

# ON CERTAIN QUESTIONS RELATING TO THE URINOLOGY OF THE INSANE.

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IN a section of an important work,<sup>1</sup> published in 1884, Dr. W. Zuelzer treats of changes in the composition of the urine, associated with various conditions of altered metabolism in the nervous tissue.

He maintains that, from the nervous tissue, when in a state of lowered irritability, the delivery of material is augmented, and that it is lessened in conditions of exalted irritability. Further, that each of those series of conditions is, in respect to the tissue-change, differentiated by urinary qualities peculiar to it, and of such kind that, in depression conditions, (traumatic or pathological destructive brain-lesions; chloroform, ether, morphia, narcosis, &c.), the phosphoric and glycerinphosphoric acids<sup>2</sup> of the urine are increased; whereas, excitation conditions (as induced by strychnia, phosphorus, alcohol in small doses) are attended by a diminished amount of those products in the urine.

To illustrate the points claimed by Zuelzer, the following three analyses are selected from those contained in his work:—

Chloroform narcosis of 30 minutes' duration, for excision of adenoma. The urine voided immediately before the operation contained—<sup>3</sup>

N	P <sub>2</sub> O <sub>5</sub>	R
0·2648	0·076	28·7
	0·003	1·1

<sup>1</sup> 'Untersuch. über die Semiologie des Harns,' S. 57, u. ff.

<sup>2</sup> Also the potash and lime salts; but these are beyond the scope of this paper so far as estimation of the basylous element is concerned.

<sup>3</sup> Throughout this paper the quantities found by analysis are expressed in grammes, or parts of a gramme. Where two series of figures are given under

An hour after the operation—

N	P <sub>2</sub> O <sub>5</sub>	R
0.38	0.173	45.5
	0.049	12.8

Morphia administered internally. The night urine of 21st-22nd July, contained—

4.96	0.89	17.9
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0.02 g. morphia taken during evening of 22nd. Night urine of 22nd-23rd July contained—

4.85	1.218	25.1
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*Strychnia Experiment on Dog.*

October 29th-30th.—Urine of—

2.2	0.358	16.2
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October 30th.—0.002 g. strychnia subcutaneously.

During the spasms (a portion lost)—

0.15	0.011	7.3
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October 30th-31st.—Evening and early morning,

1.74	0.164	9.4
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October 31st.—Forenoon,

1.96	0.279	14.2
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Mid-day,

3.43	0.58	16.9
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Zuelzer further remarks that the alteration in the composition of the urine, associated with the first mentioned series of conditions, brings the relationship between the existing amounts of phosphoric pentoxide and nitrogen into more or less close accord with that which obtains in the nervous tissue itself, and with that present in the urine of animals (dogs) fed on brain substance.

According to his estimates, the normal gravimetric proportion of the P<sub>2</sub>O<sub>5</sub> to the N, in the 24 hours' urine of an adult, is 18 or 20 to 100. In blood, the mean proportion is as 4 : 100 ; in muscle, 15 : 100 ; in brain and other nervous

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the heading P<sub>2</sub>O<sub>5</sub>, the first indicates the phosphoric acid in combination with alkalies and alkaline earths, the second, the glycerinphosphoric acid. The numbers under R denote the gravimetric ratio of the respective P<sub>2</sub>O<sub>5</sub> to 100 N.

organs, which contain the greatest amount of lecithin, 45 : 100.

With regard to the glycerinphosphoric acid, concordant and definite estimates of the maximum quantity, present in the urine under normal circumstances, are wanting. In the 24 hours' urine of a healthy adult, Zuelzer found 0.06 gramme = 2.3 p.c. of the total  $P_2O_5$ , but he gives no numerical generalization upon the point.

Hoppe-Seyler<sup>1</sup> describes its occurrence in "very small quantity in normal urine."

Lépine and Eymonnet<sup>2</sup> place the normal amount at 0.25 to 100 N, or about 1 p.c. of the total  $P_2O_5$ .

These latter observers also have noted an increase in the renal excretion of the phosphorus compounds—particularly the glycerinphosphoric acid—as a result of gross cerebral lesions, epilepsy, and use of chloral or bromides. Thus in a case<sup>3</sup> of hæmorrhage into the external capsule and outer part of the lenticular nucleus, the urine excreted during the first six hours contained, per litre,

N	$P_2O_5$	R
2.5	0.54	21.6
0.0268	1.07	

"Forty-eight hours later, the proportion was normal."

With the view of ascertaining whether the above described urinary characteristics are commonly present in certain of the neuropathic, and psychopathic states met with in asylums, I undertook the subjoined analyses.<sup>4</sup> Especially, it seemed to

<sup>1</sup> 'Handbuch der Phys. u. Path. Chem. Anal.' 1883, S. 116.

<sup>2</sup> 'Comptes Rendus des Séances de l'Acad. des Sciences,' t. xcviii., 1884, No. 4, p. 239.

<sup>3</sup> Loc. cit.

<sup>4</sup> It may be well to designate the methods employed. In all cases the nitrogen has been determined in a Knop-Wagner's azotometer, by the process described in Zuelzer's 'Manual on Urinary Analysis,' using Dietrich's correction tables for absorption and weight. Zuelzer calculates that with this apparatus the hypobromite disengages the N to within 0.1, or at most 0.2 p.c. of the existing quantity, unless the urine contain much uric acid—2 p.c., or less, of the N may then remain in combination. With Hüfner's apparatus the deficiency is stated to be 7 p.c. The most favourable result obtained by use of the improved Simpson and O'Keefe's method left 0.09 p.c. combined (Cranstoun Charles).

The phosphoric acid united with alkaline earths has been estimated by precipitation with ammonia, and titration with standard uranic solution.

That in combination with alkalis has been similarly titrated, after precipita-

me that such investigations might throw some light upon the nervous metabolic processes underlying those transient hemiplegiæ, or monoplegiæ, with or without stupor, which frequently may occur during the course of general paralysis, without leaving any macroscopic clue to their origin.

CASE I.—General paralysis, 2 years' duration. F. S., male, 43, habitually elated, boastful, the imaginary possessor of millions of pounds, three wives, &c. Was able to walk about until October 22, 1884; stupor, with rigidity of all the limbs, developed early on that morning.

The urine drawn at 1 P.M. (excretion of about 15 hours), contained—

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
10·69	2·481	23·2	
"	0·1805	1·6	Max. axillary temp. 39·1°.
From 1 P.M. to 10 P.M.			
4·231	1·2659	29·9	
	0·0188	0·4	
From 10 P.M. to 9.30 A.M., <i>October 23rd.</i>			
7·461	2·5344	33·9	38·4°.
	0		
9.30 to 6 P.M.			
5·337	1·6898	31·6	
	0		
6 P.M. to 11 A.M., <i>October 24th.</i>			
9·24	3·024	32·7	Emerging from stupor: re-
	0		cognises attendant and
			calls him by name. Head
			and eyes persistently
			turned to right. Left
			limbs flexed and rigid:
			right limbs fairly under
			control.

tion by ammonio-magnesian solution—the known quantity of earthy phosphates being subtracted from the result.

For ascertaining the amount of glycerinphosphoric acid I have nearly always employed the indirect method—prolonged boiling of the urine with nitric acid, rendering alkaline with ammonia, precipitating by the magnesian solution, titration, and subtraction of the known amount of alkaline and earthy phosphates. The direct methods (Lépine, Hoppe-Seyler, Sotnischewsky) comparatively are complicated, and involve a great expenditure of time.

Repeatedly, when this organically combined acid has existed in traces too small to be measured with certainty by titration, the microscope has enabled me to detect it in the form of a few crystals of triple phosphate.

## 11 A.M. to 6 P.M.

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
7.357	1.2	16.3	39.4°.
	0.12	1.6	

3 A.M. to 9.30 A.M., *October 25th.*

6.15	0.929	15.1	38.7.
	0.103	1.6	

From 6 P.M. to 10 A.M., *October 26th.*

11.82	1.715	14.5	37.6°.
	0		

6 P.M. to 9.30 A.M., *October 27th*

10.097	1.1787	11.6	Left hemiplegia persists: less rigidity in palsied limbs. 36.5°.
	0		

11 A.M. to 6 P.M., *October 29th.*

0.441	37.8°.
0.0784	

*October 30th.*

10.705	0.9047	8.4	38.4°.
	0		

In this case, the large absolute quantity of the glycerin-phosphoric acid on the first day, and the increasing elimination of the inorganically combined P<sub>2</sub>O<sub>5</sub> during the period of stupor, are very prominent facts.

They certainly are independent of the food, for during those days the patient took only small quantities of milk, beef-tea, and egg—articles which he ingested freely when the stupor had passed off. Doubtless, the muscular tension and the pyrexia may have been the cause, to some extent, of the augmented excretion of the latter mentioned P<sub>2</sub>O<sub>5</sub>; but these conditions had not disappeared when the P<sub>2</sub>O<sub>5</sub> elimination had permanently fallen much below the healthy standard.

The left limbs became flaccid, and remained paralysed till death on November 7, 1884.

There was no trace of focal lesion in the encephalon—beyond old adhesions of pia to cortex.

In the next two cases there exists a notable discharge of glycerinphosphoric acid in connection with the occurrence of paralytic motor phenomena, which contrasts strongly with

the absence of that compound when the patients had regained, what may be considered, their normal state.

II.—General paralysis, 4 years' duration. A. F., female, 40, quiet, demented, cheerful and clean.

*October 10th, 1885.*—After brief prodromal emesis, right brachial monoplegia, with speechlessness, occurred to-day. No extra impairment of consciousness; understands what is said, and responds, otherwise than verbally. Paralysed limb rigidly semi-flexed at elbow.

The urine drawn 12 hours after onset of attack, contained <sup>1</sup>

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
3.298	0.105	3.2	
	0.644	19.5	
	0.028	0.8	

*October 14th.*—12 hours ending at noon.

8.514	0.1345	1.5	Remains speechless. Limb
	0.7768	9.1	less rigid: slight return
	0.013	0.1	of voluntary power.

*October 22nd.*—24 hours ending at 8 A.M.

10.289	0.272	2.6	Four convulsive attacks
	1.559	15.1	yesterday: none since
	0		2 gr. chloral were given.
			Convulsions were general:
			head and eyes to right.
			Patient can nearly articulate "Yes." Limb
			continues paralysed.

*October 24th.*—12 hours ending at 10 P.M.

4.43	0.0468	1.05	No more fits.
	0.4368	9.8	
	0.0052	0.1	

*February 26, 1886.*—1 A.M. to noon.

2.514	0.112	4.4	No fit since October. Com-
	0.272	10.8	pletely recovered use in
	0		limb. Speech partly re-
			stored.

*February 27th.*—1 A.M. to noon.

2.77	0.108	3.8	
	0.288	10.3	
	0		

<sup>1</sup> The first (topmost) group of figures shows the amount of P<sub>2</sub>O<sub>5</sub> in combination with alkaline earths; the second, that united with alkalies; the third represents the glycerinphosphoric acid. This order is followed in all cases where the three series occur in this paper.

III.—General paralysis, 5 years' duration. E. C.,<sup>1</sup> female, 40 Very demented and dirty, fairly quiet, thoroughly self-satisfied.

*November 27th, 1885.*—Left brachial monoplegia came on in night. No stupor, convulsion, nor speech loss.

Urine passed at noon and 6 P.M. contained

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
1·055	0·0728	6·8	
	0·084	7·9	
	0·0056	0·5	

*November 28th.*—Night and forenoon excretion.

2·277	0·0748	3·2	Recovered free use in limb
	0·2912	12·7	yesterday evening.
	0·2329	10·2	

*December 7th.*—Night and forenoon (part lost).

2·967	0·246	8·2	No further attack.
	0·126	4·2	
	0		

*February 8th, 1886.*—Night and forenoon.

2·8256	0·27	9·55	Has remained in usual
	0·09	3·22	state.
	0		

*February 9th.*—Night and forenoon.

2·838	0·2275	8·01	
	0·0875	3·08	
	0		

*February 10th.*—Night and forenoon.

3·001	0·26	8·66	
	0·025	0·83	
	0		

So far as my researches extend, one does not constantly find an excretion of glycerinphosphoric acid following the convulsive attacks of general paralysis. Similarly in epilepsies, even when an enormous series of fits rapidly proceeds to a fatal issue.

IV. General paralysis, unknown duration. J. W., male, 38.

*February 19th, 1886.*—Severe general convulsions from noon until 1.10 P.M. Deep coma throughout. Ten minutes before convulsions ceased, 2·7 grammes of chloral per rectum.

Urine drawn at 10 P.M.=total excretion since convulsions began, contained

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
2.393	0.14	5.8	
	0.042	1.7	
	0		

*February 20th.*—12 hours ending 10 A.M.

4.003	0.0725	1.8	No further convulsion. Recovered consciousness this morning.
	0.7395	18.4	
	0.0195	0.4	

V.—General paralysis, 2 years' duration. A. H., female, 35.

*February 10th, 1885.*—Two strong convulsive fits, from which quickly recovered.

Urine drawn 3 hours after the fits contained

0.919	0.045	4.8
	0.095	10.3
	0	

*April 23rd, 1885.*—Convulsed in forenoon. Urine drawn at 1.30 P.M.

0.891	0.066	7.4
	0.069	7.7
	0	

Next 2 hours

0.531	0.0	No fit since morning.
	0.1004	
	0	

VI.—Chronic mania, 21 years. Epileptiform seizures, 2 months. No permanent contracture or paralysis. M. A. P., female, 60.

*January 29th.*—Convulsed for 2½ hours—the spasms being strong and mainly limited to left side. 1.5 gramme chloral per rectum.

Urine drawn near end of attack contained

1.252	0.0786	6.2
	0.2824	22.5
	0	

<sup>1</sup> This patient died in April, 1886. There was no local softening, nor could the naked eye detect any appearance to account for the monoplegia.



*January 30th.*—Urine of next 7 hours contained

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
1·858	0·0982	5·2	No further convulsion.
	0·06	3·2	
	0·0109	0·5	

*June 16th, 1885.*—Fits recurred, with scarcely any intermission, for a period of 4 hours, ending at 3 A.M. 8 grammes of chloral, per rectum, during that time.

Urine passed at 2 P.M. (two previous evacuations lost) contained

0·01
0·0225
0

*October 13th, 1885.*—Strong convulsions from 5 P.M. to 7.15 P.M. 1·5 grains chloral at 7 P.M.

Urine from 6 P.M. till noon, *October 14th*, contained

2·533	0·0723	2·8
	0·1034	4·08
	0·0103	0·4

VII.—Epilepsy, many years. A. M., female, 35. Much demented, but clean and useful, corpulent.

*January 4th, 1886.*—9 severe fits in 12 hours ending 5.30 A.M. No great prostration or prolonged stupor.

Urine of night and forenoon contained

3·18	0·288	9·05	Has daily taken 4 gr. alkaline bromide for more than a year.
	0·216	6·7	
	0		

*January 5th.*—Three fits from 1 A.M. to noon.

Urine of night and forenoon contained

3·22	0·0784	2·4
	0·294	9·1
	0	

VIII.—Epilepsy, since puberty. S. T. P., female, 22. Demented, irascible and pugnacious. Movements, spastic and sprawling. Great prostration after fits, feeble health, spare.

*December 21st, 1885.*—Eight fits yesterday; 2 in night. 3 grammes of chloral in night.

Urine of night and forenoon.

2·87	0·27	9·4	For many months has taken 3·5 grammes of potassium bromide each day.
	0·4212	14·6	
	0·0243	0·8	

*December 22nd.*—Such as could be collected during 24 hours, ending at 2 P.M.

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
3.53	0.3012	8.5	No more fits or chloral.
	0.3102	8.7	
	0.0094	0.2	

*December 25th.*—Three fits from 6.30 A.M. to 9.10 A.M.

Urine drawn at 3.30 P.M. contained

1.709	0.2244	13.1
	0.4048	23.6
	0.0176	1.02

*January 3rd, 1886.*—Urine from 4 A.M. to 10.30 A.M.

1.83	0.0925	5.05	No fit for 30 hours.
	0.3071	16.7	
	0.0074	0.4	

IX.—Epilepsy, since puberty. S. H. B., female, 36. Very demented, sluggish and awkward. Corpulent.

For five days the urine was collected in the night and forenoon.

*January 23rd, 1886.*

2.545	0.13	5.1	Two fits in forenoon. No medicine.
	0.403	15.8	
	0		

*January 25th.*

1.599	0.0825	5.1	Three fits in night.
	0.2425	15.1	
	0		

*January 26th.*

2.21	0.14	6.3	One fit in morning, one in afternoon.
	0.35	15.8	
	0		

*January 27th.*

2.027	0.185	9.1	No fit.
	0.2925	14.4	
	0		

*January 28th.*

3.211	0.165	5.1	No fit.
	0.78	24.2	
	0		

X.—Epilepsy, since puberty. M. P., female, 33. Quiet, industrious, imbecile. Fair general health.

*January 16th.*—Five severe fits in the afternoon; 6 during the preceding night; 3 in the following night.

Urine from 7.30 P M. to noon, *January 17th*, contained

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
3.779	0.38	10.0	Takes 3 gr. of bromide daily.
	0.4192	11.0	
	0.0633	1.6	

*January 29th.*—Urine of similar period.

10.812	0.315	2.9	Two fits in night. None for 3 preceding nights.
	0.735	6.7	
	0		

*January 30th.*—Urine of similar period.

3.099	0.2142	6.9	No fit.
	0.4488	14.4	
	0.0102	0.3	

XI.—Epilepsy, many years. M. M., female, 30. Much demented, sluggish, feeble and obese. Average number of fits, 2 weekly.

Seventy-seven severe fits during the 48 hours ending at noon, January 31st, 1886. 9 grammes of chloral were administered in that time. Death occurred shortly before midnight, at the onset of a fit—convulsions having been absent for several hours previously;<sup>1</sup> but a fatal termination from pulmonary engorgement and œdema having appeared inevitable for many hours.

The urine drawn in the evening of January 30th, and on the morning of January 1st contained

2.112	0.085	5.96
	0.391	18.25
	0	

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<sup>1</sup> It is a noteworthy fact that, in this Asylum, during the past seven years the only cases in which chloral has failed to arrest convulsions before irremediable pulmonary hypostasis has developed, have been those in which the patient has not been taking a bromide, continuously, for a long period. The observation extends to 13 males and 17 females, who died in the epileptic status. Two of the male patients commenced the bromide just after coming to the asylum. Of them, one died within a week, the other within a fortnight. Two of the females terminated a long course of bromide a month, and five weeks, respectively, prior to the commencement of the fatal series. None of the other patients had undergone bromide treatment for many months, or years, before the last outbreak of fits occurred.

XII.—Epilepsy, 18 years. B. D., female, 21. Imbecile, robust general health.

*January 29th, 1885.*—59 strong fits last night—only 2 after a second 2 gramme dose of chloral per rectum.

The urine passed at bedtime of the 28th January, 1885, before the fits came on, contained

N	P <sub>2</sub> O <sub>5</sub>	R
2·208	0·2508	11·3
	0·3225	14·6
	0·0358	1·6

*January 29th, 1885.* Urine drawn at 11 A.M.

1·765	0·0806	4·5
	0·018	1·01
	0	

Death took place a few hours later.

Professor Lépine and M. Jacquin have recorded<sup>1</sup> some interesting observations concerning the P<sub>2</sub>O<sub>5</sub> excretion in certain cases of essential epilepsy and of epilepsy from alcoholism. They found the proportion of the P<sub>2</sub>O<sub>5</sub> to the N much below normal on the days between the fits—once as low as 8·6 p.c. In those patients the proportion notably increased immediately after a fit, the rise being absolute, and chiefly due to an increase of the earthy phosphates. An augmentation of the earthy phosphates was also noted when the patients had merely experienced sensations of a fit being imminent, or had undergone an attack of vertigo.

Those special features cannot be definitely traced in the foregoing analyses—Cases IV. to XII. Frequently, indeed, the ratio of earthy to alkaline phosphates is there excessive; but that anomaly is almost constantly owing to the remarkably small absolute quantity of the latter. Thus, reference to IV., VI., VII., and XII. shows (not without exceptions) an extraordinary failure of the alkaline phosphates in the urine first collected after the nervous discharge. A like phenomenon is present in some of Lépine's analyses. It is necessary to observe, however, that Lépine investigated the whole 24 hours' urine, for several days in succession; consequently a full comparison of my analyses, cited above, with those of Lépine, cannot be made.

<sup>1</sup> 'Revue Mensuelle de Méd. et de Chir.' tome iii. 1879, Nos. 9 et 12.

In the next two cases the 24 hours' urine was collected, save on certain days indicated. Here, also, are some manifest disproportions in the amount of the phosphates; universal in the first case, greatest during the aeme of the convulsive period in the second, but also existing on days<sup>1</sup> when no objective evidence of a fit was present. (It is not known whether auræ occurred at those times.) This disparity is, again, mainly the result of diminished alkaline phosphates.

It should be noted that the second patient took less food after the fits commenced, and then suffered from malaise, lassitude, and headache, which prevented her from working.

XIII.—Epilepsy, many years. M. M., female, 41. Much demented, excitable, quarrelsome, and noisy. Feeble health; exceedingly macilent.

*January 30-31st.*

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
3·894	0·315	8·08	One fit on Jan. 30.
	0·504	12·9	
	0·0157	0·4	

*January 31st-February 1st.*

3·505	0·368	10·4	No fit.
	0·46	13·1	
	0·092	2·6	

*February 3-4th.*

5·403	0·456	8·4	One fit on Feb. 3.
	0·57	10·5	
	0		

*February 4-5th (some lost).*

4·584	0·264	5·7	No fit.
	0·286	6·2	
	0		

*February 5-6th.*

4·0492	0·371	9·1	One fit on Feb. 5.
	0·2915	7·1	
	0		

*February 6-7th.*

4·415	0·3444	7·8	No fit.
	0·3444	7·8	

XIV.—Epilepsy, since puberty. C. H., female, 35. Not

<sup>1</sup> See Feb. 12, 13, 16, 18-20, and 27. On March 1 and 4 the ratio of earthy to alkaline phosphates is quite normal.

much demented, never displays great excitement, is a useful ward cleaner. Fair general condition. Fits usually occur at the catamenial periods.

*February 10-11th.*

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
6.544	0.887	5.9	No fit for three weeks.
	1.29	19.7	
	0.043	0.6	

*February 11-12th.—(Part lost).*

4.925	0.36	7.3
	0.88	17.8
	0	

*February 12-13th.*

5.163	0.843	6.6
	0.686	13.2
	0	

*February 13-14th.*

6.7155	0.462	6.7
	1.188	17.6
	0	

*February 14-15th.*

8.451	0.532	6.2
	1.292	15.2
	0	

*February 15-16th.*

5.544	0.432	7.7
	0.864	15.5
	0	

*February 16-17th.*

5.7	0.324	5.6
	0.9	15.7
	0	

*February 17-18th.*

7.734	0.511	6.6
	1.095	14.1
	0.073	0.9

*February 18-19th.*

7.1	0.474	6.6
	0.948	13.3
	0	

*February 19-20th.*—(A portion lost.)

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
5·465	0·441	8·06	
	0·686	12·5	
	0		

*February 20-21st.*

7·23	0·346	4·7	
	1·314	18·1	
	0		

*February 21-22nd.*

9·089	0·489	5·3	
	1·876	20·6	

*February 22-23rd.*

5·836	0·504	8·6	
	1·152	19·7	
	0		

*February 23-24th.*

5·608	0·395	7·04	
	1·187	21·1	
	0		

*February 24-25th.*

8·88	0·408	4·5	
	1·292	14·5	
	0		

*February 25-26th.*

9·018	0·528	5·8	
	1·254	13·9	
	0		

*February 26-27th.*

8·06	0·504	6·2	No fit hitherto.
	1·008	12·5	
	0		

*February 27-28th.*

11·127	0·648	5·8	One fit.
	1·8	16·1	
	0		

*February 28th-March 1st.*

8·42	0·497	5·9	One fit.
	1·704	20·2	
	0		

*March 1-2nd.*—(Part lost.)

4·897	0·424	8·6	Five fits.
	0·636	12·9	
	0·106	2·1	

*March 2-3rd.*—(Much lost.)

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
2·649	0·216	8·1	Seven fits.
	1·36	13·5	Glycosuria.
	0		

*March 3-4th.*—(Much lost.)

4·41	0·253	5·7	Three fits.
	0·897	20·3	Trace of sugar.
	0		

*March 4-5th.*—(Much lost.)

5·239	0·42	8·01	One fit.
	0·595	11·3	No sugar.
	0		

In a case of recurrent mania, some details of which are annexed, the alternating mental phases were to some extent characterised by change in the P<sub>2</sub>O<sub>5</sub> renal excretion—the ratio of that to the N was constantly lower when excitement was absent. No organically combined P<sub>2</sub>O<sub>5</sub> was found while the mental affection ran its usual course. As soon, however, as a depression condition became established (partial collapse from peritonitis, sopor induced by morphia), a large elimination of glycerinphosphoric acid occurred. Muscular activity and alimentation can each be excluded from the production of this phenomenon, because the former was reduced to the oppressed exercise of the circulatory and respiratory muscles, with infrequent emesis, and the latter was totally prevented by the inverted action of the stomach.

Analysis was made from all the urine that could be obtained in the 24 hours; on some days, little, or none, was lost. The earthy phosphates were not separated from the alkaline.

XV.—Recurrent mania, 3½ years. N. M., male, 44. When maniacal, incessantly restless, noisy, gay, and mischievous; almost sleepless for several days. During calm periods, industrious and orderly. Feeble health; heart fatty, spare condition.

*September 30th, 1884.*

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
7·037	1·937	27·4	Maniacal for three days.
	0		



*October 2nd.*

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
8.5	1.7	20.0	
	0		

*October 4th.*

6.518	1.4124	21.6	Mania subsiding.
	0		

*October 8th.*—10 A.M. to 5 P.M.

1.951	0.472	24.1	Nearly free from excitement.
	0		

*October 9th.*—Night urine.

1.756	0.315	17.9	
	0		

*October 13th.*

7.446	1.585	21.2	Quite tranquil.
	0		

*October 14th.*

3.481	0.5372	15.4	
	0		

*October 15th.*

7.669	1.116	14.5	
	0		

*October 16th.*

5.385	0.81	15.04	
	0		

*October 17th.*

6.9	1.302	18.8	
	0		

*October 21st.*—6 A.M. to 11 A.M.

3.966	0.8613	21.7	Relapse commenced yesterday. Peritonitis developed in night 0.016 gr. morphia, subcutaneously, at 9.30 A.M.
	0.1953	4.9	

Comparison of the P<sub>2</sub>O<sub>5</sub> excretion during the existence of severe melancholic emotional disorder with that obtaining when recovery had taken place, affords some interesting points in the two following cases. The period of mental disturbance is associated with a striking disproportion in the amount of the respective phosphates, which lessens during convalescence until the normal ratio is attained. This character is especially noticeable in the case of the male patient; in which, further, there is seen a significant discharge of glycerinphosphoric

acid, at the time when the disturbance of cerebral function was greatest. Here, again, this disproportion is mainly the effect of a decline in the alkaline phosphates, though there is some decided absolute excess of the earthy phosphates on the first two days, in the case last mentioned.

Each patient received the ordinary diet, throughout. The man, at no time, displayed much energy; the woman was employed at light work in the laundry, when the acute distress subsided.

XVI.—Acute melancholia. J. C., male, 46. Admitted on Oct. 31, 1884, in a state of profound dejection, almost amounting to stupor; had inflicted a dangerous suicidal wound on front of neck a few weeks prior to admission. Stated that the impulse to destroy himself arose suddenly, and he made no effort to resist it. No delusion. Motionless and silent, until roused by other persons. In good bodily condition.

*November 1-2nd, 1884.*

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
5·109	1·309	25·6	
	0·385	7·5	
	0·33	6·4	

*November 2-3rd.*

8·211	1·197	14·5	
	1·05	12·7	
	0·03	0·3	

*November 3-4th.*

5·363	0·7597	14·1	
	0·8104	15·1	
	0·0506	0·9	

*November 4-5th.*

6·375	0·642	10·7	Less depressed.
	1·19	18·6	
	0		

*November 5-6th.*

0·534
1·036
0

*December 6-7th.*

9·164	0·8	8·7	Greatly improved: still morbidly quiet and in active.
	1·0	10·9	
	0		

*December 8-9th.*

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
13·553	0·988	7·2	
	1·146	8·4	
	0		

*January 2-3rd, 1885.*

8·8	0·48	5·4	Recovered.
	1·184	13·4	
	0		

*January 4-5th.*

9·6	0·48	5·0	
	1·2	12·5	
	0		

XVII.—Acute melancholia. E. L., female, 23. Admitted Dec. 6, 1884, showed great melancholic agitation; imagined that some stuff had been given to her, which had dried up her inside; said she “felt right dried up, as though there were not a drop of anything in” her. Feeble and reduced.

*December 10-11th, 1884.*

9·9	0·824	8·3	
	0·944	9·5	
	0		

*December 12-13th.*

8·379	0·46	5·4	
	0·979	11·4	
	0		

*December 13-14th.*

6·021	0·444	7·3	Much improved: calm.
	0·756	12·5	
	0		

*January 19-20th, 1885.*

7·604	0·341	4·4	Quite well.
	0·874	11·4	
	0		

*January 20-21st.*

8·77	0·403	4·5	
	1·2307	14·03	
	0		

Apparently, ether narcosis does not always liberate glycerin-phosphoric acid. In the first case, given below, total suppression of the alkaline phosphates was observed in the urine voided soon after the narcosis; four hours later, the excretion

of those salts had reached an amount much exceeding that present in the urine before the ether was administered.

XVIII.—Ether narcosis, of about 40 minutes' duration, for removal of cystic tumour from breast. The patient, E. O., 71, was a feeble old dement; inactive, but a fair eater, and in good bodily condition.

*Feb. 12th, 1885.*—The urine, passed just before the narcosis was commenced, contained—

N	P <sub>2</sub> O <sub>5</sub>	R	REMARKS.
0·641	0·032	4·9	
	0·032	4·9	
	0		

Fifteen minutes after end of operation—

0·312	0·026	8·3
	0·0	
	0·0	

Four hours later—

0·834	0·0475	5·6	Urine has a strong etherous odour.
	0·1128	13·5	
	0		

XIX.—Ether narcosis, of 20 minutes' duration, for amputation of digit. The patient was a fairly robust, middle-aged, woman. Two and a half hours after the operation, the urine had a powerful smell of ether, and contained—

0·0987
0·4794
0·0282

The number of the foregoing analyses, without doubt, is too small to permit of safe generalisation upon the special facts displayed in them. Their value also is diminished by the circumstance that the total renal excretion of several successive 24 hours' periods was not always obtained for investigation. The explanation of that defect lies in the difficulty of collecting the urine of insane persons. Even when the catheter is frequently and regularly employed, the patient occasionally will micturate in bed, and thus frustrate the attempt to secure that 24 hours' excretion. The more intelligent patients are prone to cause failure by simultaneously evacuating the bladder and rectum into the same vessel. To avoid cumbering

literature with false data, which might insidiously originate from such causes of error, I frequently used the urine of somewhat indefinite periods.

Moreover, the question of the composition of the urine serving as an exponent of tissue change proceeding in the nervous system is beset with many conflicting facts and opinions. For instance, glycerinphosphoric acid is a decomposition product of lecithin—a substance which is abundant in nervous tissue, especially the grey matter. Were the occurrence of lecithin co-extensive with only that tissue, we should possess a sure index of some forms of nervous metabolism; but lecithin also exists in blood, bile, pus, milk, and yolk of egg, hence the significance of an excess of glycerinphosphoric acid in the urine is much reduced. Indeed, Lépine<sup>1</sup> at first regarded the presence of that acid in the urine as a diagnostic sign of fatty degeneration of the liver. Since then, he has found it in some cases of grave anæmia, icterus, enteric fever, and acute pneumonia, besides the nervous cases previously mentioned. Zuelzer has met with it in diabetes mellitus and “paralytic dementia,” in addition to the instances recorded at the commencement of this paper. One does not learn from the observers mentioned, whether the acid in question were daily excreted during the course of those diseases, or were only casually found.

Dr. Speck, in an elaborate article<sup>2</sup> upon the relations of mental activity to tissue change, gives the results of his investigations concerning the urinary excretion, and the consumption of oxygen, and the elimination of carbonic acid. He summarizes his conclusions as follows: “The final result of the experiments is this, that mental exertion produces no direct effect upon the general tissue change. The molecular processes in the brain, which constitute its basis, consequently, either are not oxidation processes, or they are so slight that they are inaccessible to our methods of research.”

However true that may be with regard to physiological conditions, it surely is not legitimate to argue therefrom that pathological events in the brain cannot produce recognisable

<sup>1</sup> See annotation in ‘Lancet,’ Sept. 23rd, 1882.

<sup>2</sup> ‘Archiv für Experiment. Path. u. Pharmacol.,’ Dec. 1881, Bd. xv. S. 81.

effects in the urine? Reading Homer, or criticising German and French scientific works (as in Speck's experiments), cannot be supposed to involve retrograde metabolic changes in the brain similar in nature, or equal in degree, to those which find expression in the phenomena of an epileptic fit, or of a non-hemorrhagic apoplectic seizure?

It would occupy too much space to discuss all Speck's objections<sup>1</sup> to the views enunciated by Zuelzer; one of them, however, is based upon the smallness of the amount of  $P_2O_5$  in the brain, and requires some consideration. Following Bibra's data, Speck estimates that only about 4.1 grammes of  $P_2O_5$  are contained in a human brain, and thus "an extraordinarily intense tissue change must be surmised if it should effect any considerable alteration in the normal daily excretion of about 3 grammes." But, apparently, Bibra and Speck have ignored the lecithin of the brain, which contains 8.798 p.c.  $P_2O_5$  (Hoppe-Seyler), and which, according to Lépine's calculations,<sup>2</sup> raises the total  $P_2O_5$  in a human brain, weighing 1350 grammes, to about 13.5 grammes.

That some of this should, by pathological action in the brain, attain excretion through the kidneys, and effect perceptible alteration in the composition of the urine, can scarcely be doubted. The following quotation from the valuable work by Dr. Cranstoun Charles<sup>3</sup> has an important bearing upon this point:—

"The embryonic brain is much richer in water and poorer in cholesterin, &c., than the developed brain. Further, we find that the lower a mammal stands in the animal scale the richer is its brain in water and the poorer in ethereal extract (chiefly cholesterin and *lecithin*), and accordingly the nearer does it approach to the embryonic brain, whilst the higher the animal's position the poorer is its brain in water, and the richer in the ethereal extract. Some of the constituents removed by the ether are probably compounds chiefly derived from retrograde metamorphosis, and as this is possibly most

<sup>1</sup> They do not relate to the glycerinphosphoric acid—at any rate that body is not mentioned by Speck, and at the date of publication of Speck's article, Zuelzer had only recently made his discoveries respecting it.

<sup>2</sup> Loc. cit., 'Rev. Mens.'

<sup>3</sup> 'Physiological and Pathological Chemistry,' 1884.

active in the highest brains, we can readily understand why the amount of ethereal extract increases in brains of high development. That it is indicative of activity may also be seen from the fact that the very active medulla oblongata and the continuously active spinal cord are poorer in water and very much richer in ethereal extractives than the brain substance itself. In the case of cholesterin, also, it has been shown (Flint) that the blood of the carotid artery is poorer in this body than that of the internal jugular vein."

Now, if these extractives be so intimately associated with the special manifestations of nervous functions, it is reasonable to suppose that their decomposition products must be eliminated when those functions are annulled by a descending metabolism. Cases I. to III. seem to indicate this.

There can be no doubt that all future analyses of the urine, made in connection with nerve states, should include determination of the glycerinphosphoric acid, the alkaline, and the earthy, phosphates—the amount of each being recorded separately.