

On The Liability Of Soldiers To Contract Diseases Of The Circulatory System (Continued)

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continuous layer. In the formation of the central nervous system, both strata of the epiblast have a share, though the principal portion is derived from the nervous layer. After the central tube has become separated from the external skin, the two layers forming it fuse together, but there is little doubt that, at a later period, the epidermic layer separates itself again as the central epithelium of the nervous system. Both the nervous and epidermic strata have a share in forming the general epiblast, and though eventually they partially form together, yet the horny layer of the adult epidermis, where such can be distinguished, is probably derived from the epidermic layer of the embryo, and the mucous layer of the epidermis from the embryonic mucous layer. In the formation of the organs of sense, the mucous layer is the most active the lens of the eye and the auditory sac being entirely derived from it, the latter having no external opening. The outer layer of epiblast cells becomes ciliated after the close of the segmentation, but the cilia gradually disappear on the formation of the internal gills. The cilia cause a close rotatory movement of the embryo within the egg, and probably assist in the respiration after it is hatched. They are especially developed on the external gills.

After the disappearance of the segmentation-cavity, the mesoblast forms, according to most authorities, a continuous sheet round the ovum underneath the epiblast. The first important differentiation in it takes place in the axial dorsal line, along which a central end of mesoblast becomes separated from the two lateral sheets to form the notochord. After the formation of the notochord, the mesoblast may be regarded as consisting of two lateral plates continuous ventrally, but separated in the middle line dorsally. By the division of the dorsal parts of these plates into segments, which commences in the region of the neck, and then extends backwards, the mesoblast of the trunk becomes divided into a vertebral portion cleft into separate somnites, and a lateral unsegmented portion.

The hypoblast is continuous with the yolk-cells laterally and in front. The definite closing in of the mesenteron by the true hypoblast cells begins in front and behind, and takes place last of all in the middle. In front this change takes place with greatest rapidity. The cells of the yolk-floor become continuously differentiated into hypoblast-cells, and very soon the whole of the front end becomes completely lined by these hypoblastic cells, while the yolk-cells become confined to the floor of the middle part. The front portion of the mesenteron gives rise to the oesophagus, stomach, and duodenum. Close to its posterior boundary there appears a ventral outgrowth, which is the commencement of the hepatic diverticulum. The yolk is therefore post-hepatic, as in vertebrates generally. The stomodæum is formed comparatively late by an epiblastic invagination. At first, the mesenteron communicates freely with the exterior by the opening of the blastopore. The lips of the blastopore gradually approximate and form a narrow passage, on the dorsal side of which the neural tube opens. The external opening of this passage finally becomes obliterated, and the passage itself is left as a narrow tract leading from the hinder end of the mesenteron into the neural canal. It forms the post-anal gut, and gradually narrows, and finally atrophies. At its front border, on the ventral side, there may be seen a very slight diverticulum of the alimentary tract directed downwards ventrally. This becomes longer, and meets with an invagination of the skin. This invagination is the proctodæum, and an anal perforation ultimately appears at its upper end. The differentiation of the hinder end of the preanal gut takes place in the same way as that of the front end, though somewhat later. It gives rise to the cloacal and intestinal part of the alimentary tract. From the ventral wall of the cloacal section, there grows out the bifid allantoic bladder, which is probably homologous with the allantois of higher vertebrates. After the differentiation of the ventral wall of the anterior and posterior ends of the alimentary tract has proceeded so far, the yolk only forms a floor for a restricted median region of the alimentary cavity, which corresponds to the umbilical canal in the amniota. The true hypoblastic epithelium then grows over the outer side of the yolk, which then constitutes a true, though small and internal, yolk-sac. The yolk-cells enclosed in this sac become gradually absorbed, and the walls of the sac form part of the intestine.

WE are requested to state that Dr. J. A. Menzies, of Cannes, having obtained the necessary permission, will in future practice at Geneva from May to October.

## ON THE LIABILITY OF SOLDIERS TO CONTRACT DISEASES OF THE CIRCULATORY SYSTEM.

BY DEPUTY SURGEON-GENERAL D. CULLEN, M.D.

(Continued from page 999.)

THE examination of the table of diseases shows two obsolete terms—*carditis* and *morbus cordis*—which disappeared with the introduction of the new nomenclature in 1869. The former term was largely used in the returns from India, and embraced cases of palpitation from irritable heart, dilatation and hypertrophy. Its inaccurate use led to criticism in the Madras Statistical Report for 1866, when 127 cases were returned from that command, and only 10 from Bengal, and 3 from Bombay. The 18th Hussars gave 47 cases attributed by the surgeon to the inordinate use of tobacco, the men appearing "to be regularly saturated with nicotine." The term *morbus cordis* had an equally wide interpretation—embracing both functional and organic ailments: thus, 10 cases from the Straits Settlements, in 1868, had "excited action of the heart, accompanied by severe dyspnoea and pain in the cardiac region, sometimes followed by syncope." Under these now happily obsolete terms will be found 616 admissions, 36 deaths, and 97 invalided. The organic diseases of the heart show 9,634 admissions, 1,230 deaths, and 3,629 invalided; while functional diseases cause 5,648 admissions, 12 deaths, and 689 invalided, syncope and palpitation being included in this section. The diseases of the aorta present a total of 959 admissions, 818 deaths, and 167 invalided; diseases of arteries, 389 admissions, 201 deaths, and 137 invalided; diseases of veins, 1,816 admissions, 11 deaths, and 1,073 invalided; while unspecified diseases of the heart and vessels constitute 1,152 admissions, 259 deaths, and 68 invalided.

In the first of these five sections, pericarditis shows no very marked annual variation; 69 admissions, 8 deaths, and 5 invalided are the average annual results. India has a predominance of admissions, the home army of deaths and invalids. The other diseases of the pericardium are unimportant. Endocarditis is a term little employed in the returns.

Disease of the valves has a large significance, the greatest for the decade in all respects of admissions, deaths, and invaliding; although, in the second quinquennial period, palpitation gives the higher admission-rate. The annual average admissions by this disease are 593, in one year reaching 727, the admission-rate for that year in the Madras Presidency being 8.78, or more than double the average of all India, which is 4.20 per 1,000 of mean strength. For the decade, the troops stationed at home, in the Mediterranean, and British America have the smallest admission-rates, varying from 2.68 to 2.88; the garrisons in China, Australia, Japan, and the Straits Settlements give a ratio of 3.51; the West Indies of 4.01; and the group consisting of Mauritius, Ceylon, the Cape of Good Hope, and St. Helena of 5.57; this being the highest annual average with the exception of Madras, which is 5.69. The annual average death-rate is highest in the China group, being .85; Bengal, the Cape group, and West India garrisons are .61; Madras, .58; British America, .51; Home, .34; and the Mediterranean the lowest, .32. The invaliding rate is highest in the Cape group—1.79, and lowest in British America—1.02; in the Mediterranean, 1.61; in India and at home, 1.59; but the Presidencies of India vary from 1.64 in Bengal to 1.38 in Bombay. The high invaliding rate at home is due to the number of recruits who break down in their first year of service.

In 1870-71, of 41,763 recruits joining, 442 were invalided in their first year, of whom 101 were from diseases of the circulation, being 2.42 per 1,000; Dr. Balfour, then the able head of the statistical branch, makes the following comment on the occurrence. Among the recently enlisted soldiers who have broken down, the third great cause of invaliding (coming after tubercular and nervous, chiefly epileptic, diseases) "has been the class of diseases of the circulatory system, and especially valve-disease and hypertrophy of the heart." He names "pack drill, severe exercise, constriction of the chest from tight clothing or accoutrements" as tending to their development, a tendency "aggravated by habits of intemperance or debauchery." This liability among recruits to break down was greatest in the Foot Guards, next in the Artillery, and lowest in the Cavalry and Infantry. Among matured soldiers of the different arms of the service, the liability appears greatest in the Artillery, next in the Infantry, third in the Cavalry, fourth in the Foot Guards; whilst it is lowest in the Household Cavalry. The

death-rate is slightly highest in the Foot Guards; the invaliding rate is highest in the depôts of the Line and Artillery, where the older soldiers are massed, and where it reaches 7 to 8 per 1,000 of mean strength. It has been shown that the highest invaliding rate for valve-disease was in that group of stations associated with the Cape. In 1866, Inspector-General Lawson wrote regarding this affection: "The cause of the valvular disease of the heart seems connected with a rheumatic diathesis, and in this country generally accompanies rheumatic fever with well-marked affection of the joints. Such cases of highly developed rheumatic fever are extremely rare among the troops in South Africa, but muscular rheumatism implicating the parietes of the chest is particularly common during the warm weather." He refers to the easily induced excitable action of the heart at that season, and the possibility, in certain diatheses, of the rheumatic affection inducing structural changes in the valves; while he combats the idea of overexertion or excesses in "Boer brandy" or tobacco causing this relative frequency of cardiac disease.

The effects of the campaign in Abyssinia in 1867-68, in inducing valve-disease, are notable. The whole of the men invalided at Netley after the operations were 76, of whom 16 were for this affection, being in respect of invaliding the most prominent of all diseases. It is, in fact, equal to the whole of the invaliding for miasmatic disease, both being 10.7 per 1,000 of the average annual strength. Inspector-General Currie remarks on the intensely cold nights and hot days—the one Siberian, the other tropical, during the progress of the expedition; these climatic features being accompanied by a remarkably dry condition of the atmosphere. It will be remembered that the forces were six months employed, and marched 800 miles to and from Magdala, some of their camping-grounds being over 10,000 feet above the sea-level, and the paths steep, difficult, and precipitous. "The long ascents and descents of mountain passes and formidable ravines proved excessively fatiguing, and demanded greater physical exertion and powers of endurance than British troops have probably ever undergone." Previous Indian service rendered the men more liable to dysentery, diarrhoea, and ague, which were prevailing diseases; rheumatism was not uncommon, one admission in nineteen being due to this cause. No native liquors were procurable, and there was no intemperance.

The recent operations in the Transvaal and Zululand afford an opportunity for comparing that period of unrest with one slightly preceding it when the troops were settled. From 1867 to 1871, the annual ratio of admissions for diseases of the circulatory system was 9.54 in South Africa; the death-rate was 1.12; the stational invaliding-rate, 3.16; and the final invaliding at Netley, 3.74. Valve-disease of the heart gave, during these five years, nearly half the admissions, more than half of the deaths, and two-thirds of the final invaliding in this class. In the later war period, 1873-80, the annual ratio of admissions for diseases of the circulatory system was 20.93, the death-rate 1.13, the stational invaliding-rate 9.39, and the final invaliding at Netley 4.55. There are no data to carry out the comparison farther.

Deputy Surgeon-General Woolfryes remarks of the Galeaka-Gaika war, that palpitation was common amongst the young soldiers, "brought on by overexertion and excessive fatigue," while "muscular rheumatism, so common in South Africa, did not affect soldiers in the field to any appreciable extent." The 99th Regiment, which was relieved from active service in Zululand, and proceeded to Bermuda, carried with it this tendency to palpitation; while in the 88th Regiment, at Mauritius, cases of valvular disease of the heart occurred attributed to "the hardships and overexertion undergone by that corps while on active service at the Cape of Good Hope."

Taking the year 1869, which gives the highest number of admissions, deaths, and invaliding in the second quinquennial period of the decade on the table, it will be found that diseases of the circulatory system gave a high ratio for that year at home in the depôt battalions of the line, and the depôt brigade, R.A.; valve-disease, hypertrophy, and palpitation being the prevailing forms. The comment is made: "The excess in the artillery may probably be, to some extent, a result of the duties of the men, and in the depôt brigade and depôt battalions it may be a consequence of tropical service, of age, and of the habits of the old soldier."

As a rule, in India the depôts give a high admission-rate for diseases of the circulation; invalids, convalescents, and pensioners being tempted to indulge in the cheap spirit of the country, and intemperance accordingly prevailing. In the foregoing observations, my object has been rather to bring forward the wear and tear of a soldier's avocation, than to lay stress on his vices and irregularities, the effects of syphilis being better understood in

regard to the production of aneurysm and dilatations than valve-disease.

Hypertrophy of the heart comes second in the list in point of importance among the organic diseases of the heart, causing

*This Table gives the Ratio per 1,000 of Mean Strength, and admits of a Comparison being made between the different Arms at Home, and the Troops serving in India for 1869.*

	Diseases of the Circulatory System.			Valve-Disease only.		
	Admission.	Deaths.	Invaliding.	Admission.	Deaths.	Invaliding.
<b>HOME:</b>						
Depôt Battalions .....	17.3	2.25	7.43	6.08	0.84	3.65
Royal Artillery .....	13.9	3.16	7.20	3.54	1.26	2.91
Infantry Regiments .....	12.3	1.17	4.47	4.33	0.35	2.15
Cavalry " .....	5.4	1.64	2.90	2.77	0.38	1.64
<b>INDIAN:</b>						
Madras Troops .....	12.1	1.95	4.50	4.47	0.48	3.46
Bengal " .....	13.9	1.71		4.47	0.85	
Bombay " .....	15.2	1.14		2.00	0.23	

2,474 admissions, 151 deaths, and 803 invalided. In the home army this disability is evenly distributed throughout the ten years; each quinquennial period giving, as compared with other groups of stations, a small admission-rate, the smallest death-rate, and the highest invaliding-rate, due to the number of immature recruits discharged the service under this head. Among the troops abroad, there is a remarkable diminution in the admissions and deaths, with an increase in the invaliding, in the second quinquennial period, probably due to the introduction of the term palpitation in the nomenclature of 1869.

The phenomena of dilatation and hypertrophy vary according to which condition predominates, and both are frequently associated with palpitation. Dr. Maclean, writing in the report for 1867, of 151 cases of heart-disease under his observation at Netley, remarks "82 were under 30, 39 between 30 and 40, the youngest 16, the oldest 40. In only 6 was there a history of acute rheumatism; 22 had a distinct history of syphilis, and 1 of gout. In 72 the aortic valves were diseased, with more or less hypertrophy of the left ventricle, when the disease was aortic obstruction. In 54 the mitral valve was affected, in 25 there was palpitation, often with dilatation of the right side of the heart." The Cape group, India and China, show the highest admission-rates; troops at sea, in the West Indies, the Cape, and India, the highest death-rates; and troops at home the highest invaliding-rate. In the home returns, the annual average is 38 admissions, 5 deaths, and 41 invalided, with no great inequality. Its causes, apart from valve-lesions and obstructions from disease of the great channels, have been ably discussed by Mr. Myers in his Alexander Prize Essay, in which he has fully shown the evils of the mechanical obstruction induced by the soldier's dress and accoutrements in exercising a special influence not at work among civilians. Surgeon Davy has contributed a short essay, written in 1877, to elucidate still farther the special conditions by which mechanical obstruction and excessive strain are induced in the recruit. He discusses the effects of the artificial dilatation of the chest in preliminary setting-up drill, and the subsequent training—four hours a day for six months—as "certain to lay the foundation of much heart-disease in the army, with or without the present uniform." His argument is that hypertrophy commences in the drill-field, the abnormally distended chest causing shallow respiration, an excited action of the right ventricle, and irregularity of the cardiac rhythmical movements, the diminished expiratory acts disturbing the balance of both pulmonary and systemic circulations, and thereby embarrassing the right side of the heart which is over distended with venous blood, the consequence being that when the recruit is made to double, dyspnoea becomes apparent, excessive strain with corresponding cardiac exhaustion results, and, in the end, hypertrophy of the right ventricle with or without dilatation. The impeded respiratory movement is the starting point of the sequence; the training exercises induce excessive muscular pressure on the venous system, and the recruit is thus "the victim of the drill-sergeant's ignorance and superstition." The injudicious handling of recruits at drill was attacked in 1862 in a report by the Professors of the Army Medical School. Atrophy of the heart appears as the cause of 53 admissions, 15 deaths, and 4 invalided—35 of the admissions and 8 of the deaths occurred in India. Dilatation of the heart occasioned 35 admissions, 15 deaths, and



27 invalided; of whom 20 admissions, 7 deaths, and 18 invalided are in the returns from India. Fatty degeneration of the heart has given rise to 106 admissions, 121 deaths, many of them sudden, without doubt, and 25 invalided. In the first quinquennial period, the term in use is degeneration, but I have here arranged them under the one heading. The men most liable to this disability are those employed as canteen and mess waiters, or in situations where tipping habits may be indulged in with considerable impunity. The effect of loss of tone from nervous exhaustion induced by malaria, tropical service, etc., is seen in the higher admission-rates in India than at home. The death-rate and invaliding-rate are almost equal in both armies. The small admission and high death-rate indicate a disease which is insidious in its progress, and rapid in its fatal termination. The abuse of alcoholic liquors, the effects of over-feeding in warm climates, and the tendency to inactive habits engendered by excessive solar heat, account for the predisposition to weak, flabby, fatty hearts so often exhibited in soldiers returning from foreign service. These points have been fully insisted on by a succession of able administrative medical officers in India.

Aneurysm of the heart is given as the cause of 30 admissions, 8 deaths, and 1 invalided. Madras is credited with half the admissions and half the deaths in one year, which is singular if not due to an error in the returns.

Rupture of the heart has occasioned 5 admissions and 13 deaths, 4 admissions and 6 deaths being from India.

Angina pectoris figures largely in the first quinquennial period, causing 216 admissions, and but 52 in the second; nearly two-thirds are from India. There are 8 deaths, and 28 invalided in the decade. [To be continued.]

## EXPERIMENTS ON THE INFLUENCE OF DRUGS ON THE EXCRETION OF UREA AND URIC ACID.

By EDMUND ALLEYNE COOK, L.R.C.P.ED., L.R.C.S.ED.

(Continued from page 858.)

### Action of Powdered Malt on the Excretion of Urea and Uric Acid.

—The commencement of this set of experiments was somewhat irregular, inasmuch as the excretion of uric acid was not normal in amount when the administration of the malt-powder was commenced; and the experiments were somewhat marred by a meeting in close rooms, which had its own influence on the excretion. The experiments were commenced November 17th, 1881, immediately after the last tomato experiments, and when the uric acid excretion, which had been sent up to 19.3 grains, had gradually decreased to 15.3 grains.

Date.	Urine.	To Litmus.	Sp. Gr.	Urea.	Uric Acid.
November 17	30 oz.	acid	1023	345 grs.	16.0 grs.
" 18	43 "	"	1023	385 "	16.6 "
" 19	39 "	"	1023	447 "	13.5 "
" 20	37 "	"	1026	477 "	20.0 "
" 21	51 "	"	1018	443 "	18.8 "
" 22	36 "	"	1028	493 "	15.0 "
" 23	30 "	"	1029	416 "	15.0 "
" 24	34 "	"	1026	400 "	14.4 "
" 25	33 "	"	1028	385 "	12.5 "

On the 16th, the first dose of malt-powder—sifted, to free it from large husks—was taken in the evening. The diet was as stated in former papers, and the quantity of liquid consumed was about six ounces more, *i.e.*, fifty ounces. On the 17th, after each meal, half a teaspoonful of malt-powder was taken, and the diet in all other respects was without variation. All day, a semi-headache was experienced, such as would ordinarily be expected with constipated bowels, but the bowels continued regular. On the 18th, the same amount of malt in the same manner, as also on the 19th; but a meeting was attended on the evening of the 19th. No change of diet. On the 20th, the regular doses of malt were taken, and again on the 21st, and then its administration was discontinued. When the malt administration began, the health was perfect. The second day, an ill-defined headache and sense of bodily fulness was experienced, and this continued more or less throughout the administration; the bowels were regular, and the exercise and sleep as usual. Setting aside the meeting, which apparently caused the large increase of uric acid in the collection of the 20th, the effect of the malt-powder seems to have been to increase the urea excretion considerably, and the uric acid also. There was no other assignable cause for the excretion continuing so much above the normal than the use of the malt; and, on the cessation of its use, the amount excreted fell. The amount of malt used would not itself produce uric acid or urea, but the action of its diastase on the food would

convert the cooked starchy material into maltose much more completely than would ordinary digestion; and this, being conveyed to the liver, and probably stored as glycogen, would increase the liver-activity; and, if the urea be a product of liver-action, the increase would be explained. These experiments are, perhaps, best considered in connection with the following.

### Action of Pepsin on the Elimination of Urea and Uric Acid.

Date.	Urine.	To Litmus.	Sp. Gr.	Urea.	Uric Acid.
December 18	30 oz.	acid	1025	431 grs.	11.6 grs.
" 19	34 "	"	1022	400 "	13.1 "
" 20	36 "	"	1022	447 "	18.0 "
" 21	54 "	"	1016	478 "	18.8 "
" 22	40 "	"	1023	424 "	17.0 "

Christmas irregularities of diet interfered with and confused the conclusion of these experiments.

On each day, pepsin-elixir, of Symes and Co. of Liverpool, was taken in three separate doses of one drachm after each meal, the digestion and bodily health being perfect. On the second day after commencing the pepsin, there existed a feeling of great depression and restlessness, with feverishness, and this continued on the 20th, but in less degree. On the 20th, eight ounces more water were taken, and also on the 21st.

These experiments with malt-powder and with pepsin are by no means perfect, but they point to an increase of both urea and uric acid, caused by the administration; and, since the administration may be presumed to cause increased liver-action because of more perfect digestion, and there exists nothing in either malt or pepsin, in the doses given, sufficient to produce by its presence the increased excretion noted, the tendency of these results is to fix the production of both urea and uric acid on the liver; or, if we cannot go so far as that, we may say that increased liver-action is coincident with increased excretion of these substances. It must be noted that the increased liver-action was caused by increased nutrition, *i.e.*, an increase of nutritive material must have been carried to that organ, although the same diet was continued, because the diet was better digested.

To throw a little more light on the subject, in November 1882, with a diet in most respects similar, and of great regularity, the following was tried.

### Influence of Euonymin on the Elimination of Urea and Uric Acid.

Date.	Urine.	To Litmus.	Sp. Gr.	Urea.	Uric Acid.
November 1	38 oz.	acid	1020	360 grs.	11.7 grs.
" 2	34 "	"	1022	382 "	14.3 "
" 3	50 "	"	1020	340 "	17.4 "
" 4	46 "	"	1020	375 "	14.3 "
" 5	43 "	"	1020	340 "	12.5 "

On October 31st, no drug was taken. On November 1st, one grain of euonymin (brown) was taken on an empty stomach and in solution. On the second, this dose was repeated, and again on the 3rd. On the 4th and 5th, no drug. The life was regular, and the increase of uric acid must be put down to the euonymin. It is seen there is no notable increase of urea. Now, euonymin is reported to be a pure excitant of the liver, and has no other action which has been well studied or which is prominent. The elimination of uric acid, after increasing, is seen to decrease, in spite of the continued administration of the drug; but it must be remembered that euonymin produces an increased action of the bowels, and this would carry off water and, doubtless, other material, which would otherwise pass by the kidneys. This looseness began on the 3rd, and continued, necessitating the conclusion of the experiment.

It has been proved that, when the liver is eliminated from the general circulation, the secretion of urine is entirely suppressed, and only recommences on injecting urea into the general circulation; hence has been deduced the proposition that the liver is the seat of urea formation. Parkes states his belief that urea is largely formed in the liver, and that in acute disease, the deficiency is in proportion to the amount of liver involved. I have not been able to ascertain whether this observation has been continued to the elimination of uric acid, though, of course, if the secretion of urine ceases when the liver is eliminated from the circulation, the excretion of uric acid must cease also.

The question whether urea and uric acid are converted, the one into the other, in the animal organism, has been often discussed and as often left unproved. Parkes remarks: "While the complete destruction of uric acid introduced into the body is quite certain, it is as certain that uric acid, or some amount of it, produced in the body, is not so destroyed, but passes off with the urine." Why should we not suppose that the unknown conditions, which in this case protect the uric acid, may be also protective if uric acid is formed directly from food? In other words, is the parallel drawn between