

be the safer of the two. I have myself never hesitated to use it in the most extensive cases of disease, and have never yet had occasion to repent having done so. I have only to add, in the words of Mr. Smith, slightly altered, that if he does not yet see the merits of the treatment by the ligature so clearly as I do, I can only hope that his conversion may arrive in time.

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## ON FATIGUE.

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THE recent discussion in the pages of THE LANCET on the effects of overwork, to which Dr. Wilks, Dr. George Johnson, and Dr. Savage have contributed their experiences, has induced the author of this paper to reduce his views on the same subject to a definite form, in the hope that they may prove interesting.

Work results in fatigue, and fatigue is a regular and constantly returning symptom experienced by all of us. Periods of functional activity invariably alternate with periods of repose, during which the waste caused by the exercise of function is repaired. We are indebted to Sir James Paget for having pointed out in his Croonian Lecture, delivered some years since before the Royal Society, that "rhythmic nutrition" is a law of nature; but, although the truth of this dogma is recognised on all hands, and may be said to be axiomatic, it has hardly received that careful consideration at the hands of practical physicians which it deserves.

Our whole life consists of a series of vibrations—periods of tension alternating with periods of relaxation; and, although the rapidity of these vibrations varies immensely, they are recognisable in all our acts, be they voluntary or involuntary. Let us look first to the "vibrations" of an organ the movements of which are placed entirely beyond our own control—the heart. Now, the rate of vibration of the heart is 72 per minute, and if the total period of each vibration be divided into ten parts, it will be found that four of these parts are devoted to the process known as *systole*, which may be looked upon as labour; three are occupied by the *diastole*, which, although hardly labour, is nevertheless exercise of function; and the remaining three parts are occupied by the *pause*, during which the heart apparently enjoys absolute rest from any exercise of function, and may be considered to be in a condition analogous to sleep. May we not apply the rate of action of this organ, which has been regulated for us, to our voluntary acts, and may not the heart be made to give the key-note, as it were, to many questions, personal and social? If we divide the day of twenty-four hours into ten equal parts, and give four of these to active work, three to functional exercise of other kinds, and three to sleep, we shall find that nine and a half hours' work, seven and a quarter hours' "relaxation," and seven and a quarter hours' sleep, is what a normal man may perform without injury to himself. "Eight hours' work and eight hours' play, eight hours' sleep and eight shillings a day," is said to be the dream of the trades unions, but, if they are guided by the heart, they ought to add an hour and a half to the period of labour, and take three-quarters of an hour from each of the other divisions of the day.

To continue with the consideration of our "vital vibrations," I may remark that it is universally ordained among civilised nations that once in every seven days there shall be a remission of labour and a change of occupation; and we further recognise the fact that it is highly advisable for those who are occupied in monotonous pursuits to break away from them at least once a year, and indulge in that variety of work which we call amusement. Monotonous repetitions of the same act are acknowledged, on all hands, to be the most potent causes of fatigue. "It aint the untin as urts im," said *Punch's* horse-dealer, "it's the ammer, ammer, ammer on the ar digh roads;" and in this remark there was undoubtedly much practical wisdom which is very generally applicable.

Fatigue occurs directly we attempt to alter the rhythm

of our vital vibrations by prolonging the periods of tension at the expense of the periods of relaxation, or by demanding for any length of time a quickening of the normal rate of vibration; and it is not unreasonable to suppose that every organ of the body has its "normal rate of vibration," if we could only determine what it is.

We recognise the fact that athletes who "over-train" run risks of cardiac troubles and loss of wind; that the man who, from any cause, is unable to sleep runs a serious risk of permanent impairment of health; and when we find patients pursuing their avocations too zealously we know that, if such offence against the laws of nature be persisted in, general paralysis or other form of "break-down" is likely to be the result.

Fatigue may be general or local, and both forms may be either acute or chronic.

That fatigue in all its forms is due to impaired nutrition there can be little doubt, and we shall find that the symptoms of chronic fatigue are often the prelude of definite and recognisable degenerative changes.

As to *general fatigue*, it is recognisable with ease both in its acute and chronic forms. There is a disability for performing either mental or physical work, and this disability is noticed first in work requiring attention and sustained effort, and, lastly, in those acts which have become automatic. The symptoms of general fatigue are referable usually to the brain and nervous system.

As to *local fatigue*, this, again, may be acute or chronic, and the symptoms of it are referable usually to the muscles; but we must always bear in mind that muscle and motor-nerve are one and indivisible, and that recent experiments have given great probability to the idea that every muscle is connected with a certain definite spot in the brain. When, therefore, we speak of a sense of fatigue we must necessarily be in doubt, notwithstanding the fact that the symptoms are referred to the muscle, whether brain, nerve, or muscle, one or all of them be really at fault. The symptoms of acute local fatigue are (1) *loss of power* to a greater or less extent. By too frequent or too prolonged stimulation the irritability of muscular tissue becomes exhausted, and it either refuses to respond or responds but feebly to the stimulus of the will; our power of adjusting the force of contraction to the act to be accomplished is lessened, and accuracy of movement and delicacy of co-ordination become impossible. (2) *Tremor* is a symptom of acute local fatigue, which everyone who has been called upon for extraordinary muscular effort must have experienced. (3) *Cramp-like* contraction is the symptom of local fatigue which disturbs our rest after a hard day's walking or riding, or muscular efforts in the ball-room or elsewhere. (4) The *pain* of fatigue is familiar to most of us, and is readily distinguishable from other forms of pain.

Local fatigue is caused far sooner by prolonged and sustained muscular effort than by repetitions of short muscular efforts having due intervals of relaxation between them. Anyone who has attempted to hold out a weight at arm's-length knows the impossibility of a long continuance of the effort, and it is proverbially true that standing in one position is to most people far more tiring than walking, the reason apparently being that in standing the muscles which support the body are subjected to a prolonged strain, while in walking we use the muscles on either side of the body alternately. The great increase of working power which we obtain by this alternating use of the muscles would seem to be one of the chief reasons for the bilateral symmetry of the body. Not only is sustained effort a far more potent cause of fatigue than repeated effort, but we find that, when fatigue supervenes, actions requiring sustained effort, be they physical or mental, are the first to fail, while automatic actions endure the longest, and in this respect local fatigue resembles general fatigue. It is quite possible to exhaust a muscle by artificial stimulation, and if one of the small interossei muscles of the hand be continuously faradised, it will be found that in a short time its power of contracting under any form of stimulus will be absolutely abolished. It is tolerably certain that the brain can have no share in artificial fatigue thus produced, and there seems good reason to suppose that in some people of energetic temperament the irritability of a muscle may be exhausted while the power of mental stimulation remains unimpaired.

*Chronic local fatigue* has causes and symptoms similar to

those of acute local fatigue, and there can be little doubt that this condition is a common cause of many of those chronic maladies which seem to result from overwork, and which are characterised by irregular muscular action. That some cases of writer's cramp, torticollis, and hammer-palsy, are due to chronic fatigue of the muscles employed, there can be little doubt. Duchenne and Mr. Brudenell Carter have pointed out how, in cases of short sight, the prolonged strain of the internal recti has caused troubles of vision and even cerebral symptoms; and quite lately Dr. C. B. Taylor, of Nottingham, has shown reason for including in the category of "fatigue diseases" a peculiar form of nystagmus occurring amongst miners, who try their eyes by working in the dark, and the author has little doubt that, attention having been directed to the symptoms and effects of fatigue, additional light on the subject will be forthcoming.

Wimpole-street.

### CONCLUDING REPORT

OF A

### CASE OF INNOMINATE ANEURISM.

LIGATURE OF THE LEFT COMMON CAROTID ARTERY, FOR ANEURISM AT ITS BIFURCATION.

By FREDERICK ENSOR, M.R.C.S.,

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THE readers of THE LANCET of February 6th last will have noticed the report of a case of innominate aneurism treated by ligature of the carotid and subclavian arteries simultaneously. As it may be considered one of some surgical interest, and an example of a mode of treatment as yet on its trial, I think it right to publish the ultimate result of the case.

The operation was performed on Sept. 8th, and up to date of last report the man was going on favourably. The subclavian wound had firmly healed, and there was but a little stain of discharge from a granulating spot in the line of the carotid incision. The patient had little or no pain, the impulse was less, the bruit was less marked, and there was very trifling impediment to his deglutition, and he was allowed to go about the ward.

On Oct. 24th he very imprudently went out of his room with simply his night-dress on, remaining some half an hour out of his bed in the cold. The next morning he was taken with shivering, and had rheumatic-like pains generally. The pulse rose to 95, the impulse became very marked above the clavicle, and a little bleeding came on from the lowest part of the carotid wound. Ordered a mixture of carbonate of ammonia, chlorate of potash, and tincture of aconite, half a minim, every four hours.

Oct. 25th.—Pulse 88.

26th.—Pulse 80; impulse less. No pain.

27th.—Pulse 80.

28th.—Pulse 76. To take the mixture at eleven, four, and nine o'clock.

29th.—Pulse 76. Mixture at eleven and nine o'clock.

30th.—Pulse 75. Bowels too relaxed. To take two minims of tincture of aconite, twenty-five minims of chlorodyne, and one ounce of infusion of gentian, twice a day.

31st.—Pulse 92. Cough very troublesome last night, and after a paroxysm free hæmorrhage came on from carotid wound at 9 P.M. Applied lint soaked in tincture of iron, and strapping, and gave a dose of solution of morphia. This morning lies in a sleepy state. No more hæmorrhage; tumour pulsating forcibly; marked œdema of left hand; some œdema of feet.

Nov. 1st.—Pulse 95. Hæmorrhage again last night after a bad fit of coughing.

2nd.—Pulse 96. No hæmorrhage.

3rd.—Pulse 96. Coughs up a tenacious mucus.

4th.—Pulse 88; impulse feeble.

5th.—Pulse 86. Hæmorrhage at 5 o'clock this morning.

7th.—Pulse feeble. No particular pain in chest. Has had a little œdema of right eyelid for the last two or three days, and to-day the cornea looks cloudy, and is apparently perishing.

9th.—Cornea has given way; vitreous and lens escaped;

eye collapsed. Face a little drawn to left; swallows without much difficulty.

10th.—Hæmorrhage again at 8.30 when in the act of smoking; arrested by the same means as before. Has no difficulty of breathing if he turns his head to the right, but it comes on if he turns it to the left.

11th.—Pulse weak and intermitting; complains of no pain, but, putting his hands together, says "his breath is like that."

12th.—Died comatose at 10 o'clock this morning.

*Necropsy, six hours after death.*—Body thin, but not emaciated. Base of neck above the collar-bones bulging, a plug of coagulum presenting at lower part of carotid wound. In removing the sternum and sternal end of clavicle careful dissection was needed to avoid tearing the parts immediately beneath. The ascending aorta was generally dilated, and arising from it was a semi-solid tumour, formed by the arteria innominata, the size of a small orange. Pericardium filled with fluid. Upper part of right lung symptoms of recent pleurisy. The right subclavian artery was obliterated, and adherent at ligatured part to the first rib. The aneurism had given way just below the ligature of the carotid; the pneumogastric nerve was flattened out on the aneurism. Adhesion of descending aorta to spine, tearing at one point, where a distinct little aneurism, size of a walnut, had corroded the bodies of the tenth and eleventh vertebræ. Lungs were adherent in parts from recent pleurisy, and filled with frothy mucus, but not consolidated. Dura mater adherent in several parts to hemispheres; pia mater opalescent, and evidences of chronic irritation as seen in hard drinkers; excess of fluid at base of brain. Brain-substance pale and soft. The "posterior communicans" artery on right side obliterated, or rather reduced to a fine fibrous thread. Liver very contracted, with marks of old inflammation on its capsule.

The man survived the operation sixty-five days. I think that, had it not been for his imprudence in exposing himself to the cold night air and setting up the acute attack of pleurisy, he would have survived longer; the paroxysm of cough put more strain on the circulation than the weakened artery could bear. But that he would have lived much longer is very improbable, as there was a spot on the posterior aspect of the aneurism which was as thin as a kid glove, and which would have soon given way. I think the man's life was prolonged by the operation—a questionable benefit. I have no doubt he was spared much suffering, both by the operation and by the use of aconite; for had it been left to nature, the tension and erosion of unyielding tissues would have caused constant severe pain, whereas from the time of the ligature of the arteries the pain was diminished in a marked degree; and the end was certainly a euthanasia in comparison with that which I have seen in other cases of aneurism.

In a younger subject, and with as distinct a diagnosis of innominate aneurism, I should not refuse a similar operation; but the diagnosis as to whether the arterial change is limited to the innominate is difficult—that it should be so limited is improbable.

As far as my experience goes, I believe that chronic alcoholism and syphilis are the two most important causes in bringing about that condition of artery which results in aneurism.

### ALCOHOL AS A GENERANT OF THERMO-ELECTRIC CURRENTS IN THE SYSTEM: ONE OF ITS MODES OF ACTION.

By JOHN MULVANY, STAFF-SURG. R.N.

SOME years ago, when the application of ice to the spine became popular, I performed a series of experiments for the purpose of ascertaining its mode of action. Commencing on the lower animals, and studying its influence on the bloodvessels of the brain, with the sympathetics integer or interrupted in their continuity, I soon became cognisant of the initiation of thermo-electric currents by thermal disturbance.

Searching for manifestations of electricity in man from a like source, I was obliged to experiment on an individual