tion of the toxin, the horse is bled from the jugular vein by means of a sterilised cannula, the blood being collected in sterilised vessels and allowed to coagulate. After standing for twenty-four hours the clear serum is pipetted off into sterilised vessels. This serum contains the antitoxic substance and is the antitoxin, and may be used for injection. By working aseptically there is no difficulty in collecting and keeping the serum sterile; it should, however, be stored in a dark cool place, and a little camphor may be added to it. As cases of tetanus are not common it is customary to evaporate the serum to dryness, the dry substance being more conveniently kept without change. Heat destroys the antitoxin; therefore the evaporation must be performed *in vacuo* over sulphuric acid. A series of glass dishes are arranged one above the other on a metal stand in a large and strong glass receiver, which is connected with an exhaust pump. The glass dishes contain alternately sulphuric acid and the antitoxic serum, those used for the latter having been previously sterilised and covered with pieces of sterilised filter paper. The receiver is exhausted and the serum becomes dry in three or four days. The serum yields 9 to 11 per cent. of the dried substance, which is kept in stoppered bottles in a dark cool place. For use it should be powdered finely, and dissolved in sterilised distilled water without the aid of heat.

PROPERTIES OF THE ANTITOXIN.

Experimentally, the effects of the antitoxin are little short of marvellous. Minute doses injected into animals will completely neutralise fatal doses of the tetanus toxin injected eight to twelve hours afterwards. Thus 0.0005 c.cm. of the antitoxic serum was found to be sufficient to protect a guinea-pig weighing 400 to 500 grammes from the minimum fatal dose of the tetanus toxin, which in the present instance was about 0.01 c.cm. Mixtures of the toxin with the antitoxic serum, in the proportion of 40 or 50 parts of the former to 1 of the latter, are completely inert, and 2 c.cm. of such a mixture, containing nearly 2 c.cm. of the deadly toxin may be injected into a guinea-pig without producing any effect. The antitoxin also possesses considerable curative power, but much larger doses are necessary when the disease has declared itself than when used as an immunising agent.

TREATMENT OF TETANUS IN MAN.

The antitoxin treatment of tetanus would seem to be the one which gives the best hope of cure, though it can hardly be so successful as the corresponding treatment for diphtheria is reported to be. The explanation of this is that tetanus is only recognised as being tetanus at a late stage when the toxins are circulating in the blood; the disease is far advanced before it can be diagnosed. Gowers⁶ estimates the mortality in traumatic tetanus at nearly 90 per cent., and in idiopathic at 50 per cent. I have been able to collect records of 42 cases of tetanus treated with antitoxin, nearly all traumatic, and of these 15 died and 27 recovered, giving a mortality of about 36 per cent. If these figures can be relied on, the result is encouraging, but the tendency is always to report successful cases only. The antitoxin must be administered by subcutaneous injection. It is difficult to state what the dose should be, for this has varied enormously in the recorded cases, from 10 c.cm. to 165 c.cm. Probably 20 c.cm. to 40 c.cm. for a first dose, followed by 10 c.cm. every six or twelve hours would be found most suitable.

Of the dry antitoxin, 1 gramme corresponds to about 10 c.cm. of serum, so that the dose of this would be 1 to 4 grammes. If reduced to an impalpable powder, it dissolves fairly readily, 1 gramme to every 5 c.cm. or 10 c.cm. of sterilised distilled water.

In conclusion, my thanks are due to Professor Crookshank, in whose laboratory part of the above work was carried out, and especially to Professor MacFadyean, Principal of the Royal Veterinary College, where the horse was kept, for kind advice and assistance during the progress of the work.

[NOTE.—The above work was carried out by means of a Government grant. By permission of the Grant Committee of the Royal Society, the immunised horse has been transferred to the British Institute of Preventive Medicine, and the tetanus antitoxin can be supplied on application to the Director, 101, Great Russell Street, W.C.]

⁶ *Manual of Diseases of the Nervous System*, 2nd edition, 1893, p. 685.

REMARKS ON CHRONIC RENAL DISEASE: ITS FREQUENCY IN ASYLUM NECROPSIES, AND ITS POSSIBLE CONNECTION WITH ALCOHOL AS A CAUSE OF INSANITY.

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THE object of this paper is: first, to endeavour to bring into greater prominence the great frequency with which renal disease is seen in asylum *post-mortem* examinations, and at the same time to attempt a comparison with the amount found in a *post-mortem* room of a general hospital; and in the second place, to inquire how far these renal changes may be regarded, as a factor in helping us more accurately to gauge the part alcoholic abuse plays in the etiology of insanity.

The report of the Commissioners in Lunacy for the year 1894 shows that during the five years 1888 to 1892 inclusive the yearly average number of admissions into the various asylums in England and Wales was 7,793 of the male sex, and 8,246 of the female sex, and that the percentage of these set down as caused by intemperance in drink was 20.5 for the former and 8.1 for the latter, or rather more than 14 per cent. of the total admissions of both sexes. The annual reports of individual asylums show a wide variation on each side of this figure. Thus, from the reports before me, the lowest percentage recorded is 5, and the highest is 30, including both sexes, while in the male sex the number sometimes goes up to over 40 per cent. It is very questionable, however, if the whole truth, or anything like it, is represented in these statistics. It so often happens that no trustworthy history of many asylum cases can at all be obtained, and these are then recorded in the table of causes as "Unknown." The number of these unknown causes is usually highest in those reports which show the lowest proportion of cases due to alcoholic excess. How many of these cases should fall under the heading of intemperance?

One of the first things that impressed me in the *post-mortem* room here was the large number of cases in which I found renal disease, chiefly in the form of interstitial changes; and it occurred to me that if they were collected and tabulated, they might perhaps be of service in the above direction.

From the literature regarding diseases of the kidney as seen in asylum necropsies, it would seem that at any rate in former years any special frequency was not noted. Thus, for instance, Bucknill and Tuke distinctly stated that the kidneys are remarkably free from disease in all forms of insanity.¹ Maudsley² observed that there was nothing special to be said concerning diseases of the abdominal viscera. But Dr. Howden many years ago pointed out that in the necropsies at the Montrose Asylum renal disease was frequently to be observed. More recently, especially from America, further facts have been brought forward indicating that, among asylum cases, the kidneys are much more frequently found diseased than was formerly thought; but, as far as I am aware, no attempt has been made to compare numerically the proportion found diseased in asylum *post-mortem* rooms with that in a general hospital.

The following are the results obtained from an examination into the records of the necropsies made at Banstead Asylum from April, 1893, to December, 1894. They numbered 154 (85 males and 69 females), and in 74, or 48 per cent., I found marked renal changes. These changes were visible in the males in 40 per cent., and in the females in 58 per cent. These figures are not intended to represent the entire number of instances in which the kidneys were found diseased, for in arriving at them I have excluded those cases in which there was solely a fatty, tuberculous, or waxy change, and have limited myself to the morbid conditions which might have been brought about by over-indulgence in alcohol. And thus, speaking broadly, the conditions included in my table are two—typical red granular contracted kidneys (with or

¹ In an earlier part of their *Manual* attention is drawn to the fact that alcoholic insanity was then certainly on the increase.

² *The Pathology of Mind*.

without cystic formation), and kidneys (large, normal, or slightly reduced in size) whose capsules are markedly adherent to the cortex (with or without some fatty change). The evidence of interstitial change has not been gathered from mere inspection of the organs only, for, with but few exceptions, the naked-eye observations have been verified with the microscope.³

The next point to be determined is whether this proportion of 48 per cent. is above that which would be found from a similar inquiry into the *post-mortem* records of a large general hospital. This I found by no means an easy question to solve. Dr. Leith, Pathologist to the Edinburgh Royal Infirmary, writes to me that "it is extremely common to meet with minor degrees of cirrhosis in old people, and not infrequent to find granular kidneys in cases where these conditions were not suspected during life." But he was unable to give me any figures. However, owing to the kind interest Dr. Clay Shaw has taken in the matter, I have been able to get some valuable data from St. Bartholomew's Hospital. They are especially valuable in that the district supplying patients to that hospital is included in the area whence the population of the London asylums is drawn. Dr. Herringham, the medical registrar, has been good enough to go over the *post-mortem* records there for the year 1893, and, from 422 necropsies made there during that year, he has drawn up the subjoined table:

TABLE I.—Showing the Frequency and Degree of Kidney Disease found in 422 Necropsies made at St. Bartholomew's Hospital during the year 1893.

Ages	Under 30.		30 to 39.		40 to 49.		50 to 59.		60 and above.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Number of cases in each sex in each age	130	98	39	20	44	17	38	11	20	7
Kidneys large, capsules adherent	6	3	3	3	6	3	1	0	0	0
Ditto, plus a granular surface	0	2	3	3	3	2	1	1	2	1
Ditto, plus diminished or diseased cortex	1	2	0	0	9	4	7	2	5	2
Kidneys small, capsules adherent, surface granular	1	0	0	0	1	1	1	2	0	0
Ditto, plus diminished or diseased cortex	0	1	1	7	2	2	5	4	5	2

The cases, having been primarily divided into male and female, have further been subdivided into five groups, according to age. The total number of cases whose ages fell between the several age periods are stated; and below these, arranged in columns, are the number of instances in which kidney changes were noted. These changes he has divided into five, according to the degree of disease, but in each, he says, distinct signs of interstitial nephritis were present.

On summing up the latter numbers, the following figures are obtained: 23.4 per cent. of the 269 male necropsies, and 30.7 per cent. of the 153 female cases showed one or other of the above renal changes; or, calculating on the totals, out of the whole 422 cases 26 per cent. presented one form or other of these kidney lesions. These percentages are contrasted with those similarly obtained from the *post-mortem* records at Banstead Asylum in the following table:

TABLE II.

Percentage showing Renal Disease:	St. Bartholomew's Hospital.	Banstead Asylum.
Of the male sex.....	23.4	40
Of the female sex.....	30.7	53
Of the total number of cases	26.0	48

³ Since writing the above, I notice in the *Journal of Mental Science*, January, 1895, an article by Dr. Beadles, in which he states, that in the *post-mortem* room at Colney Hatch Asylum, the kidneys show indications of chronic interstitial nephritis in as many as 70 per cent. of the cases.

In order that Dr. Herringham's cases may still further be compared with mine on parallel lines, I have arranged them in a table constructed very similarly to his. It will be observed, however, that I have not separated the kidney lesions into so many degrees; my cases being considerably less in number than his, I felt that such a procedure would be useless.

TABLE III.—Showing the Frequency and Degree of Kidney Disease found in 154 Necropsies made at Banstead Asylum during 1893 and 1894.

Ages at Death	Under 30.		30 to 39.		40 to 49.		50 to 59.		60 and above.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Number of necropsies in each sex in each age-period ..	9	3	24	15	23	13	9	14	20	24
Kidneys large or normal in size, capsules adherent, and with or without some fatty change	2	1	3	6	9	5	1	9	8	4
Granular contracted kidneys	0	0	1	0	2	3	2	2	6	10

In addition to comparing percentages for all ages combined, it was my original intention to compare those similarly calculated for each of the several age-periods; that implied that our totals, 154 and 422, would each require to be subdivided into ten groups, some of which would be represented by very small numbers indeed (for instance, the number of my female cases dying under 30 was only 3); and though trustworthy deductions, I think, may fairly be drawn from our cases collectively, it was patent that to attempt the same from much smaller numbers would be fallacious. To what must we attribute the fact that at Banstead Asylum and at St. Bartholomew's Hospital, each one of the largest institutions of its class in the kingdom, the proportion of renal disease in both sexes found in the *post-mortem* room of the former does very considerably exceed—nay, nearly doubles—the same in the latter? One or more of the agents which can ultimately induce interstitial changes in the kidney must be much more actively at work among those who become insane than among the general population.

Let us for a moment recall what are usually given in textbooks as the possible causes of interstitial overgrowth, whether this takes the form of the large or contracted white kidney following a tubal nephritis or of true renal cirrhosis. They are cold, scarlatina, pregnancy, and alcohol in the case of the former, and gout, chronic lead poisoning, and alcohol again as regards the latter. Cold need not detain us; everyone alike is liable to that at any time. As to scarlatina many of our cases of kidney disease, I have no doubt, owe their origin to the patient having had an attack of it earlier in life; but it has no relation to the etiology of the bulk of insanity, and therefore one fails to see how in any way it could account for our excess of renal disease over that found in a general hospital. Pregnancy, as an explanation, deserves consideration, for we see from the above tables that it is among the females this excess is chiefly noticeable; but I have carefully gone over the case-books and do not at all find that the greater proportion of kidney disease is among those who had borne children. Then as to gout and lead poisoning, both stand out prominently as frequent causes of renal cirrhosis, and a special variety of insanity has been associated with each, so they must not be lightly dismissed; but those whose occupation is in any way connected with lead form but a very minute fraction indeed of our asylum patients, except in certain isolated parts of the kingdom, certainly not in the London asylums; besides, we should surely expect to more frequently find symptoms of plumbism were this the agent to which we are to ascribe our excess of kidney disease. As regards gout, it is true a podagrous insanity has been described and is well recognised, but it is admittedly rare. However gout may, in neurotic families, acquire a special significance; it has been known to alternate with neuroses, apparently remaining latent during the time the mental phe-

nomena, which usually take the form of profound melancholia, are most acute. But of my 74 cases, where marked renal disease was ascertained *post mortem*, only 6 had shown during life any very marked degree of melancholia,⁴ and, curiously, in not a single instance was I able to discover tophaceous deposits in the joints or elsewhere. And, against gout being the cause of our excessive number of diseased kidneys, we further have the fact that it is eight times more common in men than women, while, as before noted, our excess of renal disease was chiefly seen in the female sex. However, were we even to admit that much of this excess is directly brought about by gout, we must not forget that in intoxicating drinks, especially in those made from malt, we have one of the most potent factors in the production of gout.

We are thus impelled, as it were, to look to alcohol as the agent for which we are seeking. But before entering into a few final details regarding it our remarks in this connection would, I think, be incomplete without a reference to that reputed cause of Bright's disease which recently has so prominently been brought before us, namely, prolonged worry. How often it acts in this way and its *modus operandi* are speculative. It has been suggested⁵ that the digestive processes become deranged, resulting in imperfectly metabolised products being thrown into the blood; but may it not possibly be that during prolonged anxiety and worry a vasomotor disturbance takes place, and the renal organs are kept in a state of greater activity than is normal, and that, as a result, hypertrophy with consecutive atrophy takes place? We all of us know how anxiety over some impending event often causes an increase in the flow of urine. However, we must not be led away into the domain of theory; and until some more extensive and repeated observations have been made upon this point it would, in my opinion, be rash indeed to attempt to explain away our excessive number of diseased kidneys upon such an hypothesis. Worry no doubt enters largely into the cause of many an example of mental breakdown; but, as a matter of fact, among the actual cases now under consideration, mental distress, as I have already said, was a prominent symptom in only a very small proportion.

As regards the power of alcohol in the production of interstitial changes in the kidney:—Fagge, in his *Textbook of Medicine*, lays special stress on it as a cause of tubal nephritis. Bright himself was strongly of this opinion, and it will be seen above from Table III that most of the kidneys showing chronic interstitial change were of such an appearance as to warrant one assuming that they had originally started with a parenchymatous lesion. When discussing the etiology of renal cirrhosis proper, though he does not speak so positively in favour of alcohol, he still again leans very strongly towards it, and points out that the general consensus of opinion of clinicians of high repute is, that it is a most powerful cause of this affection. Little is known as to the time it takes to work its disastrous results in the various organs of the body; but, while kidney disease—which at onset is mainly parenchymatous in distribution—is one of childhood and young adult life, it is rare under 35, and not frequent before 50, to find the small red kidney of renal cirrhosis. Thus, the age on admission of our cases, as well as that at death, becomes an important point to look to. We know, of course, that during their asylum residence patients have no opportunity for over-indulgence in beer or other alcoholic beverage, and therefore, should their kidneys be found diseased after death, and if alcohol be the cause of such disease, its excessive consumption must have occurred prior to their

admission. And thus, if we may presume that not much excessive drinking goes on till towards the end of adolescence and onwards, it would follow that a much smaller proportion of those admitted under, say, 25 years old, would show these renal changes if they ultimately died in the asylum; and, again, since renal cirrhosis proper is a disease that usually comes on later in life, it would follow that the age on admission of those who at death show this condition would be much higher. I think it will be seen that these points are faithfully illustrated by my cases: Of the whole 154, 15 were admitted under 25 years of age, and though these mostly lived to a fairly good age, only 1 of them at death showed interstitial change in the kidney; from 25 years of age the number of cases yearly admitted, which after death showed the first form of kidney disease in Table III, steadily rose up to the age of 40, and then declined; and on reference to the clinical histories of the 26 examples of the typical red granular contracted kidney, I find that none of these had been admitted under 35 years of age, and only 1 at this age, while 16 were admitted after the age of 60.

Let us for a moment beg the question, and see to what conclusion it leads us. The following table has been compiled from the statistics appended to the last five annual reports of the four oldest London asylums.

TABLE IV.—Showing the Number of Admissions into the London County Asylums during the Five Years 1889 to 1893 and the Percentages Ascribed to Intemperance in Drink.

	Asylums	Hanwell.			Colney Hatch.			Banstead.			Cane Hill.		
		Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.
1889	Number of admissions	131	173	304	224	295	519	267	341	608	215	197	412
	Percentage due to intemperance in drink	21.0	15.0	18.0	12.0	5.7	10.0	12.0	6.0	8.8	28.0	9.0	19.0
1890	Number of admissions	301	288	589	405	469	874	278	379	657	313	334	647
	Percentage due to intemperance in drink	16.0	11.0	14.0	10.0	6.0	7.8	17.0	8.0	12.0	16.0	12.0	14.0
1891	Number of admissions	301	288	589	320	325	645	280	323	603	210	181	391
	Percentage due to intemperance in drink	19.0	9.0	14.7	16.0	9.0	13.0	8.0	4.0	6.0	29.0	12.0	21.7
1892	Number of admissions	246	216	462	225	343	568	239	301	540	654	705	1,359
	Percentage due to intemperance in drink	24.0	12.0	18.4	17.0	8.0	11.8	9.0	2.0	5.3	14.7	7.5	11.0
1893	Number of admissions	192	161	353	212	297	509	186	199	385	237	257	494
	Percentage due to intemperance in drink	19.2	16.7	18.0	25.4	13.4	16.5	20.4	7.0	13.0	23.6	10.1	16.6
Average percentages for the five years due to drink		19.8	12.7	16.6	16.0	8.4	11.8	13.2	5.4	9.0	22.2	10.0	16.4

By grouping a large number of figures together in this way, accidental fallacies tend to neutralise each other. Taking these five years together, the average percentage due to drink for the four asylums collectively is 13.4 (that is, combining both sexes). I find from the casebooks that in only 5 instances among my 74 examples of renal disease had drink been assigned during life as the cause of the mental disorder. If we deduct these five from the 74, our 48 per cent. of renal disease becomes reduced to 44.8; the percentage found at St. Bartholomew's Hospital, we saw, was 26, so this still leaves an excess of 18.8 per cent. to be accounted for. If we may then reasonably assume that this 18.8 represents the extra proportion of insanity due to drink revealed by *post-mortem* investigation, in order to come at the true amount, we must add to it the above figure 13.4 which, we saw, represents the percentage revealed by clinical study, and this would bring the total amount up to 32.2 per cent.

⁴ Of these 74 cases, the form of mental disorder was—general paralysis in 27 per cent., senile dementia in another 27 per cent., sequential insanity accounted for 36 per cent., and epilepsy had existed in 7 per cent. Of the whole 154 necropsies, 47 had been general paralytics, 17 epileptics, 53 chronic demented, and 28 had been admitted as cases of senile insanity. I would like here to append a point of considerable interest, I think, though somewhat outside the general aim of this discussion. It is well known that, in the last stages of general paralysis and other forms of chronic brain disease, diarrhoea is not an infrequent complication, and after death an intestinal catarrh, extending sometimes to ulceration, has been observed. The same condition is also well recognised to occur in certain cases of chronic renal cirrhosis. Is not this a possible explanation of many of our examples of obstinate diarrhoea in general paralytics and others? I observe that of my 154 cases, 15 had suffered from severe diarrhoea towards the end, and in 11 of these I found very marked interstitial changes in the kidneys.

⁵ BRITISH MEDICAL JOURNAL, November 3rd, 1884.

Thus, if our premisses have been rightly taken, this important fact is brought out—that, of the patients admitted to the London asylums, more than twice the number than is at present stated, owe their entrance, partly at any rate, to the abuse of alcohol.

THE LETHAL EFFECTS OF ELECTRICAL CURRENTS.

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SINCE the introduction of electric lighting as an industry, fatal accidents have occurred from time to time to those employed in connection with it. These have usually been the result of contacts with conductors charged to a potential of 1,000 volts or upwards, whereby the body of the victim has become the path of a considerable current, discharging in most cases to earth, but sometimes to the other conductor of the system. In ordinary engineering practice these high voltages occur in the mains of the alternate current supply systems, where the pressures range between 1,000 and 2,500 volts. In the case of one London company, the enormous pressure of 10,000 volts is reached. Direct current at high tension also occurs in street lighting by arc lamps, where a number of these are connected in series and worked by a direct current, steady or pulsatory, at a pressure which may amount to 1,500 volts or more. These high potentials are not permitted by the Board of Trade regulations to be used in dwelling houses; and we may say at once that with the pressures (not exceeding 200 volts) which these rules allow in dwelling houses, there is no danger of fatal shocks from accidental contacts with the conductors. The high tension current supplied by the alternating supply companies does not enter the houses, but is used to excite a transformer fixed outside, from which a low tension current is led to the lamps within.

In this country it is the rule that high potential conductors shall be laid underground, consequently the persons exposed to the risk of fatal electric shocks are mainly those employed in the generating or transforming stations, those at work upon "live" high tension mains, or those engaged with "series" arc lamps, and almost all the accidents which have occurred in this country have been to persons engaged in one or other of these ways. Where high-pressure wires are allowed on poles overhead there is a chance of the wires breaking and falling down among the people in the street, and deaths have been caused to several persons abroad through incautiously meddling with such wires. The two accidents lately recorded, in which a creeping discharge along the surface of the ground has proved fatal to horses, are of peculiar interest but are not so likely to cause serious damage to human beings; still it is to be hoped that they will not often recur.

The mode in which electric shocks cause death is one of considerable interest because it underlies the questions of the prevention of such accidents and of the mode of treatment when they arise. Recently attention has been called to this question afresh by the writings of Professor d'Arsonval on the subject, which have given rise to much discussion in the technical journals and in the public press. His belief is that it is not the heart but rather the respiration which fails. He has even declared that in his opinion the criminals executed by electricity in the United States died from the effect of the *post-mortem* examination; that the shocks had only rendered them insensible, and that they might have been revived by artificial respiration.

Other writers following him have lamented the deaths of other victims of electricity which they consider might have been prevented by timely assistance. A case has even been recorded¹ in which a man was resuscitated in this way when he was apparently dead, although the artificial respiration was not commenced until three-quarters of an hour after the accident. Too ready an acceptance of d'Arsonval's theory is likely to be a source of danger by leading people to think less of the risks of electric shock, and already an American

medical man is said to have offered to submit to an electrical discharge provided only that his special method of resuscitation be carried out upon him afterwards.

Against d'Arsonval's views we would note that artificial respiration has been employed in vain in some of these accidents, and that in the *post-mortem* examinations upon the American criminals the heart was not found beating—I write from memory, not having a report at hand—although the necropsy was begun immediately after the execution; in fact, the stoppage of the heart's action was taken as the sign of the patient's death.

In a case reported by Dr. J. W. Brown in the *New York Medical Record*, 1893, the victim survived the first shock, the dynamo breaking down, and he began to recover. The published account states that the current was kept on for fifty-two seconds; the man remained apparently dead for twenty seconds more, and then gasped; five seconds later no pulse could be felt at the wrist, but after thirty seconds it was felt, breathing became gradually re-established, the pulse grew stronger, and some movements of a purposive nature were performed. He was then killed by a shock from an arc lighting machine. In this case the heart and respiration were both profoundly affected. Respiration recovered first, and then the heart.

In a report by Dr. Clowes² of an accident in Brompton, the patient was seen five minutes after the accident. The heart and respiration had stopped; artificial respiration was performed but was of no use. In d'Arsonval's case referred to above, three quarters of an hour had elapsed before artificial respiration was begun, and it seems unlikely that respiration could have been completely arrested for so long a time and the patient not die. It is probable that the man was in a dazed or senseless condition only, and might have come round equally well without artificial respiration.

The examination of the bodies of those killed by electric shock may afford little information as to the mode of death. In one of the earliest cases³ recorded in the medical journals, no signs of injury could be found except a small superficial burn of the thumb. It is usual to find some marks of burning at the part which has been in contact with the wire or point of entry of the current, and a careful search should always be made over the whole body for other burns at the point (point of exit) at which the current passed from the patient to the earth or to the other conductor. When the discharge has been to earth the current usually leaves the body at the feet, and these should always be examined for marks of burning, and the soles of the boots should also be looked at. When the shoes and socks are damp there may be no burn of the feet, even when a current of fatal magnitude has passed through them. The soles of the feet and the socks are almost always damp from perspiration, and the soles of the boots of working men are often full of nails; the boots, therefore, offer but little in the way of insulation resistance. The severity of the burns is to be taken rather as a measure of the duration of the contact than of the magnitude of the fatal shock, and the same may be said of the heating of the tissues which has been sometimes observed. They may be slighter in those who have been killed on the spot than in those who have escaped with their lives. When the body remains in circuit, burns of great extent may be caused by the prolonged action of the current upon it subsequent to death.

In the accounts of the necropsies mention is often made of congestions, extravasations of blood, or internal hemorrhages; these may be the result of violent muscular tetanus caused by the shock and the rise in blood pressure associated with it; they are not themselves the cause of death. It is difficult to assign its proper value to the statement which so often crops up about the fluidity of the blood in these cases. The heart is often noted to be relaxed and empty, and this is not in accord with the theory of death from asphyxia. For electric shock to cause death a current of considerable magnitude must pass through the body and must traverse a vital part. An extremity may be completely destroyed by a current without the patient himself being killed by the shock, provided that the current does not pass through the trunk as well. It is not volts which kill, and in this lies a

¹ *Comptes Rendus*, vol. xcvi.

² *Lancet* of December, 1892.

³ Sheild and Delépine, *BRITISH MEDICAL JOURNAL*, 1885, 1, p. 531.