directing attention to the fact that the well known manifestations of emotional states (for example, pallor, blushing, palpitation, increased cardiac and respiratory action, etc.) are all evidence of sympathetic nervous activity, he proceeded to investigate the question of how an emotional upset produces such results. By experiments on animals kept in a state of fear, anxiety, and anger, he was able to demonstrate that suprarenal activity was stimulated; and that an increase in the adrenin content of the blood in the suprarenal vein could be demonstrated. Adrenin acts by direct stimulation of that portion of the sympathetic nervous system which is styled the vertebral sympathetic or the sympathetic proper. It is therefore seen that it is the increased output of adrenin, by producing profound sympathetic activity, which is responsible for the physical manifestations of emotion.

Cannon also points out that the sympathetic activity produced by increased adrenin secretion is all directed towards toning up and sustaining the physical powers for battle—that is, the staying power. Without going into the question of the relative degree to which the various

organs of internal secretion may be involved in the production of this result, it seems certain that, at least, the suprarenal and thyroid glands are two of the most important.

Increased adrenin secretion causes:

1. An increase in the blood sugar;
2. An improvement in the contraction of a fatigued muscle;
3. An increase in the coagulability of the blood;
4. A rise in the blood pressure by constricting the splanchnic area.
5. An increase in force and frequency of the cardiac beat.

In view of the cases about to be described, I add here the generally accepted view of the function of thyroid secretion.

1. It is said to reinforce the action of adrenin.
2. When it is absent or diminished, conditions of mental inactivity—that is, myxoedema and cretinism, result.
3. Where it is present in excess there is a state of mental excitation.

In an individual who is exposed to emotional stress for weeks—sometimes months—without being able to perform the active bodily movements (fighting, running, etc.) which are the natural expression of the emotion, the increased internal secretions which have been produced in his body become, as it were, "a drug on the market." Their physiological circle is uncompleted, and where the emotional state has been excessive and prolonged—as was the case with soldiers under recent military conditions—it seems possible that the accumulation of the excessive products of internal secretion in the body may produce pathological conditions.

It would appear, then, that the various symptoms exhibited by men breaking down in the line have a definite basis. The patient presents those states which are recognized as being produced by sympathetic activity, but he presents them in a riotous way. He has palpitation and tachycardia, disordered activity of the alimentary canal, dilated pupils, protrusion of the eyeballs, sweating and vasomotor disturbance. Added to these are the various subjective complaints which are the results of these states—that is, headache, dizziness, dyspepsia, indigestion, loss of weight, weakness on exertion, and that general unhappy condition described by the patient as "nervousness." In this latter term he includes that feeling of irritability which he is distressed to find he is unable to control.

In a recent paper¹ it was stated that a series of cases, belonging to the group of irritable heart, psychoneuroses, etc., showed a hyper-susceptibility to injections of adrenin. The present paper supplies evidence that in the early days of severe exhaustion, symptoms attributed to hyperthyroidism may be observed. These symptoms were observed within a few hours of the patient leaving the battle line, and it was found that, after two or three weeks' rest, marked amelioration of the condition occurred. Details as to the particular nature of the fighting and the relation to the total number of psychoneuroses admitted during the time cannot be given, and systematic and scientific investigation was impossible under the circumstances.

Clinical Description.

In the first two cases that drew attention to the condition exophthalmos was pronounced and there was definite enlargement of the thyroid gland. In five other cases only was any increase in size of the thyroid gland noted, and in these the enlargement was limited to one or other lobe. The clinical picture of Graves's disease was, in all these cases, complete.

In the remaining forty-three cases it could not be said that the thyroid gland showed any alteration in size, although in many there was a slight fullness about the neck. The degree of exophthalmos, however, sufficed to occasion remark and to call for special observation and examination. It then became apparent that the whole fifty cases formed one clinical group and varied only in the degree with which the symptoms were exhibited.

The ages of the patients varied from 21 to 43 years—the majority being between the ages of 23 and 35. In only one

case was a history obtained of a previous condition of exophthalmos.

In general appearance the man was pale, looked ill, and was exhausted. There had usually been a recent loss of weight. The whole surface of the skin was soft and moist, and, in many cases, beaded with perspiration. The extremities, as a rule, were cold and cyanosed.

The mental state was usually one of subdued excitement. The patient would be worried and troubled, and possessed very little or no emotional control. Some had struggled to remain at duty and were ashamed at having broken down. A few had been sent to hospital as the result of being blown over by shell explosions, but the majority had broken down under the strain of heavy fighting. A serious result of this state of mental tension is the excessive irritability which these patients show. A very slight disturbance or noise at night is sufficient to waken them, and once awake their mental activity successfully banishes all possibility of sleep. This irregularity in sleep had frequently lasted for weeks.

Prominence of the eyes, more or less marked, was exhibited by all the cases. The facial expression was one of fear and anxiety. In some the exophthalmos was so pronounced that the eyes seemed to be starting from the head, and the patient, when handed a looking-glass, has been astounded at his own appearance. As a rule, however, the amount of sclerotic visible round the corneal margin was small and the result was a definite staring expression. In all cases von Graefe's sign (that is, lagging of the upper eyelids when the eye is made to follow a slow downward movement of the finger) was well marked. Joffrey's sign (that is, absence of wrinkling of the forehead on looking up) was found in those cases in which exophthalmos was most pronounced.

Muscular System.—Ordinary muscular movements were carried out in a quick, excitable manner, and any effort easily produced sweating and a sense of fatigue. As a rule, the inability to sustain ordinary exertion was the most common subjective condition.

Tremor was a constant phenomenon. Occasionally it could be observed—affecting the arms and head—as the patient lay quietly in bed. It could always, however, be brought out by causing the arms to be held horizontally in front of the body. It was then seen to be very fine and rhythmical, affecting more especially the fingers. If the man was made to stand up, a slight general tremulous condition could be observed affecting the whole body.

Reflexes.—The nervous reflexes showed slight alterations. The pupils were usually slightly dilated, and gave a slow diminished reaction to light. The tendon reflexes were always exaggerated, and in a few cases unsustained patellar and ankle clonus were obtained. The pilomotor reflex was more frequently absent than present. The line produced on the skin in performing this test was usually abnormally red and persistent.

The subjective symptoms varied widely. Usually the man said he had become "nervous and weak," that he suffered from throbbing headaches, dizziness, palpitation, and precordial pains, more especially on exertion. Digestive discomfort and diarrhoea were complained of more rarely. A few had frequency of micturition. Sleep would be irregular and easily disturbed. Dreams, in which the patient would wake up in a profuse perspiration, were common.

The whole general state of the individual was one of querulousness and anxiety—the attitude of the man who feels that he cannot drive himself one step further.

Case 1.—Pte. C., aged 35, prior to the war had lived all his life in Manchester. He had got thinner during the past six months, and now suffered from headache, perspirations, and general weakness. He broke down in the line. The hands were purplish-blue and showed a fine tremor. The pulse, taken in bed, was 90. There was slight prominence of the eyes, and well defined von Graefe's sign. The right side of the thyroid gland was enlarged.

Case 2.—Pte. T., aged 26, on admission complained of headache, had a general tremulous condition; speech was hesitating. The eyes were very staring and prominent, and von Graefe's sign was marked. The pulse, taken in bed, was 84. The thyroid appeared normal in size.

Case 3.—Pte. A., aged 31, complained of feeling weak and unable to stand shell fire; he had felt ashamed of his condition, and had tried his utmost to keep himself controlled. He was thin, said he easily got short of breath, and that he sweated profusely. The thyroid was apparently normal. The pulse,

taken when up, was 120. The eyes were prominent; von Graefe's sign was slight.

Case 4.—Pte. F., aged 40, was admitted mute, a shell having dropped within twenty yards of him. He had lost weight in the last two years, and now suffered from headache, palpitation, dyspnoea on exertion, and profuse perspiration. The pulse, taken when up, was 130. The hands were tremulous, and there was marked prominence of the eyeballs. Von Graefe's sign was present. There was fullness of the thyroid on the right side.

Course.

It was found that after a rest in bed (with full diet, suitable tonics, and occasionally Dover's powder at night) the condition of all patients rapidly improved in ten to fourteen days. At the end of that time the exophthalmos had greatly decreased, and in about half the cases had disappeared altogether, although von Graefe's sign was still slightly positive. The pulse remained rapid and excitable, and the general subjective symptoms always appeared to be within call if the patient experienced any excitement. It is of interest to point out here that Dr. Hale White has described cases of Graves's disease in which not only improvement but apparently complete recovery had occurred. It is, unfortunately, impossible to give the later history of the patients described in this paper. A few I kept for a month were still unfit for duty at the end of that time. The remainder were evacuated to the base after two or three weeks' observation.

Observations on Cases.

1. *Heart.*—The condition described in connexion with "effort syndrome" was frequently found—the cardiac impulse being diffuse and heaving in character. In a few cases a well marked soft systolic murmur was to be heard over the base of the heart when the patient was lying down. It was loudest over the third or fourth left intercostal space close to the sternum. It disappeared on the patient standing up or after two or three days' rest in bed. In the majority of cases the apex beat, on palpation, extended $\frac{1}{2}$ in. or more outside the nipple line.

2. *The pulse rate* varied within a wide range in the one individual without appreciable cause. The rate which had been 80 or 90 in bed would become 120 to 130 when the patient had walked a little while. Captain Walker took a careful series of pulse rates and found that this condition still persisted at the end of three weeks. The accompanying chart shows this, as also the fact that at first the pulse rate in bed takes a few days to settle down to an average of about 80, and then remains at that figure, while the "up" pulse rate keeps a fairly constant level the whole time.

Chart showing morning pulse taken in bed, and evening pulse, taken after the patient had been up a few hours. It illustrates the abnormal excitability of the pulse rate, in these patients.

3. *Blood Pressure.*—The observations we carried out showed wide variability of the maximum pressure at the wrist in different patients. It ranged from 126 mm. to 148 mm. of mercury, and did not appear to show any relation whatever to variation of the pulse rate.

4. *Vasomotor State and Sweating.*—Abnormal condition was the rule. On parade I have noticed a patient exhibiting pallor and sweating of the face, associated with a cold, moist, and dusky cyanotic condition of the hands. The same patient put to bed has presented in a short time a flushed face, hands moist and warm and a reddish-purple colour. In both states there appears to be vasomotor stasis, as pressure with the finger easily empties the vessels, and the colour takes an abnormal time to return.

5. *Blood.*—Samples of blood from six patients failed to show the presence of any hyperglycaemia.

6. *Urine.*—In about one-third of the cases the urine was tested and no reduction of Fehling's solution occurred.

7. *Adrenalin Test.*—Two drops of the ordinary adrenalin solution (1 in 1,000) were dropped into the eye in a few cases. No alteration in the size of the pupil or change in the pulse rate was observed. It is hoped to reinvestigate with various strengths of adrenalin this test, which may prove to be a highly important one.

8. *Effect on the Pulse Rate of Deep Pressure on the Eyeball.*—The result was not constant. In one marked case the pulse rate dropped from 130 to 90; in another the pulse died under one's fingers and became quite imperceptible; and in yet another the pressure in the pulse seemed to decrease markedly, and the rate fell from 120 to 100. In the normal person the pulse rate is retarded 6 to 10 beats a minute.

It is not out of place here to mention that, a short time previously to observing these cases, Lieutenant W. R. Stuart, R.A.M.C., and I made similar observations on 200 cases of men who were in need of a rest from the line. In these the heart, pulse, and vasomotor condition were all very similar to what has been mentioned above, and in fact the patients, with the exception of there being no exophthalmos, presented an identical clinical picture.

SUMMARY.

The points which I desire to draw attention to are:

- (a) The occurrence of a definite condition of exophthalmos in exhausted soldiers.
- (b) The fact that this exophthalmos is present in the early stage of advanced conditions of exhaustion, and that it is only temporary, lasting usually two to three weeks.
- (c) When it disappears the patient at once merges into the group of cases labelled "neurasthenia," and is indistinguishable from them.

The following hypothesis therefore appears possible:

1. That a large number of so-called psychoneuroses are cases in which the symptoms are due to a state of disordered internal secretion the result largely of emotional exhaustion, and, to a less degree, of physical exhaustion.
2. That many cases which are later diagnosed irritable heart, D.A.H., soldier's heart, and neurasthenia, are really cases of this class, and that possibly many have passed through a slight state of exophthalmos without its importance being realized.

I would therefore suggest the advisability of classing the whole group under a suitable term.

Exhaustion syndrome would appear to be most applicable, and would possess the great advantage of not suggesting a period of chronic invalidism—such as a soldier associates with D.A.H., neurasthenia, and similar terms.

Having observed some thousands of cases of breakdown in the line—in men otherwise healthy—I have become impressed by the fundamental unity of the group, and by the fact that exhaustion is the active etiological factor.

[I am indebted to Lieut.-Colonel Gordon Holmes for helpful criticism in the arrangement of this paper.]

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NOTE ON HAEMORRHAGIC SPINAL EFFUSIONS.

BY

COLONEL W. P. S. BRANSON, A.M.S.

(By leave of the Director-General Medical Services, British Armies in France.)

I HAVE lately seen two examples of a malady which is new to me, and I wish to put this brief note of them on record, incomplete though it is, in order to elicit information.

The cases occurred in Belgium in January, 1919. Both patients were British private soldiers of different units, and the influenza epidemic was still severe among the troops in the neighbourhood. The patients were treated in No. 48 Casualty Clearing Station at Namur.

General Clinical Features.

The clinical features of the illness were so nearly identical in the two cases (with exceptions which will be noted) that one description will serve for both.

The patient fell ill suddenly with extreme frontal headache and stiffness of the neck, and vomited once or twice but no more. He was practically afebrile throughout, though a twelve-hourly chart showed fitful elevations of temperature to 100° F. or less. His face had the peculiar subcyanotic tint so characteristic of the present epidemic of influenza. Mentally he was clear and exhibited none of the lethargy and torpor to be expected in a victim of cerebro-spinal meningitis having the same degree of headache. The pulse rate was normal and no complaint was made of generalized aching. Kernig's sign was not conclusively present.

Lumbar puncture (in one instance on the second day of the disease, in the other on the fourth) produced 40 to 50 c.cm. of a highly bloody fluid, under considerable pressure. A test tube full of this fluid left standing for twenty-four hours showed a clear supernatant fluid and a deposit of blood cells in about equal proportions. Repetition of the puncture on the two succeeding days produced 30 to 40 c.cm. of a similar fluid, but visibly less bloody. By this time in each case amelioration of symptoms was so far advanced that nothing further was done. One patient was evacuated to the base, convalescent, the other had reached the seventeenth day of his illness when I last heard of him and bade fair to make a good recovery, though both of them were slow in getting rid of their headaches.

Examination of Spinal Fluids.

The examination of the spinal fluids was carried out under great difficulties (his laboratory being some twenty miles away) by Captain G. A. Wyon, R.A.M.C., of the 19th Mobile Laboratory, to whom I am indebted for the following particulars:

1. No organisms could be found in films (five examinations).
2. Each spinal fluid was cultivated twice and all the cultures remained sterile.
3. The cytology of the fluid is uncertain. In one case no count was made, but Captain Wyon's clear impression is that polymorphonuclear leucocytes predominated, and were in excess relatively to the red blood cells. In the other case a single relative count of leucocytes gave the following result: Polymorphonuclears 96 per cent., lymphocytes 3 per cent., large mononuclears 1 per cent.

Differences between the Cases.

I spoke above of items not common to both patients.

(a) The first patient was taken ill at the conclusion of a three days' journey in a lorry, and a note from his regimental medical officer said that a number of men who had made the same journey had been seized with headache and vomiting and themselves attributed their symptoms to gassing by petrol fumes while in the lorry. We, however, in the casualty clearing station saw no more of these patients, so that it is to be presumed that the symptoms were fugitive.

(b) The second patient had made no such journey, and he also differed from the other in two subordinate respects: (1) He had a persistent cough, with expectoration; (2) the stiffness of his neck was associated with a band of bilateral hyperaesthesia (which he plotted out spontaneously in the most certain fashion). This band was about 2 inches broad, and ran downward from the cervical spine along the upper border of the trapezius to the top of the shoulder on each side.

Commentary.

I do not know what this ailment was, but it pretty certainly was not cerebro-spinal meningitis, of which disease I saw a few sporadic cases at about this time. At a guess I should say it was a variety of influenza, mainly because the complexion of its victims was that of the influenzal, and I have not observed that peculiar bluish flush in any other malady.

I saw the same flush in another anomalous patient during this period. His symptoms were high fever, lethargy, and right hemiparesis. His cerebro-spinal fluid was perfectly clear. He recovered in about three weeks, sufficiently, at least, to be sent to the base convalescent. I called his ailment "lethargic encephalitis" on the score